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Salish Sea Ecosystem Conference

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Apr 6th, 9:00 AM - 9:15 AM

Juvenile salmon density on marsh surfaces versus within tidal channels

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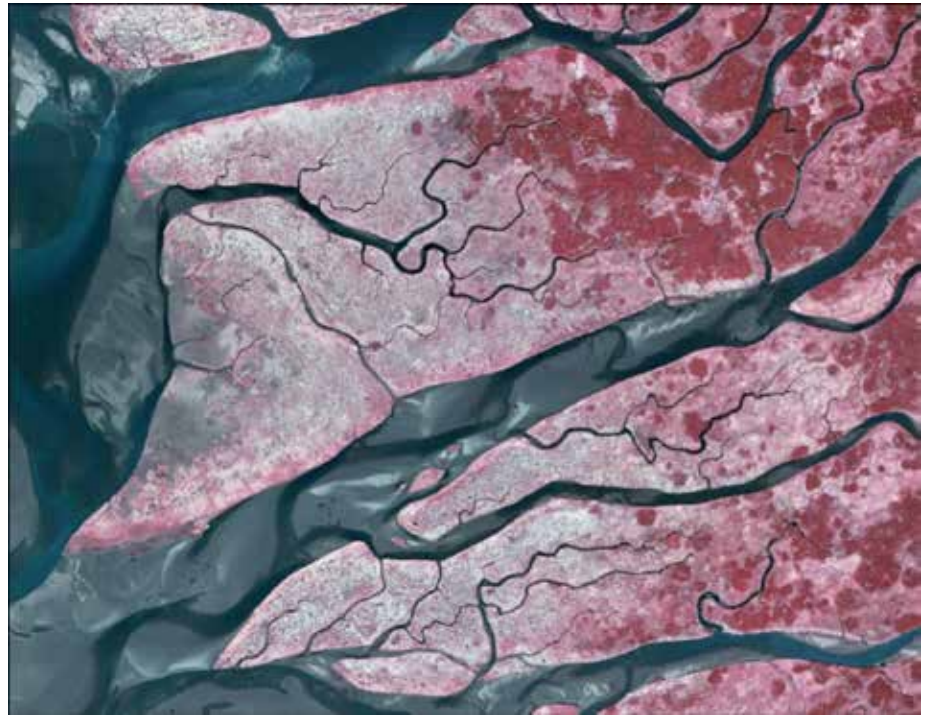
Hood, W. Gregory; Beamer, Eric M.; and Henderson, Rich, "Juvenile salmon density on marsh surfaces versus within tidal channels" (2018). *Salish Sea Ecosystem Conference*. 452.
<https://cedar.wwu.edu/ssec/2018ssec/allsessions/452>

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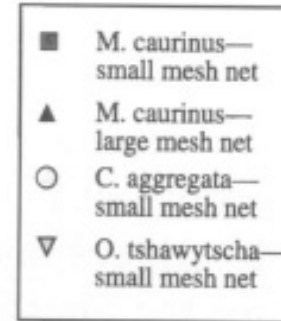
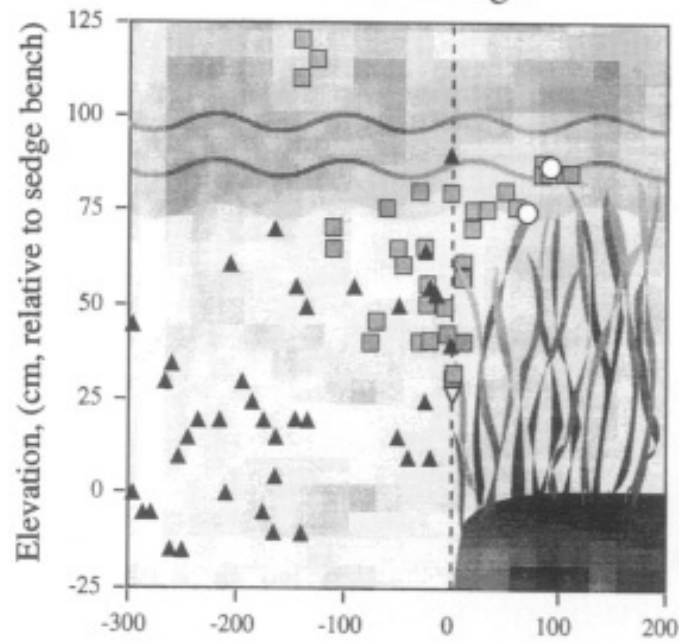
Juvenile Salmon Density on Marsh Surfaces versus within Tidal Channels

