Juvenile Coho Salmon distribution, movement, and habitat use in the Big Lake Drainage, AK

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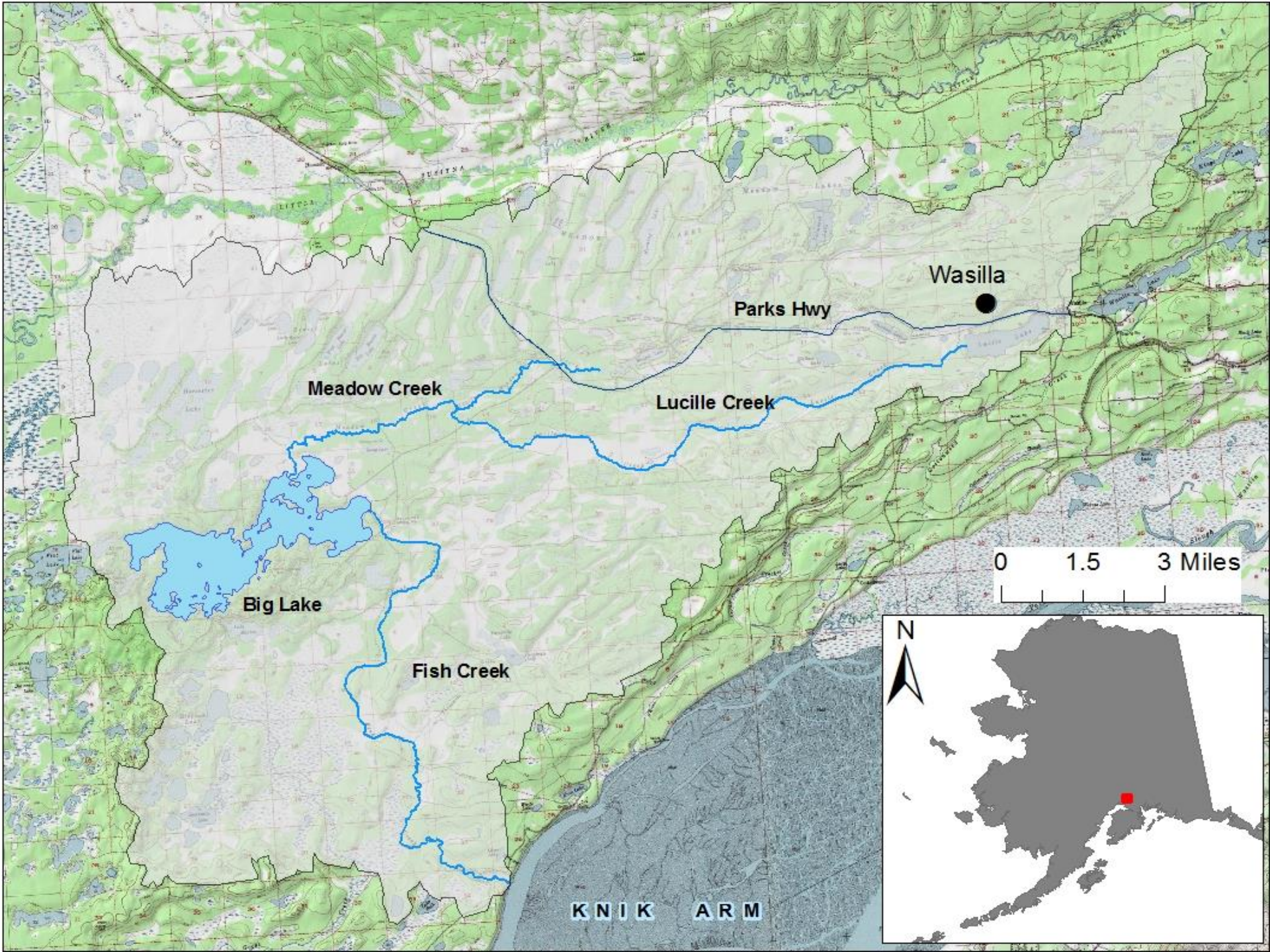
Outline

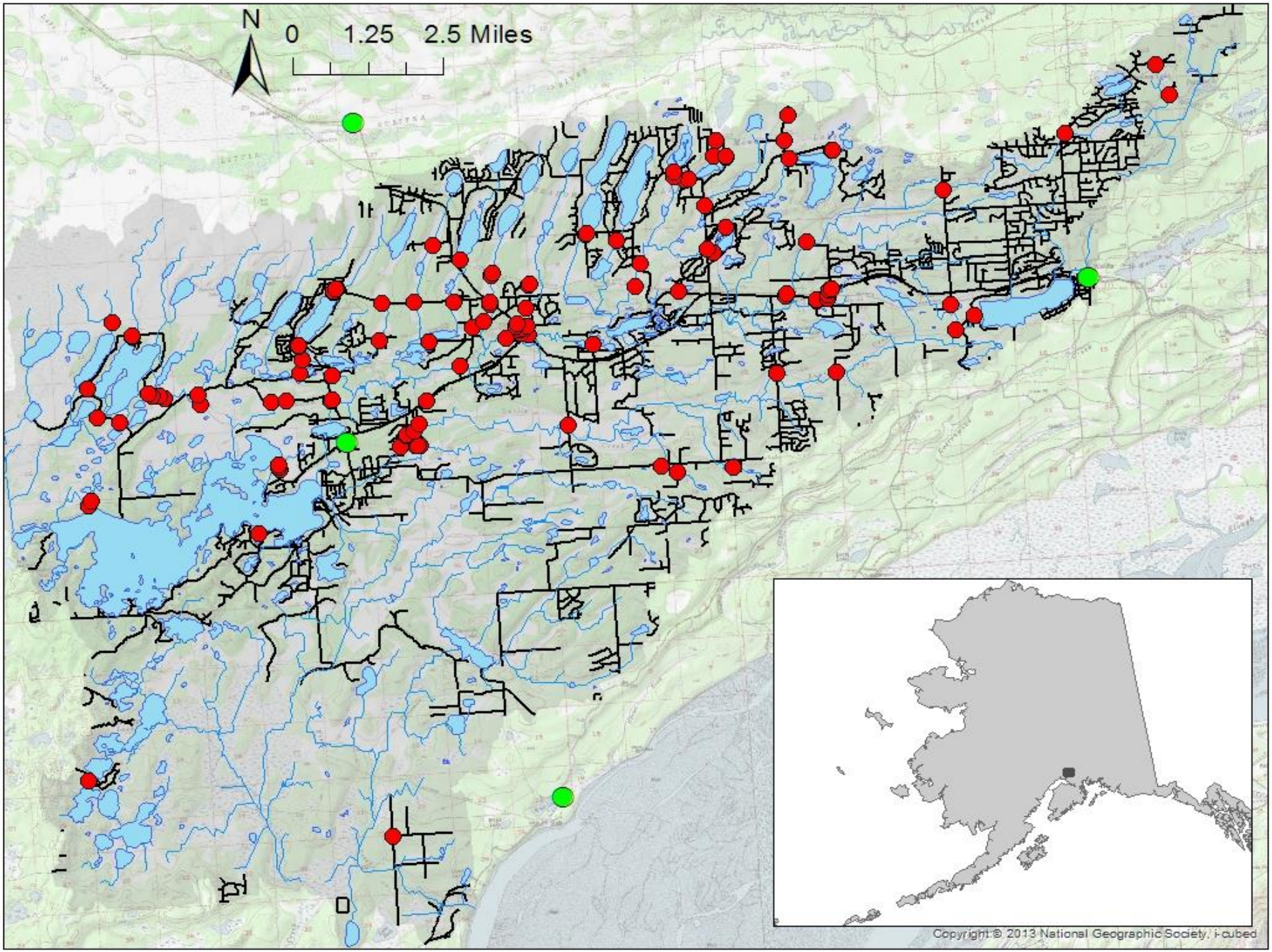
Background: fish passage issues in the Big Lake area

