



Township of Ocean Schools

Assistant Superintendent
Office of Teaching and Learning

SPARTAN MISSION:

Meeting the needs of all students with a proud tradition of academic excellence.

Curriculum Documents

School: Ocean Township High School

Course: Marine Science

Department: Science

Supervisor: Patrick Sullivan

Board Approval	Supervisor	Notes
September 2012	Patrick Sullivan	Update Standards
August 2013	Patrick Sullivan	Update Standards
December 2017	Patrick Sullivan	Update Standards

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#spartanlegacy



Timeline			
Week	Marking Period 1	Week	Marking Period 3
1	Ocean Ecosystems	11	Voyage to the Deep
2	Water On Earth	12	Biodiversity in the Oceans
3	The Ocean Over Time	13	Marine Populations
4	Migration In the Sea	14	Ocean Food Webs
5	Exploring the Seafloor	15	Marine Invertebrates
Week	Marking Period 2	Week	Marking Period 4
6	The Ocean's Formation	16	Biology of Fishes
7	Seasons of Change	17	Marine Reptiles and Birds
8	Energy and the Sea	18	Marine Mammals
9	Weather and the Sea	19	Physical Oceanography
10	Mid-Term	20	Final

Time Frame	5 days
Topic	
1 - Diving into Ocean Ecosystems	
Essential Questions	
<ul style="list-style-type: none"> • What is Oceanography? • What is the importance of laboratory safety and how do I act during a laboratory exercise? • How many oceans exist on Earth? • How are Earth's Oceans unique? • How was early exploration of the oceans achieved? • What are the seven seas? • How were Earth's atmosphere and oceans created? 	
Enduring Understandings	
<ul style="list-style-type: none"> • The ocean is three-dimensional, offering vast living space and diverse habitats from the surface through the water column to the seafloor • Most of the living space on Earth is in the ocean • Ocean habitats are defined by environmental factors • Due to interactions of abiotic factors ocean life is not evenly distributed temporally or spatially • Some regions of the ocean support more diverse and abundant life than anywhere on Earth, while much of the ocean is considered a desert 	
Alignment to NJSL-S	
HS-ESS2-1	HS-ESS3-1
HS-ESS2-2	HS-ESS3-4
HS-ESS2-4	HS-ESS3-5
HS-ESS2-6	HS-ESS3-6
Key Concepts and Skills	
<ul style="list-style-type: none"> • Recognize that while most of the planet is covered by ocean, it is not a uniform body of water • Give examples of diverse marine ecosystems and their locations on Earth • Characterize ecosystems components as abiotic and biotic factors and give examples of how they influence one another • Describe the process of biological succession, explaining that marine ecosystems undergo natural, gradual changes over time • Discuss how humans affect marine ecosystems both positively and negatively • Introduce wetlands as productive and highly diverse marine ecosystems 	
Learning Activities	
<ul style="list-style-type: none"> • Experiment – Physical Environments of the Ocean Floors • Web Quest – How Do Sailors Know Where They Are At Sea? • Experiment – Bathymetry – the shape of the sea floor – (construct a 3-D model of the ocean floor) • Activity – explore the marine ecosystem project 	
Assessments	

- Topic worksheets
- Section Quizzes and Tests
- Observation Assessment/Lab Activities
- Writing Tasks/Lab Reports
- Projects/Performing Assessment

21st Century Skills

X	Creativity	X	Critical Thinking	X	Communication	X	Collaboration
X	Skills	X	Information Literacy	X	Media Literacy		

Interdisciplinary Connections

- Math: Map reading
- Social Studies: All Lecture/Discussions Require the Historical Development of the Specific Topic Being Studied.
- Language Arts: There is a writing component to each unit in the form of lab reports, and book questions. Additionally, each test includes an essay section.
- Fine Arts: sculpture, painting, or music is used to explain and/or portray certain aspects of the main topic

Technology Integration

- PowerPoint Presentations
- Data Projector
- Elmo Incorporation
- DVD/VHS/Disc Demonstration
- YouTube Content Shorts
- Each Class Has 12 Student Computers and the Use of Lap Top Computer Carts
- Microsoft Office Suite 2010
- Integration of Cell Phone Usage by Students to Access Internet During Lecture/Discussions
- All Laboratory Equipment is Technology

Time Frame	5 days
Topic	
2 - Water on Earth	
Essential Questions	
<ul style="list-style-type: none"> • Does the Northern or Southern Hemisphere contain more land? • Which ocean is deepest? • Which ocean basin is largest? • What issues would there be in nature if ice did not float on water? • What is the melting point of fresh water? • Where do fish go when lakes, ponds, and even the ocean freeze in the winter? • How would aquatic ecosystems be different if ice formed on the bottom of these bodies of water? 	
Enduring Understandings	
<ul style="list-style-type: none"> • The ocean is the dominant physical feature on our planet Earth • Most of Earth's water (97%) is in the ocean • Seawater has unique properties • The ocean is an integral part of the water cycle and is connected to all of the Earth's water reservoirs via evaporations and precipitation processes • Although the ocean is large, it is finite and resources are limited 	
Alignment to NJSL-S	
HS-ESS2-1	HS-ESS3-1
HS-ESS2-2	HS-ESS3-4
HS-ESS2-4	HS-ESS3-5
HS-ESS2-6	HS-ESS3-6
Key Concepts and Skills	
<ul style="list-style-type: none"> • Compare and contrast the heating and cooling of fresh water and salt water • Determine whether substrates will float or sink in water based on their densities □ Give examples of how the properties of water affect marine organisms • Describe the structure of the water molecule and relate its structure to water's unique properties 	
Learning Activities	
<ul style="list-style-type: none"> • Experiment - to heat and cool fresh water and salt water and observe phase changes • Activity - Engage by making observations of Earth's surface as seen from space • Experiment - Properties of water at different temperatures • Analyze phase change diagrams • Compare the density of water to other objects and make connections to the structures and habitats of marine organism • Determine if substances will sink or float based on their densities 	
Assessments	
<ul style="list-style-type: none"> • Topic worksheets • Section Quizzes and Tests • Observation Assessment/Lab Activities • Writing Tasks/Lab Reports • Projects/Performing Assessment 	
21st Century Skills	

