

Classroom Aquarium Education Program (CAEP)

Correlations to the Next Generation Science Standards (NGSS) Quick Reference Guide

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There are many values to the process of hatching fish in the classroom. While some of these may seem obvious to us, it is helpful to teachers if they can see (and show their administrators) how the CAEP supports the State Curriculum Standards.

There are many aspects of fish, fish biology, and watersheds you can address when speaking to students, this document will assist you in approaching those areas of specific interest to particular grade levels.

Correlations to the Next Generation Science Standards (NGSS)

Quick Reference Guide

Grade: Kindergarten

Next Generation Science Standards that the Classroom Aquarium Education Program can help address include:

K-LS1-1: Use observations to describe patterns of what plants and animals (including humans) need to survive.

K-ESS3-1: Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.

K-ESS3-3: Communicate solutions that will reduce the impact of humans on land, water, air, and/or other living things in the local environment.

K-PS3-1: Make observations to determine the effect of sunlight on Earth's surface.

A theme for CAEP in Kindergarten might be: All living things need healthy food, clean water, air/oxygen, and a suitable space in which to live.

Appropriate areas of discussion include:

- The things that all animals need to survive include healthy food, clean water, air/oxygen, and suitable space in which to live. Elicit these needs from the students...Don't just tell them. Help students distinguish between needs (such as food) and wants (such as cars or televisions).
- Follow this with a discussion on what this means for humans and for fish, specifically salmonids.
 - What kinds of food do fish eat? (What kind of habitat supports fish foods?)
 - What might make water not clean? (chemical pollutants, but also silt)
 - How does air/oxygen get into the water?
 - Suitable space includes cool water. What is needed for cool water? (shade, depth)

NOTE: AT THIS EARLY AGE, THE FOCUS SHOULD BE ON GETTING STUDENTS INTERESTED IN AND EXCITED ABOUT NATURE, NOT BOMBARDING THEM WITH BAD NEWS. Focus on the positive... how interesting fish (and nature in general) are what they humans can do to help protect fish.

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Grade 1

Next Generation Science Standards that the Classroom Aquarium Education Program can help address include:

1-LS1-1: Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.

1-LS1-2: Read texts and use media to determine patterns of behavior of parents and offspring that help the offspring survive.

1-LS3-1: Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.

A theme for CAEP in Grade 1 might be: Plants and animals, including people, have body parts that enable them to survive.

Appropriate areas of discussion include:

- What people and fish need to survive and how body parts enable them to meet those needs.
 - eyes
 - nose (including salmonids using sense of smell to return to stream of birth)
 - mouth/teeth
 - fins/legs
 - skin/scales/slime/mucous coating
- The Salmonid life cycle posters and sections of the Wild About Trout CD show pictures of immature fish. Have the kids compare the immature fish to adult fish. Have them compare pictures of young and mature people...How can they tell whether the person is young or an adult? (In humans, it is not just size...It is proportion of body parts is part of it, especially the head. For fish, it is mostly color patterns.)

NOTE: AT THIS EARLY AGE, THE FOCUS SHOULD BE ON GETTING STUDENTS INTERESTED IN AND EXCITED ABOUT NATURE, NOT BOMBARDING THEM WITH BAD NEWS. Focus on the positive...what they can do to help protect fish.

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Grade 2

Next Generation Science Standards that the Classroom Aquarium Education Program can help address include:

2-LS4-1: Make observations of plants and animals to compare the diversity of life in different habitats.

2-ESS2-2: Develop a model to represent the shapes and kinds of land and bodies of water in an area.

<p>A theme for CAEP in Grade 2 might be: Different kinds of plants and animals live in different places.</p>

Appropriate areas of discussion include:

- Freshwater and streamside habitats...The images on the Wild About Trout CD and the classroom posters show a variety of organisms, many in both adult and immature forms.
 - What other animals live in fresh water? ...around streams?
 - What animals do salmonids eat? What do those food animals need to survive?
 - What animals eat salmonids? What adaptations do those animals have for catching salmonids? (Include mammals, birds, other fish, frogs, snakes, etc.)
What adaptations do salmonids have for survival?

NOTE: AT THIS EARLY AGE, THE FOCUS SHOULD BE ON GETTING KIDS INTERESTED IN AND EXCITED ABOUT NATURE, NOT BOMBARDING THEM WITH BAD NEWS. Focus on the positive...what they can do to help protect fish.

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Grade 3

Next Generation Science Standards that the Classroom Aquarium Education Program can help address include:

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.

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.

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.

3-5-ETS1-2: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

A theme for CAEP in Grade 3 might be: Fish, and other organisms, have a variety of adaptations that enable them to live in their habitat.

