

# Salmon Ecosystem Vital Signs

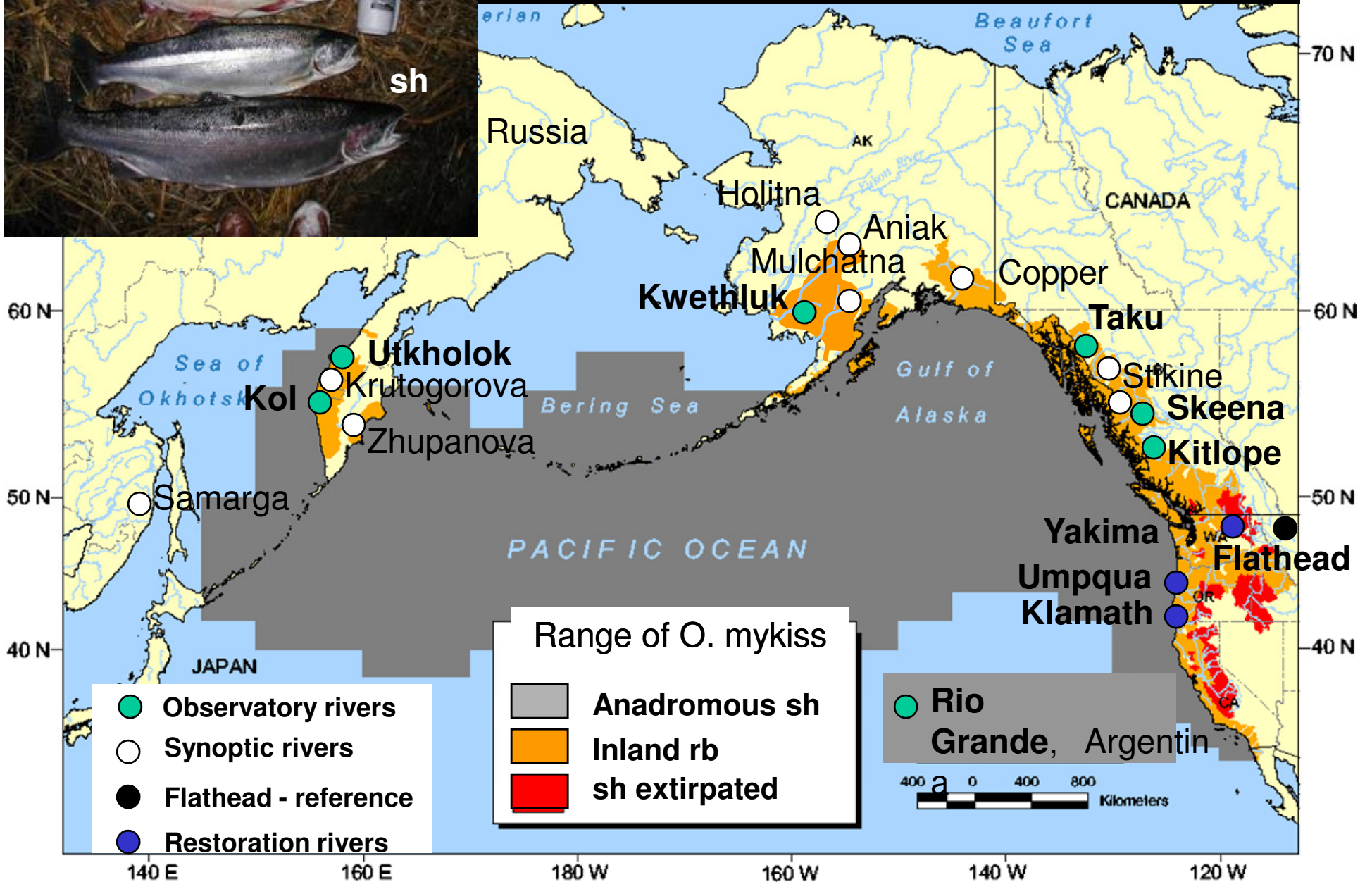
- Sustained return of spawners to all spawning habitat in numbers that provide conservative accounting for environmental variation.
- Sustained habitat-specific density and growth of juveniles.
- High habitat connectivity and productivity in freshwater, estuary and ocean (shifting habitat mosaic)
- Natural or normative hydrology
- Natural or normative temperature patterns
- Productive, biodiverse food webs with strong riparian linkages and sustained MDN inputs (salmon carcasses, naturally deposited after spawning)
- High salmonid biodiversity (diverse life histories)
- Natural or normative water chemistry (minimal pollution)
- No cultured stock introductions or supplementations

Vital signs must be quantified by routine monitoring with rigorous statistics and adaptive models that unambiguously demonstrate trends and allow comparison to patterns at a suite of unaltered reference (observatory) sites



