

***MARE* Open Ocean Curricula**

Grade 5

Activity Synopsis & Concepts Correlated To the California State Science Standards

Synopsis and Key Concepts	CA State Standards Correlation
Activities from MARE/GEMS <i>Only One Ocean</i> guide	
<p><i>APPLES AND OCEANS</i></p> <p>In this activity, students first brainstorm what they know and value about the ocean and discover where most of life is found in the ocean. Students then work in pairs, using an apple and a circle graph to represent the planet. They carefully section the apple and the graph into wedges representing various critical resources on the planet. These visuals give students an immediate sense of the small proportion of the Earth that provides resources from the land and the ocean. Students then design a mini-book or other creative writing to demonstrate what they've learned.</p> <ul style="list-style-type: none"> • <i>Most of our planet is covered in ocean, but only a small fraction of the ocean supports large concentrations of life.</i> 	<p>Grade 5</p> <p>3. Earth Sciences Water on earth moves between the oceans and land through the processes of evaporation and condensation. a. Most of Earth's water is present as salt water in the oceans, which cover most of earth's surface, d. the amount of fresh water located in rivers, lakes, underground sources and glaciers is limited and its availability can be extended by recycling and decreasing the use of water.</p> <p>4. Earth Sciences Energy from the Sun heats Earth unevenly, causing air movements that result in changing weather patterns. a. uneven heating of Earth causes air (and water) movements, b. the ocean influences the weather</p> <p>Reinforces Grade 4 Life Sciences 2: All organisms need energy and matter to live and grow. a. plants are the primary source of matter and energy entering most food chains., b. producers and consumers are related in food chains and food webs and may compete with each other for resources in an ecosystem. 3: Living organisms depend on one another and on their environment for survival. a. ecosystems can be characterized by their living and nonliving components.</p> <p>Introduces Grade 6 Life Science</p> <p>5. Ecology: Organisms in ecosystems exchange energy and nutrients among themselves and with the environment. a. energy entering ecosystems as sunlight is transferred by produces into chemical energy through photosynthesis and then from organisms to organisms through food webs. b. matter is transferred over time from one organism to others in the food web and</p>

	<p>between organisms and the physical environment. c. the number and types of organisms an ecosystem can support depends on the resources available and on abiotic factors, such as quantities of light and water and a range of temperatures.</p> <p>Introduces Grade 6 Earth Science</p> <p>2. Shaping Earth’s Surface: Topography is reshaped by the weathering of rock and soil and by the transportation and deposition of sediment. b. rivers, streams (and oceans) are dynamic systems that erode, transport, change course and flood in natural and recurring patterns. c. beaches are dynamic systems in which the sand is supplied by rivers and moved along the coast by the action of waves (and currents.)</p> <p>4. Energy in the Earth System: Many phenomena on Earth’s surface are affected by the transfer of energy through radiation and convection currents. a. the sun is the major source of energy for phenomena on earth’s surface; it powers winds, ocean currents, and the water cycle.</p> <p>6. Resources: Sources of energy and materials differ in amounts, distribution, usefulness, and the time required for their formation. a. the utility of energy sources is determined by factors that are involved in converting these sources to useful forms and the consequences of the conversion process. b. there are different natural energy and material resources, including air, soil, rocks, minerals, petroleum, fresh water, wild life, and forests; they can be classified as renewable or nonrenewable.</p>
<p><i>SQUIDS—OUTSIDE AND INSIDE</i></p> <p>Students work in pairs to dissect a squid and investigate its adaptations: its structure and how all the parts function together to allow the squid to survive and thrive in its open-ocean environment. The squid is then honored as the students participate in a Calamari Festival. In the last session, the class explores the issues surrounding the squid fishery by role-playing and discussing the problem from</p>	<p>Grade 5</p> <p>2.Life Sciences:</p> <p>Plants and animals have structures for respiration, digestion, waste disposal, and transport of materials a. many multicellular organisms have specialized structures to support the transport of materials. b. blood circulates through the heart chambers, lungs, and body and carbon dioxide and oxygen are exchanged.</p> <p>6. Investigation and Experimentation g. record data by using appropriate graphic representations and make inferences based on the data</p> <p>Reinforces Grade 4 Life Sciences 3. Living organisms depend on one another and on their environment for survival. b. in any particular environment, some kinds</p>

