

Beaver in Tidal Wetlands: *Implications for restoration*



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Why include beaver in tidal wetland restoration?

Beaver are a part of tidal wetlands—they belong
They are likely ecosystem engineers in tidal wetlands just as they are in streams
Without beaver we are doing incomplete restoration
Without dams, beaver are just a large rodent
Beaver dams likely have ecosystem function



13.1 km of tidal shrub channel surveyed.
11.9 km of tidal herbaceous channel surveyed.

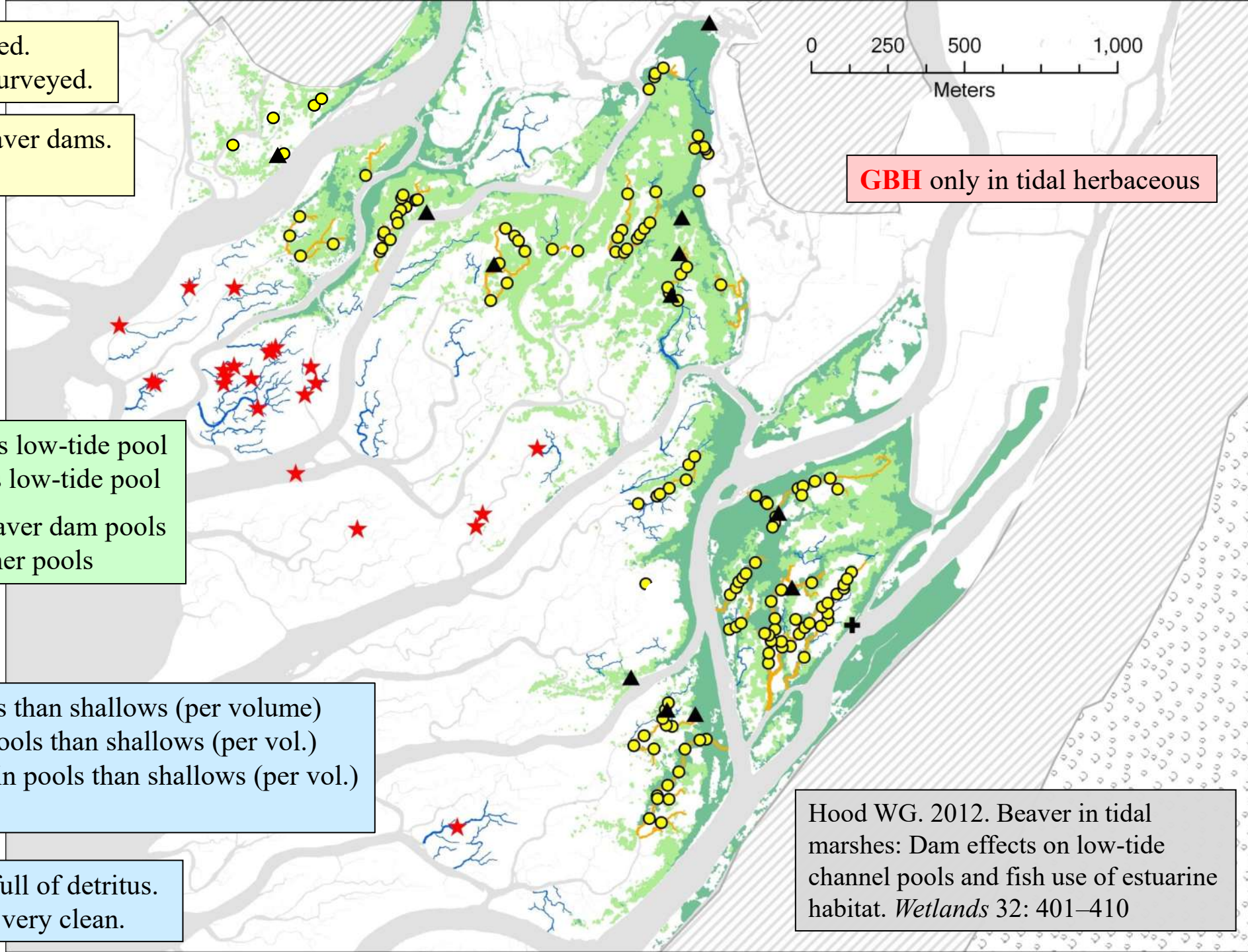
No tidal herbaceous channels have beaver dams.
66% of tidal shrub channels do.

