



Washington
Department of
**FISH and
WILDLIFE**

Hungry Orcas, Declining Salmon

6-8 grade

Themes: [Southern Resident Orca Recovery Day](#), [World Fish Migration Day](#)

Location:

Remote learning modification: Lesson can be taught over Zoom or Google Classrooms. You can provide students with the whale trail map and the salmon run map and encourage them to visit one of these locations with an adult.

Lesson can be taught in the classroom. To make these topics more tangible, we encourage a trip to a [WDFW hatchery](#) when open. You could also plan a field trip to [see a salmon run](#) or make a [stop on the whale trail](#) to see some orcas.

Standards:

[NGSS 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

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.
- 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.
- Growth of organisms and population increases are limited by access to resources.

[NGSS MS-LS2-4](#)

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

[CCSS.ELA-Literacy.WHST.6-8.9](#)

Draw evidence from informational texts to support analysis, reflection, and research.

[CCSS.ELA-Literacy.RST.6-8.7](#)

Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

[WA ESE Standard 1](#)

Ecological, Social, and Economic Systems: Students develop knowledge of the interconnections and interdependency of ecological, social, and economic systems. They demonstrate understanding of how the health of these systems determines the sustainability of natural and human communities at local, regional, national, tribal, and global levels.

Materials:

WDFW PowerPoints (introduction, species decline and barriers and paths), graphs depicting salmon decline, graphs depicting Southern Resident orca decline.

Vocabulary:

Endangered species -A species of plant or animal that is at serious risk of extinction.

Extinct- A species that is no longer in existence.

Sustainability- preventing the depletion of natural resources in order to maintain an environmental balance.

Predator-prey relationship- An interaction between two organisms in which one of them acts as a predator that captures and feeds on the organism that serves as prey.

Direct relationship- Where two variables do the same thing. If one increases/decreases, so does the other.

Inverse relationship-Where two variables do the opposite thing. If one increases, the other decreases and vice-versa.

Anadromous- fish born in freshwater who spend most of their lives in saltwater, but return to freshwater to spawn.

Ecosystem- A system of organisms who function together in a specific environment; includes living and non-living elements.

Watershed-An area of land that drains water, sediment and dissolved materials to a common outlet such as a river. Watersheds vary from the largest river basins to acres or less in size.

Spawning-the act of releasing or depositing eggs or sperm into the water by some aquatic animals.

Pod- Orca pods are extended families of closely related individuals. Pod numbers may vary for resident orcas from five to 50 individuals.

Modifications, Adaptations:

For COVID-19 distance learning, or other remote learning modification, look for **Remote learning modifications** throughout the lesson plan.

Objectives:

Students will...

1. Summarize why salmon are important to their ecosystems.
2. Describe differences and similarities of three populations of orcas.
3. Analyze data and make inferences giving three reasons why Southern Resident orca pods are declining.
4. Examine the interdependent relationship between Southern Resident orcas and Chinook salmon using empirical data.
5. Explain issues Chinook have when migrating upriver to spawn.
6. Construct an evidence-based, written, verbal or visual project that summarizes problems Southern Resident Orcas and Chinook salmon face and provide solutions to sustain or improve their populations.



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Procedure:

Part A introduction to salmon:

Remote learning modification: This lesson can be taught over Zoom or Google Classrooms.

- Ask students who has had an experience with salmon. Have them describe their experience with salmon. For example, did it include a salmon fishing trip? Have they seen salmon in an aquarium or maybe had some for dinner? Have they even heard of a salmon?
- Using WDFW Introduction PowerPoint, introduce the five species of Pacific salmon: Chinook, coho, sockeye, chum and pink.
- The PowerPoint will help you explain that salmon are a migrating, anadromous fish. It will also introduce what species eat salmon.
- After the PowerPoint, have students watch [this video introducing Pacific salmon](#) and their life cycles.
- Break students up into pairs and have them answer the following question: Salmon are often referred to as the “lifeblood” of the Pacific Northwest. Why do you think salmon are important to Pacific Northwest cultures and ecosystems? Students will return to class to share answers.

Remote-learning modification: Zoom/Google breakout rooms. Give students written prompts so they remember the question they are answering. Have students come back together to share answers.

Part B introduction to orcas:

You will continue to use the WDFW Introduction PowerPoint for this section of the lesson. It is recommended that Parts A and B of this lesson are taught together. The other parts of the lesson can be taught at a separate time.

- One species that relies on salmon for survival are Southern Resident killer whales, also known as orcas.
- Orcas are found in oceans throughout the globe. They travel in social groups known as pods.
- Play the [Southern Resident orca video](#) which describes the three different orca populations in Washington. **Stop the video at 1:05.** Have students name the three different types of orcas. They should name the following:
 1. **Transient orcas** range from Alaska to California and eat marine mammals like seals and sea lions.
 2. **Offshore orca** populations are found further than nine miles off the coast and eat sharks and other fish.
 3. **Resident orcas** reside along the coastline. Most of their diet (estimates vary between 70-80%) consists of Chinook and chum salmon.
 - 3.a **Southern Resident orcas** are made up of three pods, J,K and L. They are most commonly found in the waters around the San Juan Islands and the Eastern Strait of Juan de Fuca from late spring to fall. They spend the rest of the year on the outer coast.

