Township of Ocean Schools

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Office of Teaching and Learning

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DEPARTMENT: **Science** COURSE: **Marine Science**

Curriculum Development Timeline

School: Ocean Township High School

Course: Marine Science

Department: Science

Board Approval	Supervisor	Notes
September 2012	Patrick Sullivan	Born Date
August 2013	Patrick Sullivan	Revisions
December 2017	Patrick Sullivan	Revisions
August 2018	Patrick Sullivan	Revisions
August 2019	Patrick Sullivan	Review
August 2022	Patrick Sullivan	Alignment to Standards

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Township of Ocean Pacing Guide			
Week	**Marking Period 1**	**Week**	**Marking Period 3**
1	Diving into Ocean Ecosystems	11	Photosynthesis
2	Water on Earth/Ocean Chemistry	12	Biodiversity in the Oceans
3	Water on Earth/Ocean Chemistry	13	Population Changes/Invasive Species/ Food Webs
4	The Ocean Over Time	14	Population Change/Invasive Species/Food Webs
5	Migrations in the Sea	15	Marine Invertebrates
Week	**Marking Period 2**	**Week**	**Marking Period 4**
6	Sea Floor Formation - Ocean Voyage of the Deep	16	Biology of Fish
7	The Sea Surface - The Great Energy Distributor	17	Marine Reptiles & Birds
8	Weather	18	Marine Mammals
9	Hurricanes	19	Human Impact on Marine Ecosystems
10	Waves & Tides	20	Final Project

Climate Change: The Sea Surface - The Great Energy Distributor (NJSLS-S: HS-ESS3-5)

Core Instructional & Supplemental Materials including various levels of Texts
Marine Science The Dynamic Ocean, Meghan E. Marrero Ed.D 2012 (hardcopy & virtual) **Digital Resources (D=differentiated)** Edpuzzle (D) Gizmo (D) NOAA (https://www.noaa.gov/)

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US Satellite Laboratory
Ted Talks
Phet Simulations
Science News
PBS
National Geographic

Time Frame	**1 Week**

Topic

Diving into Ocean Ecosystems

Alignment to Standards

HS-LS2-1: Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
HS-ESS3-4: Evaluate or refine a technological solution that reduces impacts of human activities on climate change and other natural systems.
HS-LS2-6: Evaluate the claims, evidence and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

Learning Objectives and Activities

Learning Objectives:

- What is Oceanography?
- What are the different ecosystems that are found in marine systems?
- The ocean is three-dimensional, offering vast living space and diverse habitats from the surface through the water column to the seafloor.
- 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.

Learning Activities:

- 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 including whales falls
- Discuss how humans affect marine ecosystems both positively and negatively
- Present results to fellow classmates on different marine ecosystems
- Project: Diving into Open Oceans - exploration of oceans and locations
- Project: Marine Ecosystem Project
- Webquest: Marine sanctuary investigation
- Activity: Whales Falls on Marine Science Dynamic Ocean (online textbook)

Assessments

Formative:
- Identifying different marine ecosystems
- How Marine sanctuaries help conserve species
- Do Now: How the ocean is vast and contains so many species
- Human impact on marine systems
- Diving into Open Oceans project
- Marine sanctuary investigation
- Ecosystems undergoing change

Summative:
- Diving into Open Oceans - google forms multiple choice assessment with short answer critical thinking
- Marine Ecosystem Project

Benchmark:
- Marine Free Response Essay

Alternative:
- Marine Ecosystem Project

Interdisciplinary Connections

ELA:
RST.11-12.1: Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions. (HS-LS2-1), (HS-LS2-2), (HS-LS2-3), (HS-LS2-6), (HS-LS2-8)

Mathematics:
HSS-ID.A.1: Represent data with plots on the real number line. (HS-LS2-6)
HSS-IC.A.1: Understand statistics as a process for making inferences about population parameters based on a random sample from that population. (HS-LS2-6)

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HSS-IC.B.6: Evaluate reports based on data. (HS-LS2-6)
Career Readiness, Life Literacies, and Key Skills
9.4.12.CI.1: Demonstrate the ability to reflect, analyze and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
Technology Integration
Career Education
CRP-5: Students understand different technologies in marine systems. **CRP-11:** Use technology to enhance productivity.

