

California State Science Standards as addressed by

Channel Islands Marine Floating Lab

GRADE TWO

Life Sciences

2. *Plants and animals have predictable life cycles. As a basis for understanding this concept:*

a. *Students know that organisms reproduce offspring of their own kind and that the offspring resemble their parents and one another.—*

Students learn through a discussion of collected organisms, along with tactile and visual experiences with these plants and animals. A brief discussion of reproduction and common characteristics between organisms and their offspring ensues.

b. *Students know the sequential stages of life cycles are different for different animals, such as butterflies, frogs, and mice.—*

Students collect organisms directly from the ocean, and then continue with a discussion of these animals. Life cycles are often described, such as that of a crab, mussel, and fish. Students also collect plankton samples and observe the collections under a microscope. Many various species of animals and plants are often viewed at various stages in their life cycles as plankton.

c. *Students know many characteristics of an organism are inherited from the parents. Some characteristics are caused or influenced by the environment.—*

Students learn through the discussion that organisms inherit many characteristics from the parents. Habitats and niches are discussed with regard to some organisms collected to show students the importance of environment on organisms.

d. *Students know there is variation among individuals of one kind within a population.—*

Students collect organisms from the ocean and directly see similarities and differences between species. Students

directly observe variations between individuals through the tactile lab experience.

Earth Sciences

3. *Earth is made of materials that have distinct properties and provide resources for human activities. As a basis for understanding this concept:*

e. Students know rock, water, plants, and soil provide many resources, including food, fuel, and building materials, that humans use.—

Students observe the direct and indirect beneficial effects of ocean water that provides humans with valuable resources such as food.

Investigation and Experimentation

4. *Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:*

a. Make predictions based on observed patterns and not random guessing.—

Students observe many commonalities among differing species they collect. This is reinforced during the discussion and tactile experiences with the organisms collected. Students are encouraged to utilize critical thinking skills to interpret observable commonalities among the different species. This leads to discovery among students of such themes as counter-shading among fish.

b. Measure length, weight, temperature, and liquid volume with appropriate tools and express those measurements in standard metric system units.—

Students utilize specific equipment at the physical oceanography station to test aspects of the water such as depth of the water column in meters, visibility/clarity in meters, color with the Ule scale, and temperature in degrees Celsius. Also, wind direction and velocity are tested.

GRADE THREE

Physical Sciences

1. Energy and matter have multiple forms and can be changed from one form to another. As a basis for understanding this concept:

d. Students know energy can be carried from one place to another by waves, such as water waves and sound waves, by electric current, and by moving objects.—

Students learn about transference of energy through ocean waves by observing crashing waves on rocks and organisms tidal zone. The organisms living in these habitats retain special protective features, such as hard shells and strong methods of attachment to the rocks. These and other characteristics are observed and studied in the discussion, and tactile portions of the laboratory.

2. Light has a source and travels in a direction. As a basis for understanding this concept:

a. Students know sunlight can be blocked to create shadows.—

Students learn that large animals create long-casting shadows that are exaggerated in a water environment. The importance of these shadows is demonstrated with regard to view by predators and prey of the organisms. Many large animals, such as whales, have evolved keels to reduce this shadow effect.

c. Students know the color of light striking an object affects the way the object is seen.—

Through discussion, students learn that colors within white light disappear one at a time as depth increases in the water column. Therefore, some organisms may appear very different in color appearance at their normal depth than when they are observed out of the water.

Life Sciences

3. Adaptations in physical structure or behavior may improve an organism's chance for survival. As a basis for understanding this concept:

a. Students know plants and animals have structures that serve different functions in growth, survival, and reproduction.—

Students observe anatomical features of organisms collected and learn about some corresponding physiology during the discussion and tactical portions of the laboratory.

- b. Students know examples of diverse life forms in different environments, such as oceans, deserts, tundra, forests, grasslands, and wetlands.—***

Students directly observe the diversity of the oceans through the collection of organisms and the various species inevitably encountered. Each portion of the laboratory allows students to utilize critical thinking skills with regard to adaptations of animals in their specific habitats. During the discussion, students learn for example about the adaptations of a crab for survival in the ocean environment, and those of spiders on land, which are distant relatives.

