Abundance, productivity, spatial structure, and diversity associated with a mixed population of resident and anadromous *O. mykiss* in Central Washington

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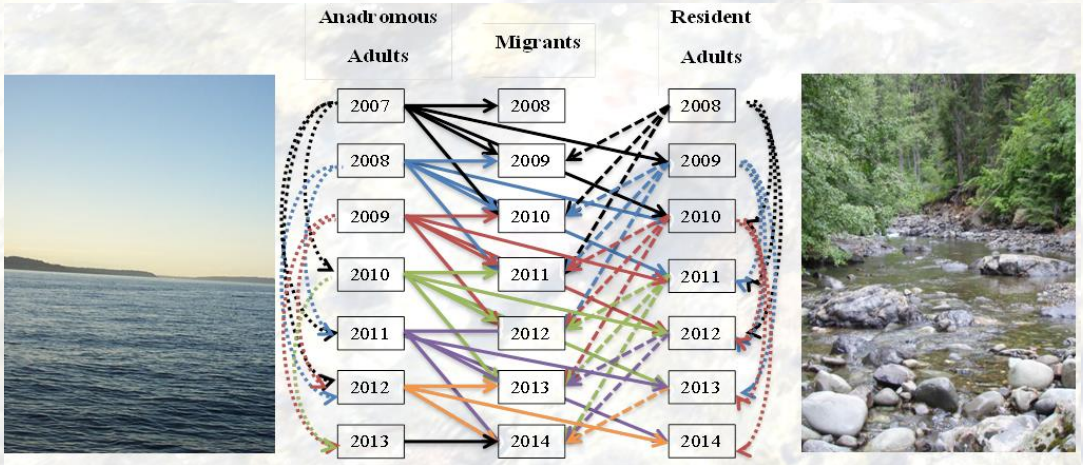
Photo: Zack Mays

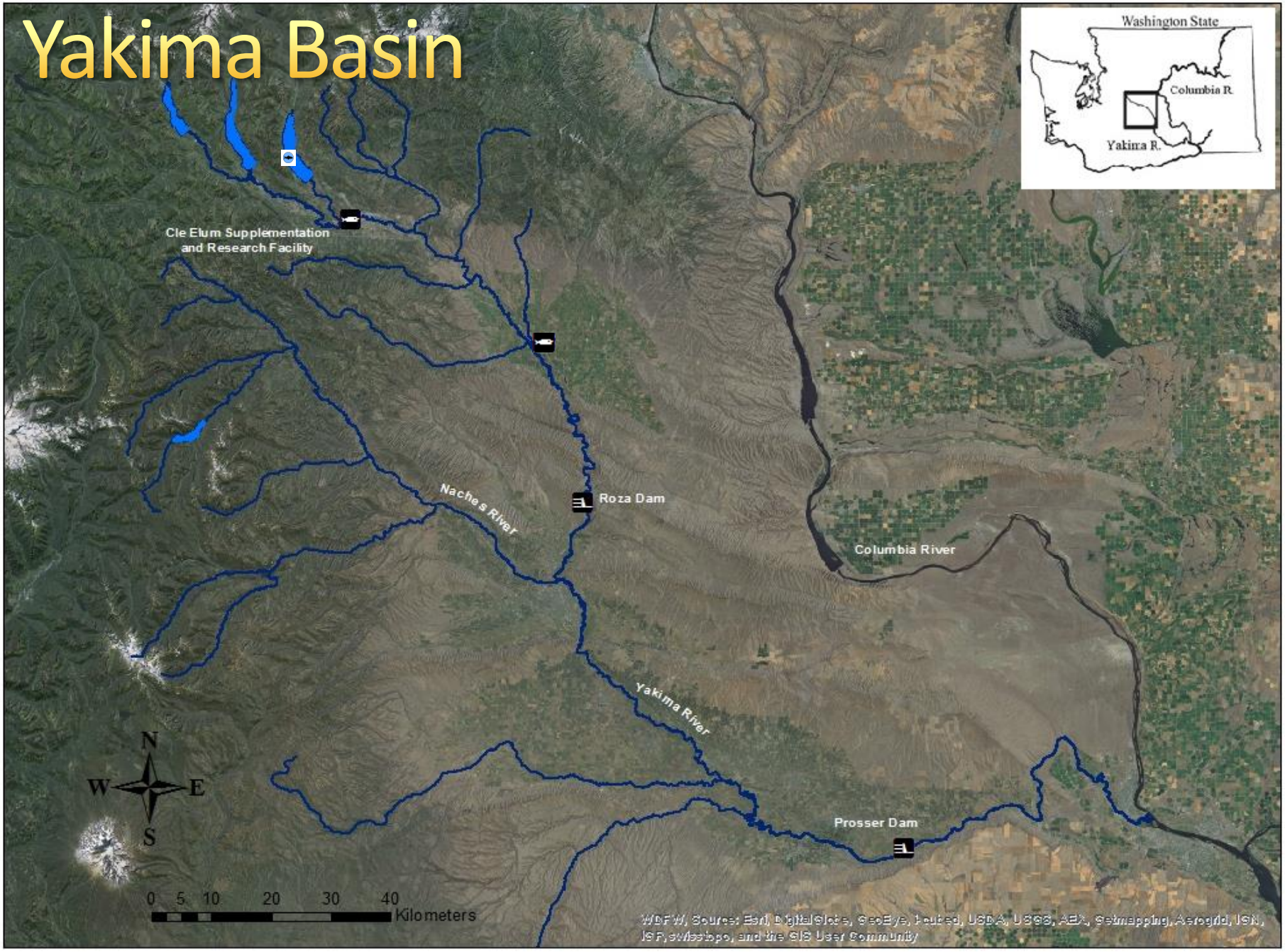
15 20 minutes

- Describe VSP Metrics for upper Yakima *O. mykiss*
  - Important because Steelhead population is depressed and listed as threatened in the Yakima Basin yet our sympatric Rainbow Trout population is robust
  - Steelhead recovery objectives under ESA, but large uncertainty surrounding interactions between life histories that may affect recovery efforts