<p>different points of view.</p> <ul style="list-style-type: none"> • <i>Pelagic creatures are organisms living in the open ocean.</i> • <i>Looking closely at an animal like the squid can tell us a lot about the adaptations needed to survive and thrive as a pelagic creature.</i> • <i>Many people depend on squids for food or for their livelihood. More discussion among these people will help create solutions to the problem of diminishing squid populations.</i> 	<p>of plants and animals survive well, some survive less well, and some cannot survive at all.</p> <p>Introduces Grade 6 Life Science</p> <p>5. Ecology: Organisms in ecosystems exchange energy and nutrients among themselves and with the environment. a. energy entering ecosystems as sunlight is transferred by produces into chemical energy through photosynthesis and then from organisms to organisms through food webs. b. matter is transferred over time from one organism to others in the food web and between organisms and the physical environment. c. the number and types of organisms an ecosystem can support depends on the resources available and on abiotic factors, such as quantities of light and water and a range of temperatures.</p> <p>Introduces Grade 6 Earth Science</p> <p>6. Resources: Sources of energy and materials differ in amounts, distribution, usefulness, and the time required for their formation. a. the utility of energy sources is determined by factors that are involved in converting these sources to useful forms and the consequences of the conversion process. b. there are different natural energy and material resources, including air, soil, rocks, minerals, petroleum, fresh water, wild life, and forests; they can be classified as renewable or nonrenewable.</p> <p>Introduces Grade 7 Structure and Function in Living Systems 5. The anatomy and physiology of plants and animals illustrate the complementary nature of structure and function</p>
<p><i>WHAT'S THE CATCH</i></p> <p>Students sample various seafoods and discuss what they know about fishing and fisheries. They read about and discuss how real people have made a difference in improving one fishery. Students then work in small groups to become the “panel of experts” on one of five fisheries that are among the most overexploited ocean resources on the planet. Each student completes a</p>	<p>Grade 5</p> <p>2.Life Sciences:</p> <p>Plants and animals have structures for respiration, digestion, waste disposal, and transport of materials a. many multicellular organisms have specialized structures to support the transport of materials. b. blood circulates through the heart chambers, lungs, and body and carbon dioxide and oxygen are exchanged.</p> <p>6. Investigation and Experimentation g. record data by using appropriate graphic representations and make inferences based on the data</p> <p>Reinforces Grade 4 Life Sciences 3. Living organisms</p>

<p>poster for a group presentation at the “World Fishery Conference” and the class makes recommendations to help manage fisheries in sustainable ways. The students are also given the opportunity to clarify their own personal decisions and choices.</p> <ul style="list-style-type: none"> • <i>Most large commercial ocean fisheries flourish where the interaction of currents and sunlight provide a productive environment.</i> • <i>Most of the ocean fisheries in the world are severely threatened due to overfishing or habitat loss, and most commercial fishing results in significant “bycatch.”</i> • <i>Personal choices about what we eat can influence public policy and the sustainability of fisheries. Scientific information should be used to help make wise choices.</i> 	<p>depend on one another and on their environment for survival. b. in any particular environment, some kinds of plants and animals survive well, some survive less well, and some cannot survive at all.</p> <p>Introduces Grade 6 Life Science 5. Ecology: Organisms in ecosystems exchange energy and nutrients among themselves and with the environment. a. energy entering ecosystems as sunlight is transferred by produces into chemical energy through photosynthesis and then from organisms to organisms through food webs. b. matter is transferred over time from one organism to others in the food web and between organisms and the physical environment. c. the number and types of organisms an ecosystem can support depends on the resources available and on abiotic factors, such as quantities of light and water and a range of temperatures.</p> <p>Introduces Grade 6 Earth Science 6. Resources: Sources of energy and materials differ in amounts, distribution, usefulness, and the time required for their formation. a. the utility of energy sources is determined by factors that are involved in converting these sources to useful forms and the consequences of the conversion process. b. there are different natural energy and material resources, including air, soil, rocks, minerals, petroleum, fresh water, wild life, and forests; they can be classified as renewable or nonrenewable.</p> <p>Introduces Grade 7 Structure and Function in Living Systems 5. The anatomy and physiology of plants and animals illustrate the complementary nature of structure and function.</p>
<p>Activities from MARE/GEMS <i>Ocean Currents</i> guide</p>	
<p><i>PLANET OCEAN</i></p> <p>Students are introduced to the vastness of our planet’s one, interconnected ocean and the importance of the ocean to all life on Earth. Students participate in a wide-ranging brainstorm about what</p>	<p>Introduces Grade 6 Earth Science 2. Shaping Earth’s Surface: Topography is reshaped by the weathering of rock and soil and by the transportation and deposition of sediment. b. rivers, streams (and oceans) are dynamic systems that erode, transport, change course and flood in natural and recurring patterns. c. beaches are dynamic systems in which the sand is supplied by rivers and moved along</p>

