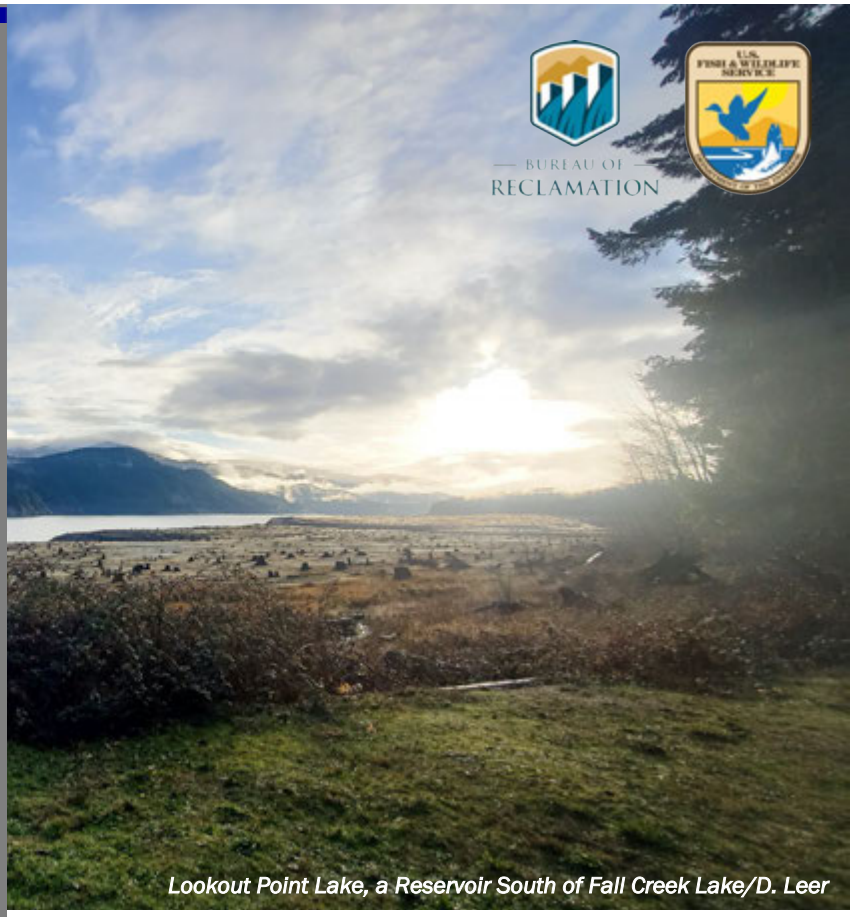
ACTIONABLE SCIENCE

Effects of Short-Term Reservoir Draining on Aquatic Food Webs in the Willamette Basin

Oregon State University

Reservoirs in the Willamette Basin (Basin) in the U.S. Pacific Northwest are managed for multiple purposes, mainly recreation and flood control. Because water levels fluctuate throughout the year, reservoirs are partially drained in the fall. Researchers, engineers and government officials investigated whether short-term complete draining of Fall Creek Dam in the Basin changed food web relationships in the reservoir. They were particularly interested in the ecosystem-level shifts that resulted from draining. Chinook salmon (*Oncorhynchus tshawytscha*) are a federally threatened species within the basin. Dams trap juvenile salmon in the reservoir, preventing their migration, and they are preyed upon by native and non-native predator fish. This research applied nitrogen stable isotope analysis to assess the dietary patterns of predators.



Lookout Point Lake, a Reservoir South of Fall Creek Lake/D. Leer

KEY ISSUES ADDRESSED

Despite their many beneficial uses, dams alter ecosystem dynamics by trapping fish in reservoirs and creating slow-moving, warm water pools that are ideal for predators. This has negative repercussions for native, vulnerable species, such as Chinook salmon (Chinook). In the Willamette Basin, dams and reservoirs trap Chinook in their upstream spawning habitat, preventing them from easily migrating downriver. By altering the ecosystem, dams have also exposed juvenile Chinook to increased predation from native cold-water Rainbow Trout and invasive warm-water Largemouth Bass. Using stable isotope analysis, researchers evaluated the effects of short-duration dam draining events on lasting ecosystem-wide shifts in food web relationships. Prior to this study, there was an absence of research on the impacts of reservoir draining. Findings allow resource managers to better understand the impacts of draining, ensuring more sustainable management practices into the future.

PROJECT GOALS

- Investigate if draining Fall Creek Reservoir for short time periods in the fall changes food web relationships through the following seasons

CONFIRMATION OF LAB RESULTS

Observed changes to predator-prey relationships from the field research demonstrated dramatic food web differences that have rarely been observed outside of lab studies.

Fall Creek Drained on a Sunny Day/Christina A. Murphy

PROJECT HIGHLIGHTS

Food Web Relationships Changed: Draining events changed food web relationships. The predatory fish that remained in the reservoir after draining and refilling occupied a different trophic position than the same species in other reservoirs. These changes lasted through the following season.

Isotope Analysis As Measure of Food Web Changes: Isotope analysis of Largemouth Bass (*Micropterus salmoides*) and Rainbow Trout (*Oncorhynchus mykiss*) tissue in Fall Creek Reservoir revealed lower isotope ratios of δ15N compared to those present in fish tissue from other reservoirs in the Basin, indicating Fall Creek predators are feeding on prey lower in the food chain.

Reduction in Predation Pressures: Reduced predation of juvenile Chinook and other small fish suggests there was an increase in predation of invertebrates. Researchers argue the most likely cause of trophic position changes (i.e., the alteration of feeding patterns) was the lower densities of prey fishes. Researchers posit predation pressures on juvenile Chinook may be reduced with draining because draining allows small fish to move downstream, forcing predators to consume other prey.

Collaborators

- Oregon Department of Fish and Wildlife
- Oregon State University
- Army Corps of Engineers
- US Forest Service

LESSONS LEARNED

Coordination with reservoir operations managers is essential for scientists to collect baseline data at research sites prior to draining. This ensures researchers do not have to rely on reference sites, as done in this study.

While focusing on ecosystem-wide dynamics seems daunting--due to time and financial costs--researchers derived a broader base of information for future research questions to better inform management decision making. For example, the broad focus of this research on ecosystem-wide dynamics led to findings that might reduce the risk of a parasite for endangered salmonids, or salmonids of concern.

Researchers learned that the Fall Creek Reservoir is a low productivity system due to low nutrient presence. Researchers initially thought there would be more productivity after draining because of the movement of sediment and the ensuing resuspension of material. However, it was not enough to cause a surge in the presence of nutrients. A high nutrient environment can cause algal blooms which can affect the quality of drinking water in communities downstream of the reservoir.

NEXT STEPS

- Evaluate the impacts of dam draining in other basin systems and at other times of year
- Use findings from this research to answer management questions and inform conservation measures in the Willamette Basin
- Assess reservoir productivity (in other systems) to determine draining impacts in other reservoirs.

For more information on this project, contact Christina A. Murphy: christina.murphy@maine.edu

R. Wildman With Predatory Bass in Hills Creek/Christina A. Murphy

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