Ecological Role of Tidal Saltwater Habitat for Salmonids

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We report on the ecological role of tidal saltwater habitat for salmonids by describing the historical and contemporary variations in juvenile Chinook salmon life histories, habitat associations, and food webs in the Columbia River estuary. Chinook salmon occur at near-shore estuary beach seining sites during all months of the year, increasing in abundance from January through late spring or early summer and declining to a lower but persistent level after July. Recently emerged fry begin dispersing throughout the estuary in early spring, and fry migrants were abundant in the estuary until at least August each year. Small (< 70mm) Chinook salmon were among the most abundant species in all wetland habitat types (emergent, forested, and scrub-shrub) surveyed in the lower 100 km of the estuary. During each spring, mean sizes of salmon increased from the tidal freshwater zone to the estuary mouth and may reflect estuarine growth and continued entry of smaller individuals from upriver. Studies of prey availability and salmon diets indicate that tidal wetlands are a major source of prey for juvenile Chinook salmon both within and outside wetland habitats. Insects produced in wetlands and other shallow habitats were dominantly utilized by salmon throughout the estuary, including larger size classes of fish that do not typically reside in wetland channels. Estimated growth rates of juvenile Chinook salmon derived from otolith analysis averaged 0.5 mm^{-1} day, comparable to rates reported for juvenile salmon in other Northwest estuaries. Estuarine salmon collections were composed of representatives from a diversity of lower and upper Columbia Basin ESUs. Genetic stock groups in the estuary exhibited distinct seasonal and temporal abundance patterns.

Wetland losses have not only reduced availability of shallow peripheral rearing habitats but also have eliminated an important carbon source for salmonid food webs. Stable isotope analyses indicate that contemporary salmon select disproportionately for food webs linked to vascular plants and benthic diatoms, most likely through their consumption of prey resources produced in wetlands and other shallow-water habitats. These results suggest that reduced sources of macrodetritus from removal of tidal wetlands could undermine the estuary's capacity to support juvenile salmon. Together, changes throughout the basin (e.g., hatchery programs, population losses, flow regulation) and in the estuary (e.g. wetland habitat losses, increased water temperatures) may have decreased the proportion of Chinook salmon using the estuary during summer and fall months compared with the patterns observed during the first salmon life history study in 1916. These results support the hypothesis that life history diversity of Columbia River salmon has diminished since early in the twentieth century and could limit the resilience of salmon populations to future environmental change.