



**NOAA
FISHERIES**

West Coast
Fisheries
Science
Centers

2.2 Monitoring and Evaluation: Sources of salmon population and freshwater habitat data

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Management questions that require data – science of managing ESA listed pacific salmonids

- What are the status and trends in fish populations?
- What are the status and trends in risks / threats to fish populations?
- What are the management strategies to mitigate the risks / threats?

What data are necessary to answer the science / management questions?

- Harvest
 - Exploitation rate, size / age structure
- Ocean
 - Survival, distribution, predator/prey dynamics
- Hatchery
 - Eco-Evo interactions
- Freshwater
 - Spawning/rearing populations and habitat
- Humans
 - Threats, risks, actions

Population and Habitat Data in the Freshwater Environment

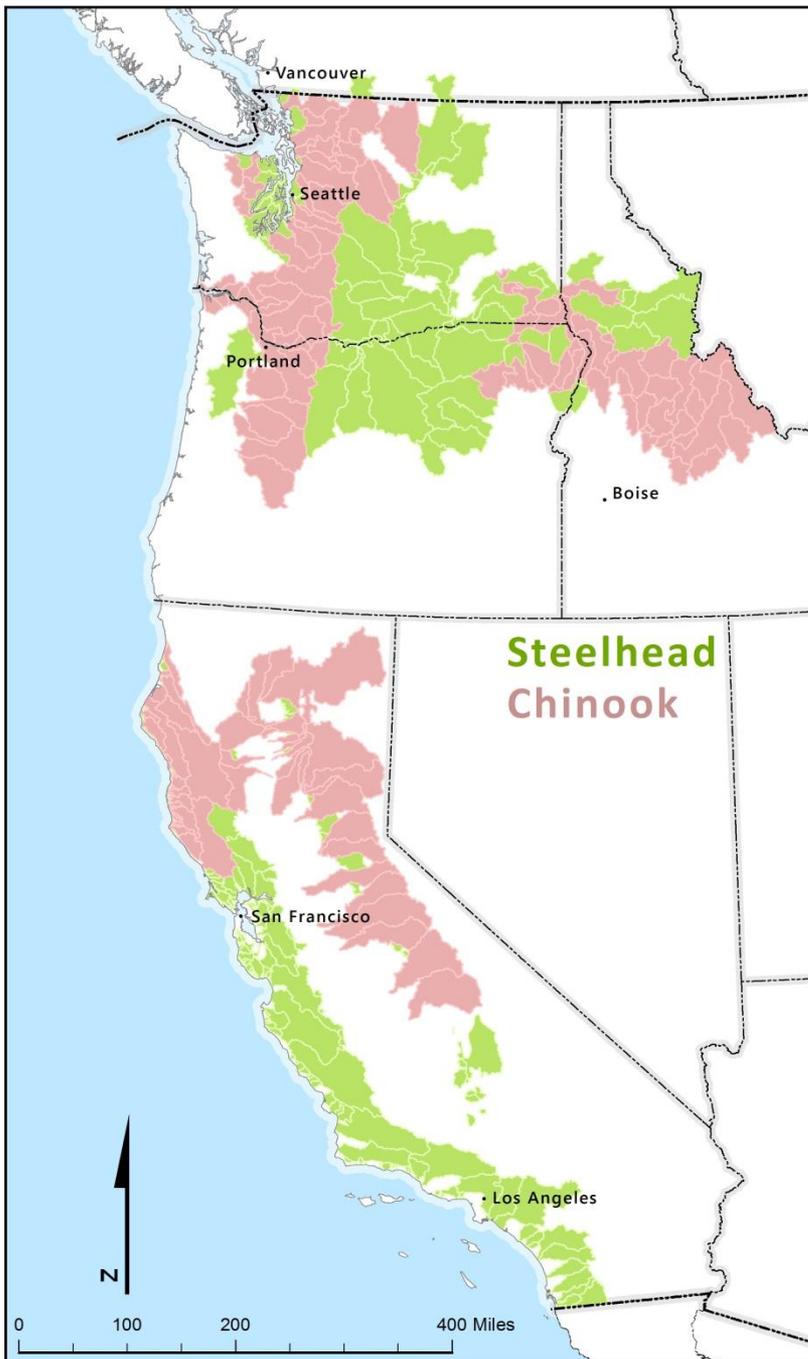
- Population
 - Abundance, productivity, spatial structure, diversity
 - Stage specific survival, age structure
 - Ecological interactions
 - Fish-habitat relationships
- Habitat
 - Wadeable / Non-wadeable
 - Physical / biological condition
 - Impairments, management actions
 - Landscape
 - Land use / land cover
 - Watershed process determinants

Spatial Extent of West Coast Salmon Data Needs



Map produced by Damon Holzer

Spatial Extent of West Coast Salmon Data Needs



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Spatial Extent of West Coast Salmon Data Needs



