



There's a Marine Biologist in my Classroom Education Standards

Session: Sharks and Their Role as Apex Predator

Ocean Literacy Principle

5d - Ocean biology provides many unique examples of life cycles, adaptations and important relationships among organisms (such as symbiosis, predator-prey dynamics and energy transfer) that do not occur on land. **(3-12 addresses concepts in depth)**

6g - Everyone is responsible for caring for the ocean. The ocean sustains life on Earth and humans must live in ways that sustain the ocean. Individual and collective actions are needed to effectively manage ocean resources for all. **(3-12 addresses concepts in depth)**

Mississippi Science Framework:

Third Grade

Inquiry

- a. Identify questions and predict outcomes that can be examined through scientific investigations.

Life Science

- c. Investigate the relationships between the basic needs of different organisms and discern how adaptations enable an organism to survive in a particular environment.

Fourth Grade

Inquiry

- f. Explain why scientists and engineers often work in teams with different individuals doing different things that contribute to the results.

Life Science

- c. Compare characteristics of organisms, including growth and development, reproduction, *acquisition and use of energy*, and response to the environment.

- Life cycles of various animals to include complete and incomplete metamorphosis
- Plant or animal *structures that serve different functions in growth, adaptation, and survival*

- e. Analyze food webs to interpret how energy flows from the sun.

Fifth Grade

Life Science

- a. Compare and contrast the diversity of organisms due to adaptations to show how organisms have evolved as a result of environmental changes.

- Diversity based on kingdoms, phyla, and classes (e.g., internal/external structure, body temperature, size, shape)
- *Adaptations that increase an organism's chances to survive and reproduce in a particular habitat (e.g., cacti needles/leaves, fur/scales)*
- Evidence of fossils as indicators of how life and environmental conditions have changed

- e. Give examples of how consumers and producers (carnivores, herbivores, omnivores, and decomposers) are related in food chains and food webs.

Sixth Grade

Inquiry

h. Recognize and analyze alternative explanations and predictions.

Life Science

a. Describe and predict interactions (among and within populations) and the effects of these interactions on population growth to include the effects on available resources.

- How cooperation, competition and predation affect population growth
- Effects of overpopulation within an ecosystem on the amount of resources available
- How natural selection acts on a population of organisms in a particular environment via enhanced reproductive success

e. Construct a diagram of the path of solar energy through food webs that include humans and explain how the organisms relate to each other.

- Autotrophs and heterotrophs, producers, consumers and decomposers
- Predator/prey relationships, competition, symbiosis, parasitism, commensalisms, mutualism

Seventh Grade

Inquiry

b. Discriminate among observations, inferences, and predictions.

e. Communicate results of scientific procedures and explanations through a variety of written and graphic methods.

Life Science

a. Assess how an organism's chances for survival are influenced by adaptations to its environment.

Earth and Space Science

d. Conclude why factors, such as lack of resources and climate can limit the growth of populations in specific niches in the ecosystem.

- Abiotic factors that affect population, growth, and size (quantity of light, water, range of temperatures, soil compositions)
- Cycles of water, carbon, oxygen, and nitrogen in the environment
- *Role of single-celled organisms (e.g., phytoplankton) in the carbon and oxygen cycles*

e. Compare and contrast how organisms obtain and utilize matter and energy.

- How organisms use resources, grow, reproduce, maintain stable internal conditions (homeostasis) and recycle waste
- How plants break down sugar to release stored chemical energy through respiration

Eighth Grade

Inquiry

d. Analyze evidence that is used to form explanations and draw conclusions.

g. Justify a scientist's need to revise conclusions after encountering new experimental evidence that does not match existing explanations.

Life Science

a. Analyze how adaptations to a particular environment (e.g., desert, aquatic, high altitude) can increase an organism's survival and reproduction and relate organisms and their ecological niches to evolutionary change and extinction.

e. Explain energy flow in a specified ecosystem.