<p>they already know, value, and enjoy about the ocean. They work in teams to explore a globe using a global exploration worksheet as a guide.</p> <p>• <i>There is only one ocean! Our Earth is covered by one interconnected world ocean that circulates around all the continents.</i></p>	<p>the coast by the action of waves (and currents.)</p> <p>4. Energy in the Earth System: Many phenomena on Earth’s surface are affected by the transfer of energy through radiation and convection currents. a. the sun is the major source of energy for phenomena on earth’s surface; it powers winds, ocean currents, and the water cycle.</p> <p>6. Resources: Sources of energy and materials differ in amounts, distribution, usefulness, and the time required for their formation. a. the utility of energy sources is determined by factors that are involved in converting these sources to useful forms and the consequences of the conversion process. b. there are different natural energy and material resources, including air, soil, rocks, minerals, petroleum, fresh water, wild life, and forests; they can be classified as renewable or nonrenewable</p> <p>Introduces Grade 6 Life Science</p> <p>5. Ecology: Organisms in ecosystems exchange energy and nutrients among themselves and with the environment. a. energy entering ecosystems as sunlight is transferred by produces into chemical energy through photosynthesis and then from organisms to organisms through food webs. b. matter is transferred over time from one organism to others in the food web and between organisms and the physical environment. c. the number and types of organisms an ecosystem can support depends on the resources available and on abiotic factors, such as quantities of light and water and a range of temperatures.</p>
<p>WASTE DISPOSAL</p> <p>Students discuss their personal experiences with currents and then make predictions about the best and worst locations in the ocean to dispose of waste from imaginary countries. They test their ideas with a simple model of an ocean and continents. Food coloring models the waste, and ice cubes are used to model temperature differences between water masses in the ocean. The students record the movement of the “waste” and then interpret and</p>	<p>Grade 5 Investigation and Experimentation 6g. record data by using appropriate graphic representations and make inferences based on the data</p> <p>Introduces Grade 6 Earth Science</p> <p>4. Energy in the Earth System: Many phenomena on Earth’s surface are affected by the transfer of energy through radiation and convection currents. a. the sun is the major source of energy for phenomena on earth’s surface; it powers winds, ocean currents, and the water cycle.</p> <p>Introduces Grade 6 Physical Science–Heat: Heat moves in a predictable flow from warmer objects to cooler objects until all the objects are at the same</p>

