Skein 7

Salmon Fry

Overview:
This skein gives students the opportunity to:

- **P / I** Read and discuss information on salmon fry
- **P / I** Test how air helps fry float/ buoyancy
- **I** Investigate the classification of animals as fish

Big Ideas:

- Fry swim and search for food in their habitat. Fry exhibit characteristics that classify them as fish.

Vocabulary:

fry (singular and plural), parr marks, camouflage, swim bladder, predator, buoyant, buoyancy, species, cold-blooded

Important Standards Netted by Teaching Skein 7

SCIENCE

	Fourth Grade	Fifth Grade	Sixth Grade
Buoyancy and Swim Bladder	SA 1.1	SA 1.1	SA 1.1
	SA 1.2	SA 1.2	SA 1.2
	SA 2.1	SA 2.1	
	SB 1.1	SC 2.2	
	SB 4.1		

MATH	Third Grade	Fourth Grade	Fifth Grade	Sixth Grade
Swim Bladder	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 7.1.2	M 7.2.2	M 7.2.2	M 7.2.2

READING

The Swim Bladder	R 1.6	R 2.6
	R 1.4b	R 2.4b
Buoyancy	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

THE FRY

Alevin emerge from the gravel as "swim-up" fry. Rapidly vibrating their tails, they emerge from the gravel, then push themselves vertically up to the surface of the water, usually taking several hours, right after nightfall, when they will be less visible to predators. They snap their mouths into the air, hold their gills closed, and force a mouthful of air into a swim bladder, a balloon-like organ in their abdomen. They may have to repeat this motion several times to initially fill their swim bladder. The air in the bladder is only for buoyancy, not for breathing. After the fry's swim bladder is initially filled it can increase the amount of air in the swim bladder by gulping more air from the surface or converting dissolved oxygen into gas form. It counters their body weight, giving them neutral buoyancy in water. Now, they are known as "free-swimming fry."

Fry are not strong enough to swim upstream, so they drift downstream until they find calm pools where they can feed. There, they defend a small feeding territory from other fry. They catch land insects that fly close to the water or fall from plants hanging over the water. They also catch food in the water, mainly insect nymphs and larvae, as well as plankton. They grow from about 2.5 cm (approximately 1 inch) to between 4.5 and 5.5 cm (approximately 2 inches).

Because they are out in open water searching for food, many salmon fry are eaten by predators, including birds and larger fish. To hide, salmon fry change their skin color. They develop camouflage markings known as parr marks, which are dark bars across their bodies. The mixture of light and dark helps them blend into the shadows on the stream or lakebed so they are less visible to predators. They also dart very quickly from spot to spot.

A crucial part of the salmon's life cycle occurs at the fry stage — imprinting. Salmon fry memorize their natal stream or lake through factors such as the type of rock and soil in the bed, plant life, and other aquatic organisms, all of which contribute to the quality and the unique scent of the water. Salmon learn to recognize this scent as very young fry and can identify it in the water when they return from the ocean. Changes in the stream's environment that occur after the fry leave can confuse the returning salmon, preventing them from finding their natal stream and spawning. Imprinting continues as the fry grow and become smolt.

Almost 90 percent of all fry die from predators, disease, or lack of food. People can help increase fry survival by protecting their environment from pollution, flooding, or blockages. Fry need fresh, flowing, cold water with plenty of oxygen and shade to keep the water from getting too warm. They also need places to hide, such as large boulders, overhanging bushes, tree stumps, or fallen logs.

Depending on the species, salmon spend from a few days to three years in their natal stream or lake. Then, they begin to migrate downstream to the estuary where the river meets the ocean.

The Swim Bladder

This activity demonstrates that air can float objects that sink in the water. It leads to a discussion of how salmon use a swim bladder to achieve neutral buoyancy.

Materials:

- One copy of Handout 7.1, "Salmon Fry," or Handout 7.2, "Salmon Fry," for each student
- Writing supplies
- Carbonated water
- Small raisins
- Clear container
- Clay–Primary Activity
- Film canisters or other similar containers (2 per group)
- Basins of water
- Option: Illustration of Salmon internal anatomy, Salmon Skein 2, Page 57

Time Required:
Two to three lessons

Level of Conceptual Difficulty:
Moderate to advanced

INTRODUCTION

- Ask students to predict what will happen when raisins are placed in a glass of carbonated water.

