

Juvenile Chinook and Coho Salmon Winter Habitats in the Susitna River

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Overwintering juvenile Chinook and coho salmon

- Juvenile salmon migrate to overwintering habitats due to:
 - changes in light,
 - decreasing fall flows,
 - winter freshets, and
 - loss of open water due to freezing (Bjornn 1971, McMahon and Hartman 1989, Prowse 1994).
- In glacial rivers:
 - Juvenile Chinook and coho salmon migrate from spawning tributaries to the Susitna River for overwintering (ADFG 1981, 1983, 1986).
 - Juvenile Chinook and coho salmon overwinter in off-channel habitats of the glacial Taku River (Murphy et al. 1984).
 - Juvenile Chinook have been documented overwintering in non-natal tributaries of the Yukon River.

What is known about overwintering juvenile salmon

- Juvenile salmon generally select overwintering habitats with low water velocity, cover, and relatively warmer water from springs or upwelling groundwater (Giannico and Hinch 2003, Hillman et al. 1987, Cunjak 1996).
- Chinook
 - Lower water velocities up to <20 cm/s
 - Preference for cobble/boulder substrate
 - Preference for cover provided by woody debris (Hillman et al. 1987, Bjornn 1971).
- Coho salmon
 - Slow water (<15 cm/s) off-channel habitats fed by groundwater (Giannico and Hinch 2003),
 - Beaver ponds (Bustard and Narver 1975)
 - Cover provided by woody debris (Petersen 1982, Swales et al. 1986).

Research Questions

A photograph of a winter landscape. A snow-covered path or frozen stream leads from the foreground towards a line of bare trees in the distance. The sky is filled with soft, golden light from a low sun, creating a hazy, atmospheric effect. The snow is piled up on either side of the path, and the overall scene is quiet and serene.

- Test for significant small-scale localized (m^2) correlations between juvenile coho and Chinook salmon and habitat characteristics and determine if those relationships can be used to characterize overwintering habitat at higher spatial scales: sampling sites ($\sim 1,000 \text{ m}^2$) and macrohabitat classes.

Glacial River Macrohabitats



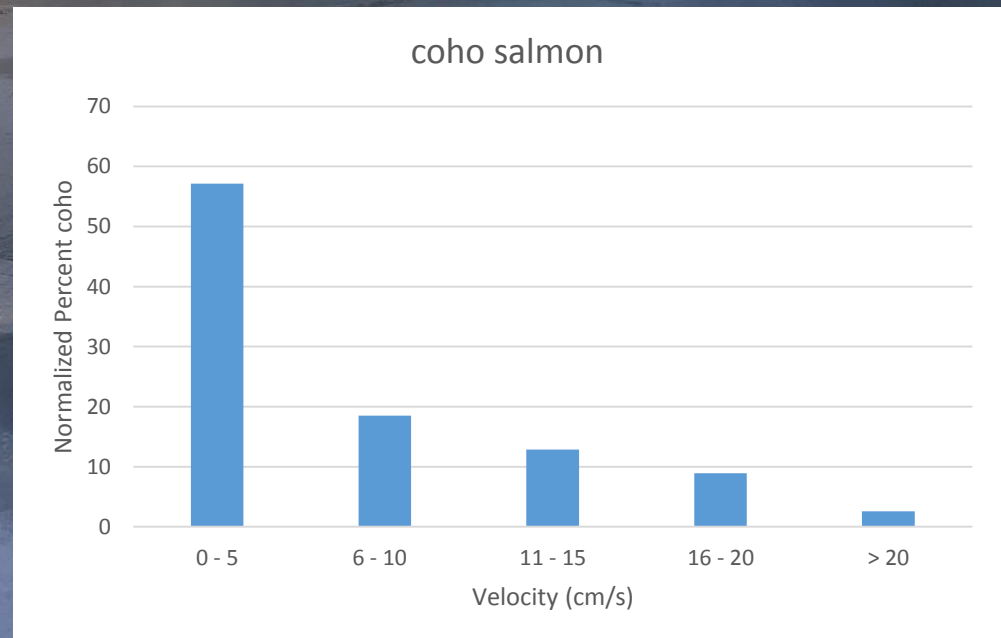
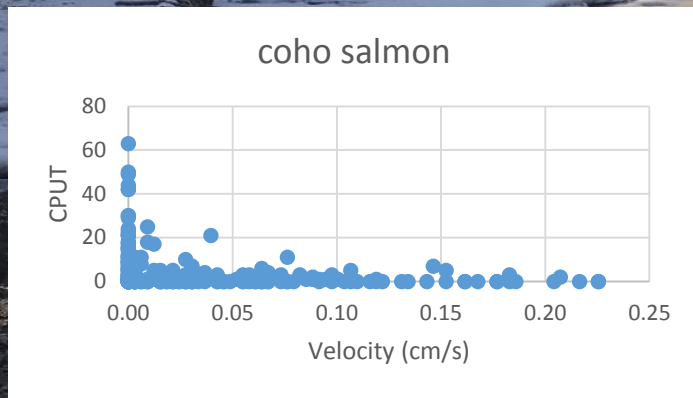
Glacial River Macrohabitats

(March 29)