<p>present their findings. Finally, the teacher uses the model ocean set on an overhead projector to show how wind sets water in motion. These wind-driven currents are projected onto a map of the Pacific Ocean Rim, modeling the major circulating patterns in the ocean.</p> <ul style="list-style-type: none"> • <i>Things dumped into the ocean may be distributed by currents throughout the ocean.</i> • <i>Wind and the temperature differences between masses of water are two factors that cause currents.</i> • <i>Winds blowing across the surface of the ocean—combined with other factors—cause major circulating currents, or gyres.</i> 	<p>temperature. a. energy can be carried from one place to another by heat flow or by waves, including water, ... or by moving objects.</p> <p>Introduces Grade 7: Investigation and Experimentation. c. communicate the logical connection among hypotheses, science concepts, tests conducted, data collected, and conclusions drawn from the scientific evidence. d. construct scale models, maps, and appropriately labeled diagrams to communicate scientific knowledge</p>
<p><i>CURRENT TRENDS</i></p> <p>This activity provides students with a range of experiences relating to salinity and temperature and model how these factors and their interactions affect density and the creation of real currents. Cooperative student groups examine the relationship between temperature, salinity, and density as rotate through three different activities and experiments set up as stations. The students create currents by combining water of different temperature and salinity, and discover how the force of the wind and differences in density affect motion at all levels. Students apply their knowledge as they make a poster describing how the station activities relate to actual currents.</p> <ul style="list-style-type: none"> • <i>Salinity and temperature</i> 	<p>Grade 5</p> <p>4. Earth Sciences Energy from the Sun heats Earth unevenly, causing air movements that result in changing weather patterns. a. uneven heating of Earth causes air (and water) movements, b. the ocean influences the weather</p> <p>6. Investigation and Experimentation 6g. record data by using appropriate graphic representations and make inferences based on the data</p> <p>Introduces Grade 6 Physical Science—Heat: Heat moves in a predictable flow from warmer objects to cooler objects until all the objects are at the same temperature. a. energy can be carried from one place to another by heat flow or by waves, including water, ... or by moving objects.</p> <p>Introduces Grade 6 Earth Science</p> <p>4. Energy in the Earth System: Many phenomena on Earth’s surface are affected by the transfer of energy through radiation and convection currents. a. the sun is the major source of energy for phenomena on earth’s surface; it powers winds, ocean currents, and the water cycle. c. currents distribute heat in the atmosphere and</p>

<p><i>differences create masses of water with different densities.</i></p> <ul style="list-style-type: none"> • <i>Gravity causes more dense water to sink below less dense water. As a result, the less dense water rises.</i> 	<p>oceans.</p> <p>Introduces Grade 7: Investigation and Experimentation. c. communicate the logical connection among hypotheses, science concepts, tests conducted, data collected, and conclusions drawn from the scientific evidence. d. construct scale models, maps, and appropriately labeled diagrams to communicate scientific knowledge. e. communicate the steps and results from an investigation in written reports and oral presentations.</p> <p>Introduces Grade 8 Density and Buoyancy All objects experience a buoyant force when immersed in a fluid. a. density is mass per unit volume. b. the density of substances can be measured using mass and volume c. predictions can be made about whether an object (or substance) will sink or float.</p>
<p>LAYERING LIQUIDS</p> <p>Students are challenged to apply information they have learned about different liquids to create four distinct layers in straw cylinders using only colored water and salt. In a followup discussion and demonstration, the concept of density is introduced at a molecular level, and students are guided to an understanding that explains the concrete phenomena they have witnessed.</p> <ul style="list-style-type: none"> • <i>The ocean is made up of layers of water of different densities.</i> • <i>Cold water is denser than warm water.</i> • <i>Water with salt is denser than fresh water.</i> • <i>The more closely packed the molecules in a substance, the denser the substance.</i> 	<p>Grade 5 6. Investigation and Experimentation 6g. record data by using appropriate graphic representations and make inferences based on the data</p> <p>Introduces Grade 8 Physical Science: Structure of Matter 3 d. the states of matter depend on molecular motion e. in solids the atoms are closely locked in position and can only vibrate; in liquids the atoms and molecules are more loosely connected and can collide with and move past one another</p> <p>Introduces Grade 8 Density and Buoyancy All objects experience a buoyant force when immersed in a fluid. a. density is mass per unit volume. b. the density of substances can be measured using mass and volume d. predictions can be made about whether an object (or substance) will sink or float.</p> <p>Introduces Grade 8 Investigation and Experimentation 9 Plan and conduct a scientific investigation to test a hypothesis</p>