Map produced by Damon Holzer

28 ESU/DPS
~600 populations

4 States
14 Ecoregions (EPA III)

Monitoring Data for Science of Salmon Management

- Salmon Population Data
 - Adults
 - Redd and carcass surveys
 - Fish counts, mark-recapture tagging
 - Juveniles
 - Emigrant (“smolts”) traps
 - Counts, mark-recapture rearing “parr”
- Freshwater Habitat Data
 - Wadeable
 - Stream physical / biological, in-stream metrics
 - Non-wadeable, landscape
 - Remote sensing

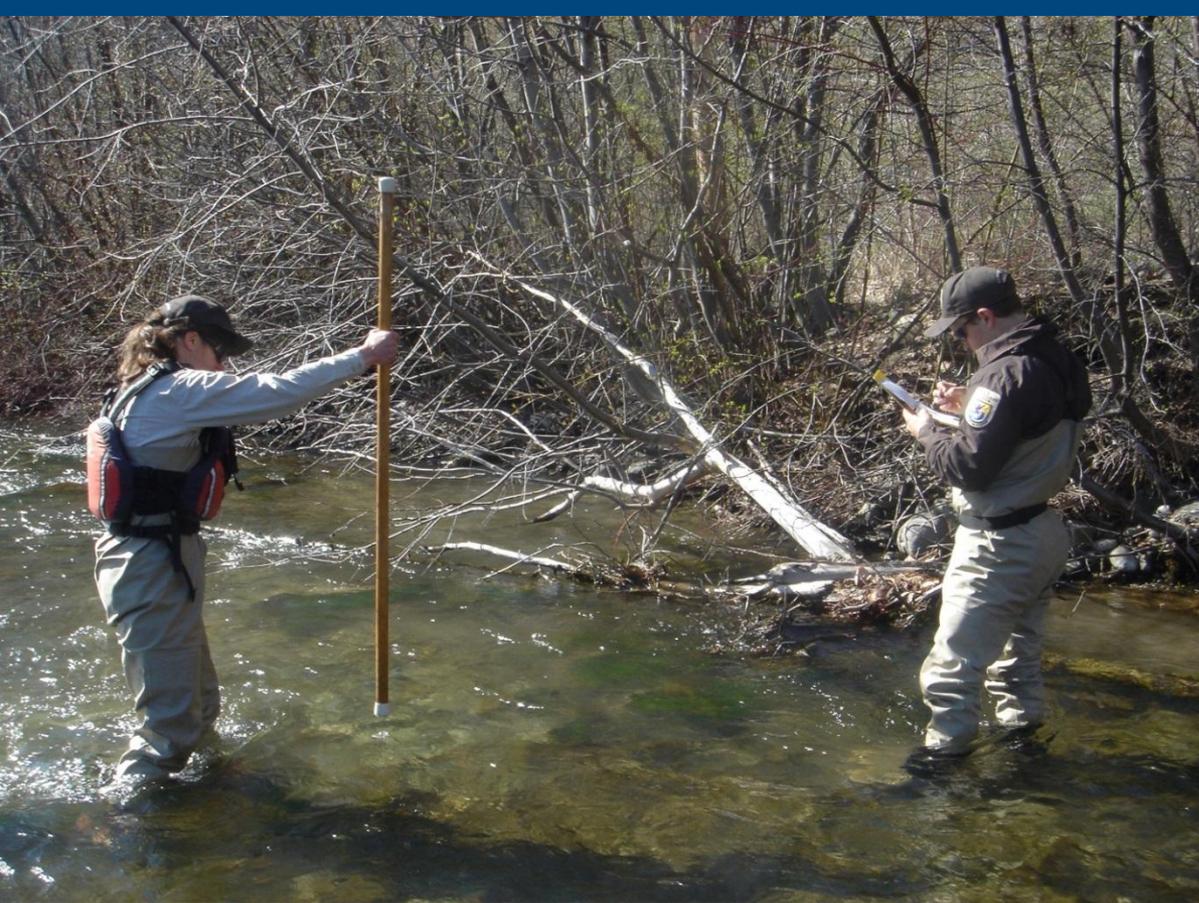




Photo credit: Billy Arnsberg NPT





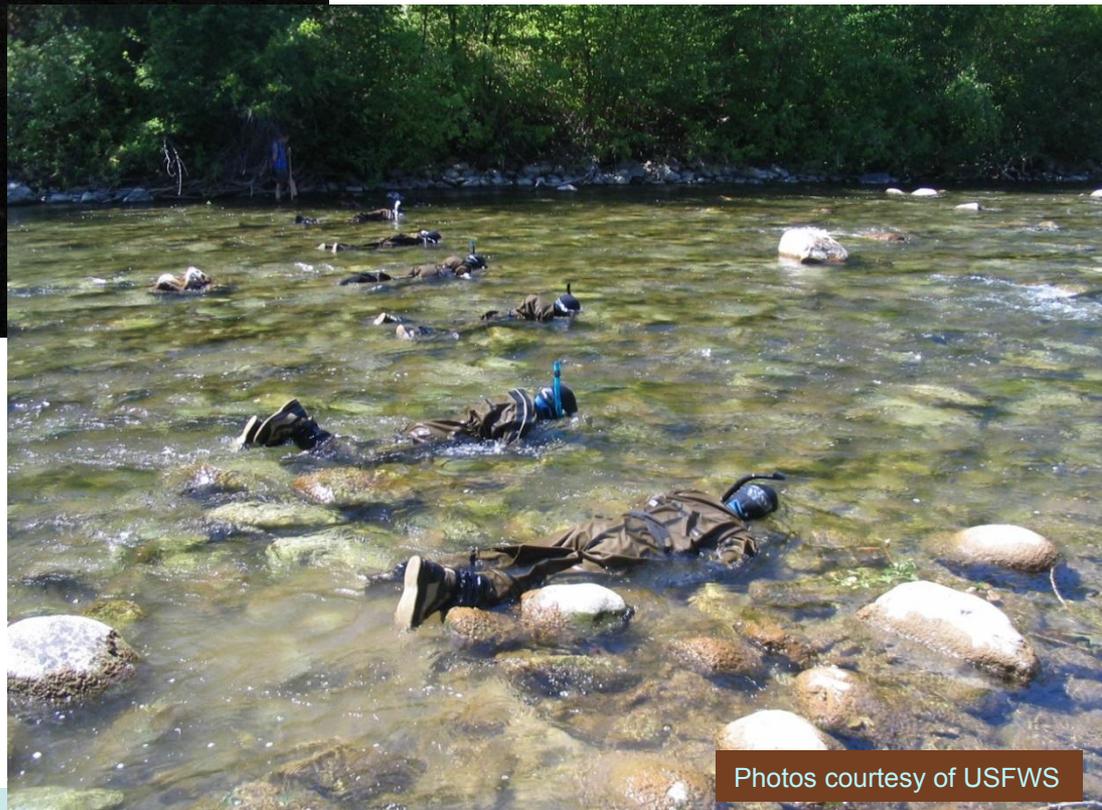
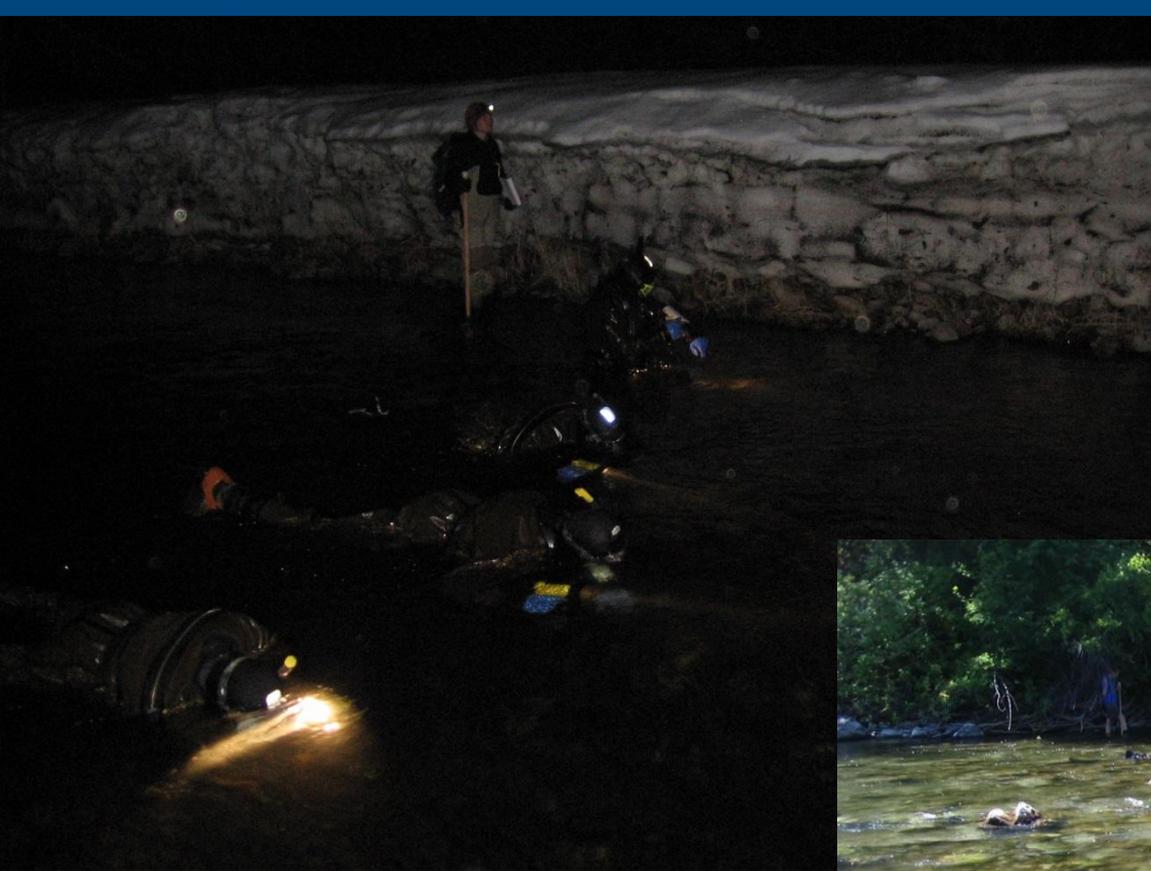
Photo credit: Bill Young NPT