EXPERIMENT

- Demonstrate or have students test their prediction by pouring 200 to 300 mL (approximately 1 cup) of carbonated water into a clear container with 5 or 6 raisins.
  The raisins float as bubbles form on them, sink as the bubbles pop at the surface, and continue to rise and sink until all the air bubbles out of the water. The bubbles are most easily visible against a dark background.

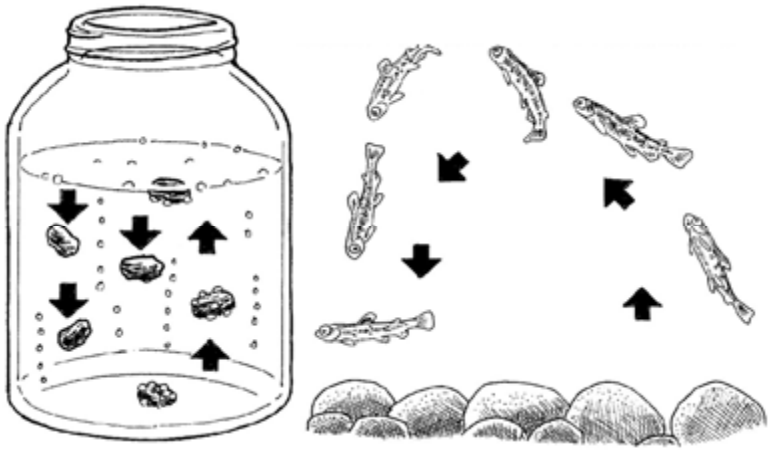


Illustration: Donald Gunn

DISCUSSION

- Ask students to suggest reasons for the raisins rising and falling.
  Air clinging to the raisins makes them more buoyant, so they float to the surface. When the air bubbles pop, the raisins loose buoyancy.

- Explain that fish, like raisins, are heavier than water, and that they would sink to the bottom of the water if they did not have an easy way to rise and fall. Ask the class to suggest ways that fry can float in water.

Evidence for Assessment

Monitor the students' buoyancy experiments and review their charts to ensure that they can describe how air helps fry achieve neutral buoyancy.

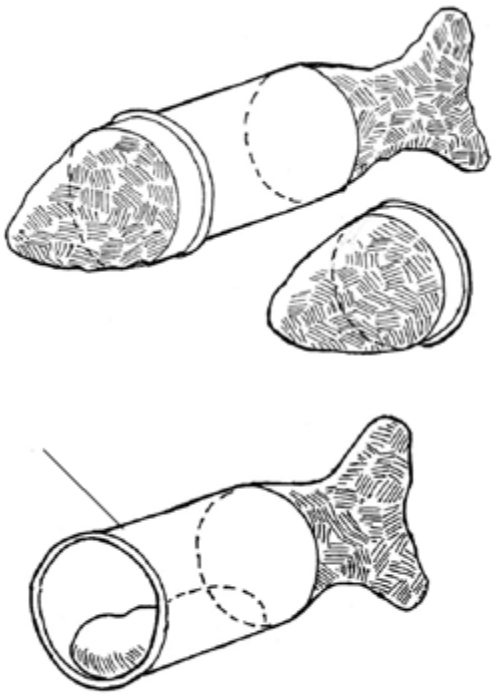


Illustration: Donald Gunn

☞ Ask students to suggest how humans can float without using any flotation items.

By taking in a large breath of air to fill the lungs, humans have better floating ability.

☞ Ask students to suggest ways that fry can float in water.

To help them float, fry fill their swim bladders by swallowing air from the surface of the water. (See next activity.)

ACTIVITY

☞ Have groups of students use clay and film canisters or other similar containers to make two model fry with hollow abdomens (see illustration). Have them add bits of clay into one of the film canister models until it neither rises nor falls in a basin of water. Have them compare the action of the two models in a basin of water.

DISCUSSION

☞ Have students describe what happened to their two models in the basin of water. Ask them to suggest reasons for one model sinking and the other not. Have students record their observations and conclusion.

☞ Have students explain how fry use a swim bladder to float in water.

Fry have a small sac, a swim bladder, that acts like a balloon inside of their bodies. The fry will swim to a desired depth and then adjust the amount of air in that sac to keep them at that depth.