X	Creativity	X	Critical Thinking	X	Communication	X	Collaboration
X	Life and Career Skills	X	Information Literacy	X	Media Literacy		

Interdisciplinary Connections

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Time Frame	5 days		
Topic			
4 - The Ocean over Time			
Essential Questions			
<ul style="list-style-type: none"> • Can you think of a list of 10 examples of tools that scientists use to extend human senses? • What regions of the world have been changed due to ocean explorations? • What is Aquarius? • What are some advantages of an underwater research habitat? • What are some disadvantages of an underwater research habitat? 			
Enduring Understandings			
<ul style="list-style-type: none"> • Some major groups are found exclusively in the ocean • The diversity of major groups of organisms is much greater in the ocean than on land • From the ocean we get foods, medicines and mineral and energy resources • The ocean is a source of inspiration, recreation rejuvenation and discovery • Much of the world's population lives in coastal areas • Everyone is responsible for caring for the ocean • The ocean sustains life on Earth, and humans must live in ways that sustain the ocean 			
Alignment to NJSL-S			
	HS-ESS2-1	HS-ESS3-1	
	HS-ESS2-2	HS-ESS3-4	
	HS-ESS2-4	HS-ESS3-5	
	HS-ESS2-6	HS-ESS3-6	
Key Concepts and Skills			
<ul style="list-style-type: none"> • Identify how humans have relied upon and utilized the ocean for thousands of years □ Construct a timeline of ocean events to scale • Observe that scientific inquiry is a cyclical process and describe the value of differing perspective about the process of science • Investigate the many technologies and tools that scientist use to make observations about ocean processes 			
Learning Activities			
<ul style="list-style-type: none"> • Experiment – Investigating Marine Algae • Activity – The Ocean in History – An Ocean Timeline • Discuss how humans use the ocean • Create a timeline and map that illustrate a number of human uses of the ocean throughout history and across cultures • Compare and contrast human reliance on the ocean in the past and today • Consider the nature of science and the scientific exploration of the ocean • Identify examples of how the ocean is an integral part of an aspect of human life 			
Assessments			
<ul style="list-style-type: none"> • Topic worksheets • Section Quizzes and Tests • Observation Assessment/Lab Activities • Writing Tasks/Lab Reports • Projects/Performing Assessment 			
21st Century Skills			
X	Creativity	X	Critical
X	Communication	X	Collaboration

			Thinking			
X	Life and Career Skills	X	Information Literacy	X	Media Literacy	

Interdisciplinary Connections

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Time Frame	6 days					
Topic						
5 - Migration in the Sea						
Essential Questions						
<ul style="list-style-type: none"> • Other species of animals move around a great deal or migrate. What other types of animal migrate? • What time of year do whales travel? • Why satellite tags are improvements over VHF radio tags? 						
Enduring Understandings						
<ul style="list-style-type: none"> • The ocean is the last and largest unexplored place on Earth • Understand the ocean is more than a matter of curiosity • Exploration, inquiry, and study are required to better understand ocean systems and processes 						
Alignment to NJSLS-S						
		HS-ESS2-1			HS-ESS3-1	
		HS-ESS2-2			HS-ESS3-4	
		HS-ESS2-4			HS-ESS3-5	
		HS-ESS2-6			HS-ESS3-6	
Key Concepts and Skills						
<ul style="list-style-type: none"> • Compare and contrast migratory movements of different marine animals • Utilize mapping and plotting skills to plotting sample animal movement data • Relate satellite tagging of marine animals to principles of the Nature of Science 						
Learning Activities						
<ul style="list-style-type: none"> • Observe migration routes of select marine species using the e-tools satellite and signs of spring web site • Activity - Plot animal location data on a map and evaluate reasons for animals movements • Explain by discovering how scientists around the world use satellites technologies to learn about diverse areas of marine science • Make predictions about how physical parameters affect marine animals • Describe scientific discoveries that were made possible by satellite technology 						
Assessments						
<ul style="list-style-type: none"> • Topic worksheets • Section Quizzes and Tests • Observation Assessment/Lab Activities • Writing Tasks/Lab Reports • Projects/Performing Assessment 						
21st Century Skills						
X	Creativity	X	Critical Thinking	X	Communication	X Collaboration
X	Life and Career Skills	X	Information Literacy	X	Media Literacy	
Interdisciplinary Connections						

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Time Frame	5 days		
Topic			
6- Explore the Seafloor			
Essential Questions			
<ul style="list-style-type: none"> • What is the tallest mountain above the ocean? • What is the tallest mountain under the ocean? • Where is the tallest mountain located? • What are some seafloor features? • How can scientists explore the floor? • What is echolocation? • Why is echolocation helpful? • How do satellites help scientist to map remote area of the ocean for the first time? • What do you imagine sediments on the sea floor to be like? • What kinds of foods might animals dive for? 			
Enduring Understandings			
<ul style="list-style-type: none"> • An ocean basin’s size, shape, and features vary due to the movement of Earth’s lithospheric plates • Earth’s highest peaks, deepest valleys and flattest vast plains are all in the ocean • Sea level changes over time have expanded and contracted continental shelves, created and destroyed inland seas and shaped the surface of the land • The ocean is the last and largest unexplored place on Earth • New technologies, sensors and tools are expanding our ability to explore the ocean 			
Alignment to NJSL-S			
	HS-ESS2-1	HS-ESS3-1	
	HS-ESS2-2	HS-ESS3-4	
	HS-ESS2-4	HS-ESS3-5	
	HS-ESS2-6	HS-ESS3-6	
Key Concepts and Skills			
<ul style="list-style-type: none"> • Analyze bathymetric images and identify seafloor features • Describe how scientists map the ocean floor • Create a model of seafloor features 			
Learning Activities			
<ul style="list-style-type: none"> • Experiment – A Classroom Model of the Sea Floor • View topographic images and animations • Explain how scientists map the seafloor • Relate marine animal movements to bathymetric imagery □ Interpret a bathymetric image 			
Assessments			
<ul style="list-style-type: none"> • Topic worksheets • Section Quizzes and Tests • Observation Assessment/Lab Activities • Writing Tasks/Lab Reports • Projects/Performing Assessment 			
21st Century Skills			
X	Creativity	X	Critical Thinking
X	Communication	X	Collaboration