Photo credit: Jim Ruzycski ODFW



Photo credit: Sean Gallagher CDFW



Photos courtesy of USFWS



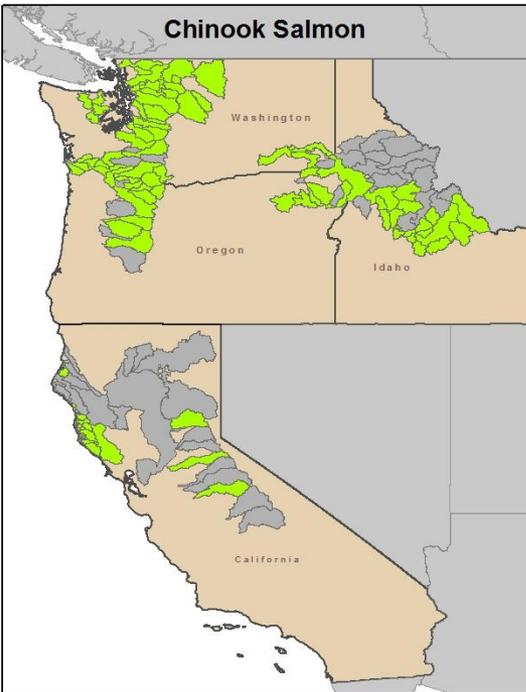


Photos by: Chris Beasley QCI

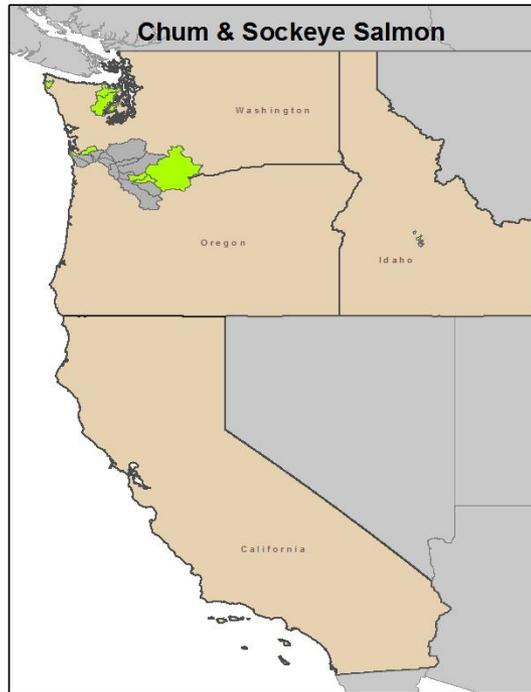
Where do we have population data?

- Adult abundance
 - 348 of 618
- Juvenile outmigrants
 - ~50% of above
- Juvenile rearing
 - ~50% of above