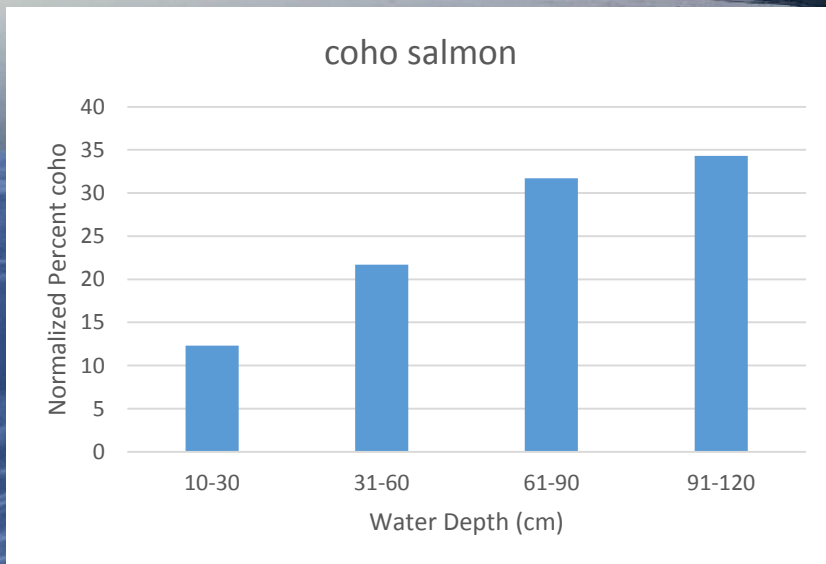
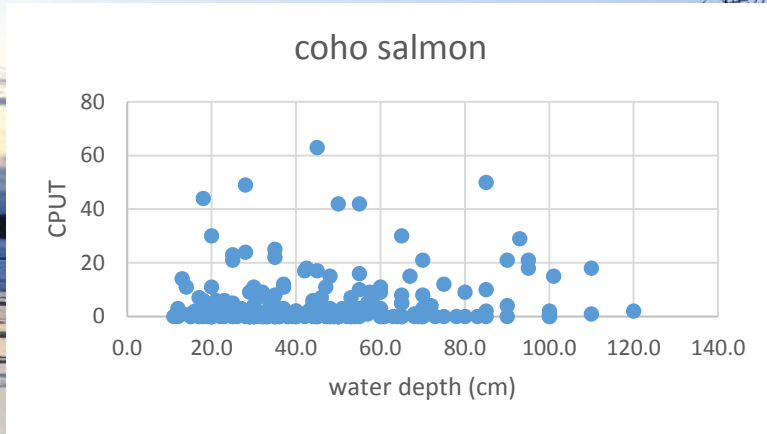
Results Coho: Small Scale ($\sim m^2$)

- Significant relationship with water velocity ($p < 0.001$, $N = 1123$).



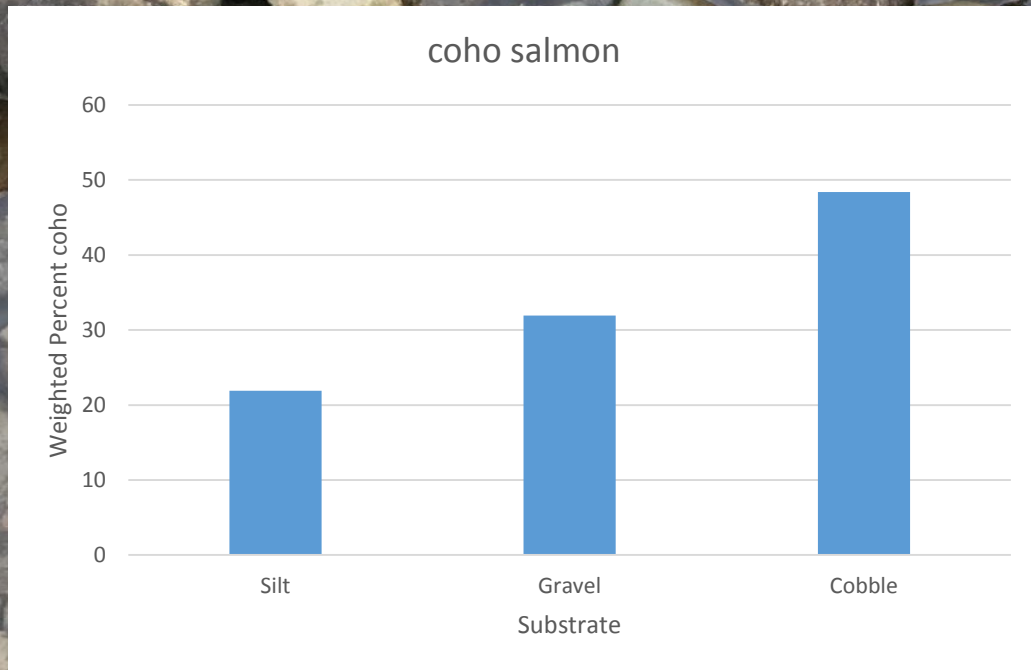
Results Coho: Small Scale ($\sim m^2$)

- No significant relationship with water depth.