W. Gregory Hood, Eric Beamer, Rich Henderson

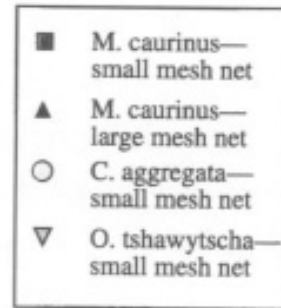
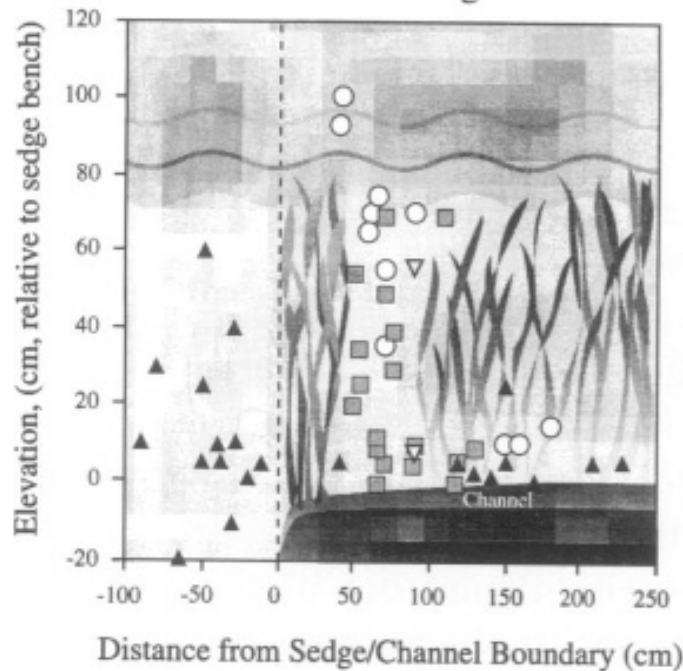
Skagit River System Cooperative, PO Box 368, LaConner, WA 98257, USA