X	Life and Career	X	Information Literacy	X	Media Literacy
	Skills				

Interdisciplinary Connections

- Math: Conversions to metric & to scale. Map reading.
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Time Frame	4 days
Topic	
7 – The Formation of the Ocean	
Essential Questions	
<ul style="list-style-type: none"> • What events are associated with crustal movements? • What is Wegener’s theory? • How did the discovery of mid-ocean ridges, trenches, and transform faults support Wegener’s theory? 	
Enduring Understandings	
<ul style="list-style-type: none"> • The ocean is the dominant physical feature on our planet Earth • There is one ocean with many ocean basins • An ocean basin’s size, shape, and features vary due to the movement of Earth’s lithospheric plates • Earth’s highest peaks, deepest valleys, and flattest vast plains are all in the ocean • Sea level changes over time have expanded and contracted continental shelves, created and destroyed inland seas and shaped the surface of land • Tectonic activity, sea level changes, and force of wave influence the physical structure and landforms of the coast • Understanding the ocean is more than a matter of curiosity 	
Alignment to NJSL-S	
HS-ESS2-1	HS-ESS3-1
HS-ESS2-2	HS-ESS3-4
HS-ESS2-4	HS-ESS3-5
HS-ESS2-6	HS-ESS3-6
Key Concepts and Skills	
<ul style="list-style-type: none"> • Explain the Theory of Plate Tectonics by describing the processes involved , the geologic features used as supporting evidence and the major changes I Earth’s crust that have occurred as a result of crustal movements • Use the development of the Theory of Plate Tectonics to discuss how scientific ideas and research evolve into a unified theory • Identify the major layers of the Earth 	
Learning Activities	
<ul style="list-style-type: none"> • Experiment – Exploring Oceanic Evidence for Plate Tectonics • Experiment – Plate Tectonics View and discuss an animation of the beak up of Pangaea and recall prior knowledge of the Theory of Plate Tectonics • Exam maps of changes in Earth’s continents over geologic time • Analyze primary source documents to understand the development of the Theory of Plate Tectonics • Relate crustal movement to active areas of scientific research • Design a research plan to extend exploration of a plate tectonics-related topic □ Video – If We Had No Moon – Discovery 	
Assessments	

- Topic worksheets
- Section Quizzes and Tests
- Observation Assessment/Lab Activities Writing Tasks/Lab Reports
- Projects/Performing Assessment

21st Century Skills

X	Creativity	X	Critical Thinking	X	Communication	X	Collaboration
X	Life and Career Skills		Information Literacy	X	Media Literacy		

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Time Frame	5 days
Topic	
8 – Seasons of Change	
Essential Questions	
<ul style="list-style-type: none"> • Why the Polar Bear Club is named The Polar Bear Club? • Why were the Winter and Summer Solstices so important to ancient people? • How does knowledge of the changing seasons compare to that of ancient cultures that started many of the Solstice traditions? • Where do the rays appear to hit the Earth’s surface most directly, by striking at an angle perpendicular to the surface? • If Earth were not tilted, would the amount of energy received at different latitudes vary from each other? • At what time of year do the Northern and Southern Hemispheres appear to be mirror image of one another? 	
Enduring Understandings	
<ul style="list-style-type: none"> • The ocean is the dominant physical feature on our planet Earth • The ocean covers approximately 70% of the planet’s surfaced • There is one ocean with many ocean basins • An ocean basin’s size, shape, and features vary due to the movement of Earth’s lithospheric plates • Earth’s highest peaks, deepest valleys, and flattest vast plains are all in the ocean • Sea level changes over time have expanded and contracted continental shelves, created and destroyed inland seas and shaped the surface of land • Understanding the ocean is more than a matter of curiosity 	
Alignment to NJSL-S	
HS-ESS2-1	HS-ESS3-1
HS-ESS2-2	HS-ESS3-4
HS-ESS2-4	HS-ESS3-5
HS-ESS2-6	HS-ESS3-6
Key Concepts and Skills	
<ul style="list-style-type: none"> • Explain seasonal changes on Earth in terms of the intensity of solar radiation energy and the Earth’s tilt • Understand that Earth’s slightly varying distance from the Sun has nothing to do with the cause of the seasons • Illustrate how the angle of insolation relates to differential heating of the Earth’s surface • Differentiate between types of incoming solar radiation • Give examples of how marine mammals respond to seasonal clues 	
Learning Activities	
<ul style="list-style-type: none"> • Experiment – Surface Area Measuring • Experiment – Modeling the Seasons • Experiment – It’s All About the Rays • Discuss the Polar Bear Club • Model Earth’ revolution around the Sun and the changes in insolation with respect to latitude • Quantify how the angle of insolation affects locations on Earth • List examples of tracks of animals that migrate seasonally and animals that do not • Draw a diagram to show the reasons for Earth’s seasons 	
Assessments	

- Topic worksheets
- Section Quizzes and Tests
- Observation Assessment/Lab Activities
- Writing Tasks/Lab Reports
- Projects/Performing Assessment

21st Century Skills

X	Creativity	X	Critical Thinking	X	Communication	X	Collaboration
X	Life and Career Skills	X	Information Literacy	X	Media Literacy		

