

Redband Trout and Climate Change

Grade Level: 3rd grade

Duration: 45 minutes

Lesson Overview: Students will learn about the Redband Trout and the challenges they face in the Spokane River using real data collected from the Spokane River.

Authors: Spokane Riverkeeper

Spokane Riverkeeper is a vigilant guardian and advocate for the Spokane River and its watershed. The Spokane Riverkeeper works to protect the river's ecological health, its aesthetic integrity, and the public uses of the river for future generations of our community.

Disciplinary Area:
**Ecosystem
Resilience**

Key Concepts:

- Water level
- Fish biology
- Native fish
- Habitat threats
- Climate change

Key Lesson Information

Materials List

- Accompanying PowerPoint for the Lesson
- Attached Redband Trout Coloring Page

NGGS Performance Standards Addressed

3. Interdependent Relationships in Ecosystems: Environmental Impacts on Organisms	
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 cause when the environment changes and they types of plants and animals that live there may change.
LS2.C	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.
LS4.D	Populations live in a variety of habitats, and change in those habitats affects the organisms living there.

Big Question: How do changes in water level in the Spokane River affect trout eggs and survival of Redband Trout?

Key Terms List:

- **Redband Trout:** A wild native fish that lives in the Spokane River that is a species of concern.
- **Habitat Destruction:** the process by which a natural habitat becomes incapable of supporting its native species.
- **Redd:** a spawning nest made by a fish
- **Cubic Feet Per Second:** A measurement of how much water is flowing a river at one time.
- **Climate Change:** a change in the regional climate pattern that can lead to

5E model part 1: Engage

Introduction and Background

The wild native Redband Trout has lived in the streams and rivers of this region for thousands of years, feeding countless generations of inhabitants of the Spokane and surrounding areas.

- Spokane's iconic Redband Trout is a subspecies of the rainbow trout.
- The Redband Trout is visually distinct with its rosy to brick red coloring running the length of its body, from its gills to tail. It often has white tipped fins.
- The Redband has darker and larger rounded spots than a rainbow trout and keeps these beautiful, freckle like dark marks through adulthood.

Fish Anatomy

Students will follow along with the teacher as they label and color in their own Redband Trout.

Essential Concepts

This activity help to introduce students to specific anatomy of fish and the unique coloring of the Redband Trout.

The Redband inhabit the cool clean waters of the Spokane River ecosystem. The Spokane River and its tributaries are prime spawning habitats for trout. The Redband Trout are not stocked and naturally reproduce. Redbands need gravel riverbeds free of silt for successful spawning.

The following video is a short introduction to trout reproduction.

Video: <https://www.youtube.com/watch?v=NoIA1QNnbSQ> (pause at 1:43)

Now that we know a little more about fish anatomy and what Redband Trout look like, let's learn more about their habitat.

5E model part 2: Explore

Introduce Activity

Redband trout can act like a thermometer for how the rest of the ecosystem is doing. What do you think will happen to the Redband trout if there isn't as much water in the river as there used to be?

Redband Trout and Streamflow

In this activity, students will look at real data collected by the Riverkeeper in the Spokane River about water levels to determine if there is enough water for trout eggs in the redds to survive.

Essential Concepts

- Changes in climate and streamflow impact the organisms living in the ecosystem.
- The Redband trout eggs can only survive if there is enough water.

Activity Procedure

1. Review the following information with students at the beginning of the activity:
 - a. Trout in the Spokane River dig shallow holes with their tails called redds to lay their eggs in.
 - b. The eggs and redds are built in river gravel in less than 8 feet of water, near the edges of the river.
 - c. The redds need to be covered in water until the eggs hatch and the fish swim into the river.
 - d. Climate change is changing the river flows across the Northwest. The rivers have lots of water early in the winter and less water in early spring than they used to.
2. Review the Spokane River Cross Sectional diagram with the students
 - a. Explain how to read the diagram
 - b. Discuss different water scenarios and the effects on Redband Trout Redds
 - c. Ask students to develop hypotheses about how the different water scenarios might affect how many trout eggs survive.
 - d. Ensure students understand that Redband Trout Redds require 6500 CFS on June 15th to ensure the eggs can hatch.

- i. If the water level falls below 6500 CFS before June 15th, the redds might start to die before they can hatch from the gravel.
3. Provide students with the 2009 Graph of the Spokane River Discharge
 - a. Have students work in groups to analyze the graph
4. Did the trout eggs survive this year?
5. What was the water flow on June 15th, 2009?
6. Students should pair and share about their hypothesis.
7. Provide students with the 2010 Graph of the Spokane River Discharge and complete steps 4 – 6 with the 2010 graph.

5E model part 3: Explain

Time to check in and recap!

Stand-up Quiz

Teachers can utilize a standing quiz to get students on their feet and moving around for a few minutes.

- Explain that each corner is a letter, A B C or D
- Ask a question and pull up the possible answers on the PowerPoint slide
- Tell them to go to the letter they think is the correct answer

Suggested Questions:

- Fish diagram/anatomy question
- What is a redd?
- How much water does a redd in the Spokane River need to survive?
- What happens if there isn't enough water?

The Redband Trout is our iconic native fish and is threatened by habitat degradation. The Redband population has been severely reduced due to habitat destruction, warm water temperatures and the reduced water flow in rivers.

The current population estimates for Redband Trout are lower than for other trout species. The United State Fish and Wildlife Service identifies the Redband Trout as a species of concern.

