Executive Summary

3/16/2021

Skagit 2020 Monitoring & Adaptive Management Report

This report was compiled from many independent research and monitoring projects completed between 2000 and 2016. The purpose of this Monitoring and Adaptive Management (M&AM) report is:

1. To present an adaptive management framework for collective decision-making;
2. To present a summary of the status and trends (where available) of explicit and implied habitat indicators from the Skagit Chinook Recovery Plan (2005); and
3. To make recommendations for future monitoring and adaptive management.

This report provides a comprehensive framework for quantifying indicators of key ecological attributes for multiple ecosystem components important to Skagit River Chinook Salmon viability, including 2005 habitat status, available current habitat status and trends data, and the desired future status where proposed. Ecosystem components in the report include natal Chinook estuaries (referred to as the tidal delta), pocket estuaries, large and small freshwater channels, off-channel lakes and wetlands, and uplands. This report does not include salmon monitoring nor does it attempt to link salmon performance and habitat.

These data summaries and conclusions represent complex ecosystems influenced by many variables, some of which we have limited knowledge about their interactions. These data represent our best assessments at this time, but with very few years of information care should be taken in how status and trends are interpreted and acted upon.

Technical recommendations were provided by the Skagit Watershed Council M&AM Subcommittee by category, including for improving monitoring; research; habitat protection & restoration strategies; and scientific hypotheses and desired future conditions. It is up to other committees, organizations, and communities to determine what to do with the strategy, hypotheses, and desired future condition recommendations.

<u>Tidal Delta Habitat Conclusions</u>

Chapter 3 quantifies five indicators (*shown in italics*). Overall, one was moving in a positive direction, one was negative, and the remaining three have not yet reported sufficient data.

- *Tidal delta extent* is the sum of the area of all habitat types within the vegetated Skagit tidal delta and *distributary/blind channel area* is the sum of the area of channel habitat types within the vegetated Skagit tidal delta. They were both mapped and classified for the year 2004, while tidal delta extent was repeated for the year 2013, allowing a trend analysis for the latter. In general, we are gaining tidal delta habitat faster than we are losing it, with an overall increase of 83 hectares (ha). About 122 ha were gained

through active restoration projects and another 28 ha gained through natural progradation and a passive dike breach, while about 67 ha were lost predominantly through "natural" bayfront erosion and invasive spartina removal.
    - Active restoration projects are working, and often improve habitat quality outside and "downstream" of the dike removal areas.
    - Regulatory protections have minimized further losses of tidal delta habitat.
    - When including "natural" loss of mostly bayfront habitat due to erosion, current rates of restoration do not meet desired future conditions until sometime around the year 2100, 95 years after the Recovery Plan was adopted. If current conditions persist (or get worse) then future restoration work will need to continue even past 2100 to offset erosion.
    - The sooner desired future conditions are met, the less habitat restoration and agricultural land conversion will be needed to offset erosion over time.
- Skagit *tidal delta progradation* is the rate of change in habitat along the seaward boundary of the vegetated tidal delta. These progradation rates declined, and habitat was lost, even during a period of increasing timber harvest, subsequent landslides, and sediment delivery since the mid-19th century.
    - This suggests that relative sea level rise and sediment re-routing within the tidal delta are responsible for the "natural" erosion and decline in the formation of tidal delta habitat.
- *Blind channel landscape connectivity* is a measure of the length and complexity of the pathway a juvenile salmon must follow to access this rearing habitat. Connectivity was highest in the South and North Forks and lowest in Swinomish Channel/Padilla Bay. The report notes significant historic reduction in connectivity to the latter and to Central Fir Island due to historic changes in fish migration pathways through Fir Island and McGlinn jetty & causeway, respectively. No contemporary trend data is reported here.
- *Habitat Connectivity/Fragmentation* was intended when proposed in 2005 to assess continuity and scale of available habitat in the tidal delta. This report documents that it is difficult to conclude tidal delta habitat is not currently continuous, but that the estuarine wetland zone extent and width are so dramatically reduced that it may present minimum threshold concerns.