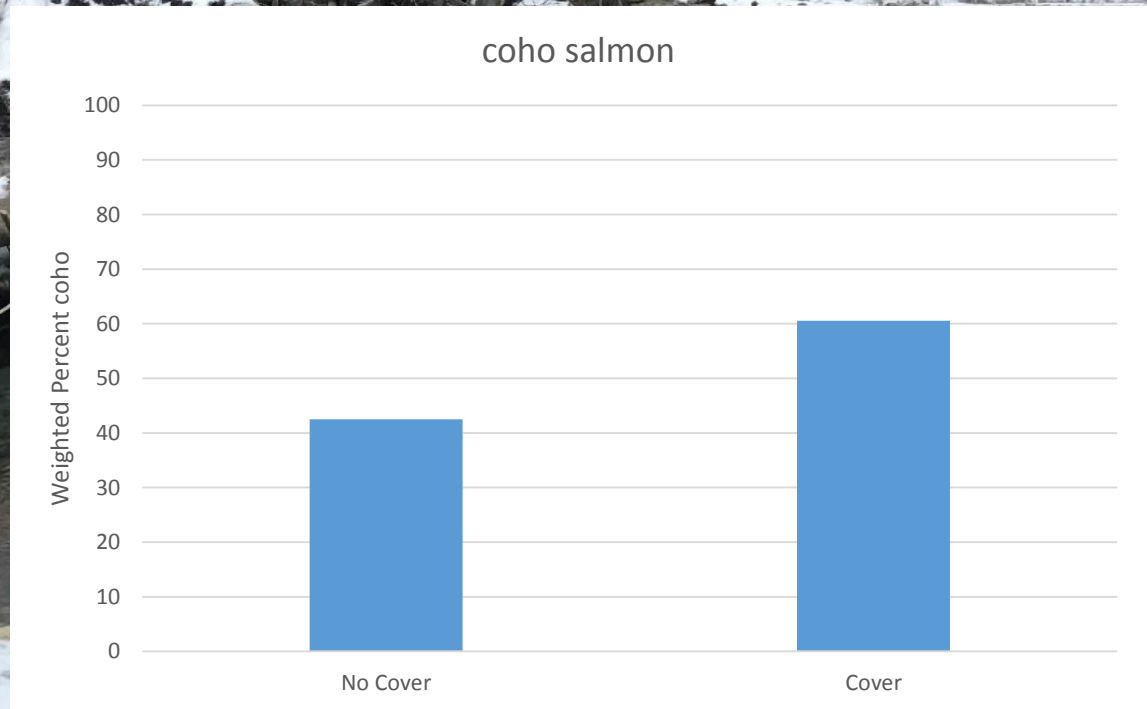
Results Coho: Small Scale ($\sim m^2$)

- Significant difference in coho CPUT between cobble, gravel, and silt substrates.



