Salmon Run Lesson Plan

Overview

In this lesson, students will learn about the life cycle of the Pacific salmon and the impact of humans on salmon migration. Salmon commonly migrate hundreds of miles from their freshwater birthplace to the ocean, and later return to their birthplace to spawn (i.e. lay eggs). The cycle of life and death of the salmon is important to inland vegetation, as nutrients are transported from the ocean to the headwaters by the salmon and released after the salmon dies. Students will learn how damming of rivers has disrupted salmon migration routes and affected reproduction of salmon populations by tracing migration routes as they appear on satellite imagery, and completing mock calculations of the differences in expenditure of energy that enable salmon to cross dams where no migration impediments previously existed. Important cultural connections of the salmon to Native Americans are explored through legends that illustrate the importance of this magnificent fish to native peoples of North America.

This lesson contains several distinct lesson activities that may be implemented over multiple class periods.

Suggested Lesson Sequence	Please see the Greenlinks, Migrations del Mundo, and Earth Systems and Humans module descriptions.
Lesson Level	Extended
Science Connections	· Students will learn about the **life cycle** of the **salmon**. · Students explore the **migrations** of salmon from freshwater birthplaces, to the ocean, and back to freshwater streams again to **spawn**. · Students will learn about how salmon play an important role in the **recycling of nutrients** by transporting them from the ocean to headwater streams.
Math Connections	· Students will **calculate the energy** expended by salmon as they swim up fish ladders on dams.
Technology Connections	· Students will trace salmon migration routes using a **satellite image** and **maps** of dams in the Columbia River Basin.

Human Connections	· Students will learn about the impact humans have had on salmon migration routes by damming rivers. · Students will learn about the importance of salmon for the culture and survival of Native American peoples.
Lesson Assessment	· Assessment and Standards Table (Word) · Assessment Activity Description (below) · Authentic Assessment (below)

Materials and Resources

Salmon Legends Activity Sheet (Acrobat)
Life Cycle Journey photo essay (Powerpoint)
Human Impact photo essay (Word)
Salmon Migration activity sheet (Word)
Salmon Energy activity sheet (Word)

About the photo essay slideshows: these slideshows are not meant for students to read through on their own. They are intended to be viewed together, to outline and illustrate a discussion of the lesson's themes, led by the teacher. You might have a different student read each slide's text.

Vocabulary Note: students will likely be unfamiliar with other vocabulary presented in this lesson. This is done intentionally, to spur additional conversations and discussion about these words and their meanings. Encourage your students to ask about words they may be unfamiliar with.

Procedure

I. Assessing Prior Knowledge

As a general introduction to this series of lesson activities, students can use the Life Cycle Journey photo essay to learn about the life cycle of salmon. This photo essay contains pictures of salmon at various stages of life – from incubation in eggs to death.

Summary of Life Cycle Journey: In the life cycle journey, students will learn about the natural history and life cycle of the Pacific Salmon. The Pacific salmon are born in freshwater streams or rivers and migrate hundreds – even thousands – of miles to the ocean. The ocean provides abundant food for the salmon, and the fish typically stay there 1-5 years, depending on the species. As adults, salmon can weigh more than 100 lbs. and primarily eat smaller fish. Salmon return to their freshwater birthplace to spawn (i.e. lay eggs). Scientists think that salmon follow their sense of smell to find their birth waters.

In order to conserve their energy, most salmon do not eat once they return to freshwater and they die within a week after spawning. Some fish get lost and end up spawning elsewhere. When this happens, their offspring are not as well adapted to foreign conditions, and the survival rate diminishes. The cycle of life and death of the salmon is important as nutrients are transported from the ocean to the headwaters by the salmon and released after the salmon decomposes. In class discussion and subsequent activities, teachers should emphasize the delicate balance for survival of these magnificent fish, particularly in the face of human-made dams (and other alterations) to the migratory paths that the ancestors of these salmon have followed for hundreds of years.

II. Contextual Preparation

Native American Salmon Legends

Salmon are fascinating animals, as students will learn throughout this lesson. One particularly unique aspect of the life of salmon is how intimately related salmon are to the culture and very existence of Native American peoples across the world, and throughout history. For tribes of Native Americans in the Pacific Northwest, the salmon has taken a central place in their culture, traditions, and practices of daily life.

To help students appreciate the significance of salmon – their beauty, mystery, amazing migrations, and relationships with human civilizations – this lesson begins by sharing five stories about Salmon that have been told for centuries by various Native American tribes. These legends can be found in the Salmon Legends activity sheet.

Each of these five stories presents a different view of salmon – how they were perceived by humans, how they were intimately connected to the spirits and ancestors of native peoples, and how their amazing lives were captured and described in the form of oral traditions.

Teachers may choose to do any number of activities with these stories. Certainly, they represent an opportunity for students to read (and perhaps compose) compelling and creative literature. Teachers may choose to begin each activity in this lesson with one of the stories. Students might be asked to read and summarize individual stories. Teachers may choose to use these stories as content-based reading material. In any event, these stories evoke powerful images of Native peoples and their relationship to the earth and, in particular, to salmon. They also convey the ecological knowledge that Native peoples had about salmon (such as their importance in the process of recycling nutrients). These stories may be used later as anchors to help students recall and more deeply understand the content of the lesson activities.

III. Student Activities

Activity One: Human Impact Activity Sheet/Photo Essay

Students can learn about the impact of human activity on the salmon by completing the Human Impact Activity Sheet/Photo Essay. This photo essay is designed to be self-paced or completed as a whole class. Information about salmon and questions/answers are provided with each photo.