125 beaver dams
8.9/km of shrub channel

16.4% of herbaceous channel length is low-tide pool
65.5% of tidal shrub channel length is low-tide pool
47.7% of shrub channel length are beaver dam pools
17.8% of shrub channel length are other pools

Chinook density: **3.2 x** higher in pools than shallows (per volume)
Stickleback density: **2.2 x** higher in pools than shallows (per vol.)
Prickly sculpin density: **7.5 x** higher in pools than shallows (per vol.)
River lamprey only present in pools.

Seines in ss-channels were generally full of detritus.
Seines in em-channels were generally very clean.



GBH only in tidal herbaceous

Hood WG. 2012. Beaver in tidal marshes: Dam effects on low-tide channel pools and fish use of estuarine habitat. *Wetlands* 32: 401–410

Possible Ecosystem Role of Tidal Beaver Dams and Pools

❖ Low-tide fish refuge—confirmed

- ❖ Do juvenile salmon reside longer in tidal marsh systems with beaver dams/pools?
- ❖ Are predation rates on fish lower in low-tide beaver pools?
- ❖ Is fish productivity higher in tidal marsh systems with beaver dams/pools?

❖ Detritus trap, detritivore production hot-spot → fish feeding hot-spot

❖ Sediment trap (what is the significance?)

- ❖ C-sequestration hot-spot?
- ❖ Geomorphological consequence?
- ❖ Nutrient trap?

❖ Salinity barriers → channel and marsh freshening?

❖ Habitat for other animals (ducks, others?)