McElhany et al. 2000, NMFS-NWFSC-42; Crawford and Rumsey 2011; Guidance Document

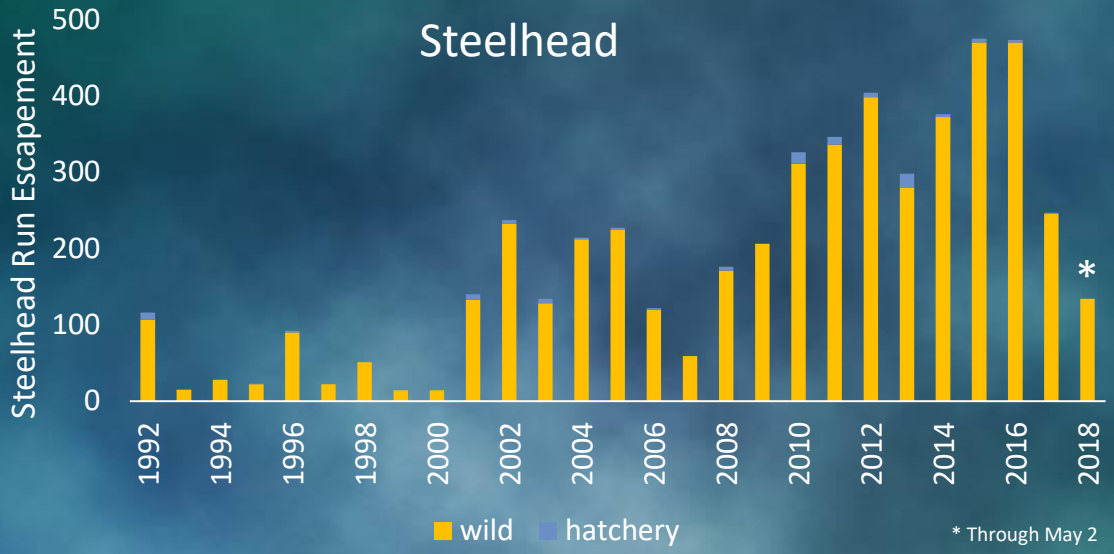
Yakima Basin

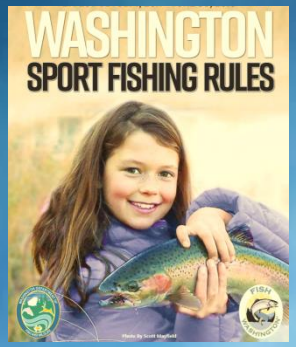


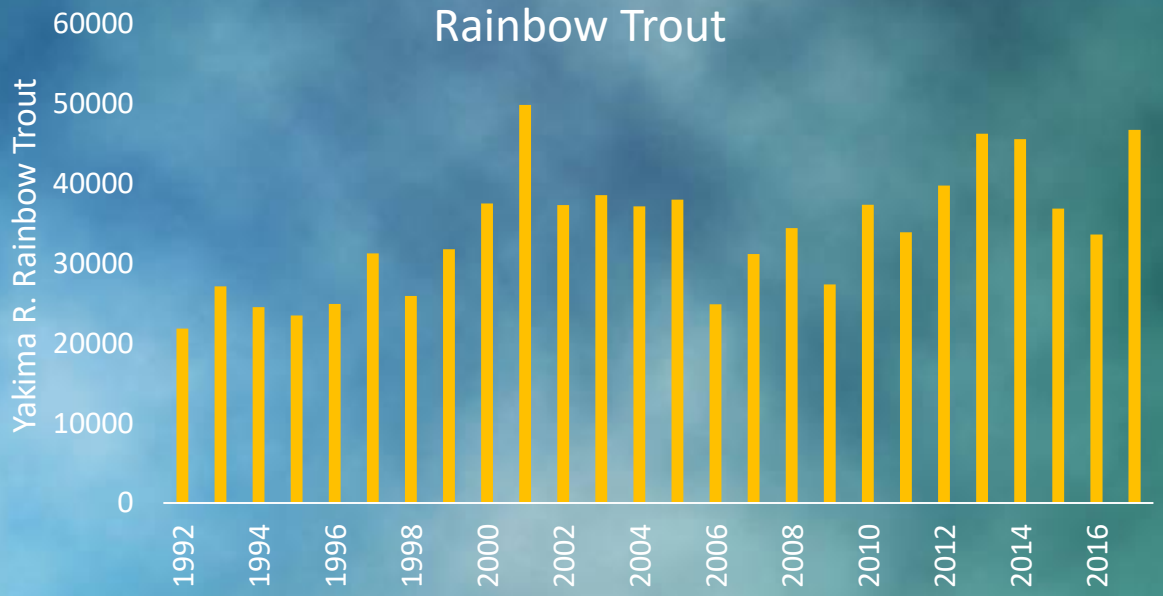
Background – Yakima *O. mykiss*

- 1) Very Little Hatchery Steelhead Influence
- 2) Extensive Hatchery Trout Stocking
  - Goldendale Hatchery, South Tacoma
- 3) Genetic Admixture of Hatchery and Wild trout (Campton and Johnston 1985)
- 4) Overlap in Spawn Timing and Distribution of both Resident and Anadromous *O. mykiss* (Pearsons et al. 2007)
- 5) Rainbow Trout and Steelhead Genetically More Similar in Individual Streams than the Same Life History Forms are Between Streams (Blankenship et al. 2009)
- 6) Courter et al. 2013 report up to 20% of Steelhead kelts originated from resident mothers

So What?


Steelhead
Steelhead Run Escapement
500
400
300
200
100
0
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
*
wild
hatchery
* Through May 2

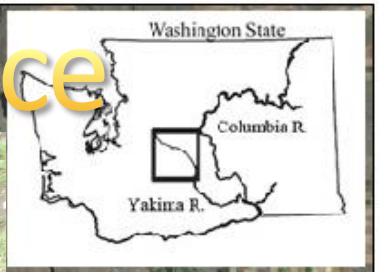

WASHINGTON
SPORT FISHING RULES


Rainbow Trout
Yakima R. Rainbow Trout
60000
50000
40000
30000
20000
10000
0
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016

Objectives

- Determine influence a large resident trout population has on recovery of Steelhead
- Employ large scale PIT tagging project
- Couple with a basin scale genetic parentage assessment
- Get a handle on how many smolts are produced from where
- And who their parents are
- Explore factors influencing anadromy
  - Genetics vs Environment