A species of concern is a species about which there are some concerns regarding threats to their survival.

What are some ways you think you might be able to help make sure Redband trout eggs have enough water to hatch?

Potential answers:

- Save water at home by not letting the water run when you brush your teeth
- Take shorter showers
- In the spring, make sure you watch where you walk if you visit the Spokane River.
- Talk to your family or people at home about the Redband Trout!

Important Concept Check in: Key Terms

Key Terms List:

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- **Habitat Destruction:** the process by which a natural habitat becomes incapable of supporting its native species.
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5E model part 4: Elaborate

Clarify the Connection

We think water temperature may be increasing in the Spokane River. Increasing air temperatures and lower water flows can lead to increased water temperature. Let's look at the temperature of the Spokane River over the last five years. Our water temperature data shows high temperatures in the Spokane River from 2015-2020.

Expand Water Temperature in the Spokane River

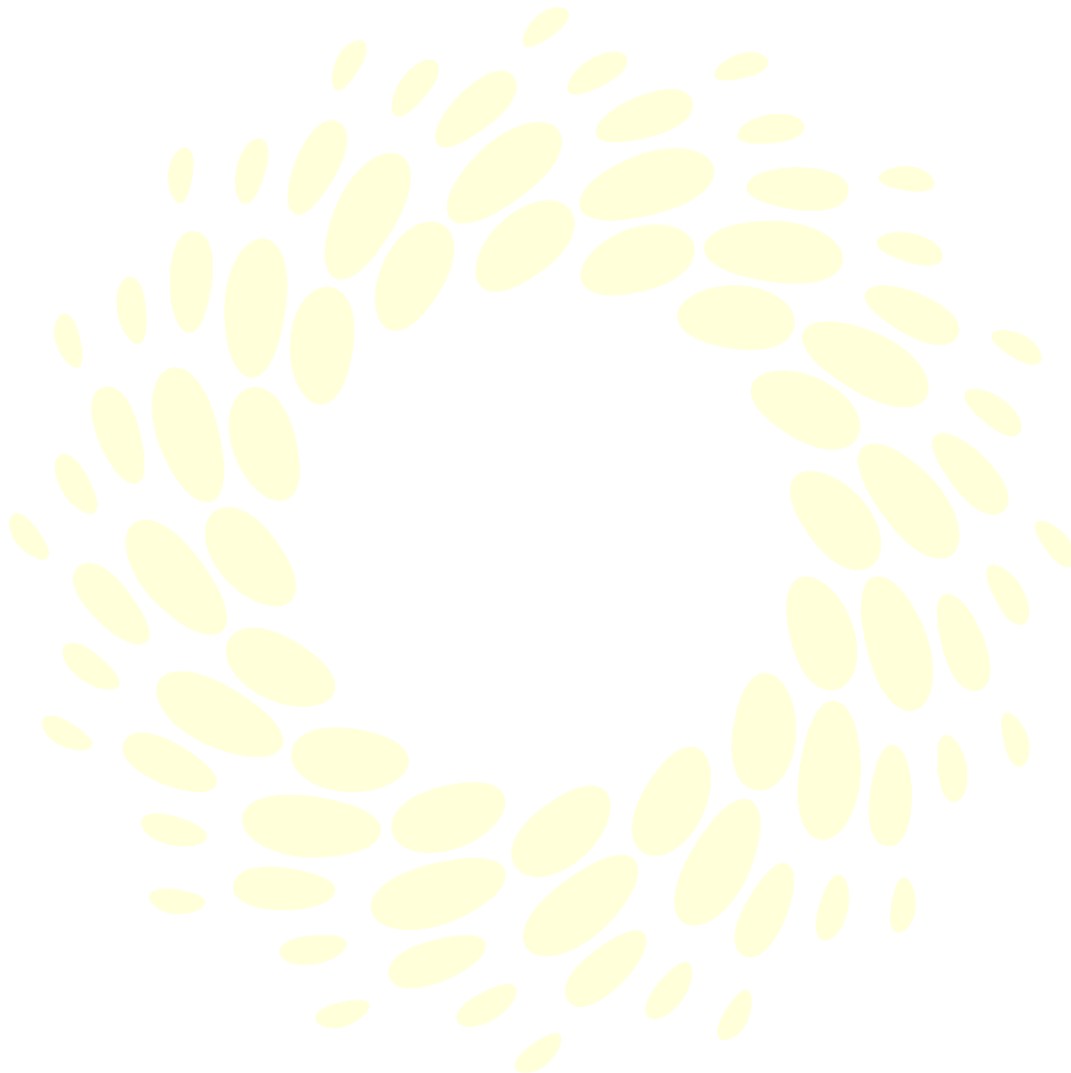
High water temperatures kill trout and have other negative consequences.

Fish breathe underwater by pulling oxygen out of the water. Did you know that warm water has less oxygen than cold water?

What do you think will happen to fish if the water gets too warm?

The water quality standard for maximum temperature is 18 C (64 F). A water quality standard is the ideal condition for a body of water. This means that the ideal temperature for the Spokane River is 18 degrees Celsius or 64 degrees Fahrenheit

- What is the maximum water temperature recorded on the graph below?
- Was temperature of the water in 2020 at the ideal temperature?



5E model part 5: Evaluate

Include how you plan to evaluate student learning and progress at the end of the lesson.