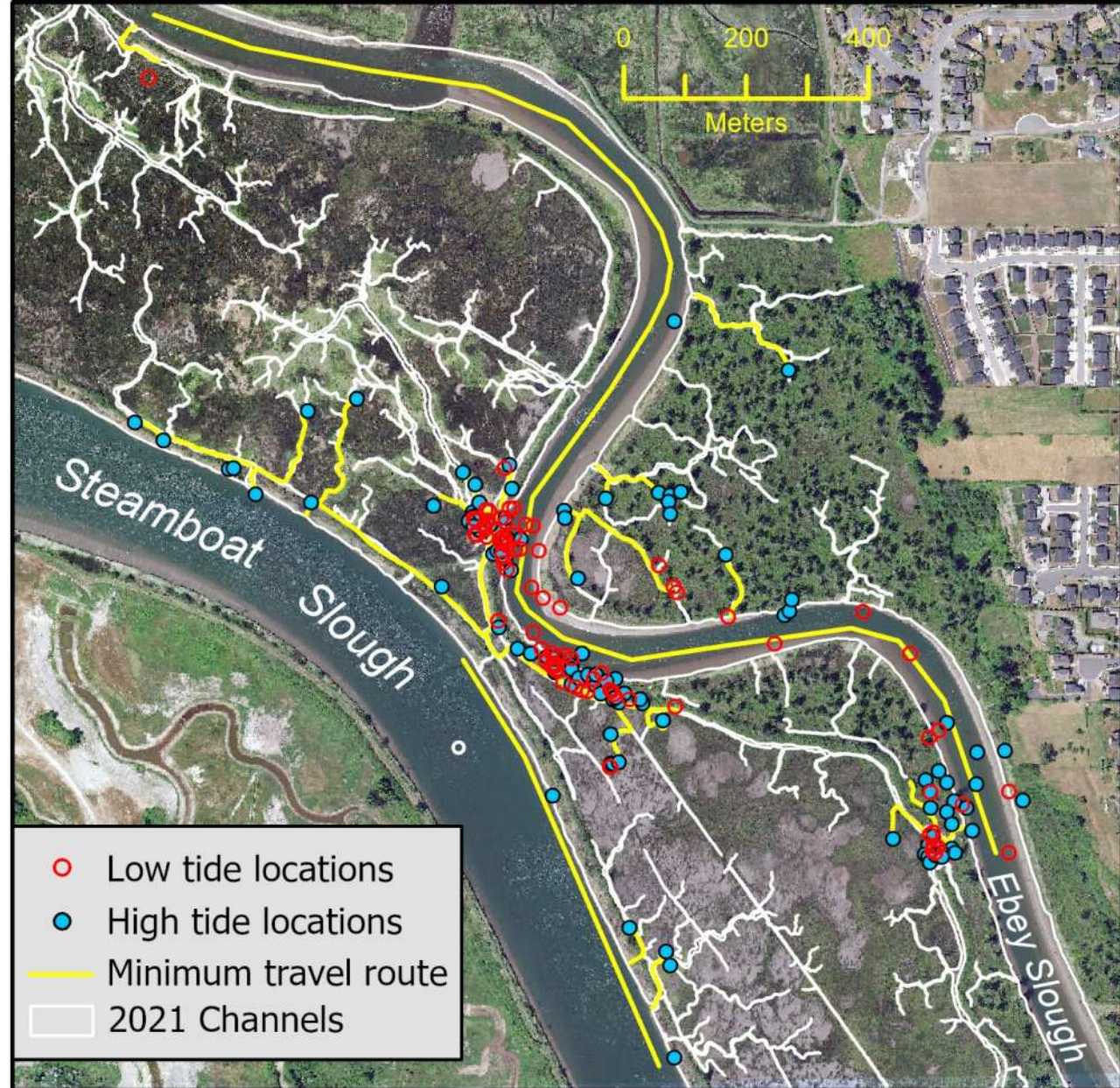
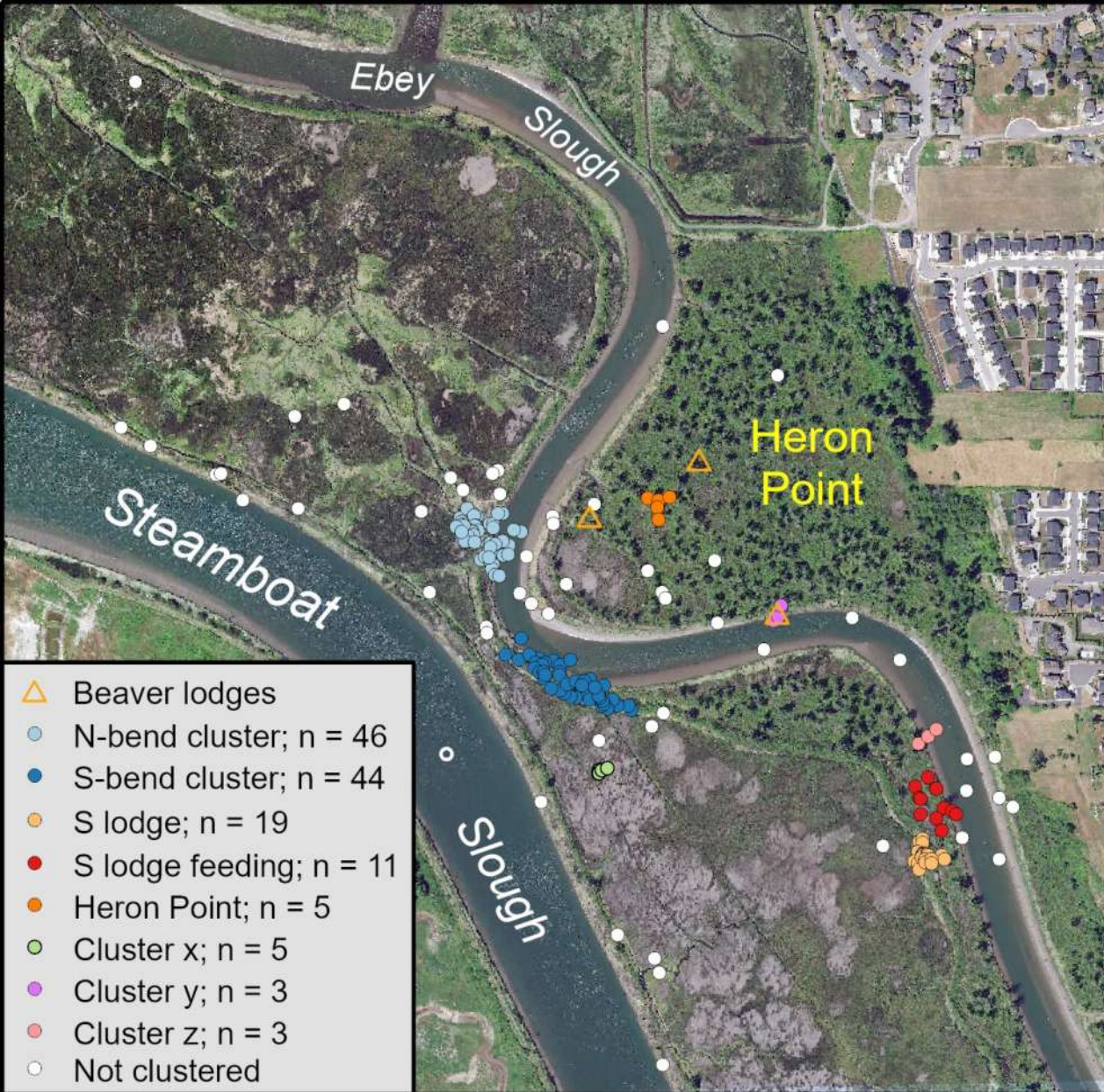
South Fork Skagit Delta

