Jason Ching/University of Washington

As lake water warms, sockeye salmon are spending more time there, where food is more plentiful.

Sockeye salmon in global warming

Michelle Ma
University of Washington.

An ample buffet of freshwater food, brought on by climate change, is altering the life history of one of the world's most important salmon species.

Sockeye salmon in Alaska's Bristol Bay region are skipping an entire year in freshwater because climate change has produced more favorable conditions in lakes and streams, which allow the young fish to grow and put on weight much faster. Previously, these fish would spend up to two years in their birth lakes before heading to the ocean, where they feed and reach maturity two to three years later. Now they are more likely to head out to sea after only one year.

These findings were published May 27 in Nature Ecology & Evolution by University of Washington researchers.

"Climate change is literally speeding up the early part of their lifecycle across the whole region," said senior author Daniel Schindler, a UW professor in the School of Aquatic and Fishery Sciences. "We know climate warming is making rivers more productive for the food juvenile salmon eat, meaning their growth rate is speeding up. That puts the salmon on a growth trajectory that moves them to the ocean faster."

But this "jumpstart" in freshwater doesn't necessarily benefit salmon in the long run. The same fish are now spending an extra year in the ocean, taking longer to grow and mature. This extra year at sea is likely caused by climate stressors, as well as other fish: In the ocean, wild sockeye compete for food with close to 6 billion hatchery-raised salmon released each year throughout the North Pacific Ocean. That number has grown steadily since the 1970s, when only half a billion hatchery salmon were released.

"Hatchery fish have really changed the competitive environment for juvenile salmon in the ocean," said lead author Timothy Cline, a postdoctoral researcher at the University of Michigan who completed this work as a doctoral student at the UW. "In Bristol Bay, the habitat is totally intact and fisheries management is excellent, but these fish are living in lakes warming with climate change, then competing with other salmon for food in the ocean."

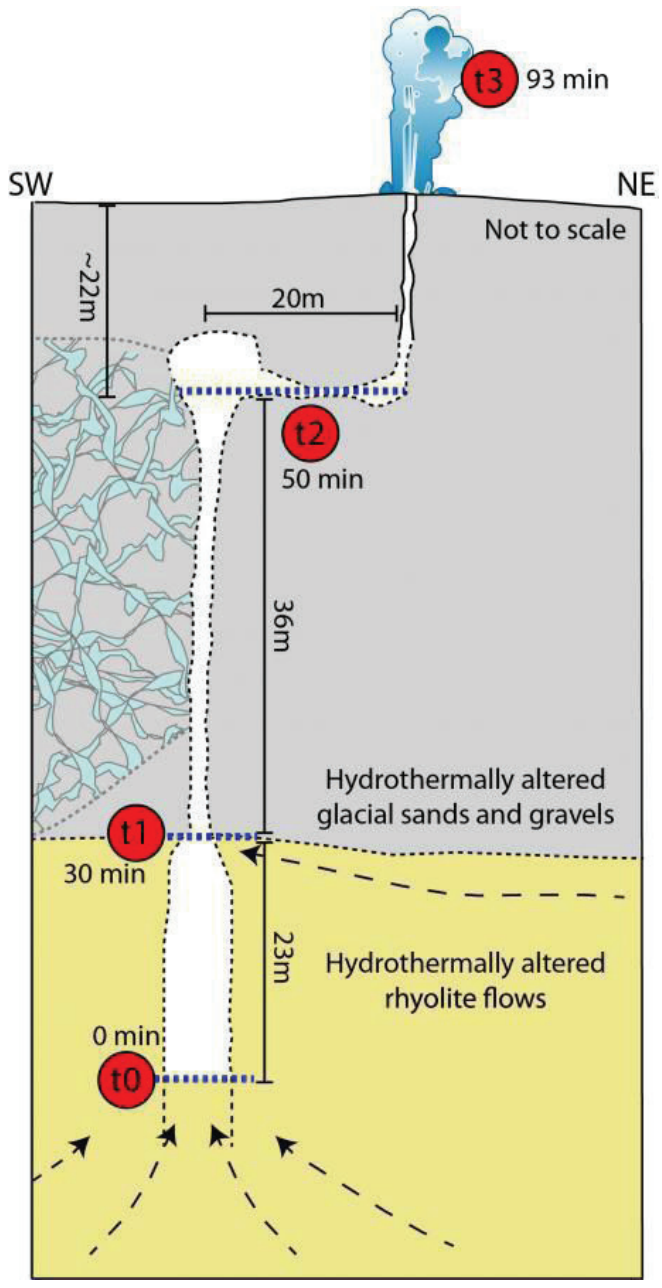
A new view of Old Faithful's plumbing

Yellowstone Volcano Observatory

Since Yellowstone National Park was founded the iconic Old Faithful geyser has attracted millions of tourists every year. Although Old Faithful's activity on the surface is well observed and monitored, our current knowledge of the subsurface properties and processes, such as the depth of the plumbing system and how Old Faithful recharges over time, remains largely unknown. But new research is helping to shed light on this problem by using seismology to image geysers in much the same way as an MRI is used to image the human body.

