

Chehalis Basin Strategy: Reducing Flood Damage and Enhancing Aquatic Species

Fish-Habitat Studies

*Technical Committee Meeting
Olympia, Washington
May 7-8, 2014*



Fish-habitat studies were designed to fill gaps in understanding about Chehalis River Ecosystem.

- Salmonid spawners
- Smolt abundance
- Summer fish distribution
- Juvenile salmonid summer movement
- Juvenile salmonid winter & spring movements
- Adult spring Chinook movements & temperature selectivity



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Chehalis Riverscape Study: 2013 Results

Mara Zimmerman & John Winkowski
Washington Department of Fish and Wildlife



Riverscape describes the basin-scale landscape of the river.

- Before we ask what habitat variables limit a fish life stage, we need to know where the fish are at that life stage.

Landscapes to Riverscapes: Bridging the Gap between Research and Conservation of Stream Fishes

Ecological Applications, 9(1), 1999, pp. 301-319
© 1999 by the Ecological Society of America

KURT D. FA

Riverscapes
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MULTISCALE THERMAL REFUGIA AND STREAM HABITAT ASSOCIATIONS OF CHINOOK SALMON IN NORTHEASTERN OREGON

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Department of Fisheries and
³Department of Forest

Abstract. We quantifi
(*Oncorhynchus tshawytsch*)

1-1-2012

A riverscape perspective of Pacific salmonids and aquatic habitats prior to large-scale dam removal in the Elwha River, Washington, USA

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ARTICLE

Using a Stream Network Census of Fish and Habitat to Assess Models of Juvenile Salmonid Distribution

John R. McMillan* and Martin C. Liermann

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Riverscape Objectives

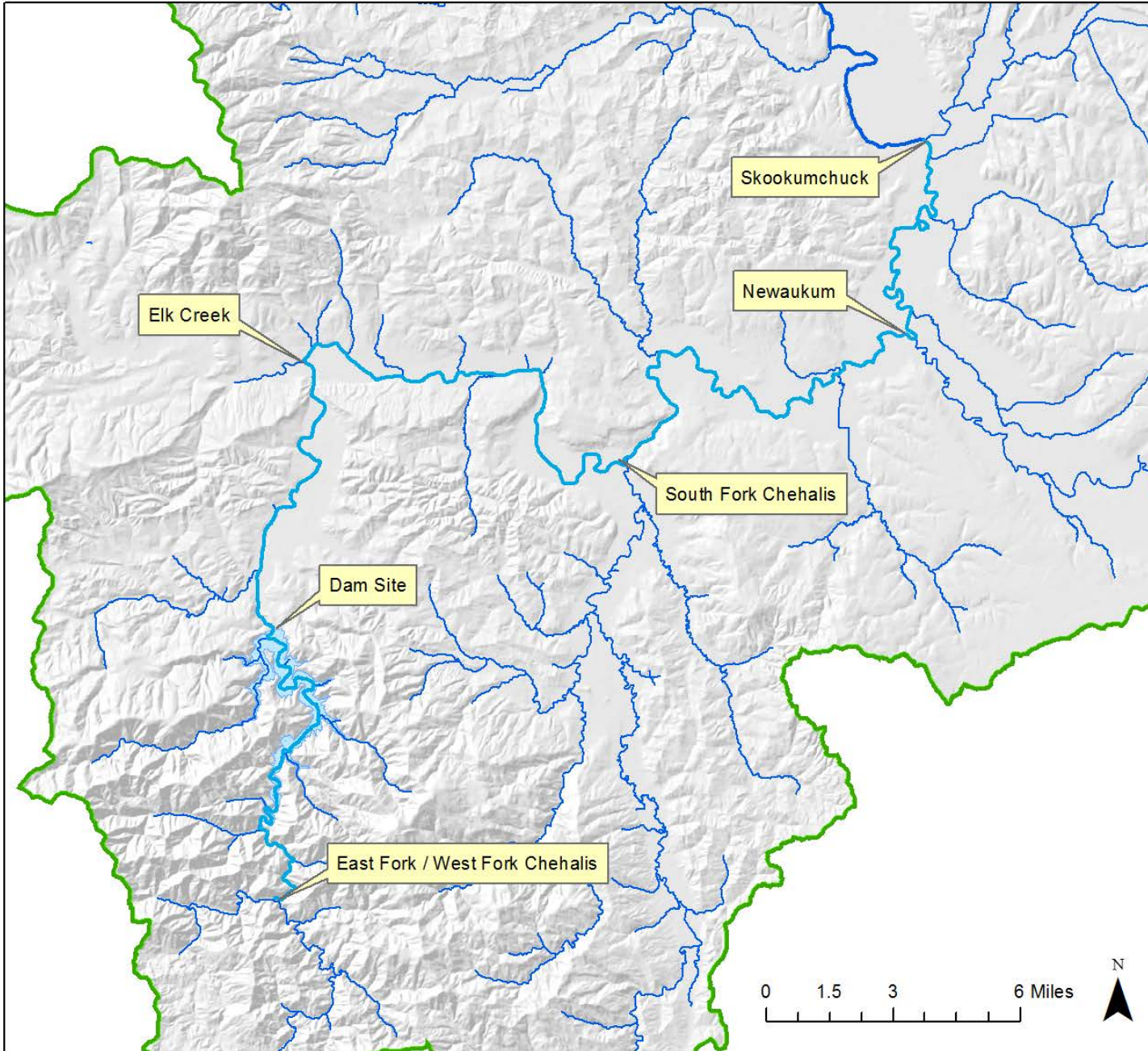
- Describe summer fish distributions and associated habitats in the mainstem Chehalis River above and below the potential dam site.