Time Frame	**2 Weeks**
Topic	
Water on Earth/Ocean Chemistry	
Alignment to Standards	
HS-LS2-2: Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. **HS-LS2-4:** Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. **HS-ESS2-5:** Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.	
Learning Objectives and Activities	
Learning Objectives: • What are the percentages of water in the ocean vs in freshwater? • What is surface tension and how does it relate to adhesion and cohesion? • How would aquatic ecosystems be different if ice formed on the bottom of these bodies of water? • Why is the sea water salty? • Why are estuaries important?	

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- The ocean is an integral part of the water cycle and is connected to all of the Earth's water reservoirs via evaporation and precipitation processes.

Learning Activities:

- 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
- Experiment: Different properties of water - surface tension, adhesion, cohesion
- Webquest: Water properties - what makes water unique?
- Experiment: Boats & Buoyancy Lab - which boat will float and which will sink?
- Experiment: A Funny Tasty Lab - taste and investigate different salty bodies of water
- Webquest: Osmoregulation and Fish - how does this affect water intake in fish?
- Simulation: Estuary card game - study the characteristics of estuaries

Assessments

Formative:

- Identifying marine ecosystems
- Edpuzzle on Cohesion, Adhesion, Surface Tension
- DO NOW – how estuaries are important marine systems
- Strategic questioning - Osmoregulation & how this affects organisms
- Properties of water

Summative:

- Water Chemistry - google forms multiple choice assessment with short answer critical thinking
- Water Station Lab
- Floating & Sinking Lab/Boats & Buoyancy Lab
- Tasty Salty Lab

Benchmark: N/A

Alternative:

- 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

Interdisciplinary Connections

ELA:

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WHST.9-12.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments or technical processes. (HS-LS2-1), (HS-LS2-2), (HS-LS2-3)

Mathematics:
HSN-Q.A.1: Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-LS2-1), (HS-LS2-2), (HS-LS2-4), (HS-LS2-7)

Career Readiness, Life Literacies, and Key Skills

Technology Integration

Career Education

CRP-1: Students understand how they can make marine systems sustainable.
CRP-2: Students use knowledge and skills through their lab work.
CRP-4: Communicate clearly and effectively and with reason.
CRP-12: Students work productively in collaborative groups using culturally global competence.

Time Frame	**2 Weeks**

Topic

The Ocean over Time/Migrations in the Sea

Alignment to Standards

HS-LS2-8: Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.
HS-LS2-7: Design, evaluate and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

Learning Objectives and Activities

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Learning Objectives:

- How have humans relied on the ocean in the past and present?
- Why do animals migrate?
- How is tagging animals important for marine research?
- The oceans are used for trade and navigation, recreation, scientific exploration, national security, marine technology and ecosystem protection and management.
- From the ocean we get foods, medicines and mineral and energy resources.
- The ocean is a source of inspiration, recreation, rejuvenation and discovery.
- Tagging marine animals helps biologists understand and conserve species.

Learning Activities:

- Identify how humans have relied upon and utilized the ocean for thousands of years
- Construct a timeline of ocean events to scale
- Understand how and why marine animals are tagged
- Activity: The Ocean in History - An Ocean Timeline
- Webquest: Human reliance on the Ocean in the past and present
- Webquest: Investigating Marine Algae - different types found
- Experiment: Plotting Animal Movements The Dynamic Ocean Lab - how migrations occur
- Video: Media clips on marine technology and Aquarius underwater habitat
- Webquest: Tagging Marine Mammals - why this is useful
- Video: Humpback Whale Documentary

Assessments

Formative:

- How have humans relied on oceans in the past?
- Do Now: technologies and tools
- Human reliance on ocean in past and present
- Tagging Marine Animals - why is this useful

Summative:

- An Ocean Timeline
- Plotting Animal Movements
- Tagging Marine Mammals Webquest

Benchmark: N/A

Alternative:

- Investigate the many technologies and tools that scientists use to make observations about ocean processes.

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Interdisciplinary Connections
ELA: **WHST.9-12.7:** Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-LS2-7) **RST.11-12.8:** Evaluate the hypotheses, data, analysis and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-LS2-6), (HS-LS2-7), (HS-LS2-8) **Mathematics:** N/A
Career Readiness, Life Literacies, and Key Skills
9.4.12.CI.2: Identify career pathways that highlight personal talents, skills and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
Technology Integration
Career Education
CRP-1: Students understand how they can make marine systems sustainable. **CRP-2:** Students use knowledge and skills through their lab work. **CRP-4:** Communicate clearly and effectively and with reason. **CRP-12:** Students work productively in collaborative groups using culturally global competence.