- Populations, communities, and habitats
- Niches, ecosystems and biomes
- Producers, consumers and decomposers in an ecosystem

3rd - 5th Grade Next Generation Standards

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. (*secondary to 3-LS4-4*)

LS2.D: Social Interactions and Group Behavior

- Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size. (Note: Moved from K–2) (3-LS2-1)

LS3.B: Variation of Traits

- Different organisms vary in how they look and function because they have different inherited information. (3-LS3-1)
- The environment also affects the traits that an organism develops. (3-LS3-2)

LS4.C: Adaptation

- For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. (3-LS4-3)

6th – 8th Grade Next Generation Standards

LS2.A: Interdependent Relationships in Ecosystems

- Organism, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS-LS2-1)
- In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. (MS-LS2-1)
- Growth of organisms and population increase are limited by access to resources. (MS-LS2-1)

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health.

Session: Shark Anatomy and Dissection

Ocean Literacy Principle

5d - Ocean biology provides many unique examples of life cycles, adaptations and important relationships among organisms (such as symbiosis, predator-prey dynamics and energy transfer) that do not occur on land. **(3-12 addresses concepts in depth)**

5e - The ocean is three-dimensional, offering vast living space and diverse habitats from the surface through the water column to the seafloor. Most of the living space on Earth is in the ocean.

5i - Estuaries provide important and productive nursery areas for many marine and aquatic species.

Mississippi Science Framework

Third Grade

Life Science

- Identify and describe the purpose of the digestive, nervous, skeletal, and muscular systems of the body.
- Investigate the relationships between the basic needs of different organisms and discern how adaptations enable an organism to survive in a particular environment.

Fourth Grade

Life Science

- Classify the organs and functions of the nervous, circulatory, and respiratory systems of the body.
- Compare characteristics of organisms, including growth and development, reproduction, acquisition and use of energy, and response to the environment.

Fifth Grade

Life Science

a. Compare and contrast the diversity of organisms due to adaptations to show how organisms have evolved as a result of environmental changes.

- Diversity based on kingdoms, phyla, and classes (e.g., internal/external structure, body temperature, size, shape)
- Adaptations that increase an organism's chances to survive and reproduce in a particular habitat (e.g., cacti needles/leaves, fur/scales)

Sixth Grade

Life Science

b. Compare and contrast structure and function in living things to include cells and whole organisms.

- Hierarchy of cells, tissues, organs, and organ systems to their functions in an organism

Seventh Grade

Life Science

a. Assess how an organism's chances for survival are influenced by adaptations to its environment.

Eighth Grade

Life Science

a. Analyze how adaptations to a particular environment (e.g., desert, aquatic, high altitude) can increase an organism's survival and reproduction and relate organisms and their ecological niches to evolutionary change and extinction.

b. Compare and contrast the major components and functions of different types of cells.

- Different types of cells and tissues (e.g., epithelial, nerve, bone, blood, muscle)

3rd - 5th Grade Next Generation Standards

LS1.B: Growth and Development of Organisms

- Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles. (3-LS1-1)

PS4.B: Electromagnetic Radiation

- An object can be seen when light reflected from its surface enters the eyes. (4-PS4-2)

LS1.A: Structure and Function

- Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4-LS1-1)

LS1.D: Information Processing

- Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions. (4-LS1-2)

6th – 8th Grade Next Generation Standards

LS1.A: Structure and Function

- All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular). (MS-LS1-1)
- Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. (MS-LS1-2)
- In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions. (MS-LS1-3)

LS1.D: Information Processing

- Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories. (MS-LS1-8)

Session: Conservation Measures for Shark Populations on a Global Scale

Ocean Literacy Standards

*6d - Much of the world's population lives in coastal areas. (3-12 addresses concepts in depth)

6g - Everyone is responsible for caring for the ocean. The ocean sustains life on Earth and humans must live in ways that sustain the ocean. Individual and collective actions are needed to effectively manage ocean resources for all. (3-12 addresses concepts in depth)

*7c - Over the last 40 years, use of ocean resources has increased significantly, therefore the future sustainability of ocean resources depends on our understanding of those resources and their potential and limitations. (3-5 mentions concepts, 6-12 addresses concepts in depth)

Mississippi Science Framework

Third Grade

Inquiry

b. Identify questions and predict outcomes that can be examined through scientific investigations.

