

California Water Science Center

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Drought River Temperatures Potentially Dangerous for Fish

□ 23 SEPTEMBER 2015

During this unprecedented drought, the rising temperatures in many of California's rivers have become potentially lethal to anadromous fish, steel head and other fish species. Even in rivers controlled by reservoirs, where operators have traditionally been able to help control river temperature by timed releases, the combination of low flows, reduced cold-water pools in reservoirs and high air temperatures has resulted in elevated river temperatures.



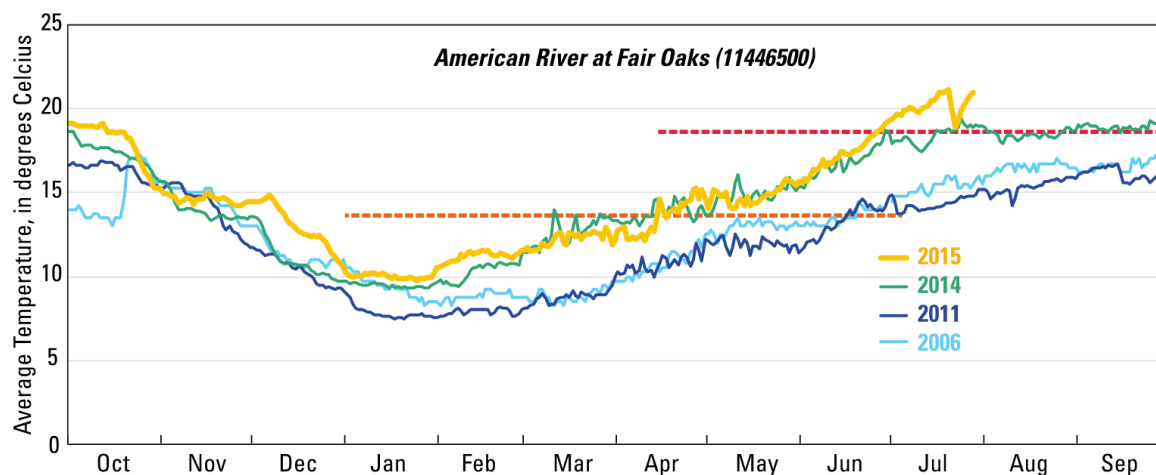
PCFFA-137, 1

Low water levels can be seen on the American River from Watt Ave. in Sacramento on January 16, 2014. From California Department of Water Resources archive.

"Stream temperature has long been recognized as an important water-quality parameter. Temperature plays a key role in the health of a stream's aquatic life, both in the water column and in the benthic habitat of streambed sediments. Many fish are sensitive to temperature. For example, anadromous salmon require specific temperature ranges to successfully develop, migrate, and spawn [see Halupka and others, 2000]. Metabolic rates, oxygen requirements and availability, predation patterns, and susceptibility of organisms to contaminants are but a few of the many environmental responses regulated by temperature." ¹

In order to understand how river temperatures are being affected by drought and climate change, careful collection and analysis of temperature data is key. USGS stream gages, already established throughout California and the nation to monitor river flows, are ideally located to also monitor temperature in California's rivers. Of the approximately 500 USGS stream gages in California, 151 monitor temperature continuously, 132 collect data that data in real-time.

Dangerous Temperatures for Fish at Various Life-Cycle Stages



This graph shows temperature data collected at a stream gage on the American River. Temperatures above the orange bar are increasingly dangerous to steelhead egg incubation and parr-smolt transformation. Temperatures in excess of the red bar are increasingly dangerous to migrating juvenile steelhead.²

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In June 2014, assisted by such temperature monitoring data, the California Department of Fish and Wildlife forecasted that summer water temperatures would exceed 78°F in the American River—too warm for young trout and salmon to survive. To save fish, CDFW decided to evacuate the American River and Nimbus Hatcheries that raise rainbow trout, salmon and steelhead

(respectively) from eggs through release size. This was the first time all stocks of fish, totaling 430,000 fingerlings, were evacuated and released six months ahead of the normal February release time. Scientists will know in Summer 2017 if this action was successful.

In another drought-related incident, high Sacramento River temperatures in 2014 resulted in loss of the winter and fall run salmon in the upper river when water released from Lake Shasta was too warm to sustain incubating salmon. To prevent further losses of the federally protected endangered specie, the U.S. Fish and Wildlife Service, in cooperation with California Department of Fish and Wildlife, decided to truck juvenile salmon from Coleman National Fish Hatchery near Redding, to Rio Vista in the Bay-Delta during this drought. Trucking the fish downstream shortens their trip and avoids the lethal high-temperature river waters, but reduces the likelihood that fish will return upstream in the Sacramento to spawn. However, officials believe that the transported salmon will have a better chance of surviving the journey to the ocean and that more will be able to return upstream to mate. Additionally, the Shasta Temperature Management Plan was created in 2015 to conserve cold water storage in Lake Shasta. The plan, developed by the U.S. Bureau of Reclamation in coordination with the NMFS, USFWS, CDFW, the California Department of Water Resources and the State Water Resources Control Board, makes changes in the Federal Central Valley Project and State Water Project operations in order not to lose temperature control in September, as happened in 2014.

Long-term temperature data is one of the foundations to understanding the quality of water in California's and our nation's waterways. Baseline and continuous river temperature information is needed so that resource managers can understand how ecosystems fare under normal climatic conditions, and so that they can make agile and informed decisions to better steward those resources as conditions change.

¹ USGS Circular 1260, Introduction, page 1, [Heat as a tool for studying the movement of ground water near streams](#).

² 2009 NOAA National Marine Fisheries Service (NMFS) Biological Opinion for the Long-term Operations of the Central Valley Project and the State Water Project, pg 285: "Temperatures of 52°F or lower are best for steelhead egg incubation. However temperatures less than 56°F are considered suitable." Yellow bar on graph is 56°F. pg 288-89, "Steelhead in the American River exhibit symptoms of thermal stress...at temperatures over 65°F", which is the Orange bar on the graph.

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