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Time Frame	4 days
Topic	
9 – The Sea Surface: the great energy distributor	
Essential Questions	
<ul style="list-style-type: none"> • Does the ocean have the same temperature everywhere? • How do you know? • Would the temperature of the ocean ever go below zero degrees Celsius? • Could the air temperature over the sea ice be lower than zero degrees Celsius? • When might buoys provide more useful information than satellites? • How might buoy data be used by fishers and boaters? • How do the SST's compare off the East and West Coasts at 35° North? • For what other reason might currents curve or change directions from those of the prevailing winds? 	
Enduring Understandings	
<ul style="list-style-type: none"> • Throughout the ocean there is one interconnected circulation system powered by wind, tides, the force of the Earth's rotation • The shape of ocean basins and adjacent land masses influence the path of circulation • The ocean has had, and will continue to have, a significant influence on climate change by absorbing, storing, and moving heat, carbon, and water • New technologies, sensors, and tools are expanding our ability to explore the ocean • Use of mathematical models is now an essential part of ocean sciences 	
Alignment to NJSL-S	
HS-ESS2-1	HS-ESS3-1
HS-ESS2-2	HS-ESS3-4
HS-ESS2-4	HS-ESS3-5
HS-ESS2-6	HS-ESS3-6
Key Concepts and Skills	
<ul style="list-style-type: none"> • Indicate that energy in the ocean is distributed through currents • Identify sea surface temperatures (SST) and ocean currents from satellite imagery • Explain how Earth's ocean basins are interconnected through the flow of currents • Define terms including current, gyre, and Coriolis Effect • Relate changes in SSTs to changes in animal movements 	
Learning Activities	
<ul style="list-style-type: none"> • Experiment – Investigating Warm and Cold Water • Activity – National Buoy Center & data collection • Create a false color image of data provided by the e-Tools web site • View a demonstration and animation of the flow of cold and warm water currents • Relate surface currents to winds • Explain how ocean currents redistribute energy 	
Assessments	
<ul style="list-style-type: none"> • Topic worksheets • Section Quizzes and Tests • Observation Assessment/Lab Activities • Writing Tasks/Lab Reports • Projects/Performing Assessment 	

21st Century Skills

X	Creativity	X	Critical Thinking	X	Communication	X	Collaboration
X	Life and Career Skills	X	Information Literacy	X	Media Literacy		

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Time Frame	5 days			
Topic				
10 – Energy and the Ocean				
Essential Questions				
<ul style="list-style-type: none"> • Why is the air temperature sometimes cooler than the water at the beach? • How did the ocean get so warm? • Why do you think Denmark can get so much of its electrical power from the wind? • How are wind power density maps important? 				
Enduring Understandings				
<ul style="list-style-type: none"> • The ocean has had, and will continue to have, a significant influence on climate change by absorbing, storing , and moving heat, carbon, and water • Over the last 40 years, use of ocean resources has increased significantly, therefore the future sustainability of ocean resources depends on our understanding of those resources and their potential and limitations • New technologies, sensors, and tools are expanding our ability to explore the ocean • Ocean scientist are relying more and more on satellites , drifters, buoys, subsea observatories, and unmanned submersibles • Use of mathematical models is now an essential part of ocean sciences 				
Alignment to NJSL-S				
	HS-ESS2-1	HS-ESS3-1		
	HS-ESS2-2	HS-ESS3-4		
	HS-ESS2-4	HS-ESS3-5		
	HS-ESS2-6	HS-ESS3-6		
Key Concepts and Skills				
<ul style="list-style-type: none"> • Explain the concept of heat capacity and the role of the ocean in moderating Earth’s climate • Differentiate between open, closed, and isolated systems • Demonstrated the Law of Conservation of Energy in various scenarios of energy transformation 				
Learning Activities				
<ul style="list-style-type: none"> • Experiment – Investigating Heat Flow • Experiment – Law of Conservation of Energy • Experiment – The Ocean Helps Support Life • Relate heat capacity of the ocean to Earth’s habitability • Activity – Human Thermometer Simulation • Discuss energy transformations in terms of the Law of Conservation of Energy • Describe how energy is converted to different forms within the Earth system 				
Assessments				
<ul style="list-style-type: none"> • Topic worksheets • Section Quizzes and Tests • Observation Assessment/Lab Activities • Writing Tasks/Lab Reports • Projects/Performing Assessment 				
21st Century Skills				
X	Creativity	X	Critical Thinking	X
		X	Communication	X
				X
				Collaboration

X	Life and Career Skills	X	Information Literacy	X	Media Literacy
Interdisciplinary Connections					
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Technology Integration					
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Time Frame	5 days
Topic	
11 – Weather, Climate, and the Ocean	
Essential Questions	
<ul style="list-style-type: none"> • Explain the science behind hurricanes? • What experiences do you have with hurricanes? • What causes hurricanes to develop? • Why should we discuss weather and climate in a marine science course? • Which air masses develop over the ocean? • How are they different? • Why does it make sense to study hurricanes in a marine science course? 	
Enduring Understandings	
<ul style="list-style-type: none"> • The ocean controls weather and climate by dominating the Earth’s energy, water, and carbon systems • The ocean absorbs much of the solar radiation reaching Earth • The ocean loses heat by evaporations • Most rain that falls on land originally evaporated from the tropical ocean • The ocean has had and will continue to have, a significant influence on climate changes by absorbing, storing, and moving heat, carbon and water • The ocean affects every human life • New technologies, sensors, and tools are expanding our ability to explore the ocean • Ocean exploration is truly interdisciplinary 	
Alignment to NJSL-S	
HS-ESS2-1	HS-ESS3-1
HS-ESS2-2	HS-ESS3-4
HS-ESS2-4	HS-ESS3-5
HS-ESS2-6	HS-ESS3-6
Key Concepts and Skills	
<ul style="list-style-type: none"> • Explain how pressure, temperature, density, salinity, and light change with increasing depth • Describe the characteristics of some animals that allow them to cope with changes in pressure, temperature, density, salinity, and light • Analyze and interpret plots of density, salinity, pressure, and temperature with respect to depth at various locations 	
Learning Activities	
<ul style="list-style-type: none"> • Experiment – Investigating Hurricane Data • Experiment – Air Temperature and Water Vapor • Activity – Analyzing Weather and Climate Data • Read about the construction and use of submersibles • Plot and analyze temperature, pressure, salinity, and density data with respect to depth • Discuss the changes in the physical parameters with increasing depth and how diving animals cope with these conditions • Compare observed data for several parameters at different sites • Make predictions about how parameters would vary in tropical and polar seas 	
Assessments	

