Skein 6

Salmon Alevin

Overview:
This skein gives students the opportunity to:

- **P** Compare a bean seed and a bag lunch to an alevin's yolk sac
- **P / I** Discuss survival needs of newborns
- **I** Review and discuss how temperature affects rate of growth
- **I** Review and discuss how people affect the temperature of the water and ways of minimizing human impacts

Big Ideas:

- Alevin hatch from an egg and continue to grow by using food from the egg yolk.

Vocabulary:

alevin, yolk sac, hatch, egg wall, embryo

Important Standards Netted by Teaching Skein 6

SCIENCE

	Fourth Grade	Fifth Grade	Sixth Grade
Energy and Growth	SA 1.1	SA 1.1	SA 1.1
	SA 1.2	SA 1.2	SA 1.2
	SA 3.1	SA 3.1	SA 3.1
	SC 3.1	SB 3.1	SC 3.1
	SC 3.4	SC 3.2	
	SE 3.1		

MATH	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade
Energy and Growth	M 2.1.1	M 2.2.1	M 2.2.1	M 2.2.1
	M 2.1.3	M 2.2.3	M 2.2.3	M 2.2.3
	M 2.1.4	M 2.2.5	M 2.2.5	M 2.2.5
	M 7.1.2	M 7.2.2	M 7.2.2	M 7.2.2

READING

Bag Lunch	R 1.1	R 1.2
	R 1.4b	R 2.4b
	R 3.3	R 4.2
Energy and Growth	R 1.6	R 2.6
	R 1.4b	R 2.4b

WRITING	Fourth Grade	Fifth Grade	Sixth Grade
	W 2.1.2	W 2.1.1	W 2.1.1
		W 2.1.2	W 2.1.2

BACKGROUND INFORMATION

Alevin

The salmon embryo inside an egg hatches out to become an alevin (the A is pronounced AY as in play or AH as in cat). Wiggling energetically and releasing a little enzyme from its head, the embryo breaks through the egg membrane. For the next month or two, it hides in the dark spaces in the gravel of its natal stream or lake.

The yolk sac from the embryo remains attached to the alevin's belly and provides the food it needs. The sac shrinks as the alevin develops its teeth, eyes, and digestive system. It begins to eat some external food that floats through the water in the gravel. The alevin's respiratory system also develops, allowing it to breathe through its gills.

Alevin cannot swim very well, so they are an easy target for predators. To hide from predators, they avoid light and live as much as 30 cm (about 1 foot) down in the gravel. As they grow stronger and their yolk sac shrinks, alevin move up to the surface of the gravel. They lose their bright orange color, and begin to develop a fish shape.

Alevin need cold running water that is rich in oxygen and clean gravel with spaces it can hide in. Threats include predators in the water, siltation, pollution, and floods or other activity that can disturb the gravel. Human activity that disturbs the gravel can be very harmful, so people can protect the alevin by keeping dirt or other pollutants out of the water and by staying out of the gravel.

When the yolk sac is completely absorbed, or "buttoned up," alevin grow to about 2.5 cm (approximately 1 inch). Then, they must emerge from the gravel and begin to search for food. Alevin emerge in the spring when the water begins to warm and plankton grow in lakes and rivers.

BACKGROUND INFORMATION

Alevin

In addition to the information in Handout 6.2, "Salmon Alevin," the following information may be useful.

Alevin can move about and swim, but their yolk sac makes them awkward and slow-moving. Since the bright color of the yolk sac makes them very visible, they avoid light and live in spaces between the gravel. However, they are mobile, and they can move large distances through gravel if necessary.

As long as there is water and enough space between the gravel pieces, they can avoid silt or find more oxygen-rich water.

Alevin begin to breathe through their gills when they hatch from the egg. Their rate of respiration can be estimated by observing the number of gill movements. As cold-blooded animals, their metabolic rate depends on the temperature of their environment, which also controls the rate of their respiration. As a result, they breathe more slowly, and grow more slowly, in colder water. At higher temperatures, they grow more rapidly, but their overall body growth is reduced because metabolic processes such as digestion and respiration are less efficient.

