

Proposal for Skagit Basin Water Task Force Work Group  
Submitted by Correigh Greene (NOAA)  
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## **Title: Updated “Delta Study” Evaluating Current and Future Habitat Needs in the Skagit Delta**

**What:** Hydrodynamic evaluation of the influence of freshwater flows upon estuarine habitat forming processes and habitat use by salmon, addressing current and future climate scenarios for the Skagit delta and associated Skagit Bay nearshore.

**Why:** River flow can affect many habitat features in estuaries, the extent of wetland marshes, and migratory connectivity for salmon populations. The “Delta Study” (Duke Engineering 1999) partially addressed these issues by determining how river flow would affect the amount of estuary area inundated by at least one foot water depth over the season. In their review of the Delta Study, the Washington State Academy of Sciences (WSAS) recommended a number of improvements. These included hydrodynamic models of tidal inundation and river flow, incorporation of climate impacts, use of lidar and other remotely sensed information, and improved understanding of the fish habitat use. *Many of these products have been developed for the Skagit Basin, but have not yet been used to update conclusions about contributions of river flow to tidal delta habitats used by fish.*

**How:** 1) Construct an integrated model of fish habitat opportunity in the delta and nearshore as functions of existing and potential future delta footprint, tidal inundation, temperature, and most importantly, the Skagit River hydrograph. 2) Integrate existing datasets and model products, including:

- The Salish Sea Model (Khangaonkar et al. 2018, 2021) and Skagit Delta Hydrodynamic Model (Yang and Khangaonkar 2006, 2009), which examine circulation, tidal inundation, river flow, and other water properties in the delta and nearshore.
- Analyses linking salinity variation, vegetation change, and sediment accretion,
- Modeled climate impacts including downscaled air temperature and Skagit river flow (see Skagit Story Map), and tidal delta impacts of sea level rise and changes in circulation (Northwest Science, 2016, Volume 90 (1)).
- lidar-based maps of tidal elevation and channel structure (Beechie et al. 2018)
- 20+ years of fish monitoring data (Greene et al. 2021) coupled with physical observations, enabling evaluation of site-specific fish-habitat relationships.

**Data Uses and Impacts:** The goal of the instream flow rule is to define seasonal flows that maintain species habitat requirements and habitat-forming processes. This proposal will help update the Delta instream flow rule through improved understanding of:

- *Fish habitat:* The integrated model will evaluate what levels of seasonal flow maximize residency of salmonids across the tidal delta and nearshore for the full rearing season, taking into account changes to the delta wetland footprint.
- *Future climate:* Climate impacts impose both seasonal constraints (e.g., increased temperatures) as well as potential opportunities (increased inundation from sea level rise)

for fishes in the tidal delta, so incorporating scenarios of these cumulative effects is necessary to address the influence of seasonal flow.

- *Surface water*: The new study will better quantify how much water is needed to support fish habitat in the delta and nearshore, in turn providing new and improved information on the potential for water use by people.