GREEN/DUWAMISH AND CENTRAL PUGET SOUND (WRIA 9)IMPLEMENTATION TECHNICAL COMMITTEE

WRIA 9 Implementation Technical Committee Meeting
August 17, 2022 | 9:30 am – 11:30 am
Zoom Link: https://us02web.zoom.us/j/89069145463?pwd=SUhLOHhTVEs2VlhIeTFML0x4V3J2UT09
Meeting ID: 890 6914 5463
Passcode: salmon

9:30 **Welcome & Introductions**

9:40 **Investigating Juvenile Life History of Adult Green River Fall Chinook Salmon using Otolith Chemistry** — Lance Campbell, Washington Department of Fish & Wildlife
Presentation followed by Q&A and group discussion

Lance Campbell and co-authors recently finalized a report assessing the contribution of juvenile freshwater life histories among returning adult Green River Chinook across three years of returns and evaluating which juvenile life history strategies are most likely to survive to return to spawn. Results suggest that early fry migrants are disproportionately not surviving to adult return while longer-rearing parr outmigrants contribute the majority of successful returns. This work received WRIA 9 FCD Cooperative Watershed Management funding support.

11:15 **Round Robin Updates** — All
Slide deck activity

- **Pre-meeting prep (5 minutes) –** Please find a slide deck with instructions on slide 1 at this link: https://docs.google.com/presentation/d/1pRLEMU9Qn6zE9kqIoePrEXw4mTy7jGgR3-k0k6_b9L8/edit?usp=sharing. Use your slide to include relevant updates from your jurisdiction, project, or team. Make the slide your own with photos or maps of project sites. Slides are pre-filled with individual names for convenience; please feel free to combine slides for your team/group/organization.

11:30 **Adjourn**

WRIA 9 ITC web page: http://www.govlink.org/watersheds/9/committees/ImpleTechCmte.aspx

Participant list:
Alexandra Doty, Chris Korwel, Jacqueline Miller, Josh Hopkins, Julian Douglas, Kerry Bauman, Kollin Higgins, Lance Campbell, Marc Marcantonio, Matt Goehring, Matt Knox, Mike Perfetti, Nik Novotny, Rowena Valencia-Gica, Suzanna Smith

Round-table Updates and Reminders

Read through our **WRIA 9 ITC August round robin** slides at this link: https://docs.google.com/presentation/d/1pRLEMU9Qn6zE9kqIoePrEXw4mTy7jGgR3-k0k6_b9L8/edit?usp=sharing. Includes relevant updates from WRIA 9 staff, Puget Sound Partnership, USFS, King County, Covington Water District, City of Tukwila, City of Kent, and Mid Sound Fisheries Enhancement Group.

WRIA 9 is wrapping up the 2022 grant round and beginning 2023 grant round preparation. Suzanna will be reaching out to project sponsors over the next month. Please email susmith@kingcounty.gov with questions, comments, and project/proposal ideas.

Investigating Juvenile Life History of Adult Green River Fall Chinook Salmon using Otolith Chemistry

Lance and his team are using otolith analysis to assess the contribution of juvenile life histories to adult returns of chinook in the Green River as well as in other watersheds. This work began as part of the Salish Sea Marine Survival Project then was expanded in Green River with WRIA 9 FCD Cooperative Watershed Management funding.

Salmon outmigrate in pulses: early migrants (fry), late migrants (parr), yearling migrants. It used to be thought that fry seeded the system but didn't contribute significantly to adult returns. However, Lance et al.'s research shows this idea is not necessarily true; small fish do contribute to adult populations. The extent of contribution varies across watersheds.

Lance et al. randomly sampled adult fish returning to Green River spawning grounds in 2015-2017 and 2019 and used otolith microchemistry to define a marker of estuary entrance and estimate approximate fish size at saltwater entry. Based on data from those years, the Green River produces similar abundances of fry and parr outmigrants. However, few (<5%) small fish (<60 mm) returned as adults. Returning adults represented outmigrants averaging about 80 mm with little interannual variation. Lance et al. also identified a few wild yearlings contributing to adult returns. Concurrent studies showed high accuracy in identifying hatchery vs. wild fish based on otolith chemistry. Additional work currently underway will add 2018 and 2020 returns to the Green River dataset.

The Green, Puyallup, and Cedar have low fry contributions to returning adult populations. However, in other systems like the Skagit and Nooksack, fry contribute 20-30% of returning adults. Lance's working hypothesis is that watersheds with little functional estuary habitat have low fry contributions to adult populations while watersheds with lots of estuary habitat have higher fry contributions. Even in relatively natural/less-developed watersheds, fry contribute less to returning adults when estuary habitat is limited – for example, the Quileute River has

almost no hatchery contribution and little development but has a very small estuary and <5% of adult returns were fry outmigrants. Other factors (e.g., contaminant issues and high parasite loads) could cause or contribute to differential survival among size classes. Timing (e.g., later migration) could also play a part.