Time Frame	**1 Week**
Topic	
Sea Floor Formation - Ocean Voyage of the Deep	
Alignment to Standards	
HS-LS2-1: Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. **HS-LS2-2:** Use mathematical representations to support and revise explanations based on	

evidence about factors affecting biodiversity and populations in ecosystems of different scales.

Learning Objectives and Activities

Learning Objectives:

- How does the sea floor form and what are the different components found there?
- What is found in the deep ocean?
- What is echolocation and how does noise affect this?
- The sea floor is composed of different landscapes.
- It took millions of years for the ocean to form.
- Organisms are found in different zones of the ocean based on their needs and food preferences.

Learning Activities:

- Learn about continental drift and the formation of the ocean.
- Understand that during different geologic time frames oceans have changed and developed
- Media: Observe continental drift & Earth's oceans through time on media lesson - Dynamic Ocean.
- Activity: Identify different parts and features of the ocean floor.
- Experiment: Model the ocean floor utilizing clay
- Edpuzzle: Sea floor spreading
- Close Read: Case studies of Steph the Gray Seal & Miguel the Elephant - Marine textbook
- Close Read: Deep Ocean - the largest migration on earth
- Ted Talk: The Astonishing World of the Deep Ocean
- Video: Creatures of the Deep (Life Series) - different marine creatures found in ocean

Assessments

Formative:

- Do Now: Formation of ocean
- Strategic questions on continental drift
- Parts and features of ocean floor activity
- Reading Steph the Gray Seal & Miguel
- Google question: Deep Ocean analysis

Summative:

- Sea Floor Formation & Voyage of the Deep - google forms multiple choice assessment with short answer critical thinking

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- Modeling ocean floor
- Sea Floor Spreading Edpuzzle
- Geologic time scale analysis

Benchmark: N/A

Alternative:
- Create a model of the different parts of the ocean floor

Interdisciplinary Connections

ELA:
WHST.9-12.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments or technical processes. (HS-LS2-1), (HS-LS2-2), (HS-LS2-3)

Mathematics:
MP.4: Model with mathematics. (HS-LS2-1), (HS-LS2-2), (HS-LS2-4)

Career Readiness, Life Literacies, and Key Skills

9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).

Technology Integration

Career Education

CRP-1: Students understand how they can make marine systems sustainable.
CRP-2: Students use knowledge and skills through their lab work.
CRP-4: Communicate clearly and effectively and with reason.

Time Frame	**4 Weeks**

Topic

The Sea Surface - The Great Energy Distributor: Weather, Hurricanes, Waves & Tides

Alignment to Standards

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HS-LS2-8: Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.
HS-PS3-4: Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).
HS-ESS3-5: Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.

Learning Objectives and Activities

Learning Objectives:

- How do the different currents in the ocean circulate and what are the SST?
- Is the Bermuda Triangle fact or fiction?
- How do tropical cyclones form and what environmental effects do they cause?
- What are different hurricanes throughout history?
- What is the difference between Tidal and Wave Energy?
- How do organisms adapt to life in the intertidal zone?
- Throughout the ocean there is one interconnected circulation system powered by wind, tides and 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 are creating more renewable energy sources from the ocean
- Use of mathematical models is now an essential part of ocean sciences

Learning Activities:

- Define terms including current, gyre and Coriolis Effect
- Relate changes in SSTs to changes in animal movements
- Differentiate between tidal and wave energy
- Webquest: Ocean Great Distributor - how does heat transfer around oceans?
- Construct a model on the effects climate change may/will have on the oceans and its inhabitants
- Webquest: Introduction to Waves Worksheet - defining characteristics of waves
- Debate: Bermuda Triangle - is it real or pseudoscience?
- Video: Bermuda Triangle - the real truth (investigates the scientific vs pseudoscience claims)
- Project & Presentation: Tropical Cyclones - worst storms in history
- Experiment: Investigating Hurricane Data Lab - looks at temperatures and pressures found during tropical storms, depressions and hurricanes