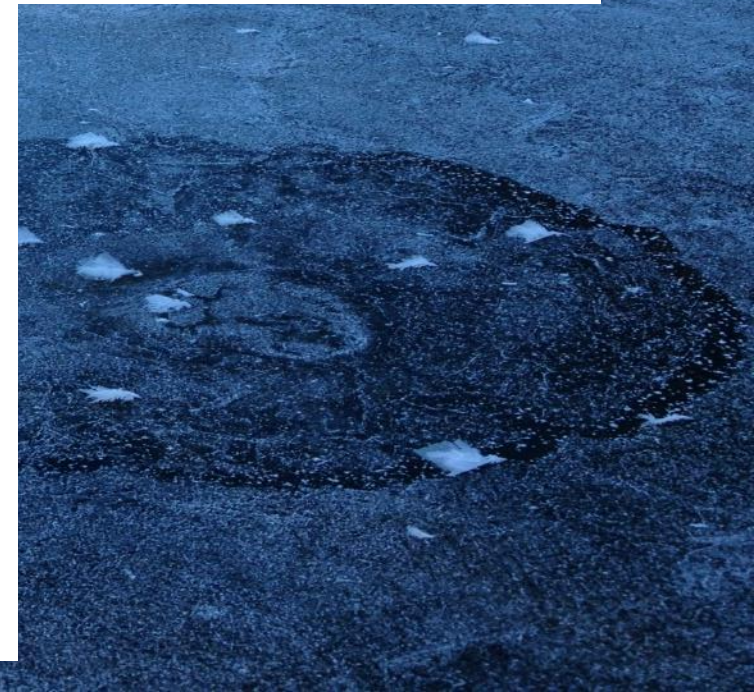
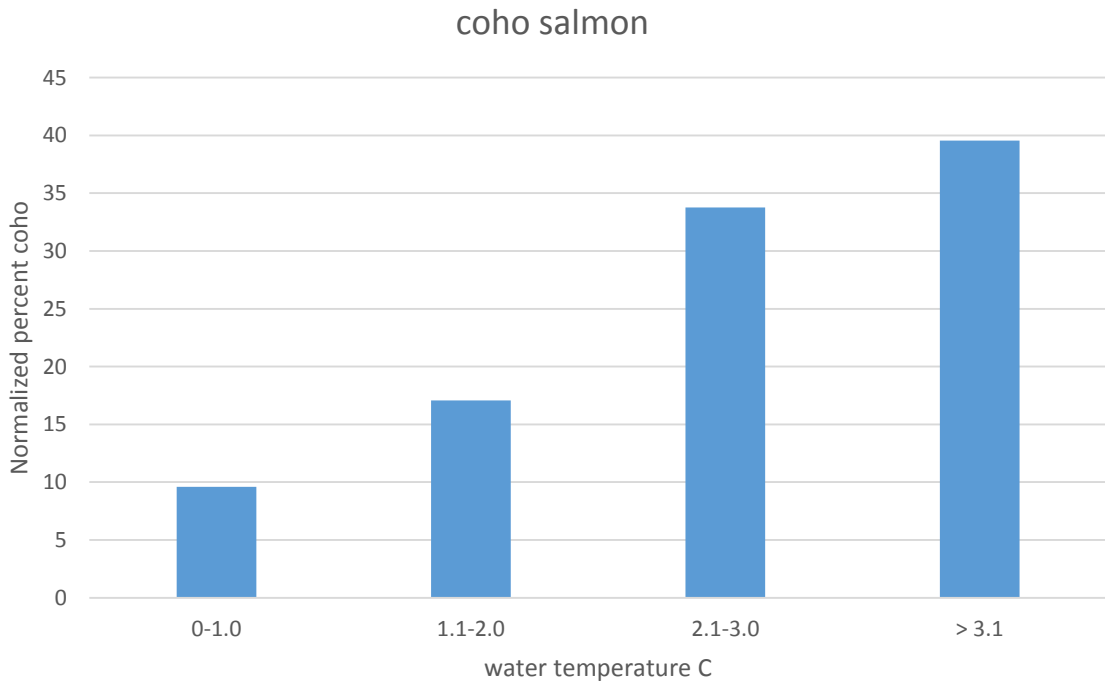
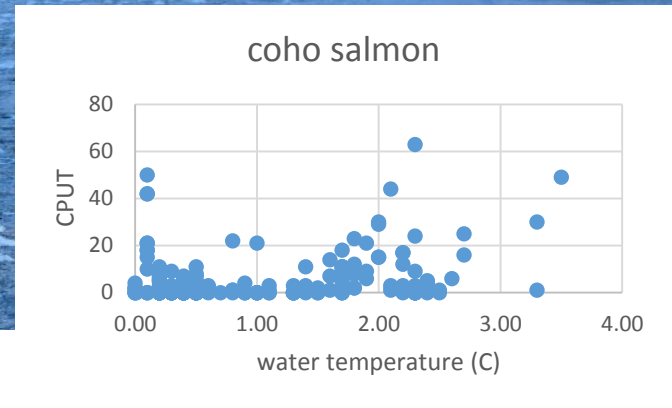
Results Coho: Small Scale ($\sim m^2$)

- No significant difference in coho CPUT between sampling locations with cover (LWD, shrubs, macrophytes) and no cover (includes ice cover).
- Better relationship with velocity when large wood absent.



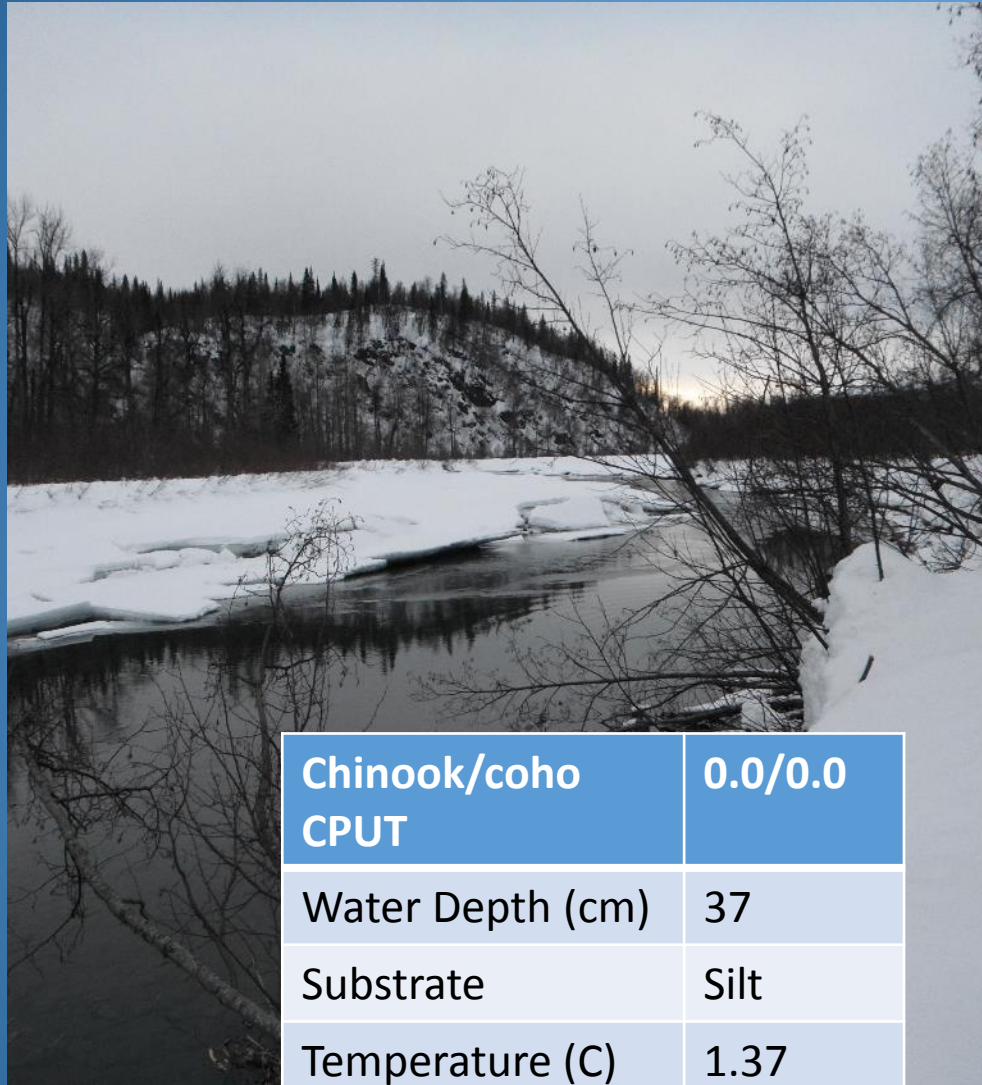
Results Coho: Small Scale ($\sim m^2$)