☞ Ask students to suggest ways in which raisins floating in water is different from fry floating in water.

Air bubbles that cling to the outside of the raisins help them to float. Fry swallow air from the surface of the water, filling their swim bladder to help them float.
(Note: You may wish to use the salmon internal anatomy illustration on page 57 of Skein 2 to show students where the swim bladder is located.)

Salmon Fry

Handout 7.1

Illustration: Karen Uldall-Ekman

When alevin finish the food in their yolk sacs, they have developed into fry. Fry catch their own food.

At first, fry cannot float in water. Fry sink in water. To float they must swallow air. They flutter their tail very hard to swim up. When they reach the air, they swallow large gulps. They keep air in a swim bladder, like a balloon in their stomach. Then they can swim up and down easily by moving their fins.

Once fry swim, they can chase food. They catch small insects. They also eat bits of animals that drift downstream.

Plants beside the stream or lake keep the water cool and shady. Fry can hide in the shadows. Their skin changes color to help them hide. Dark lines called parr marks also help them hide.

Birds and bigger fish try to eat fry. Fry dart about very quickly to avoid predators.

Salmon fry remember where they grew up. When they are adults, they will find their way back to the same stream or lake.

Salmon Fry

Handout 7.2

Alevin emerge from the gravel to begin the next stage of their life as "swim-up" fry and then "free-swimming" fry.

Rapidly vibrating their tail, they push themselves up to the surface of the water and swallow a mouthful of air. The air is not for breathing, but to balance the weight of their body and allow them to float in water. It goes into a swim bladder, an organ like a balloon in their abdomen. They may have to take several gulps until they have enough air.

Fry are not strong enough to swim upstream, so they drift downstream until they find calm pools where they can feed. There, they defend a small feeding territory from other fry. Salmon fry eat the nymphs and larvae of insects such as stonefly, mayfly, caddisfly, and black fly. They also eat plankton and some land insects that fall into the water. They grow from about 2.5 cm (1") to between 4.5 and 5.5 cm (approximately 2") during the summer.

Many salmon fry are eaten by predators, including birds and larger fish. To hide, salmon fry change their skin color. They develop camouflage markings known as parr marks, dark bars across their bodies. The mixture of light and dark helps them blend into the shadows on the streambed so they are harder to see. They also dart very quickly from spot to spot.

Almost 90 percent of all fry die from predators, disease or lack of food. They still need fresh flowing, cold water, with plenty of oxygen and shade to keep the water from getting too warm. People can help increase their survival by protecting their environment from pollution, flooding, or blockages.

A crucial part of the salmon life cycle begins at the fry stage—imprinting. Salmon fry remember the smell of the water they grew up in. When they return as adults, they try to find the same spot. The rocks and soil in the streambed, plant life, and other aquatic organisms all create the scent that salmon return to. Changes in the environment of the stream can confuse the returning salmon, and prevent them from spawning.

Some salmon species spend just a few days in their natal stream, but most spend one to three years.

- Pink and chum spend one to three months in fresh water.
- Chinook, coho and sockeye spend about one year.

Then, they begin to migrate downstream to the estuary where the river meets the ocean. Sometimes, dams or other blockages prevent salmon from traveling to the sea. They remain in lakes and rivers through their entire life cycle, but can continue to produce land-locked offspring.

Buoyancy [optional experiment]

Materials:

For each group of students:

- Plastic drinking straw
- A small container
- A balloon
- Waterproof tape
- A basin of water
- Scissors
- One copy of Handout 7.3, "Buoyancy," (Parts 1 & 2), for each student
- Writing supplies

Time Required:

Approximately 60 minutes

Level of Conceptual Difficulty:

Simple

Evidence for Assessment

Review the students' written observations and class discussion to ensure that the students can describe how a balloon can help fish achieve buoyancy in water.

INTRODUCTION

- Ask the class to predict what will happen if a container filled with water is placed in another container of water.
  It will sink.

- Ask the students to suggest ways to make the container float.