<p>ICE CUBES</p> <p>This demonstration synthesizes what students have learned about density-related currents. Temperature and salinity are combined to look at the interactions that create ocean currents. Students make predictions about whether ice cubes will melt faster in fresh water or salt water and explain their reasoning. They watch an experiment and hypothesize about the results.</p> <p><i>(Students write their own key concepts for this activity.)</i></p>	<p>Grade 5</p> <p>4. Earth Sciences Energy from the Sun heats Earth unevenly, causing air movements that result in changing weather patterns. a. uneven heating of Earth causes air (and water) movements, b. the ocean influences the weather</p> <p>6. Investigation and Experimentation 6g. record data by using appropriate graphic representations and make inferences based on the data</p> <p>Introduces Grade 6 Physical Science–Heat: Heat moves in a predictable flow from warmer objects to cooler objects until all the objects are at the same temperature. a. energy can be carried from one place to another by heat flow or by waves, including water, ... or by moving objects.</p> <p>Introduces Grade 6 Earth Science</p> <p>4. Energy in the Earth System: Many phenomena on Earth’s surface are affected by the transfer of energy through radiation and convection currents. a. the sun is the major source of energy for phenomena on earth’s surface; it powers winds, ocean currents, and the water cycle. c. currents distribute heat in the atmosphere and oceans.</p> <p>Introduces Grade 8 Density and Buoyancy All objects experience a buoyant force when immersed in a fluid. a. density is mass per unit volume. b. the density of substances can be measured using mass and volume d. predictions can be made about whether an object (or substance) will sink or float.</p> <p>Introduces Grade 8 Investigation and Experimentation 9 Plan and conduct a scientific investigation to test a hypothesis</p>
<p>OCEAN ROUTES</p> <p>Students apply what they have learned about ocean currents to find the best routes for traveling across the ocean. They use information on wind-driven surface currents, density-driven deep currents, upwelling zones, and downwelling zones. Pairs of students go to</p>	<p>California History and Social Science Standards for Grade 5</p> <p>Students trace the routes of early explorers and describe the early explorations of the Americans. 1. Describe the entrepreneurial characteristics of early explorers and the technological developments that made sea exploration by latitude and longitude possible 3. Trace the routes of the major land (and sea) explorers... the distances traveled by explorers, and the trade routes.</p>

<p>different stations around the room at their own pace, drawing routes on their data sheet maps with colored pens. Students then share their ideas and routes and the actual routes are then discussed.</p>	
<p><i>MESSAGE IN A BOTTLE</i></p> <p>In this embedded assessment activity, students use world currents maps and the knowledge they have gained to make up their own fictional stories involving ocean currents. Students use their stories to express the main things they have learned about the ocean including information on ocean currents, their causes and effects; as well as discussing information relating to wind, density, temperature and salinity.</p>	<p>California Language Arts Standards Grade 5-8 1.0 Writing Strategies and 2.0 Writing Applications</p>
<p><i>SUPPLEMENTAL ACTIVITIES</i></p>	
<p><i>THE GREAT PLANKTON RACE</i></p> <p>Students observe, sketch and categorize a diversity of plankton from video footage and transparency cutouts and focus on the adaptations to slow down how fast they sink. Students then construct plankton models from materials of various shapes and densities to simulate adaptations, which slow sinking. They then “race” their models and calculate and graph sinking rates. The students then make increasingly detailed observation of live plankton and relate what they have learned about plankton adaptations to the living organism.</p> <p>• <i>Plankton have adaptations which</i></p>	<p>Grade 5 6. Investigation and Experimentation: a. classify objects in accordance with appropriate criteria. c. plan and conduct a simple investigation, g. record data.</p> <p>Reinforces Grade 4 Life Sciences 3. Living organisms depend on one another and on their environment for survival. b. in any particular environment, some kinds of plants and animals survive well, some survive less well, and some cannot survive at all.</p>

<p><i>help them avoid sinking below the sunlit photic zone.</i></p>	
<p>WHALE WITH CLASS</p> <p>In this activity, students first discuss what they already know about mammals and then work with a partner to change a terrestrial mammal so that it is adapted to a completely aquatic environment. The general categories of changes the students suggest are then used to describe marine mammal adaptations to the ocean. Students then take on the role of a specific body part of a whale and put all the parts together in a choreographed production demonstrating several behaviors and adaptations in a “movable whale” with the entire class. Finally, students work with a partner and choose a terrestrial mammal for which they make several drawings with written descriptions, each one 10 million years apart, until their animal is a highly specialized marine mammal.</p> <ul style="list-style-type: none"> • <i>Evolution is change in an organism over time.</i> • <i>Over 50 million years, whales have evolved from land mammals into ocean mammals.</i> 	<p>Grade 5</p> <p>2. Life Sciences: Plants and animals have structures for respiration, digestion, waste disposal, and transport of materials a. many multicellular organisms have specialized structures to support the transport of materials. b. blood circulates through the heart chambers, lungs, and body and carbon dioxide and oxygen are exchanged</p> <p>Reinforces Grade 4 Life Sciences 3. Living organisms depend on one another and on their environment for survival. b. in any particular environment, some kinds of plants and animals survive well, some survive less well, and some cannot survive at all.</p> <p>Introduces Grade 7 Evolution Biological evolution accounts for the diversity of species developed through gradual processes over many generations.3e. extinction of a species occurs when the environment changes, and the adaptive characteristics of a species are insufficient for its survival.</p>
<p>BUILDAN OPEN OCEAN</p> <p>Students review what they have learned about open ocean organisms and take a virtual field trip while keeping “field notes” with a partner. Students then research an open ocean organ ism, complete a page for the class Field Guide, and participate in presentations to the</p>	<p>Grade 5</p> <p>6. Investigation and Experimentation a. classify objects in accordance with appropriate criteria. g. record data by using appropriate graphic representations and make inferences based on those data. i. write a report that includes conducting tests, collecting data or examining evidence, and drawing conclusions</p> <p>Introduces Grade 6 Life Science</p> <p>5. Ecology Organisms in ecosystems exchange energy</p>