Methods

- Continuous 200-m reaches
- 77 km main stem habitat
- Fish observations by snorkel
- Habitat observations on foot



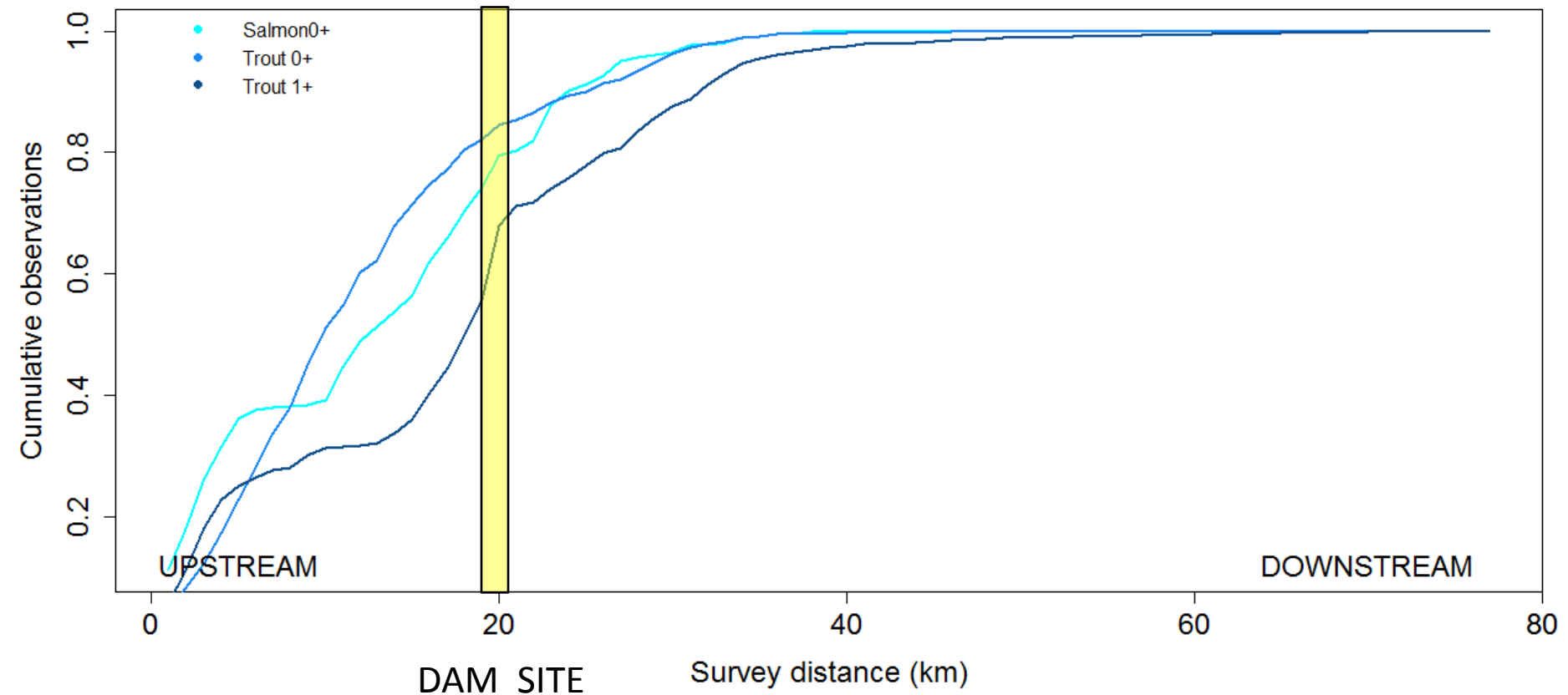
Riverscape Snorkel Reaches



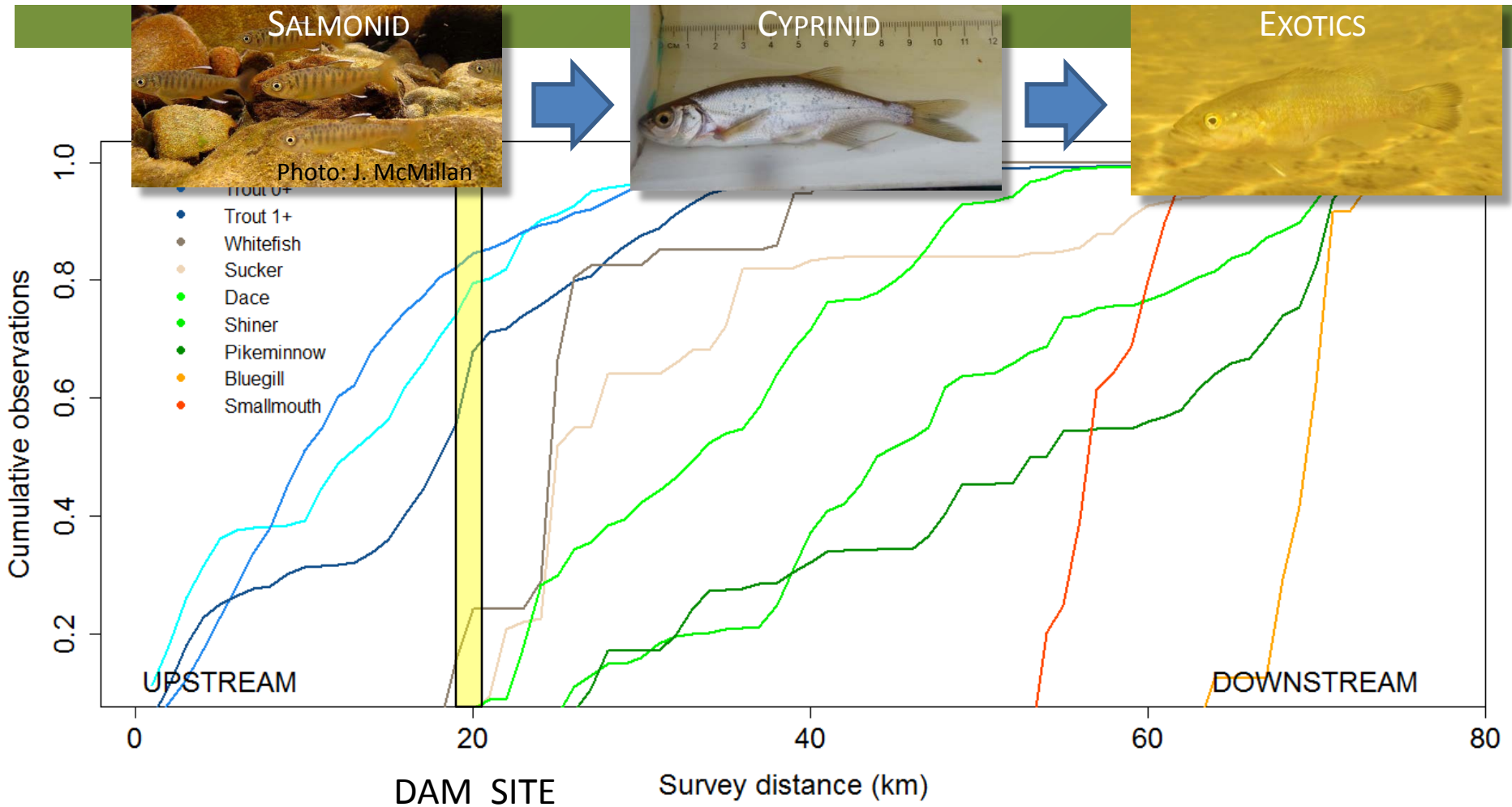
-  Riverscape Snorkel Reaches
-  Chehalis Mainstem
-  Anadromous Streams
-  Multipurpose Inundation

Map: Andy Weiss

Summer rearing of juvenile salmonids mostly occurred above dam site.