Juvenile Coho summer habitat use

Juvenile Coho movement patterns

Conclusions about Coho ecology and fish passage barriers


Wasilla
Parks Hwy
Meadow Creek
Lucille Creek
Big Lake
Fish Creek
KNIK ARM
0 1.5 3 Miles
N


N
0 1.25 2.5 Miles
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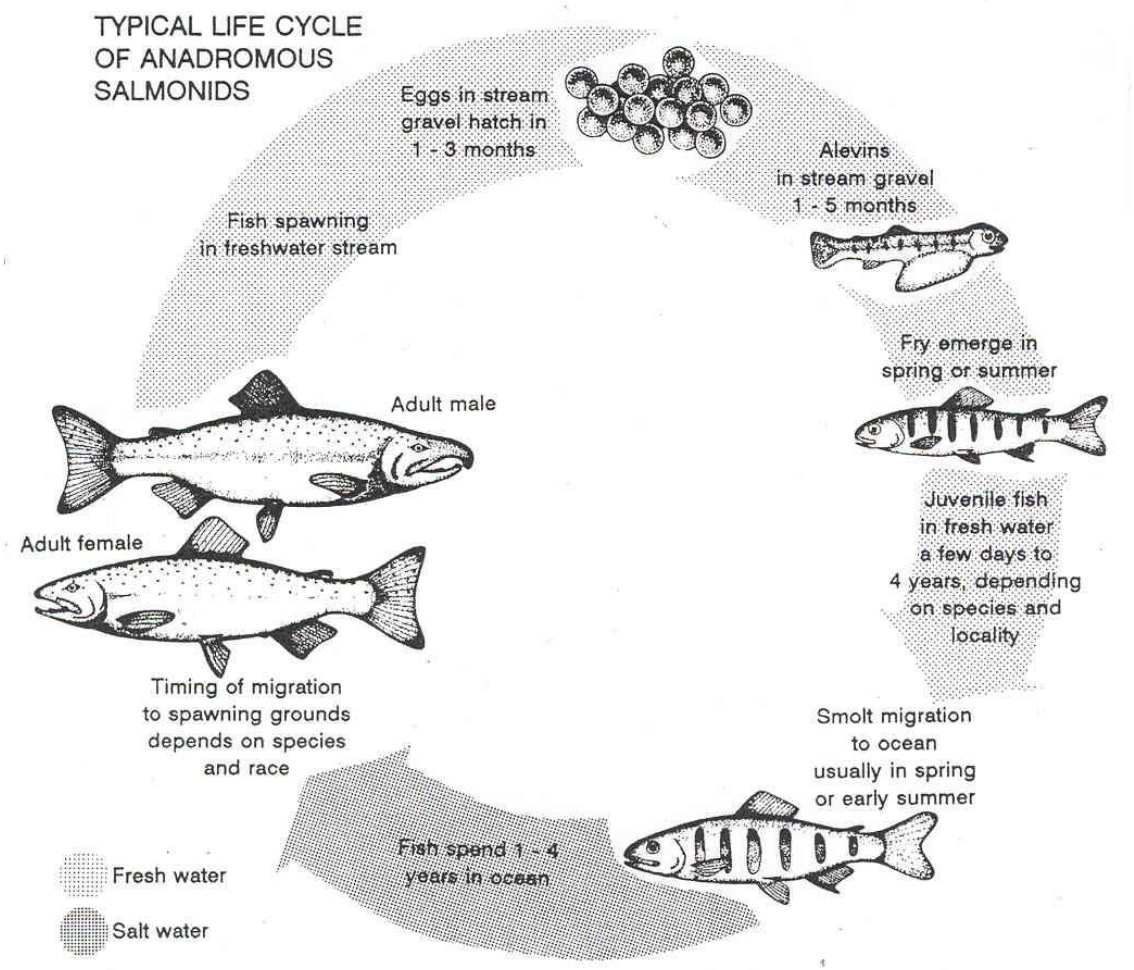
Motivation: ecological study to inform best management decisions

Culverts pose a threat to salmon habitat by blocking passage and fragmenting habitat.

Culverts are expensive to restore.

To be effective, we need information to prioritize which culverts to restore.

