

**Southern Cayuga Central School District – Curriculum Map**

Subject: **Marine Science**

School Year: **2021-2022**

<b>Title or Topics w/ NYS Standards</b>	<b>Essential Questions &amp; Vocabulary</b>	<b>Content Skills (Activities to cover Essential Questions)</b>	<b>Major Assessments (Tests, Project, etc.)</b>	<b>Time Frame</b>
Unit 1: Chemistry of Water  HS-PS1-3 HS-PS1-4 HS-PS1-5 HS-PS3-1	<ol style="list-style-type: none"> <li>1. Compare and Contrast the heating cooling of freshwater and salt water.</li> <li>2. Determine whether substances will float or sink in water based on densities</li> <li>3. Properties that affect marine organisms.</li> <li>4. Describe the structure of the water molecule and relate its structure to water’s unique properties.</li> <li>5. Explain the sources of salt in sea water.</li> <li>6. Explain how the properties of water affect marine organisms.</li> <li>7. Indicate that energy in the ocean is distributed through currents.</li> <li>8. Identify sea surface temperature (SST) and ocean currents from satellite imagery.</li> <li>9. Explain how Earth’s Ocean basins are interconnected through the flow of currents.</li> <li>10. Explain concept of heat capacity and the role of the ocean in moderating Earth’s climate.</li> <li>11. Differentiate between open, closed, and isolated systems.</li> <li>12. Demonstrate the Law of Conservation of Energy in various scenarios of energy transformation.</li> </ol> <p><u>Vocabulary:</u>                      Atom, molecule, bond, hydrogen bonding, density, solution, solubility, brackish, estuaries, erosion, osmosis, isolines, radiometer, buoy, current, convection, radiation, heat capacity,</p>	Demonstration: Warm and Cold Water Activity: SST Maps Demonstration: Investigating Warm and Cold Water Demonstration: Ocean Supports Life Video: Water Molecules	Lab: Freezing, Melting, and Boiling Lab: Floating and Sinking Lab: Solutions Lab: Investigating Surface Tension Lab: Investigating Heat Flow	6 Weeks