Fish species assemblage changes over 77 km of main stem.

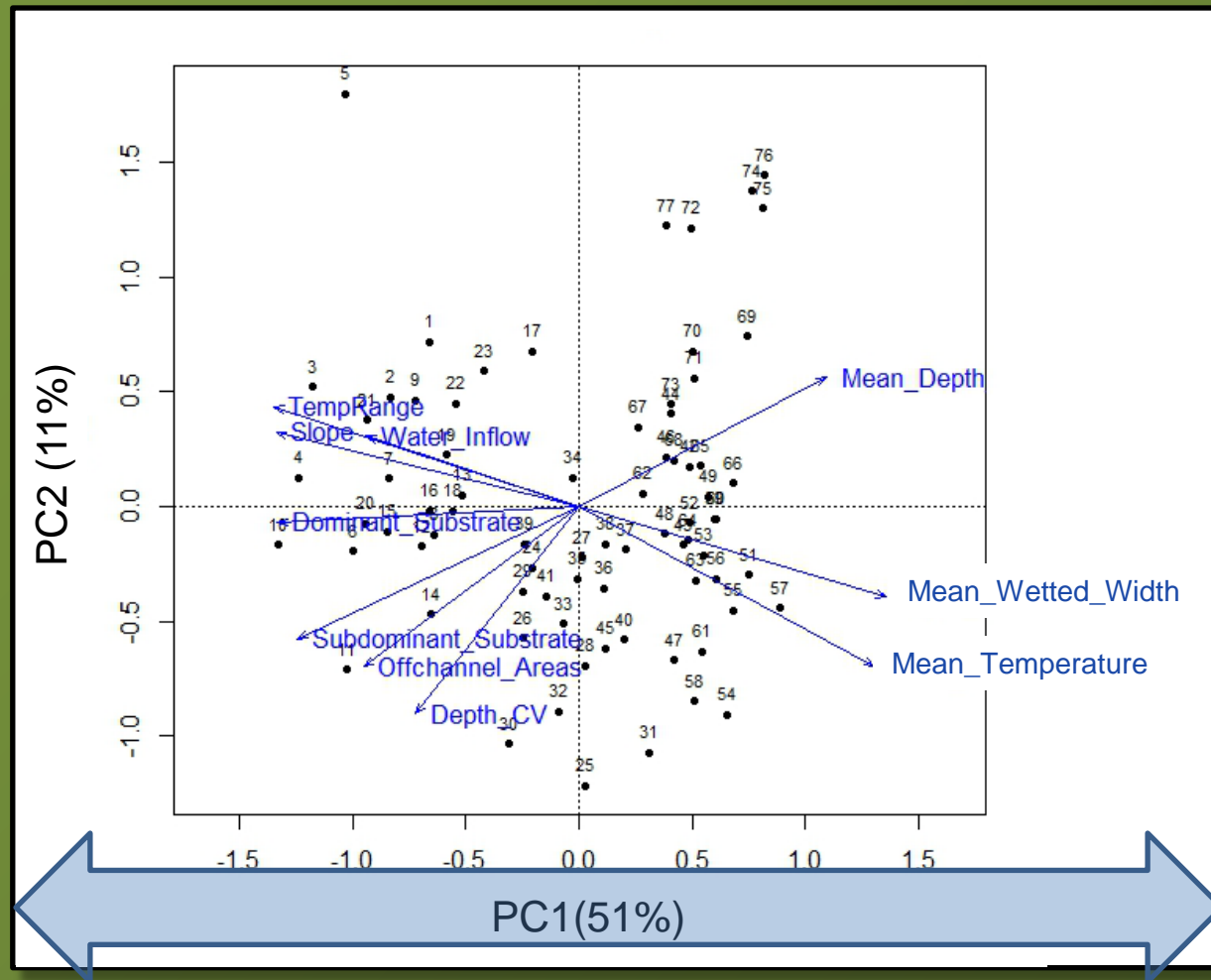


Habitat variables describing mainstem Chehalis River are highly correlated.

- Elevation
- Slope
- Temperature (mean)
- Temperature (range)
- Depth (mean)
- Depth (max)
- Depth (CV)
- Wetted Width (mean)
- Dominant Substrate (rank)
- Subdominant Substrate (rank)
- Water Inflows
- Offchannel Areas



Principal component analysis provided a multivariate description of habitat.