Pacific salmon freshwater life history



	FW	SW
Sockeye	1-3	1-4
Chinook	1-2	1-4
Coho	***1-3***	***1***
Pink	0	1
Chum	0	1-4

Fish passage barriers can affect life history strategies

lake side view

outlet side view

Behold: Cohokanee

sexually mature **male**
(216mm), Aug 2015

sexually mature **female**
(200mm+), Aug 2015

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Summer rearing habitat use

Methods

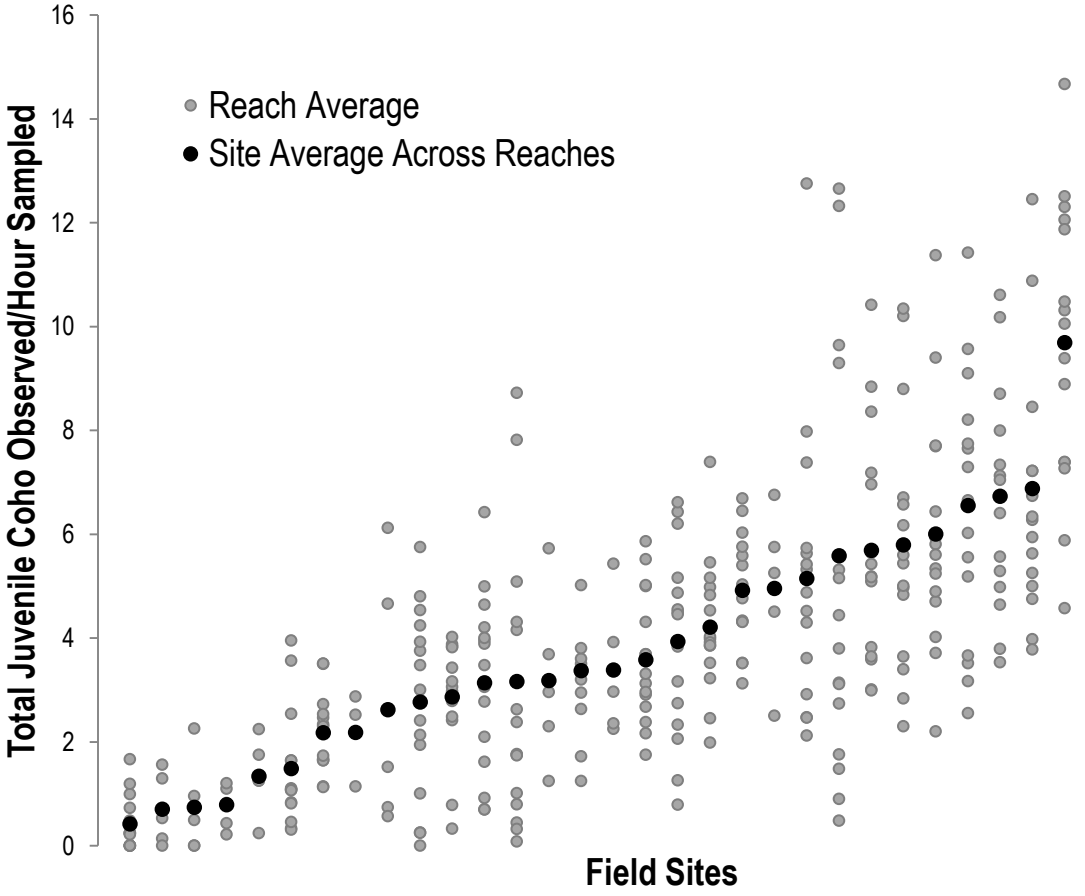
Sampling in Meadow Creek and Fish Creek drainages, 2012 and 2013

Minnow trapping, habitat surveys, fancy GLMM regression

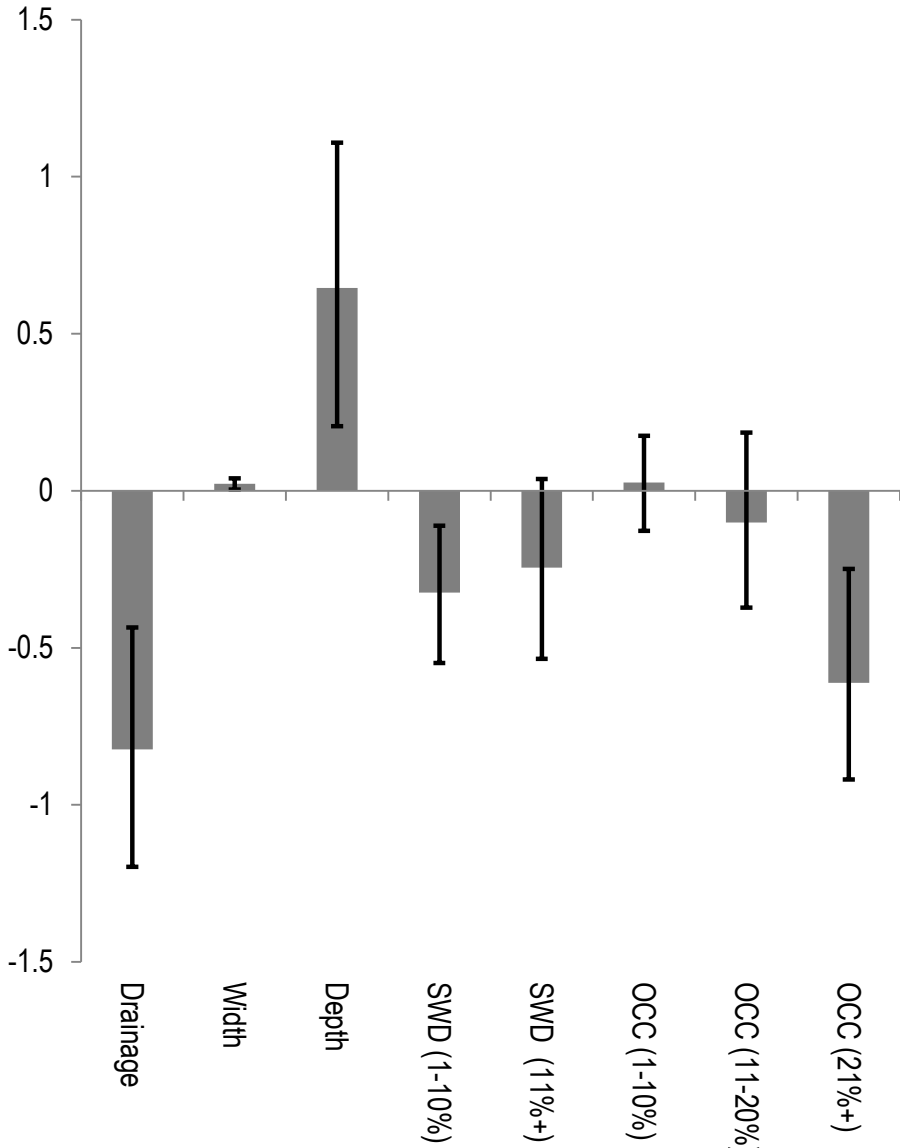
Habitat characteristics

- Wetted width
- Depth
- Substrate composition
- Hydrologic flow characteristics
- Frequency of deep pools and undercut banks
- Instream vegetation, woody debris, canopy cover