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- Experiment: Land vs Ocean Lab - which holds heat better?
- Guest speaker: Patrick Sullivan - hurricanes and current activity
- Project: Tidal vs Wave Powerpoint - how systems work and advantages vs disadvantages
- Persuasive Waves essay
- Webquest: Life in the Intertidal Zone - how organisms adapt here
- Video: Blackfish Documentary - the truth behind killer whales ("orcas")
- Experiment: Amazing Waves Kit - how waves form and cause land erosion

Assessments

Formative:

- How does heat capacity & oceans relate? (google question)
- Strategic questioning - tidal vs wave
- Do Now: Hurricanes & their history
- How organisms adapt in intertidal zone analysis

Summative:

- Energy - multiple choice assessment with short answer critical thinking
- Amazing Waves Lab
- Heat Capacity Lab
- Persuasive Waves Essay
- Identify sea surface temperatures (SST) and ocean currents from satellite imagery

Benchmark: N/A

Alternative:

- Tropical Cyclones Project

Interdisciplinary Connections

ELA:
RST.11-12.2: Determine the central ideas or conclusions of a text; summarize complex concepts, processes or information presented in a text by paraphrasing them in simpler but still accurate terms. (HS-ESS3-5)

Mathematics:
HSN-Q.A.3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6)

Career Readiness, Life Literacies, and Key Skills

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Technology Integration
9.4.12.IML.5: Evaluate, synthesize, and apply information on climate change from various sources appropriately (e.g., 2.1.12.CHSS.6, S.IC.B.4, S.IC.B.6, 8.1.12.DA.1)
Career Education
CRP-5: Students understand different technologies in marine systems. **CRP-7:** Employ valid & reliable research strategies. **CRP-8:** Utilize critical thinking to make sense of problems and persevere in solving them. **CRP-11:** Use technology to enhance productivity.

Time Frame	**2 Weeks**
Topic	
Photosynthesis/Biodiversity in the Ocean	
Alignment to Standards	
HS-LS1-5: Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. **HS-LS2-5:** Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere and geosphere. **HS-LS2-3:** Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.	
Learning Objectives and Activities	
Learning Objectives: • What is the difference between an autotroph and a heterotroph? • What is the difference between phytoplankton and zooplankton? • Why are algal blooms harmful? • What happens to fish that are trapped in a dead zone? • Why are marine populations becoming endangered? • The earliest evidence of life is found in the ocean. • Ocean life ranges in size from the smallest plankton to the largest animal that has lived on Earth, the blue whale. • Most life in the ocean exists as microbes.	

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- Phytoplankton are the most important primary producers in the ocean.
- There are deep ocean ecosystems that are independent of energy from sunlight and photosynthetic organisms.
- Marine Biodiversity is affected by human interactions.

Learning Activities:

- 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
- Understand how human actions cause marine problems
- Experiment: Observing Photosynthesis Lab - how light affects photosynthesis; different algae species; how carbon cycle works
- Webquest: Harmful Algal blooms webquest
- Activity: Trapped in a Dead Zone - what it would like to be a fish with no oxygen
- Experiment: Oceans in a Box - different specimens found in marine life
- Virtual Lab: cyber-lab to analyze the characteristics of plankton
- Webquest: Dynamic Ocean website - Analyzing Marine Populations - how populations are increasing and decreasing of certain marine mammals
- Video: Marine Mammals - what defines a mammal and characteristics found
- Project: Endangered Species - pick an endangered species and outline why and the threat
- Video: Finding Nemo (shows impact of humans on marine life)

Assessments

Formative:

- Do Now: Biodiversity found in the ocean
- Strategic questions - what are similarities and differences between organisms?
- How human activities cause marine problems.
- Characteristics of Mammals interactive
- How autotrophs and heterotrophs obtain food analysis

Summative:

- Photosynthesis - google forms multiple choice assessment with short answer critical thinking
- Analyzing marine populations and populations increase/decrease
- Harmful Algal Blooms webquest

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- Oceans in a Box Lab
- Photosynthesis Lab

Benchmark: N/A

Alternative:
- Trapped in a Dead Zone activity
- Endangered Species Project

Interdisciplinary Connections

ELA:
WHST.9-12.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments or technical processes. (HS-LS2-1), (HS-LS2-2), (HS-LS2-3)

Mathematics: N/A

Career Readiness, Life Literacies, and Key Skills

Technology Integration

Career Education

CRP-1: Students understand how they can make marine systems sustainable.
CRP-4: Communicate clearly and effectively and with reason.
CRP-7: Employ valid & reliable research strategies.
CRP-8: Utilize critical thinking to make sense of problems and persevere in solving them.
CRP-12: Students work productively in collaborative groups using culturally global competence.

