LESSON 14: THE IMPACT OF HYDROELECTRIC DAMS ON SALMON

ESSENTIAL QUESTION:

What combination of factors both natural and manmade is necessary for healthy river restoration and how does this enhance the sustainability of natural and human communities?

GUIDING QUESTION:

Dams are important to people but they have a serious impact on salmon migration. How do dams affect salmon and what successes have people had in trying to help salmon migration?

OVERVIEW:

This lesson focuses on the impacts that hydroelectric dams have had on anadromous salmon migration and some of the mitigation techniques that have been designed to reduce these impacts. Hydroelectric projects were started during the Great Depression and continued through the 1960's and 1970's for the purpose of channeling water for irrigation in the arid Columbia Basin and to generate cheap electricity. However, the dams created obstructions for migrating salmon. Even those dams built with fish passage, such as fish ladders and navigation canals, have had major impacts on the survivorship of juvenile salmon due to mortality in the turbines and spillways, increased water temperatures, predation, and a myriad of other factors.

TIME:

One class period

MATERIALS:

- **Lesson 14- Impact of Dams on Salmon.pptx**
- **Lesson 14a- Impact of Dams on Salmon.pdf**
- **Dam Site Selection.pptx**
- **Dam Site Selection.pdf**
- Reflection Journal Pages (printable handout)
- Vocabulary Notes (printable handouts)

PROCEDURE:

1. Review Essential Question; introduce Guiding Question.

2. Students should take a few minutes to respond to the first reflection prompts. Discuss their answers and any questions they've generated.
3. Hand out the Vocabulary Notes. *With this lesson you may want to define the words before presenting the PowerPoint Lesson.*
4. Present the PowerPoint Lesson
5. **Class discussion-** Have students discuss the pros and cons of dams in the Pacific Northwest. The pros should include water diversion for irrigation and agriculture in a desert landscape, cheap, renewable, and clean hydroelectricity, ability to barge goods over long distances rather than having them put on trucks or trains, and recreational opportunities like boating and fishing for warm-water species. The cons include the destruction of native salmon runs, the loss of native ecosystems under the reservoirs, and the tilling of desert ecosystems into farmland.
6. Dam site selection project
7. Hand out the second Reflection Journal Page. Give students time for a final reflection the lesson.

WASHINGTON STATE STANDARDS:

SCIENCE

1. **EALR 4: 6-8 LS2A** An ecosystem consists of all the populations living within a specific area and the nonliving factors they interact with. One geographical area may contain many ecosystems.
    a. Explain that an ecosystem is a defined area that contains populations of organisms and nonliving factors.
    b. Give examples of ecosystems (e.g., Olympic National Forest, Puget Sound, one square foot of lawn) and describe their boundaries and contents.
2. **EALR 4: 6-8 LS3A** The scientific theory of evolution underlies the study of biology and explains both the diversity of life on Earth and similarities of all living organisms at the the chemical, cellular, and molecular level. Evolution is supported by multiple forms of scientific evidence.
    a. Explain and provide evidence of how biological evolution accounts for the diversity of species on Earth today.
3. **EALR 4: 6-8 LS3E** Adaptations are physical or behavioral changes that are inherited and enhance the ability of an organism to survive and reproduce in particular environment.
    a. Give an example of a plant or animal adaptation that would confer a survival and reproductive advantage during a given environmental change.

READING

1. **EALR 1:** The student understands and uses different skills and strategies to read.
    a. **Component 1.2** Use vocabulary (word meaning) strategies to comprehend text.

SOCIAL STUDIES

1. **EALR 5:** The student understands and applies reasoning skills to conduct research, deliberate, form, and evaluate positions through the processes of reading, writing, and communicating.
    a. **Component 5.2:** Uses inquiry-based research.

WRITING

1. **EALR 2:** The student writes in a variety of forms for different audiences and purposes.
    a. **Component 2.1:** Adapts writing for a variety of audiences.
    b. **Component 2.2** Writes for different purposes.