EXPERIMENT

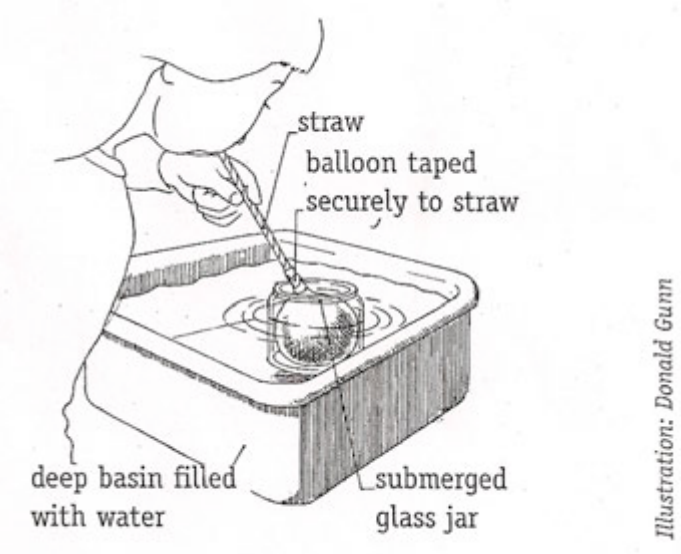
- Have students, in groups, use Handout 7.3, "Buoyancy," (Parts 1 & 2), to conduct a test for buoyancy.

- Option: Have students invent and test other ways in which a heavier-than-water object can achieve neutral buoyancy in water.

DISCUSSION

- Have students discuss ways in which a submarine, a scuba diver, a fish and an amphibian could use the balloon method or another method to move in water. If necessary, prompt them with questions, such as:

  - Does the balloon help or prevent easy movement?
  - Does the balloon take up a practical amount of space?
  - Can the balloon be inflated, as needed, or must it remain inflated?
  - Where would the balloon fit?



Buoyancy

Handout 7.3, (Part 1)

Name _____

Heavy objects sink when you put them in water. To float, they need buoyancy (pronounced BOY- an-cy). Buoyancy is the ability to float. The bodies of fish (and other animals) do not sink to the bottom of the water. They are buoyant. This experiment shows how heavy objects can be buoyant.

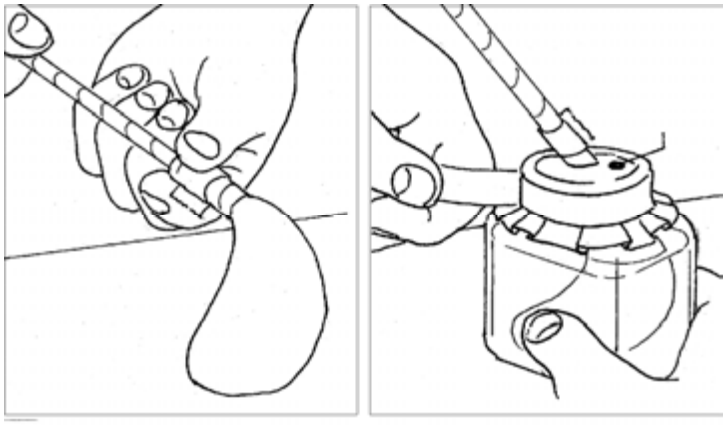
Materials

- Plastic drinking straw
- A small bottle with a narrow mouth
- A balloon
- Waterproof tape
- A basin of water

Hypothesis

A balloon can help an object float in water.

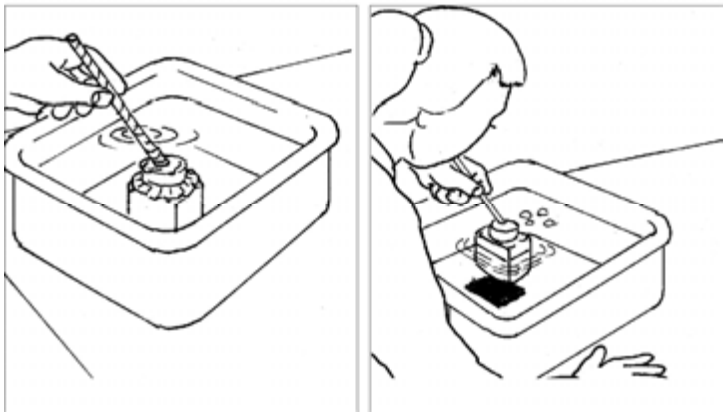
1. Tape balloon onto a drinking straw



2. Insert straw/ balloon through seal on small water-filled bottle.

Illustration: Donald Gunn

3. Immerse bottle in a basin of water.



4. Blow gently through straw to inflate balloon.

Buoyancy

Handout 7.6, (Part 2)

Procedure

1. Tightly tie a balloon around the end of a drinking straw (but do not crush the straw).
2. Tape the straw to the mouth of the bottle so the balloon is inside.
3. Submerge the container in the basin of water.
4. Observations: Describe what happens to the container.