Time Frame	**2 Weeks**

Topic

Population Changes/Invasive Species/Food Webs

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Alignment to Standards

HS-LS2-1: Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
HS-LS2-7: Design, evaluate and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

Learning Objectives and Activities

Learning Objectives:

- How are marine mammals adapted for life in the ocean?
- Why are marine invasive species not welcome in the ocean?
- How do species interact in the trophic levels of a marine ecosystem?
- What are the characteristics of different marine ecosystems?
- How do symbiotic relationships exist among different marine ecosystems?
- Ocean biology provides many unique examples of life cycles, adaptations and important relationships among organisms that do not occur on land.
- The ocean is three-dimensional, offering vast living space and diverse habitats from the surface, through the water column down to the sea floor.
- Abiotic factors and biotic factors work together to create a marine ecosystem.

Learning Activities:

- Explain how predators and prey interact in an ecosystem
- Determine how invasive species result in biodiversity loss
- Give examples of adaptations in diverse marine ecosystems
- Determine different trophic levels in a marine ecosystem
- Identify different symbiotic relationships found in the ocean
- Experiment: Modeling Changes Over Time in Sea Stars - how predators and prey interact through this simulation
- Activity: Adaptations in the Sea - how different organisms adapt in ocean examples
- Ted Talk: David Gallo, Underwater Astonishments
- Project: Invasive Species Awareness - why is this a potential problem?
- Edpuzzle: Lionfish Invasive Species
- Activity: Create a Marine Food Web - utilize cards to arrange a food web and discuss trophic levels
- Virtual Lab: Dynamic Marine Ocean, Arctic Food Web - how does temperature change make up of this food web
- Activity: Symbiosis Interactive - how marine life exhibits mutualism, parasitism and commensalism

Assessments

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Formative:
- Identifying marine ecosystems
- Symbiosis Interactive
- Strategic questioning on different trophic levels in a marine ecosystem
- How invasive species result in biodiversity loss analysis
- Adaptations in the Sea

Summative:
- Population changes - google forms multiple choice assessment with short answer critical thinking
- Modeling Changes Over Time Lab
- Create a Food Web

Benchmark: N/A

Alternative:
- Invasive Species Awareness

Interdisciplinary Connections

ELA:
WHST.9-12.7: Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-LS2-7)

Mathematics:
HSN-Q.A.2: Define appropriate quantities for the purpose of descriptive modeling. (HS-LS2-1), (HS-LS2-2), (HS-LS2-4), (HS-LS2-7)

Career Readiness, Life Literacies, and Key Skills

Technology Integration

Career Education

CRP-1: Students understand how they can make marine systems sustainable.
CRP-4: Communicate clearly and effectively and with reason.

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CRP-8: Utilize critical thinking to make sense of problems and persevere in solving them.
CRP-12: Students work productively in collaborative groups using culturally global competence .

Time Frame	**2 Weeks**

Topic

Marine Invertebrates/Biology of Fish

Alignment to Standards

HS-PS3-4: Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).
HS-LS4-6: Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.
HS-ETS1-1: Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

Learning Objectives and Activities

Learning Objectives:

- What is the difference between an invertebrate and a vertebrate?
- How are invertebrates adapted to function?
- What are external and internal structures of different invertebrates and vertebrates?
- Ocean biology provides many unique examples of life cycles, adaptations and important relationships among organisms.
- Human intervention can negatively affect marine ecosystems.

Learning Activities:

- 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
- Compare differences between invertebrates and vertebrates
- Large scale commercial fishing can negatively affect marine ecosystems
- Activity: Invertebrate picture identification and research - describe different phyla
- Lab Activity: Investigating different invertebrates in an organizer - view specimen jars and determine what phylum they belong too

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- Close Read: Bioluminescence - how does this adaptation allow organisms to survive?
- Webquest: Jelly characteristics - what makes jellyfish unique and safety measures if stung
- Experiment: Clam Dissection - internal and external adaptations found
- Experiment: Trawling for Shrimp Lab - how this overfishing practice catches bycatch and how can we prevent this by creating a BRD (bycatch reduction device)
- Virtual Lab: Starfish - view the internal and external anatomy
- Experiment: Perch Dissection - how does this vertebrate different from clam and starfish
- Lab Activity: Shells & Sand Lab - different shells and sand from across the world