Alevin can flush small amounts of silt out of their gills, but their gills are very sensitive and their breathing is easily clogged.

Alevin depend entirely on their yolk sac for nourishment, except in the final days before the yolk sac becomes "buttoned up," when the alevin begin to catch bits of organic debris that float through the water. The yolk sac, containing a mixture of water, fats, protein and salts, contains enough nourishment for the alevin to live in the gravel for two to three months. As the yolk sac is absorbed, the alevin become more active and move up through the gravel. When the sac is absorbed, they emerge from the gravel and migrate toward food sources. This usually coincides with the spring bloom of plankton and aquatic insects.

Bag Lunch

Materials:

- Option: Student's bag lunch
- Option: Growing bean seed
- Illustration of salmon alevin (from Life Cycle poster or Handout 6.1, "Salmon Alevin,")

Time Required:
One lesson

Level of Conceptual Difficulty:
Simple

Evidence for Assessment:
Monitor student discussion of bag lunches to ensure they know that the yolk sac provides nutrition to alevin, just as a bag lunch does for people.

INTRODUCTION

- Ask students to volunteer to show what they bring to school for lunch, or to describe what they would like to bring.

- With the class, list the kinds of food people bring in bag lunches, and form the foods into categories such as grains, fruits, vegetables, dairy, etc.

- Have students explain what happens when they eat the food in the bags.
  The bag empties and the students get nutrients to grow.

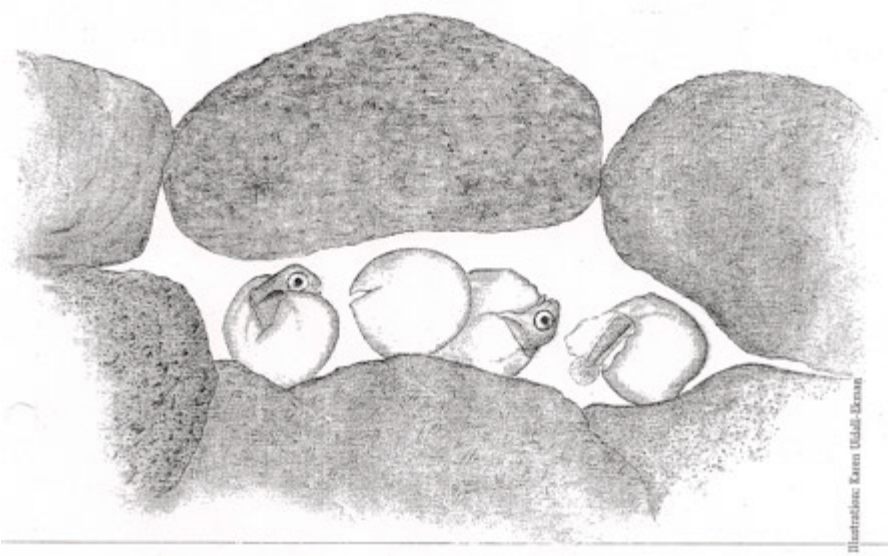
- Option: Have students describe what happened to the bean seed as the bean plant grew. The food segments shrank as the bean grew. Have students explain how a bean is similar to a bag lunch.
  Both provide food for growing.

EXPLANATION

- Show student an illustration of a salmon alevin. Explain that an egg yolk provides food for a chicken or a salmon in its egg, like a bag lunch or a bean seed. A baby salmon takes its lunch with it when it hatches.

Salmon Alevín

Handout 6.1



Alevin hatch from salmon eggs. The salmon growing inside the egg gets too big for the egg. The salmon emit an enzyme from its head that makes the egg wall break.

The alevin pushes its head through the egg wall. It wiggles more and more. The hole gets bigger. The alevin pushes its whole body out.

The alevin has a bag on its stomach. This is the yolk sac. It is left from the yolk inside the egg.

The alevin still feeds on the yolk. The yolk is like a bag lunch. It goes where the alevin goes. Alevin start to eat bits of other food as they get older. When the yolk sac is used up, they will have to feed themselves.