Teacher Information for the Human Impact Photo Essay:

Salmon are a nutritious and staple source of food in the diet of most Native American tribes in the Pacific Northwest. Salmon migrate through rivers of the Columbia River Basin that have been extensively dammed for hydroelectric power and irrigation. Because salmon don't eat once they begin their migration, their energy is limited. Unfortunately, the damming of rivers interferes with their migration because salmon must expend extra energy to travel across dams to their spawning sites. If a salmon expends too much energy crossing dams, then it may get lost and spawn elsewhere. Often young fish are not adapted to those local conditions as they would normally be in their intended birth waters. In addition, the decomposing bodies of the salmon will not deposit nutrients that replenish the forest ecosystem upstream.

Additionally, dams turn moving, cold water into more stagnant, warm water. Salmon are better adapted to living and reproducing in cold, fast moving water. Salmon are extinct in almost 40 percent of the rivers where they originally spawned in the Pacific Northwest. Efforts are underway to remove some dams from the Columbia River Basin.

Activity Two: Salmon Migration Activity

In this activity, students will use a satellite image and a map of the Columbia River Basin to trace the migration routes of the salmon. Teachers should print out the activity sheet for students to work in pairs or small groups. On the satellite image, students should label geographic features, including: Vancouver Island, Pacific Ocean, snowy mountain ranges, Seattle, Washington, outer space, and rivers of the Columbia River Basin. Students may need to refer to a map of the region to assist in identifying features and locations.

On the second page of the activity sheet is a map of the Columbia River Basin that shows locations of all existing dams. Students should compare this map to the locations of the dams on the satellite image by noting where the river is swollen. By completing this activity, students should gain an appreciation of the distance that salmon travel (e.g. farther than straight up to outer space!) and the number of dams that the fish must cross during migration. During class discussion, teacher may refer back to the "Human Impact Photo Essay" to discuss the problems that dams create for salmon migration.

Activity Three: Salmon Energy Activity

In this activity, students will calculate the amount of energy (in calories) used by two hypothetical salmon to migrate from the ocean to their birthplace spawning waters. Teachers may print out the activity sheet for students or complete the calculations as a whole class activity. The data used (i.e. number of calories) for this activity is hypothetical, but the context is intended to illustrate the effect of dams on the capacity of salmon to produce eggs.
Teacher Background Information:

In order to conserve energy while traveling from the ocean to their spawning sites in freshwater rivers or lakes, salmon do not eat. Instead, they use all their limited energy to swim upstream and lay eggs. Salmon lay up to 12,000 eggs in the place they were born. Because many of the rivers through which salmon travel are dammed, salmon must also use energy to go up fish ladders or around the dams.

The energy that animals use to do different activities is measured in *calories*. Animals absorb calories by eating food. If an animal does not eat, however, then the animal must use calories that are stored in its body for energy.

Problem: In this activity, calculate the amount of energy (i.e. calories) that two fish use to swim upstream from the ocean to spawn. One of the salmon, Fish A, is able to swim upstream without any dams blocking the migration route. Fish B must swim up a river with three dams in the way. Each fish will start from the same location with a reserve of 75,000 calories. To swim 1 mile takes 50 calories. To produce an egg takes 5 calories. To swim up a fish ladder requires 250 calories.

Students should follow the directions on the activity sheet. The answers to the calculations are found in the charts below:

Fish A (no dam)

Energy to Start	75,000 calories
Energy to swim 1000 miles	50,000 calories
Energy Left Over To Make Eggs	25,000 calories
Number of Eggs	5,000 eggs

Fish B (with dams)

Energy to Start	75,000 calories
Energy to Jump Fish Ladders	7500 calories
Energy Left to Travel Upstream	67,500 calories
Energy Need to Swim 1000 miles	50,000 calories
Energy Left to Make Eggs	17,500 calories
Number of Eggs	3,500 eggs

Answers to Summary Questions:

1. Which fish used the most energy to get up the river (before laying the eggs)? How much more energy did this fish use than the other fish? **Fish B; 7500**

2. Which fish would be able to produce more eggs? How many more eggs? **Fish A; 1500**

3. Why would it be important for scientists to study problems like this one? What might this experiment suggest to us about the lives of salmon, and the impact of humans on their survival? **Answers will vary. It is important to be aware of the impact humans have on the ultimate survival of salmon. It is interesting to contrast the rapid decline of salmon populations in the last 50 years with the mutually beneficial relationship that Native Americans had with salmon for hundreds of years.**

IV. Assessment

In the Salmon Run Lesson, teachers should assess student understanding of the lesson objectives through the completion of the activities. Particular attention should be made to understanding the salmon life cycles and the ecological issues related to salmon migration. The following questions concerning salmon migrations and the impact of humans could be addressed.

1. What vital role do salmon play in the ecosystem of the rivers and forest where they spawn? *(Provide nutrients when bodies decompose)*

2. What value do salmon have to humans? *(Source of food, cultural heritage, nutrients to the ecosystem)*

3. How is salmon migration affected by the impact of dams? *(In addition to interfering with migration routes, dams also increase the energy required for salmon to migrate across dams result in fewer eggs laid or inability to return to original spawning waters, eventually resulting in salmon extinction)*

Lesson Extensions for Authentic Assessment

1. Students may wish to write a report on the importance of salmon to Native American tribes throughout history. There are many sources in public libraries on this subject, as well as a growing number of websites on the internet that also provide important

information about salmon and Native American peoples.

2. Students may wish to research conservation efforts currently in place to protect populations of wild salmon.
3. Encourage students to use what they have learned about salmon to study another type of fish species, along with their special life cycle and habitat characteristics.