Wildlife Communities in the Riparian Zone of the Elwha Valley:

Studying amphibian and mammalian populations before ecosystem restoration

Abstract

The year 2012 will mark the beginning of a deconstruction project involving two dams that have blocked the annual return of salmon to the heart of Olympic National Park's Elwha River system for over 100 years. The removal of the Elwha dams will not only restore salmon to the upper river, but will also restore natural movements of sediments and wood to the middle and lower river below the dams. A team of wildlife biologists is working together to survey the current distributions of amphibians and mid-sized mammalian herbivores (beaver) and carnivores (raccoon, spotted skunk, mink, two species of weasel, and river otter) that depend on the Elwha River for their habitats and foods. Team efforts will provide a baseline of information for future comparisons after dams are removed, salmon return to the upper river, and natural patterns of sediment and wood transport are restored in the lower river.

Introduction

The Elwha River flows over 70 kilometers (45 miles) from its headwaters on Mount Queets eastward and then northward to the Strait of Juan de Fuca on Washington's Olympic Peninsula. Throughout this length, the river forms a unique ecosystem, known as a riparian zone, where flowing water meets the land. Riparian zones are always changing because of the constant rising and falling of water onto the land. The great power of the river works to transport and deposit sediments and large wood (woody debris) downriver during floods. Vegetation in the riparian zone is often very diverse, a reflection of the impact of flooding that changes plant communities over time. Riparian zones are important areas for many wildlife communities.

The riparian zone at the mouth of the Elwha River during the Winter 2007 flood. Photo By Christian Polyak

The diversity of vegetation, foods, and structures (logs, large trees, pools, river banks) found in the riparian zone creates important habitat for a great variety of wildlife species. Habitat is a home for wildlife that meets needs for water, food, shelter, and security. As a human animal your habitat is your home and local community: those places where you find the resources you need to survive. But many other animals make their home on riparian zones of river systems because of the proximity to water, the many foods that live in or near the water, and the abundance of shelter and/or secure areas in the form of log jams, large trees, and river channels formed by the river.

Biologists expect removal of the Glines Canyon and Elwha Dams from the Elwha River in 2012 will affect several species of wildlife that are associated with riparian zones in the Elwha Valley. Dam removal will have two primary effects on wildlife habitat. First, once the dams are removed, salmon are expected to expand their range upriver and begin spawning in portions of the upper river that were previously blocked by the dams. Over twenty different wildlife species have been observed feeding on spawned-out salmon in nearby river systems of the Olympic Peninsula and over 30 species are in some way dependent upon salmon for food (Cederholm et al. 1989, 2001). Second, dam removal will influence movement of sediments and woody debris from the headwaters to the mouth of the Elwha River. Sediments include rocks, gravel, sands, and silts that move downriver with flowing water, whereas woody debris refers to logs and other coarse woods transported with the river. Changes to the transport of sediments and wood may influence the formation of river channels and the dynamics of floodplains downriver. Lake Mills and Lake Aldwell, impounded by dams, work to block salmon passage and trap sediments and woody debris in the reservoirs.

At this point in time, biologists can only hypothesize about the potential effects that restoring salmon and sedimentation processes will have on riparian wildlife populations in the Elwha Valley. The Elwha Wildlife Research Team, comprised of biologists from different agencies and universities, are working together to answer a wide variety of research

This motion sensing camera automatically takes a photograph when an animal passes in front of it. Photo by USGS

questions. For example, what are the current distributions of a variety of wildlife species in the Elwha River? What environmental factors are associated with wildlife distributions? What is the abundance of amphibian pools in the floodplain?

Answers to these questions will provide a baseline of information by which to gauge population-level responses of these wildlife groups to changes in salmon abundance/distribution, sediment transport, and river channels. The behavior of an individual animal is different than the behavior of a population of animals. Populations involve more than one individual and show changes that will likely be passed on to future generations. These changes might only be documented by the Elwha Wildlife Research Team if they study many animals as opposed to just a few animals.