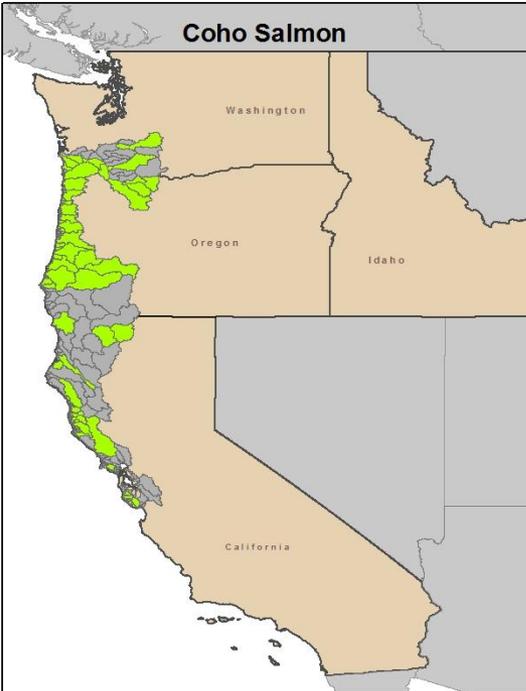
Chinook Salmon



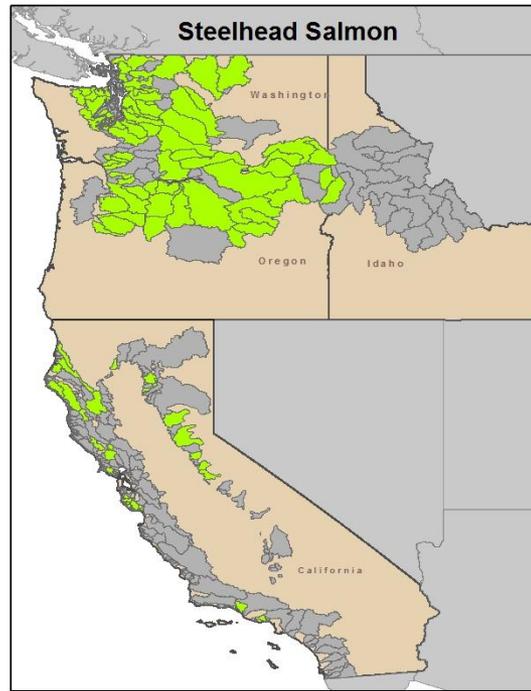
Chum & Sockeye Salmon



Coho Salmon



Steelhead Salmon



Development of Population Monitoring in California



Feb 2014

Monitoring Data for Science of Salmon Management

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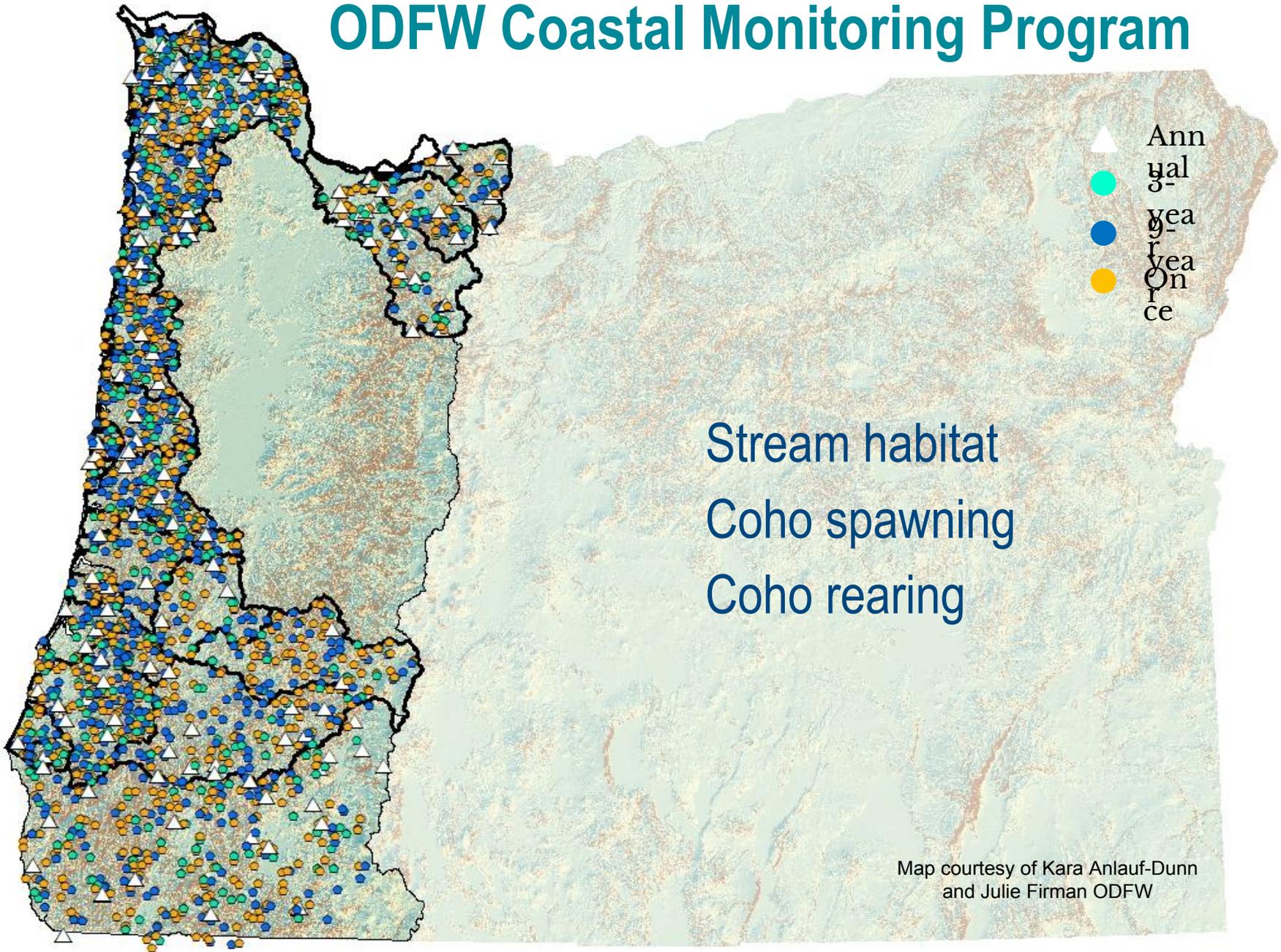
Photos by: Boyd Bouwes WSI