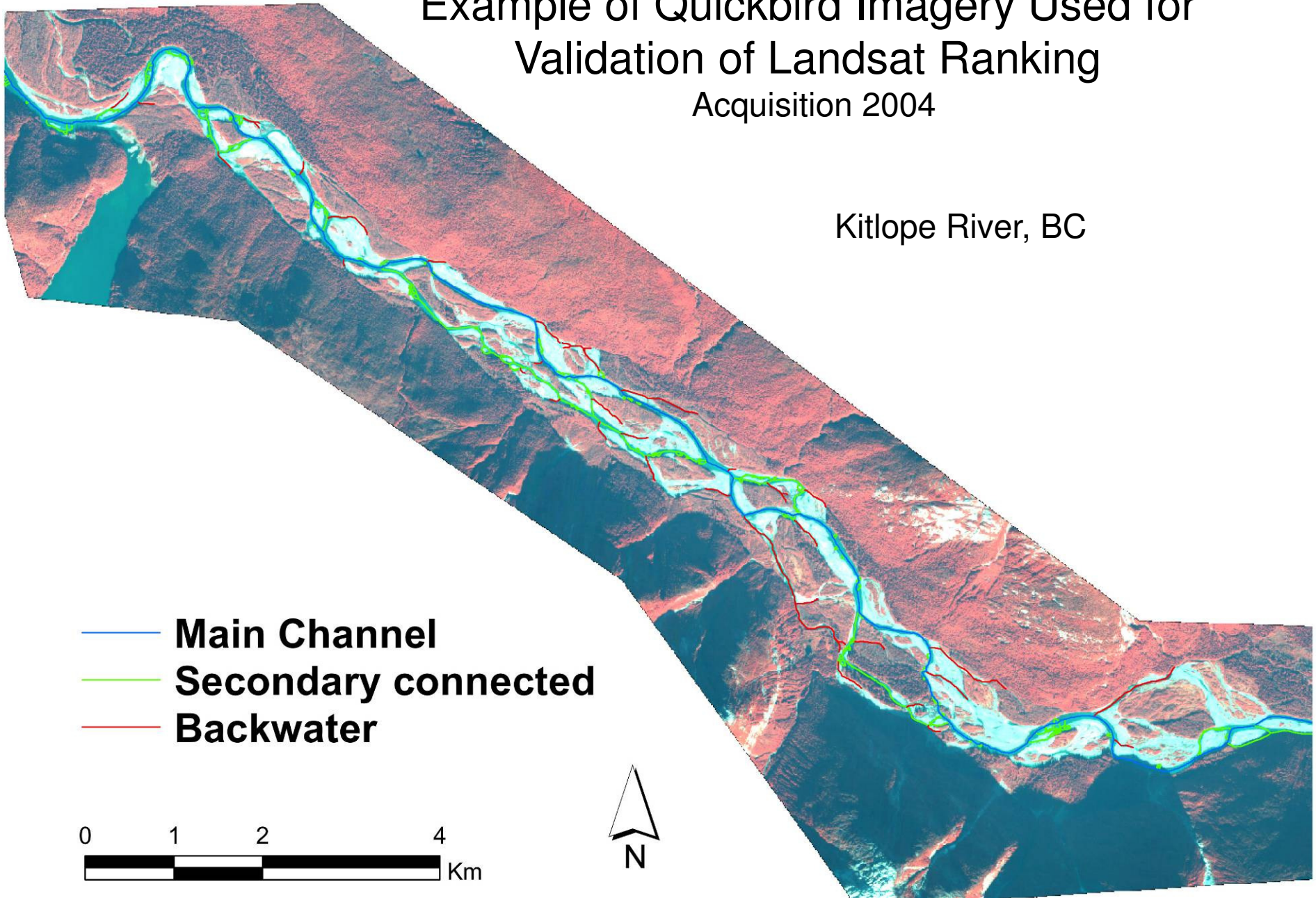
# Salmonid Rivers Observatory Network (SaRON)