<p>class. Students then transform the classroom into an open ocean as they create 3-dimensional organisms.</p> <ul style="list-style-type: none"> • <i>The open ocean is home to many different organisms that interact with one another as predators, prey or competitors.</i> 	<p>and nutrients among themselves and with the environment. a. energy entering ecosystems as sunlight is transferred by produces into chemical energy through photosynthesis and then from organisms to organisms through food webs. b. matter is transferred over time from one organism to others in the food web and between organisms and the physical environment. c. the number and types of organisms an ecosystem can support depends on the resources available and on abiotic factors, such as quantities of light and water and a range of temperatures.</p> <p>Introduces Grade 7 Investigation and Experimentation 7. b. use a variety of print and or resources to collect information and evidence as part of a research project. d. construct scale models, maps and labeled diagrams to communicate scientific knowledge</p> <p>Reinforces Grade 4 Life Sciences 3. Living organisms depend on one another and on their environment for survival.</p>
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Overview

- **Life Science 2a, b** [*Squid, What's the Catch, Whale with Class*]
- **Earth Science 3a,d; 4a, b** [*Apples and Oceans*]; 4a,b [*Current Trends, Ice Cubes*]
- **Invest, & Exper. 6a, c, g** [*Great Plankton Race*]; **6g** [*What's the Catch, Waste Disposal, Current Trends, Layering Liquids, Ice Cubes*]; **6a, g, i** [*Build an Open Ocean*]
- **Reinforces Grade 4 Life Science 2a,b, 3a** [*Apples and Oceans*]; **3b** [*Squid, What's the Catch, Great Plankton Race, Whale with Class, Build an Open Ocean*]
- **Introduction to Grade 6 Physical Science – Heat** [*Waste Disposal, Current Trends, Ice Cubes*]
- **Introduction to Grade 6 Earth Science**
 - Shaping Earth's Surface 2b,c** [*Apples and Oceans, Planet Ocean*]
 - Energy in Earth System 4a, c** [*Apples and Oceans, Planet ocean, Current Trends, Waste Disposal, Ice Cubes*]
 - Resources 6a,b** [*Apples and Oceans, Planet Ocean, What's the Catch*]
- **Introduction to Grade 6 Life Science**
 - Ecology 5a, b, c** [*Apples and Oceans, Planet Ocean, What's the Catch, Build an Open Ocean*]
- **Introduction to Grade 7 Structure and Function** [*Squid, What's the Catch*]
- **Introduction to Grade 7 Evolution 3e** [*Whale With Class*]
- **Introduction to Grade 7 Invest. & Exper. 7c, d** [*Waste Disposal*]; **7c, d, e** [*Current Trends*]; **7b,d** [*Build an Open Ocean*]

Introduction to Grade 8 Physical Science

- **Structure of Matter 3d,e** [*Layering Liquids*]
- **Density and Buoyancy 8a,b,c,d** [*Current Trends, Layering Liquids, Ice Cubes*]

Introduction to Grade 8 Invest. & Exper. 9 [*Layering Liquids, Ice Cubes*]

History and Social Studies Standards for Grade 5 # 1, 3

Language Arts Standards Grade 5 #1, 2