- Significant relationship with water temperature ($p < 0.001$, $N = 1123$).



If overwintering juvenile salmon prefer warmer, low velocity, deep water habitats with cover;

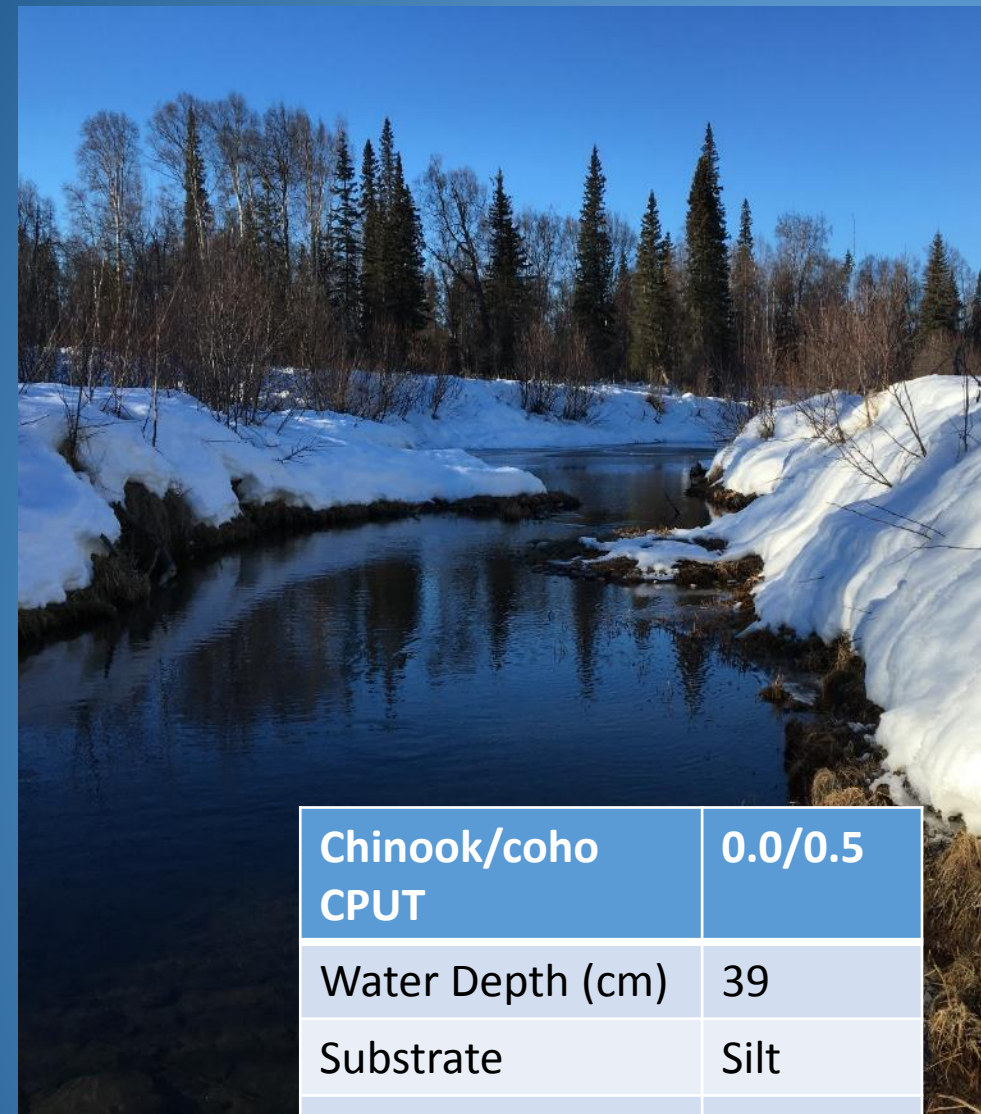
then, do sites or macrohabitats with these characteristics have a greater abundance of overwintering juvenile salmon.



