Enhancing cold water refuges at small tributaries in the lower Columbia River

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During the past century, a combination of factors has degraded Columbia River water quality, including its thermal regime. Adult and juvenile salmonids migrate through the mainstem Columbia River (including the Columbia River estuary) during periods when temperatures average 18-22˚C and reach as high as 24˚C. The effects of these temperatures include physiological stress and higher susceptibility to predation. Despite data gaps, available evidence suggests that thermal refuges provide important benefits to returning adult salmonids and likely to outmigrating juvenile salmonids. This is particularly true for adult summer steelhead and both adult and subyearling Fall-run Chinook, whose migration timing coincides with the period of warmest mainstem Columbia River temperatures. This reliance has important implications for salmon recovery, particularly in the face of climate change (warmer air temperatures and changes in precipitation patterns), which is anticipated to increase mainstem temperatures above already stressful levels. The anticipated benefits (and potential future reliance) of thermal refuge also presents a new habitat enhancement strategy for salmon recovery projects in the Columbia River estuary. We present a summary of physical characteristics that are anticipated to provide thermal refuge and the results of a feasibility study that utilized high resolution, 3D hydrodynamic and water quality modeling to evaluate two new approaches to expanding the size of cold water plumes originating from small tributaries whose discharge currently is subsumed and diluted almost immediately upon entering the mainstem Columbia River.