Steelhead Spawner Abundance



Cle Elum Supplementation and Research Facility

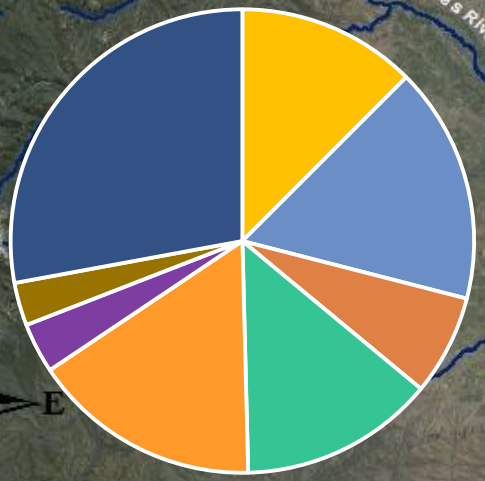
Roza Dam

Nache s River

Yakima River

Prosser Dam

Steelhead Spawner Distribution



N
W E
S

SWK TAN MST NFT MFT/WFT MAN UMT YAK

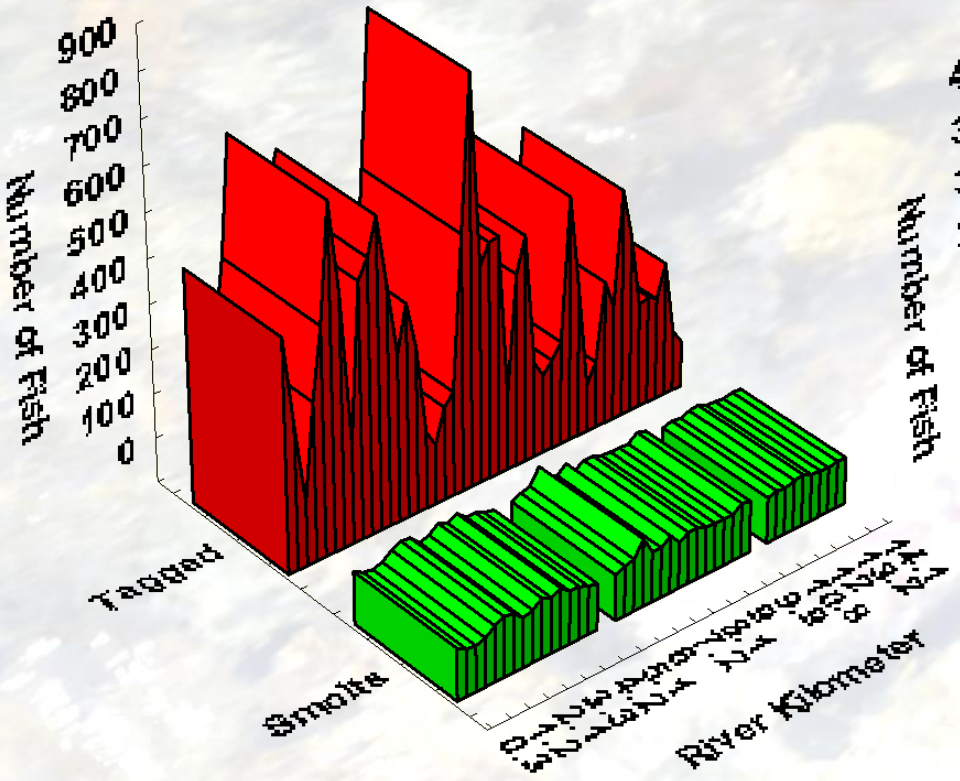
0 5 10 20 30 40
Kilometers

WDFW, Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

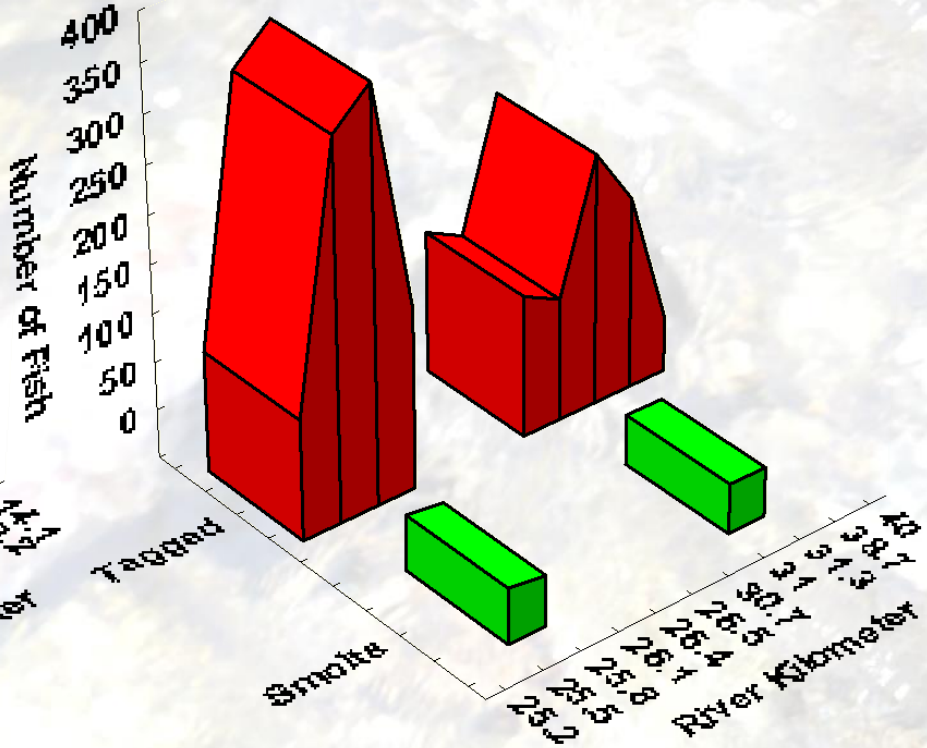
Juvenile Sampling


Strait of Juan de Fuca
101
Everett
2
Washington
Seattle
405
90
Tacoma
Olympia
12
30
26
82
182
Kenne
97
84
205
Portland
Image Landsat / Copernicus
© 2018 Google
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Migrant Production per Rkm

