FishTracker NGSS Associations

The FishTracker program has many direct connections to the Next Generation Science Standards (NGSS). The NGSS standards which most clearly relate to FishTracker activities and educational materials are listed below. Relevant NGSS standards are grouped by grade level. Each topic contains a link to the appropriate NGSS standard.

Elementary – Grades 3-5

3-LS1 From Molecules to Organisms: Structures and Processes

https://www.nextgenscience.org/sites/default/files/dci-arrangement/3.LS1June2017.pdf

3-LS1-1. Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.

[Clarification Statement: Changes organisms go through during their life form a pattern.] [Assessment Boundary: Assessment of plant life cycles is limited to those of flowering plants. Assessment does not include details of human reproduction.]

Disciplinary Core Ideas

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)

Crosscutting Concepts

Patterns: Patterns of change can be used to make predictions. (3-LS1-1)

3-LS2 Ecosystems: Interactions, Energy, and Dynamics

https://www.nextgenscience.org/sites/default/files/dci-arrangement/3.LS2June2017.pdf

3-LS2-1. Construct an argument that some animals form groups that help members survive.

Disciplinary Core Ideas

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. (3-LS2-1)

Crosscutting Concepts

Cause and Effect: Cause and effect relationships are routinely identified and used to explain change. (3-LS2- 1)

3-LS4 Biological Evolution: Unity and Diversity

https://www.nextgenscience.org/sites/default/files/dci-arrangement/3.LS4June2017.pdf

3-LS4-2. Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.

[Clarification Statement: Examples of cause and effect relationships could be plants that have larger thorns than other plants may be less likely to be eaten by predators; and, animals that have better camouflage coloration than other animals may be more likely to survive and therefore more likely to leave offspring.]

3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

[Clarification Statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.]

3-LS4-4. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

[Clarification Statement: Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food, and other organisms.] [Assessment Boundary: Assessment is limited to a single environmental change. Assessment does not include the greenhouse effect or climate change.]

Disciplinary Core Ideas

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)

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.B: Natural Selection. Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing. (3-LS4-2)

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)

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)

Crosscutting Concepts

Cause and Effect: Cause and effect relationships are routinely identified and used to explain change. (3-LS4-2) (3-LS4-3)

Scale, Proportion, and Quantity: Observable phenomena exist from very short to very long time periods. (3-LS4-1)

Systems and System Models: A system can be described in terms of its components and their interactions. (3-LS4-4)

Connections to Engineering, Technology, and Applications of Science Interdependence of Science, Engineering, and Technology: Knowledge of relevant scientific concepts and research findings is important in engineering. (3-LS4-4)

Connections to Nature of Science: Scientific Knowledge Assumes an Order and Consistency in Natural Systems: Science assumes consistent patterns in natural systems. (3-LS4-1)

Middle School (6-8)

MS-LS1. From Molecules to Organisms: Structures and Processes

https://www.nextgenscience.org/sites/default/files/dci-arrangement/MS-LS106.21.17.pdf

MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

[Clarification Statement: Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms. Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds.] [Assessment Boundary: Assessment does not include genetic mechanisms, gene regulation, or biochemical processes.]

Disciplinary Core Ideas

LS1.B: Growth and Development of Organisms. Animals engage in characteristic behaviors that increase the odds of reproduction. (MS-LS1-4)

Crosscutting Concepts

Cause and Effect. Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS1-8)

MS-LS2. Ecosystems: Interactions, Energy, and Dynamics

https://www.nextgenscience.org/sites/default/files/MS-LS2%2004.08.14.pdf

MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

[Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.]

MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

[Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among

and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.]

MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

[Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.]

MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

[Clarification Statement: Examples of Ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.]

Disciplinary Core Ideas

LS2.A: Interdependent Relationships in Ecosystems

- Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (M S-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 increases are limited by access to resources. (M S -LS 2-1)
- Similarly, predatory interactions may reduce the number of organisms or eliminate w hole 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. (M S-LS 2-4)
- 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. (M S -LS2-5)

LS4.D: Biodiversity and Humans
Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling. (secondary toMS-LS2-5)

ET S1. B: Developing Possible Solutions
There are systematic processes for evaluating solutions with respect to how w ell they meet the criteria and constraints of a problem. (secondary to MS-LS2-5)

Crosscutting Concepts

Patterns. Patterns can be used to identify cause and effect relationships. (M S-LS 2-2)
Cause and Effect. Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-LS2-1)
Stability and Change. Small changes in one part of a system might cause large changes in another part. (M S - LS 2-4) (M S -LS2-5)

Connections to Engineering, Technology, and Applications of Science:
Influence of Science, Engineering, and Technology on Society and the Natural World. The use of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus, technology use varies from region to region and over time. (MS-LS2-5)