Investigation and Experimentation

- 4. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:***

- c. Use numerical data in describing and comparing objects, events, and measurements.—***

The physical oceanography station allows and encourages students to utilize numerical data in describing measurements. Students measure depth of the water column, water visibility, temperature, wind direction and speed.

GRADE FOUR

Life Sciences

- 2. All organisms need energy and matter to live and grow. As a basis for understanding this concept:***
- a. Students know plants are the primary source of matter and energy entering most food chains.—***
- The plankton station allows students to observe phytoplankton under a microscope. Student learn that phytoplankton are the main producers in the oceans and therefore are the primary source of matter and energy entering the oceans food webs.
- b. Students know producers and consumers (herbivores, carnivores, omnivores, and decomposers) are related in food chains and food webs and may compete with each other for resources in an ecosystem.—***

Students learn through discussion and in the plankton laboratory about food chains and predator/prey relationships. Food chains also are described as food webs to better encompass the predator/prey relationship. Therefore, students learn that competition for food and other resources is prevalent among ocean organisms.

c. *Students know decomposers, including many fungi, insects, and microorganisms recycle matter from dead plants and animals.—*

The plankton laboratory exposes students to needs of the plankton for survival and growth. This, in turn, leads to discussion of the recycling of accessible elements, such as nitrogen and phosphorus, which are liberated from decomposing organisms by microorganisms. Then the upwelling process is discussed, which provides these essential nutrients back to the phytoplankton.

3. *Living organisms depend on one another and on their environment for survival. As a basis for understanding this concept:*

b. *Students know that in any particular environment, some kinds of plants and animals survive well, some survive less well, and some cannot survive at all.—*

Students learn through collection of marine organisms and subsequent discussion about the necessity of animals to adapt to their environment. The species that are best adapted to a certain niche survive and out-compete others that are less well adapted to the specific niche. Also, students observe that only certain types of organisms may be found in certain habitats due to their specific adaptations, as demonstrated at the mud station. Meanwhile, students question the reasons for the lack of presence of other organisms in these habitats.

d. *Students know that most microorganisms do not cause disease and that many are beneficial.—*

Mud station activities and corresponding worksheet questions encourage students to understand the necessity of beneficial microorganisms in the environment. Students learn basis methods to determine whether microorganisms are beneficial or harmful to their environment and humans. Students come to realize the vital role microorganisms have on their environment and food webs.

6. *Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:*

c. Measure and estimate the weight, length, or volume of objects.—

Multiple measurements are conducted at the physical oceanography station by the students. Actual measurements often differ greatly from estimations of the students.

GRADE FIVE

Life Sciences

2. *Plants and animals have structures for respiration, digestion, waste disposal, and transport of materials. As a basis for understanding this concept:*

a. *Students know many multicellular organisms have specialized structures to support the transport of materials.—*

Some discussion of anatomy and physiology occurs with respect to marine organisms collected. Students are then able to directly observe some of these complex structures during the tactile laboratory experiences.

Earth Sciences

3. *Water on Earth moves between the oceans and land through the processes of evaporation and condensation. As a basis for understanding this concept:*

a. *Students know most of Earth's water is present as salt water in the oceans, which cover most of Earth's surface.—*

Students learn most of the Earth's water contains salt and is located in the oceans. From this, students are encouraged to think about methods of salt removal that organisms living in the marine environment utilize to obtain necessary water from their environment.

Investigation and Experimentation

6. *Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands,*

students should develop their own questions and perform investigations. Students will:

- f. Select appropriate tools (e.g., thermometers, meter sticks, balances, and graduated cylinders) and make quantitative observations.—*

The physical oceanography station allows students to perform tests and measurements relevant to the ocean. Students utilize thermometers and other measuring devices to test a series of water characteristics that affect organisms living in the marine environment.

GRADE SIX

Focus on Earth Sciences

Heat (Thermal Energy) (Physical Sciences)

- 3. Heat moves in a predictable flow from warmer objects to cooler objects until all the objects are at the same temperature. As a basis for understanding this concept:*

- a. Students know energy can be carried from one place to another by heat flow or by waves, including water, light and sound waves, or by moving objects.—*

Students often observe sea lions above the water while resting, and some in the water with flippers and tail emerging from the water. Students learn the purpose for this is a process called thermoregulation, necessary for the survival of these animals. This allows for the removal of excess heat from the animals into the surrounding environment due to the natural flow of energy from warmer objects to cooler objects.