ADDITIONAL RESOURCES AND ENRICHMENT:

http://videos.howstuffworks.com/hsw/6140-geography-basics-dams-video.htm
http://adventure.howstuffworks.com/outdoor-activities/fishing/fish-conservation/fish-populations/salmon-population.htm
http://www.mapbureau.com/salmon/index.html

A controversial article that might be fun to examine for enrichment:
http://www.oregonlive.com/news/index.ssf/2008/10/research_hints_dam_improvement.html
http://news.nationalgeographic.com/news/2008/10/081027-salmon-dams.html

VOCABULARY TERMS:

- **Fish Ladder-** A series of stepped waterfalls which bypass the dam, descending from the reservoir to the riverbed below the dam, designed to allow migrating fish to pass the dam structure.

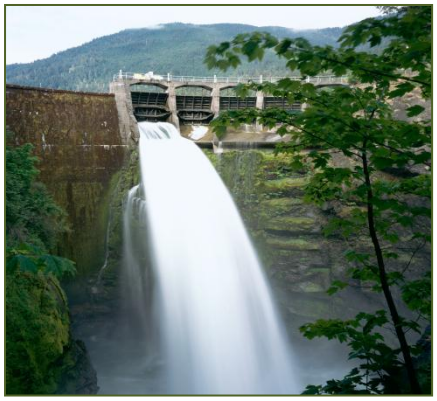
- **Penstock-** A intake tube for channeling water through the turbines of a dam or via spillways and floodgates.

- **Reservoir-** A man-made water containment system often the result of lake filling behind a dam, but also can be water stored in large tanks or underground storage.

- **Navigation Canal-** A series of locks used to allow boat traffic to bypass the dam. They typically contain mechanisms for raising or lowering water levels to enter and leave reservoirs.

- **Turbine-** A rotating device surrounded by magnets, which is spun by the pressure of flowing water for the purpose of generating electricity.

- **Barging-** A technique to assist juvenile salmon migrating past the dams by loading them on a barge and sailing them downriver, so as to reduce the mortality related to passing through turbines, falling over spillways, or being eaten by predators. This technique is controversial and the success remains unclear.



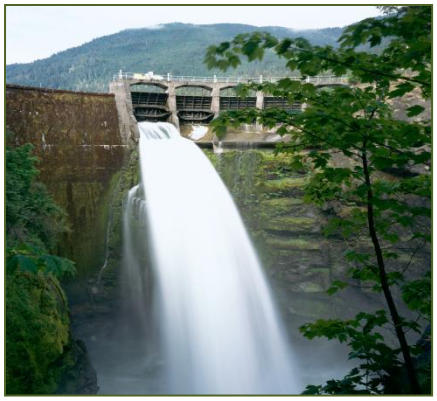
Elwha River Restoration

The Impact of Hydroelectric Dams on Salmon

Reflection Journal 1

Why do people build dams?

What questions do you have about dams?



Elwha River Restoration
The Impact of Hydroelectric Dams on Salmon
Vocabulary Notes

Fish Ladder:

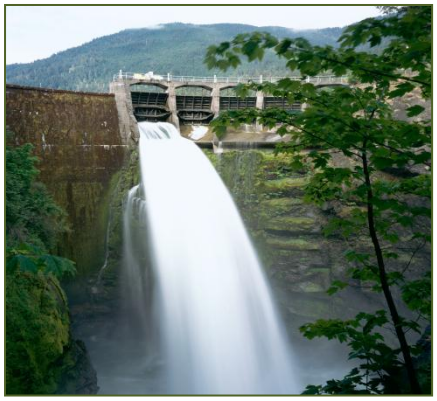
Penstock:

Reservoir:

Navigation Canal:

Turbine:

Barging:



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Reflection Journal 2

How have salmon responded to the change in their environment brought on by the building of dams?

Now that you've selected a dam site, what questions do you have about dams?