- Topic worksheets
- Section Quizzes and Tests
- Observation Assessment/Lab Activities
- Writing Tasks/Lab Reports
- Projects/Performing Assessment

21st Century Skills

X	Creativity	X	Critical Thinking	X	Communication	X	Collaboration
X	Life and Career Skills	X	Information Literacy	X	Media Literacy		

Interdisciplinary Connections

- Math: Conversions to metric & to scale. Map reading.
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Technology Integration

- PowerPoint Presentations
- Data Projector
- Elmo Incorporation
- DVD/VHS/Disc Demonstration
- YouTube Content Shorts
- Each Class Has 12 Student Computers and the Use of Lap Top Computer Carts
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Time Frame	3 days						
Topic							
12 – Voyage to the Deep							
Essential Questions							
<ul style="list-style-type: none"> • Have you ever experience temperature differences in a pool or other body of water? • What happens to you as you travel from the surface to the bottom of the pool? • How does the angle of insolation vary seasonally? • How does this affect the ocean? 							
Enduring Understandings							
<ul style="list-style-type: none"> • Throughout the ocean there is one interconnected circulation system powered by wind, tides, the force of the Earth’s rotation and water density differences. • The shape of ocean basins and adjacent land masses influence the path of circulation • The ocean has had, and will continue to have, a significant influence on climate change by absorbing, storing , and moving heat, carbon and water 							
Alignment to NJSLS-S							
		HS-ESS2-1		HS-ESS3-1			
		HS-ESS2-2		HS-ESS3-4			
		HS-ESS2-4		HS-ESS3-5			
		HS-ESS2-6		HS-ESS3-6			
Key Concepts and Skills							
<ul style="list-style-type: none"> • Explain how pressure, temperature, density, salinity, and light change with increasing depth • Describe the characteristics of some animal that allow them to cope with changes in pressure, temperatures, density, salinity, and light • Analyze and interpret plots of density, salinity, pressure, and temperature with respect to depth at various locations 							
Learning Activities							
<ul style="list-style-type: none"> • Experiment – Modeling changes in water temperatures • Activity – Changes with Depth • Plot and analyze temperature, pressure, salinity, and density data with respect to depth • Discuss the changes in the physical parameters with increasing depths and how diving animals cope with these conditions • Compare data for several parameter at different sites 							
Assessments							
<ul style="list-style-type: none"> • Topic worksheets • Section Quizzes and Tests • Observation Assessment/Lab Activities • Writing Tasks/Lab Reports • Projects/Performing Assessment 							
21st Century Skills							
Creativity	X	Critical Thinking	X	Communication	X	Collaboration	X
Life and Career Skills	X	Information Literacy	X	Media Literacy	X		
Interdisciplinary Connections							

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Time Frame | 3 days**Topic**

14 – Biodiversity in the Ocean

Essential Questions

- Which land ecosystems have high biodiversity?
- Which have low biodiversity?
- Why is biodiversity important?
- Are zooplankton autotrophs or heterotrophs?
- What characteristics differentiate species from one another?
- Which characteristics of organisms are not used by scientists for classification?
- Why might it benefit some species to spend their juvenile time among the plankton community?

Enduring Understandings

- The first life is thought to have started in the ocean
- The earliest evidence of life is found in the ocean
- Ocean life ranges in size from the smallest virus to the largest animal that has lived on Earth, the blue whale
- Most life in the ocean exists as microbes
- Microbes are the most important primary producers in the ocean
- There are deep ocean ecosystems that are independent of energy from sunlight and photosynthetic organisms
- Hydrothermal vents, submarine hot springs, and methane cold seeps rely only on chemical energy and chemosynthetic organism to support life

Alignment to NJSL-S

HS-ESS2-1	HS-ESS3-1
HS-ESS2-2	HS-ESS3-4
HS-ESS2-4	HS-ESS3-5
HS-ESS2-6	HS-ESS3-6

Key Concepts and Skills

- Discuss the importance of biodiversity and provide examples of diverse organisms in the ocean
- Describe the system of classification used by biologists
- Classify organisms based on their characteristics
- Analyze the similarities and differences between major groups of organisms
- Explain how the structures of marine organisms support their functions
- Identify the characteristics that all living things share

Learning Activities

- Experiment - Plankton Exploration
- Experiment – The Tree of Life
- Activity – The Kingdoms of Life
- Discuss the importance of biodiversity in the Earth system
- Use a cyber-lab to analyze the characteristics of plankton
- Compare and contrast the characteristics of major groups of organism
- Conduct a field investigation of the plankton in a scummy pond

Assessments

- Topic worksheets
- Section Quizzes and Tests
- Observation Assessment/Lab Activities
- Writing Tasks/Lab Reports
- Projects/Performing Assessment

21st Century Skills

X	Creativity	X	Critical Thinking	X	Communication	X	Collaboration
X	Life and Career Skills	X	Information Literacy	X	Media Literacy		

Interdisciplinary Connections

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Time Frame	5 days						
Topic							
15 – Marine Populations							
Essential Questions							
<ul style="list-style-type: none"> • How can we explain the population increase around 1350 C.E.? • Why does increasing human population have an effect on ecosystems? • Why is it important to understand the ways in which populations are distributed? • What do you think of the Endangered Species Act? 							
Enduring Understandings							
<ul style="list-style-type: none"> • Although the ocean is large, it is finite and resources are limited • Ocean biology provides many unique examples of life cycles, adaptations, and important relationships among organisms that do not occur on land • Everyone is responsible for caring for the oceans • The ocean sustains life on Earth, and humans must live in ways that sustain the ocean individual and collective actions are needed to effectively manage ocean resources for all 							
Alignment to NJSLS-S							
		HS-ESS2-1	HS-ESS3-1				
		HS-ESS2-2	HS-ESS3-4				
		HS-ESS2-4	HS-ESS3-5				
		HS-ESS2-6	HS-ESS3-6				
Key Concepts and Skills							
<ul style="list-style-type: none"> • Explain the concepts of carrying capacity and population density • Identify the factors that increase or decrease population sizes and analyze changes in animal populations • Describe the importance of the Endanger Species Act 							
Learning Activities							
<ul style="list-style-type: none"> • Experiment – Endangered Marine Species • Activity – Analyzing Marine Populations • Activity – Researching Endangered Species • Graph changes in human populations over time • Examine case studies of three animal species • Interpret and summarize age structure diagrams and relate them to marine animal populations 							
Assessments							
<ul style="list-style-type: none"> • Topic worksheets • Section Quizzes and Tests • Observation Assessment/Lab Activities • Writing Tasks/Lab Reports • Projects/Performing Assessment 							
21st Century Skills							
X	Creativity	X	Critical Thinking	X	Communication	X	Collaboration
X	Life and Career Skills	X	Information Literacy	X	Media Literacy		
Interdisciplinary Connections							