Life Science

a. Research and explain diverse life forms (including vertebrates and invertebrates) that live in different environments (e.g., deserts, tundras, forests, grasslands, taigas, wetlands) and the structures that serve different functions in their survival (e.g., methods of movement, defense, camouflage). (DOK 2)

c. Investigate the relationships between the basic needs of different organisms and discern how adaptations enable an organism to survive in a particular environment.

d. Illustrate how the adult animal will look, when given pictures of young animals (e.g., birds, fish, cats, frogs, caterpillars, etc.) (DOK 2)

e. Recall that organisms can survive only when in environments (deserts, tundras, forests, grasslands, taigas, wetlands) in which their needs are met and interpret the interdependency of plants and animals within a food chain, including producer, consumer, decomposer, herbivore, carnivore, omnivore, predator, and prey. (DOK 2)

Fourth Grade

Inquiry

e. Interpret and describe patterns of data using drawings, diagrams, charts, tables, graphs, and maps. (DOK 2)

f. Explain why scientists and engineers often work in teams with different individuals doing different things that contribute to the results. (DOK 2)

Life Science

a. Describe the cause and effect relationships that explain the diversity and evolution of organisms over time. (DOK 2)

- Observable traits due to inherited or environmental adaptations
- Variations in environment (over time and from place to place)
- Variations in species as exemplified by fossils
- Extinction of a species due to insufficient adaptive capability in the face of environmental changes

Fifth Grade

Inquiry

g. Evaluate results of different data (whether trivial or significant). (DOK 2)

Life Science

c. Research and cite evidence of the work of scientists (e.g., Pasteur, Fleming, 2010 Mississippi Science Framework Approved July 25, 2008 39 Salk) as it contributed to the discovery and prevention of disease. (DOK3)

Sixth Grade

Inquiry

g. Infer explanations for why scientists might draw different conclusions from a given set of data. (DOK 2)

h. Recognize and analyze alternative explanations and predictions.

Life Science

a. Describe and predict interactions (among and within populations) and the effects of these interactions on population growth to include the effects on available resources.

- How cooperation, competition and predation affect population growth
- Effects of overpopulation within an ecosystem on the amount of resources available
- How natural selection acts on a population of organisms in a particular environment via enhanced reproductive success

Seventh Grade

Inquiry

b. Discriminate among observations, inferences, and predictions.

e. Communicate results of scientific procedures and explanations through a variety of written and graphic methods.

Life Science

a. Assess how an organism's chances for survival are influenced by adaptations to its environment.

d. Conclude why factors, such as lack of resources and climate can limit the growth of populations in specific niches in the ecosystem.

- Abiotic factors that affect population, growth, and size (quantity of light, water, range of temperatures, soil compositions)
- Cycles of water, carbon, oxygen, and nitrogen in the environment
- *Role of single-celled organisms (e.g., phytoplankton) in the carbon and oxygen cycles*

Earth and Space Science

e. Compare and contrast how organisms obtain and utilize matter and energy.

- How organisms use resources, grow, reproduce, maintain stable internal conditions (homeostasis) and recycle waste
- How plants break down sugar to release stored chemical energy through respiration

Eighth Grade

Inquiry

d. Analyze evidence that is used to form explanations and draw conclusions.

g. Justify a scientist's need to revise conclusions after encountering new experimental evidence that does not match existing explanations.

Life Science

a. Analyze how adaptations to a particular environment (e.g., desert, aquatic, high altitude) can increase an organism's survival and reproduction and relate organisms and their ecological niches to evolutionary change and extinction.

e. Explain energy flow in a specified ecosystem.