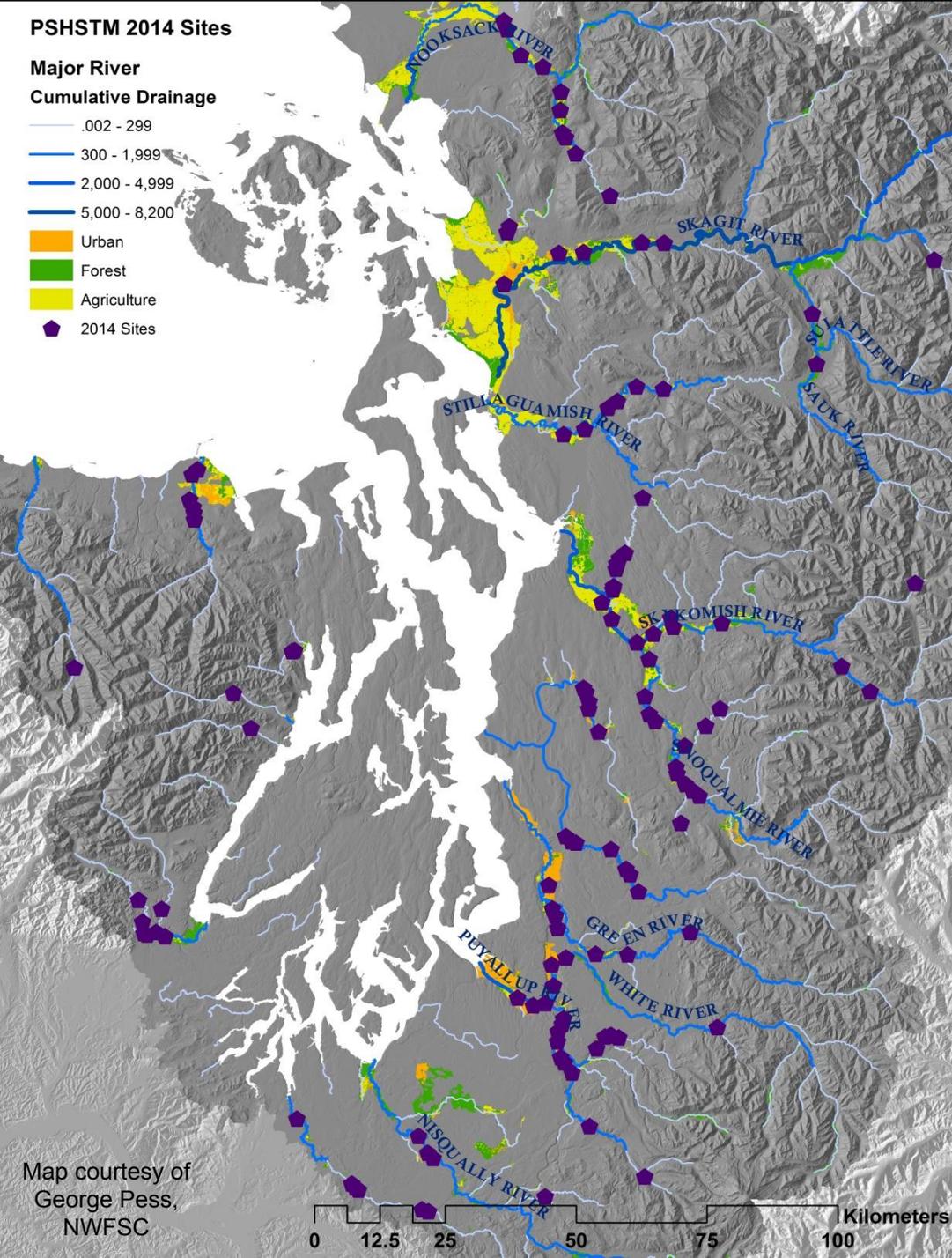
Photo credit: Sean Gallagher CDFW



ODFW Coastal Monitoring Program



PSHSTM 2014 Sites

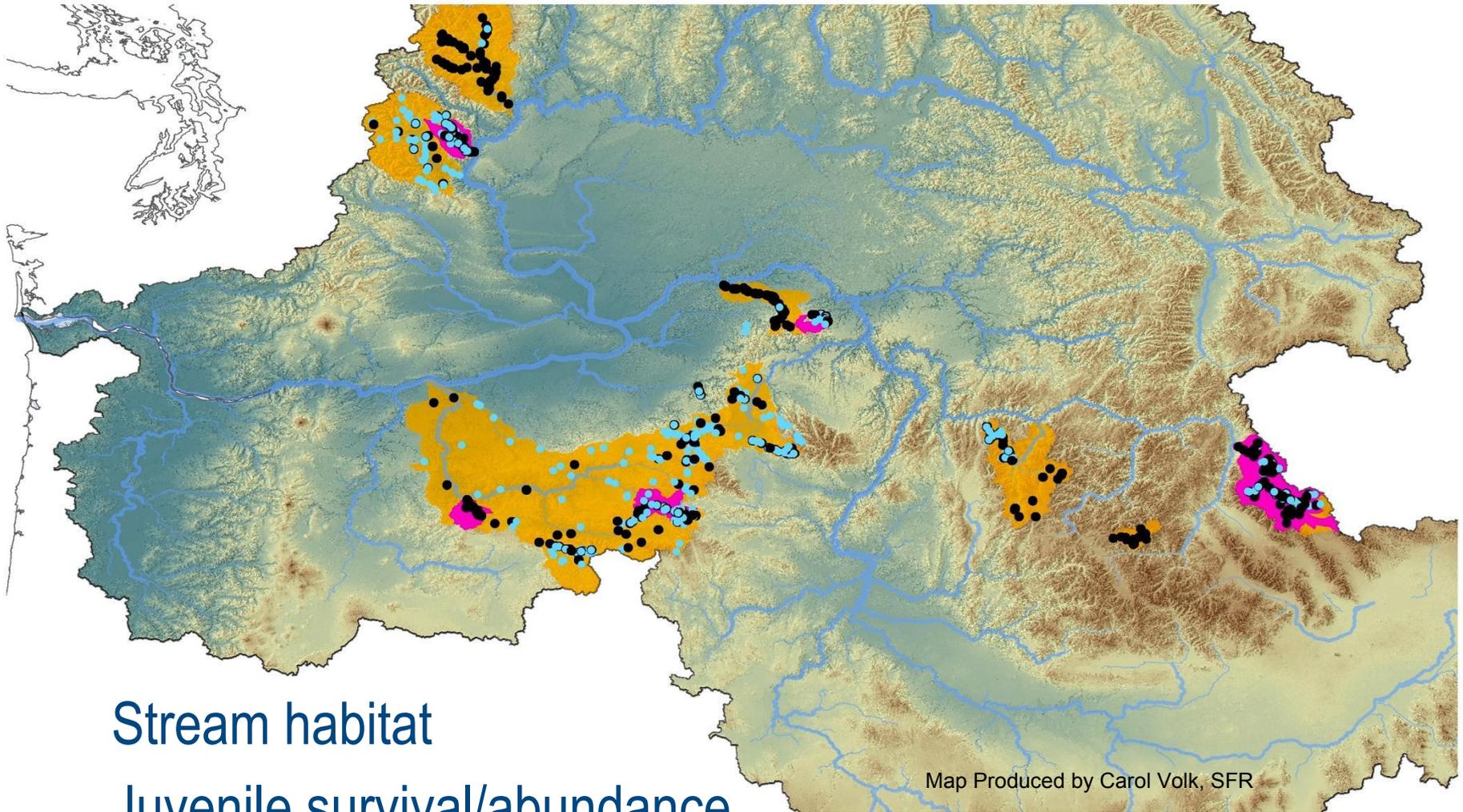


Puget Sound Habitat Status and Trends Monitoring Program

- Mainstem Rivers
- Floodplains