_____

_____

5. Blow through the long straw into the container.
6. Observations: Describe what happens to the container.

_____

_____

_____

7. Suck the air out of the balloon.
8. Observations: Describe what happens to the container.

_____

_____

_____

9. See if you can keep enough air in the balloon so that it floats just below the surface of the water.
10. Observations: Describe what happens when you try to float the balloon just below the surface.

_____

_____

_____

Conclusion

How do your observations support or question the hypothesis?_____

_____

What conclusion can you make from your observations?_____

_____

How could salmon and other fish make use of buoyancy? _____

_____

SALMON FRY
WRAP-UP

REVIEW

- Materials: chart paper and markers. Have students draw and label three ways by which a salmon fry survives in its environment.

  It swallows air and then uses its swim bladder to make its buoyancy neutral in the water. It catches food and relies on camouflage to hide from predators.

- Explain that these elements make a safe home for a salmon fry and that if it gets enough food and avoids predators, the fry will grow into a smolt.

EVIDENCE FOR SKEIN ASSESSMENT

- Have students make a fry habitat in an aquarium or basin, using rocks, sand, water, plants, and modeling clay. Use it to explain how fry live in the environment.

- Have students make a pop-up book with a mouth that opens and draw food that salmon fry would eat.

- Have students make a web linking a fry's needs with its environment, then use it to explain how a fry lives in its environment.

- Have students make a web or write a sentence listing ways in which a salmon fry is different from a salmon alevin.

- Have students complete a stem sentence, such as, "I used to think... about salmon fry but now I know that..." or "One thing I learned about salmon fry is that...".

- Have students add their materials to their salmon science notebook and write a sentence explaining what they learned.

LANGUAGE AND ARTS INTEGRATION

- If your school is near a salmon stream or lake, arrange a field trip to identify the plant and animal life living there. This activity is particularly meaningful if done when incubated fry are released into the stream or lake.

- Have students use a heavy paper clip to seal the end of a balloon and find out how much the balloon has to be inflated so it neither rises nor falls in a basin of water. Discuss how the balloon is like a salmon's swim bladder.

HOME CONNECTIONS

- Have students demonstrate to an adult how a salmon fry swallows air and catches food.

SALMON FRY

WRAP-UP

EXTENSION ACTIVITIES

- ☞ Arrange a field trip to conduct a systematic stream survey and identify plants, animals, and environmental factors that make the site a good (or poor) habitat for salmon (e.g., running water, gravel, shade, food sources).

- ☞ Have students conduct a stream mapping or clean-up activity on a local stream. (Contact a local naturalist or Alaska Department of Fish and Game to find out about local projects and procedures to use.)

- ☞ Have students use a dichotomous key of salmon fry species to identify different types of salmon fry.

- ☞ Have students paint a picture of an underwater stream environment, then paint fry in different colors and patterns to identify the camouflage patterns that best allow fry to avoid detection by predators.

SUGGESTIONS FOR ASSESSMENT

- ☞ Have students draw a Venn diagram comparing fish with other species, then explain what distinguishes fish from other species.

- ☞ Monitor the discussion as students make and present their lists in the review activity to ensure that the students can use factual information from the activities to support an opinion about the life of salmon fry.

- ☞ Monitor student discussions of the [illegible] to ensure that the students can identify the needs of salmon fry, as well as their habitat and threats to it.

- ☞ Have students write quiz questions about salmon fry 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 (giving the answers and asking for a question).

- ☞ Have students add their notes, experiment observations and other materials to a salmon science notebook or portfolio.

- ☞ Have students reflect on what they learned about salmon fry independently in their salmon science notebook.

HOME AND COMMUNITY CONNECTIONS

- ☞ Have students visit a nearby stream or lake with an adult, identify a variety of aquatic organisms, and explain how the organisms contribute to salmon habitat.

- ☞ Suggest that the class begin a project to identify and remove any obstructions that make it difficult for migrating smolt to travel to the estuary, or suggest the class identify damaged estuary habitat and investigate how to restore it.