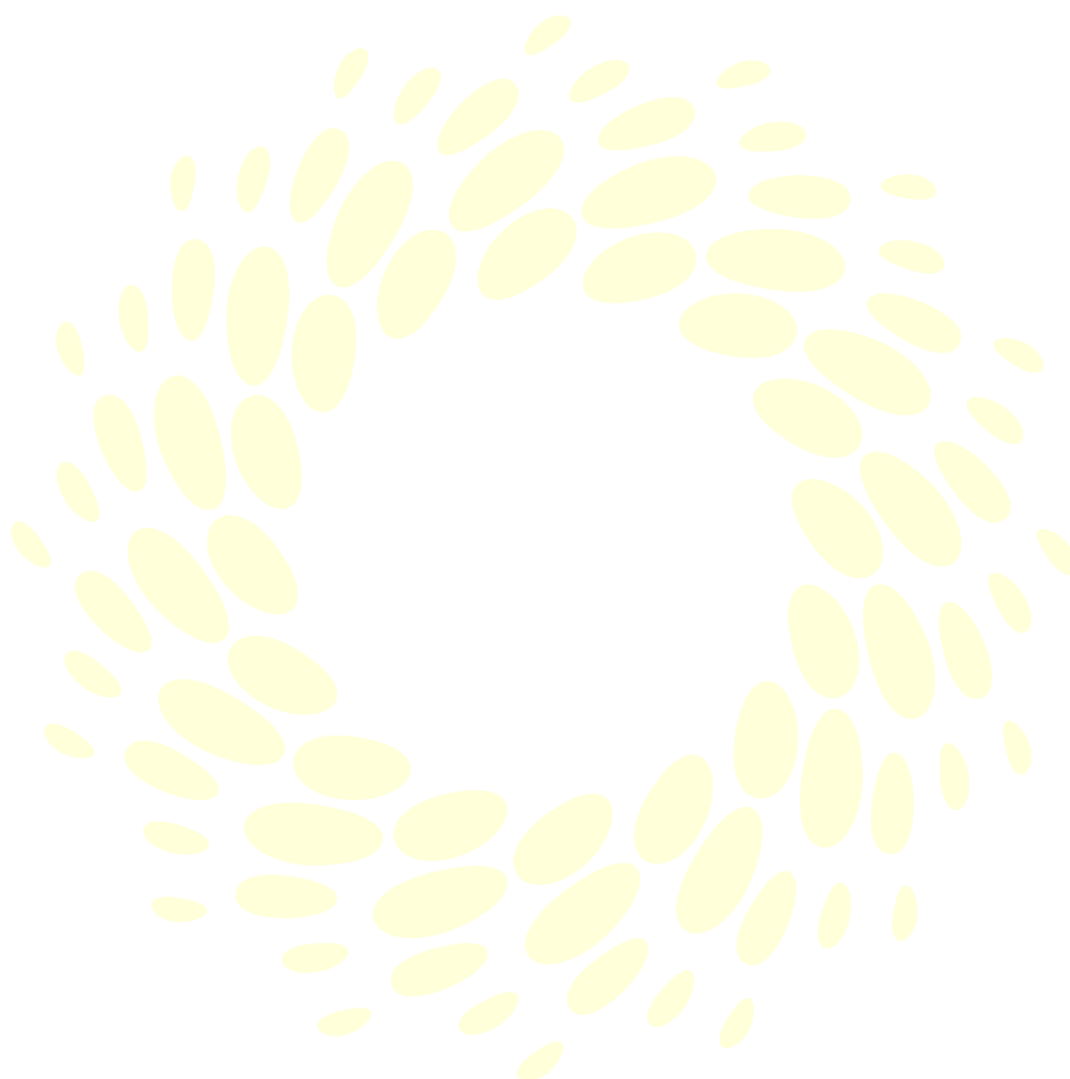
By the end of this Lesson

Concepts Learned:

- Changes in climate and streamflow impact the organisms living in the ecosystem.
- The Redband trout eggs can only survive if there is enough water.
- The anatomy of the Redband Trout and their unique coloring.

Connection/Evidence Gathered:

- Water flow out of the Spokane River for 2009 and 2010
- Water temperature of the Spokane River from 2015 to 2020
- Data informed hypothesis about the effects of water flow and water temperature on Redband Trout Redds



Redband Trout and Climate Change

Developed by
The Spokane Riverkeeper and
Center for Climate, Society, and the Environment