Flathead Lake Biological Station, University of Montana



# Example of Quickbird Imagery Used for Validation of Landsat Ranking Acquisition 2004

Kitlope River, BC



- Main Channel
- Secondary connected
- Backwater

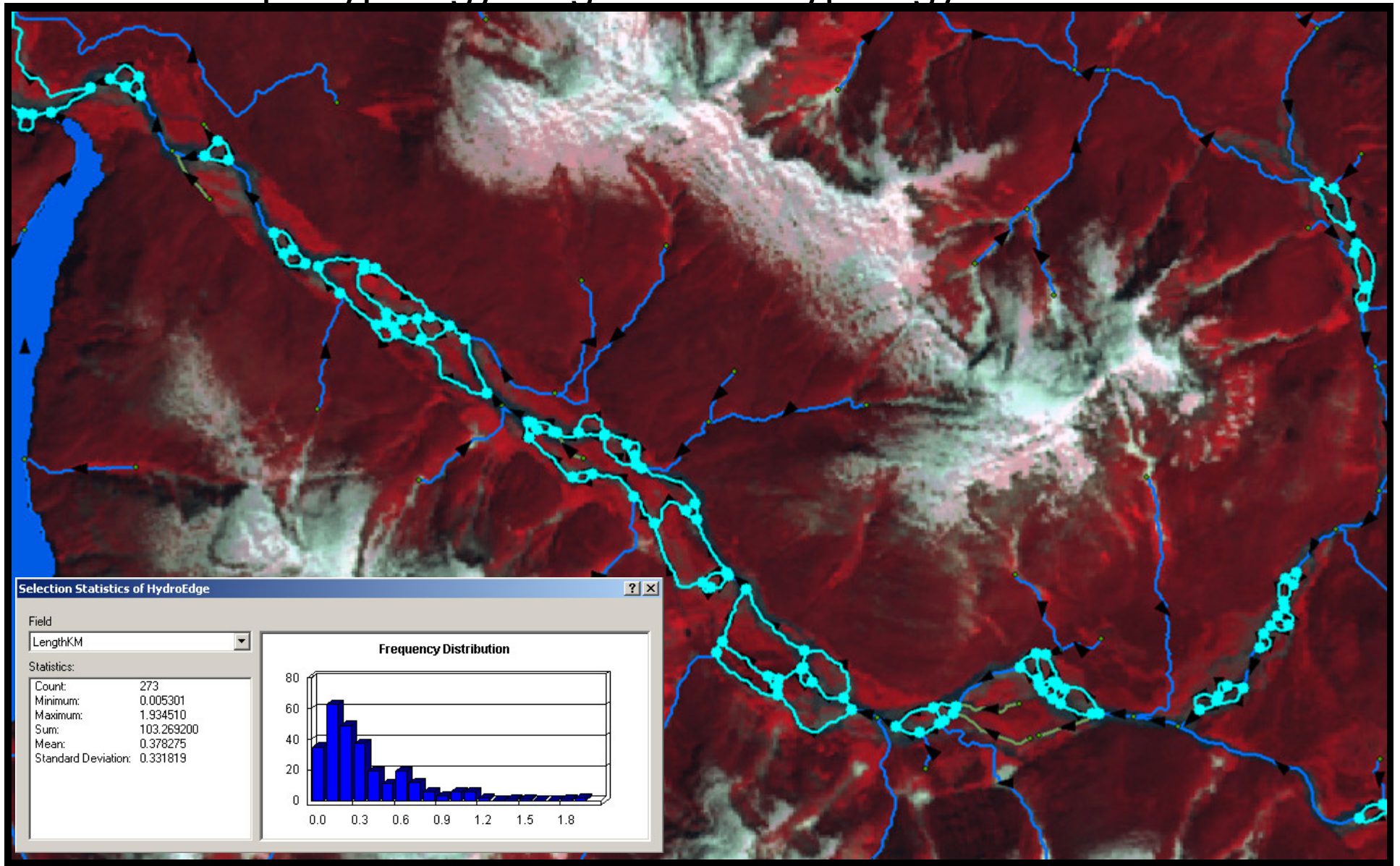
0 1 2 4 Km



# FLBS River TYPOLOGY Database

provides coarse classification of geomorphic complexity

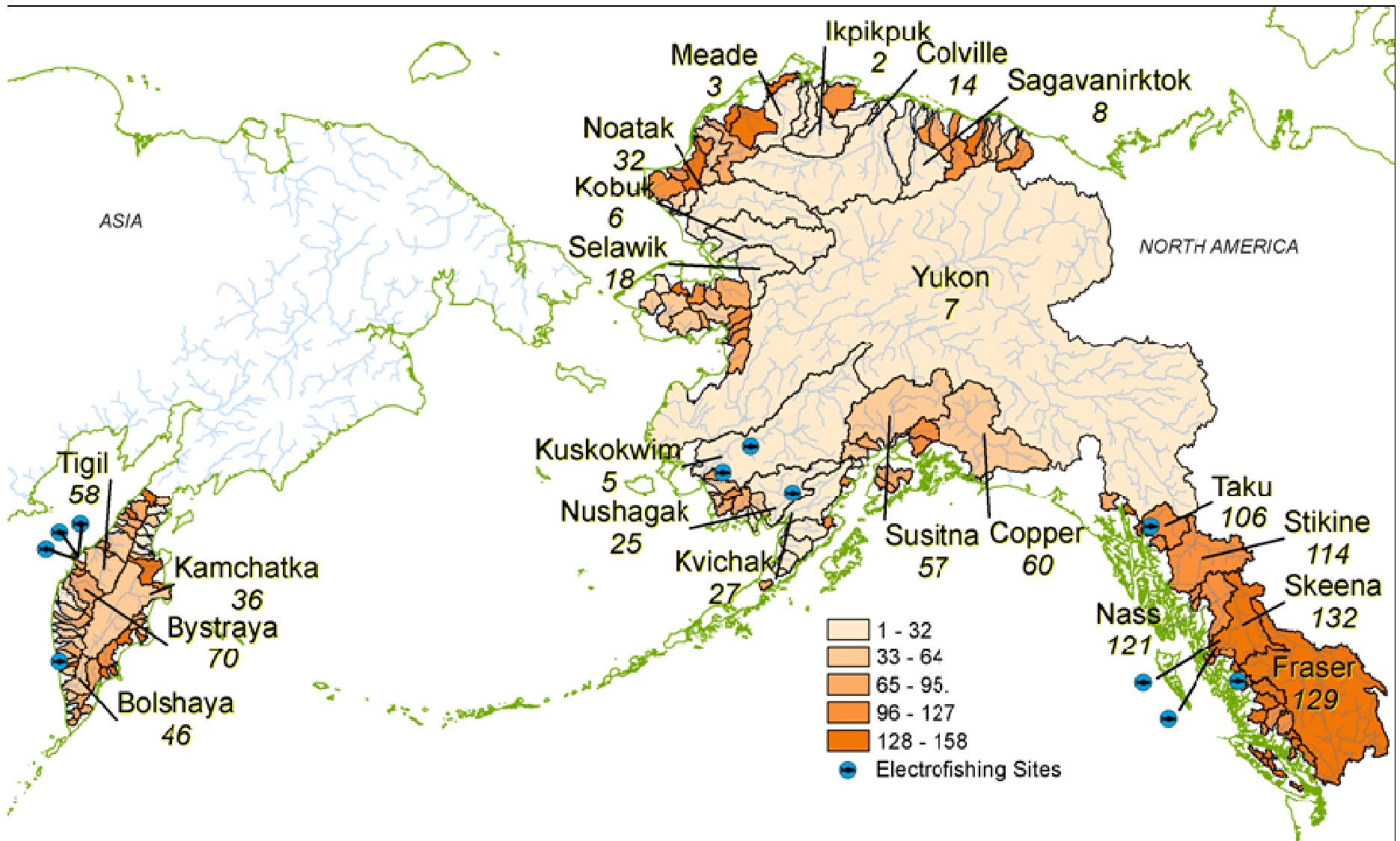
[http://typology.ntsug.umt.edu/typology\\_index.htm](http://typology.ntsug.umt.edu/typology_index.htm)



# Typology Metrics

- Elevation (Range, Coefficient of Variation, Median, Mean, Minimum, Standard Deviation, Maximum)
- Nodes (Density, Abundance)
- Water Bodies (Perimeter Area, Density, Area Ratio, Average Area, Abundance, Standard Deviation of the Area, Total Length, Total Area)
- Location (Longitude, Latitude)
- Flood Plains (Abundance, Sinuosity Number, Total Length, Total Area, Area Ratio, Average Area, Density, Standard Deviation of the Area, Sinuosity)
- Watershed (Area, Length, Perimeter Area)

## Ranking Rivers of the Pacific Rim by Physical Complexity



Rankings for the 158 catchments over 1,000 km<sup>2</sup> as mean of principal components and mean feature class physical complexity. Labels are for the 22 catchments larger than 10,000 km<sup>2</sup>.

Matt Luck, N. Maumanee, J. Kimball, J. Stanford, M. Lorang, D. Whited. Submitted ms.

# Typology Website

<http://typology.ntsg.umt.edu>

- Results are represented as thematic maps.
  - Select Ranking results from the drop-down on the upper left corner.
- The [Analysis](#) interface allows users to query the database.
  - The Subwatershed tool allows users to delineate a subwatershed on the fly and summarize typology variables.
- Database queries run from the analysis page output results that may be downloaded.
  - This may then be incorporated into another GIS to examine relationships with field data.

