

Effect of Elevated Water Temperatures on Smolt Development and Non-Specific Immune Functions in Trinity River Chinook Salmon Smolts

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Juvenile Chinook salmon in the Trinity and Klamath Rivers of Northern California can experience elevated water temperatures, in excess of 23°C, during their spring out-migration. The literature on Pacific NW salmonids and elevated temperature indicates that such conditions can lead to physiological impairment. We performed a 5-week experiment that subjected 80 mm fork length Chinook salmon to mean daily temperatures (MDT) of 17°, 20°, 22°C under a 4–5 ° C diurnal, fluctuating regime. Prior to the temperature challenge, Trinity R. hatchery fish were acclimated for 6 days from their mean hatchery water temperature (10°C) to their respective lower experimental base temperature (16°, 18°, 20°C). Subgroups were also moved to either cooler or warmer temperatures during the experiment. The following measurements were made on a weekly basis: 48 hr Saltwater challenge response, Gill ATPase activity (both FW and SW fish), plasma lysozyme activity, plasma cortisol, anterior kidney cell composition, number, and nitro blue tetrazolium activity; and survival from *Yersinia ruckeri* challenge. Severe physiological impairment occurred in smolts that were initially reared at 22° MDT. Smolts moved from 20° MDT to 22°C performed as well as 17°C groups. Gill ATPase activity was markedly higher in SW challenge survivors than their FW cohorts and did not correlate well with plasma sodium regulation. It appears that Trinity R. smolts will tolerate relatively high water temperatures if allowed to acclimate and provided with adequate food and water quality conditions.