<p>Unit 2: Ecosystems</p> <p>HS-LS2-6 HS-LS2-7</p>	<ol style="list-style-type: none"> <li>1. Recognize that the ocean is not a uniform body of water.</li> <li>2. Cite examples of diverse marine ecosystems and their locations on Earth</li> <li>3. Characterize ecosystem components as abiotic and biotic factors and give examples of how they influence one another.</li> <li>4. Describe the process of biological succession, explaining that marine ecosystems undergo natural, gradual changes over time.</li> <li>5. Discuss how humans affect marine ecosystems both positively and negatively.</li> <li>6. Introduce wetlands as productive and highly diverse marine ecosystems.</li> <li>7. Identify how humans have relied upon and utilized the ocean for thousands of years.</li> <li>8. Investigate the many technologies and tools that scientists use to make observations about marine processes.</li> <li>9. Compare and contrast migratory movements of different marine animals. .</li> <li>10. Utilize mapping and plotting skills by plotting sample animal movement data.</li> <li>11. Relate satellite tagging of marine animals to principles of the nature of science.</li> <li>12. Explain how pressure, temperature, density, salinity, and light change with increasing depth.</li> <li>13. Describe the characteristics of some animals that allow them to cope with changes in pressure, temperature, density, salinity, and light.</li> </ol> <p><u>Vocabulary:</u> Biological community, ecosystem, organism, succession, latitude, longitude, uplink, downlink, satellite, remote sensing,</p>	<p>Activity: Marine Ecosystems Activity: The Ocean in History Activity: Investigating Marine Algae Activity: Plotting Animal Movements Activity: Changes with Depth</p>	<p>Lab: Modeling Changes in Water Temperature Lab: Study CTD Data</p>	<p>6 Weeks</p>
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<p>Unit 3: Oceanography</p> <p>HS-ESS1-5 HS-ESS2-1 HS-ESS2-5</p>	<ol style="list-style-type: none"> <li>1. Analyze bathymetric images and identify seafloor features.</li> <li>2. Describe how scientists map the ocean floor.</li> <li>3. Create a model of seafloor features.</li> <li>4. Explain the theory of plate tectonics by describing the process involved, the geologic features used as supporting evidence, and the major changes in Earth's crust that have occurred as a result of crustal movement.</li> <li>5. Use the development of the Theory of Plate Tectonics to discuss how scientific ideas and research evolve into a unified theory.</li> <li>6. Identify the major layers of the Earth.</li> </ol> <p><u>Vocabulary:</u> Continental slope, mid-ocean ridge, seamount, abyssal plain, submarine canyon, trench, continental shelf, continental rise, plate tectonics, subduction, convection, bathymetry,</p>	<p>Activity: Exploring Oceanic Evidence for Plate Tectonics Video: Plate Tectonics Video: Tsunamis</p>	<p>Lab: Classroom Model of the Ocean Floor Lab: SONAR</p>	<p>3 weeks</p>
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<p>Unit 4: Weather and the Ocean</p> <p>HS-PS4-1 HS-ESS1-1</p>	<ol style="list-style-type: none"> <li>1. Explain seasonal changes on Earth in terms of the intensity of solar radiation energy and the Earth's tilt, and understand that Earth's slightly varying distance from the Sun has nothing to do with the cause of the seasons.</li> <li>2. Illustrate how the angle of insolation relates to differential heating of the Earth's surface.</li> <li>3. Differentiate between types of incoming solar radiation.</li> <li>4. Give examples of how marine mammals respond to seasonal cues.</li> <li>5. Explain how energy and water are transferred from the ocean to the atmosphere through the formation of air masses and tropical weather systems.</li> <li>6. Describe how air masses, the water cycle, air pressure, and wind contribute to hurricane formation.</li> <li>7. Give examples of the ocean's influence on weather and climate.</li> <li>8. Describe how seabirds can be affected by wind patterns.</li> <li>9. Analyze the characteristics of waves using mathematical calculations.</li> <li>10. Determine the factors that influence wave height and wave speed.</li> <li>11. Evaluate a proposal for constructing a wave power plant.</li> <li>12. Relate tides to the alignment and natural gravitational forces of the Earth, Sun, and Moon.</li> <li>13. Distinguish between tides, currents, and waves.</li> <li>14. Give examples of how tides affect marine organisms.</li> </ol> <p><u>Vocabulary:</u> Solar radiation, albedo, differential heating, climate, front, leeward, wave, spring tide, neap tide, surf zone, rip current</p>	<p>Demonstration: Modeling the Seasons          Demonstration: It's all about the Rays          Activity: The Sun's Rays          Activity: Analyzing Weather and Climate          Demonstration: Human Wave          Activity: Wind and Waves          Activity: A Problem to Solve          Activity: Analyzing Tides in Three Locations</p>	<p>Cyber Lab: Investigating Hurricane Data          Cyber Lab: Air Temperature and Water Vapor          Project: Hurricane PSA</p>	<p>3 weeks</p>
