

Benefits of Barrier Embayments/Pocket Estuaries to Salmon in Puget Sound

IMPORTANT FOR SALMON RECOVERY

Barrier embayments/pocket estuaries are an important habitat for juvenile salmonids in Puget Sound for both passage to and from freshwater and for extended rearing. Chinook, coho, and chum salmon are three culturally important species that show evidence of extended residence in a number of these intertidal environments. Populations of all three species are federally listed as threatened under the Endangered Species Act in many watersheds in Washington. Other listed species such as steelhead and bull trout may use barrier embayments/pocket estuaries briefly or only during migration, and fish passage barriers in these systems are impediments to movement of these species (Greene et al. 2017).



Embayments. This term describes protected estuaries and lagoons within which there is too little wave action to form beaches. The term **pocket estuary** has been widely used on Puget Sound to describe these features. Most of these small embayments are tidally influenced, but they also include isolated lagoons and wetlands. **Estuaries** are those with a significant input of freshwater – for example, from a surface stream, whereas lagoons have limited freshwater input. A large number of the estuaries and lagoons on Puget Sound are formed and enclosed by **barrier beaches**, emphasizing an important geomorphological relationship between the wave-dominated beach environments and these small protected estuarine environments.

—Taken from “A Geomorphic Classification of Puget Sound Nearshore Landforms” by Hugh Shipman (WDOE)

