UNDERSTANDING POTENTIAL CHANGES IN TROPHIC RELATIONSHIPS DUE TO DEEP DRAWDOWN AT FALL CREEK RESERVOIR USING STABLE ISOTOPES RATIOS

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Deep drawdown of reservoirs (defined as the drawdown below conservation pool) may induce highly variable and complex effects in fish communities and ecosystems. Here, we examined trophic relationships among fishes in two reservoirs under different drawdown regimes including Fall Creek (after a deep drawdown) and Hills Creek (reference site without deep drawdown) during late summer and early fall.

We hypothesized that deep drawdown will lead to export of nutrients and taxa downstream (i.e., native and introduced fishes) triggering potential cascading effects on reservoir's food web and productivity the following seasons. Specifically, the export of both native and introduced fishes may alleviate predation upon juvenile salmonids, but changes in nutrient availability, primary production, and zooplankton composition may modify the quality of reservoir rearing habitat (e.g., food resources) for juvenile salmonids as well.

To identify trophic relationships among consumers (e.g., dietary overlap and piscivory), we used stable isotopes ratios of nitrogen, carbon, and sulfur from each reservoir food web (primary producers, macroinvertebrates, zooplankton, and fishes). For the analyses of stable isotopes we collected tissue from primary producers, macroinvertebrates and zooplankton using standard limnological methods. In addition, we extracted tissue from fin clips of fish that were captured using a variety of methods including short-set gill and trap nets, as well as USACE collected fishes as incidental mortalities of individuals that passed through the dams. All samples were freeze-dried to avoid posterior isotopic enrichment. In this study, we included data from both native and introduced fishes that are often found in these reservoirs including Black Crappie (*Pomoxis nigromaculatus*), White Crappie (*P. annularis*), Blue Gill (*Lepomis macrochirus*), Brown Bullhead (*Ameiurus nebulosus*), Yellow Bullhead (*A. natalis*), Largemouth bass (*Micropterus salmoides*), Northern Pikeminnow (*Ptychocheilus oregonensis*), Blackside Dace (*Phoxinus cumberlandensis*), Longnose Dace (*Rhinichthys cataractae*), Rainbow Trout (*Oncorhynchus mykiss*), Cutthroat Trout (*O. clarkii*), Chinook salmon (*O. tshawytscha*), Redside Shiner (*Richardsonius balteatus*), Sculpin (*Cottus spp.*) and Largescale Sucker (*Catostomus macrocheilus*).

Carbon and nitrogen stable isotope ratios from Chinook Salmon were relatively similar between the two reservoirs. In addition, sulfur isotope ratios from Chinook Salmon did not show a strong

signal of benthic macroinvertebrates, reinforcing the importance of zooplankton as their main food resource. Isotope ratios of Largemouth Bass, a potential predator of Chinook Salmon, showed noticeable differences between the two reservoirs. At Fall Creek Reservoir (deep drawdown), nitrogen and carbon isotope ratios of Largemouth Bass were very similar to Chinook Salmon, suggesting the potential for competition for food, although additional evidence would be required to confirm this. Conversely, higher nitrogen isotope ratios from Largemouth Bass at Hills Creek Reservoir indicated a higher trophic level than Chinook Salmon suggesting that Largemouth Bass may prey upon Chinook Salmon in that reservoir. Further, at the fish community level, taxa from Fall Creek Reservoir (deep drawdown) had a very narrow carbon base compared to Hills Creek Reservoir (reference reservoir), suggesting that the food web has less diverse basal resources. A narrower carbon base is indicative of many taxa using similar basal resources and thus, a greater potential for diet overlap among fishes. We found a lower maximum nitrogen isotopic ratio at Fall Creek Reservoir suggesting a shorter food web length than at Hills Creek Reservoir.

These findings are consistent with the idea that deep drawdown exports many of the introduced fishes downstream and afterward there is an overall reduction in fish abundance within the reservoir. Under such conditions, generalist predators may switch their diets from piscivory to the remaining and more abundant prey (e.g., zooplankton). Results from additional sampling conducted at Blue River Reservoir (secondary reference site) revealed that Rainbow Trout and Bluegill had broader carbon base there than in the other reservoirs. We also examined the level of individual specialization and potential trophic relationship among fishes using several metrics of isotopic niche and their overlap among reservoirs. We found that isotopic niches can vary between reservoirs depending on the availability of prey, fish ontogenic stage and species.