- Estuaries
- Nearshore Marine

Map courtesy of George Pess, NWFSC

Columbia Habitat Monitoring Program



Stream habitat
Juvenile survival/abundance

Map Produced by Carol Volk, SFR

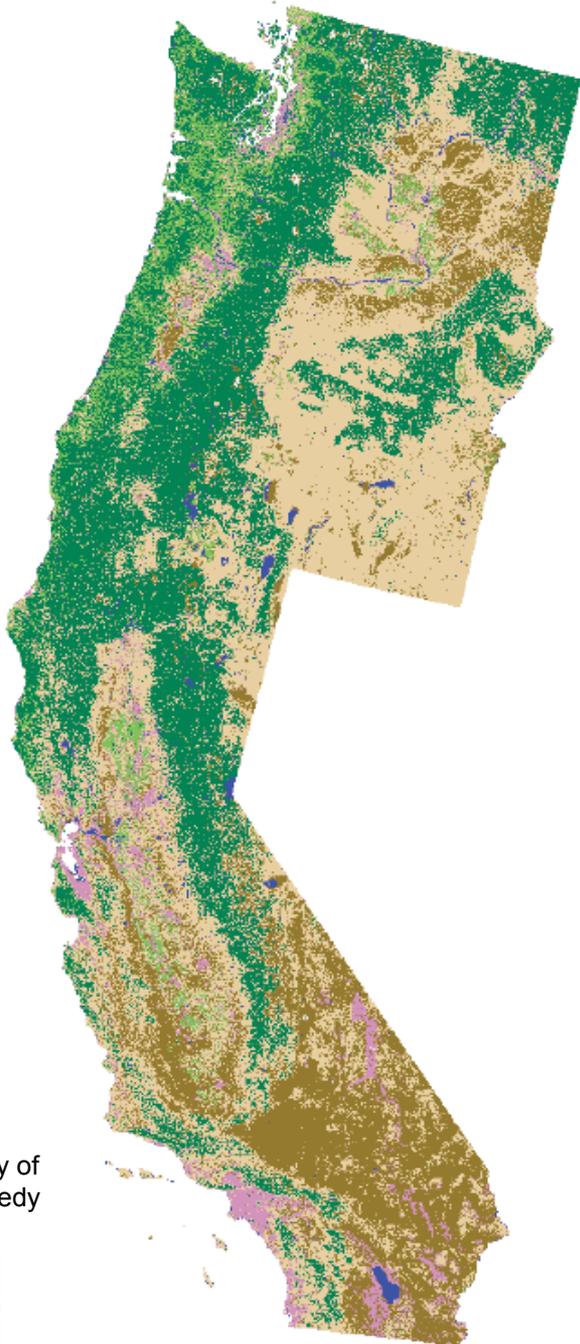
Land Cover Classification Based on Landsat Imagery