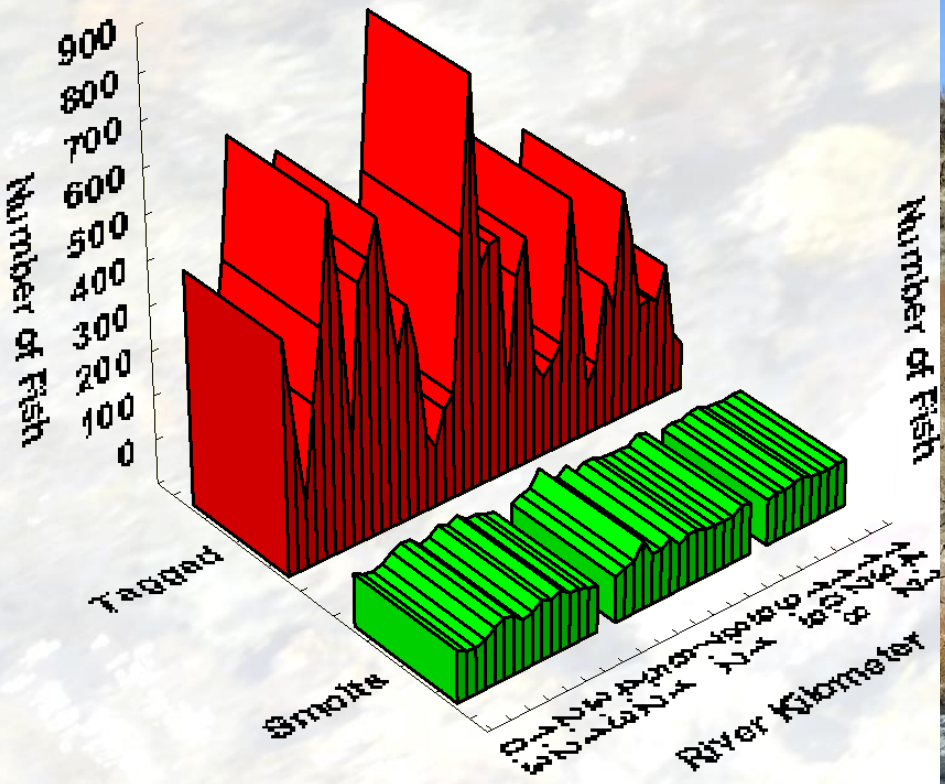


North Fork Teanaway River



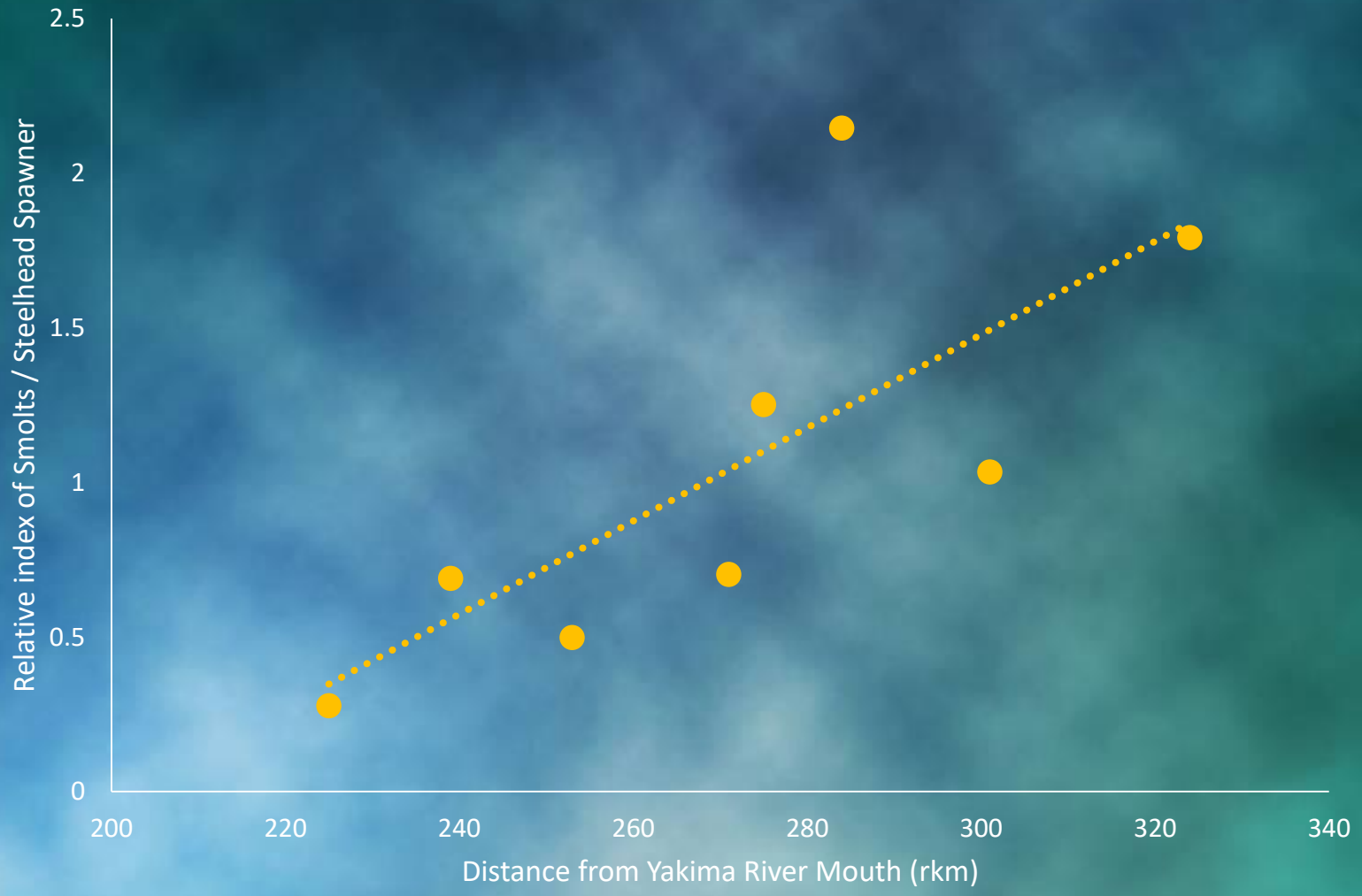
Wenas Creek

Migrant Production per Rkm

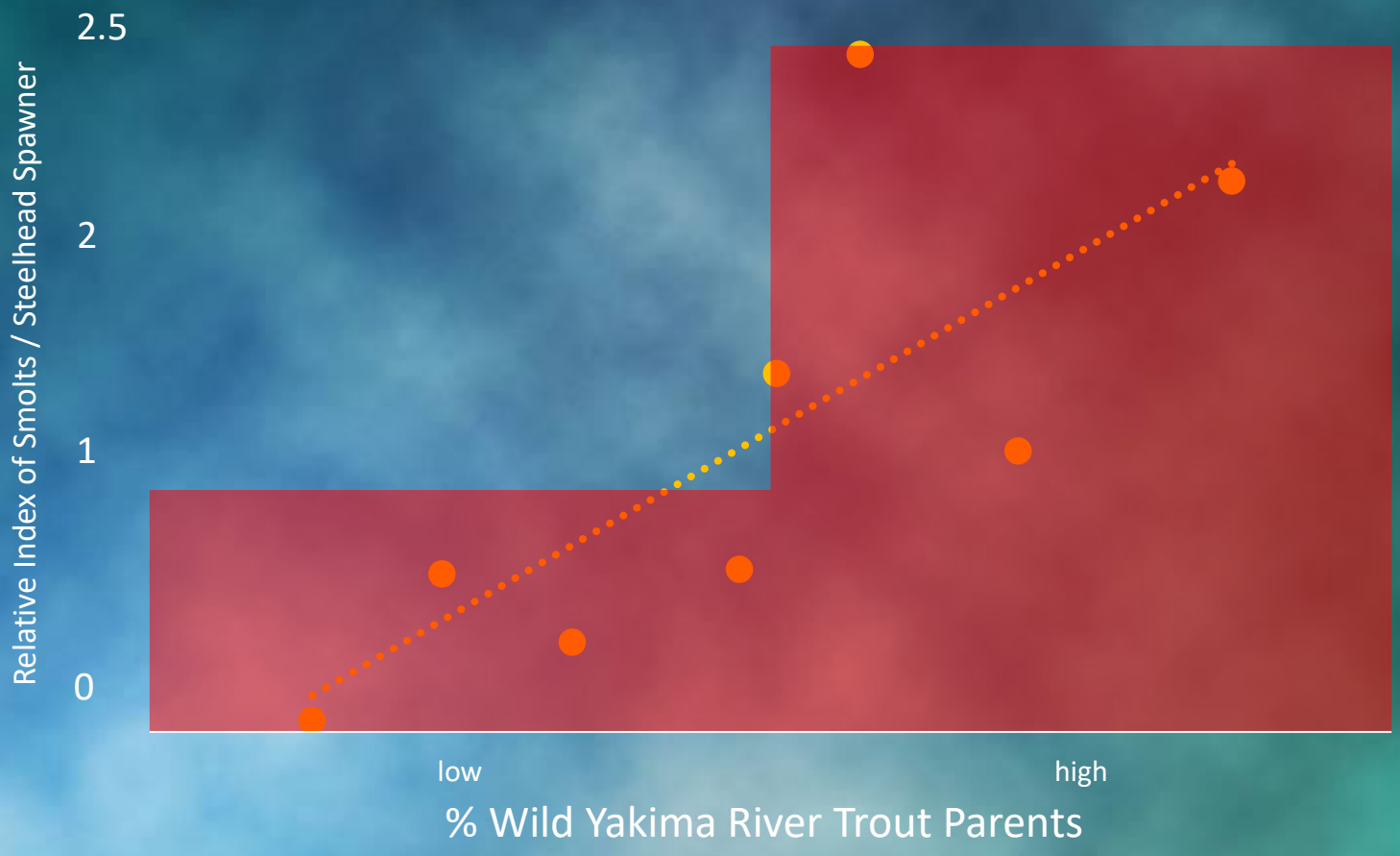