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<p>Unit 5: Plant Life</p> <p>HS-LS1-5 HS-LS1-7</p>	<ol style="list-style-type: none"> <li>1. Identify the reactants and products of photosynthesis and note the sources of the reactants in the ocean.</li> <li>2. Describe how carbon is cycled through Earth's spheres.</li> <li>3. Analyze chlorophyll imagery, looking for evidence of blooms of phytoplankton that contribute to the food sources of marine animals.</li> <li>4. Discuss the importance of biodiversity and provide examples of diverse organisms in the ocean.</li> <li>5. Describe the system of classification used by biologists.</li> <li>6. Classify organisms based on their characteristics.</li> <li>7. Analyze the similarities and differences between major groups of organisms.</li> <li>8. Explain how the structures of marine organisms support their functions.</li> <li>9. Identify the characteristics that all living things share.</li> </ol> <p><u>Vocabulary:</u> Autotroph, photosynthesis, phytoplankton, cyanobacteria, ozone, chloroplast, decompose, biodiversity, population, genetic diversity, plankton, nekton, halophile, methanogen, thermophile, chemosynthesis</p>	<p>Demonstration: Observing Photosynthesis Activity: Water Samples</p>	<p>Cyberlab: Virtual Plankton Exploration Lab: Local Plankton Exploration</p>	<p>3 weeks</p>
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<p>Unit 6: Populations</p> <p>HS-LS2-1 HS-LS2-2 HS-LS2-4</p>	<ol style="list-style-type: none"> <li>1. Explain the concepts of carrying capacity and population density.</li> <li>2. Identify the factors that increase or decrease population sizes and analyze changes in animal populations.</li> <li>3. Describe the importance of the Endangered Species Act and give examples of species that are listed under the Act.</li> <li>4. Explain how the process of natural selection influences the evolution of species.</li> <li>5. Determine how invasive species can result in biodiversity loss.</li> <li>6. Give examples of adaptations in diverse marine ecosystems.</li> <li>7. Construct a sample marine food web.</li> <li>8. Describe the critical role of phytoplankton in marine food webs.</li> <li>9. Make predictions about changes in food webs that result from natural disruptions and human activities. Explain why nutrient cycling is critical within the Earth system.</li> <li>10. Describe the relationship between water temperature, and dissolved oxygen.</li> <li>11. Explain the process of upwelling and relate the process to atmospheric winds, ocean currents, eddies, and bathymetry.</li> <li>12. Identify areas of upwelling and eddies in sea surface and phytoplankton satellite imagery</li> <li>13. Relate the process of upwelling to the tracking of marine animals.</li> </ol> <p><u>Vocabulary:</u> Population, carrying capacity, population density, evolve, natural selection, species, mutation, fitness, adaptation, speciation, producer, consumer, heterotroph, trophic level, decomposer</p>	<p>Activity: Analyzing Marine Populations</p> <p>Activity: Researching Endangered Species</p> <p>Activity: Modeling Changes Over Time in Sea Stars</p> <p>Activity: Invasive Species Awareness</p> <p>Activity: North Atlantic Right Whales</p> <p>Activity: Marine Food Webs</p>	<p>Cyberlab: The Arctic Food Web</p> <p>Cyberlab: Oxygen in the Water</p>	<p>4 weeks</p>
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<p>Unit 7: Animals</p> <p>HS-LS1-3</p> <p>HS-LS1-2</p> <p>HS-LS1-5</p>	<ol style="list-style-type: none"> <li>1. Identify common organisms classified into the major invertebrate phyla.</li> <li>2. Give examples of how the structures of marine invertebrates support their functions.</li> <li>3. Describe diverse strategies for obtaining food in the ocean.</li> <li>4. Analyze the internal and external anatomy of common marine invertebrate.</li> <li>5. Identify and analyze the external structures of fish.</li> <li>6. Compare and contrast cartilaginous and bony fishes.</li> <li>7. Give examples of adaptations of fish species in various marine ecosystems.</li> <li>8. Give the reasons for sharks' evolutionary success over the last 450 million years.</li> <li>9. Compare and contrast the characteristics of marine reptiles and birds.</li> <li>10. Give examples of adaptations that allow some reptile and bird species to inhabit the ocean.</li> <li>11. Explain the adaptations that allow birds to be far more far-ranging than reptiles.</li> <li>12. Observe and describe characteristics and behaviors of marine mammals.</li> <li>13. Classify marine mammals into their major groups.</li> <li>14. Give examples of behaviors observed in marine mammals.</li> <li>15. Describe ways in which marine biologists study marine mammals.</li> <li>16. Describe examples of mutualism, parasitism, and commensalism in the ocean.</li> <li>17. Consider the costs and benefits of diverse reproductive strategies used by species.</li> </ol> <p><u>Vocabulary:</u></p>	<p>Activity: Investigating the Animal Kingdom</p> <p>Activity: Exploring the Structures and Function of Marine Fishes</p> <p>Activity: Examining the Ranges of Marine Reptiles and Birds</p> <p>Activity: Identifying Individual Whales</p> <p>Activity: Symbiotic Relationships in the Ocean</p> <p>Activity: Symbiosis Game</p>	<p>Lab: Investigating Structure and Function in the Squid</p> <p>Cyberlab: Lights at Night</p> <p>Cyberlab: Observing Marine Mammal Behavior</p> <p>Lab: 6 Animal Dissections</p>	<p>6 weeks</p>
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