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Technology Integration

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Time Frame	2 days		
Topic			
16 – Population Changes			
Essential Questions			
<ul style="list-style-type: none"> Mammals that live in water (the ocean) face a survival challenge. What is it? How does fossil evidence support the idea of natural selection? How does observation of homologous structures support the idea of natural selection? How does DNA evidence support the idea of natural selection? What are some other examples of adaptations that marine organisms have that help them survive? 			
Enduring Understandings			
<ul style="list-style-type: none"> The ocean is three-dimensional, offering vast living space and diverse habitats from the surface through the water column to the seafloor. Most of the living space on Earth is in the ocean Ocean habitats are defined by environmental factors Due to interactions of abiotic factors Ocean life is not evenly distributed temporally or spatially Some regions of the ocean support more diverse and abundant life than anywhere on Earth 			
Alignment to NJSL-S			
	HS-ESS2-1	HS-ESS3-1	
	HS-ESS2-2	HS-ESS3-4	
	HS-ESS2-4	HS-ESS3-5	
	HS-ESS2-6	HS-ESS3-6	
Key Concepts and Skills			
<ul style="list-style-type: none"> Explain how the process of natural selection influences the evolution of species Determine how invasive species can result in biodiversity loss Give examples of adaptations in diverse marine ecosystems 			
Learning Activities			
<ul style="list-style-type: none"> Experiment – Modeling Changes Over Time in Sea Stars Experiment – Non-native Species Activity – Invasive Species Awareness Examine change in cetaceans over geologic time Model the process of natural selection Describe the tenets of Charles Darwin’s Theory of Evolution by Natural Selection Relate the mechanisms of natural selection to changes in populations in response to human impacts Describe how populations change over time and giving examples of adaptations in diverse marine ecosystems 			
Assessments			
<ul style="list-style-type: none"> Topic worksheets Section Quizzes and Tests Observation Assessment/Lab Activities Writing Tasks/Lab Reports Projects/Performing Assessment 			
21st Century Skills			
X	Creativity	X	Critical Thinking
X		X	Communication
X		X	Collaboration

X	Life and Career Skills	X	Information Literacy	X	Media Literacy
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Interdisciplinary Connections

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Time Frame – 1 day							
Topic							
17 – Food Webs in Action							
Essential Questions							
<ul style="list-style-type: none"> • If the North Atlantic Right Whales do not eat phytoplankton, why would it matter that the animals were located in a high phytoplankton area? • What happens to phytoplankton once they bloom? • What do you think eats phytoplankton? • Do ecosystems generally contain more producers or consumers? • What are some examples of primary/ secondary/tertiary consumers on land and in the water? 							
Enduring Understandings							
<ul style="list-style-type: none"> • Many Earth materials and geochemical cycles originate in the ocean • Ocean biology provides many unique examples of life cycles, adaptations and important relationships among organisms that do not occur on land 							
Alignment to NJSLS-S							
HS-ESS2-1		HS-ESS3-1					
HS-ESS2-2		HS-ESS3-4					
HS-ESS2-4		HS-ESS3-5					
HS-ESS2-6		HS-ESS3-6					
Key Concepts and Skills							
<ul style="list-style-type: none"> • Construct a sample marine food web • Describe the critical role of phytoplankton in marine food webs • Explain why nutrient cycling is critical within the Earth system 							
Learning Activities							
<ul style="list-style-type: none"> • Activity - Create a model food web • Experiment – Cyber lab - The Arctic Food Web • Diagram the flow of energy and nutrients through ecosystems • Observe phytoplankton and Northern Right Whale location data • Predict how changes to a food web would impact specific organisms • Identify organisms in a food web as producers, consumers, decomposers 							
Assessments							
<ul style="list-style-type: none"> • Topic worksheets • Section Quizzes and Tests • Observation Assessment/Lab Activities • Writing Tasks/Lab Reports • Projects/Performing Assessment 							
21st Century Skills							
Creativity	X	Critical Thinking	X	Communication	X	Collaboration	X
Life and Career Skills	X	Information Literacy	X	Media Literacy	X		
Interdisciplinary Connections							

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Time Frame – 2 days**Topic**

18 – Introduction to Marine Invertebrates

Essential Questions

- Why might there be more animal phyla in the ocean than on land and in other bodies of water?
- Which groups share the characteristics of radial symmetry?
- Which phylum is most interesting to you?
- What is the difference between deposit feeders and filter feeders?