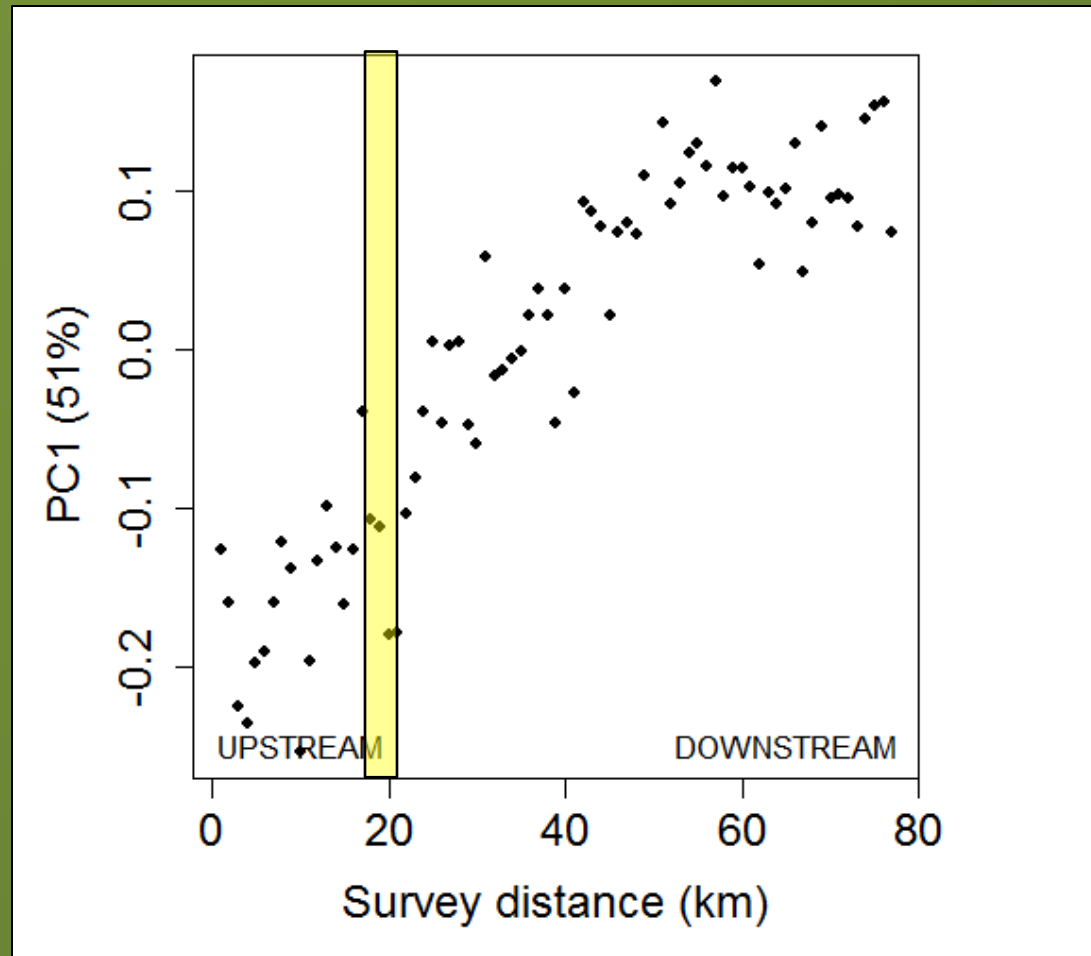


Multivariate habitat variable describes a river continuum.

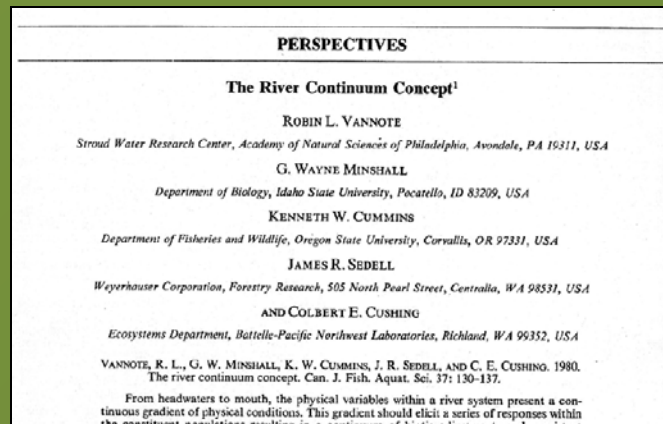
Flat Slope
Wide Channel
Fine Substrate
Warm Temps
Low Diversity



Steep Slope
Narrow Channel
Coarse Substrate
Cool Temps
High Diversity



Results describe a river continuum. Difficult to isolate how individual habitat factors contribute to fish distribution.



“From headwaters to mouth, the physical variables within a river system present a continuous gradient of physical conditions.”
– Vannote et al. 1980

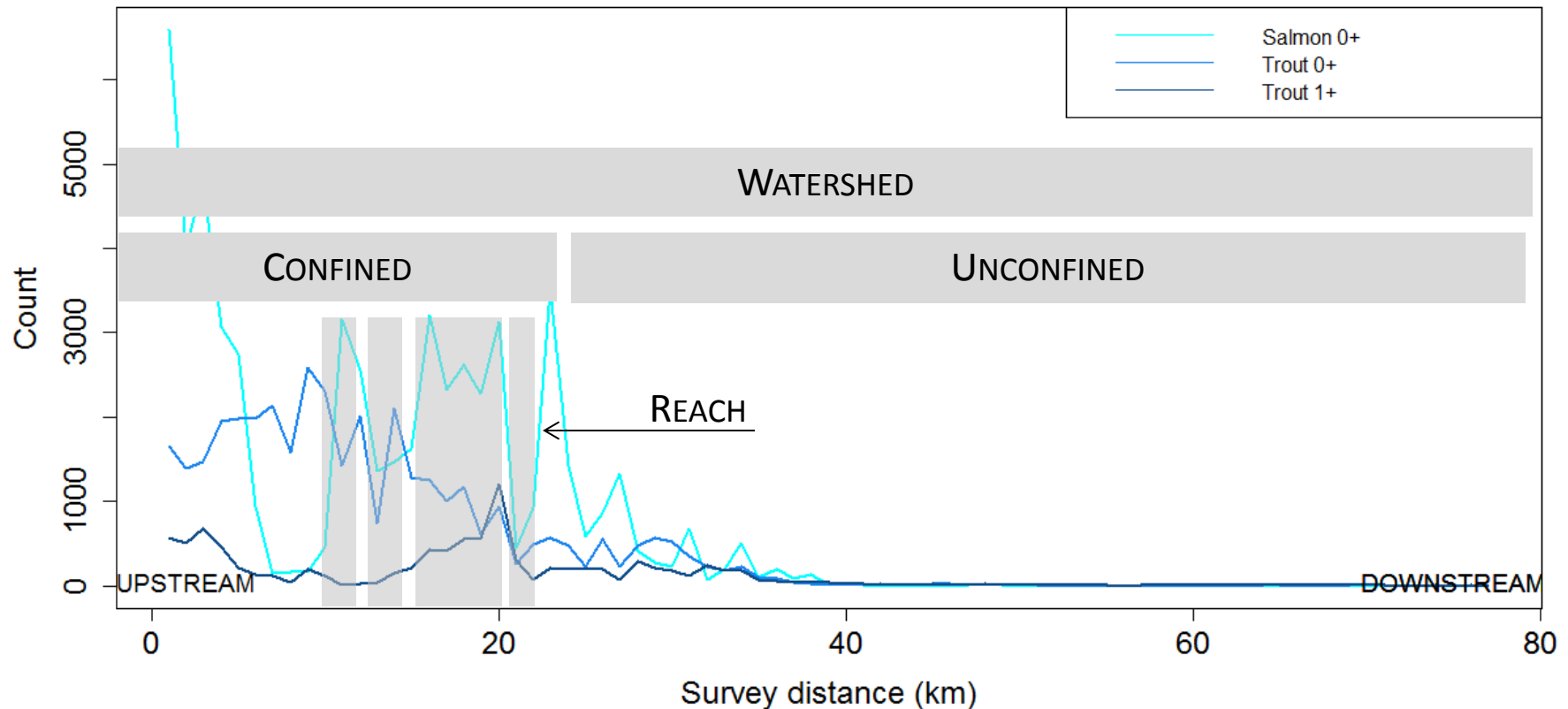
“Resist mechanistic interpretations.”
– Lucero et al 2011