The Elwha Wildlife Research Team is using many noninvasive strategies to study baseline distributions of wildlife species in the riparian zone prior to dam removal. The term 'noninvasive' means that the methods used generally avoid disturbing the privacy or security of wildlife. Although it would be instructive to estimate abundance and distribution patterns of all mammalian species in the Elwha riparian zone prior to dam removal, estimation of abundance is often very time consuming and beyond the scope of the current study (except perhaps the river otter, see below). For most species the research team is focusing their efforts on documenting baseline patterns of distribution based on natural history surveys and samples of species presence. The goal of the Elwha Wildlife Research Team in conducting wildlife population surveys is to chart patterns of animal distribution. These patterns will then be used to provide evidence that riparian wildlife species have or have not changed in distribution once the dams are removed.

Methods

The first step in conducting a large-scale wildlife survey is to develop a repeatable survey design. Since it is not feasible for the research team to survey wildlife populations throughout all of the riparian zones in the Elwha River system, the team is focusing their survey efforts on river segments representative of both the Elwha main channel and side-channels from the river's mouth to river mile thirty-five above both dams. Through this approach, approximately one third of the whole river will be studied, which is predicted to receive the most significant changes in the watershed. The research team will repeatedly survey the selected river segments to determine the proportion of sites occupied or used by targeted riparian wildlife populations. The Wildlife Research Team is using different survey methods to study different groups of wildlife, which are outlined below.

Entrance to a track box where an animal will enter for cat food and leave behind tracks. See tracks on next page. Photo by USGS

Amphibians

Amphibians are a class of animals, including frogs and salamanders, that generally spend part of their life cycle in the water. The research team is using two primary methods to study amphibians in the Elwha floodplain. First, the research team is mapping and counting pool habitats that are used for breeding by many amphibian species. The research team maps the location of pools so that changes in the numbers of pools associated with future changes in the river can be documented. This information will help to understand whether or not changes in the transport of sediments and logs downriver following dam removal influences the overall qualities of amphibian habitats on the floodplain. Second, the team is determining the proportion of pools that are used by the different amphibian species found.

Beaver

Unlike most of the other mammal species being studied, beavers are herbivores rather than carnivores. They feed on riparian plants like cottonwoods, willows, red alder, salmonberries, and other shrubs. The research team is studying the distribution of beavers in the Elwha by closely examining vegetation at the river's edge for signs of feeding activity. When beavers feed on woody vegetation, they chew on tree trunks, branches, and leaves in a characteristic manner, often eating the bark or cutting down entire stems to gain access to the buds, leaves, and fine twigs beyond their low reach. Beavers create bite marks, wood chips, and leave angled stumps that are all characteristic 'beaver sign.' Beaver feeding spots were counted at eighty-four locations along the Elwha. The amount of beaver feeding activity at each location is being compared to river features like stream depth and steepness of the river's bank to see if beavers feed more in particular types of habitat.

River Otters

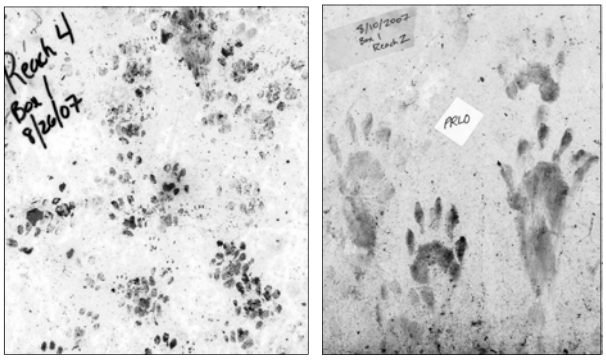
River otters are one of the larger members of the weasel family and spend the majority of their time in water. Since fish are the primary source of food for this carnivore, the research team hypothesizes that the return of salmon may directly affect their future patterns of distribution and abundance. Although otters spend much of their time in rivers, they frequently come on land to use latrine sites (just what it sounds like). Latrines are sites used for scent marking that allow for communication between otters. These special sites are characterized by otter sign such as trails, steep 'slides' into the water, soil disturbance, and piles of leaves or other debris gathered into small 'scent mounds.' The research team is searching for and mapping latrine sites, collecting hair samples from otters using hair grabbing devices that do not harm the animals, and collecting otter scats.