Ecology (Life Sciences)

- 5. Organisms in ecosystems exchange energy and nutrients among themselves and with the environment. As a basis for understanding this concept:*

- a. Students know energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis and then from organism to organism through food webs.—*

Students learn that producers in the ocean transfer energy entering ecosystems as sunlight into chemical energy through photosynthesis. The plankton station allows

students to view phytoplankton under a microscope, and to learn that these organisms are the major producers within the oceans. Students learn that phytoplankton are the base of many food webs in the marine environment. As the plankton are ingested and digested by other organisms, this chemical energy, in turn, is transferred to the subsequent organisms in the food chain.

- e. Students know 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, a range of temperatures, and soil composition.—***

Students collect marine organisms and directly see actual number and types of organisms presently in the ecosystem. Discussion follows regarding these organisms and their environment. Students realize resources available and abiotic factors have great impacts on the ecosystem.

Investigation and Experimentation

- 7. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:***

- b. Select and use appropriate tools and technology (including calculators, computers, balances, spring scales, microscopes, and binoculars) to perform tests, collect data, and display data.—***

The physical oceanography station allows students to utilize measurement tools for various tests. A worksheet is provided which encourages groups to compare and analyze data recorded. Also, at the plankton station, students collect a sample of plankton and observe the organisms under a microscope.

GRADE SEVEN

Focus on Life Sciences

Cell Biology

- 1. All living organisms are composed of cells, from just one to many trillions, whose details usually are visible only through a microscope. As a basis for understanding this concept:***

a. *Students know cells function similarly in all living organisms. –*

Students learn through discussion of collected animal and plant specimens. Macroscopic and microscopic observation of some organisms demonstrates similar cell functions through all living organisms.

Genetics

2. *A typical cell of any organism contains genetic instructions that specify its traits. Those traits may be modified by environmental influences. As a basis for understanding this concept:*

a. *Students know the differences between the life cycles and reproduction methods of sexual and asexual organisms.–*

By collection and discussion of marine species, students learn differences between sexual and asexual reproduction (i.e. budding). Students also learn about the life cycles of many marine organisms they collect.

Evolution

3. *Biological evolution accounts for the diversity of species developed through gradual processes over many generations. As a basis for understanding this concept:*

a. *Students know both genetic variation and environmental factors are causes of evolution and diversity of organisms. –*

Students observe results of evolution through collection, discussion and tactile lab experiences with a variety of marine species. The students become aware that evolution occurs over many generations and is an ongoing process guided by both genetic variation and environmental factors.

e. *Students know that extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient for its survival. –*

Students are encouraged to utilize critical thinking skills about organisms and evolution through discussion and tactile laboratory experiences.

Structure and Function in Living Systems

5. *The anatomy and physiology of plants and animals illustrate the complementary nature of structure and function. As a basis for*

understanding this concept:

- a. Students know plants and animals have levels of organization for structure and function, including cells, tissues, organs, organ systems, and the whole organism.—**

Discussion and tactile laboratory experiences with marine organisms, along with a view of plankton under a projection microscope, reinforce the complementary nature of anatomy and physiology throughout species.

Physical Principles in Living Systems (Physical Sciences)

- 6. Physical principles underlie biological structures and functions. As a basis for understanding this concept:**

- e. Students know that white light is a mixture of many wavelengths (colors) and that retinal cells react differently to different wavelengths. –**

Students utilize critical thinking skills throughout the discussion and tactile laboratory exercises with marine organisms. Adaptations of plants and animals living at various depths are shown and discussed with regard to colors within white light as they disappear to demonstrate that organisms utilize the wavelengths present at their respective depths.

- f. Students know light can be reflected, refracted, transmitted, and absorbed by matter. –**

Discussion encourages critical thinking about animals and camouflage with respect to light penetration of water. Lighter shades and colors reflect more light than darker colors, and this is demonstrated by animals and their camouflage patterns.