# Typology Website – Floodplain Rank Map

About opens overview instructions for the website

Attribute Query – Type in name

Spatial Data Download Page

© 2009 The North Pacific Rim Typology Project

Left click on a polygon to see name and rank

# Typology Website – Lake Rank Map

The screenshot shows a web browser window displaying the 'Typology Overview' page. The browser's address bar shows 'http://typology.ntsg.umt.edu/'. The page header includes the title 'The North Pacific Rim Typology Project' and a sub-header 'Conducted by the Flathead Lake Biological Station with support from the Gordon and Betty Moore Foundation'. Below the header is a navigation bar with buttons for 'About', 'Analysis', 'Typology DB Query', and 'Data Download'. A 'SELECT MAP:' dropdown menu is set to 'Lake'. The main content area features a map of the Pacific Northwest region, with lakes colored according to their rank. A legend on the right side of the map, titled 'Lake Rank', provides a color key for the ranks: 1-12 (yellow), 13-25 (light green), 26-37 (medium green), 38-50 (dark green), 51-62 (teal), 63-75 (blue-green), 76-87 (blue), 88-100 (dark blue), and 101-112 (darkest blue). Below the legend, it lists 'Variables include: WTB\_Z\_MEAN, WTB\_A\_RATIO, WTB\_DENSITY' and notes 'Data rescaled between 0 and 1' and 'Relative rank determined'. The footer of the page includes logos for 'The University of Montana Flathead Lake Biological Station' and 'NTSG'. Annotations with arrows point to various elements: 'Result Map Dropdown' points to the 'SELECT MAP:' dropdown; 'Map Controls – zoom in and out' points to the zoom controls on the map; '- Left Click and hold to Pan' points to the map area; 'Map Legend' points to the legend box; and 'Variables used in Rank' points to the list of variables.

Result Map Dropdown

Map Controls – zoom in and out

- Left Click and hold to Pan

Map Legend

Variables used in Rank

Feature Rank Maps depend on presence or absence of feature (ex. - lakes)