Otolith analyses like this could potentially be used to evaluate estuary restoration effectiveness by comparing life history expression before/after restoration work. As restoration efforts increase and habitat function and availability changes, we would expect to see shifts in life history expression. Upcoming potential work includes assessing chemical patterns in ocean distribution and nearshore residency/marine transition patterns.

Further questions? Contact Lance Campbell at lance.campbell@dfw.wa.gov.

Discussion

- Nik – what is the percentage of yearlings returning as adults compared to percentage of yearling outmigrants? In watersheds where Chinook have access to headwaters, do larger proportions of yearlings return?
    - Lance – there are relatively few wild yearling outmigrants, so they are likely surviving well. It is difficult to estimate due to uncertainties around trap efficiency/yearling avoidance of trap, etc. Other watersheds like Snohomish do have higher proportions of yearling returns. However, keep in mind that this analysis targets specific populations, not basin-level patterns. There are limitations on where we can collect fish.
- Nik – comparing the Skagit and Green, does that suggest we focus our efforts more on upstream restoration rather than estuary restoration?
    - Lance – HHD fish passage should be a major focus. The Green is tributary-limited. The Duwamish is also limited. What we don't know is what level of estuary restoration would make a significant difference. Is it 5% functional habitat? 50%?
    - Kerry – passage at the dam is the most important focus. Creating edge habitat is also important, despite limited opportunity in Lower and Middle Green.
- Kerry – can you speak to concerns over losing a fry life history in the Green? What is your sense of genetic control versus behavioral expression of life histories?
    - Lance – from an evolutionary standpoint, Chinook are plastic. One explanation for the patterns we observe is a genetic component to life history expression – for example, Green River fish may have adapted to a small nonfunctional estuary and put evolutionary energy into producing parr life histories. On the other hand, Nisqually fish are genetically Green River stock and fry do contribute to Nisqually adult returns. Many other variables (flow, population size, etc.) could affect life history expression. For example, Zimmerman et al. showed that high flows and high densities produce more fry expression.
- Kerry – the screw trap data set defines fry as <45 mm while your methods use <60 mm. Are you correcting for the different definitions?

    - Lance – would recommend going with the <45 mm screw trap definition as those are empirical measurements of fry lengths. Comparing real lengths with backcalculated estimates from otoliths will never be a direct comparison. There is some error/wiggle room in otolith estimations and some freshwater growth between trap and estuary entry. Lance's team will continue to try to do both: the smolt trap's <45 mm fry definition and otolith-based "small fish" vs. "big fish".

- Kollin – the Green has always had a relatively smaller estuary than the Skagit, even prior to urbanization: https://your.kingcounty.gov/dnrp/library/2005/kcr2038.pdf. The estuary was near Auburn before lahars filled it in; Kent was marine. We do see lots of fry outmigrants using the Green/Duwamish before parr come down.
    - Mike – from the restoration practitioner point of view, we've been working on the assumption that habitat limitation and chemical contaminants are causing these patterns. But is a small fry return actually historically natural for the Green based on its hydrology and geomorphology?
    - Lance – our work doesn't take lower river habitat into account. Looking at relationships between distance from estuary and size of arrival at estuary, we see a linkage between proximity and size which suggests that outmigrants need lower river mainstem and tidal freshwater habitats.
- Mike – does time spent on transition zone show on otoliths?
    - Lance – we occasionally find "sloppy" patterns that may have to do with the transition zone. But we can't reliably determine since strontium uptake is quick even at low levels.
- Kerry – how do flood patterns and weather come into this story? Tough to compare across basins with so many differences.
    - Lance – definitely. There is evidence that high flow events and timing of events can impact fry outmigrant proportions.
- Kollin – from the WRIA perspective, we have discussed including periodic otolith analyses in status and trends – a check-in every few years. We're slowly working on Duwamish restoration but projects are small and we don't know where the tipping point would be to produce a noticeable signal in otolith data. Fish passage at HHD and Superfund cleanup are both ~10 years out which could create confounding factors.
    - Lance – for estuary specifically, a touchpoint every 3-5 years is reasonable. We would be trying other avenues for annual collections at minimum because we'd be concerned about losing continuity, brood year effects. The other avenue we're interested in for the Green is habitat-origin work – e.g., chemistry for Newaukum vs. mainstem habitats to determine where yearlings are coming from, rearing, etc. to partition out habitats and get a baseline prior to dam passage.