- Populations, communities, and habitats
- Niches, ecosystems and biomes
- Producers, consumers and decomposers in an ecosystem

3-5 Next Generation Standards

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. (secondary to 3-LS4-4)

LS2.D: Social Interactions and Group Behavior

- Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size. (Note: Moved from K-2) (3-LS2-1)

LS4.A: Evidence of Common Ancestry and Diversity

- Some kinds of plants and animals that once lived on Earth are no longer found anywhere. (Note: Moved from K–2) (3-LS4-1)
- Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments. (3-LS4-1)

LS4.C: Adaptation

- For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. (3-LS4-3)

LS4.D: Biodiversity and Humans

- Populations live in a variety of habitats, and change in those habitats affects the organisms living there. (3-LS4-4)

6-8 Next Generation Standards**LS2.A: Interdependent Relationships in Ecosystems**

- Organism, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS-LS2-1)
- In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. (MS-LS2-1)
- Growth of organisms and population increase are limited by access to resources. (MS-LS2-1)

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (MS-LS2-4)

LS2.A: Interdependent Relationships in Ecosystems

- Similarly, predatory interaction may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared. (MS-LS2-5)

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health.

Session: Shark Tagging and Recapture Data, - What do we Learn?

Ocean Literacy Standards

5e - The ocean is three-dimensional, offering vast living space and diverse habitats from the surface through the water column to the seafloor. Most of the living space on Earth is in the ocean. **(3-5 addresses concepts in depth, 6-12 mentions concepts)**

5f - Ocean habitats are defined by environmental factors. Due to interactions of abiotic factors such as salinity, temperature, oxygen, pH, light, nutrients, pressure, substrate and circulation, ocean life is not evenly distributed temporally or spatially, i.e., it is “patchy”. Some regions of the ocean support more diverse and abundant life than anywhere on Earth, while much of the ocean is considered a desert. **(3-12 addresses concepts in depth)**

7d - New technologies, sensors and tools are expanding our ability to explore the ocean. Ocean scientists are relying more and more on satellites, drifters, buoys, subsea observatories and unmanned submersibles. **(3-12 addresses concepts in depth)**

7f - Ocean exploration is truly interdisciplinary. It requires close collaboration among biologists, chemists, climatologists, computer programmers, engineers, geologists, meteorologists, and physicists, and new ways of thinking. **(3-12 addresses concepts in depth)**

Mississippi Science Framework

Third Grade

Inquiry

- a. Identify questions and predict outcomes that can be examined through scientific investigations.
- d. Draw conclusions and communicate the results of an investigation. (DOK 2)
- f. Ask questions and seek answers to explain why different results sometimes occur in repeated investigations. (DOK 2)

Life Science

- a. Research and explain diverse life forms (including vertebrates and invertebrates) that live in different environments (e.g., deserts, tundras, forests, grasslands, taigas, wetlands) and the structures that serve different functions in their survival (e.g., methods of movement, defense, camouflage). (DOK 2)
 - c. Investigate the relationships between the basic needs of different organisms and discern how adaptations enable an organism to survive in a particular environment.
- e. Recall that organisms can survive only when in environments (deserts, tundras, forests, grasslands, taigas, wetlands) in which their needs are met and interpret the interdependency of plants and animals within a food chain, including producer, consumer, decomposer, herbivore, carnivore, omnivore, predator, and prey. (DOK 2)

Fourth Grade

Inquiry

- a. Form hypotheses and predict outcomes of problems to be investigated. (DOK 3)
- d. Use simple sketches, diagrams, tables, charts, and writing to draw conclusions and communicate data results. (DOK 2)
- e. Interpret and describe patterns of data using drawings, diagrams, charts, tables, graphs, and maps. (DOK 2)
- f. Explain why scientists and engineers often work in teams with different individuals doing different things that contribute to the results. (DOK 2)
- g. Draw conclusions about important steps (e.g., making observations, asking questions, trying to solve a problem, etc.) that led to inventions and discoveries. (DOK 3)

Life Science

- a. Describe the cause and effect relationships that explain the diversity and evolution of organisms over time. (DOK 2)
 - Observable traits due to inherited or environmental adaptations
 - Variations in environment (over time and from place to place)
 - Variations in species as exemplified by fossils
 - Extinction of a species due to insufficient adaptive capability in the face of environmental changes

Fifth Grade

Inquiry

- a. Form a hypothesis, predict outcomes, and conduct a fair investigation that includes manipulating variables and using experimental controls. (DOK 3)
- d. Organize and interpret data in tables and graphs to construct explanations and draw conclusions. (DOK 2)
- e. Use drawings, tables, graphs, and written and oral language to describe objects and explain ideas and actions. (DOK 2)
- g. Evaluate results of different data (whether trivial or significant). (DOK 2)