# Analysis Map Interface

Basins with user-selected feature ranges

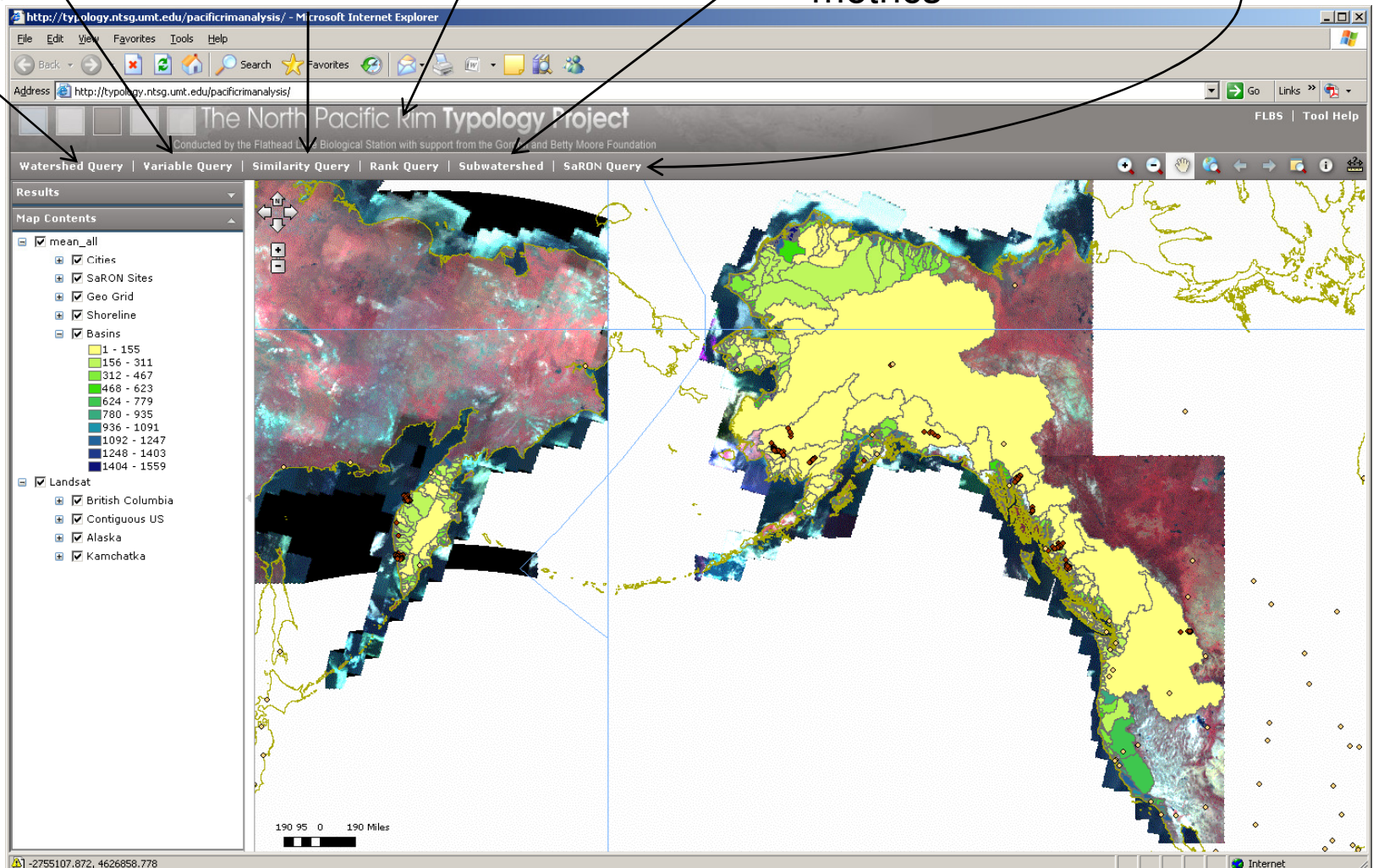
Identifies Basin

Similar basins based on rank

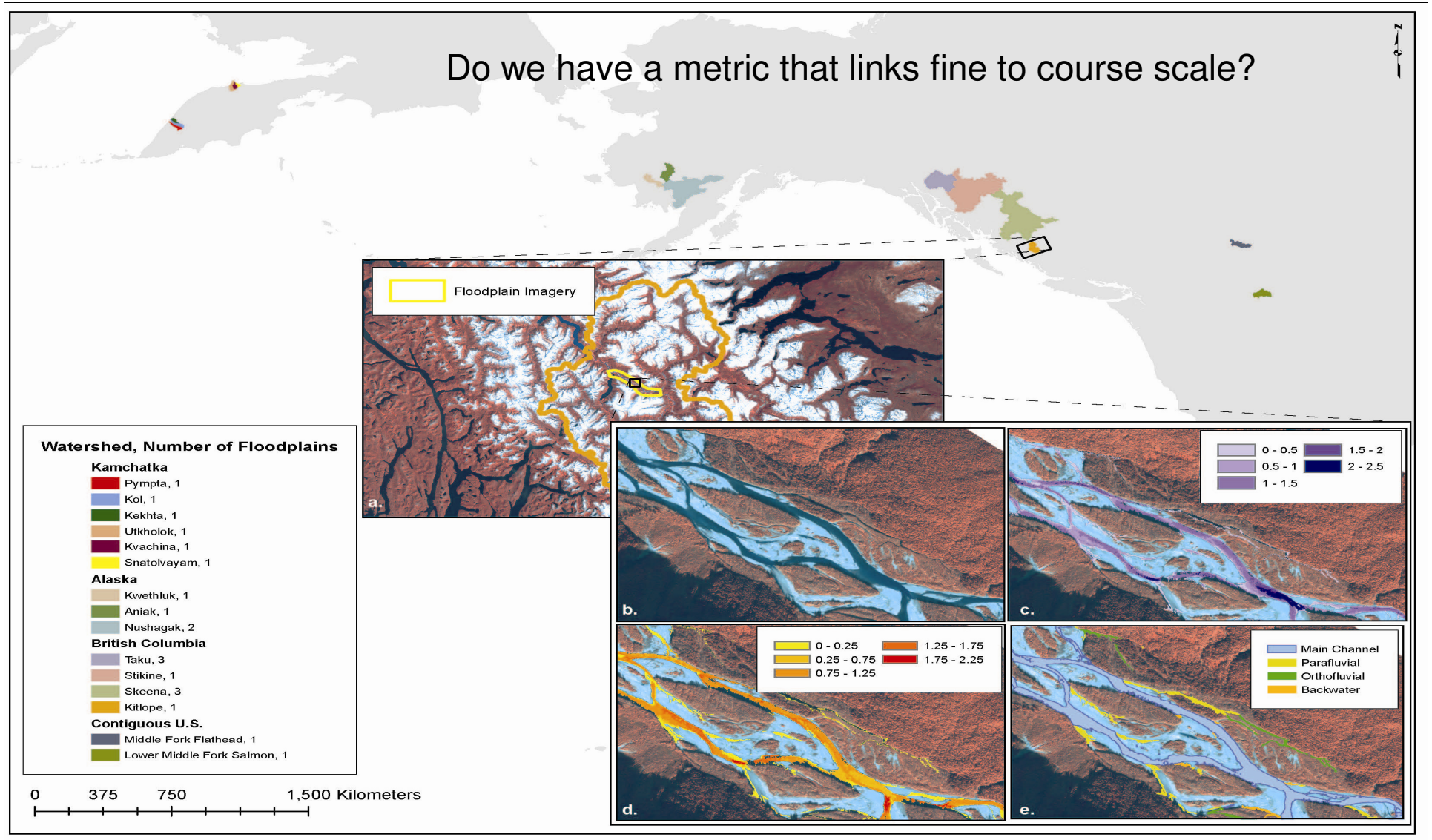