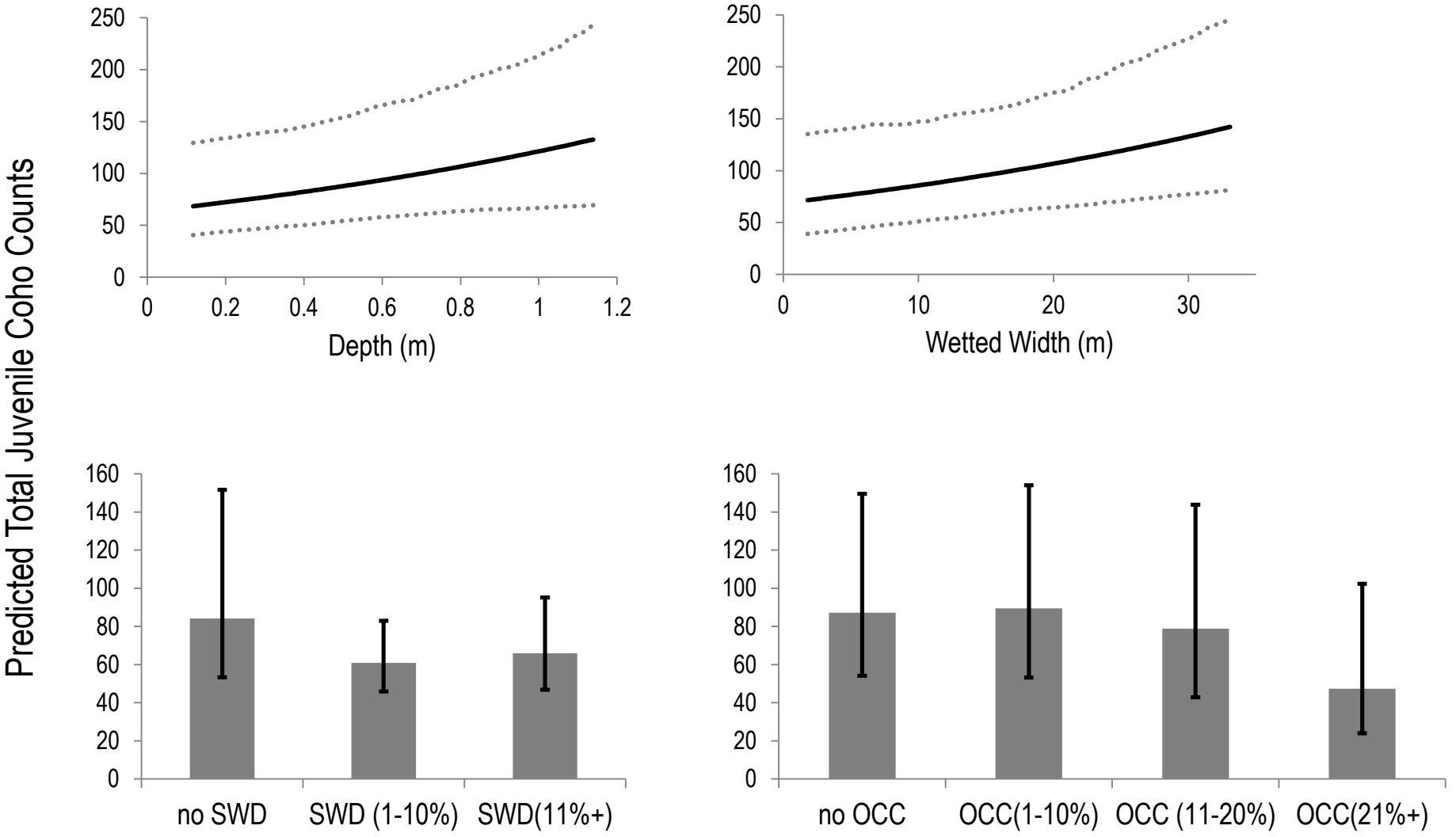
Over 17,000 coho sampled June-Oct, averaging 3.8 fish/sampling hour



AIC top model parameter estimates

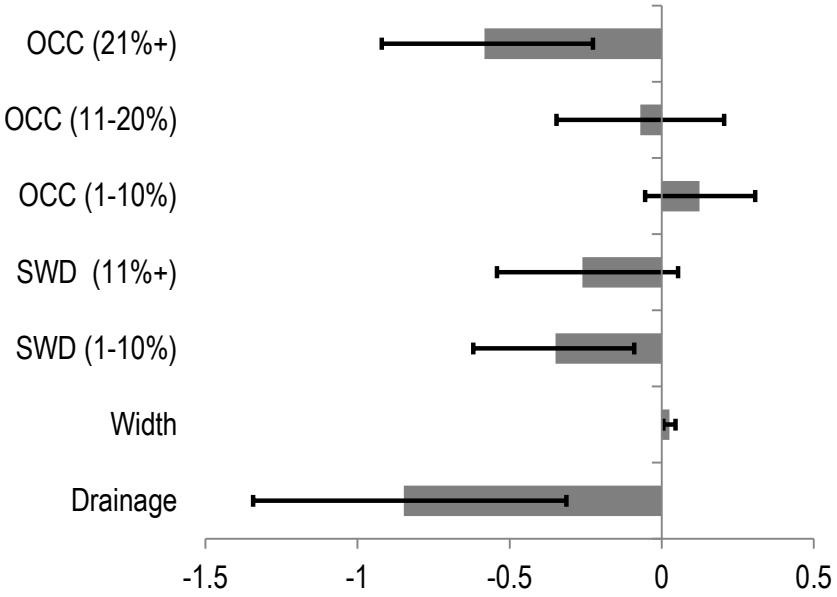


Specific habitat condition effects

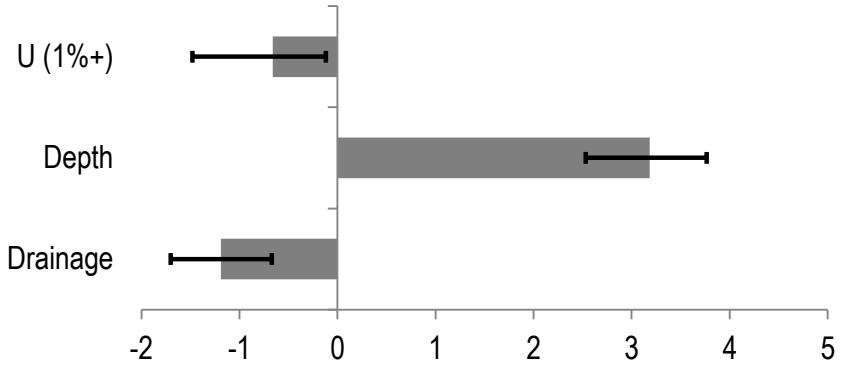


Does age matter? Yes.