North Fork Teanaway River

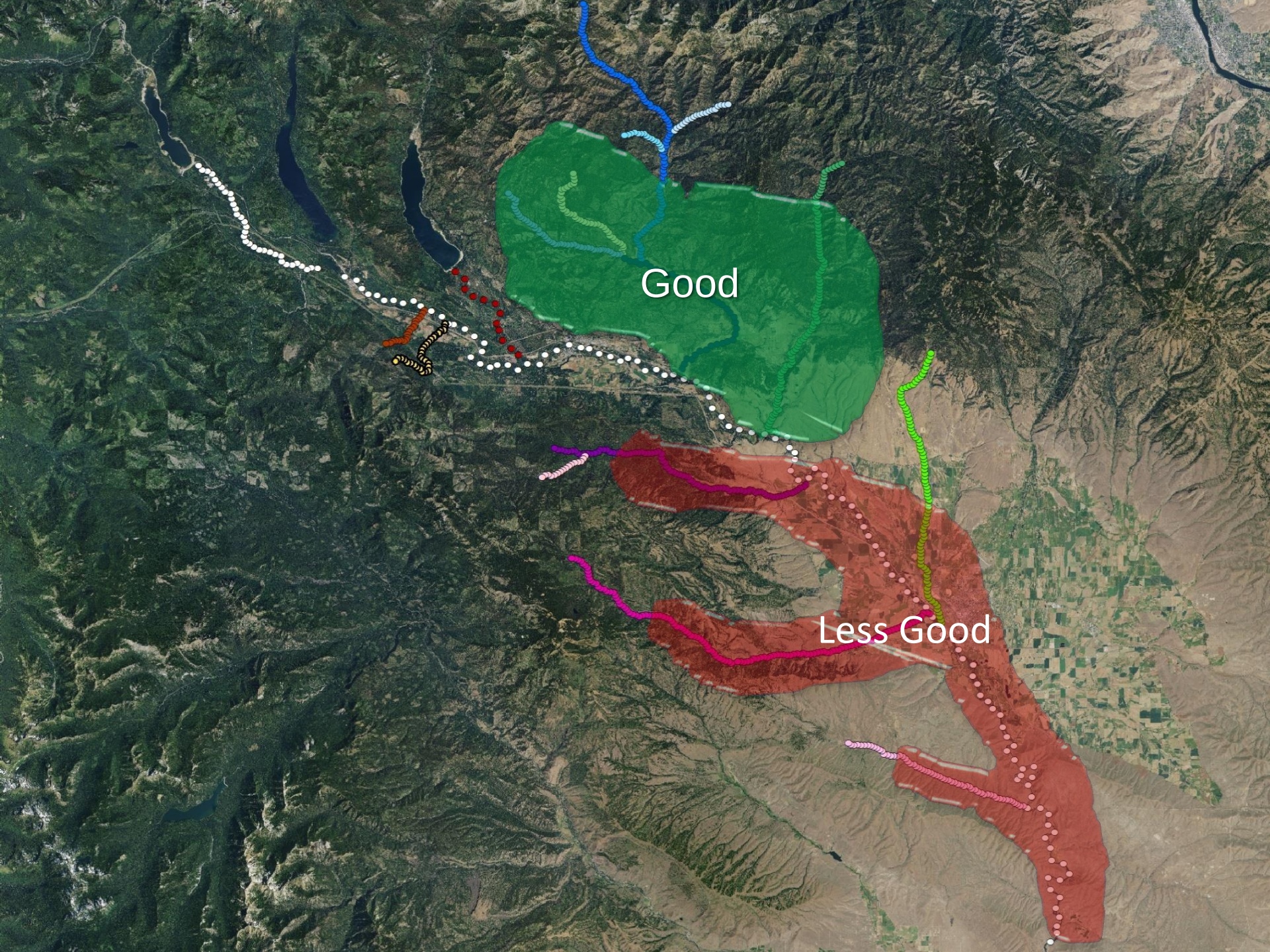
Smolts/Spawner by Location

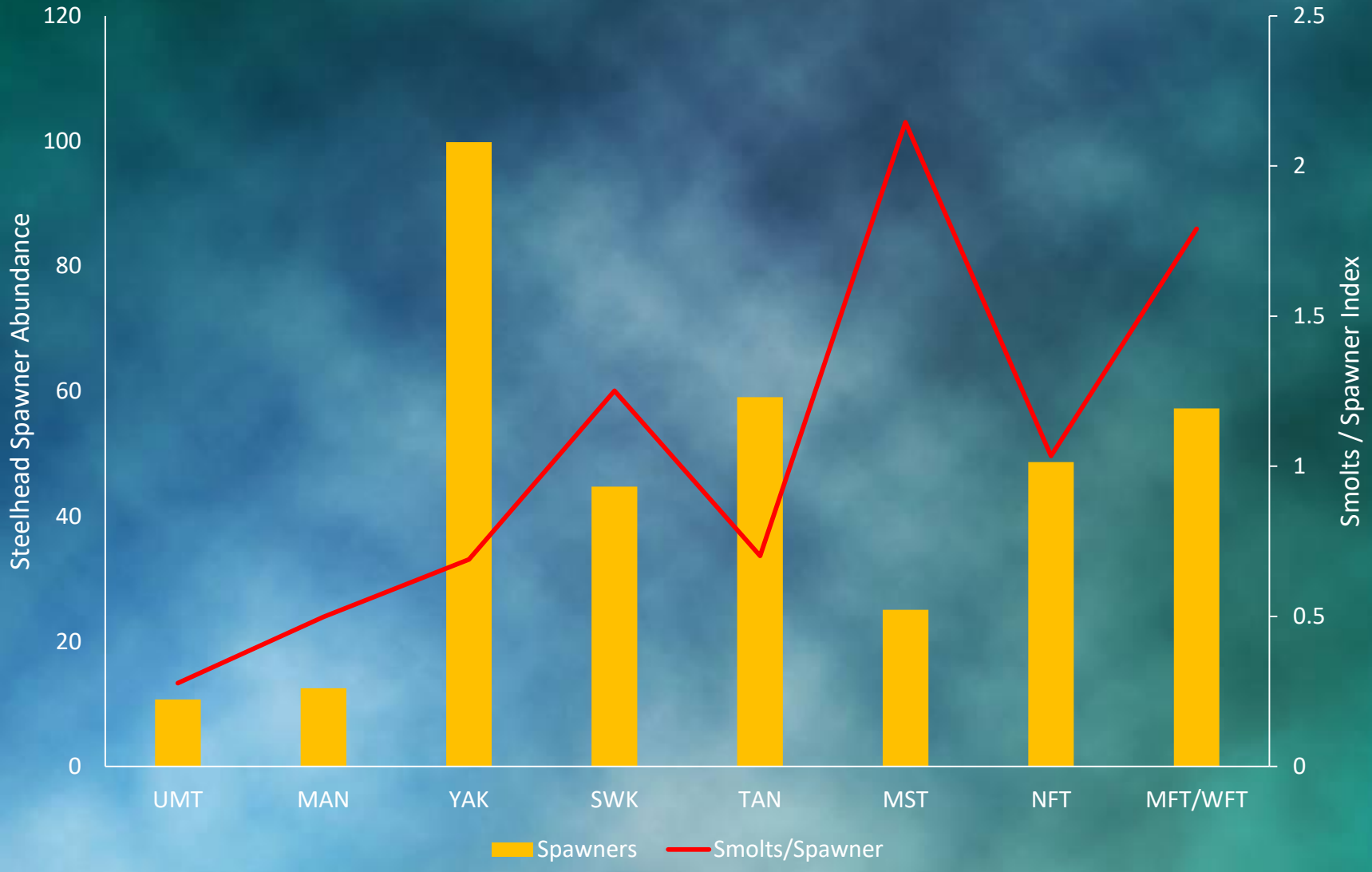


% Wild Parental Origin (Rainbow Trout)