Center for
Climate,
Society, and the
Environment



Big Question

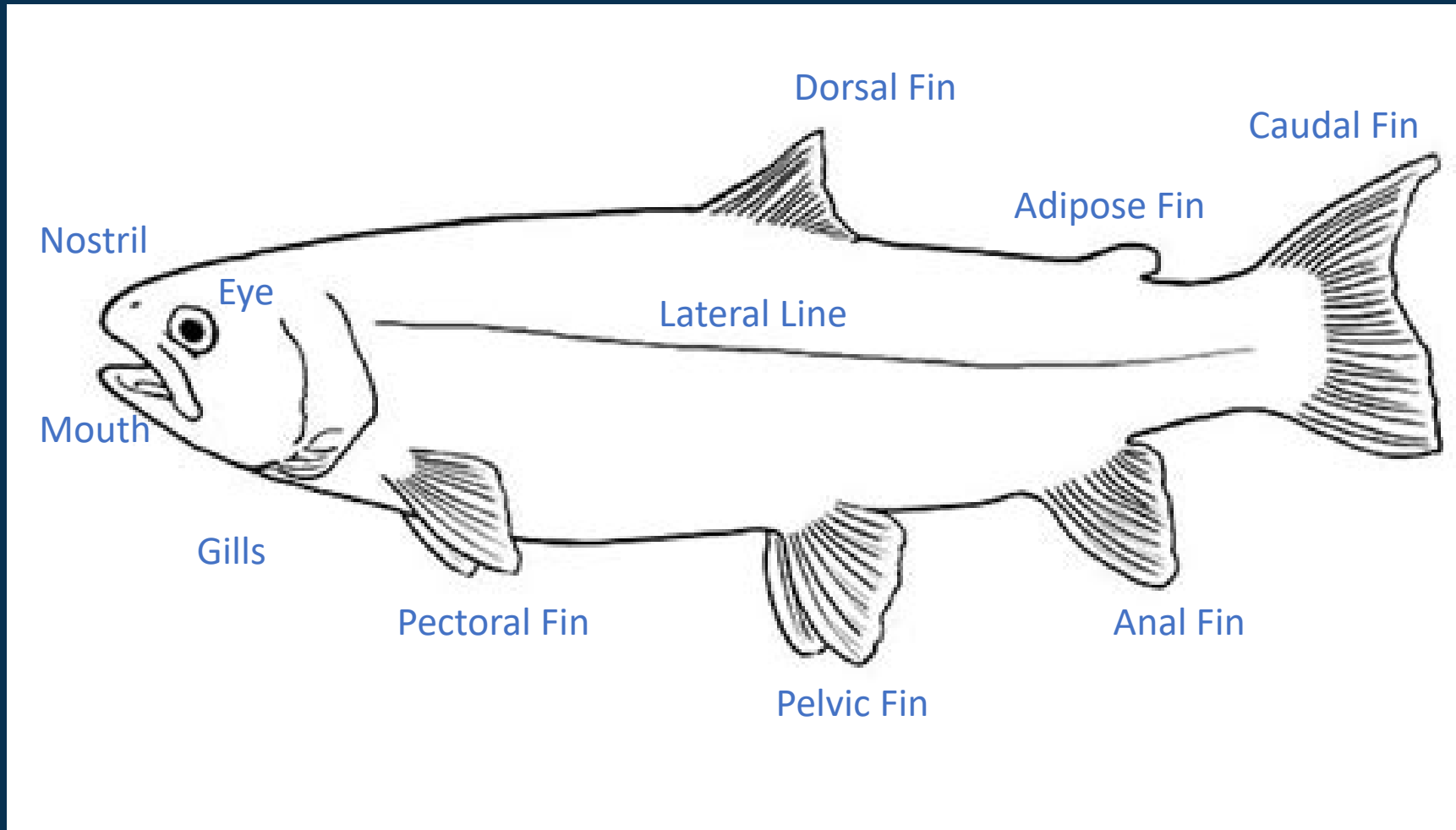
How do changes in water level in the Spokane River affect trout eggs and the survival of the Redband Trout?



Key Terms

- **Redband Trout:** A wild native fish that lives in the Spokane River that is a species of concern.
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- **Climate Change:** a change in the regional climate pattern that can lead to hotter temperatures and drought.

Redband Trout Anatomy



Color your Redband Trout!



Photo by Tim Connor

Livin' the **Wildlife**

Spawning **Brown Trout**



What do you remember?

Where do trout lay their eggs?

- In shallow holes in gravel on the sides of a river

What is a trout nest called?