Young-of-the-Year



Aged 1 and Older



- YOY fish made up >80% of fish sampled; similar model to pooled cohort data but depth is not significant.
- Depth was the most significant predictor of Aged 1+ juveniles

Juvenile coho summer habitat use summary

- Juvenile coho preferred wider, deeper, reaches. Fish were less prevalent in smaller, wooded and shady reaches.

- Habitat preference segregated by age cohort with young of year preferring the shallower reaches, and the 1+ fish deeper reaches and pools.

- Substantial differences in fish abundances across drainages (Fish Creek is truly fishy).

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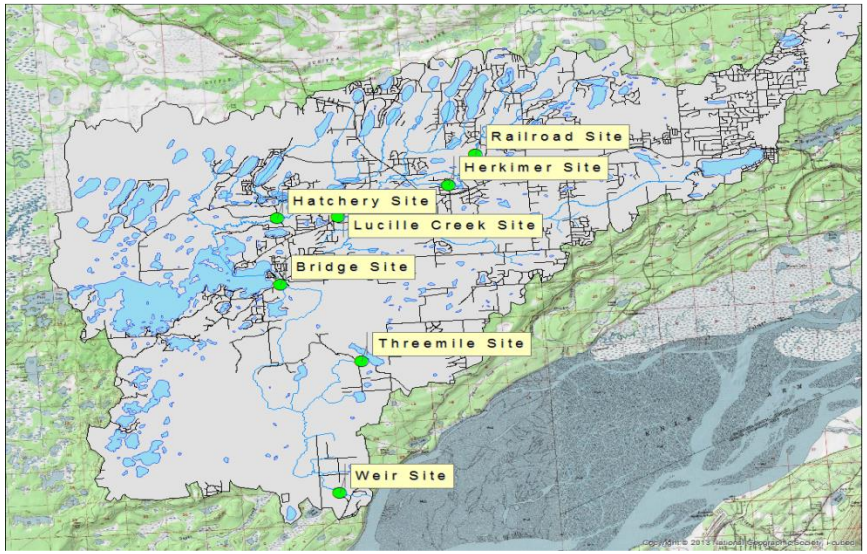
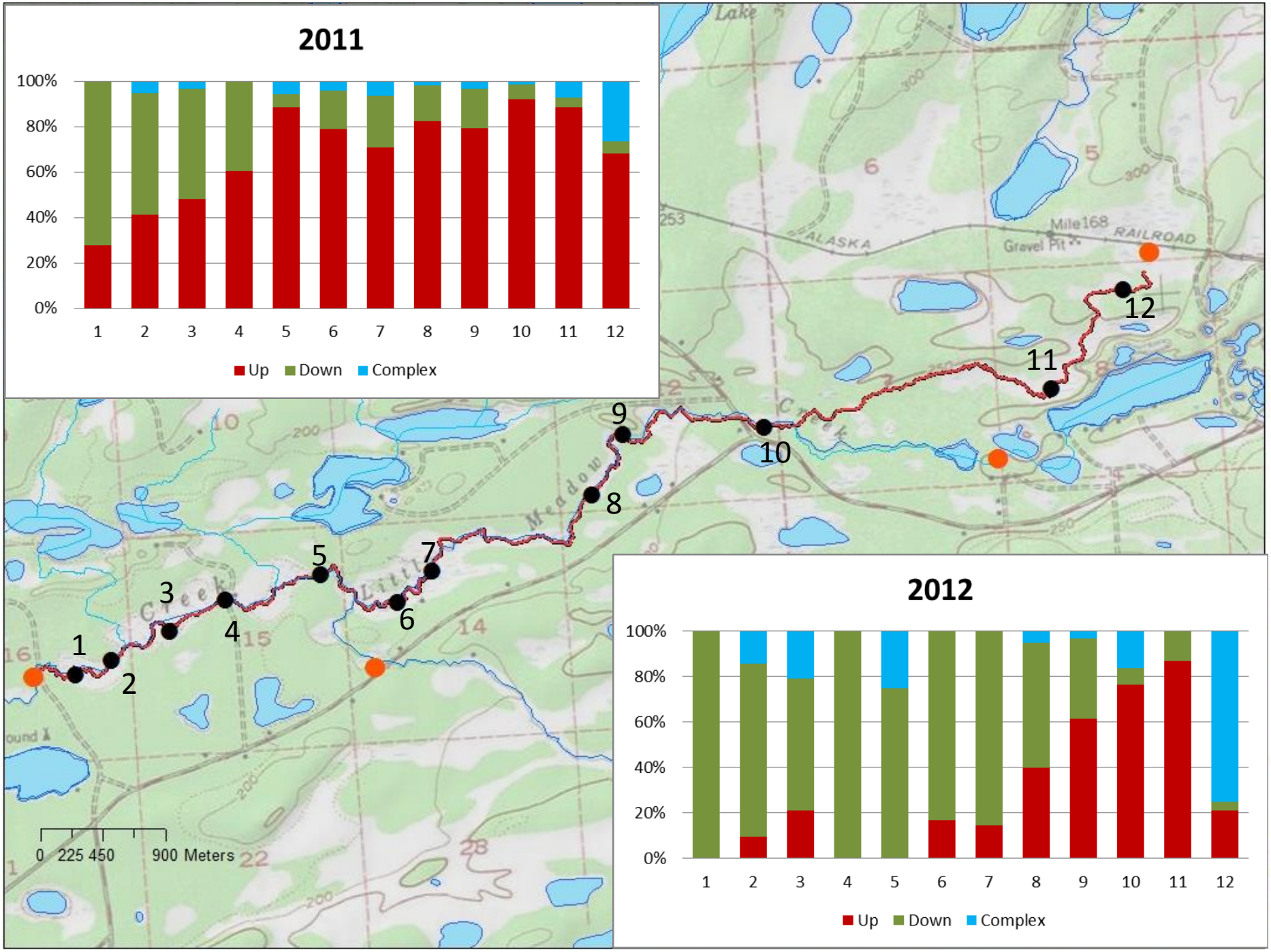
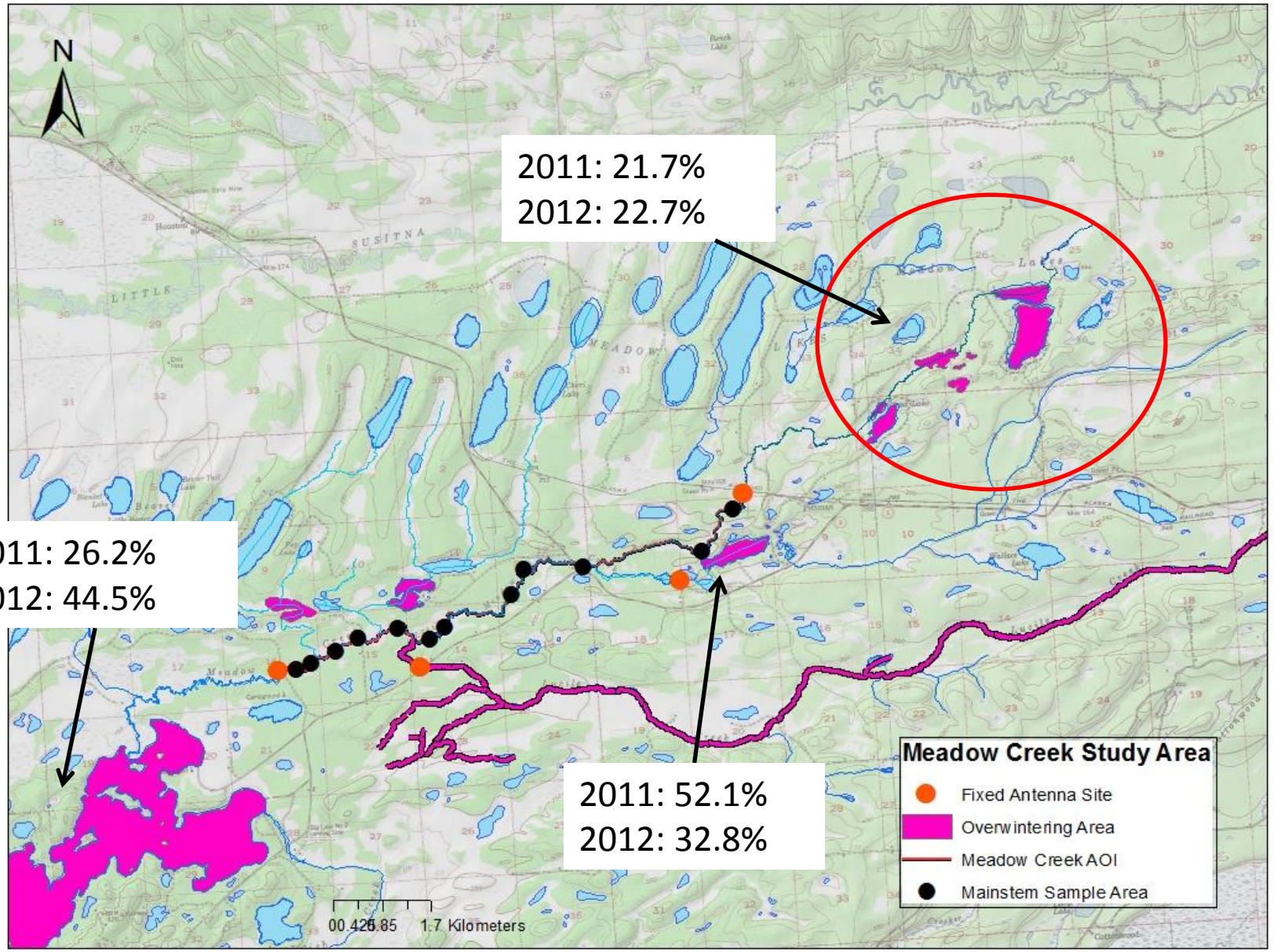
Juvenile coho movement patterns