The alevin is orange, like the egg. It has to hide from other animals. It lives in spaces in the gravel. It breathes oxygen dissolved in the water.

Protecting Alevin

Materials:

- ✏ Writing or drawing supplies

Time Required:

Two or three lessons

Level of Conceptual Difficulty:

Moderate

Evidence for Assessment:

Monitor student discussion and review their list to ensure they can recognize ways people can protect alevin.

INTRODUCTION

- ☞ Have the class describe things people do that could harm the things alevin need to live. If necessary, prompt them with questions such as the following:

  - What would happen if people walked or drove machines through the gravel that alevin live in?
    Alevin or their homes could be crushed.
  - What would happen if someone dug the gravel out of the stream or lake?
    The alevin would have nowhere to live.
  - What would happen if sand or dirt got into the stream or lake water?
    Alevin can clear a small amount of silt from their gills, but silt can smother alevin, or fill the spaces between the gravel.
  - What would happen if people dammed the stream or diverted the water somewhere else?
    The alevin would have no water to live in.
  - What would happen if people cut all the plants down around the stream or lake?
    Sunlight might make the water too warm or remove possible food sources for older alevin. When it rains, the water might get silty from the runoff.
  - What happens when people empty drains and sewers into streams?
    They can pollute the water the alevin live in.

Energy and Growth

[demonstration]

Materials:

- 5 mL dry yeast
- 5 mL sugar
- 750 mL water
- Three small containers (test tubes or 500-mL clear plastic pop bottles)
- Funnel (optional)
- Measuring cup
- Measuring spoon
- Stirring sticks
- Three balloons (try to find Latex Free balloons that blow up easily)
- Thermometer (optional)
- One copy of Handout 6.2, "Salmon Alevin," for each student
- One copy of Handout 6.3, "Energy and Growth," for each student
- Writing supplies

Time Required:
60 to 90 minutes

Level of Conceptual Difficulty:
Simple to moderate

INTRODUCTION

- Temperature affects the rate at which plants and animals grow. Cold-blooded animals, such as fish and reptiles, and microorganisms cannot control their body temperature by themselves. Instead, the surrounding environment controls their temperature and the temperature controls the amount of energy they use. This experiment shows how temperature affects yeast, a microorganism that uses sugar for food.

- Ask the class to compare the way their body feels when they are sitting quietly and the way it feels when they are being physically active. Ask if they can explain the difference.

  When they are more active, their body gets warm, they breathe harder, and their heart pumps more. This happens because they are turning more of the food stored in their body into energy and producing more carbon dioxide, which they must expel by breathing harder.

- Explain that all animals turn food into energy and produce more carbon dioxide when they work harder. Salmon alevin and other cold-blooded animals convert food to energy at a rate determined mainly by water temperature. Although yeast is a different type of organism, it shows the effect of temperature on growth.

PROCEDURE

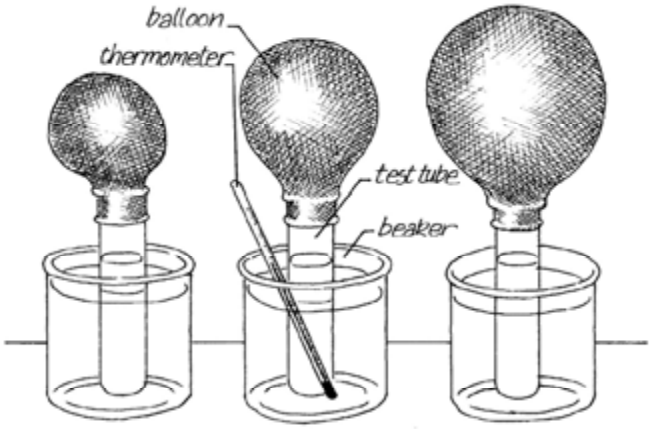
- 1. Use a thermometer or your hand to find three places in the classroom with different temperatures, one warm, one room temperature and one cool.