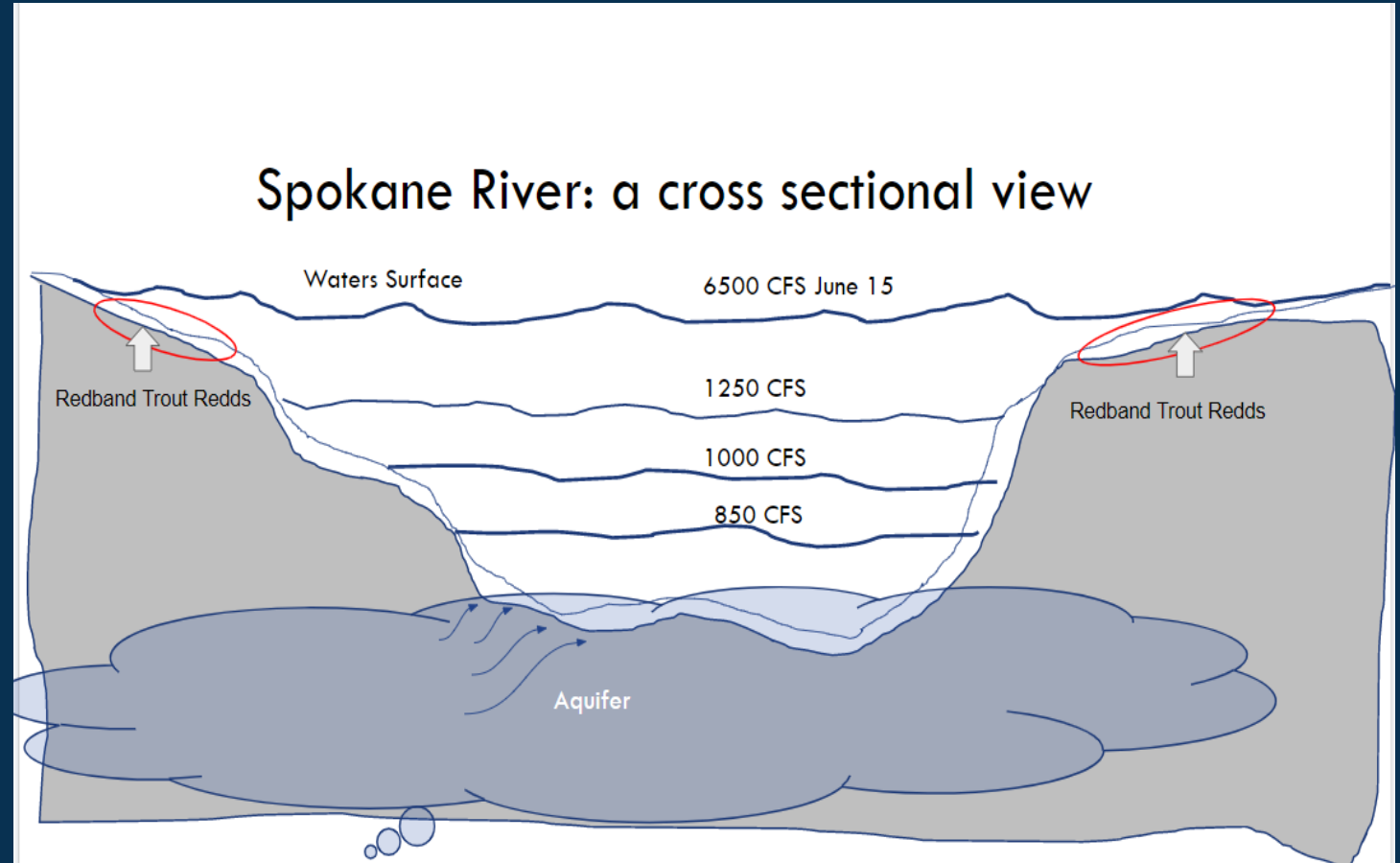
- A redd

What do redds need for the trout to hatch?

- Water!

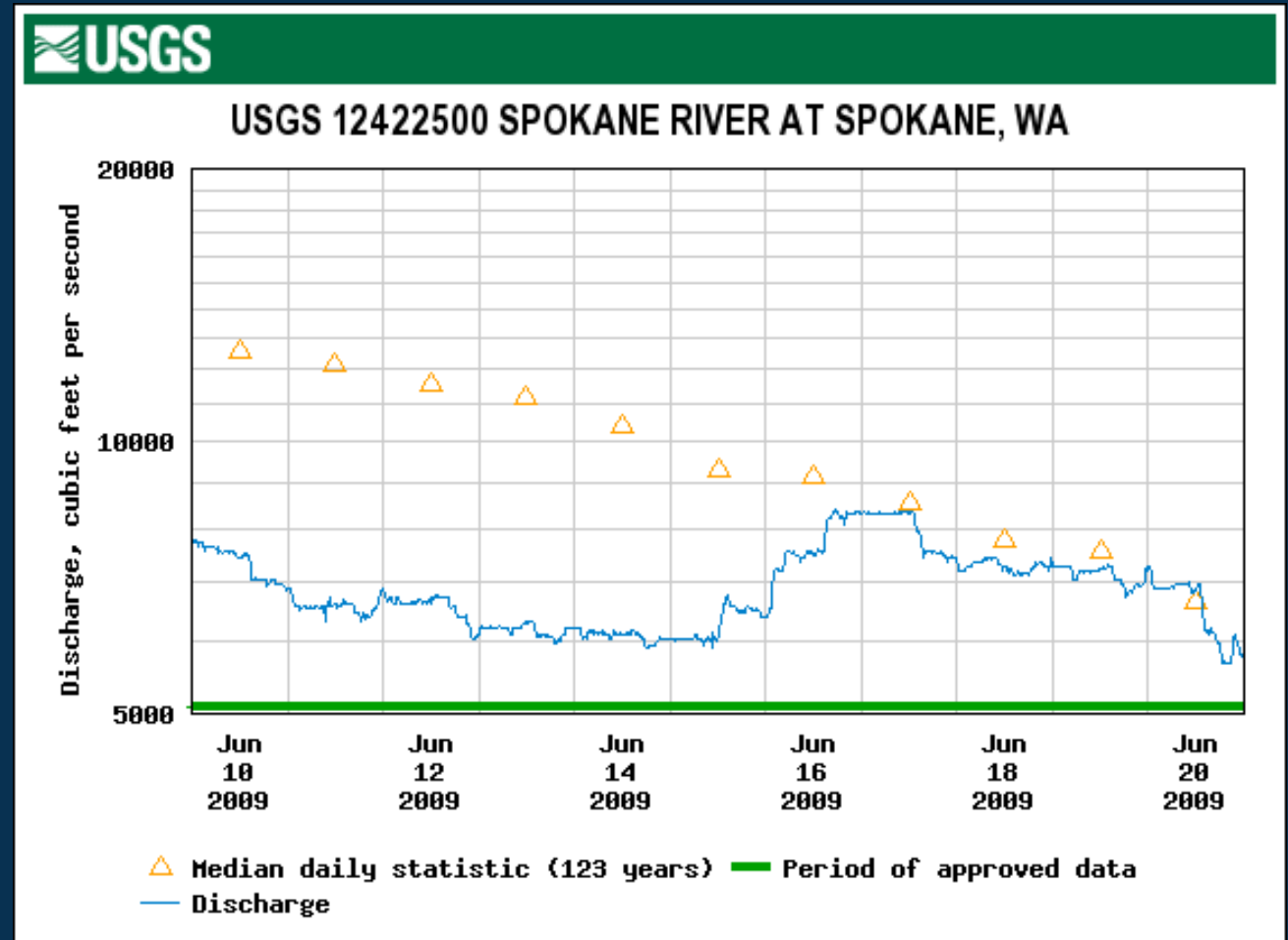
How much water is flowing in the Spokane River?

