

For fish and rice to thrive in Yolo Bypass, 'just add water'

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UC Davis Center for Watershed Sciences and California Trout researchers study salmon growth in seasonally flooded rice fields in the Yolo Bypass near Woodland, Calif., on Feb. 19, 2013. Scientists are investigating whether the Central Valley's historical floodplains could be managed to help recover California's populations of Chinook salmon. Credit: Carson Jeffres/UC Davis

From a fish-eye view, rice fields in California's Yolo Bypass provide an all-you-can-eat bug buffet for juvenile salmon seeking nourishment on their journey to the sea. That's according to a new report detailing the scientific findings of an experiment that planted fish in harvested rice fields earlier this year, resulting in the fattest, fastest-growing salmon on record in the state's rivers.

The report, provided to the U.S. Bureau of Reclamation, describes three concurrent studies from researchers at the University of California, Davis, nonprofit California Trout and the California Department of Water Resources. The scientists investigated whether rice fields on the floodplain of Yolo Bypass could be managed to help recover California's populations of Chinook [salmon](#), and if so, the ideal habitats and management approaches that could allow both fish and farms to thrive.

"We're finding that land managers and regulatory agencies can use these agricultural fields to mimic natural processes," said co-author Carson Jeffres, field and laboratory director of the Center for Watershed Sciences at UC Davis. "We still have some things to learn, but this report is a big step in understanding that."

Researchers found that the fish did not have a preference among the three rice field types tested: stubble, plowed and fallow. The food supply was so plentiful that salmon had high growth rates across habitats and management methods.

"It's like a dehydrated food web," said Jeffres of the harvested rice fields. "Just add water. All of those habitats are very productive for fish."

The salmon did demonstrate a preference for habitats with better water

flow. Jeffres compared it to choosing among three good restaurants: Each offers good food with hearty portions, but one has better ambience and so is chosen above the others. In this case, the better water flow was the ambience the fish preferred.



In winter 2013, a UC Davis-affiliated experiment in rearing salmon on the farmed Yolo Bypass floodway near Sacramento produced remarkable results. In 40 days, juvenile Chinook salmon grew nearly 1.5 inches longer and packed on weight at an average rate of 0.17 grams a day (pictured). Juvenile salmon that started at the same size and were released into the Sacramento River at the same time grew only about half as fast (not pictured). Credit: Carson Jeffres/UC Davis

Among the key findings:

- Experimental flooding of Yolo Bypass rice fields during the winter can create productive aquatic food webs for salmon.
- Average growth rates during the study's 41 days were the highest recorded in freshwater in California. Growth of juvenile Chinook averaged 0.93mm per day, with growth of 1.5 mm per day observed during specific two-week intervals.
- Mortality was greater than in the team's previous 2012 study at Knaggs Ranch. In the 2013 study, between 0 and 29 percent of free-swimming fish survived, while 35-98 percent of fish in enclosures survived.
- Lower survival rates were attributed to bird predation. The winter of 2013, when the study was conducted, was one of the driest on record in the Sacramento Valley, which may have drawn more birds to the inundated rice fields, and to the fish. The study plots were also relatively shallow, providing little escape for fish. A follow-up study planned for 2014 will explore the role of depth as a refuge for fish against avian predators.
- Fish reared in plowed rice fields grew faster than those reared over stubble or weedy vegetation. However, all habitat types were beneficial to the fish, suggesting farm managers may have more flexibility in land treatment after harvest.

"These results are good news for the effort to rebuild [salmon populations](#) in California," said lead author Jacob Katz, a biologist with California Trout. "We've always suspected that when we mimic natural flood processes in [agricultural fields](#), we give these fish a food-rich habitat they recognize and thrive in. These findings support that theory and provide a strong path forward for California land use planners, conservationists and farmers alike. This is a win-win model that can be replicated around the state."

The Yolo Bypass is the Central Valley's largest contiguous floodplain and provides critical [fish](#) and wildlife habitat, the report said. It is covered by floodway easement held by the state of California, making other land uses subservient to flood control. Agriculture is a major land use in the bypass, with rice the primary crop.

More than 95 percent of Central Valley floodplain [habitat](#) that was historically used to rear juvenile Chinook salmon has been altered, primarily diked, and drained for agriculture conversion. Most former floodplain wetlands are now only inundated during major floods. The report said access to floodplain habitats and the high growth rates associated with them during even a limited time may be critical in improving return rates for Central Valley salmon populations.

More information: watershed.ucdavis.edu/files/biblio/Knaggs%202013%20final%20BOR%20report.pdf

Provided by UC Davis

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