- 2. Mix 5 mL of dry yeast, 5 mL of sugar and 500 mL of water in the measuring cup. Stir them together until they are dissolved.

- 3. Carefully pour an equal amount of the mixture into the three containers. Label the containers with your name and a number. Fit a balloon tightly over the opening of the container.

Evidence for Assessment:
Review student's written observation sheets and class discussion to ensure that the students describe the effect of external temperature on the rate of growth in salmon alevin and yeast.

☞ 4. Place one container in each of the locations you have chosen, and label them "Warm", "Cool" and "Control".



lustration: Donald Gunn

1 Yeast, sugar in cold water | 2 Yeast, sugar in tepid water | 3 Yeast, sugar in warm water

EXPERIMENT

☞ Thirty minutes after setting up and starting the demonstration, give students a copy of Handout 6.3, "Energy and Growth," and have them individually complete it. Repeat the observations after an hour, if necessary, to see a visible difference.

DISCUSSION

☞ With the class, discuss the observations and conclusions the students recorded. If necessary, prompt them with questions, such as:

- What happened inside the containers?
  The yeast consumed the sugar and produced carbon dioxide, which caused the bubbles and expanded the balloon.
- What was the difference between the three bottles?
  The warm mixture produced more bubbles and a larger balloon than the control, while the cool mixture produced fewer bubbles and a smaller balloon.
- What conclusions did you draw?
  The yeast grows faster and produces more carbon dioxide in the warm location.

RESEARCH/DISCUSSION

☞ Have students, in small groups, read Handout 6.2, "Salmon Alevin," then list ways in which salmon alevin are similar to the yeast in the experiment and ways in which they are different. Have the groups report their conclusions to the class and discuss their observations. If necessary, prompt them with questions, such as:

- How is the alevin habitat similar to or different from the habitat in the bottle?
  Both are watery, but the bottle is enclosed, while alevin live in gravel in free-running streams or along lake shores.
- How are the food sources similar or different?
  The alevin carries its food in its yolk sac, while the yeast consumes sugar dissolved in the water.
- How is their respiration similar or different?
  Both take oxygen from the water and produce carbon dioxide.
- How is their rate of growth similar or different?
  Both are affected by the temperature of the environment.

SUMMATION

☞ Have students add information on salmon alevin to the chart of the salmon life cycle, which they began in Skein Three: Salmon Eggs.

Salmon Alevín

Handout 6.2

Wiggling energetically, the salmon embryo in an egg breaks through the egg lining and makes its way out of its egg and into the gravel. For the next 30 to 50 days, it lives as an alevin (A-le-vin – the A can be pronounced as in play or as in cat) in the dark spaces between the stones in the gravel of its natal stream. As with the egg, the rate of alevin development depends mainly on the water temperature, which should range from 4°C to 14°C (40°-57°F).

The yolk sac, which remains attached to the alevin belly, provides the food it needs. The sac shrinks as the alevin develops, gradually allowing it to move about more easily.

The alevin respiratory, or breathing system, also develops, allowing it to breathe through its gills. Clear, flowing water is still important, but an alevin can swim through spaces in the gravel away from gravel that is too silty.

Alevin need cold running water that is rich in oxygen and they need clean gravel with spaces in which they can hide. Threats include predators in the water, heavy siltation, pollution, floods, and other activities that can disturb the gravel. People can protect the alevin by keeping dirt or other pollutants out of the water and by staying out of stream gravel.

Because alevin keep the orange color of the salmon egg and their yolk sac slows their movements, they are an easy target for predators. Alevin avoid light and live as much as 30 cm (1 foot) down in the gravel. However, as they grow stronger and their yolk sac grows smaller, they begin to move up to the surface of the gravel.

When the yolk sac is completely absorbed, or "buttoned up", alevin are about 2.5 cm (approximately 1 inch) long. In spring, when the water begins to warm and insects and plankton grow in lakes and rivers, alevin emerge as fry to begin the next stage of their life.