Appropriate areas of discussion include:

- Compare Salmonid life cycles to humans.
- What do fish need from their habitat to survive? (food, clean water, oxygen, shelter)
- How do salmonids meet those needs?
- What would happen if those needs aren't met?
- What kinds of food do fish eat? (What kind of habitat supports fish foods?)
- What might make water not clean? (pollutants including chemicals, litter, and silt)
- How does air/oxygen get into the water?
- Suitable space includes cool water. What is needed for cool water? (shade, depth)
- What is a drought? What would happen to a streambed if the stream dried up...Would other kinds of plants and animals move in?

NOTE: AT THIS EARLY AGE, THE FOCUS SHOULD BE ON GETTING KIDS INTERESTED IN AND EXCITED ABOUT NATURE, NOT BOMBARDING THEM WITH BAD NEWS. Focus on the positive...what they can do to help protect fish.

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Grade 4

Next Generation Science Standards that the Classroom Aquarium Education Program can help address include:

4-LS1-1: Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

4-LS1-2: Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

4-ESS3-2: Generate and compare multiple solutions to reduce impacts of natural Earth processes on humans

3-5ETS1-2: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

A theme for C.A.E.P. in Grade 4 might be: Fish, and other plants and animals, have structures that enable them to survive in their environment.

Appropriate areas of discussion include:

- The fish anatomy diagrams on the posters and in the Wild About Trout CD. How does each part of the anatomy help the fish survive? What are the analogous human body parts?
 - How do their body parts help fish obtain food?
 - How do their body parts help fish obtain oxygen?
 - How do their body parts help fish find suitable habitat/shelter?
 - How do their body parts help fish avoid predators?
- What are some problems that fish encounter, and how can the students help. Include such things as:
 - Not allowing anything but water to flow in a gutter toward a storm drain
 - Picking up litter so it does not go down the storm drains
- **Be prepared to help the teacher connect with local agencies and non-profits that are working to help and protect fish and habitat, including streamside restoration.**

NOTE: Grade 4 students can begin to understand environmental problems and how they can be involved with solutions, both now and when they are adults. Focus discussions on things students can do to help, not just the problems.

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Grade 5

Next Generation Science Standards that the Classroom Aquarium Education Program can help address include:

5-LS2-1: Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

5-ESS2-1: Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

3-5ETS1-2: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

A theme for CAEP in Grade 5 might be: The matter of which animals, including people and fish, are made comes from the food that they eat. Plants and animals are part of food webs that depend on the physical parts of the environment.

Appropriate areas of discussion include:

- Food chains and food webs. Introduce with a simple food chain, then expand it to a web.
- Some students will know that fish eat worms, but not be aware of the importance of insects and other organisms such as clams, smaller fish, frogs, etc. Point out that a variety of organisms eat fish.
- What are some problems that fish encounter, and how can the students help? Include such things as:
 - Not allowing anything but water to flow in gutters or down storm drains
 - Picking up litter

Be prepared to help the teacher connect with local agencies and non-profits that are working to help and protect fish and habitat, including streamside restoration.

NOTE: Grade 5 students can begin to understand environmental problems and how they can be involved with solutions, both now and when they are adults. Focus discussions on things students can do to help, not just the problems.

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Grade 6

Next Generation Science Standards that the Classroom Aquarium Education Program can help address include:

MS-ESS3-3: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

MS-ETS1-1: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

A theme for CAEP in Grade 6 might be: People have impacts, both positive and negative on the environment. So that we don't damage the environment, we need to study it and find ways to help protect it.

Appropriate areas of discussion include:

- What are some problems that fish encounter, especially problems that are caused by humans, and how can the students help. Include such things as:
 - Not allowing anything but water to flow in gutters or down storm drains
 - Picking up litter
 - helping restore streamside vegetation...
- Include problems that affect fish, and problems that humans cause for other organisms, such as urban development, farming, water diversions, dams, etc.

Be prepared to help the teacher connect with local agencies and non-profits that are working to help and protect fish and habitat, including streamside restoration.

NOTE: Grade 6 students can begin to understand environmental problems and how they can be involved with solutions, both now and when they are adults. Focus discussions on things students can do to help, not just the problems.

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Grade 7

Next Generation Science Standards that the Classroom Aquarium Education Program can help address include:

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.

MS-LS2-3: Develop a model to describe the cycling of matter and flow of energy among living and non-living parts of an ecosystem.

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

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

MS-ETS1-1: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

A theme for CAEP in Grade 7 might be: All organisms, including both fish and people, depend on the environment for the resources that they need. This includes both materials resources (food) and energy resources.

Appropriate areas of discussion include:

- Resources that fish need (food, clean water, cool water, oxygen in the water, shelter (from predators, and shade for cooling water)
- How changes in the environment would affect populations of fish and other organisms
- Cycling of matter: This is basically the complete food chain, from plants to animals to decomposers and back to plants. Discuss food chains on land and in the water.
- Energy flow: Tall energy comes from the sun and transfers from plants to animals. . As animals move, and as they decompose, energy returns to the environment in the form of heat.
- How do humans deal with such problems as:
 - loss of suitable fish habitat (laws and regulations, streamside restoration)
 - diminished numbers due to a variety of factors (limits, hatcheries)
 - interference with spawning (fish ladders, stream restoration, hatcheries)
 - water quality (laws, education)

Be prepared to help the teacher connect with local agencies and non-profits that are working to help and protect fish and habitat, including streamside restoration.