Connections to Nature of Science
Scientific Knowledge Assumes an Order and Consistency in Natural Systems. Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS2-3)
Science Addresses Questions About the Natural and Material World. Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (MS-LS2-5)

MS-ESS3-4 Earth and Human Activity

https://www.nextgenscience.org/pe/ms-ess3-4-earth-and-human-activity

MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

[Clarification Statement: Examples of evidence include grade-appropriate databases on human populations and the rates of consumption of food and natural resources (such as freshwater, mineral, and energy). Examples of impacts can include changes to the appearance, composition, and structure of Earth's systems as well as the rates at which they change. The consequences of increases in human populations and consumption of

natural resources are described by science, but science does not make the decisions for the actions society takes.]

Disciplinary Core Ideas

ESS3.C: Human Impacts on Earth Systems. Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. (MS-ESS3-3) Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise. (MSESS3-3) (MS-ESS3-4)

Crosscutting Concepts

Cause and Effect. Cause and effect relationships may be used to predict phenomena in natural or designed systems.

Stability and Change: Stability might be disturbed either by sudden events or gradual changes that accumulate over time. (MS-ESS3-5)

Connections to Engineering, Technology, and Applications of Science

Influence of Science, Engineering, and Technology on Society and the Natural World: All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ESS3-1) (MS-ESS3-4)

The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus, technology use varies from region to region and over time. (MS-ESS3-2) (MSESS3-3)

Connections to Nature of Science

Science Addresses Questions About the Natural and Material World: Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (MS-ESS3-4)

High School (9 - 12)

HS. Interdependent Relationships in Ecosystems

HS-LS2 Ecosystems: Interactions, Energy, and Dynamics

https://www.nextgenscience.org/sites/default/files/dci-arrangement/HS-LS2062117withfooter.pdf

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.

[Clarification Statement: Examples of changes in ecosystem conditions could include modest biological or physical changes, such as moderate hunting or a seasonal flood; and extreme changes, such as volcanic eruption or sea level rise.]

HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. *

[Clarification Statement: Examples of human activities can include urbanization, building dams, and dissemination of invasive species.]

* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

HS-LS2-8 Ecosystems: Interactions, Energy, and Dynamics. Evaluate evidence for the role of group behavior on individual and species' chances to survive and reproduce.

[Clarification Statement: Emphasis is on: (1) distinguishing between group and individual behavior, (2) identifying evidence supporting the outcomes of group behavior, and (3) developing logical and reasonable arguments based on evidence. Examples of group behaviors could include flocking, schooling, herding, and cooperative behaviors such as hunting, migrating, and swarming.]

Disciplinary Core Ideas

LS2.A: Interdependent Relationships in Ecosystems. Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. (HS-LS2-1), (HSLS2-2)

LS2.C: Ecosystem Dynamics, Functioning, and Resilience: A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. (HS-LS2-2), (HS-LS2-6)

Crosscutting Concepts

Cause and Effect: Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-LS2-8)
Scale, Proportion, and Quantity: The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. (HS-LS2-1)
Stability and Change: Much of science deals with constructing explanations of how things change and how they remain stable. (HS-LS2-6), (HSLS2-7)

HS-LS4 Biological Evolution: Unity and Diversity

https://www.nextgenscience.org/sites/default/files/HS-LS4%205.8.13With%20Footer.pdf

HS-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

Clarification Statement: Emphasis is on using data to provide evidence for how specific biotic and abiotic differences in ecosystems (such as ranges of seasonal temperature, long-term climate change, acidity, light, geographic barriers, or evolution of other organisms) contribute to a change in gene frequency over time, leading to adaptation of populations.

HS-LS4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

[Clarification Statement: Emphasis is on determining cause and effect relationships for how changes to the environment such as deforestation, fishing, application of fertilizers, drought, flood, and the rate of change of the environment affect distribution or disappearance of traits in species.]

HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity. *

[Clarification Statement: Emphasis is on testing solutions for a proposed problem related to threatened or endangered species, or to genetic variation of organisms for multiple species.] * The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

Disciplinary Core Ideas

LS4.C: Adaptation. Evolution is a consequence of the interaction of four factors:
(1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment's limited supply of the resources that individuals need in order to survive and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment. (HS-LS4-2)

- Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. (HS-LS4-3) (HS-LS4-4)
- Adaptation also means that the distribution of traits in a population can change when conditions change. (H S -LS 4-3)
- Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline –and sometimes the extinction– of some species. (H S -LS 4-5) (H S -LS 4-6)

Crosscutting Concepts

Patterns

Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (H S -LS 4-1) (H S -LS 4-3)

Cause and Effect

Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-LS4- 2) (H S -LS 4-4) (H S -LS 4-5) (H S -LS 4-6)