Scales of variation

Fish may be correlated with different factors at different scales.

Salmonid Distribution at Summer Low Flows, Chehalis River 2013



Model river continuum and reach scale habitat predictors of fish abundance.

Generalized Additive Model (GAM)

Fish \sim rkm + habitat variables



River Scale:

Variation in fish abundance correlated with habitat continuum.



Reach Scale:

Habitat correlations after river –scale continuum has been accounted for.

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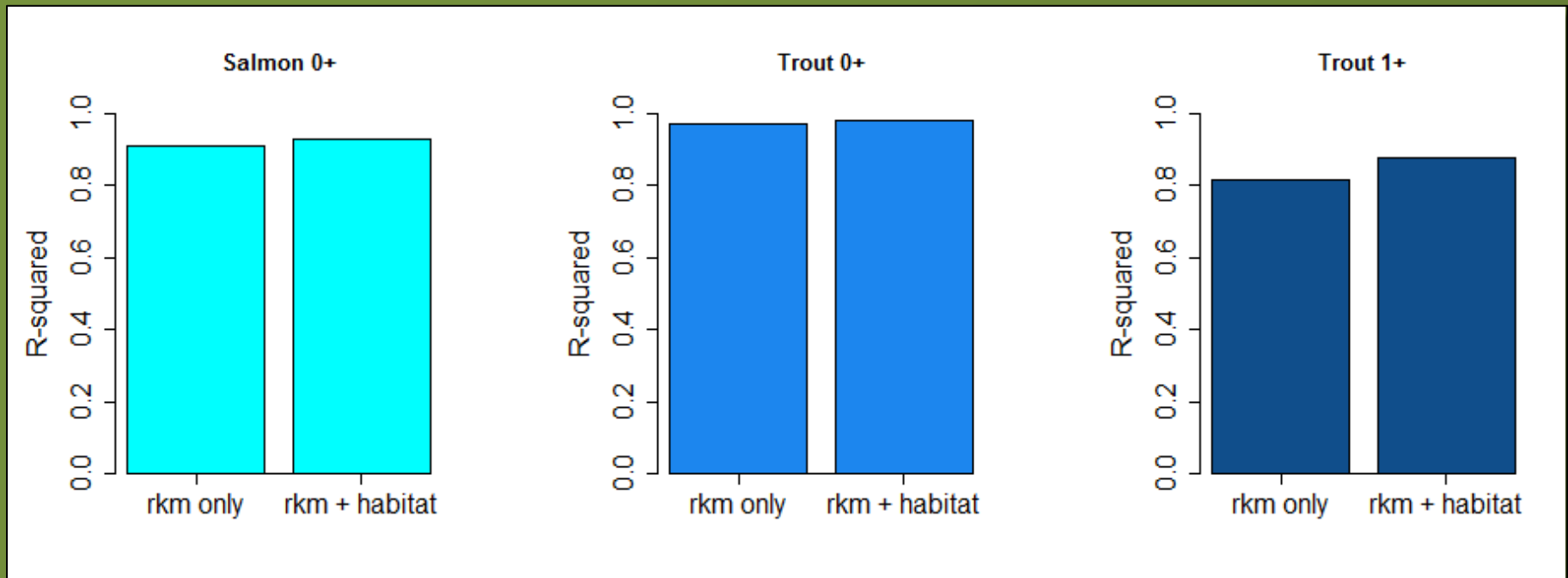
ARTICLE