Multiple basins based on rank

User defined sub-basin metrics

SaRON Database Summary

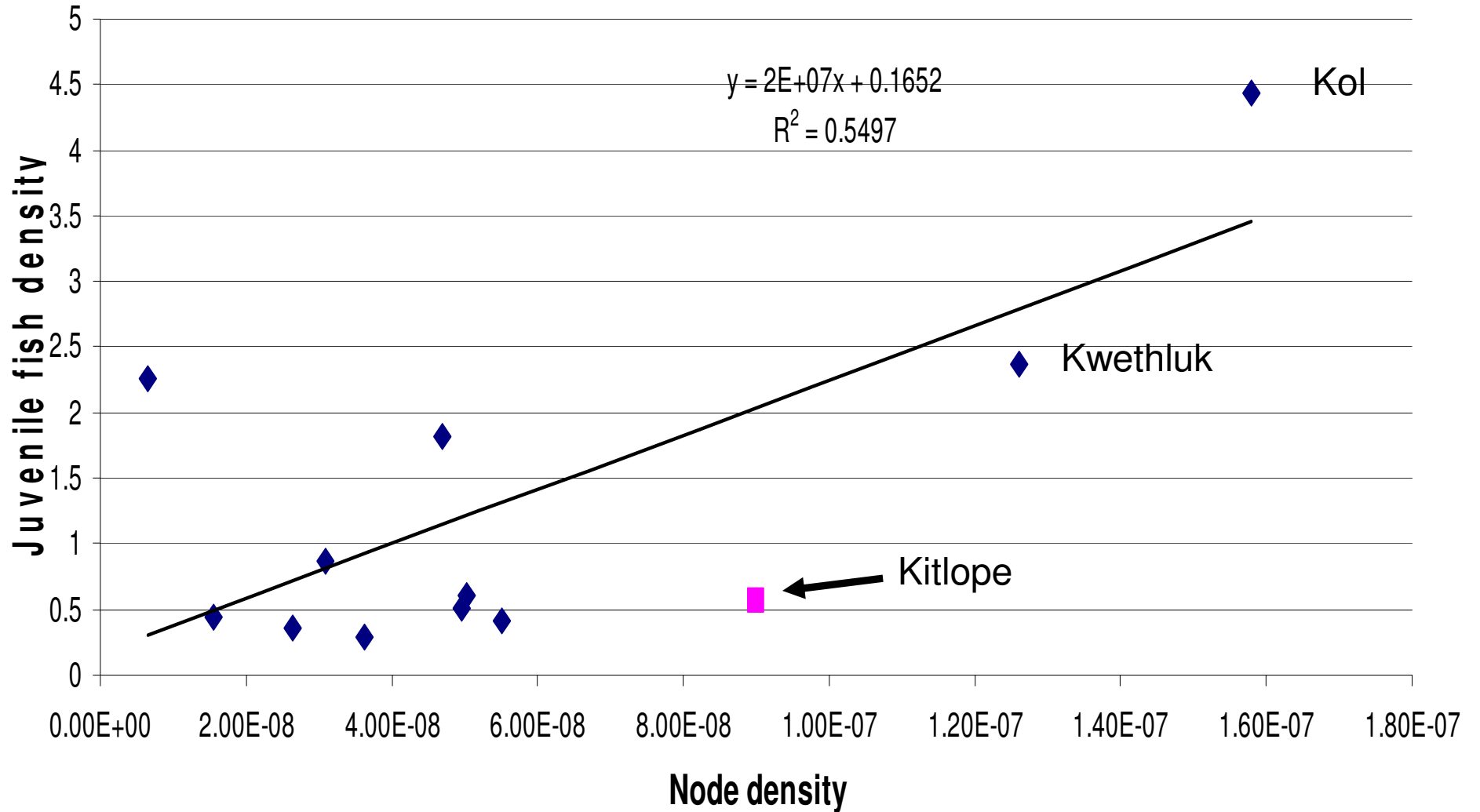


Do we have a metric that links fine to course scale?