Spotted Skunk (*Spilogale gracilis)* **and Raccoon** *(Procyon lotor)* **attracted to bait and photographed. Photo by USGS**

The goal of otter and beaver surveys is to plot the known distributions of latrine sites and feeding activity, respectively. In the case of river otters, the research team is also hoping to accurately identify individual otters to estimate their abundance. If individuals can be recognized using genetic analysis of their hair or scat, then the number of animals using the sampled segments of the Elwha River may be determined using a mathematical tool called 'mark-recapture modeling.' In mark-recapture modeling, the research team can calculate the ratio of the number of individual river otters that visited latrines multiple times to the number of otters that visited latrines just one time and then calculate an estimate of the total number of otters using an area.

Mesocarnivores

Less known carnivores like raccoons, spotted skunks, mink, and weasels will also likely feed on salmon. Carnivores are those animals that feed on other animals, and 'mesocarnivores' are medium sized carnivores (about the size of an Xbox). The Elwha Wildlife Research Team will estimate the proportion of riparian segments that are occupied by each of the species; mathematical models will then allow scientists to potentially discover environmental patterns influencing the chance that a site is occupied by one or more species of mesocarnivore. To document presence of different wildlife species along the river, the research team uses a combination of motion-sensing cameras and boxes designed to record the tracks of animals.



Spotted Skunk and Raccoon tracks (respectively) from track boxes. Images were collected by USGS

Animals are drawn to specific riparian sites by baiting each camera or track box with a small can of cat food (as seen in photographs). When an animal passes in front of a camera, an infrared monitoring system senses the animal and triggers the camera to take a photo. Since tracks in nature are difficult to find and are often confusing based on substrate (sand, mud, logs, moss, etc.) and interactions with other animals, animal tracks are recorded on specialized track plates designed to 'capture' the best possible track. These aluminum boxes are treated with soot or a light dusting of toner to blacken the feet of wildlife that enter the boxes. To reach the bait at the closed end of the box, an animal must enter the box and walk across the sooty substrate onto a layer of sticky white paper.

Discussion

Studies of the distribution of wildlife species in the riparian zone of the Elwha River are still in progress; only when the dams start coming down will the Elwha Wildlife Team be able to define the 'before removal' wildlife conditions. Furthermore, the potential long-term effects of dam removal on the distributions of wildlife species are not currently understood. Preliminary results, however, indicate that the riparian zone is home to many species of amphibian and mammalian wildlife and that several species are distributed unevenly throughout the riparian zone of the Elwha River. With more data collection in 2008 and beyond to add to this study, trends with each species will become better defined.

The process of discovery is important to the Elwha Wildlife Team. The development of hypotheses about how removal of the dams and the restoration of salmon habitat will affect future generations is central to this process. Hypotheses may be thought of as informed guesses of how systems behave. After much background reading and information gathering, a reasonable hypothesis can work to guide scientists logically through their research and keep them narrowly focused on answering main questions of interest. The scientific process of developing hypotheses, and then testing these hypotheses by reading and observing animal sign (such as tracks and scat) over time is a process that will take many years to unfold. A critical component of this process is designing baseline studies that will provide answers to research questions. The involvement of the next generation of scientists, like you, will be paramount to asking new questions and looking at the world from a different point of view. Involvement in the Elwha Ecosystem Restoration Project requires only a curious mind and interest in the surrounding environment.

