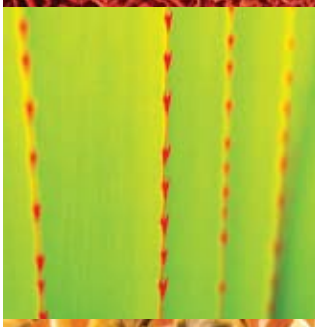
Erratum to Case Study: Western Coastline

Under “For More Information”

First bullet, correct URL is: http://globalchange.gov/publications/reports

ECOREGION: WESTERN COASTLINE



Subjected to the wind and waves of the Pacific Ocean and shaped by molten lava pushing to the surface, the Western Coastline includes the coastal zone that stretches from southern California through Oregon, Washington, and up to southern Alaska. Great volcanoes as well as lava vents in the ocean helped to mold the mountain ranges that lie along this coast.[1,2] From the Santa Monica Mountains in southern California to the Cascades and the Columbia Mountains further north in Oregon and Washington, these mountain ranges and their proximity to the ocean shape the differing climates and rugged landscapes of this ecoregion.

As varied as the region's topography, the climate here includes southern California's mediterranean ecosystem with mild rainy winters and warm dry summers, as well as the more northern and generally colder regions with high precipitation toward Oregon and Washington.[3,4] From sandy and rocky intertidal zones, to rivers, streams, **montane** forests, and glaciers, the different landscapes and their climates provide habitats for a host of species, including sea lions and bears in Alaska to bobcats and the beautiful northern harrier hawk in the Santa Monica Mountains.[5,6,7,8]

IMPACTS OF CLIMATE CHANGE

Climate change will affect the habitats of this varied ecoregion in several ways. Along the coastline, climate change is expected to cause sea level rise in many areas. In addition, 140 years of tide gauge data in San Francisco indicate that the number of severe winter storms has increased since 1950. Thus, the Western Coastline could experience an increase in sea level, increased frequency of severe storms as well as increased coastal erosion from California to Alaska.[9] Further inland, over the 20th century, the region has grown warmer and wetter, with the average temperature in the northwestern United States increasing 1 to 3° F (0.6 – 1.7° C) with annual variation.[10] In the western coastline region, warmer years tend to be drier with low stream-flow and light snowpack, and cool years tend to be more damp with high stream-flow and heavy snowpack. While the observed differences in temperature and precipitation are small, they have noticeable impacts on important resources. Warmer years tend to bring water shortages during summer months and increased probability of forest fires.[11]

SPOTLIGHT ON A SPECIES

The Chinook salmon, *Oncorhynchus tshawytscha*, is one of the many important species in the Western Coastline ecoregion that is being affected by climate change. The largest of all Pacific salmon, the Chinook often weighs more than 30 pounds and plays a significant role in stream ecosystems and their surrounding forests.[12]

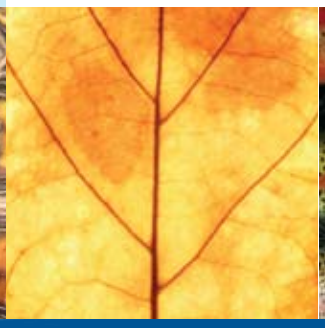
Chinook salmon, like all species of Pacific salmon, are anadramous. This means that the fish hatch in fresh water, migrate to the ocean and spend part of their lives there, and then migrate back to their original rivers to fertilize and lay eggs, or spawn. Once the fish spawn, they die. The course of this life cycle is not only amazing, but it also serves an important role in the development of the surrounding ecosystems by aiding in the redistribution of nutrients. These fish spend a large portion of their lives growing in the ocean. When they die, the nutrients from the food that they ate while growing in the ocean are distributed along the banks of rivers or in forests if they were eaten by bears or other land-based predators.[13] Thus, these fish act to transport nutrients from the ocean to the streams and forests of much of the Western Coastline.[14]