- CFS: Cubic Feet Per Second
- Redband Trout eggs need to be covered by water to survive.
- Redband Trout redds hatch around June 15th. This means they need to be covered by water until at least June 15th.
- Where is 6500 CFS on the picture?
- What does that mean?
- Where would the water level be if the river was flowing at 1000 CFS?



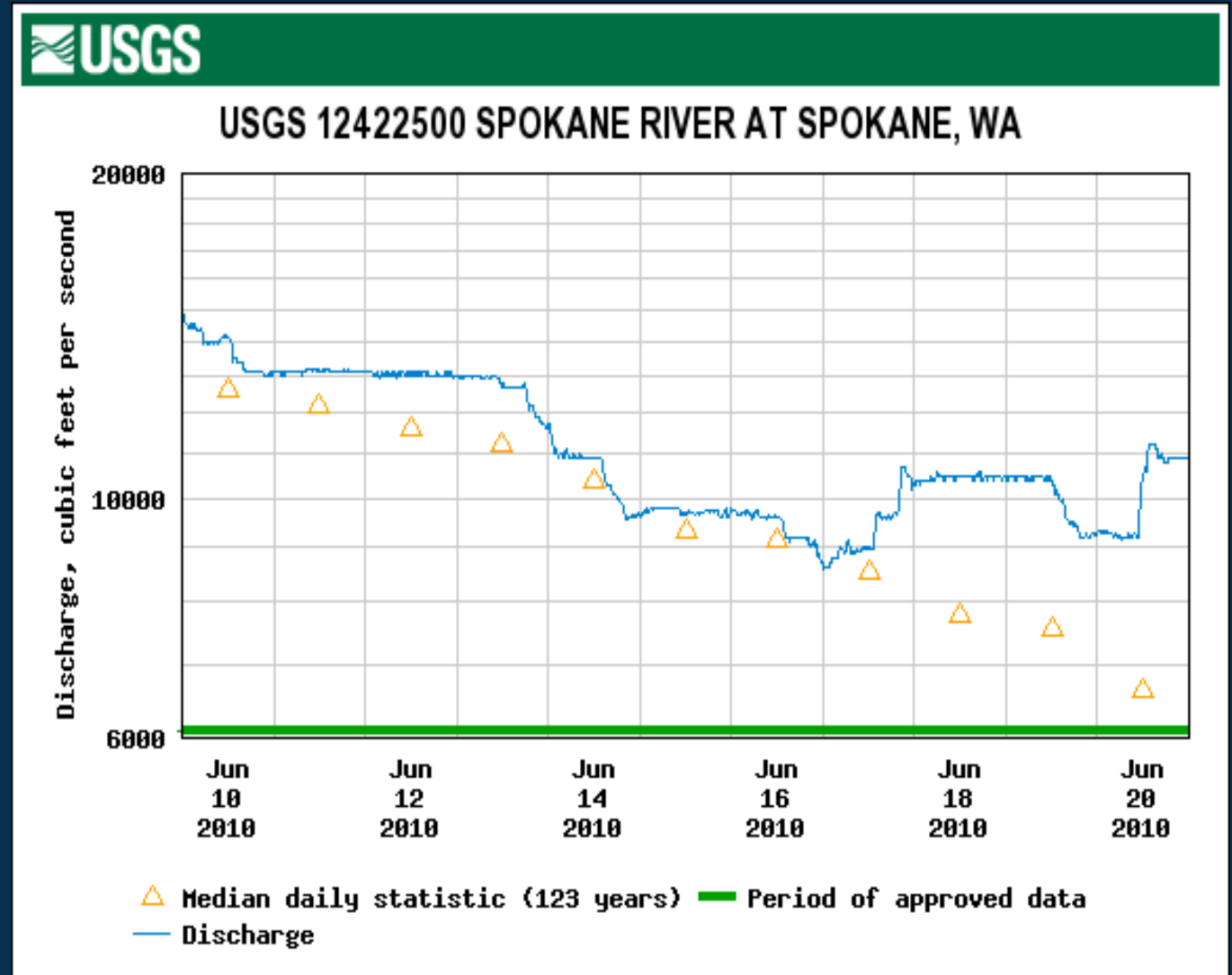
Water Flow in the Spokane River in 2009

- What was the water flow on June 15th?
- Did the Redband Trout eggs survive this year?
- Why or why not?



Water Flow in the Spokane River in 2010

- What was the water flow on June 15th?
- Did the Redband Trout eggs survive this year?
- Why or why not?



Stand- Up Quiz

Where do trout lay their eggs?