Including Beaver in Tidal Marsh Restoration

- ❖ Trap and translocate??
 - ❖ Are there already beaver present in the area who would have to compete for food?
 - ❖ How much habitat does a tidal beaver need?
 - ❖ What kind of habitat, or habitat mix do tidal beaver need?
 - ❖ What kind of dispersal pathways do offspring need in estuarine systems?
- ❖ Restore appropriate habitat and create conditions for colonization
 - ❖ How much habitat does a tidal beaver need?
 - ❖ What kind of habitat, or habitat mix do tidal beaver need?
 - ❖ Are beaver present nearby to provide colonizers?
- ❖ Appropriate habitat
 - ❖ Tidal channels (the more the merrier)
 - ❖ Freshwater source (more detail needed for small systems)
 - ❖ Woody vegetation for dam and lodge building material, and food
 - Shrubs (willow, black twinberry, wild rose, sweetgale, etc.)
 - Can be in bordering uplands, not necessarily in tidal wetland
 - On nurse logs, or nurse log analogs (NLAs)
 - On natural (or mimicked) channel levees
 - ❖ Herbaceous vegetation for food

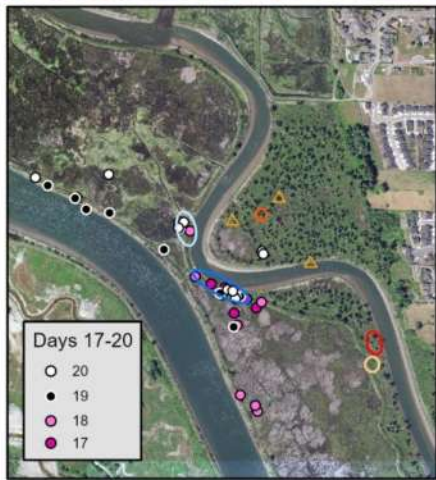
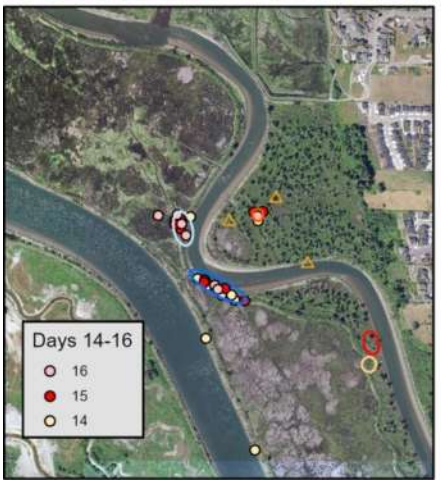
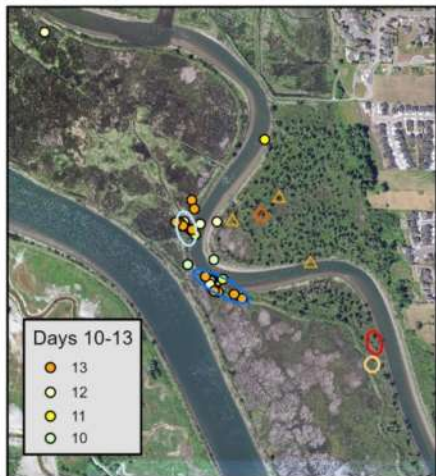
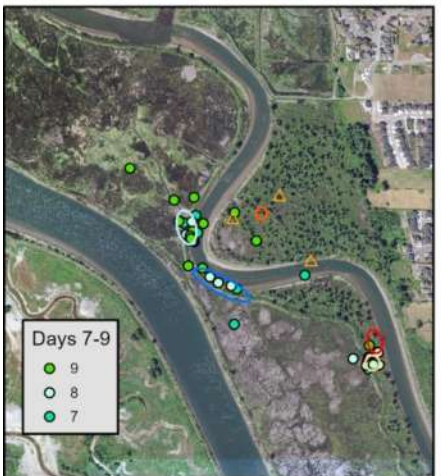
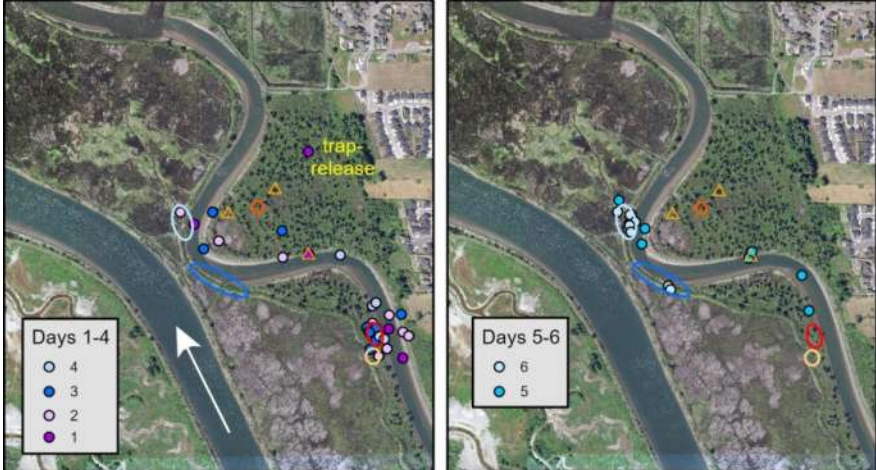