The Chinook salmon's complex lifecycle involves several stages, each of which requires a particular habitat type. Females lay from 3,000 to 14,000 eggs in several gravel nests called "redds," which they excavate in relatively deep, moving water. These eggs generally hatch in late winter or early spring, and the newly hatched fish, called alevins, live in the gravel for several weeks as they gradually absorb the food in their attached yolk sac. At the juvenile stage, they are called "fry," and they wiggle up through the gravel by early spring. Juvenile Chinooks in fresh water feed on plankton and later eat insects. While in the ocean, they eat a variety of organisms including herring, squid, and crustaceans. Salmon grow rapidly in the ocean, often doubling their weight during a single summer season, and growing to be very large over a series of seasons.[15]

Throughout these stages, the salmon need freshwater habitat that includes cool, clean water; appropriate water depth, quantity and flow velocities; wetlands and estuaries; upland and riparian (stream bank) vegetation to stabilize soil and provide shade; clean gravel for spawning and egg-rearing; large woody debris to provide resting and hiding

Did you know?

The Chinook salmon has numerous local names. In Washington and Oregon, Chinook salmon are called Chinook, while in British Columbia they are called spring salmon. Other names are quinnat, tyee, tule, blackmouth, and king.

Because the habitats that the salmon need during each stage are sensitive to alteration, Chinook salmon are vulnerable to the impacts of human alteration of landscapes as well as climate change. Warmer temperatures will likely increase water temperatures which could be harmful to salmon during the spawning, incubation, and rearing stages. In addition, these warmer temperatures may also lead to earlier snowmelt and to more precipitation falling as rain, which could lead to higher winter flows in the streams. This increased flow could scour the stream beds and destroy salmon eggs and habitat, thus raising salmon mortality. Research does indicate, however, that habitat preservation and restoration strategies could have positive impacts on the salmon populations.[17]

PROFILING A CLIMATE STEWARD

Over the last several decades, salmon have been under increasing pressure from a host of factors such as disease, overfishing, and construction of dams. Climate change poses a new threat to the salmon population.

Many of the streams in the Pacific Northwest and Northern California are fueled by water from snowmelt. Climate change is expected to cause snow to melt earlier in the year, and more precipitation is expected to fall as rain rather than snow. These changes in precipitation will alter stream flow patterns that salmon populations have grown accustomed to over thousands of years. In addition, salmon are coldwater fish that could be negatively affected by warmer waters.

Since its founding in 1996, the Salmon Watcher Program has trained volunteers to keep an eye on the status of the salmon population in many streams throughout King and Snohomish counties in Washington state. In one simple course, volunteers are trained to identify different species of salmon.

Once trained, these volunteers go to their assigned stream site(s) twice a week from September through December to observe how many salmon are spawning. The information they collect helps scientists determine how salmon populations may be changing with time. Data collected by volunteers may also be used to identify obstructions in the stream that can removed so the salmon can return. New volunteers are trained every September.

To find more information about the project, visit the Salmon Watcher Program's website: http://www.kingcounty.gov/environment/animalsAndPlants/salmon-and-trout/salmon-watchers.aspx

FOR MORE INFORMATION

- The Intergovernmental Panel on Climate Change (IPCC) is the definitive source of unbiased climate change science. http://www.ipcc-wg2.org/index.html
- The National Oceanic and Atmospheric Administration's National Marine Fisheries Service provides in-depth information about the region's efforts to recover the Chinook salmon population. For more information, visit: http://www.nwr.noaa.gov/
- The National Oceanic and Atmospheric Administration's National Marine Fisheries Service provides detailed information on the Chinook salmon's life cycle, and the threats that its populations face. To learn more, visit: http://www.nmfs.noaa.gov/pr/species/fish/chinooksalmon.htm
- The US Global Change Research Program's website includes information about how climate change will affect coastal areas as well as links to other research on these topics. For more information, visit: http://www.usgcrp.gov/usgcrp/Library/nationalassessment/overviewcoastal.htm

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