Mox Chuck Slough

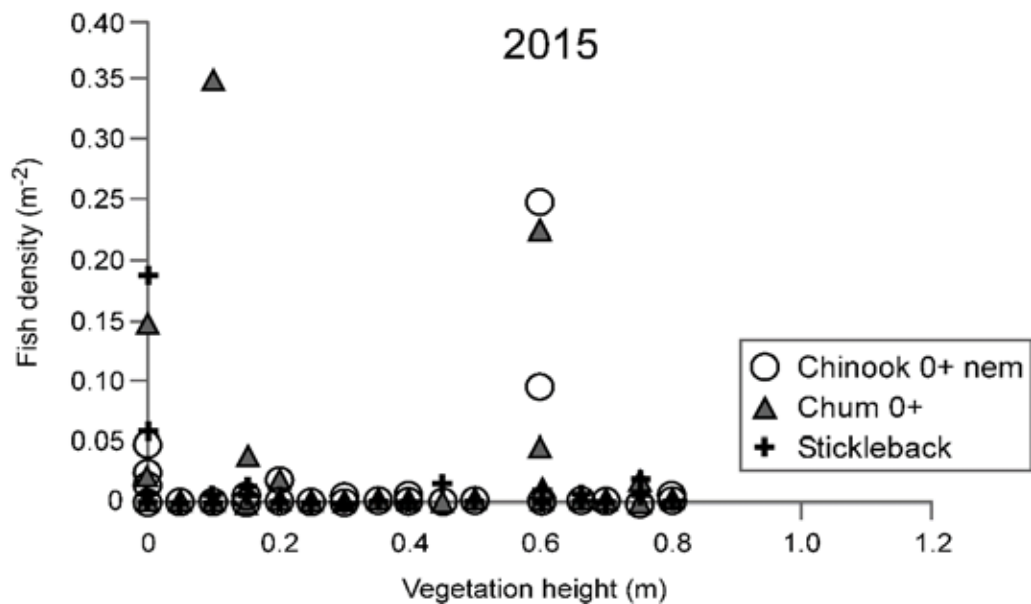
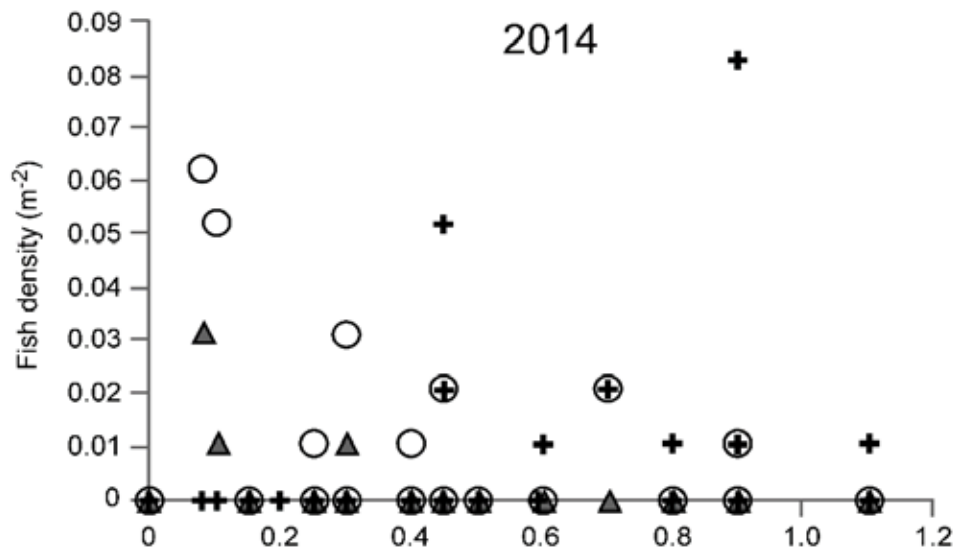