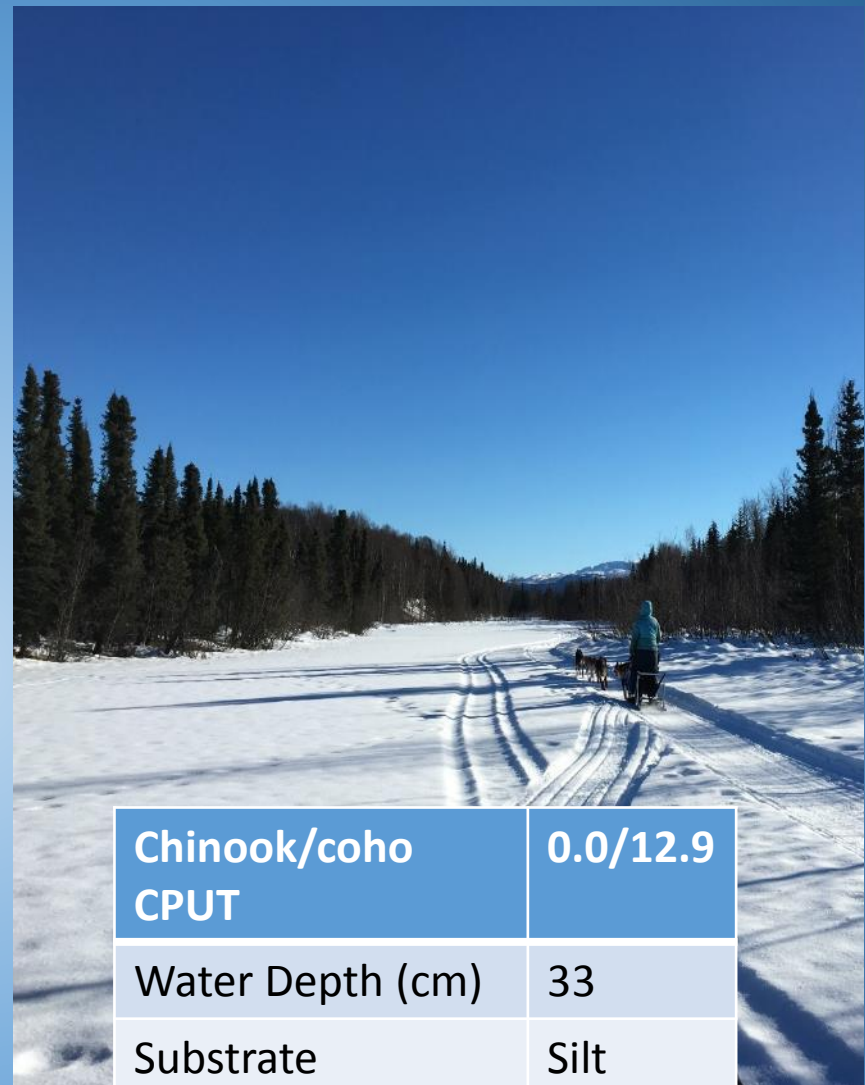
Chinook/coho CPUT	0.0/0.0
Water Depth (cm)	37
Substrate	Silt
Temperature (C)	1.37
Cover	8/10
Velocity (cm/s)	6.25