References

Cederholm, C.J., D.H. Johnson, R.E. Bilby, L.G. Domingues, A.M. Garret, W.H. Graeber, E.L. Greda, M.D. Kunze, B.G. Marcot, J.F. Palmisano, R.W. Plotnikoff, W.G. Pearcy, C.A. Simenstad, and P.C. Trotter. 2001. Pacific salmon and wildlife: ecological contexts, relationships, and implications for management. Pages 628-685 ini D.H. Johnson and Thomas A. O'Neil, Managing Directorsm Wildlife-Habitat Relationships in Oregon and Washington. Oregon State University Press, Corvallis.

Cederholm, C.J., D.B. Houston, D.L. Cole,, and W.J. Scarlett. 1989. Fate of coho salmon carcasses in spawning streams. Canadian Jounral of Fisheries and Aquatic Sciences 46:1347-1355.

Glossary

Mammalian: pertaining to mammals, animals that have a spine (vertebrate), hair, give milk to young, and are warm-blooded.

Spawn: the reproductive process of salmon. To spawn, females release eggs while males release milt into a depression on the riverbed called a 'redd.' Fertilization takes place as the eggs drift down into the gravel.

Floodplains: lowland flat area (formed by the water carrying sediment) where a river or stream tends to flood during occasional events.

Hypothesis: an explanation for an observation or fact that is then tested in an experiment, an important part of the scientific process.

Distribution: the geographical range of an animal.

Abundance: the number of animals.

Amphibian pools: small ponds of water found in a floodplain, often move when floods change landscape.

Survey: a scientific count or study of a wildlife population.

Characteristic: a trait or quality that is typical or distinctive.

Scat: animal feces, a category of animal sign.

Researcher Biographies

Dr. Kurt Jenkins, USGS - Forest and Rangeland Ecosystem Science Center

As a teen, Kurt decided to pursue a career working in the national parks as either a ranger or a biologist. His interests were kindled by his family's long association with Yosemite National Park, and his frequent trips hiking in the Sierra Nevada. An inspirational zoology professor at U.C. Davis and a summer spent working as an undergraduate biological intern at Olympic National Park convinced him that a career in wildlife research in the National Parks was his calling. To pursue his goals he completed graduate degrees with National Park Service research units at Oregon State University and University of Idaho studying the ecology of elk and other large mammals in Olympic and Glacier National Parks. He taught on the faculty at South Dakota State University for a few years before switching to work as a wildlife research biologist with the National Park Service in Alaska. For 18 years Kurt has worked as a wildlife research biologist with the National Park Service and the USGS providing research in support of wildlife management issues and monitoring programs, with a primary focus on mammalian ecology in the National Parks.

Dr. Patti Happe, NPS, Olympic National Park

Patti's desire to study wildlife stemmed from her childhood walks with her grandfather on his farm, and was cemented on a trip throughout the Rocky Mountains with her grandparents as a teen. Although her career path has always been heading towards that goal, the route was sometimes circuitous, because at the time few women entered her chosen profession. Her undergraduate degree is in Environment Resource Management from Penn State University, Masters in Wildlife Ecology from Oregon State University and PhD in Rangeland Ecology from Oregon State. Patti has worked a variety of jobs, ranging from Environmental Specialist (focusing on mining impact analysis and compliance) to Dairy Science, to her current job as the lead wildlife biologist for Olympic National Park, where she has been for the past 12 years. In this job Patti works on both research and management, and is responsible for all wildlife species in the park, ranging from songbirds, to fisher, elk, spotted owls, bears and bats.