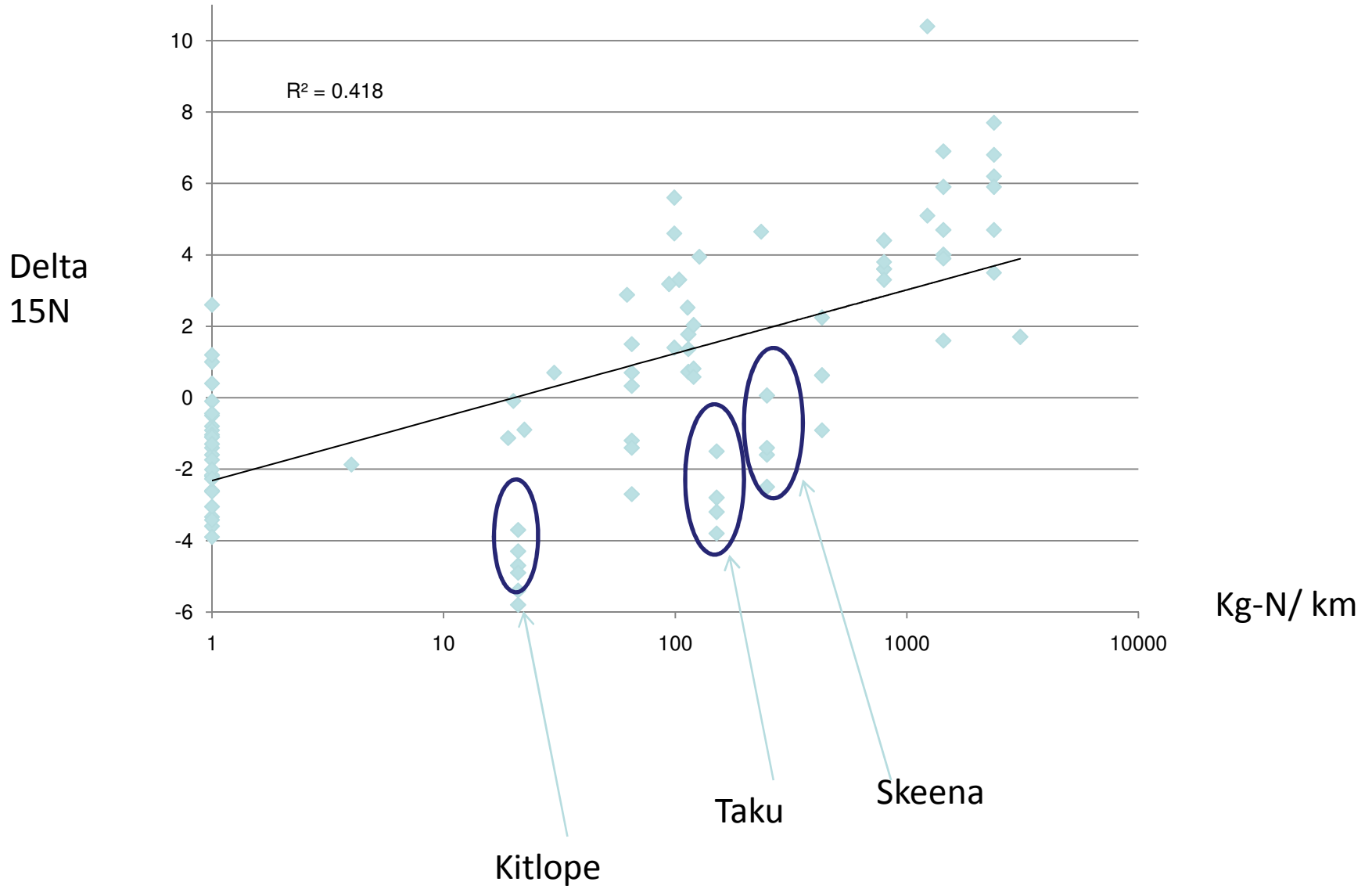


As of this morning, “using 22 quickbird floodplains, the % abiotic (cobble & water) scales the best with landsat ( $r^2 = 0.99$ ), followed by the # of nodes ( $r^2 = 0.81$ ), and then sinuosity ( $r^2 = 0.79$ )” - Diane Whited, FLBS

SaRON data only – average density of all salmonid juveniles per square meter across all habitats during ice free months, 2005-08



Foliar MDN as function of carcass N loading – high end rivers are the most complex ones (MDN feedback very strong) but relationship moderated by glacier outwash and also likely by harvest legacy.



your attention!!

Thanks to the  
funders (Moore, Walton)

's.



# SaRON Partner Organizations



Yukon Delta N.W.R.

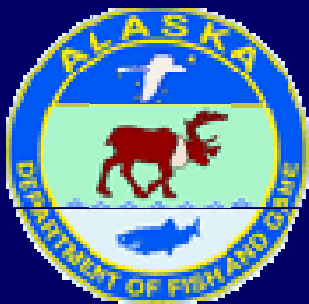


Tahltan/Iskut First Nation

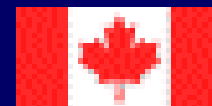
University of Washington  
Montana State University  
University of Idaho



Wild Fishes and Biodiversity  
Foundation, Russia  
KamchatNIRO, Russia



Nervous Waters, Argentina



Fisheries and Oceans  
Canada