Nearshore ecosystem function response to large dam removals: Pacific sand lance (*Ammodytes personatus*) spawn distribution in the Elwha nearshore ten years after large dam removal

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Goal To test our hypothesis: *'Sand lance spawn distribution will expand along the Elwha drift cell after/as a result of dam removals'*

Context and Findings to Date

Sand lance, (a forage fish), are a foundation for northeast Pacific ecosystems. Sand lance spawn on very specific grain size beaches (Moulton & Penttila 2001). Historically only one small reach of shoreline of the Elwha drift cell was suitable for sand lance spawning due to significant sediment starvation from 100 years of shoreline armoring and in river dams (Shaffer et al 2008). A decade after two large dams were removed in the Elwha River and upwards of 10 mcm of sediment was delivered along the Elwha drift cell, shorelines have widened, and grain size has decreased significantly (Parks 2022). Subsequent to dam removals, the extent of potentially suitable sand lance spawning habitat throughout the drift cell has greatly increased.

We conducted sand lance spawn surveys in winter 2022-2023 to determine changes, if any, in the distribution of sand lance spawning in the Elwha drift cell. A total of 34 samples were collected from the shoreline of the Elwha drift cell and a comparative site. Sampling concluded January 2023 and 50% of samples have been worked up in the lab. A total of five eggs have been found so far.

Methods

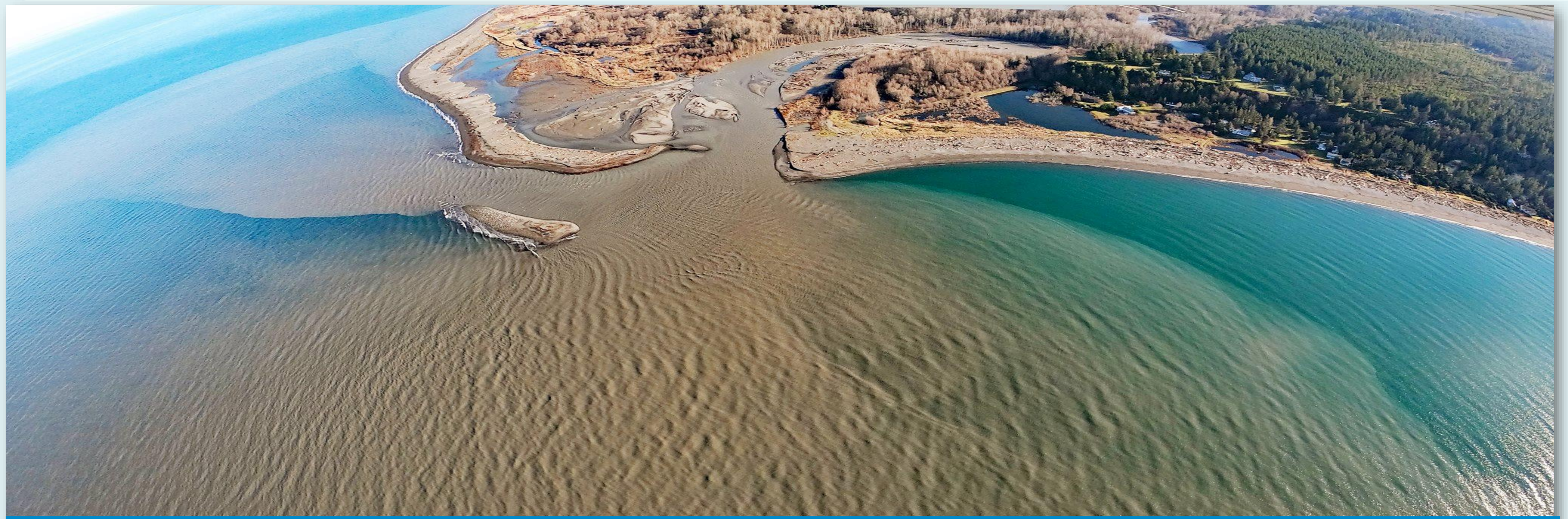
Beaches were sampled per Moulton and Penttila (2001). Sites were sampled along a series of 33 m long transects. Along each transect the top 6 cm of sediment were sampled to fill a 0.1239 m^2 volume plastic bag. We sampled a total of 3265 m of linear shoreline.

Samples were processed per Dionne (2015), also known as the 'Vortex method' Each sample was rinsed with a hose through size 2 and 0.5 mm mesh sieves. The sediment was transferred from the 0.5 mm mesh sieve to the blue bowl vortex generated by a small electric pump. Sediment was stirred with the plastic spoon starting from the center to the outer wall of the bowl for 3 minutes and all floating material spill into a fine mesh under sieve. The sample was then decanted to a jar and preserved in Stockard's solution. All equipment was thoroughly rinsed in-between samples to prevent cross contamination.