Ann's Slough







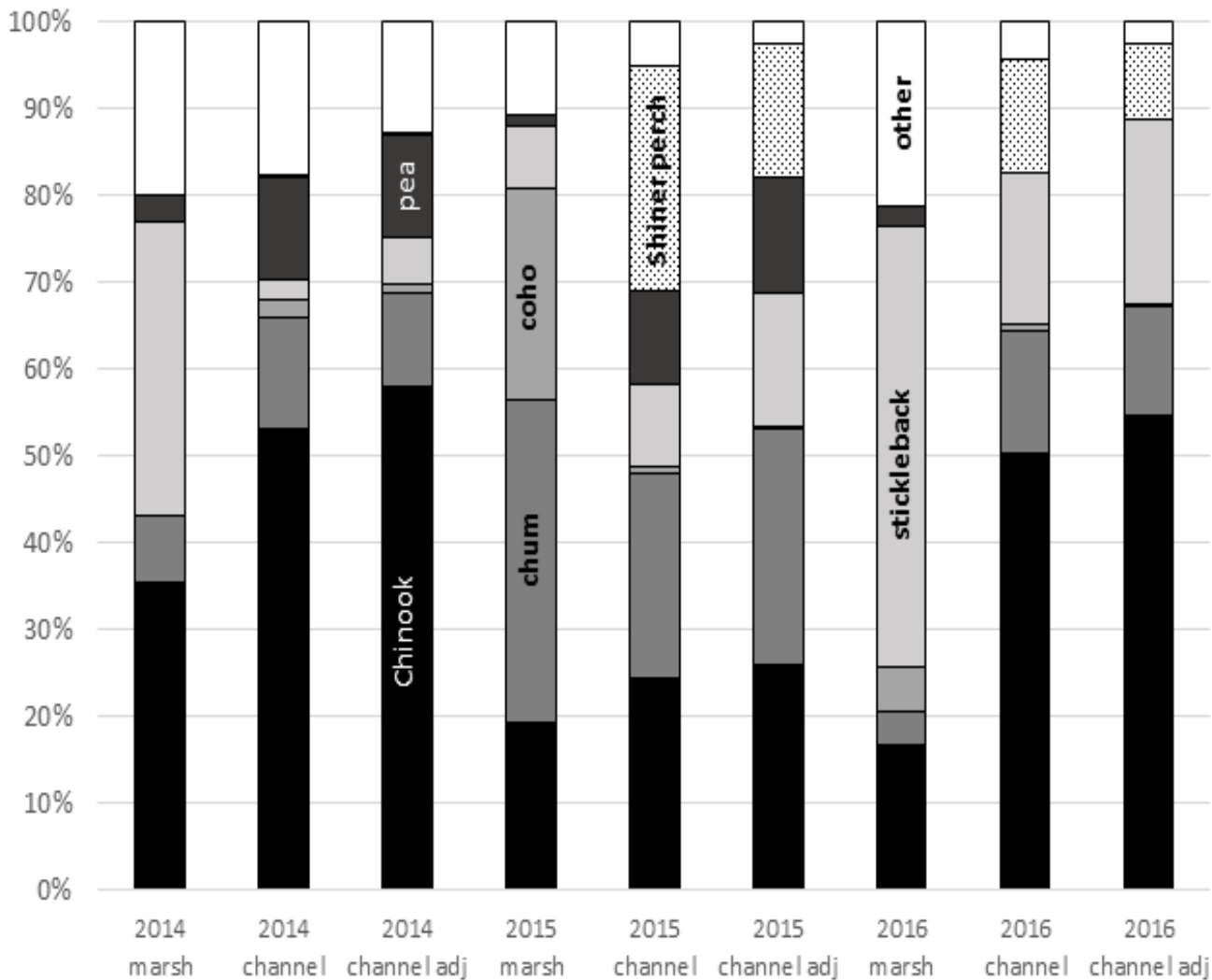


Results/interpretation

[1] Marsh surface fish density is not related to vegetation height.

[2] While fish may be excluded from vegetation canopy, they are likely swimming over the canopy.