North Fork Skagit Delta



[1-D] 140 GPS fixes grouped into 8 clusters along 1150-m of distributary channel

[2-D] Minimum travel path to all points via all channel networks = 4.7 km



GPS fixes by vegetation community

Sedge: 26%

Shrubs: 20%

Cattail: 20%

Spruce: 13%

Herbaceous vegetation: 46%

Shrub and spruce: 33%

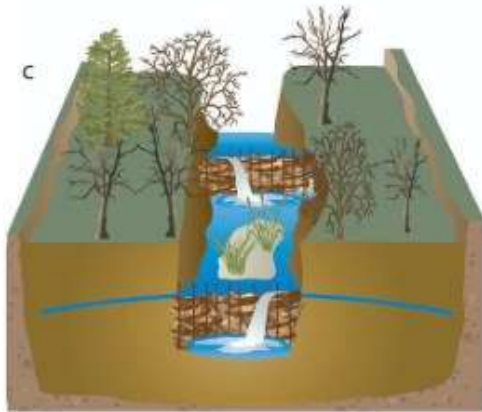
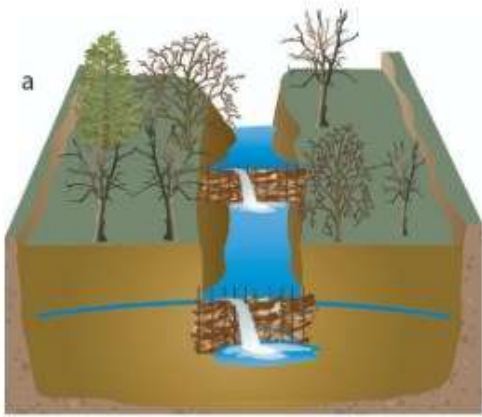
Distributary swimming: 21%

N-bend cluster: 90% herbaceous vegetation (split evenly between sedge & cattail), 10% shrubs

S-bend cluster: 39% sedge, 61% shrub

Beaver Dam Analogs (BDAs)

For incised streams!



BDAs trap sediment, raise the bed elevation, raise the water table, allow riparian vegetation growth in arid areas, reconnect/redevelop a floodplain.

Pollock et al. 2014. Using Beaver Dams to Restore Incised Stream Ecosystems. *BioScience* 64: 279–290.

BDAs For tidal channels?

Why?

Possible reasons why:

- Encourage beaver colonization?? (yes, in most fluvial systems)
But do we have enough habitat to support a colony?
- Create low-tide pools for juvenile salmon
- Trap detritus for higher prey production?
- Trap sediment for C-sequestration?
- Act as salinity barriers to freshen wetlands for juvenile salmon??
- Support other wildlife, e.g., ducks?? (design matters, don't make dam so high it inhibits fish movement)

Question: Do tidal BDAs require maintenance, how long do they last?
(< 1 yr to several decades in fluvial systems)

Recommendations

1. Do more research
 - a. What are the ecological functions of tidal beaver dams (pools generally)?
 - b. What are the movement patterns of beaver?
 - c. What is a typical territory size?
 - d. What kinds of habitat do they spend time in?
 - e. How do offspring disperse?
2. Do not rush to introduce beaver, might do more harm than good
3. Do not rush to build BDAs (be thoughtful, maybe try well-designed experiments to test hypotheses)
4. Try to provide attractive habitat (pre-requisite to introductions or BDAs to attract beaver)
 - a. Freshwater inflow
 - b. Complex tidal channel networks (maximize edge, minimize over-marsh distance)
 - c. Abundant woody vegetation in or near marsh
 - d. Access to herbaceous tidal marsh

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Tidal beaver YouTube: by SeaDocs Society at <https://www.youtube.com/watch?v=IYYULzuE>



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