In the lab all processed samples were examined under a dissecting microscope and all eggs were identified, counted, and their life-history stage recorded.

Considerations

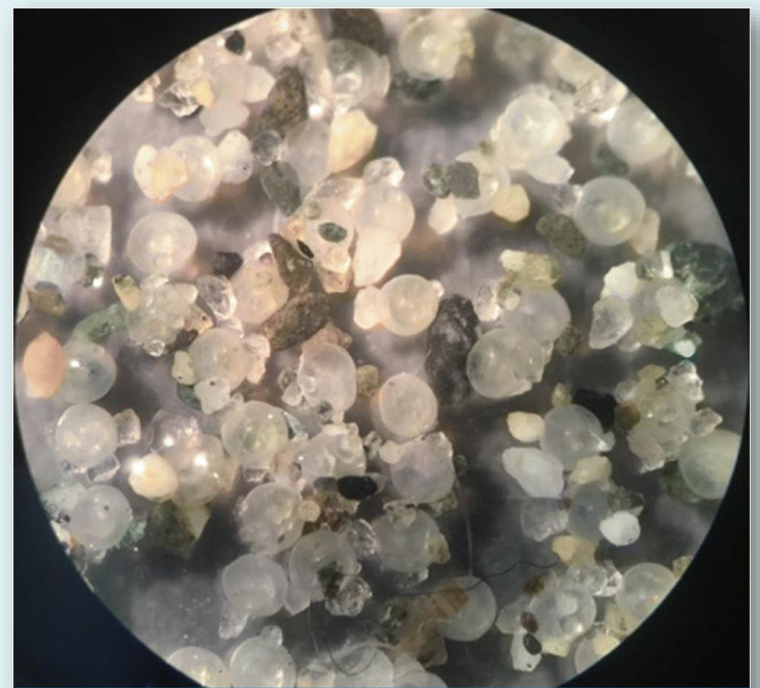
Despite dramatic changes in Elwha beaches since dam removal, we have found very few eggs. Low egg number is consistent with findings of other sand lance spawn studies of the region, including Huard et al (2022) who determined that distance to estuaries, beach slope, distance to subtidal habitat, fetch, and aspect (south-facing closely followed by east and west facing beaches) play a role in predicting habitat suitability for sand lance spawning. We look forward to completing our sample work up and considering our results for future dam removal recommendations and to validate Huard's modeling to a larger geographic context.



Sediment plume along the Strait of Juan de Fuca from the mouth of the Elwha River seven years after dam removal.

Collecting sand lance spawn sample December 2022.

Sample processing using the 'Vortex method' January 2023.



An example of Pacific sand lance eggs and substrate. Photo by Tomlin et al 2021.

Beaches surveyed December 2022-January 2023	# of samples	Beach length (m)
Cline Spit (Comparison site)*	2	104
West Elwha Delta	8	640
Freshwater Bay*	22	2155
Ediz Hook	2	305
Total	**34**	**3204**

*Eggs present in sample

Pacific sand lance caught by a Pacific salmon smolt. Photo by Dave Parks, CWI.

References

Dionne, P., 2015. Vortex method for separation of forage fish eggs from beach sediment. *Washington Department of Fish and Wildlife*, pp.1-14.

Huard, J.R., Proudfoot, B., Rooper, C.N., Martin, T.G. and Robinson, C.L., 2022. Intertidal beach habitat suitability model for Pacific sand lance (*Ammodytes personatus*) in the Salish Sea, Canada. *Canadian Journal of Fisheries and Aquatic Sciences*, *79*(10), pp.1681-1696.

Moulton, L. and Penttila, D.E., 2001. San Juan County forage fish assessment project: field manual for sampling forage fish spawn in intertidal shore regions First Edition. *San Juan County Marine Resource Committee and Northwest Straits Commission, La Conner, WA. 23p*.

Parks, D. 2022. Beach morphology and grain-size distributions in the Elwha and Dungeness drift cells: before, during, and after Elwha Dam Removals, 2010-2022 . A poster presented at Elwha Sciencescape 2022.

Shaffer J. A., Crain P., Winter B., McHenry M., Lear C., and Randle T., (2008) Nearshore Restoration of the Elwha River Through Removal of the Elwha and Glines Canyon Dams: An Overview. Northwest Science. 82:48-58.

Tomlin, H., Schellenberg, C., Barrs, J.B., Vivani, A.J. and Shaw, P., 2021. Identifying and monitoring of forage fish spawning beaches in British Columbia's Salish Sea for conservation of forage fish. *FACETS*, *6*(1), pp.1024-1043.

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