

# Can salmon eat their way out of climate change?

December 11 2019, by Kat Kerlin

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With Mount Shasta in the background, a series of enclosures contain juvenile coho salmon as part of a UC Davis experiment in the Shasta River Basin. Credit: Rob Lusardi/UC Davis

Warm waters are a threat to cold water fish like salmon and trout. But a study led by researchers at University of California, Davis suggests that habitats with abundant food sources may help buffer the effects of increasing water temperature.

The study, published in the *Canadian Journal of Fisheries and Aquatic Sciences* today, Dec. 10, shows that the availability of food in a natural system—not just stream [temperature](#) and flows—is an essential component of [fish](#) habitat.

"In the future under climate change, productive ecosystems like spring-fed rivers, floodplains, estuaries and seasonal lagoons will be key links that give [cold-water fish](#) like [salmon](#) and trout a leg up," said lead author Robert Lusardi, a research ecologist and adjunct faculty at UC Davis and the California Trout Coldwater Fish Scientist.

For the experiment, researchers reared juvenile Coho salmon in a series of enclosures within the Shasta River basin, which is a tributary to the Klamath River. They examined how natural gradients in temperature and prey availability affected summer growth rates and survival.

Southern Oregon/Northern California Coast Coho salmon, like those used in the experiment, are a threatened species and are among the most temperature intolerant of Pacific salmonids. They can experience stress under water temperatures as low as 60.8 degrees Fahrenheit in many ecosystems. Previous studies put their optimal stream temperatures between 53-57 F.



These fish were the same size pre-experiment. Coho on the left were reared at a mean temperature of 13 C and maximum weekly temperature of 16 C. Their mass changed, on average, 1.4 grams during the experiment. The coho on the right were reared at a mean temperature of 16.6 C and maximum weekly temperature of 21.1 C. Their average change in mass was 9.1 grams. Food was the strongest predictor of growth differences. Credit: Rob Lusardi/UC Davis

For this study, the researchers were surprised to find that Coho salmon growth rates peaked at average water temperatures of 61.8 F (16.6 degrees Celsius) and an "unheard of" maximum weekly temperature of 70 degrees (21.1 C), according to Lusardi.



## Food made the difference

Does this mean that salmon can live in water temperatures of 70 degrees or more? Not generally. Food made the difference.

Unlike humans, fish lack an ability to thermoregulate, or adjust their body temperature to the environment. Generally, they are the temperature that surrounds them. So when it's too hot, they seek colder water.

Their metabolism also increases as they warm up. As this study shows, if there is enough food around them in the form of aquatic invertebrates, it can help compensate for increases in temperature. But there is a catch:

"Fish can't just eat their way out of it," Lusardi said. "It's to a point. The temperature and food offset each other, and both are really important. I think the implications of this study are that fish can do well if there's enough food and there are slight increases in [water temperature](#) associated with climate change. Productive habitats are and will continue to be of high conservation value for salmonids and other cold-[water](#) fishes under a changing climate."

Many rivers inhabited by salmon are either nutrient-poor or are fundamentally altered and lack the [food](#) supply found in places like spring-fed rivers, estuaries and floodplains. Many salmon stocks in California are also listed as threatened or endangered under the U.S. Endangered Species Act. The study indicates that conserving diverse productive habitats can help build resilience for fish and the ecosystems they inhabit.

**More information:** Robert A. Lusardi et al. Oversummer growth and survival of juvenile coho salmon (*Oncorhynchus kisutch*) across a natural gradient of stream water temperature and prey availability: an in

situ enclosure experiment, *Canadian Journal of Fisheries and Aquatic Sciences* (2019). [DOI: 10.1139/cjfas-2018-0484](https://doi.org/10.1139/cjfas-2018-0484)

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