

Review of Wetland Habitat Characteristics in the Lower Columbia River and Estuary

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Shallow water habitat in the lower Columbia River and estuary (LCRE) is diverse and varies longitudinally along the main stem and laterally away from the main stem as tidal amplitude decreases and overall land elevation increases. However, the extent of these habitats is limited and has been modified from historic coverage due to changes in land use practices and modified river flows. We have monitored biological and morphological aspects of wetland habitat structure throughout the lower Columbia River and estuary as part of numerous programs designed to evaluate status and trends, to provide a means of evaluating restoration actions, and to improve restoration design. Our underlying goal of this research is to provide indicators of ecosystem processes such as macrodetritus input, nutrient cycling, and maintenance of biodiversity. Additionally, evaluating habitat structure and hydrologic patterns provides a means of evaluating the potential use by salmonids. For example, the potential for site access by juvenile salmonids is linked to the morphology of wetland channels and the inundation regime. Further, the type of vegetation present may affect the types of prey resources and the quality of cover for refuge. Additional research is needed to solidify the links between habitat structure and function in the LCRE; however evaluating the characteristics of these shallow water habitat types is a first step in understanding the potential for these ecosystems to provide critical functions.

The types of vegetated shallow water habitat in the LCRE can be divided into four broad categories: submerged aquatic vegetation (SAV), emergent marshes, shrub scrub, and forested wetlands. Within the LCRE, these habitats vary depending on location within the landscape and dominant hydrologic influence (tidal or riverine). Submerged aquatic vegetation is present throughout the estuary in shallow water areas; limited in distribution by the extent of the photic zone at the lower edge and desiccation at the upper limit. At the mouth of the estuary a marine SAV species is present: *Zostera marina*. *Z. marina*, known commonly as eelgrass, occurs throughout the world and is known to provide important habitat for many juvenile fish species. In the LCRE we have been evaluating the distribution, factors controlling survival, and potential for restoration of eelgrass. Preliminary results indicate the species may have been more abundant historically and is now recruitment-limited, suggesting restoration may be a successful means of increasing this limited habitat. Emergent marshes have also been shown to be important rearing and refuge areas for juvenile fish species world-wide. In the LCRE these habitats have been degraded or disconnected from tidal flows throughout the estuary. The elevation range of native vegetation species, channel morphology, and inundation frequency changes depending on the hydrogeomorphic location of the marsh in the estuary. Knowing the range in these controlling factors required by the wetland species will help ensure restoration success for these habitats.

Tidal shrub scrub systems are a successional stage between emergent marshes and forested systems and may provide benefits to salmon based on their cover and inundation regime, however further research is needed in this under studied system. Tidally influenced Sitka spruce

(Picea sitchensis) swamps in the lower estuary (below river mile 40) have become relatively rare habitats and are not well-studied in the Northwest. However, the prevalence of tidally influenced spruce swamps in the LCRE historically suggests this habitat may be an important niche for salmonids. Recent research has shown that topographic heterogeneity and a complex structure of large wood in tidal channels are critical components of these systems. Tidally influenced riparian forested systems dominated by cottonwood (*Populus balsamifera*) and Oregon ash (*Fraxinus latifolia*) are found above river mile 40 in the estuary. This is a dominant habitat type on islands and is found along undisturbed stretches of mainland beaches and tributaries. The age of these systems appears to be one factor influencing the habitat structure, however further research comparing sites of different ages is necessary.

In general, a mosaic of habitat diversity is critical for any functioning ecosystem, regardless of scale. In the LCRE, all shallow water habitats are significantly limited in spatial cover and distribution compared to historical conditions, therefore salmon habitat improvement in the estuary should focus on restoration of a mosaic of shallow water habitat types to increase existing habitat diversity.