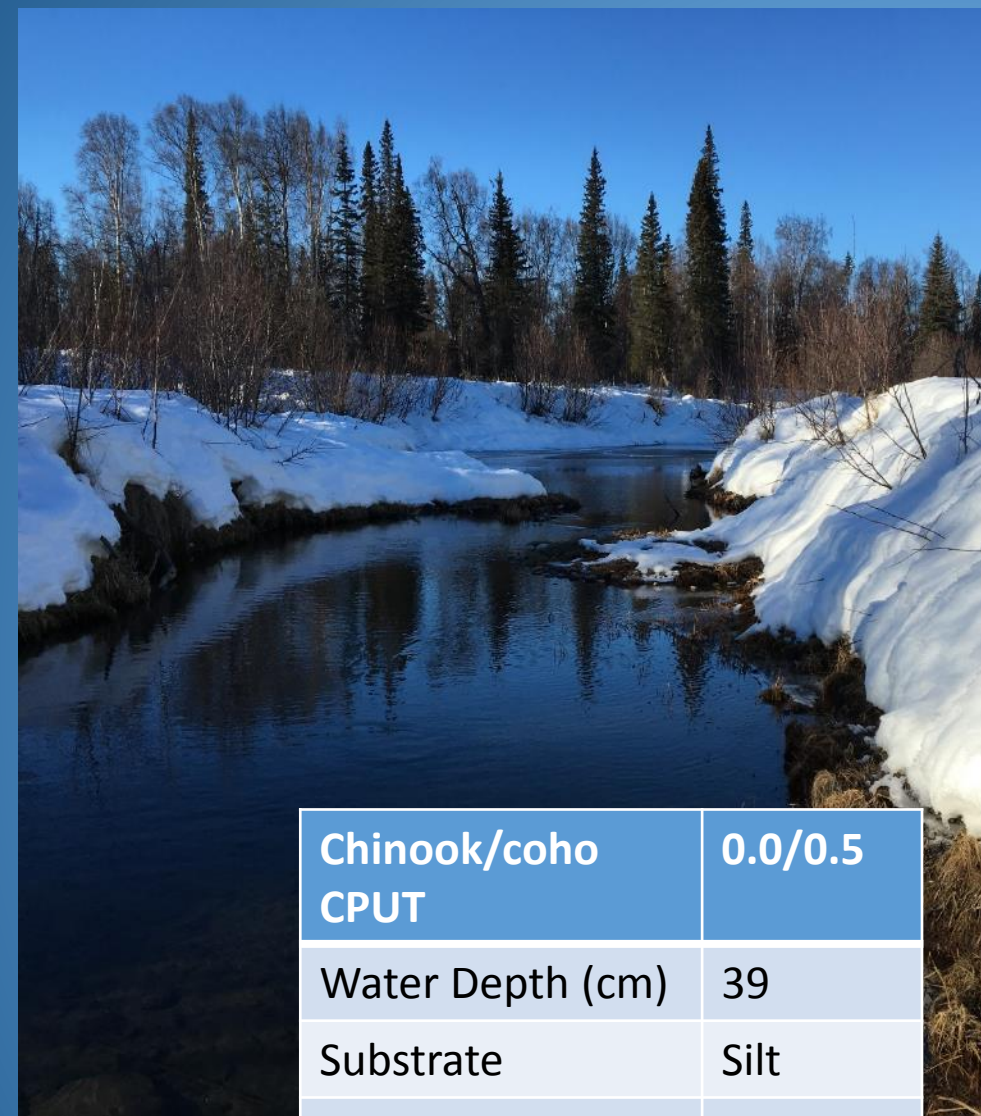
Chinook/coho CPUT	4.1/1.1
Water Depth (cm)	35
Substrate	Silt
Temperature (C)	2.07
Cover	3/10
Velocity (cm/s)	1.22



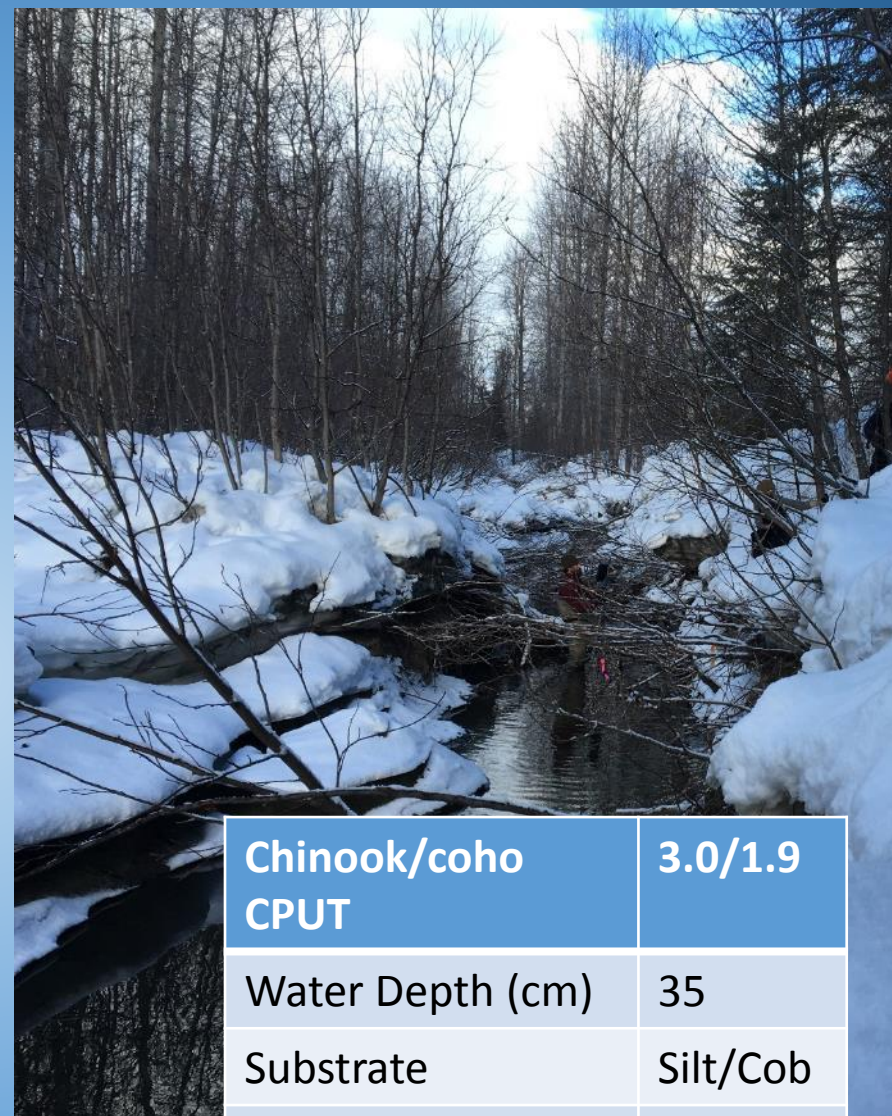
Chinook/coho CPUT	0.0/0.5
Water Depth (cm)	39
Substrate	Silt
Temperature (C)	2.57
Cover	2/10
Velocity (cm/s)	0.21