Investigation and Experimentation

- 7. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:**

- a. Select and use appropriate tools and technology (including calculators, computers, balances, spring scales, microscopes, and binoculars) to perform tests, collect data, and display data.—**

Students collect data through use of a series of instruments for physical oceanography. Students also collect marine plankton to view under a projection microscope.

GRADE EIGHT

Focus on Physical Sciences

Chemistry of Living Systems (Life Sciences)

6. *Principles of chemistry underlie the functioning of biological systems. As a basis for understanding this concept:*

b. Students know that living organisms are made of molecules consisting largely of carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulfur. –

During the plankton laboratory, students learn about the plankton they collect as well as the necessary elements in the ocean that are necessary for plankton and ultimately the entire food chain to thrive. Students learn about upwelling processes that replenish the surface waters of the ocean with these necessary elements (i.e. phosphorus and nitrogen).

Investigation and Experimentation

9. *Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations. Students will:*

c. Evaluate the accuracy and reproducibility of data. –

Students conduct a series of tests at the physical oceanography station including depth of water column, visibility/clarity, water color, wind velocity and direction. These tests are repeated within each group, and the supplied worksheets allow for comparisons between groups in the class.

GRADES NINE THROUGH TWELVE

Biology/Life Sciences

Cell Biology

1. *The fundamental life processes of plants and animals depend on*

a variety of chemical reactions that occur in specialized areas of the organism's cells. As a basis for understanding this concept:

- f. *Students know usable energy is captured from sunlight by chloroplasts and is stored through the synthesis of sugar from carbon dioxide. –***

Students determine the water color utilizing the Ule scale while learning about the many small photosynthetic organisms which lend to the color. The students then study the photosynthetic organisms in the plankton sample they collect under a microscope. Discussion follows regarding these organisms as a critical base of the food chain in the ocean.

Genetics

- 2. *Mutation and sexual reproduction lead to genetic variation in a population. As a basis for understanding this concept:***

- d. *Students know why approximately half of an individual's DNA sequence comes from each parent. –***

Some of the animals collected by the students and survival of species lend to discussion of sexual reproduction, where both parents supply approximately half of each individual's DNA to the offspring. Students learn that variation is encouraged as a result of meiosis and sexual reproduction.

Ecology

- 6. *Stability in an ecosystem is a balance between competing effects. As a basis for understanding this concept:***

- a. *Students know biodiversity is the sum total of different kinds of organisms and is affected by alterations of habitats. –***

The students directly observe biodiversity of the oceans through their broad collection of organisms in a comparatively small area in the harbor. Often many various species are collected. Predator-prey relationships are discussed and analyzed. Also, students learn that certain equipment and techniques for collection are less harmful to the surrounding habitat of these organisms.

- e. *Students know a vital part of an ecosystem is the stability of its producers and decomposers. –***

Students collect a plankton sample from the ocean and view the plankton under a microscope. They learn about

the vital role plankton play in ocean food webs. Students learn that phytoplankton are the major producers within the oceans of the world. The discussion continues with decomposers, such as bacteria, which break down decaying organic matter into its elements, such as nitrogen and phosphorus, to be reintroduced to the surface water and plankton through upwelling processes.

Evolution

8. ***Evolution is the result of genetic changes that occur in constantly changing environments. As a basis for understanding this concept:***
 - b. ***Students know a great diversity of species increases the chance that at least some organisms survive major changes in the environment. –***

Students learn that biodiversity is very important to the sustenance of the oceans. Through the collection of marine organisms, students see great biodiversity. Students recognize that each species fulfills its own niche. With pollution and other threats to the oceans, biodiversity allows for long term sustenance of the oceans.

Physiology

9. ***As a result of the coordinated structures and functions of organ systems, the internal environment of the human body remains relatively stable (homeostatic) despite changes in the outside environment. As a basis for understanding this concept:***
 - a. ***Students know how the complementary activity of major body systems provides cells with oxygen and nutrients and removes toxic waste products such as carbon dioxide.–***

Students observe respiratory organs, such as gills, on many of the organisms collected. Discussions of these organs lead to organ systems and methods the organisms utilize to extract wastes and procure necessary elements, such as oxygen.