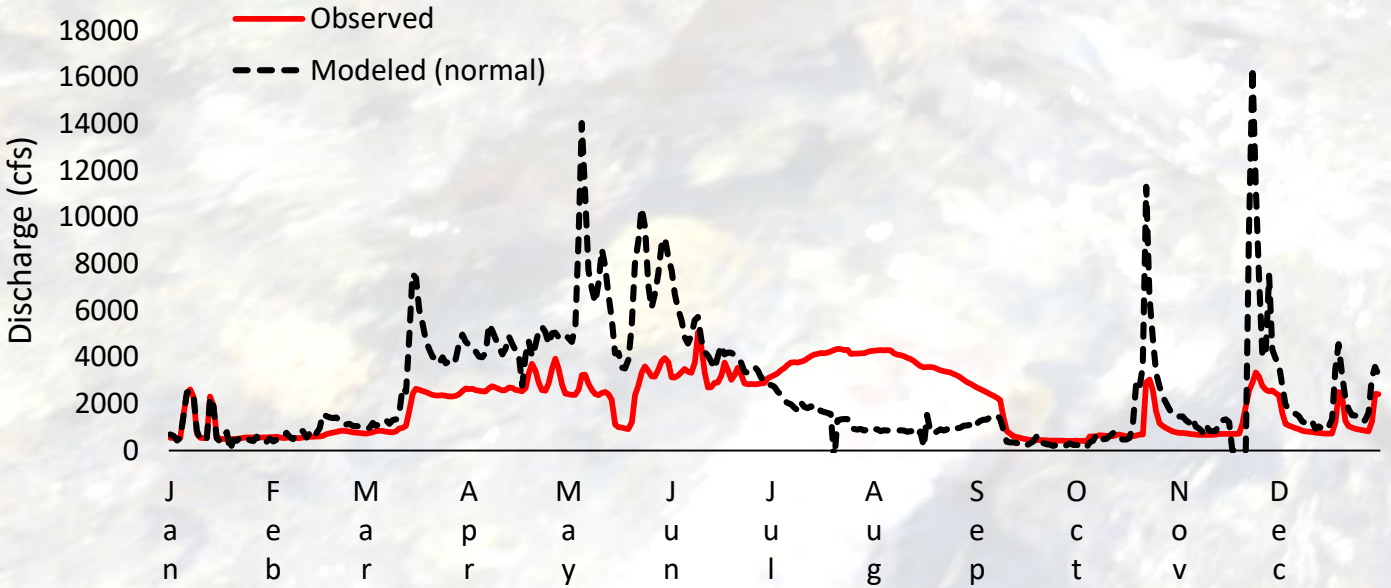


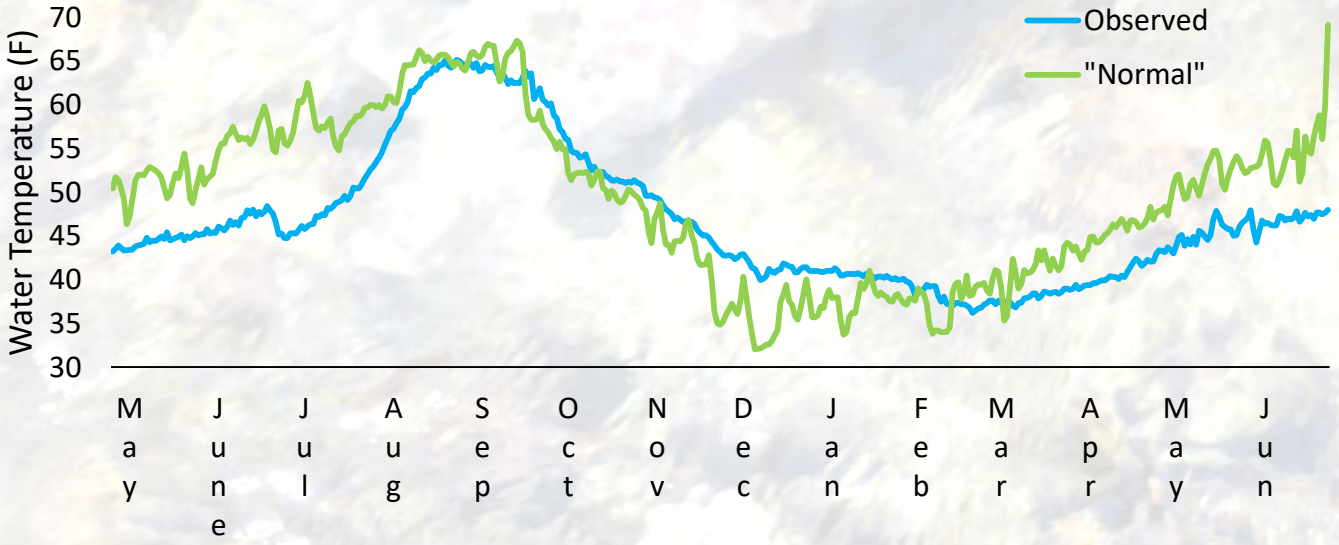
Pearsons et al. 2007


Good
Less Good

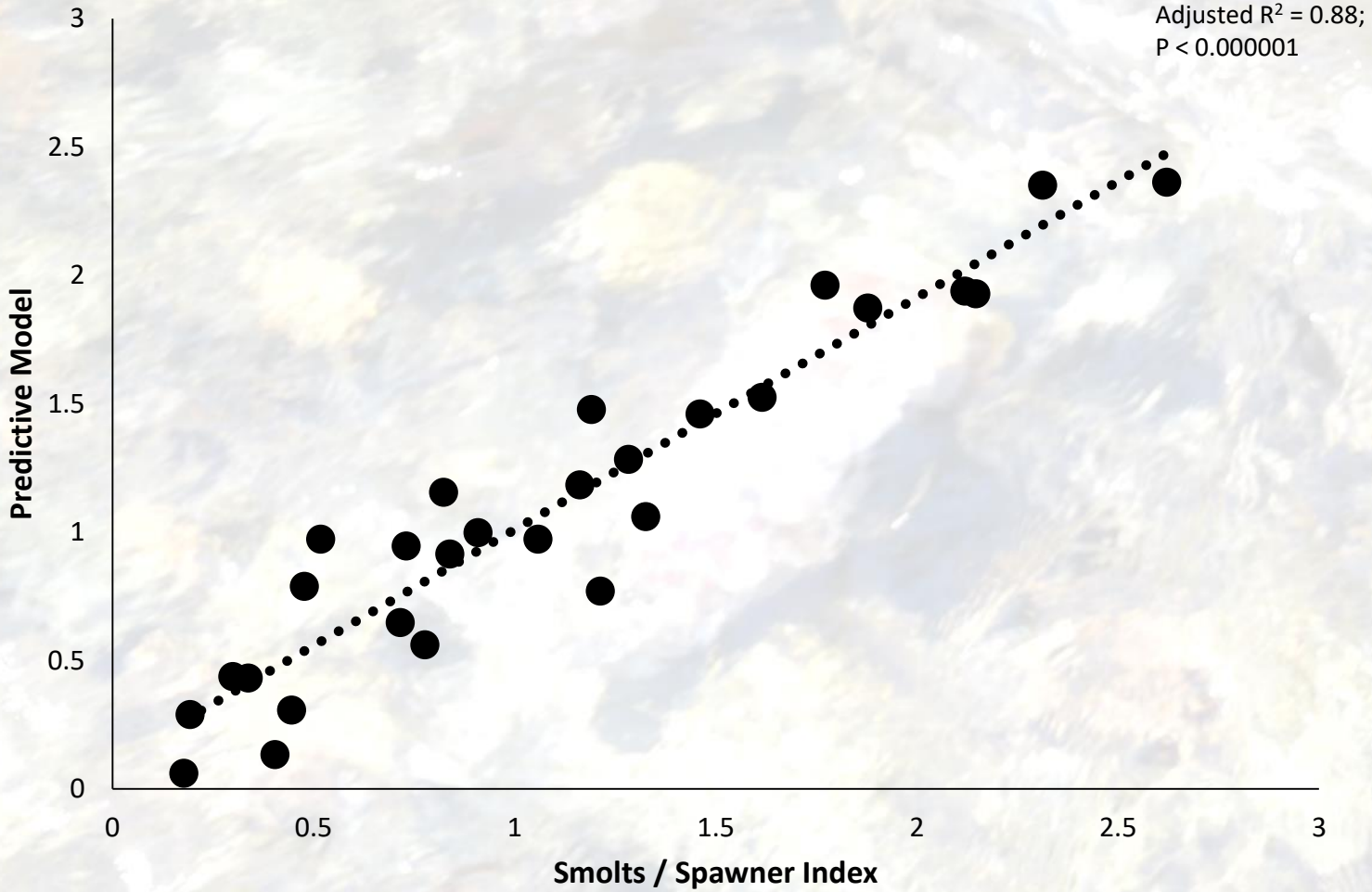

120
100
80
60
40
20
0
Steelhead Spawner Abundance
2.5
2
1.5
1
0.5
0
Smolts / Spawner Index
UMT
MAN
YAK
SWK
TAN
MST
NFT