Assessments

Formative:

- Do Now: List differences between vertebrates and invertebrates
- Diverse ways to obtain food strategic questioning
- Large scale fishing affects marine ecosystems analysis
- Jellyfish webquest

Summative:

- Marine Invertebrates - google forms multiple choice assessment with short answer critical thinking
- Shells & Sands Lab
- Clam Dissection
- Trawling for Shrimp Lab
- Perch Lab

Benchmark: N/A

Alternative:

- Analyze the internal and external anatomy of the clam, starfish and perch

Interdisciplinary Connections

ELA:
RST.11-12.1: Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-PS3-4)
WHST.9-12.5: Develop and strengthen writing as needed by planning, revising, editing, rewriting or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-LS4-6)

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WHST.9-12.7: Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-LS4-6)

Mathematics: N/A

Career Readiness, Life Literacies, and Key Skills

9.4.12.CI.1: Demonstrate the ability to reflect, analyze and use creative skills and ideas (e.g., 1.1.12prof.CR3a).

Technology Integration

Career Education

CRP-1: Students understand how they can make marine systems sustainable.
CRP-2: Students use knowledge and skills through their lab work.

Time Frame	**2 Weeks**

Topic

Marine Reptiles, Birds & Mammals

Alignment to Standards

HS-LS2-1: Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
HS-LS2-2: Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
HS-ESS3-4: Evaluate or refine a technological solution that reduces impacts of human activities on climate change and other natural systems.

Learning Objectives and Activities

Learning Objectives:

- What are the differences between marine reptiles, birds and mammals?

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- How are mammals different from other vertebrates?
- What makes dolphins unique?
- How have whales evolved?
- What are different types of sharks?

Learning Activities:

- Compare and contrast the characteristics of marine reptiles, birds and mammals
- Give examples of adaptations that allow some reptiles and bird species to inhabit the ocean
- Investigate common behaviors of marine mammals
- Understand different evolutionary stages of whales
- Dolphins are advanced marine species that have similarities to humans
- Project: Sea Turtle Life Stages - hatchling, juvenile, sub-adult, adult
- Advertisement: Pick a Penguin for a Pet - which species would you choose
- Video: Mission Blue (Sylvia Earle's journey about exploring and protecting the ocean)
- Debate: Would you rather be a crocodile vs an alligator? Why?
- Cyber Lab: Dynamic Marine - Marine Mammal Behavior - different behaviors such as swimming and porpoise-ing in marine life
- Video: Dolphins - Spy in Pod - how dolphins can be studied through marine tagging
- Webquest: Whale Evolution - how the whale has evolved through time
- Game: Whale Migration - why whales migrate through the ocean
- Webquest: Dolphin Behavior - what specific behaviors do you find with dolphins
- Reading: Short Shark Story - characteristics of shark
- Survey: Shark Fears - what fears do you have in common?
- Table: Shark Smart - ways to protect yourself in oceans
- Project: Meet The Sharks powerpoint - different species of sharks and their location and characteristics
- Challenges: Shark Mystery - did you know these shark mysteries

Assessments

Formative:

- Do Now: How do reptiles, birds and mammals compare
- How sharks are different from whales analysis
- Dolphins and their characteristics film analysis
- How to protect against sharks
- Short Shark Story
- How whales have evolved
- Strategic questions - do you know these shark mysteries?

Summative:

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- Diving into Open Oceans - google forms multiple choice assessment with short answer critical thinking
- Dolphin Behavior webquest
- Sea Turtle Life Stages

Benchmark:
- Marine free response essay

Alternative:
- Meet the Sharks powerpoint
- Pick a Penguin for a Pet

Interdisciplinary Connections

ELA:
RST.11-12.8: Evaluate the hypotheses, data, analysis and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-ESS3-2), (HS-ESS3-4)

Mathematics:
MP.2: Reason abstractly and quantitatively. (HS-ESS3-1), (HS-ESS3-2), (HS-ESS3-3), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6)

Career Readiness, Life Literacies, and Key Skills

9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).

Technology Integration

Career Education

CRP-6: Demonstrate creativity and innovation.
CRP-7: Employ valid and reliable research strategies.
CRP-8: Utilize critical thinking to make sense of problems and persevere in solving them.