Adapted from Jim Wiese,
Salmon Below the Surface, pp 35-36

Energy And Growth I

Handout 6.3

Name _____

Observations

After about 30 minutes, check the containers and compare what you see happening in them. Write or draw your observations in the table below.

Warm	Cool	Control

Hypothesis

What do you think is happening in the bottle?_____

_____

_____

_____

_____

Conclusions

What conclusions can you make from your observations?_____

_____

_____

_____

SALMON ALEVIN

WRAP-UP

REVIEW

- ☞ Materials: chart paper and markers
- ☞ Have students draw and label on the paper the things a salmon alevin needs for a healthy environment.

  Rocks and gravel; cold, clean water; air in the stream or lake water; vegetation on the stream bank.

- ☞ Explain that the alevin does not have to hunt for food because it carries its food in its yolk sac, but once the yolk sac is gone, the alevin will have to find its own food.

EVIDENCE FOR SKEIN ASSESSMENT

- ☞ List the key words about salmon alevin on sheets of paper and have pairs of students tell each other everything they know about the word.
- ☞ Have students make a cardboard puppet on a straw and use it in a puppet play to describe how people affect alevin homes and to identify ways of protecting them.
- ☞ Have students make a web or write a sentence listing ways that a salmon alevin is different from a salmon egg.
- ☞ Have students complete a stem sentence, such as, "I used to think… about salmon alevin but now I know that…" or, "One thing I learned about salmon alevin is that…"
- ☞ Have students add their materials to their salmon science notebook and write a sentence explaining what they learned.

LANGUAGE AND ARTS INTEGRATION

- ☞ Use food pictures or displays to have students analyze their own food sources and the types of food they need for healthy eating, then compare how they obtain food with how alevin obtain food.
- ☞ Have students bring in pictures of themselves as small children learning to move and walk, then write webs or poems comparing very young children with alevin that are beginning to move about.
- ☞ Have students demonstrate active games they can play to grow strong, healthy bodies, and compare their movements with the movements of salmon alevin.

HOME CONNECTIONS

- ☞ Have students show an adult how alevin wiggle out of an egg, and explain how an alevin yolk sac is like a lunch bag.

SALMON ALEVIN
WRAP-UP

EXTENSION ACTIVITIES

- Have students discuss the ethics of experiments involving live animals.
- If your class has access to a salmon incubator, have the students observe the alevin when they hatch and count the number of mouth and gill openings. Have them calculate the ATUs the alevin receive and project when the alevin will swim to the surface as fry.
- Have students research and compare the basic nutritional needs of humans and alevin.
- Have students research the difference between modern and old landfills.
- Have students research where landfills are located in their community or where their community's garbage goes, and identify any known impacts on the environment.
- Contact your local fly shop or fly tying club and get assistance tying a fishing fly that imitates an egg, eyed egg, alevin, and a fry. Discuss which predators would be looking for these.

EVIDENCE FOR ASSESSMENT

- Have students prepare a presentation, using appropriate graphics, to explain to a younger class how alevin live, the kind of environment they need, reasons young people should not harm the alevin environment, and ways of avoiding damage to spawning streams.
- Monitor the discussion as the students make and present their lists in the review activity to ensure that they can use factual information from the activities to support an opinion about the life of salmon alevin.
- Monitor student discussions of the class' habitat mural and life cycle chart to ensure that the students can identify the needs of salmon alevin, as well as their habitat and threats to it.
- Have students write quiz questions about salmon alevin on one side of an index card and answers on the other. Have them quiz each other by asking the questions or by using a Jeopardy-style format, by giving the answers and asking for a question.
- Have students add their notes, experiment observations and other materials to a salmon science notebook.
- Have students review their own learning in their salmon science notebook.

HOME AND COMMUNITY CONNECTIONS

- Have students ask an adult to visit the classroom to see the landfill demonstration or to take them to a local landfill and observe how waste is managed.
- Suggest that the class begin a project to identify and remove any unnatural threats to salmon alevin in waterways in the community (e.g., silt or pollution entering salmon streams, people interfering with growing alevin).