



News and information about the salmon, trout and the rivers of the northern section of the Central Region of the California Department of Fish & Wildlife

Fish and Fire

How do wildfires affect salmon and trout?

Wildfires can be devastating. Blackened tree trunks and barren landscapes replace what was once a lush forest. Even though water doesn't burn, wildfires can also have significant impacts on fish and other aquatic life.

Wildfires were not allowed to burn in California after the United States Forest Service was established in 1905. Fire was considered a serious danger to people and their livelihoods as farmers, ranchers, gold miners and loggers. The U.S. Forest Service started several campaigns and policies, including the Smokey Bear campaign, to prevent and suppress fires as quickly as possible. However, these techniques led to overgrown forests that actually made the forests more prone to large, high intensity fires. Last year, the Rim Fire devoured 257,314 acres in Tuolumne and Mariposa counties. It was the biggest fire on record in the Sierra Nevada Mountains, burning the Stanislaus National Forest and parts of Yosemite National Park. Ninety-six percent of the fire burned in the Tuolumne River watershed, turning portions of the Tuolumne and Clavey rivers dark brown from ash and mud that washed down after it rained.

The extent of the impact from a fire depends on its size, intensity, location, timing, and the characteristics of the plants and animals living there. High intensity fires tend to do the most severe damage. Forests in high intensity burn areas take the longest time to regrow. However, even large, high intensity fires like the Rim Fire have areas that

sustained little damage and will recover quickly. Fires have different impacts on rivers depending on their location on the length of the river and how close they get to the water. Fires that occur during fish migrations or in areas where fish habitats have already been lost are going to have a worse impact.

Salmon, trout, and many of the aquatic insects that they eat are very sensitive to water pollution and cannot survive without cold, clean water. Fish are directly impacted by wildfires when the heat from a fire increases the water temperature. Fires can also negatively change the water chemistry by increasing phosphorous and nitrogen when plants are burned. Increased phosphorous and nitrogen can cause algae to bloom. Algal blooms can block sunlight to the streambed and removes oxygen from the water when the algae dies and decomposes. Wood ash is very alkaline and can raise the pH of the water. Changes in water quality and habitat may make streams more inviting to non-native invasive species and dangerous to native fish. These species will compete with the native wildlife for food and space, and might even eat salmon and trout.

One of the biggest impacts on fish from wildfires is from increased runoff and erosion. When a hot fire burns a lot of plant material, it creates a gas that condenses as a waxy coating on the soil. The waxy coating repels water and forces rain water to run off the soil instead of soaking in. Increasing runoff makes streams flow faster, stronger, and deeper and that leads to erosion of stream banks and mud or rock slides that can block or change the course of the river. Fine soil (called silt) and debris can fill pools that fish need, but erosion might also create new ones in different locations.

If stream banks are burned, they lose the plants that support the bank and hold back the soil. Silt and ash can be washed down into the stream where it damages and clogs delicate fish gills and smothers young salmon, trout, and eggs. Loss of streamside plants also exposes more of the stream to sunlight that can warm the water. This can increase mutations and cause death in light sensitive salmonid eggs and newly hatched salmon and trout.

Another concern for salmonids is the use of fire retardants. Most fire retardants used on wildfires in California are made of fertilizer (containing ammonia), clay, and a red coloring so pilots can see it. Most fire retardants are considered safe, but ammonia is toxic to fish and there have been reports of fish dying after water has been contaminated with fire retardant. Recent studies on rainbow trout show that the more developed eyed-egg stage is the most resilient to toxicity from fire retardant and researchers suspect that the egg shell helps to protect them. Young salmon and trout that have just absorbed their yolk sac and are starting to swim around and search for food are the most sensitive. Firefighters take great care to keep retardant away from streams and marshy areas. They try to leave a 300 foot buffer on each side of a stream.

Wildfires aren't always bad. Plants and animals in California are adapted to fire. In fact, some plants even require fire to reproduce. Large fires provide woody debris that fish need for shelter. Mud and debris flow downriver and carry stones and gravel that salmonids need for spawning. Some research shows that insect populations thrive a few years after a major fire. While a fire may kill any fish that are in the river at the time, new fish will come in and replace them if they can.

Salmon and steelhead have an advantage. They are "anadromous," meaning they migrate to the ocean as juveniles and return to freshwater streams to spawn as adults. Not all adults return in the same year. There are also different seasonal "runs" of salmon migration (spring, fall, late fall, etc.) based on when the adults return to the river. As a species, they have a better chance of surviving natural hazards (wildfires, mudslides, droughts, etc.) when only part of the population (the run for that year) is at risk.

Wildfires can have major impacts on salmon and trout. Fire can make river water unsafe by changing the chemistry, temperature, and adding in deadly amounts of silt. It can cause erosion that can change the course of the river. However, salmon and trout are adapted to living in areas that experience fires and they can usually recover within a few years.

If you would like more information about this topic, check out these sources:

US Forest Service -Does Wildfire Threaten Extinction for Salmonids?

http://www.fs.fed.us/rm/boise/publications/fisheries/abstract_rieman.shtml

US Fish & Wildlife Service Biological Opinion -Effects to Listed Species from US Forest Service aerial Application of Fire Retardants on National Forest System Land

http://a123.g.akamai.net/7/123/11558/abc123/forestservic.download.akamai.com/11558/www/nepa/71615_FSPLT2_066530.pdf

New Mexico Environment Department -Wildfire Impacts on Surface Water Quality

<http://www.nmenv.state.nm.us/swqb/Wildfire/>

United States Geologic Survey -Acute Toxicity of Three Fire-Retardant and Two Foam-Suppressant Foam Formulations to the Early Life Stages of Rainbow Trout (*Oncorhynchus mykiss*)

<http://www.npwrc.usgs.gov/resource/habitat/fireweb/oncomyki/intro.htm>

This article was written by Angela Materne and Gail Hickman Davis, Classroom Aquarium Education Program, California Department of Fish & Wildlife, Central Region

Healing is a matter of time, but it is sometimes also a matter of opportunity.

-Hippocrates