Time Frame	**2 Weeks**

Topic

Township of Ocean Schools

Assistant Superintendent
Office of Teaching and Learning

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Human Impact on Marine Ecosystems & Final Project

Alignment to Standards

HS-LS4-6: Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.
HS-ESS3-4: Evaluate or refine a technological solution that reduces impacts of human activities on climate change and other natural systems.

Learning Objectives and Activities

Learning Objectives:

- How have humans impacted marine ecosystems?
- What impact is plastic pollution having on marine systems?
- What impact does trash and offshore drilling have on marine ecosystems?
- How are watersheds, human coastlines and barrier islands affected by human interactions?
- How are Marine Protected Habitats regulated?
- How is climate change and sea level rise creating marine problems?

Learning Activities:

- We must consider and correct the problems associated with human population growth that stresses marine ecosystems.
- Experiment: Human Impact Ocean Trash - effect of garbage and oil on oceans
- Socratic Seminar: Offshore Drilling - should we allow this or be more concerned with environmental effect?
- Video: Plastic Paradise (uncovering the truth of the Great Pacific Garbage Patch)
- Human Impact on Oceans Final Project - watersheds, point pollution, nonpoint pollution, commercial fishing practices, protecting marine habitats, climate change, coastlines and barrier islands

Assessments

Formative:

- How have humans disturbed or helped marine systems - strategic questioning
- Solutions to ocean problems analysis
- Great Pacific Garbage Patch - impact on the ocean

Summative:

- Submit Ocean Analysis - Film Analysis Book
- Human Impact Ocean Trash Lab

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Benchmark:

- Marine free response essay

Alternative:

- Human Impact on Oceans Final Project

Interdisciplinary Connections

ELA:
WHST.9-12.5: Develop and strengthen writing as needed by planning, revising, editing, rewriting or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-LS4-6)

Mathematics:
HSN-Q.A.2: Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS3-1), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6)

Career Readiness, Life Literacies, and Key Skills

9.4.12.GCA.1: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political. economic, cultural) may work better than others (e.g., SL.11-12.1., HS-ETS1-1, HS-ETS1-2, HS-ETS1-4, 6.3.12.GeoGI.1, 7.1.IH.IPERS.6, 7.1.IL.IPERS.7, 8.2.12.ETW.3).

Technology Integration

9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change (e.g., NJSLSA.W1, 7.1.AL.PRSNT.4).

Career Education

CRP-1: Students understand how they can make marine systems sustainable.
CRP-2: Students use knowledge and skills through their lab work.
CRP-4: Communicate clearly and effectively and with reason.
CRP-12: Students work productively in collaborative groups using culturally global competence.

Modifications (ELL, Special Education, At Risk Students, Gifted & Talented, & 504 Plans)

ELL:

- Work toward longer passages as skills in English increase
- Use visuals
- Introduce key vocabulary before lesson
- Teacher models reading aloud daily
- Provide peer tutoring
- Use of Bilingual Dictionary
- Guided notes and/or scaffold outline for written assignments
- Provide students with English Learner leveled readers.

Supports for Students With IEPs:

- Allow extra time to complete assignments or tests
- Guided notes and/or scaffold outline for written assignments
- Work in a small group
- Allow answers to be given orally or dictated
- Use large print books, Braille, or books on CD (digital text)
- Follow all IEP modifications

At-Risk Students:

- Guided notes and/or scaffold outline for written assignments
- Introduce key vocabulary before lesson
- Work in a small group
- Lesson taught again using a differentiated approach
- Allow answers to be given orally or dictated
- Use visuals / Anchor Charts
- Leveled texts according to ability

Gifted and Talented:

- Create an enhanced set of introductory activities (e.g. advance organizers, concept maps, concept puzzles)
- Provide options, alternatives and choices to differentiate and broaden the curriculum
- Organize and offer flexible small group learning activities
- Provide whole group enrichment explorations
- Teach cognitive and methodological skills
- Use center, stations, or contracts
- Organize integrated problem-solving simulations
- Propose interest-based extension activities
- Expose students to beyond level texts.

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Supports for Students With 504 Plans:

- Follow all the 504 plan modifications
- Text to speech/audio recorded selections
- Amplification system as needed
- Leveled texts according to ability
- Fine motor skill stations embedded in rotation as needed
- Modified or constrained spelling word lists
- Provide anchor charts with high frequency words and phonemic patterns