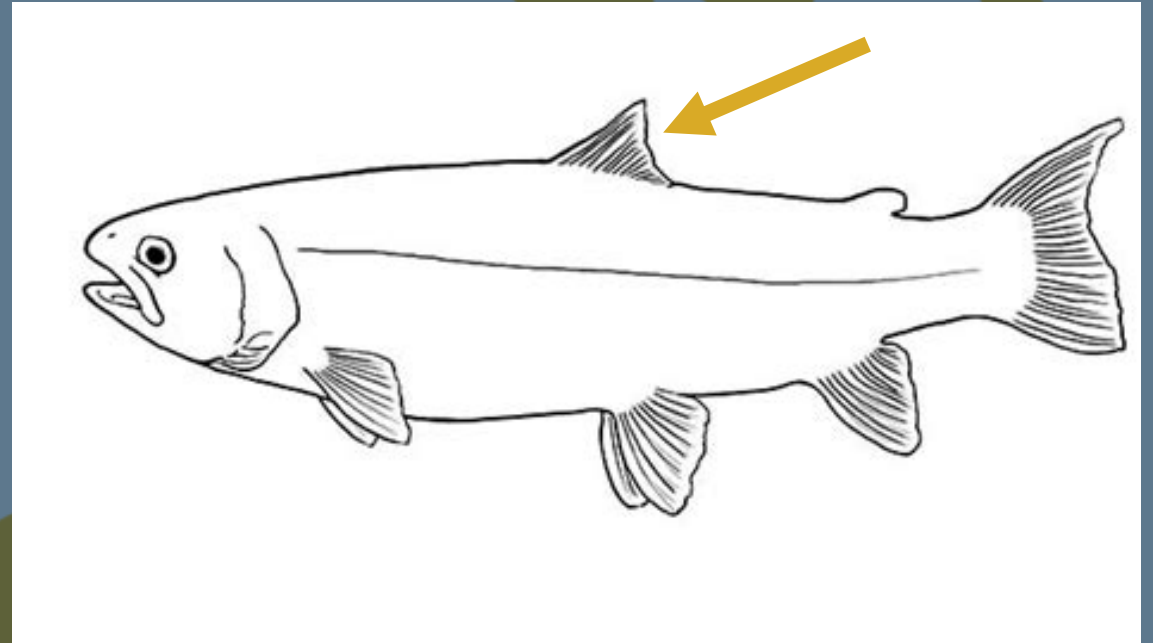
- A. In gravel on the sides of a river
- B. In gravel at the bottom of a river
- C. On the plants that grow in a river
- D. In a tree



Stand- Up Quiz

What is this part of a fish called?

- A. Nostril
- B. Dorsal Fin ★
- C. Pectoral Fin
- D. Lateral Line



Stand- Up Quiz

How much water is needed in the River for Trout Redds to survive?

- A. 850 CFS
- B. 1000 CFS
- C. 1200 CFS
- D. 6500 CFS



Stand- Up Quiz

What happens to the trout eggs if there isn't enough water?

- A. They turn into frogs and live on land
- B. The eggs roll to find more water
- C. They dry out and die ★
- D. They hatch early

Why do we care about Redband Trout?