<u>Tidal Delta Habitat Recommendations:</u>
Monitoring recommendations include continuing tidal delta extent trend monitoring at 5-year intervals, including adding the unvegetated part of the tidal delta and tidal delta progradation rates as indicators. Refine functional vs. nonfunctional habitat extent and the connectivity/fragmentation indicators. Complete a GIS habitat census error assessment. And add new indicators for monitoring overwater structures and shoreline armoring.

Five tidal delta habitat recommendations are made for reassessing our strategies in this area. Strategies should explicitly address the global-scale stressor of carbon pollution and landscape-scale stressors such as sediment re-routing in the lower river and tidal delta. Restoration site locations and the overall approach to the tidal delta restoration strategy should be re-evaluated for risk from sea level rise and disrupted sediment regimes, including the timeline and its cost

effectiveness implications. Continue habitat protection strategies to protect habitat that currently exists.
Finally, a research recommendation includes launching a coordinated, comprehensive, and funded habitat and fish linkage program to address critical uncertainties and further improve current efforts.

Pocket Estuary Conclusions:
Chapter 4 quantifies four indicators (*shown in italics*). Pocket estuaries are partially enclosed embayments found along the shoreline, often exhibiting depressed salinity compared to adjacent marine waters due to freshwater inflow. Overall, three of the four indicators were moving in a positive direction, with no trend data reported for the fourth.

- The *count of pocket estuaries accessible to salmon* is defined as those pocket estuaries in the Whidbey Basin that have tidal connection at least some of the time. Pocket estuary count increased by one between 2005 and 2014 (from 24 to 25) due to a 94 ha restoration at Crescent Harbor.
- The *pocket estuary area/extent of functional channels accessible to juvenile salmon* are the sum of accessible areas that include tidal and subtidal habitats between tidal stages of Mean Low Water and Mean Higher High Water. Total habitat area increased by 104.8 ha due primarily to restoration, including the 94 ha project at Crescent Harbor and two smaller projects at Lone Tree Lagoon and Turner's Bay. Differences in mapping methods, image resolution, and surveyor differences between the two years likely contributed as well. Fifteen out of 25 pocket estuaries had smaller intertidal footprints than occurred historically/naturally due to human activity. Tidal channel function evaluation found 4 out of 25 mapped pocket estuaries had impaired tidal channels in 2015.
- The landscape position of pocket estuaries is important to determining availability and connectivity of these habitats to outmigrating juvenile Chinook salmon. It is assessed via two indicators, the *median distance between pocket estuaries* and *median distance of pocket estuaries from natal estuaries*. The landscape position of pocket estuaries improved because of the addition of one pocket estuary which decreased the median distance between pocket estuaries. This is not reported specifically (calculated) , but follows qualitatively from what is reported.

Pocket Estuary Recommendations:
Monitoring recommendations for pocket estuaries include continuing efforts on a 5-year interval for all indicators. Two research recommendations include conducting assessments of both climate change vulnerability and opportunity for drift cell scale sediment dynamics and coastal landform translation.

Freshwater Ecosystems Conclusions:
Chapter 5 quantifies nine freshwater ecosystem indicators (*shown in italics*). Overall, two of nine indicators were moving in a positive direction, one was moving in a negative direction, and the remaining either showed no direction or did not report sufficient data.