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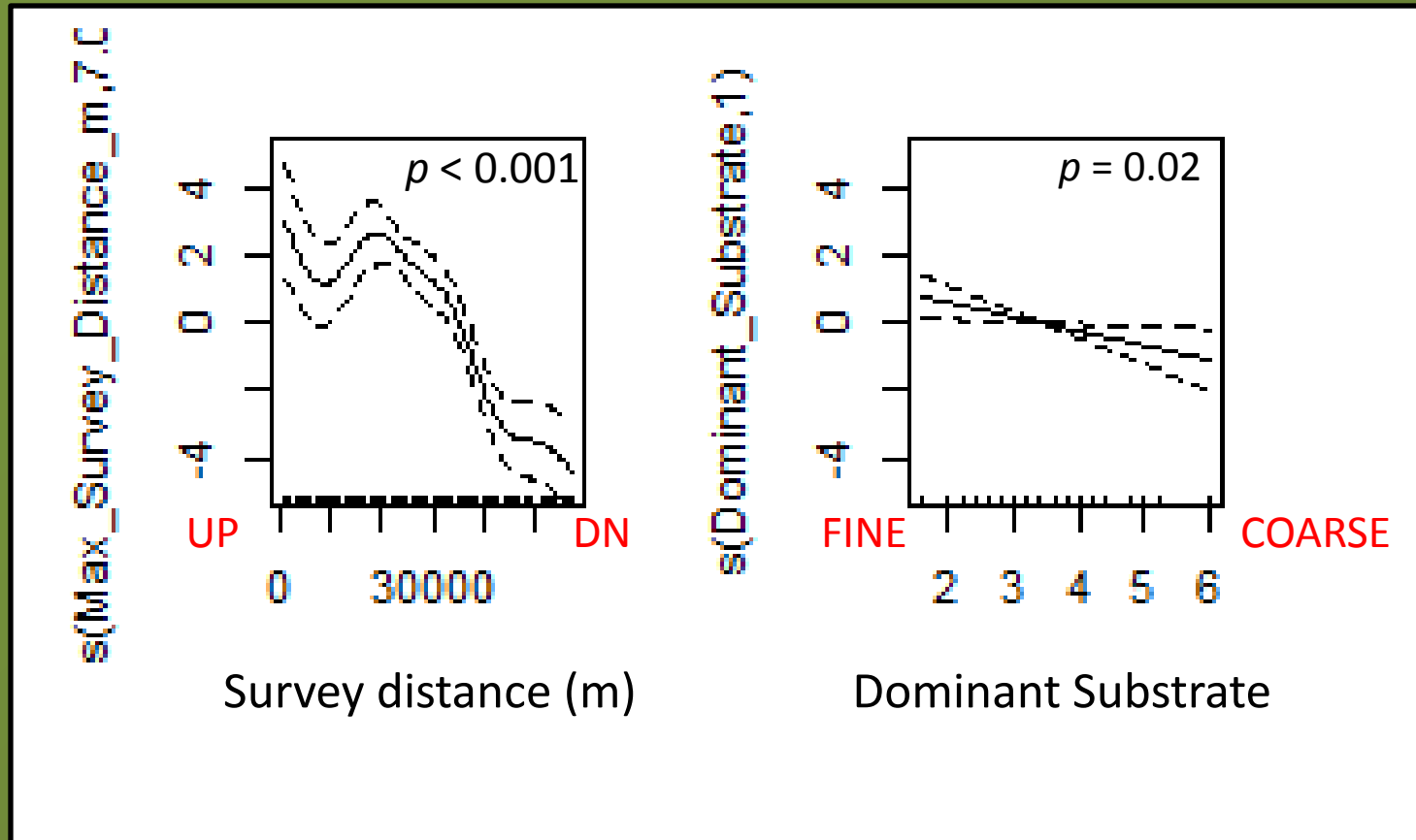
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Most of the variation in juvenile salmonid abundance can be explained by river scale habitat continuum (rkm only).



R^2 shows the amount of variation in fish abundance that can be explained by the predictor variables.

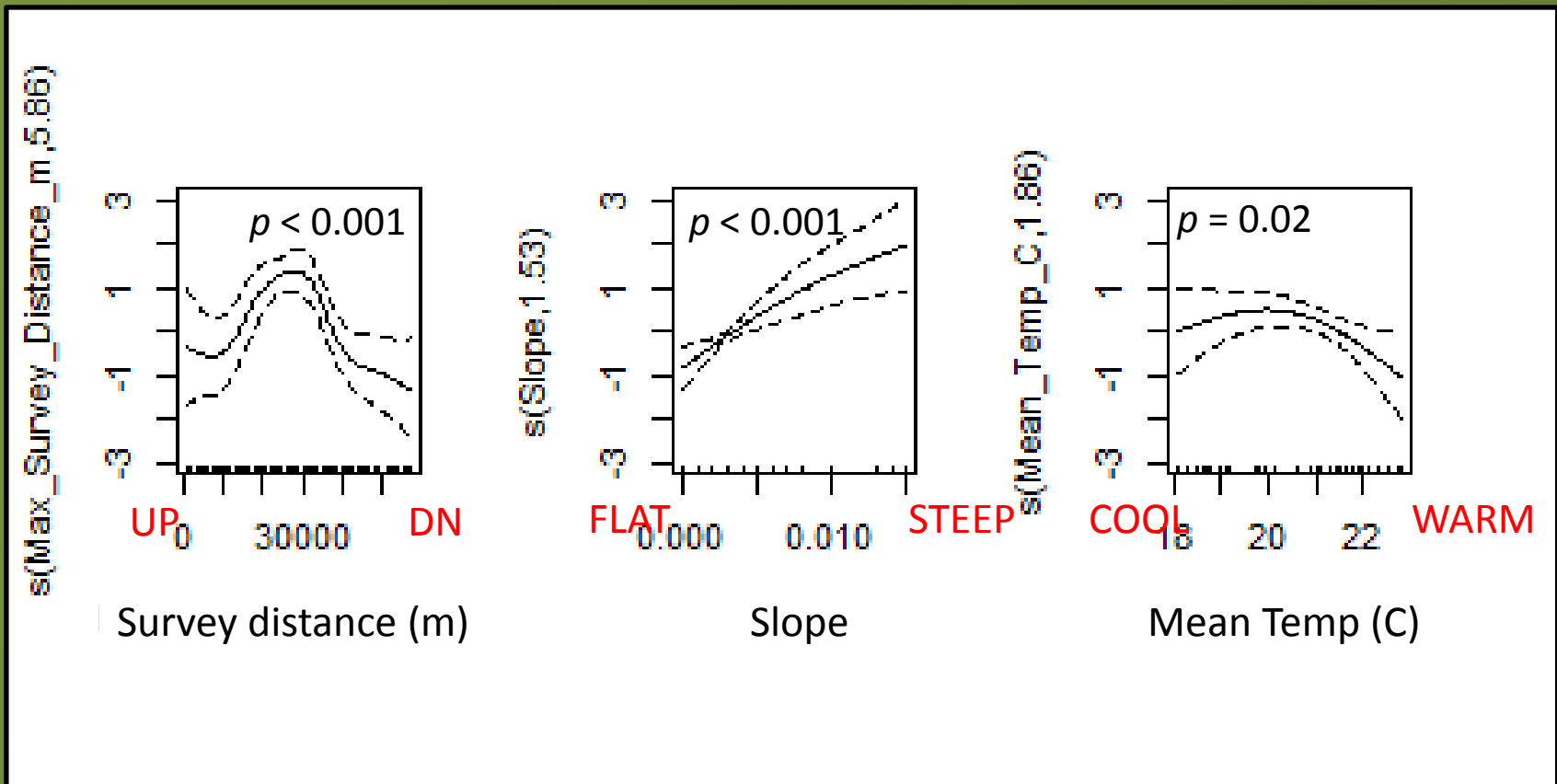
Within the river continuum, more salmon 0+ are found in reaches with finer substrate.



Reach scale = 1 km

Salmon 0+ are juvenile coho (mostly) and juvenile Chinook (few).