Enduring Understandings

- Some major groups are found exclusively in the ocean
- The diversity of major groups of organism is much greater in the ocean than on the land
- Ocean biology provides many unique examples of life cycles, adaptations, and important relationships among organisms
- The ocean is three-dimensional, offering vast living space and diverse habitats from the surface through the water column to the sea floor.
- Most of the living space on Earth is in the ocean

Alignment to NJSL-S

HS-ESS2-1	HS-ESS3-1
HS-ESS2-2	HS-ESS3-4
HS-ESS2-4	HS-ESS3-5
HS-ESS2-6	HS-ESS3-6

Key Concepts and Skills

- Identify common organisms classified into the major invertebrate phyla
- Give examples of how the structures of marine invertebrates support their functions
- Describe diverse strategies for obtaining food in the ocean
- Analyze the internal and external anatomy of a common marine invertebrate, the squid

Learning Activities

- Experiment - Relate structures to function which dissecting a common invertebrate – the squid Activity – Invertebrate Graphic Organizer
- Activity – Investigating the Animal Kingdom
- Observe pictures of diverse organisms and predict if the picture is of a living organism
- Research one of the major invertebrate animal phyla
- Consider how some marine invertebrates accomplish the life function of nutrition

Assessments

- Topic worksheets
- Section Quizzes and Tests
- Observation Assessment/Lab Activities
- Writing Tasks/Lab Reports
- Projects/Performing Assessment

21st Century Skills

Creativity	X	Critical Thinking	X	Communication	X	Collaboration	
Life and Career Skills	X	Information Literacy	X	Media Literacy	X		

Interdisciplinary Connections

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Time Frame – 5 days							
Topic							
19 – Biology of Fishes							
Essential Questions							
<ul style="list-style-type: none"> • What patterns can be observed in fishes in similar ecosystems? • How would a fish species fare in a new ecosystem? • Why do some fish have small pectoral fins and others have large pectoral fins? • Why can't two fish species occupy the same niche? • What are some differences between bony fish and cartilaginous fish? • What are some similarities between bony fish and cartilaginous fish? 							
Enduring Understandings							
<ul style="list-style-type: none"> • Ocean biology provides many unique examples of life cycles, adaptations, and important relationships among organisms • The ocean is three-dimensional, offering vast living space and diverse habitats from the surface through the water column to the sea floor. • Most of the living space on Earth is in the ocean • From the ocean we get foods, medicines, and mineral and energy resources • The ocean provides jobs, supports out nation's economy, serves as a highway for transportation of goods and people, and plays a role in national security • The ocean is the last and largest unexplored place on Earth 							
Alignment to NJSLS-S							
		HS-ESS2-1	HS-ESS3-1				
		HS-ESS2-2	HS-ESS3-4				
		HS-ESS2-4	HS-ESS3-5				
		HS-ESS2-6	HS-ESS3-6				
Key Concepts and Skills							
<ul style="list-style-type: none"> • Identify and analyze the external structure of fish • Compare and contrast cartilaginous and bony fish • Give examples of adaptations of fish species in various marine ecosystems • Give the reasons for sharks' evolutionary success over the last 450 million years 							
Learning Activities							
<ul style="list-style-type: none"> • Experiment – Exploring the structures and Functions of Fishes • Discuss experiences with fish • Link body structure of fish with fish habitats and niches • Distinguish the difference between cartilaginous fish and bony fish • Activity – Sharks: Great Ocean Predators 							
Assessments							
<ul style="list-style-type: none"> • Topic worksheets • Section Quizzes and Tests • Observation Assessment/Lab Activities • Writing Tasks/Lab Reports • Projects/Performing Assessment 							
21st Century Skills							
X	Creativity	X	Critical Thinking	X	Communication	X	Collaboration
X	Life and Career Skills	X	Information Literacy	X	Media Literacy		

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Time Frame – 2 days							
Topic							
20 – Marine Reptiles and Birds							
Essential Questions							
<ul style="list-style-type: none"> • What do all birds have in common? • What similarities do amphibians share with fishes? • Why don't amphibians live in salt water environments? • What are some examples of birds that do not fly? 							
Enduring Understandings							
<ul style="list-style-type: none"> • The ocean is the dominant physical feature on our planet- Earth • There is one ocean with many ocean basins, such as the North Pacific, South Pacific, North Atlantic, South Atlantic, Indian, and Arctic • The ocean is three-dimensional, offering vast living space and diverse habitats from the surface through the water column to the seafloor • Most of the living space on Earth is in the ocean <p>Exploration, inquiry, and study are required to better understand ocean systems and processes</p>							
Alignment to NJSL-S							
		HS-ESS2-1	HS-ESS3-1				
		HS-ESS2-2	HS-ESS3-4				
		HS-ESS2-4	HS-ESS3-5				
		HS-ESS2-6	HS-ESS3-6				
Key Concepts and Skills							
<ul style="list-style-type: none"> • Compare and contrast the characteristics of marine reptiles and birds • Give examples of adaptations that allow some reptiles and bird species to inhabit the ocean • Explain the adaptations that allow birds to be more far –ranging than reptiles 							
Learning Activities							
<ul style="list-style-type: none"> • Experiment – Lights at Night • Observe sea turtles and marine birds via the e-tools and discuss the evolutionary connection between these two groups • Analyze the ranges and satellite tracks of some seabird and sea turtle species • Identify the specific characteristics of marine reptiles and marine birds • Examine one human impact on nesting sea turtle populations • Describe adaptations of marine reptiles and marine birds 							
Assessments							
<ul style="list-style-type: none"> • Topic worksheets • Section Quizzes and Tests • Observation Assessment/Lab Activities • Writing Tasks/Lab Reports • Projects/Performing Assessment 							
21st Century Skills							
X	Creativity	X	Critical Thinking	X	Communication	X	Collaboration
X	Life and Career Skills	X	Information Literacy	X	Media Literacy		