- *Floodplain extent* is quantified from a geomorphic floodplain polygon dating to 1998. It has been held constant since then as the basis for the following indicator calculations.
- *Large river floodplain structure and connectivity* is the area of all habitat types exposed to river hydrological processes, including channels and floodplains. Hydromodification and road data were used to determine level of connectivity, including functional, shadowed, or isolated. Total new area exposed to floodplain processes between 1998 and 2015 was 352 ha, which reduced percent impaired floodplain from 31% to 28% overall, which is a positive trend. Most of this new floodplain area is attributed to 1) newly mapped eroded areas, 2) changes in road presence, and 3) changes in hydromodification mapping and presence.
- Additional indicators under the umbrella of floodplain structure and connectivity include:
    - *Mainstem edge length* remained about the same between 1998 and 2015 after accounting for variation in methods and river flow/stage, increasing from 500.7 km to 501.2 km.
    - *Mainstem hydromodified edge length* (hydromods include riprap bank armoring and levees) decreased from 49.4 km in 1998 to 41.4 km in 2006 to 39.9 km in 2015, which is a positive trend. Some of the difference is due to passive (natural erosion) and active (anthropogenic restoration) removal of hydromodifications, but some of the difference is also due to mainstem channel migration away from the hydromods resulting in researchers not capturing it in subsequent surveys.
    - *Mainstem backwater perimeter length* (backwaters are low gradient areas of high quality rearing habitat) decreases from 23.7 km to 20.1 km between 2006 and 2015, which is a negative trend.
    - *Floodplain channel area* (defined as polygonal areas of mainstem, backwater, braids, and side/secondary channels) for each dataset was nearly identical: 2,415 ha in 2006 and 2,428 ha in 2015.
    - *Floodplain channel length* (defined as the length of all floodplain channels in unconfined reaches) totaled 371.1 km in 2005 but did not report trend data.
    - *Connectivity of large river floodplain habitats* (defined as the count of and distance between backwaters and floodplain channels) was reported as fragmented in the 2005 Skagit Chinook Plan with 20 mainstem reaches with gaps in habitat availability that may be priority areas for restoration. This analysis has not been repeated since the Skagit Chinook Recovery Plan so no trends reported.
    - *Tributary connectivity and structure* includes natural and artificial barriers to fish passage. Barrier assessment is currently underway.
    - *Tributary length* assessment has been started, but only exists for current conditions. Habitats are shown sorted first by gradient class and accessibility, and then by watershed position and accessibility.

Freshwater Ecosystems Recommendations: Seventeen freshwater habitat monitoring recommendations are made. Repeat floodplain, hydromodification, and channel monitoring protocols on a five to ten year period, updating protocols and databases where appropriate. Refine the original 1998 channel data to make it more comparable to recent time stamps.

Utilize LiDAR-derived Relative Elevation Modeling to better map floodplain features for both M&AM and protection/restoration planning purposes. Revisit 2006 and 2015 time stamps to measure floodplain channel lengths. Develop and measure a new indicator for alluvial fans (where tributaries enter the mainstem floodplains). Field verify fish barriers. Incorporate channel width estimates into the hydro layer in order to re-run the intrinsic potential models with updated fish distribution layers. Make estimates of large woody debris recruitment and trends therein. Create a new freshwater implementation monitoring framework and connect to broader ambient monitoring to understand how our actions are working in context to other trends. Improve indicator linkage to Chinook benefit.

Riparian Habitat Conclusions:
Chapter 6 develops and quantifies one riparian indicator, *spatial extent & continuity*, and recommends another be further developed, *community structure & function*. Desired future condition is currently defined as protecting existing riparian functions and continuing to restore degraded riparian functions within at least 40m of anadromous salmon habitat. Overall, riparian spatial extent & continuity are moving in a positive direction within SWC's priority Target Areas. While about 280 acres of functional riparian land cover was lost to anthropogenic activities (mostly from logging) between 2006 and 2013, about 1,170 acres were replanted by riparian project sponsors and landowners between 1998 and 2016. This increase of about 880 acres increases functional riparian areas by about 3.1% in WRIA 3 and about 1.1% in WRIA 4, attributed to current strategies of steady voluntary and regulatory protection coupled with voluntary riparian planting.

Riparian Habitat Recommendations:
Nine riparian recommendations are made, including five monitoring recommendations. Repeat land cover classification on a decadal time period while updating the SWC riparian action and WDFW high resolution change detection databases every two years. Improve hydrography layer accuracy. Monitor riparian planting effectiveness. Develop a new community structure indicator by comparing canopy heights across decades. And explore other indicators such as canopy cover and functional stream shading.

Toward improving the framework for M&AM, this report recommends more explicitly outlining desired future conditions and goals to better track progress in relation to them.

This report makes three strategy recommendations including clarifying recommended geographic extent of riparian target areas including in the context of mobile channels; generating technical guidance for how planting can provide most benefit for climate change adaptation; and sharing best practices and lessons learned among practitioners.

Potential future indicators for freshwater ecosystems and riparian habitats include large woody debris. Possible indicators and methods have been examined with two recommendations for future monitoring include quantifying LWD in mainstems and linking LWD, riparian, and sediment metrics to better characterize habitat processes.