MFT/WFT
Spawners
Smolts/Spawner

Yakima River Conditions



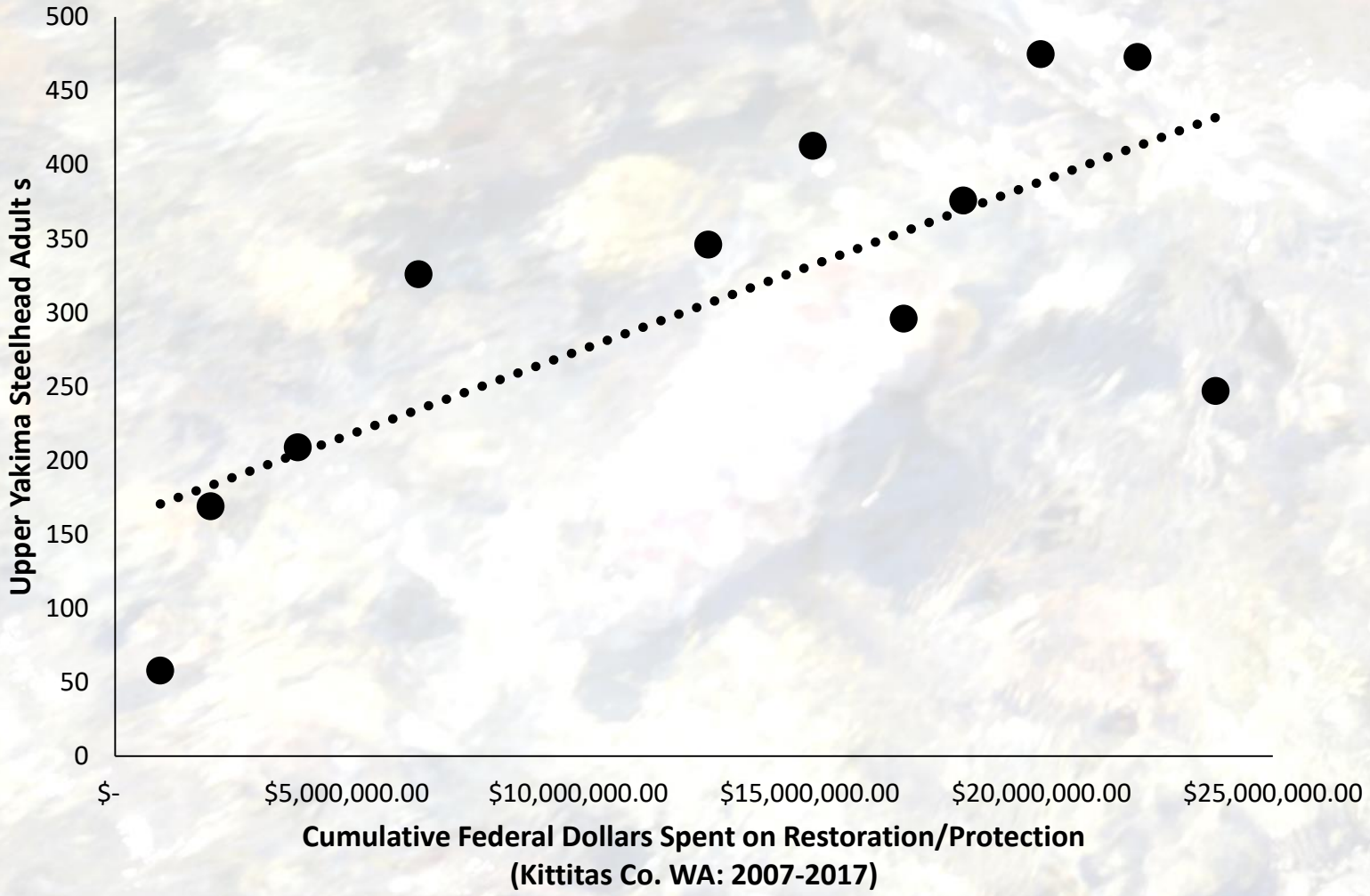


Tribs- Potential Explanatory Variables



Factors include summer baseflow discharge, stream size, August water temp, trout density, habitat complexity Index, and amount of pool habitat