Figure 1. Marsh surface fish density versus vegetation height.



Results

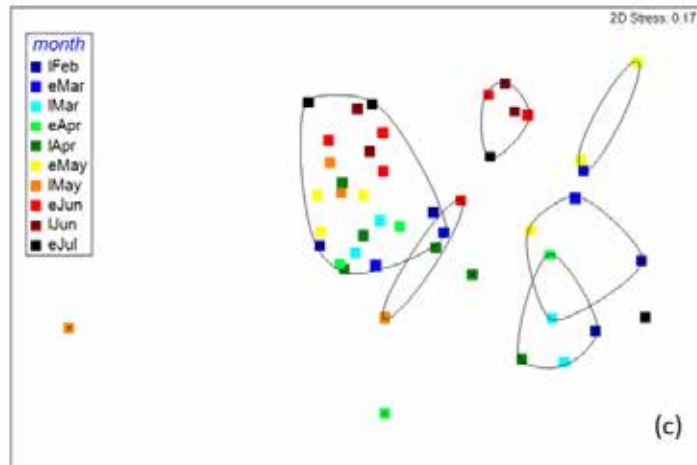
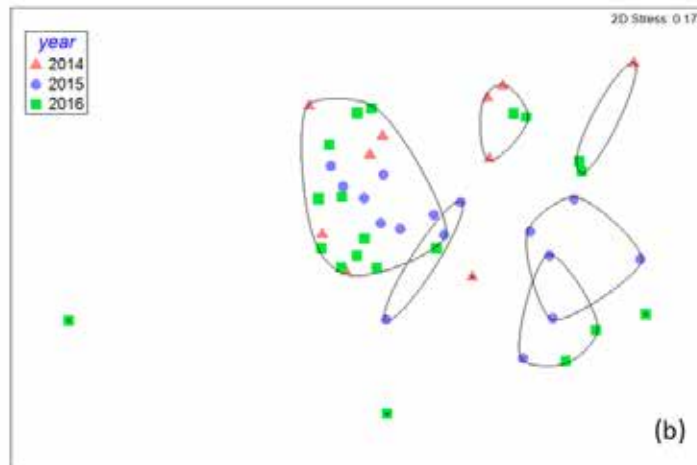
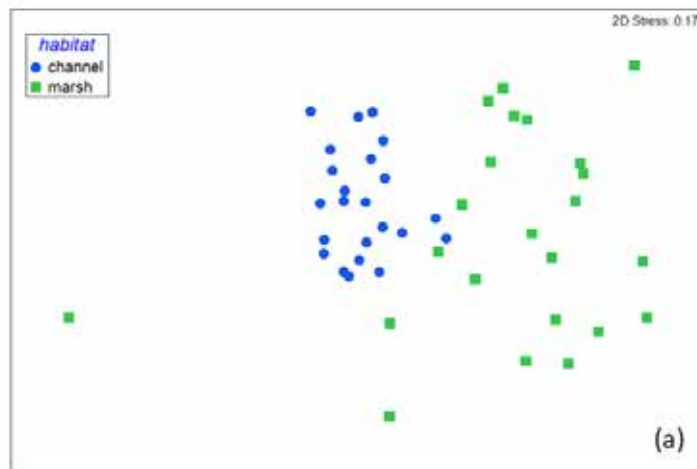
[1] Recovery efficiency adjustments have little effect on catch proportions.