PIT tagging, antennae arrays, and mobile tracking (trapping) 2012-2013

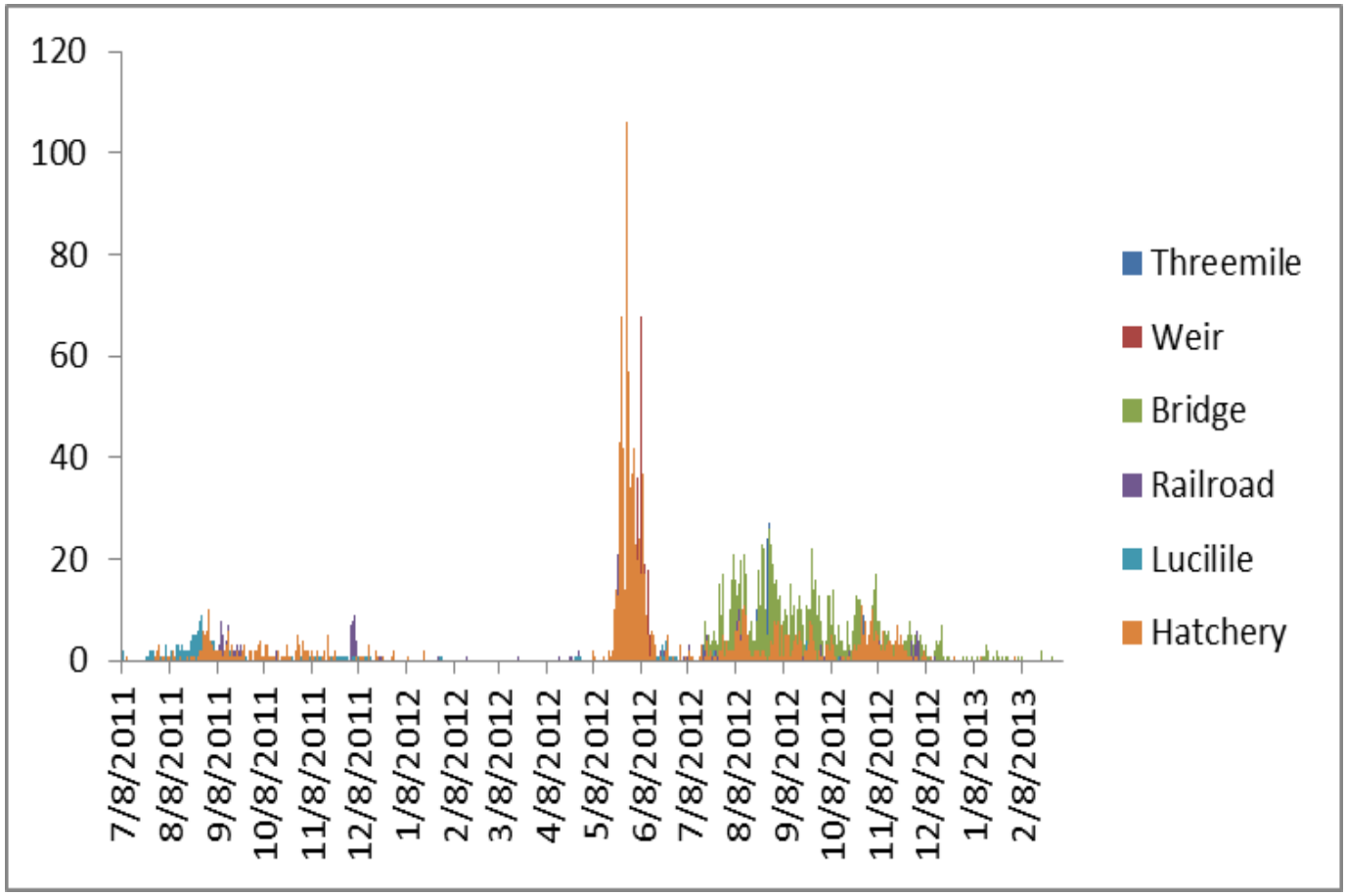



2011
100%
80%
60%
40%
20%
0%
1 2 3 4 5 6 7 8 9 10 11 12
Up Down Complex
Lake
ALASKA
Mile 168
RAILROAD
Gravel Pit
Meadow
Creek
0 225 450 900 Meters
1
2
3
4
5
6
7
8
9
10
11
12
2012
100%
80%
60%
40%
20%
0%
1 2 3 4 5 6 7 8 9 10 11 12
Up Down Complex

Juvenile coho overwinter selection



Juvenile coho migration waves



Year	Big Lake	Blodgett Lake	Upper Meadow Creek***
2011	9/30	9/16	9/23
2012	9/19	8/29	9/1
Difference	11	18	22

Juvenile coho movement summary

- Directional movement appears related to summer rearing location
- Majority of tagged individuals move directly to one of three overwintering areas
- Arrival timing is variable between overwintering areas and years

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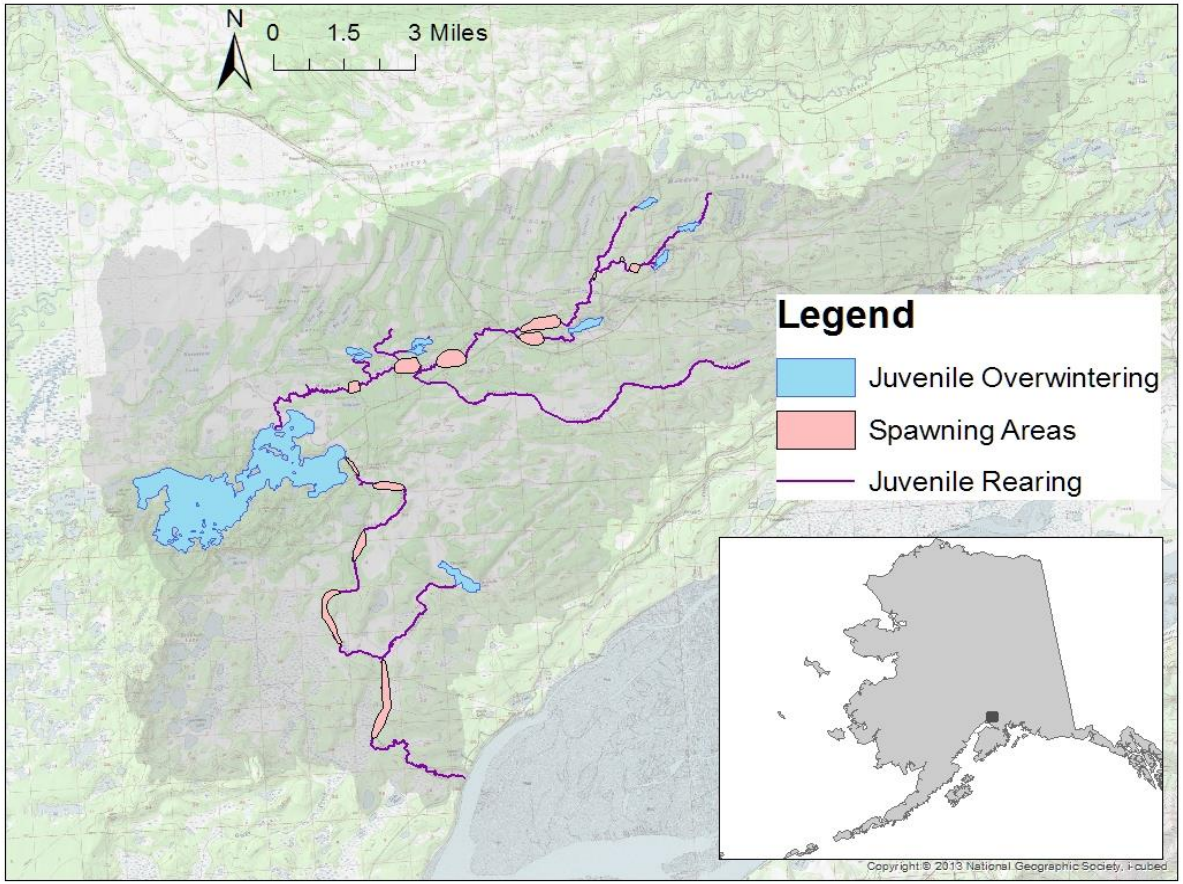
Summary conclusions

- Juvenile coho salmon exhibit extensive and synchronized migrations.

- Mainstem environment = rearing (wider, deeper, open reaches preferred), Tributaries = important movement corridors, Lakes = overwintering.

- Culvert design should account for year round passage.

- Select culverts are significant barriers and fragmenting important habitats.



Acknowledgments

Thank you.