Seismic signals originating in volcanic systems have often been used to infer the status of magmatic activity. Similarly, active hydrothermal systems also generate observable seismic signals, called hydrothermal tremor, due to steam bubble formation and collapse. A better understanding of the origin of the hydrothermal tremor can lead to better understanding of the subsurface fluid movement. Most previous work, however, has used just a few seismometers and consequently does not have the ability to precisely determine the spatial and temporal characteristics of the tremor sources.

With the recent availability of low-cost, easily deployed nodal seismometers, however, it is now possible to deploy dense seismic arrays close to hydrothermal features and record high-quality hydrothermal tremor signals. When data from these dense arrays, made up of tens to hundreds of stations, are analyzed together, we can image the subsurface with unprecedented spatial and temporal resolution — we can get a four-dimensional (4-D) view of a geyser system.



USGS/TownNews.com Content Exchange

This schematic model shows a cross section of Old Faithful's plumbing system as determined from seismic studies. The red circles show the location of the tremor source over time, and how the tremor source migrates upward prior to an Old Faithful eruption. Times between red circles are based on a 93-minute eruption interval.

In November 2016, the University of Utah, in collaboration with Yellowstone National Park and the University of Texas at El Paso, deployed a nodal array with 80 seismic stations on and around Old Faithful (this was done under Yellowstone research permit YELL-2016-SCI-0114). The stations recorded ground vibration in three directions (north-south, east-west, and vertical), which can be used to reconstruct the incoming directions of the observed hydrothermal tremor signals. With the dense array configuration it is possible to identify the tremor source locations. By locating these tremor signals, the fluid pathway of Old Faithful geyser down to a depth of about 260 feet (80 meters) is illuminated. Moreover, the observation provides new constraints on the eruption dynamics and recharge process of Old Faithful.

Based on the results of this work, Old Faithful's deeper plumbing system is approximately vertical between about 65 and 260 feet (20 and 80 meters) deep and is offset by 65 feet (20 meters) southwest of the geyser vent. The top portion of this deeper conduit is in the same place as a bubble-trap structure that allows fluid and pressure to build up prior to an eruption. So the main source of the water feeding Old Faithful eruptions is not coming from directly beneath the geyser, but actually from off to the side. And with seismology, we can actually "watch" the boiling water rise toward the surface before Old Faithful eruptions.

With the 4-D imaging, we can probe Old Faithful's recharge evolution and further understand the driving physics of geysers. The methodology also provides new opportunities for exploring the deep plumbing geometry of other hydrothermal features including Steamboat Geyser, which has been quite active over the past year. In fact, the same nodal seismic array that was deployed at Old Faithful is currently in place around Steamboat. The instruments will be collected in late July, and hopefully those data will help to define Steamboat's plumbing system, just as it has with Old Faithful. Stay tuned for more details about the seismology of geysers.

National Park Service Graphic

The John Day mesonychid was initially misidentified as this creature, *Hemipsaladon grandis*, another large predator that would have shared a range with the mesonychid.

Ancient 'hyena-pig' discovered to have once roamed Oregon

By Erin Ross
Oregon Public Broadcasting

JOHN DAY — Oregon's weirdest predator, the first of its kind in the state, was found in a museum drawer. A piece of it, anyway.

Hyena-pig. Murder-cow. With no modern analog, scientists have resorted to combinations of common animals to describe it. Dug up decades ago in the Hancock Mammal Quarry near John Day, the bone from this prehistoric creature languished, misidentified in museum storage, until Selina Robson pulled it from its drawer.

Robson wasn't looking for a murder-cow when she found the specimen. It was a fossilized jaw, slightly smooshed, and it was huge: about the length of her forearm. It was labeled "Hemipsaladon," a type of creodont, which were large, bear-like predators that roamed Oregon 40 million years ago.