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Grade 8

Next Generation Science Standards that the Classroom Aquarium Education Program can help address include:

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.

MS-ETS1-1: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

A theme for C.A.E.P. in Grade 8 might be: People, like all organisms, depend on resources from the environment. Our modern life style requires a lot of resources. Resources are limited and finite, so the more people there are competing for resources, the fewer resources there are for each person. Resource use causes a variety of problems, and we need to seek solutions to those problems.

Appropriate areas of discussion include:

- Earth's resources are finite/limited. As human population increases, the less of any given resource is available per person. (You may need to define/explain "finite" and "per capita.")
- As human population increases, more pollution is produced, which, in turn, reduces the amount of healthy habitat for fish and other organisms.
- Discuss issues such as:
 - pollution...fresh water and ocean
 - Ocean warming
 - overfishing
 - habitat degradation (including streamside)
- Students who have never gone fishing may not feel much of a connection for protecting fish. Expand the discussion to include any resource...open space, space to play/ride bikes, walk, drive, etc. Include the finiteness of resources such as oil, gold, copper, iron, and clean water.

Be prepared to help the teacher connect with local agencies and non-profits that are working to help and protect fish and habitat, including streamside restoration.

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High School Life Science/Biology

Next Generation Science Standards that the Classroom Aquarium Education Program can help address include:

HS-LS2-6: Evaluate 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

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

A theme for CAEP in Biology might be: Ecosystems are complex, and human activities can have positive and negative impacts on them.

Appropriate areas of discussion include:

- Salmonid life cycle and the environmental requirements for a healthy Salmonid population.
- What would happen if...
 - the water in the stream got warmer
 - streamside vegetation is removed
 - a lot of silt entered the stream
 - the ocean continues warming
 - non-native animals such as bullfrogs or other fish entered the stream
- Ask students for ideas on how they can have a positive effect on the above.
- The importance of biodiversity. If fish had only mosquitoes to eat, and something wiped out the mosquitoes, what would happen to the fish?

Be prepared to help the teacher connect with local agencies and non-profits that are working to help and protect fish and habitat, including streamside restoration.

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High School Earth Science

Next Generation Science Standards that the Classroom Aquarium Education Program can help address include:

HS-ESS2-2: Analyze geosciences data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth Systems.

HS-ESS3-4: Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

A theme for C.A.E.P. in Earth Science might be: Organisms, including people and fish, depend on the physical environment. People can affect the physical environment in both positive and negative ways.

Appropriate areas of discussion include:

- Climate change is a major topic in the Next Generation Science Standards. How might changing climate affect salmonids... in streams and the ocean?
- How can road building affect silt levels in streams, and how does silt affect salmonids?
- How can agricultural practices affect fish? (silt, fertilizers, pesticides)
- How does urban growth impact fish?
- Be sure to discuss how students can help reduce the above problems. That can include being aware of political candidates' stances on environmental issues and supporting conservation efforts and groups.

Be prepared to help the teacher connect with local agencies and non-profits that are working to help and protect fish and habitat, including streamside restoration.

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High School Physical Science, Chemistry, or Physics

The Physical Science Next Generation Science Standards don't clearly focus on Classroom Aquarium Education Program topics, but Chemistry studies should include measurement of water chemistry (dissolved oxygen, phosphates, nitrates, other pollutants), and ways that temperature affects dissolved oxygen. The high school Engineering, Technology, and Science Performance Expectations, which apply to all science classes/grades, do address problem solving. They include:

HS-ETS1-1: Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

HS-ETS1-2: Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS-ETS1-3: Evaluate a solution to a complex real-world problem based on prioritized criteria and tradeoffs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

A theme for CAEP in a Physical Science class might be: Because all organisms depend on the physical environment, we need to understand the physical environment. Chemistry and Physics can be used to monitor the environment, and also have both positive and negative impacts.

Appropriate areas of discussion include:

- salmonids' need for cool water, which is largely due to the need for lots of dissolved oxygen
- the impacts of various kinds of pollutants, and how to prevent such pollution
 - oil from pipelines and oil rigs, but also from changing automotive oil
 - other pollutants such as fertilizers, pesticides, gasoline etc.
- Discuss how students can help reduce the above problems. That can include personal actions, but also being aware of political candidates' stances on environmental issues and supporting conservation efforts and groups.

Be prepared to help the teacher connect with local agencies and non-profits that are working to help and protect fish and habitat, including streamside restoration.