Life Science

- c. Research and cite evidence of the work of scientists (e.g., Pasteur, Fleming, 2010 Mississippi Science Framework Approved July 25, 2008 39 Salk) as it contributed to the discovery and prevention of disease. (DOK3)

Sixth Grade

Inquiry

- b. Distinguish between qualitative and quantitative observations and make inferences based on observations. (DOK 3)
- g. Infer explanations for why scientists might draw different conclusions from a given set of data. (DOK 2)
- h. Recognize and analyze alternative explanations and predictions.

Life Science

- a. Describe and predict interactions (among and within populations) and the effects of these interactions on population growth to include the effects on available resources.
 - How cooperation, competition and predation affect population growth
 - Effects of overpopulation within an ecosystem on the amount of resources available
 - How natural selection acts on a population of organisms in a particular environment via enhanced reproductive success

Seventh Grade

Inquiry

- a. Design, conduct, and draw conclusions from an investigation that includes using experimental controls. (DOK 3)
- b. Discriminate among observations, inferences, and predictions.
- e. Communicate results of scientific procedures and explanations through a variety of written and graphic methods.
- d. Organize data in tables and graphs and analyze data to construct explanations and draw conclusions. (DOK 3) e. Communicate results of scientific procedures and explanations through a variety of written and graphic methods. (DOK 2)
- f. Explain how science and technology are reciprocal. (DOK 1)
- g. Develop a logical argument to explain why scientists often review and ask questions about the results of other scientists' work. (DOK 3)
- h. Make relationships between evidence and explanations. (DOK 2)

Life Science

- a. Assess how an organism's chances for survival are influenced by adaptations to its environment.
- e. Compare and contrast how organisms obtain and utilize matter and energy.
 - How organisms use resources, grow, reproduce, maintain stable internal conditions (homeostasis) and recycle waste
 - How plants break down sugar to release stored chemical energy through respiration

Earth and Space Science

- d. Conclude why factors, such as lack of resources and climate can limit the growth of populations in specific niches in the ecosystem.
 - Abiotic factors that affect population, growth, and size (quantity of light, water, range of temperatures, soil compositions)
 - Cycles of water, carbon, oxygen, and nitrogen in the environment
 - *Role of single-celled organisms (e.g., phytoplankton) in the carbon and oxygen cycles*

Eighth Grade

Inquiry

- a. Design, conduct, and analyze conclusions from an investigation that includes using experimental controls. (DOK 3)
- b. Distinguish between qualitative and quantitative observations and make inferences based on observations. (DOK 3)
- c. Summarize data to show the cause and effect relationship between qualitative and quantitative observations (using standard, metric, and non-standard units of measurement). (DOK 3)
- d. Analyze evidence that is used to form explanations and draw conclusions.
- g. Justify a scientist's need to revise conclusions after encountering new experimental evidence that does not match existing explanations.

Life Science

- a. Analyze how adaptations to a particular environment (e.g., desert, aquatic, high altitude) can increase an organism's survival and reproduction and relate organisms and their ecological niches to evolutionary change and extinction.
- e. Explain energy flow in a specified ecosystem.
 - Populations, communities, and habitats
 - Niches, ecosystems and biomes
 - Producers, consumers and decomposers in an ecosystem

Earth and Space Science

- g. Justify the importance of continued research and use of new technology in the development and commercialization of potentially useful natural products, including, but not limited to research efforts in Mississippi. (DOK 3)

3-5 Next Generation Standards

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. (*secondary to 3-LS4-4*)

LS2.D: Social Interactions and Group Behavior

- Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size (*Note: Moved from K-2*). (3-LS2-1)

LS4.C: Adaptation

- For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. (3-LS4-3)

LS4.D: Biodiversity and Humans

- Populations live in a variety of habitats, and change in those habitats affects the organisms living there. (3-LS4-4)

6-8 Next Generation Standards

LS2.A: Interdependent Relationships in Ecosystems

- Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared. (MS-LS2-2)

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (MS-LS2-4)