2) The decline of Southern Residents

- Have students watch the National Oceanic and Atmospheric Administration’s [video on the Southern Resident orcas](#). Encourage students to take notes.
- After the movie is finished, have students write down or draw the three reasons scientists have stated the Southern Resident population of orcas is declining. Share these reasons as a class.
- Engage the class in a discussion:
 - Scientists have said the Southern Residents are endangered. What does it mean for a species to be endangered?
 - In the discussion, they might mention extinction. Ask the class to discuss with a partner for one minute what they think it means for a species to go extinct. After they have discussed this, they should pair with a new partner and answer the following questions: (You can write these questions on a whiteboard).
 1. If a species goes extinct, how does that affect the ecosystem it lives in?
 2. How might a species’ extinction affect other species who live in that ecosystem?
 3. How might an extinction event affect humans?

Remote-learning modification: Zoom/Google breakout rooms. Give students written prompts so they remember what questions they need to be answering. Have students come back together to share answers. You can write answers on a shared document.

- After the discussion, review the WDFW story map titled, [Washington’s Orcas are Hungry](#). After you’ve viewed the map together, have students write down:
 1. One thing that surprised you.
 2. One thing that you found interesting.
 3. One thing you would like to know more about.



Idea: Have students popcorn read and take turns reading out loud throughout the story map.

- Using the information collected from the video and the story map, have students hypothesize why the Southern Resident population is in decline. They should use evidence to support their hypothesis.

3) The decline of Chinook salmon

- As a class, have students recall the three reasons Southern Resident orcas are declining.
- Using WDFW species decline PowerPoint, introduce students to a brief natural history of Chinook salmon.
- Highlight graphs on the PowerPoint showing decline of Chinook in Puget Sound. (These graphs are available in PDF for you to post so students can cite them).
- The PowerPoint will then introduce predator-prey relationships between Southern Resident orcas and Chinook salmon.
- Have students write a brief paragraph describing the relationship between Chinook and Southern Resident Orcas. Have them cite empirical data supporting their answer.



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Procedure Continued

4) Barriers to species survival

- Have the class review answers to the previous activity. This can be done in a think-pair-share or can be shared as an entire class. .
- Ask students to take a moment and brainstorm the following questions:
 - Why might Chinook populations be declining?
 - What steps could be taken to help improve Chinook populations?
 Students will keep their answers to themselves and these questions will be discussed in the PowerPoint.
- Review short informational slides about why Chinook may be declining and steps WDFW and partners are taking to aid in Chinook and orca recovery.
- The last slide talks about barriers to fish passage and has a link to [Fish Passage: A Sense of Urgency](#) story map. Review the story map with your class, highlighting the link where they can map fish barriers they find in their community.
- Career/work highlight:** Washington Department of Fish and Wildlife scientific technicians, biologists, and engineers working together to remove barriers to fish passage.
- Things students and families can do to support healthy orca and salmon populations.

5) Research and assessment

You may choose to give students a couple of weeks on this project to ensure thorough research and quality work.

- Using the graphs provided in this lesson and their own research, students will either write a story (with or without pictures), write a scientific paper, create a movie, etc. telling the story of interdependence between Chinook and Southern Resident orcas. Their piece must:
 - Have a beginning, middle and end.
 - Cite reputable sources (government agency, scientific paper or academic study, etc.)
 - Translate at least one piece of quantitative information into visual information (for example, a graph, a flow chart, a table, etc.).

The work should answer the following questions:

- If Chinook populations improved, would the numbers of Southern Resident orcas improve as well? Why or why not?
- Is it likely the Southern Resident orca population would increase if Chinook populations continued to decline? Why or why not? What other factors are Southern Resident orcas facing?
- What other species might begin to see an increase in population with a larger Chinook population? Do you think this would be good or bad for the ecosystem? Explain.
- Are there other ways that salmon benefit their

ecosystem other than being prey? Explain.

- Are there other ways scientists think we can support Southern Resident recovery which does not involve salmon? Explain.
- Describe at least one way you and your family can help support Southern Resident and Chinook recovery.



Idea: Show off your students' work! Share student projects from this lesson with WDFW:

Facebook: @WashingtonFishWildlife

Instagram: @TheWDFW

Twitter: @WDFW

#WildWashington #WildWa

Additional Resources :

You can use the following resources to build onto this lesson, or share these resources with students for their research project.

- [Orca Conservation and Management-WDFW](#)
- [Species profile-orca-WDFW](#)
- [Species profile-king salmon-WDFW](#)
- [Barriers to fish passage in WA map-WDFW](#)
- [Southern Resident Orca Recovery Task Force](#)
- [Southern Resident recovery and planning-NOAA](#)
- [Orca recovery beings with salmon habitat-NOAA](#)
- [Southern resident connections-NOAA](#)
- [Protecting wild behavior and instincts-NOAA](#)
- [Priority Chinook salmon-NOAA](#)
- [Species of concern killer whales-MMA](#)
- [Studying orcas-UW](#)
- [Orcas and salmon-Whale Research Center](#)
- [Protect orcas, protect salmon-Wild Salmon](#)
- [How to help salmon-State of Salmon](#)
- [Salmon recovery stories- State of Salmon](#)
- [2018 executive summary- State of Salmon](#)
- [Salmon journey in Cedar River-Seattle Aquarium](#)
- [Chinook salmon profile-NOAA](#)
- [Humans and salmon-PBS](#)
- [Salish Sea Chinook Salmon-EPA](#)
- [Where to view salmon in Puget Sound](#)