FULL RESTORATION FOR FISH BENEFITS



Thorndyke Estuary at High Tide



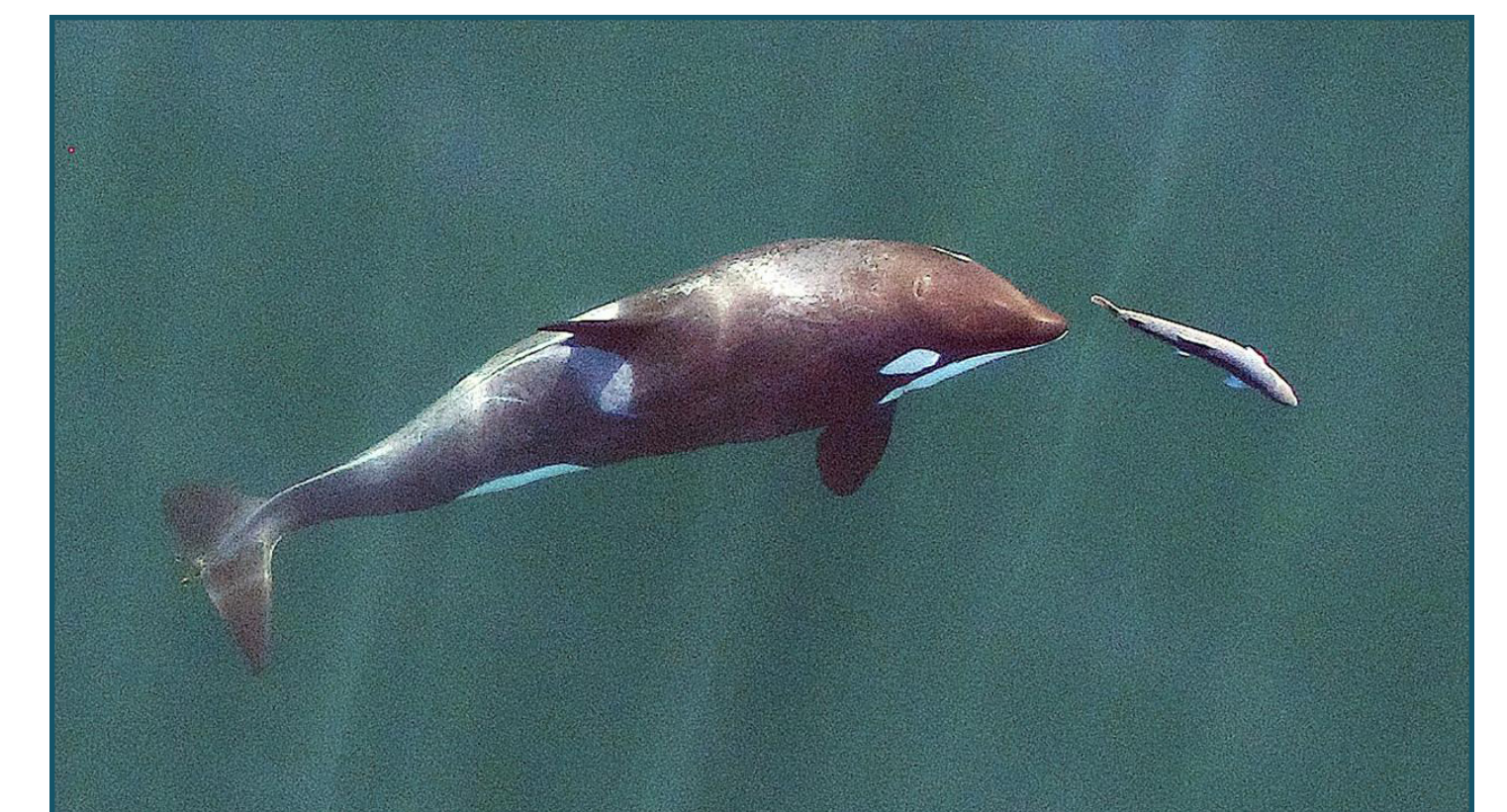
Thorndyke Estuary at Low Tide

Networks of smaller tidal channels that terminate in the upper end of barrier embayment/pocket estuary marshes are important rearing habitats for these young salmon and are important to their survival to adulthood. These marsh habitats are dense with prey (insects, invertebrates) for salmon to feed on and grow rapidly (Fresh et al. 2006; Beamer et al. 2005). Quantity and quality of channels/habitats formed increases significantly as you restore more tidal exchange to the system. Whiteman Cove was cited as one of the six most important sites for barrier embayment/pocket estuary restoration in Puget Sound (Cergehino et al. 2012).

ORCA RECOVERY

“The Southern Resident killer whale is an icon of the West Coast. These striking black and white mammals are recognized for their cultural and spiritual importance to coastal tribes and communities. The Southern Residents are also among the most at-risk marine mammals in the world. Noise and crowding by boat traffic, chemical contaminants, as well as a scarcity of their preferred food—Chinook salmon—pose serious threats to this endangered population.”

—NOAA



Benefits of Barrier Embayments/Pocket Estuaries to Salmon in Puget Sound

CONNECTIVITY OF BARRIER EMBAYMENTS/POCKET ESTUARIES



- Modified, not accessible to salmon
- Intact, no human-made barriers
- Juvenile fish migration for extended rearing
- - - Salmon out-migration through Puget Sound

Juvenile salmonids (Chinook and chum) leave their natal delta and migrate along the shallow shoreline area of Puget Sound's inlets and islands. Research shows smaller juveniles (fry) often seek barrier embayments/pocket estuaries that are within one day's swim of their natal delta to extend rearing (Beamer 2018; Greene et al. 2017). Whitman Cove is located along a stretch of Carr Inlet shoreline with no available open estuaries, in between numerous streams and open estuaries to the north, south, and west and would provide benefits to Chinook salmon migrating from locations such as the Nisqually River.

EFFECTS OF CULVERTS AND TIDE GATES

Culverts and tide gates reduce fish passage by creating a physical barrier (closed gate, high velocities, or not connected during entire tidal cycle). However, structures also reduce habitat quality and quantity on the marsh side by reducing the tidal volume exchange in and out of the structure, which can change salinity, increase water temperature, increase sedimentation, and reduce dissolved oxygen. Complexity and number of tidal channels is also reduced by the structure. These processes affect both vegetation and the fish and invertebrate community. Many studies have demonstrated large changes to fish communities associated with intertidal structures (Greene et al. 2017).



SUPPORTING NEARBY RESTORATION EFFORTS



Two key nearby rivers (Nisqually River and Goldsborough Creek) have had extensive restoration; Whitman Cove restoration would further support this significant investment, as barrier embayments/pocket estuaries support fish survival once they are out in Puget Sound. The Nisqually River is one of the ten most important rivers in Puget Sound for salmon recovery, and since restoration in 2009 the delta is one of the healthiest and least developed in Puget Sound. Wild steelhead populations in the Nisqually have increased from 269 in 2012 to 2,000 in 2016. Over 12,000 Chinook salmon now come back to spawn annually (<https://nativefishsociety.org/watersheds/nisqually-river>) as compared to only 400 in 1995 (<https://nwtreatytribes.org/nisqually-river-chinook-trending-towards-recovery/>). A dam was removed on Goldsborough Creek in 2001, opening over 30 miles of habitat, and additional habitat restoration has been occurring for many years. Populations of chum, coho, and Chinook salmon have all significantly increased as a result of this investment and would be further improved by estuary restoration.