Kimberly Sager-Fradkin, Lower Elwha Klallam Tribe

As a child in Montana, Kim had a love of both animals and the outdoor world that inspired her to want to become a veterinarian. The realization the most veterinarians worked indoors, however, caused Kim to question her ambitions and seek other goals. It wasn't until Kim traveled to Africa in her early 20's that she became enamored with the idea of studying wild animals. An exhaustive search through college catalogues caused her to realize that she could actually pursue a major in Wildlife Biology. She wholeheartedly embarked on this endeavor, attending Humboldt State University and completing her degree in 1996. Kim landed in Port Angeles, Washington in 1999 where she helped develop a black bear management program for Olympic National Park, surveyed for the elusive marbled murrelet, tracked black-tailed deer for the USGS, and finally settled into a graduate program at the University of Idaho studying black bear distribution patterns in the Elwha Valley. Currently, Kim is a wildlife biologist for the Lower Elwha Klallam Tribe where she spends her time studying everything from otters to elk.

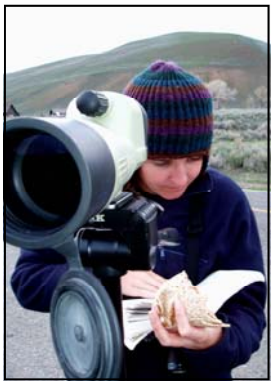
Nate Chelgren, USGS—Forest and Rangeland Ecosystem Science Center

Nate pursued a career in wildlife research because of his interest in the environment and in mathematics. Ecological research is the perfect field where both interests come together. Nate began by studying migratory birds. This interest then expanded to include other kinds of animals such as amphibians. Many amphibians also migrate, often between fresh water habitats where they lay eggs and forested habitats where they reside as adults. Because they are less mobile than birds, amphibians are affected differently by roads and other types of development that can block migration routes. Nate now conducts research for the U.S. Geological Survey to provide information about how populations of animals like amphibians, birds and other groups can be best conserved when their habitat is under pressure to be changed to meet competing human needs such as wood production or the generation of electricity.

Robert Knapp, Western Washington University Graduate Student

During Robert's youth, many family vacations took him to the national parks of the Pacific Northwest where he discovered a fascination with wildlife. Robert is especially fond of marmots. Moving to Port Angeles WA to begin a career as an electrician gave Robert the opportunity to spend his free time observing the wildlife of the Olympic Peninsula. After 16 yeas as an electrician, Robert decided to become a science instructor. Over the last three years he has been fortunate to work on a number of wildlife research projects studying beavers, river otters, and other medium-sized animals. Robert also spent a month researching wildlife, insects, plants, and soil in the rainforest of Costa Rica. Robert hopes to teach science at a college and continue to do wildlife research.

Curriculum Writer's Biography



Carolyn Wilcox, Olympic Park Institute

Carolyn's wilderness ethic blossomed in Ohio as she played in a small creek while her mother gardened. While in the research team is searching for and mapping latrine sites, collecting hair samples from otters using hair grabbing devices that do not harm the animals, and is collecting otter scats." college, she was privileged enough to participate in a Mexican Wolf Reintroduction Project in the Southwest. This pivotal experience eventually led her to graduate school studying Mojave Desert shrubs. While completing her Master of Science degree, she also worked towards a teaching certification. Carolyn ended up in Seattle with her first teaching job at a suburban public high school where she tried to teach a wilderness ethic. This eventually led to teaching at Olympic Park Institute. Carolyn now works with USGS on Elwha Wildlife Research and continues to ponder how to live on a planet of finite resources.

Elwha Research Learning Unit

This research summary is a piece of a larger Elwha Research Learning Unit which has been funded by the Research Learning Network and coordinated by Olympic Park Institute. This is one of seven research summaries which capture the diverse and exciting science which is being done in preparation for the upcoming Elwha River dam removals. All seven summaries are examples of the important work which fits together to help us better understand the Elwha River Ecosystem and neighboring Strait of Juan de Fuca. Three of these research topics have been turned into activities which have been designed for us to practice the scientific process by using real research from this inspiring dam removal effort. For the complete learning unit, go to OlympicParkInstitute.org or ElwhaScienceEd.org.

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