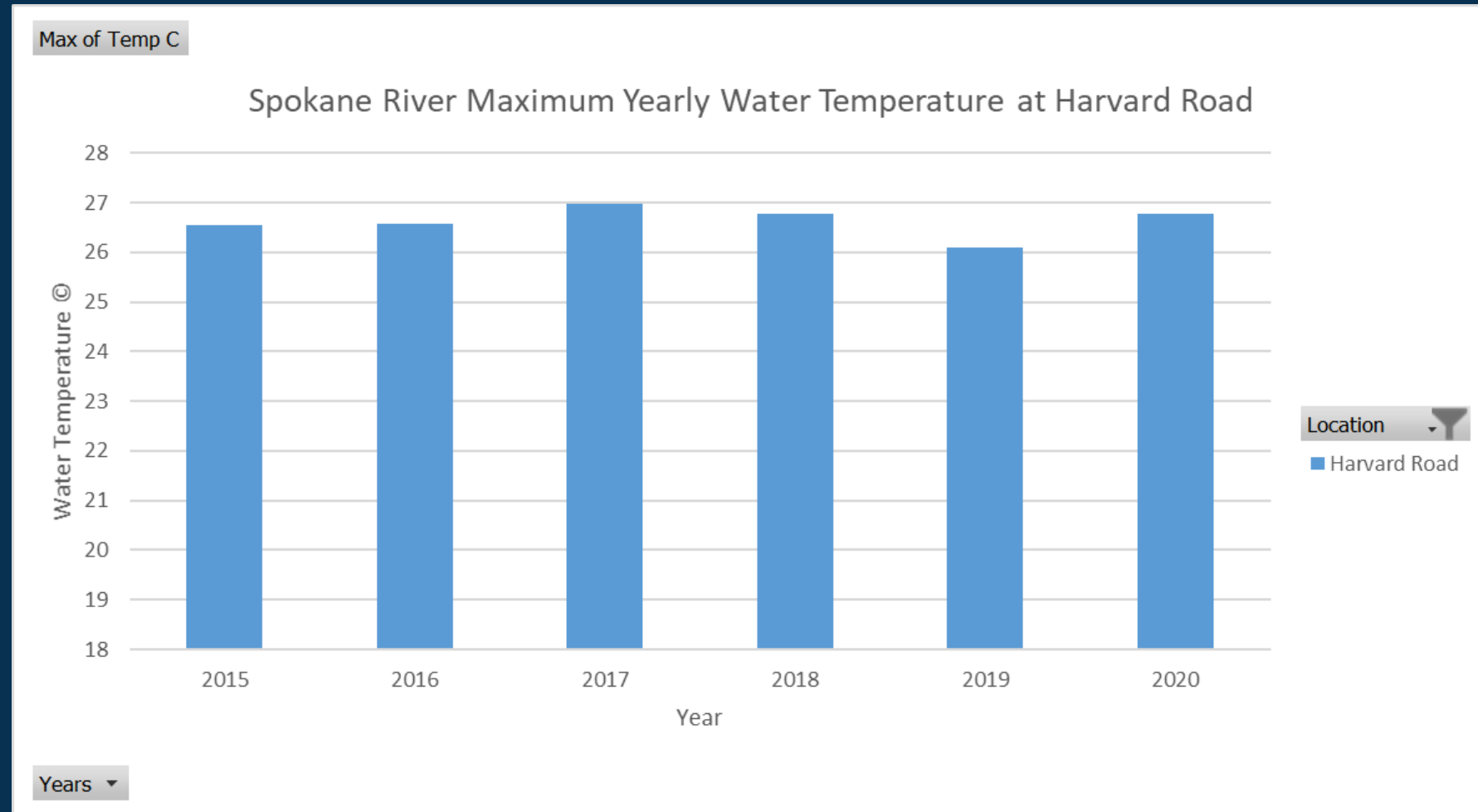


Warmer Waters

- The water in the Spokane River might be getting warmer!
- Climate change can cause warmer weather and less precipitation.
- How do fish breathe underwater?
- What do you think will happen to fish if the water gets too warm?



How warm is the Spokane River?



Big Question

How do changes in water level in the Spokane River affect trout eggs and the survival of the Redband Trout?



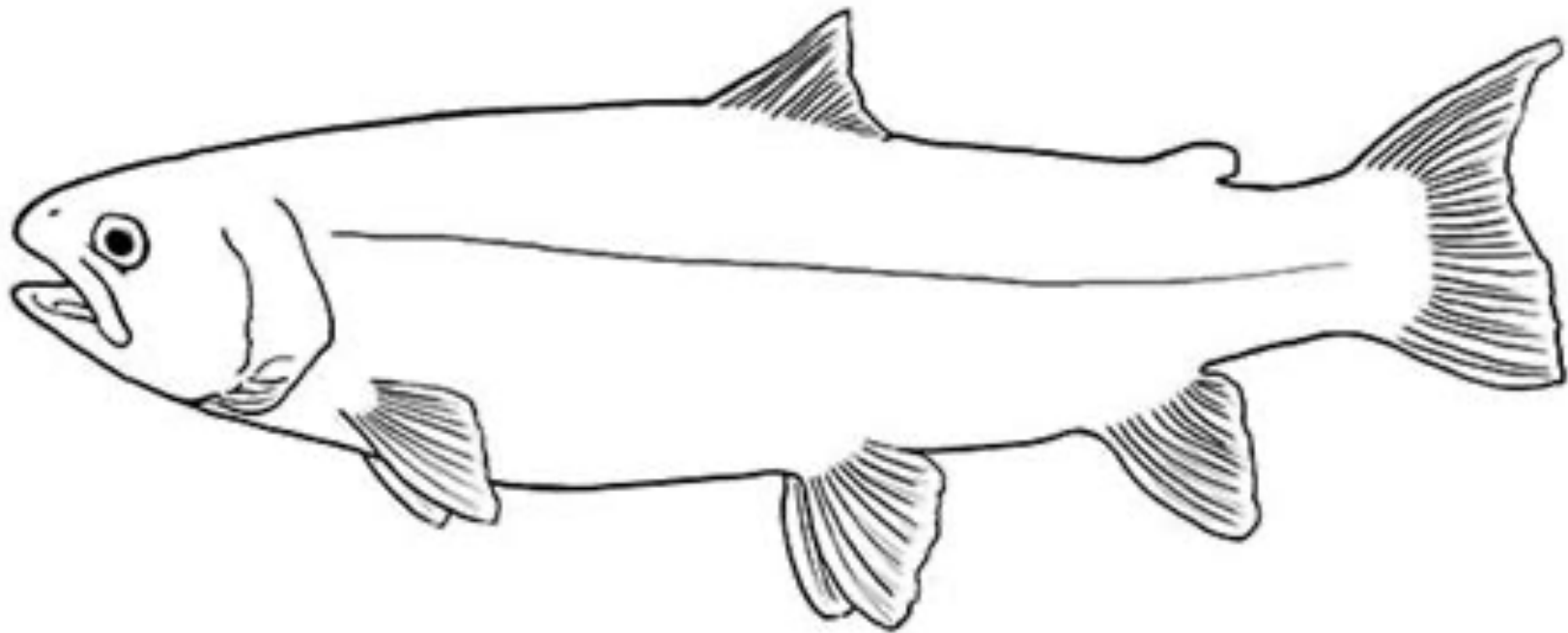
One Word Sharing

- Everyone gets to say one word about how they feel after learning about Redband Trout!
- Here are some examples of what you can say:
 - Excited
 - Fishy
 - Curious
 - Smart
 - Scientist

Name:

Redband Trout Anatomy and Coloring Page

- The Redband Trout has a rosy to brick red coloring running the length of its body, from its gills to tail. It often has white tipped fins.
- The Redband has darker and larger rounded spots than a rainbow trout and keeps these beautiful, freckle like dark marks through adulthood.



Word Bank:

Dorsal Fin

Pectoral Fin

Anal Fin

Eye

Mouth

Caudal Fin

Adipose Fin

Pelvic Fin

Gills

Nostrils

Lateral Line