[2] Dominant **channel** species are **Chinook, chum, and stickleback**; peamouth and shiner perch abundant in 2 of 3 years.

[3] Dominant **marsh surface** species are **Chinook, chum, and sticklebacks**. Yearling coho abundant during 2015.

[4] Sticklebacks were disproportionately over the marsh; Chinook disproportionately in tidal channels; chum variable.

Figure 2. Relative abundance of the most common fish caught over the marsh surface and in tidal channels. Tidal channel fish catches were adjusted by net trapping efficiency. Adjusted and unadjusted catches are both shown for comparison.



Results/interpretation

[1] Marsh surface and channel communities are different, based on differences in abundance and frequency of occurrence.

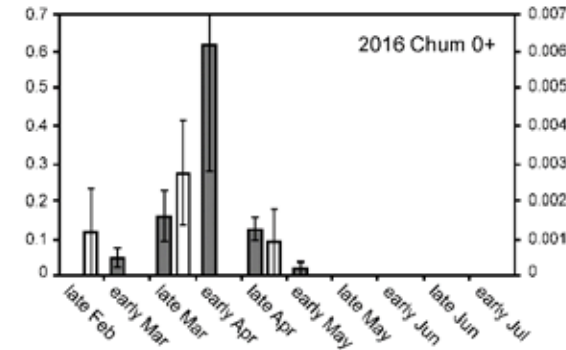
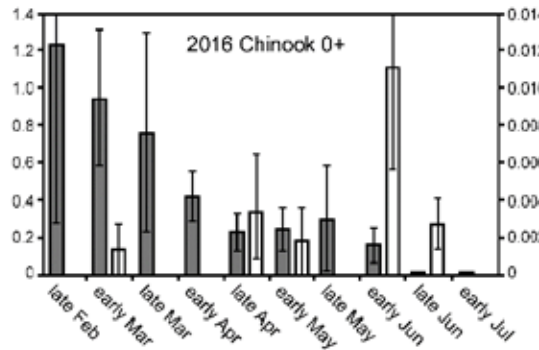
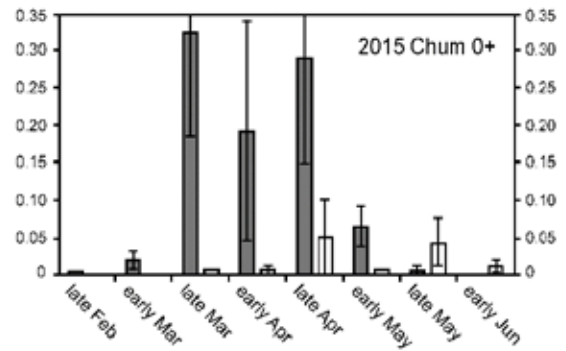
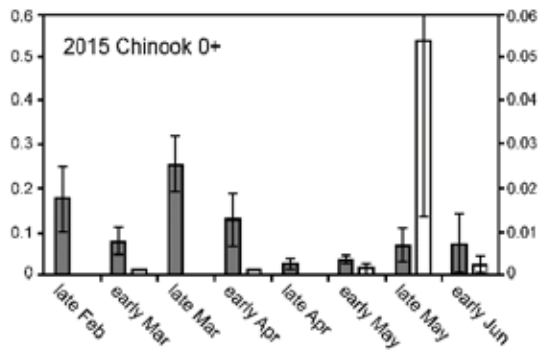
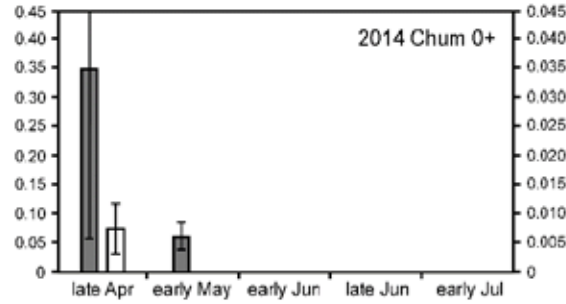
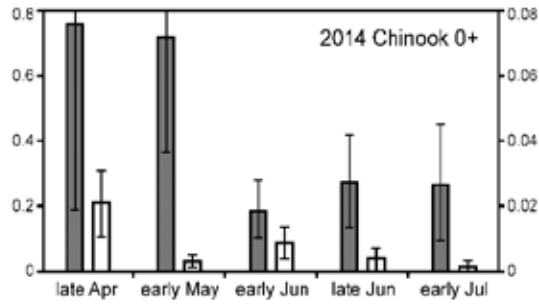
[2] Greater dispersion (variance) in marsh surface samples vs. channel samples. Suggests a sampling effect: (a) Natural sampling of fish randomly moving from channel to marsh surface; (b) Researcher sampling of finite-area seines of low density fish on marsh surface. (But also some volition and some biological differences.)