Within the river continuum, more trout 1+ are found in reaches with steeper slope and cooler temperatures.



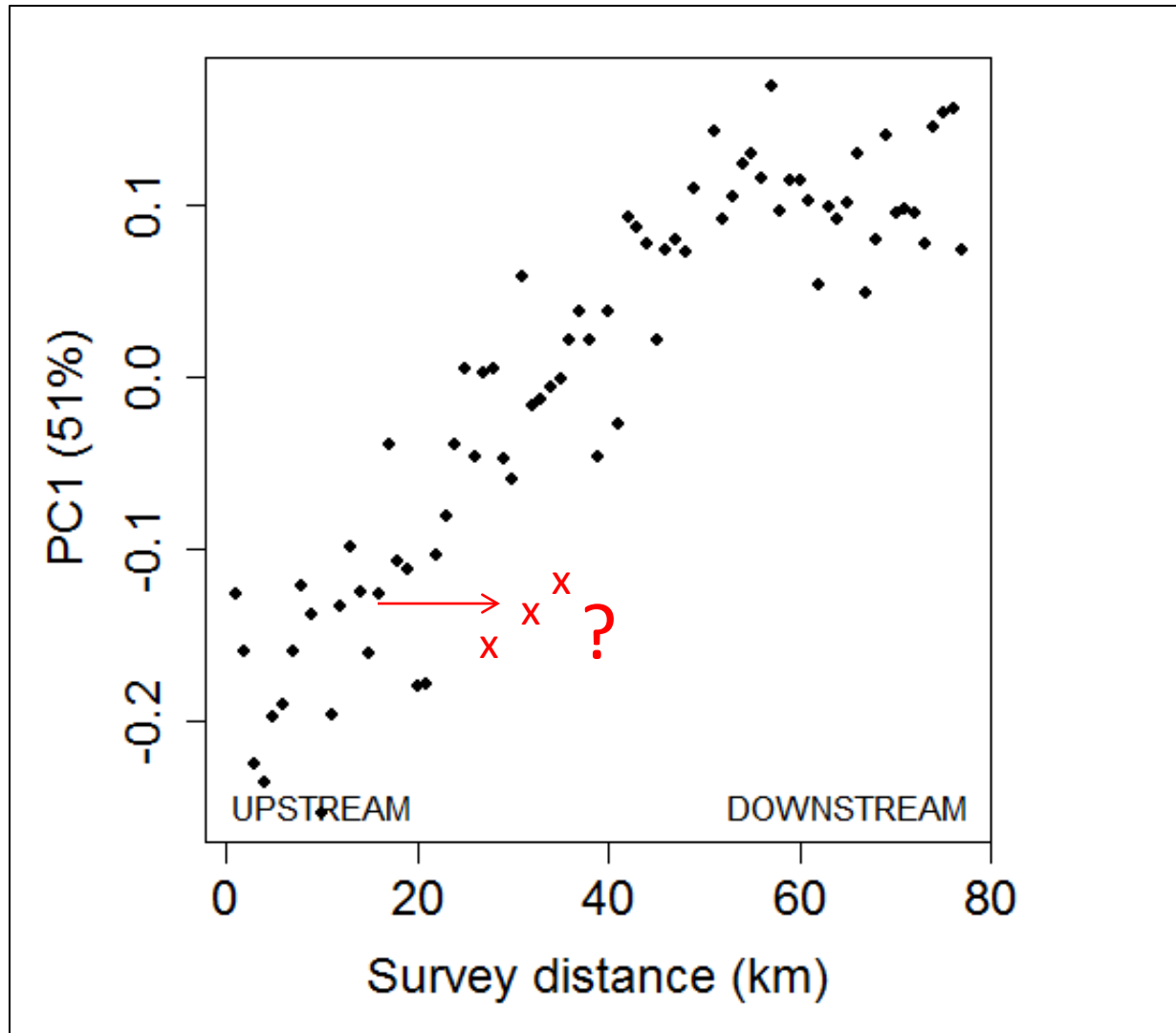
Reach scale = 1 km

Trout 1+ are > 100 mm in length that are likely rearing for the second or third summer in the river.

Summary

- River scale variation in fish abundance is closely correlated with a continuum in habitat and temperature.
- Reach scale variation exists but is poorly explained by measured habitat variables.
- Habitat and temperature co-vary in the river. Together they are good predictors of fish abundance.
- Isolating the contribution of one variable (e.g, temperature) to salmonid rearing will require alternative study design.

