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Research article

Inter-population differences in salinity tolerance of adult wild Sacramento splittail: osmoregulatory and metabolic responses to salinity

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The Sacramento splittail (*Pogonichthys macrolepidotus*) is composed of two genetically distinct populations endemic to the San Francisco Estuary (SFE). The allopatric upstream spawning habitat of the Central Valley (CV) population connects with the sympatric rearing grounds via relatively low salinity waters, whereas the San Pablo (SP) population must pass through the relatively high-salinity Upper SFE to reach its allopatric downstream spawning habitat. We hypothesize that if migration through SFE salinities to SP spawning grounds is more challenging for adult CV than SP splittail, then salinity tolerance, osmoregulatory capacity, and metabolic responses to salinity will differ between populations. Osmoregulatory disturbances, assessed by measuring plasma osmolality and ions, muscle moisture and Na^+-K^+-ATPase activity after 168 to 336 h at 11‰ salinity, showed evidence for a more robust osmoregulatory capacity in adult SP relative to CV splittail. While both resting and maximum metabolic rates were elevated in SP splittail in response to increased salinity, CV splittail metabolic rates were unaffected by salinity. Further, the calculated difference between resting and maximum metabolic values, aerobic scope, did not differ significantly between populations. Therefore, improved osmoregulation came at a metabolic cost for SP splittail but was not associated with negative impacts on scope for aerobic metabolism. These results suggest that SP splittail may be physiologically adjusted to allow for migration through higher-salinity waters. The trends in interpopulation variation in osmoregulatory and metabolic responses to salinity exposures support our hypothesis of greater salinity-related challenges to adult CV than SP splittail migration and are consistent with our previous findings for juvenile splittail populations, further supporting our recommendation of population-specific management.

Key words: California, cyprinid, metabolism, osmoregulation, salinity, splittail

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