[3] Interannual differences.

[4] Parallel seasonal differences for channels and marsh; Feb-Apr vs. May-July. The April – May break may reflect increasing importance of the sedge canopy.

Fig. 3. nMDS of 4th-root transformed fish density samples: distributions by (a) **habitat**; (b) **year**; (c) **sample dates**. Overlying polygons enclose samples with > 50% similarity. The largest polygon encloses the channel habitat samples.

Tidal channel densities (m^{-2})



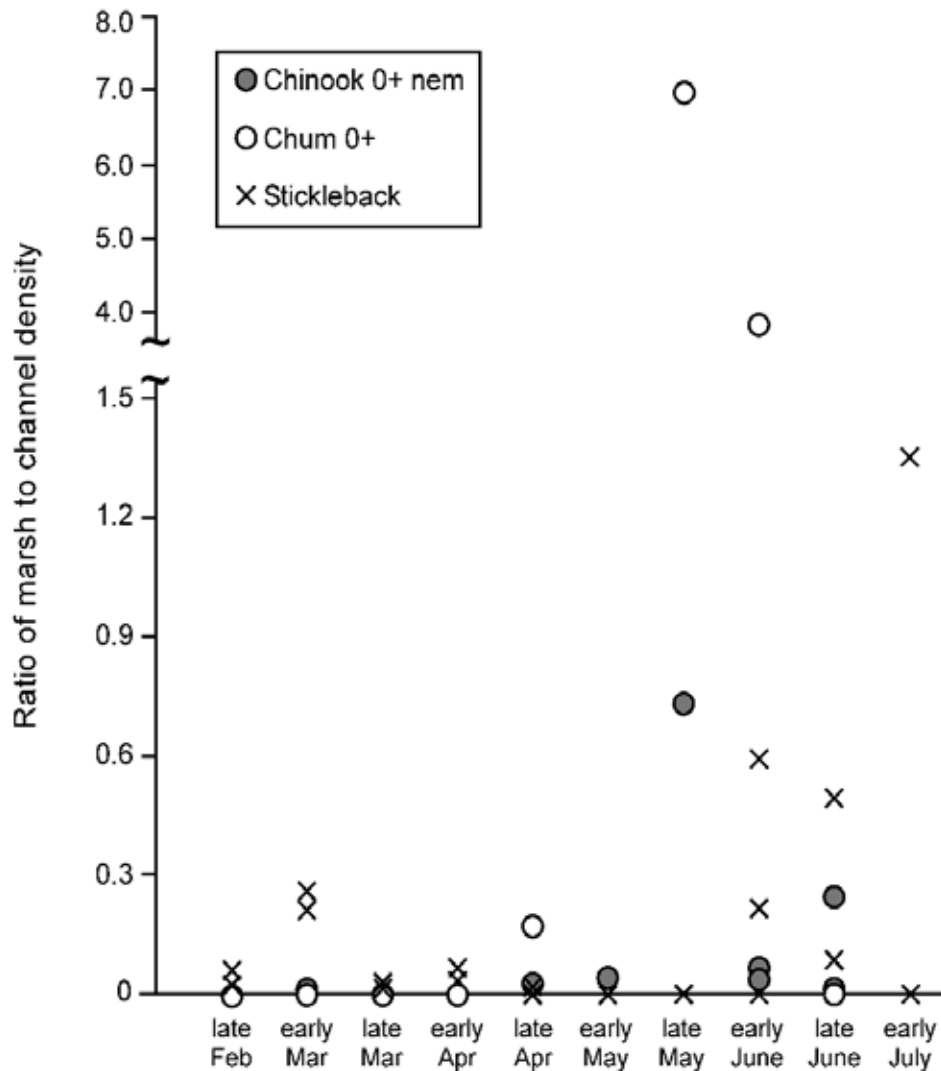
■ Tidal channel □ Marsh surface

Results/interpretation

[1] **Chinook** densities average **63x** higher in channels vs. marsh; **chum** average **19x** higher; **sticklebacks** average **20x** higher.

[2] Marsh area >> channel area, so total fish abundance (density x area) for **chum** is **1.6x higher** on marsh surface vs. channel; for **sticklebacks**, **1.5 x higher**. However, **Chinook** still have **2.3x higher abundance in channels**.

[3] Seasonal patterns are not parallel between channel and marsh. So fish aren't moving to marsh because they are pushed out of channels by density dependent effects. Suggests volitional movement.



Results/interpretation

[1] Marsh:channel ratios increase over the season, coincident with vegetation canopy development and increasing invertebrate production.

[2] Fish may be increasingly motivated to move onto increasingly productive marsh surfaces.

Figure 5. Seasonality in the ratio of marsh surface to channel fish density for all three years of sampling (2014-12016). Note the discontinuity in the y-axis scale.

Management implications

Salmon habitat is not just tidal channels; it is also tidal marsh.

[1] The taller the sedge canopy the less time fish can spend on the marsh surface. From late Feb to mid-April, when sedges are ankle-high, sedge habitat is accessible by fish 36% of the time. When the canopy is 0.5 m high, accessibility drops to 22%; when the canopy is 1.0 m high, it drops to 11%.

[2] Snow geese and dabbling ducks graze on young sedges, thereby extending marsh accessibility by ~2-4 weeks. This grazing has an unknown effect on salmon prey production or accessibility. Waterfowl management could affect fish.



Management implications

Salmon habitat is not just tidal channels; it is also tidal marsh.

[1] ≥ 20 cm inundation from late Feb to mid-April: for cattail 13%, sweetgale 10%, and sedges 36% of the time.

[2] Different vegetation communities likely provide different functions for salmonids. Puget Sound recovery metrics currently focus on area of tidal marsh restored without consideration of qualitative differences.





Management implications

Salmon habitat is not just tidal channels; it is also tidal marsh.

[1] SRTs used to restore flow through channels, but not to adjacent property. SRTs are a very limited form of habitat restoration.

[2] Without restoring tidal marsh, both direct and indirect benefits of marsh habitat are impacted by SRT substitution for real restoration. SRTs should be a last resort.

Summary

1. Chinook, chum, and coho juveniles use the marsh surface. Other small fish also.
2. Densities higher in channels, but...
3. Total abundance on marsh surface for each species is broadly comparable to abundance within channels.
4. Accessibility to marsh surface varies with vegetation canopy growth, and vegetation zone.
5. Tidal sedge habitat appears to have direct value for juvenile salmon as an area to forage for prey, as well as indirect value as a source of prey exported to tidal channels.
6. Follow-up questions: [a] do juvenile salmon use marsh surface of cattail and shrub zones for foraging (sample with minnow traps)? [b] how do marsh surface diets vary seasonally? [c] does goose grazing negatively or positively affect salmon use of marsh surfaces?



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