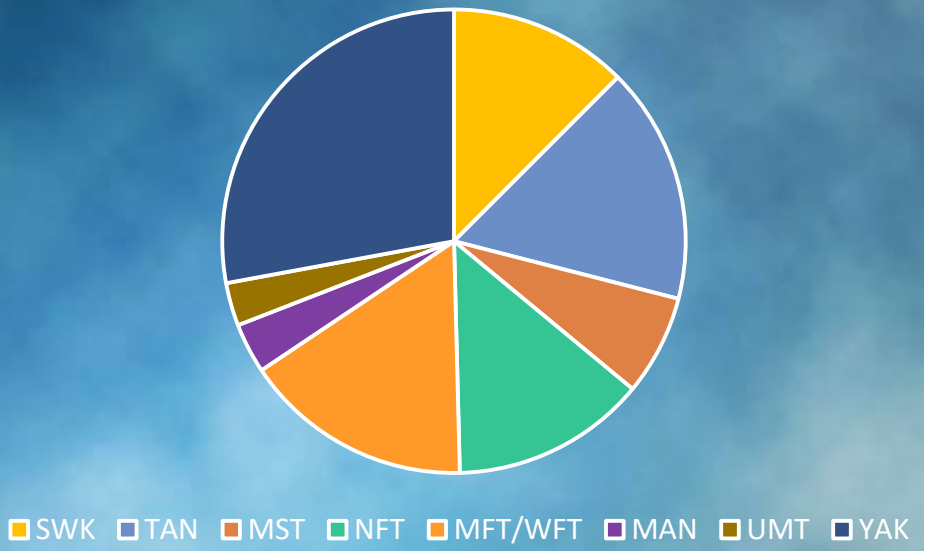
Restoration vs. Steelhead

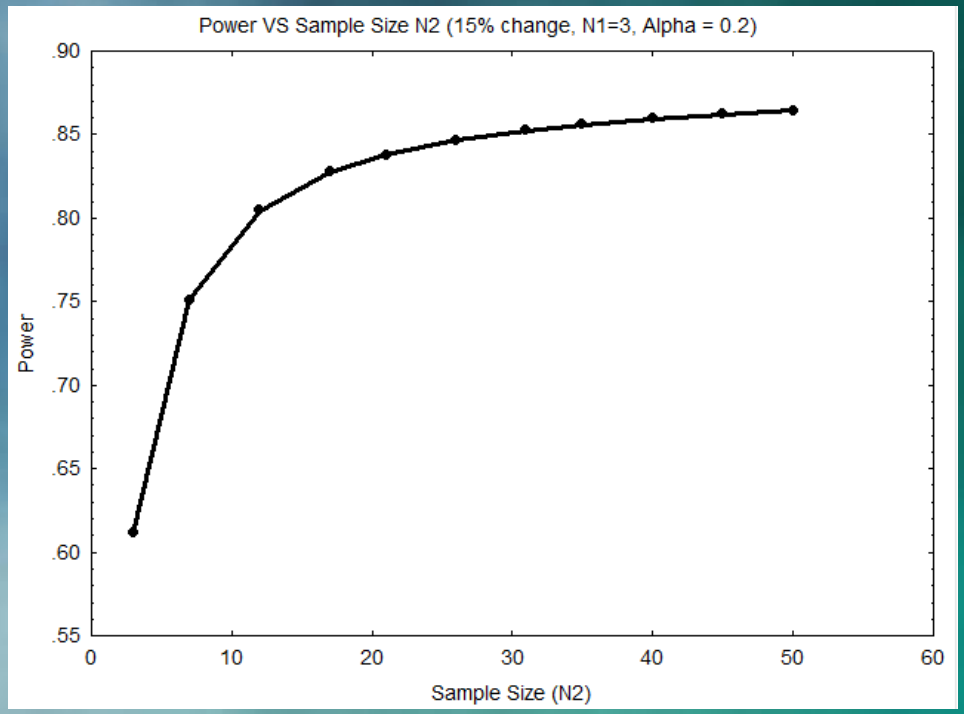


Spatial Structure

- NMFS Recommendation-Determine spatial distribution with the ability to detect a change in distribution of ± 15% with 80% certainty.

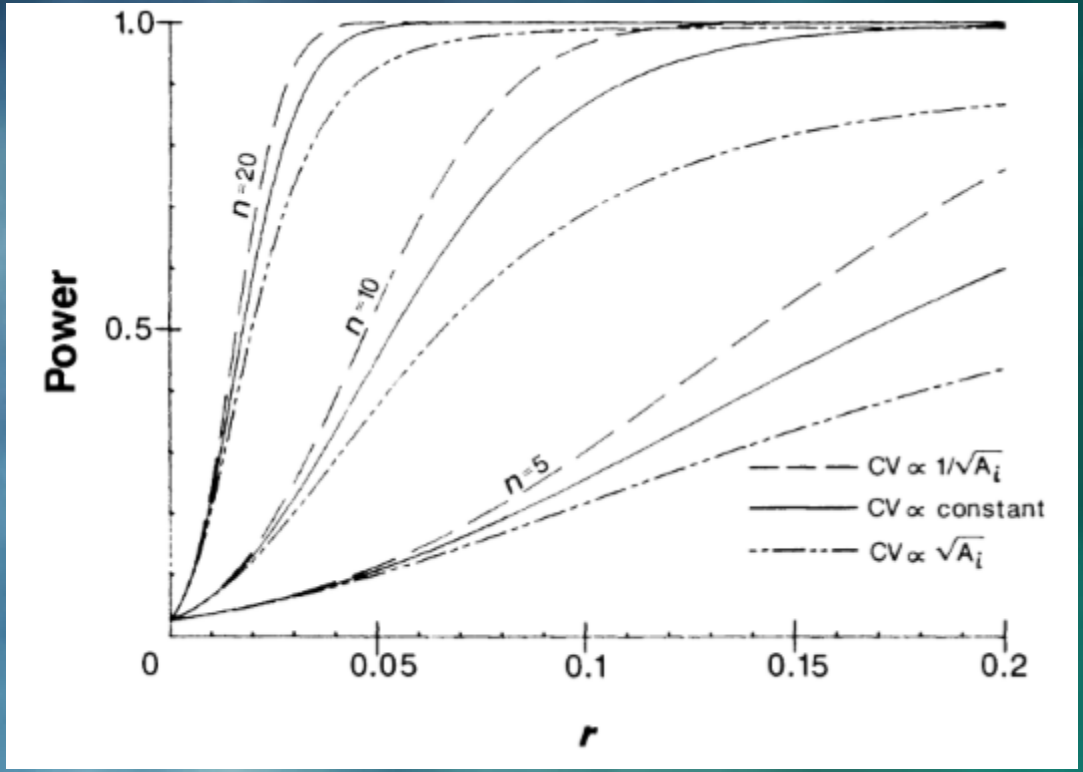
Steelhead Spawner Distribution





Diversity

- Run timing
- Sex ratio's
- Age at maturity
- Spawn timing
- Age distribution
- Size structure
- Genetic sampling
- Life history expression



Gerrodette, T. 1987.
Power Analysis for Detecting Trends.
Ecology 68:1364-1372.

Summary

- Upper Yakima River *O. mykiss* may be genetically predisposed to a resident life history and current conditions likely favor that life history pathway
- Likely different drivers of life history expression in different geographical areas of the basin
- Interdependency of life histories and their interaction with the environment suggest restoring habitat features that favor one life history or another will be more effective than managing adult spawning (McPhee et al. 2007)
- *O. mykiss* life history interaction stuff is complicated