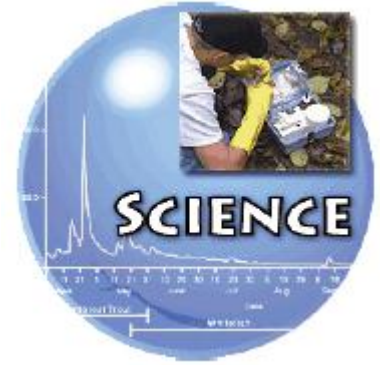


LESSON 12: MARINE DERIVED NUTRIENTS FROM SALMON



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:

How do the carcasses of dead adult salmon support young salmon and how are salmon essential to the marine food web as well as the freshwater ecosystems of the Pacific Northwest?

OVERVIEW:

Discuss the marine food web related to salmon. Introduce the idea of algal blooms in the cold nutrient-rich waters of the North Pacific. Explain trophic levels, energy movement, bioaccumulation and biomagnification of nutrients and chemicals into top-level predators such as salmon. Introduce the idea of these marine-derived nutrients entering the freshwater ecosystems and becoming the basis of the freshwater ecosystem food web. Freshwater ecosystems in the Pacific Northwest tend to be oligotrophic (containing few nutrients), so these marine-derived nutrients constitute an important influx that greatly increases the productivity of these rivers.

MATERIALS:

- **Lesson 12- Marine Derived Nutrients from Salmon.pptx**
- **Lesson 12a- Marine Derived Nutrients from Salmon.pdf**
- **Functional Feeding Groups.pdf**
- Watch glasses
- Depression slides
- Macroinvertebrates from a nearby stream or pond
- Algae and aquatic vegetation from a nearby stream or pond
- Dissecting scopes
- Tweezers
- Eye droppers
- Reflection Journal Pages (printable handout)
- Vocabulary Notes (printable handout)

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. Macroinvertebrate Lab Activity
6. Hand out the second Reflection Journal Page. Give students time for a final reflection the lesson.

ASSESSMENTS:

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 LS2B** Energy flows through an ecosystem from producers (plants) to consumers to decomposers. These relationships can be shown for specific populations in a food web.
 - a. Analyze the flow of energy in a local ecosystem, and draw a labeled food web showing the relationships among all of the ecosystem's plant and animal populations.

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.
 - i. **1.2.1** Understand and apply dictionary skills and other reference skills.
 - ii. **1.2.2** Apply a variety of strategies to comprehend words and ideas in complex 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.

- i. **5.2.1** Creates and uses research questions to guide inquiry on an issue or event.

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.
 - i. **2.2.1** Demonstrates understanding of different purposes for writing.
 - 1. Writes to learn (double-entry journal in math, social studies, or science; letter to teacher assessing own work; reflection).

ADDITIONAL RESOURCES AND ENRICHMENT:

http://nationalzoo.si.edu/Publications/ZooGoer/2004/1/Pacific_Salmon.cfm

VOCABULARY TERMS:

- **Shredder**- Eat leaves and other vegetative particles and select those with fungi and bacteria attached to them for protein (includes mayfly and caddisfly larva).
- **Scraper/Grazers**- Scrape biofilm, algae, and detritus from rocks, wood, and vegetation (includes snails and caddisfly larva)
- **Filter-feeder**- Filter small particles out of the water-column, often dislodged by the shredders and scrapers (includes copepods, amphipods, blackfly and midge larva, hydra, etc.).
- **Collector-gatherer**- Forage along the streambed for detritus, food particles, and fungi (includes stonefly larva and some mayfly larva).
- **Predator**- An organism that hunts and feeds on other animals (includes dragonfly larva, water beetles, water striders, etc.)
- **Biofilm**- A community of microorganisms living within a matrix of secreted materials secured to a solid structure such as river rocks or aquatic vegetation. They are often complex environments containing bacteria, algae, fungi, and protozoans.
- **Marine-derived nutrients (MDN)**- Nutrients acquired by an anadromous fish and deposited in a freshwater or terrestrial ecosystem when that fish dies.
- **Oligotrophic**- Containing few nutrients and therefore unable to support much life

- **Eutrophic-** An ecosystem containing high levels of nutrients and therefore supporting high productivity. However, an overly eutrophic environment can result in algal blooms that cause the waters to become deficient in oxygen through the bacterial consumption of dying algae. These anoxic aquatic environments can then become dead zones to all but algae.
- **Nutrient cycle-**Transfer of NUTRIENTS from one part of an ecosystem to another.
- **Saprophyte-** An organism, especially a fungus or bacterium, that grows on and derives its nourishment from dead or decaying organic matter.



**Elwha River Restoration
Marine Derived Nutrients from Salmon
Reflection Journal 1**

How can a dead animal be part of a healthy ecosystem?

What questions do you have about dead animals in the ecosystem?



**Elwha River Restoration
Marine Derived Nutrients from Salmon
Vocabulary Notes**

Shredder:

Scraper/Grazers:

Filter-feeder:

Collector-gatherer:

Predator:

Biofilm:

Marine-derived nutrients (MDN):

Oligotrophic:

Eutrophic:

Nutrient cycle:

Saprophyte:



**Elwha River Restoration
Marine Derived Nutrients from Salmon
Reflection Journal 1**

How do the carcasses of dead adult salmon support young salmon, and how are salmon essential to the marine food web as well as the freshwater ecosystems of the Pacific Northwest?

What questions do you have about salmon, the marine food web, or the freshwater ecosystems of the Pacific Northwest?

LAB ACTIVITY

In the Macroinvertebrate Lab you will collect aquatic insects and other macroinvertebrates from a local stream. They can be stored overnight in a refrigerator. Most organisms collected in nearby streams and ponds in North America will be similar to those in the Elwha River. Have the students examine them under the microscopes, key them out to a group or class of organisms (genus or family if possible), and identify the functional feeding group they belong to. Click on the side below to open the pdf.

ADDITIONAL LAB RESOURCES:

<http://people.virginia.edu/~sos-iwla/Stream-Study/StreamStudyHomePage/StreamStudy.HTML>

**Some fun Language arts activities to help students identify Aquatic insects and macroinvertebrates

Go to *benthic language arts lessons* from Rivers Project

<http://www.siue.edu/OSME/river/water&kicknets/inexpideaforrivstudy1.htm>