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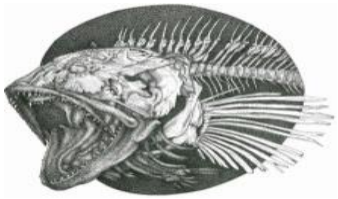


F.A.S.T. lab

Data Analysis

Poisson GLMM regressing total coho counts against habitat variables, environment, and drainage

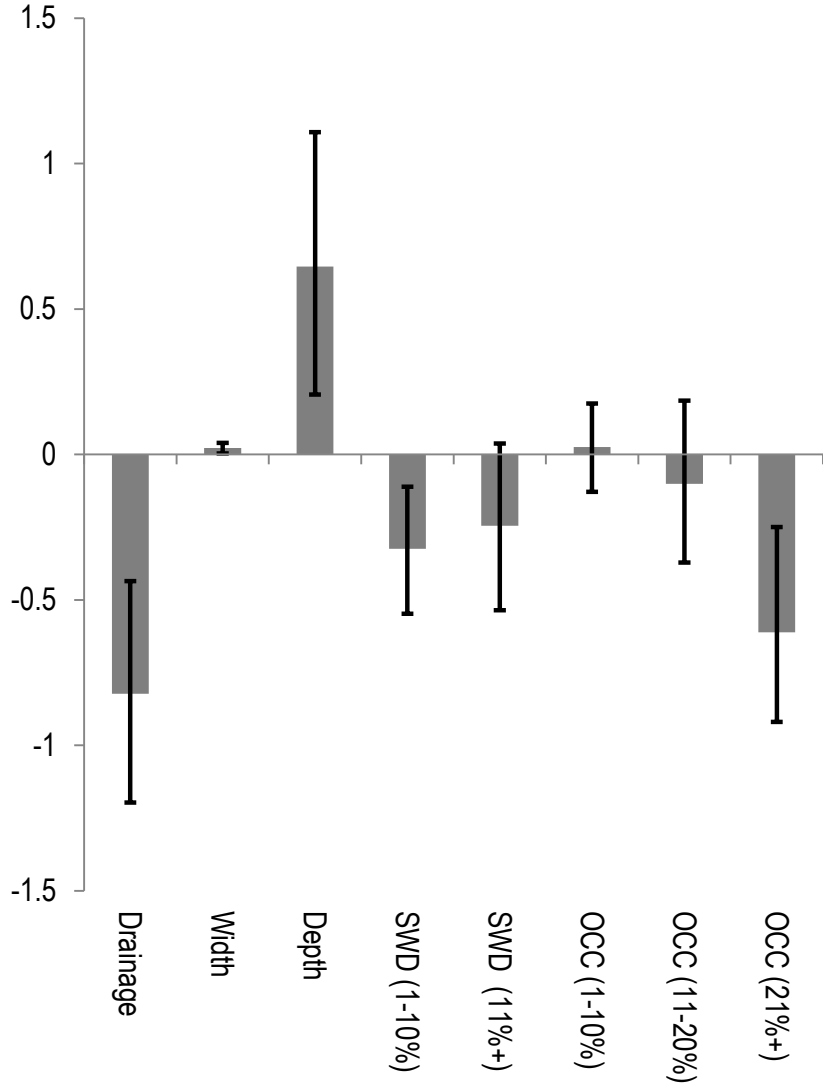
Random effect for field site, an observation-level random effect, and an offset term to account for the time spent at each field site included in the model

Model selection based on marginal AIC and relative variable importance

Final Model:

- Positive effect of depth and wetted width
- Negative effect of SWD and high levels of OCC
- Marginal R^2: 0.32

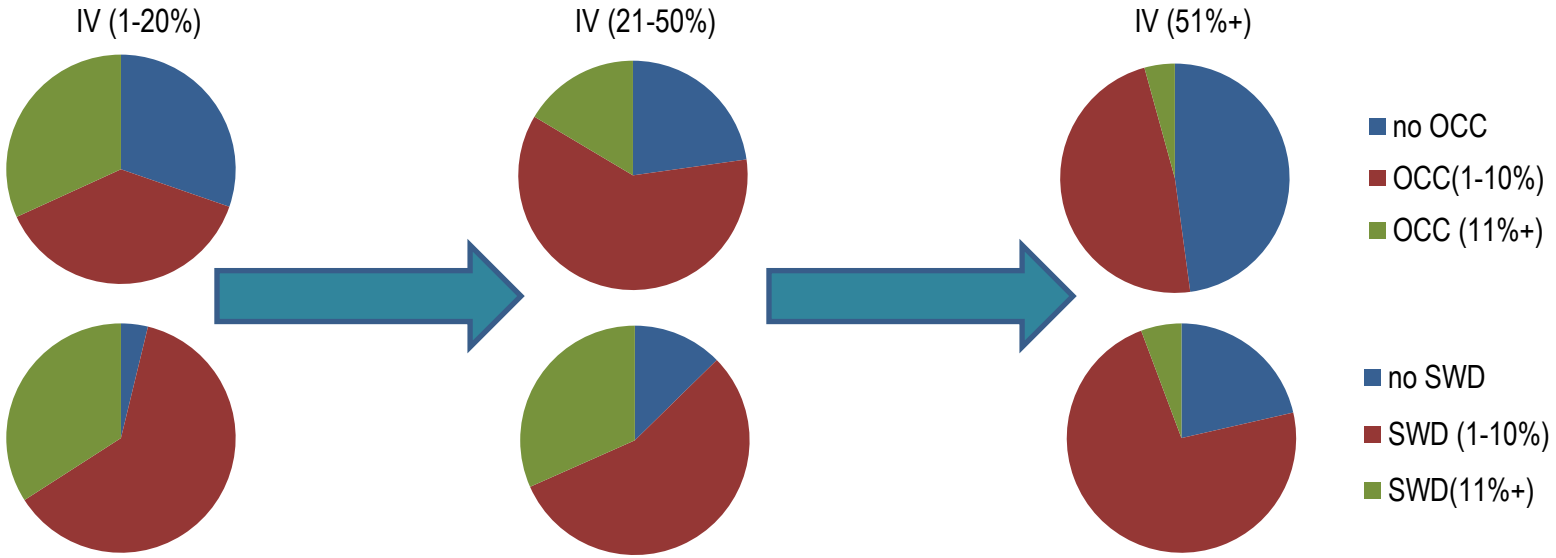
Final Model Parameter Estimates



Conclusions

- A simple model including depth, width, overhead canopy coverage, small woody debris, and a covariate for drainage explained 32% of the variation in the total counts of juvenile coho observed at the reach-scale.

- The negative effect of overhead canopy coverage and small woody debris likely reflects the negative association each has with instream vegetation.



- Dropping overhead canopy coverage and small woody debris reduced the variance explained by 3%
  - Categorizing sites by only the most easily obtainable variables, width and depth, is feasible without loss of explanatory power

Tagging Statistics- Meadow Creek

Year	Tags Deployed	Detectable Movement	
		Yes	No
2011	2,295	675	451
2012	986	292	155

Directional Movement

Year	Up	Down	Complex
2011	71 %	25 %	4 %
2012	51 %	34 %	15 %

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2011	71 %	25 %	4 %
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