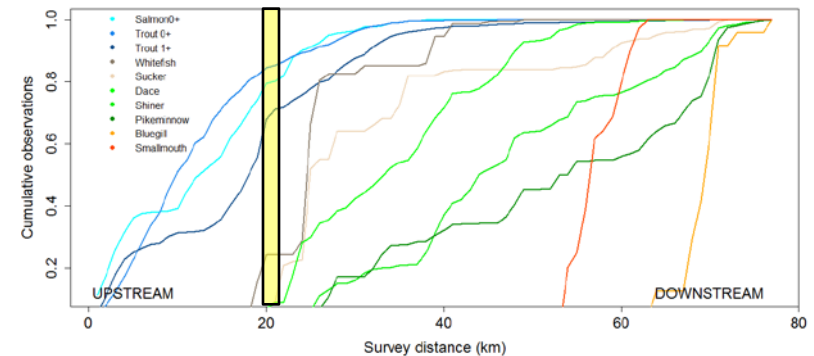
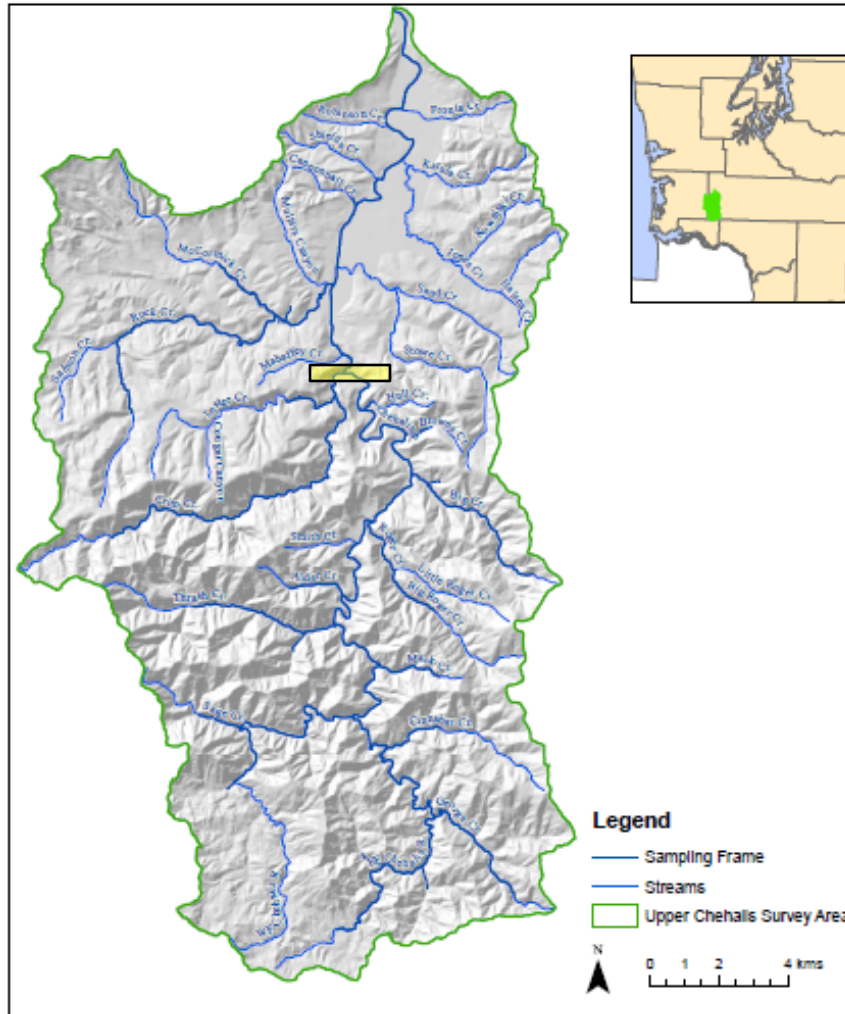
How do we expect a dam to reset the river scale habitat continuum?



Transition in fish assemblage occurs at dam location and is associated with confined vs. unconfined channel.



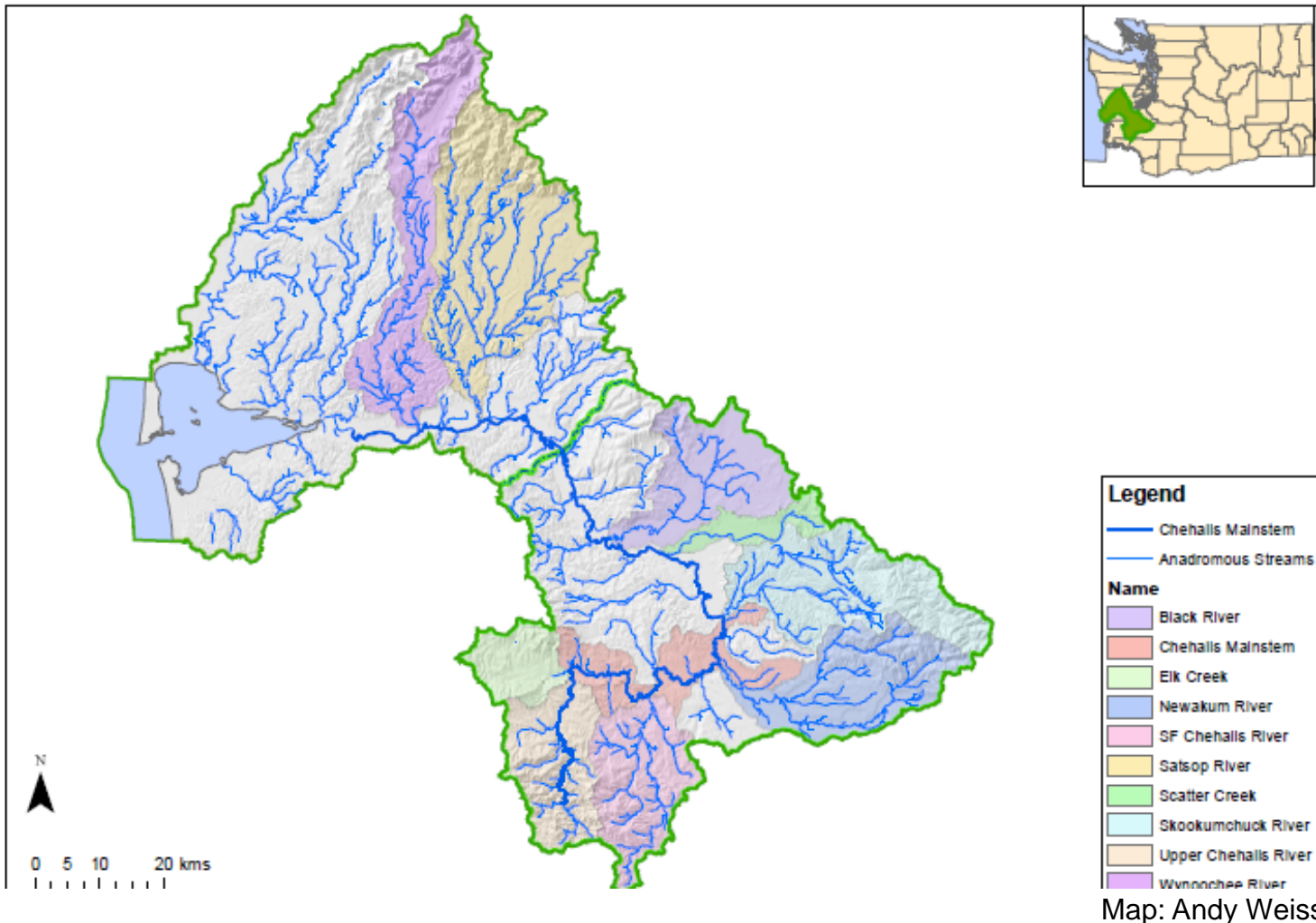
Upper Chehalis Sampling Frame



At a sub-basin scale, are confined headwater reaches important summer rearing habitat for salmonids?



Chehalis River Study Areas / Subbasins



Experimental/comparative approach is needed to isolate contributions of temperature and habitat.