Interdisciplinary Connections

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Time Frame	4 days						
Topic							
21 – Marine Mammals							
Essential Questions							
<ul style="list-style-type: none"> • Why are mammals in the ocean able to grow so much larger than on land? • In what ways are field observations of marine mammals difficult for scientists? • Which marine mammals are never observed on land? • Why might Humpback Whales roll on their sides so much? 							
Enduring Understandings							
<ul style="list-style-type: none"> • Most life in the ocean exists as microbes • Ocean biology provides many unique examples of life cycles, adaptations, and important relationships among organism that do not occur on land • There are deep ocean ecosystems that are independent of energy from from sunlight and photosynthetic organisms • Hydrothermal vents, submarine hot springs, and methane cold seeps rely only on chemical energy and chemosynthetic organisms to support life 							
Alignment to NJSL-S							
	HS-ESS2-1		HS-ESS3-1				
	HS-ESS2-2		HS-ESS3-4				
	HS-ESS2-4		HS-ESS3-5				
	HS-ESS2-6		HS-ESS3-6				
Key Concepts and Skills							
<ul style="list-style-type: none"> • Describe examples of mutualism, parasitism, and commensalism in the ocean • Consider the costs and benefits of diverse reproductive strategies used by species • Record notes from secondary sources and attribute the sources of information recorded 							
Learning Activities							
Discuss							
Assessments							
<ul style="list-style-type: none"> • Topic worksheets • Section Quizzes and Tests • Observation Assessment/Lab Activities • Writing Tasks/Lab Reports • Projects/Performing Assessment 							
21st Century Skills							
X	Creativity	X	Critical Thinking	X	Communication	X	Collaboration
X	Life and Career Skills	X	Information Literacy	X	Media Literacy		
Interdisciplinary Connections							
<ul style="list-style-type: none"> • Math: Conversions to metric & to scale. Map reading. • Social Studies: All Lecture/Discussions Require the Historical Development of the Specific Topic Being Studied. • Language Arts: There is a writing component to each unit in the form of lab reports, and book questions. Additionally, each test includes an essay section. • Fine Arts: sculpture, painting, or music is used to explain and/or portray certain aspects of the main topic 							
Technology Integration							

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Time Frame – 5 days**Topic**

23 – The Ocean's Waves

Essential Questions

- What do all waves have in common?
- Where do you think waves come from?
- What happens to a wave's energy when they crash on the shoreline?
- What factors affect the size of a wave?
- What factors make Hawaii a favorite destination for surfers?
- Why are sand dunes such harsh places for plants?
- Which organism would be the first to colonize a sand dune community?

Enduring Understandings

- Erosion occurs in coastal areas as wind, waves, and currents in rivers and the ocean move sediments
- Sand consists of tiny bits of animals, plants, rocks, and minerals
- Most beach sand is eroded from land sources and carried to the coast by rivers, but sand is also eroded from coastal sources by surf
- From the ocean we get foods, medicines, and mineral and energy resources
- Humans affect the ocean in a variety of ways
- Everyone is responsible for caring for the ocean
- New technologies, sensors, and tools are expanding our ability to explore the ocean
- Ocean scientists are relying more and more on satellites, drifters, buoys, subsea observatories, and unmanned submersibles

Alignment to NJSLS-S

HS-ESS2-1	HS-ESS3-1
HS-ESS2-2	HS-ESS3-4
HS-ESS2-4	HS-ESS3-5
HS-ESS2-6	HS-ESS3-6

Key Concepts and Skills

- Use mathematical calculations as you analyze the characteristics of waves
- Determine the factors that influence wave height and wave speed
- Evaluate a proposal for constructing a wave power plant

Learning Activities

- Experiment – Produce and analyze a wave
- View pictures and videos of ocean waves
- Create a wave in the classroom
- Use mathematics to analyze waves
- Discuss the pros and cons of a proposed wave power plant

Assessments

- Topic worksheets
- Section Quizzes and Tests
- Observation Assessment/Lab Activities
- Writing Tasks/Lab Reports
- Projects/Performing Assessment

21st Century Skills

X	Creativity	X	Critical Thinking	X	Communication	X	Collaboration
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X	Life and Career Skills	X	Information Literacy	X	Media Literacy
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Interdisciplinary Connections

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Technology Integration

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Time Frame	2days						
Topic							
24- A Time for Tides							
Essential Questions							
<ul style="list-style-type: none"> • How do animals change their behavior with the tides? • Why is the Bay of Fundy an excellent area to investigate the possibility of electric power generation using tides? • Why do tidal patterns matter to boaters? • In a semidiurnal tidal pattern, how long does it take to go from high tide to low tide? • How long does it take to go from spring to neap tide? • How long does it take to go from a spring tide to spring tide? 							
Enduring Understandings							
<ul style="list-style-type: none"> • Throughout the ocean there is one interconnected circulation system powered by wind, tides, the force of the Earth’s rotation • The shape of the ocean basin and adjacent land masses influence the path of circulation • Ocean habitats are defined by environmental factors • Tides, waves, and predation cause vertical zonation patterns along the shore, influencing the distribution and diversity of organisms • Coastal regions are susceptible to natural hazards 							
Alignment to NJSLS-S							
	HS-ESS2-1		HS-ESS3-1				
	HS-ESS2-2		HS-ESS3-4				
	HS-ESS2-4		HS-ESS3-5				
	HS-ESS2-6		HS-ESS3-6				
Key Concepts and Skills							
<ul style="list-style-type: none"> • Relate tides to the alignment and natural gravitational forces of the Earth, Sun, and Moon • Distinguish between tides, currents, and waves • Give examples of how tides affect marine organisms 							
Learning Activities							
<ul style="list-style-type: none"> • Review tidal data and discuss personal experiences with tides • Analyze tide charts and make a graph of a tidal cycle 							
Assessments							
<ul style="list-style-type: none"> • Topic worksheets • Section Quizzes and Tests • Observation Assessment/Lab Activities • Writing Tasks/Lab Reports • Projects/Performing Assessment 							
21st Century Skills							
X	Creativity	X	Critical Thinking	X	Communication	X	Collaboration
X	Life and Career Skills	X	Information Literacy	X	Media Literacy		
Interdisciplinary Connections							

- Math: Conversions to metric & to scale. Map reading.
- Social Studies: All Lecture/Discussions Require the Historical Development of the Specific Topic Being Studied.
- Language Arts: There is a writing component to each unit in the form of lab reports, and book questions. Additionally, each test includes an essay section.
- Fine Arts: sculpture, painting, or music is used to explain and/or portray certain aspects of the main topic

Technology Integration

- PowerPoint Presentations
- Data Projector
- Elmo Incorporation
- DVD/VHS/Disc Demonstration
- YouTube Content Shorts
- Each Class Has 12 Student Computers and the Use of Lap Top Computer Carts
- Microsoft Office Suite 2010
- Integration of Cell Phone Usage by Students to Access Internet During Lecture/Discussions
- All Laboratory Equipment is Technology