Chinook/coho CPUT	0.0/12.9
Water Depth (cm)	33
Substrate	Silt
Temperature (C)	0.27
Cover	5/10
Velocity (cm/s)	0.00



Chinook/coho CPUT	0.0/0.5
Water Depth (cm)	39
Substrate	Silt
Temperature (C)	2.57
Cover	2/10
Velocity (cm/s)	0.21

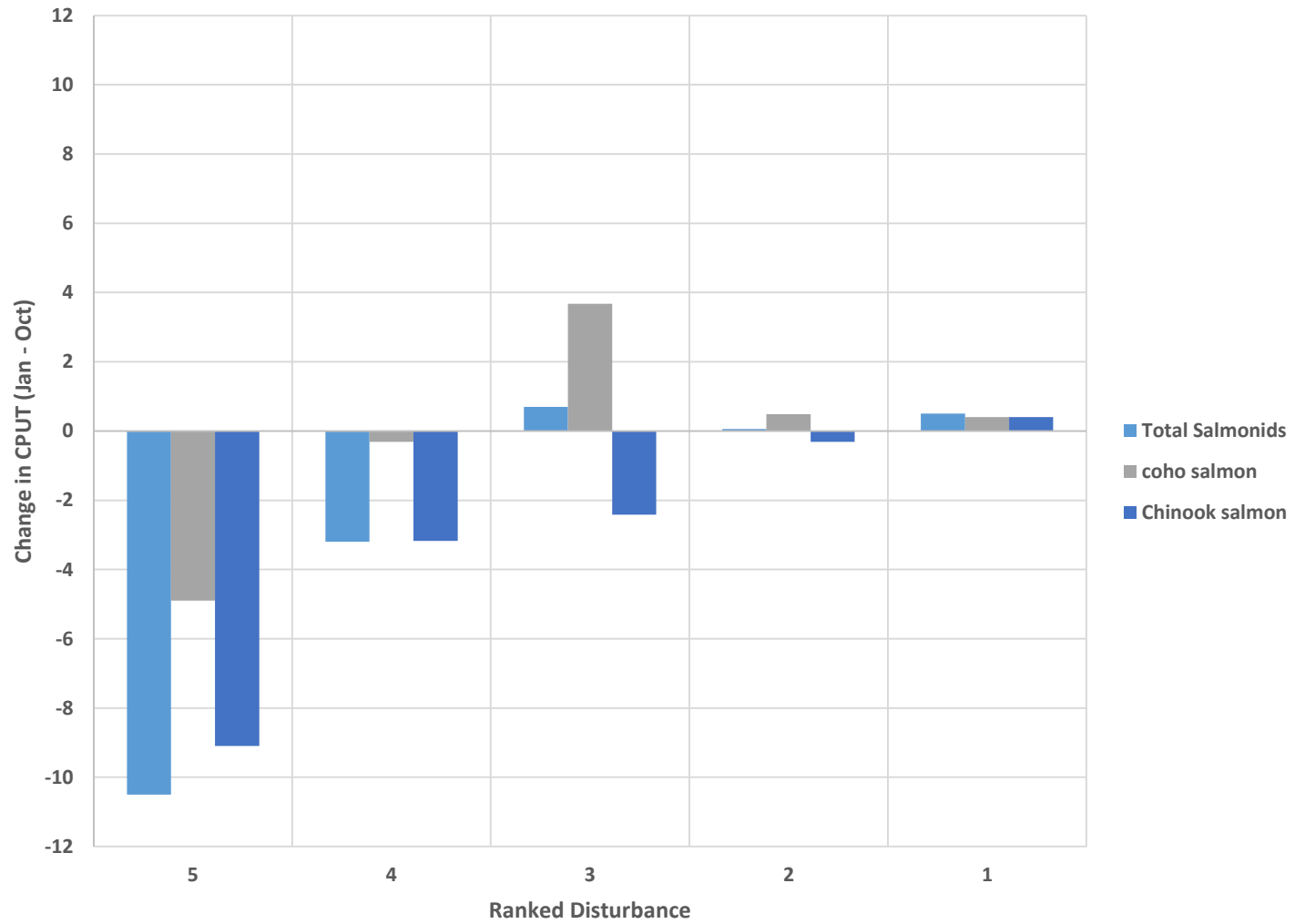


Chinook/coho CPUT	3.0/1.9
Water Depth (cm)	35
Substrate	Silt/Cob
Temperature (C)	3.03
Cover	9/10
Velocity (cm/s)	3.60

Short-term adverse conditions







Summary

- **Low water velocity, cover, substrate, and temperature were important habitat characteristics for overwintering juvenile salmon.**
- **Site habitat characteristics could not be used to estimate coho salmon winter habitat as adverse conditions during ice formation may displace salmon or inhibit habitat selection.**
- **Mainstem ice formation, channel location and stage height can have a large influence on velocity and depth in off-channel habitats.**

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