10⁹ pixels

20 year time series

7 cover classes

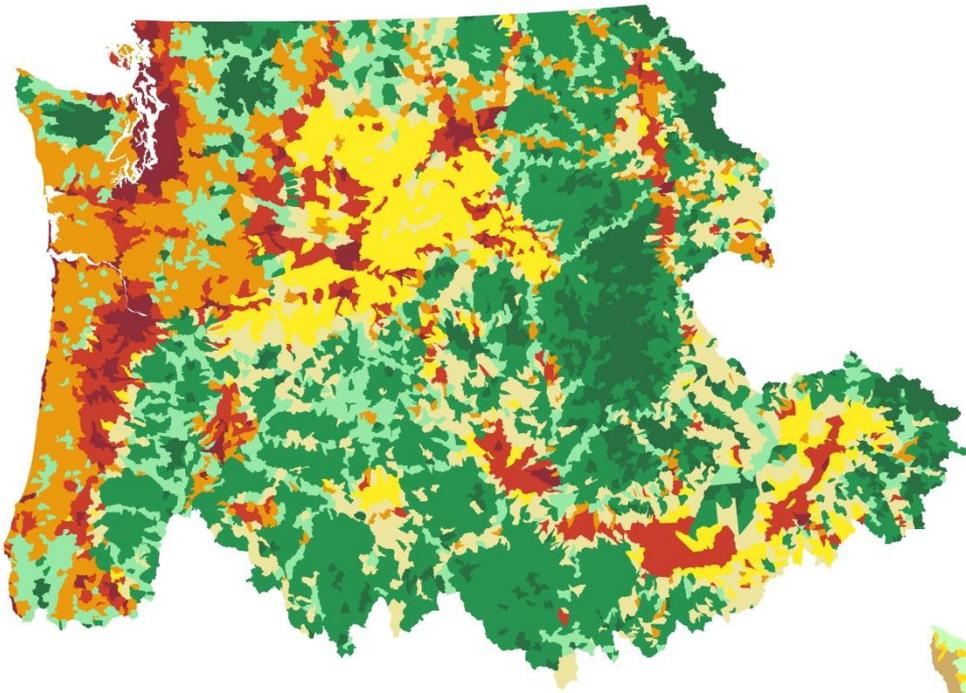
11 conversion types



Map courtesy of
Robert Kennedy
OSU



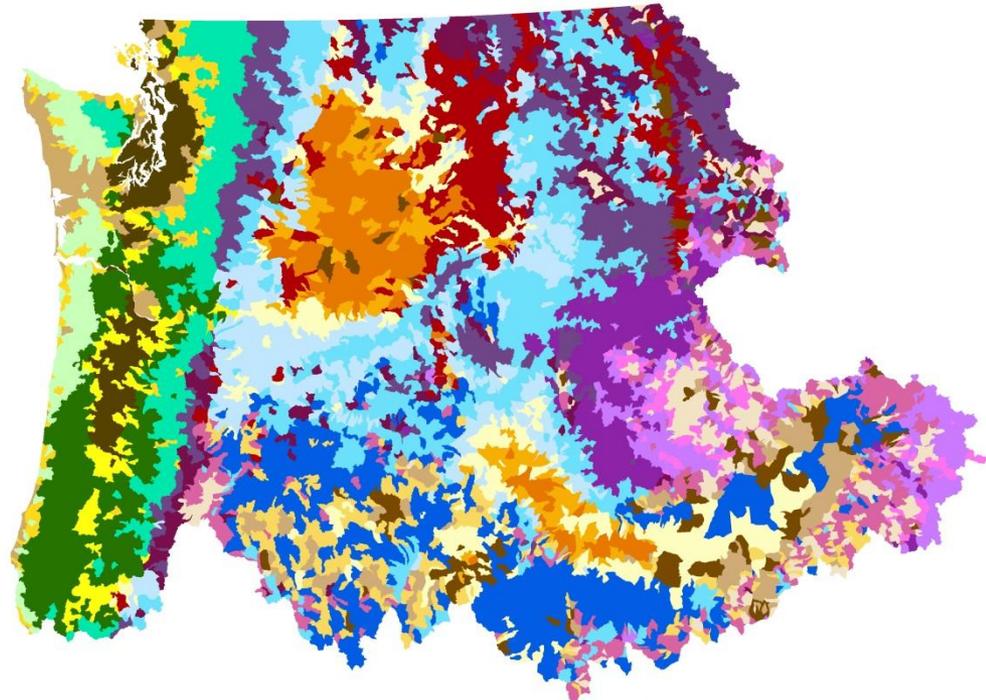
Geomorphic, Climate and Human - disturbance Based Watershed Classification



10^4 HUC6

24 watershed classes

8 disturbance classes



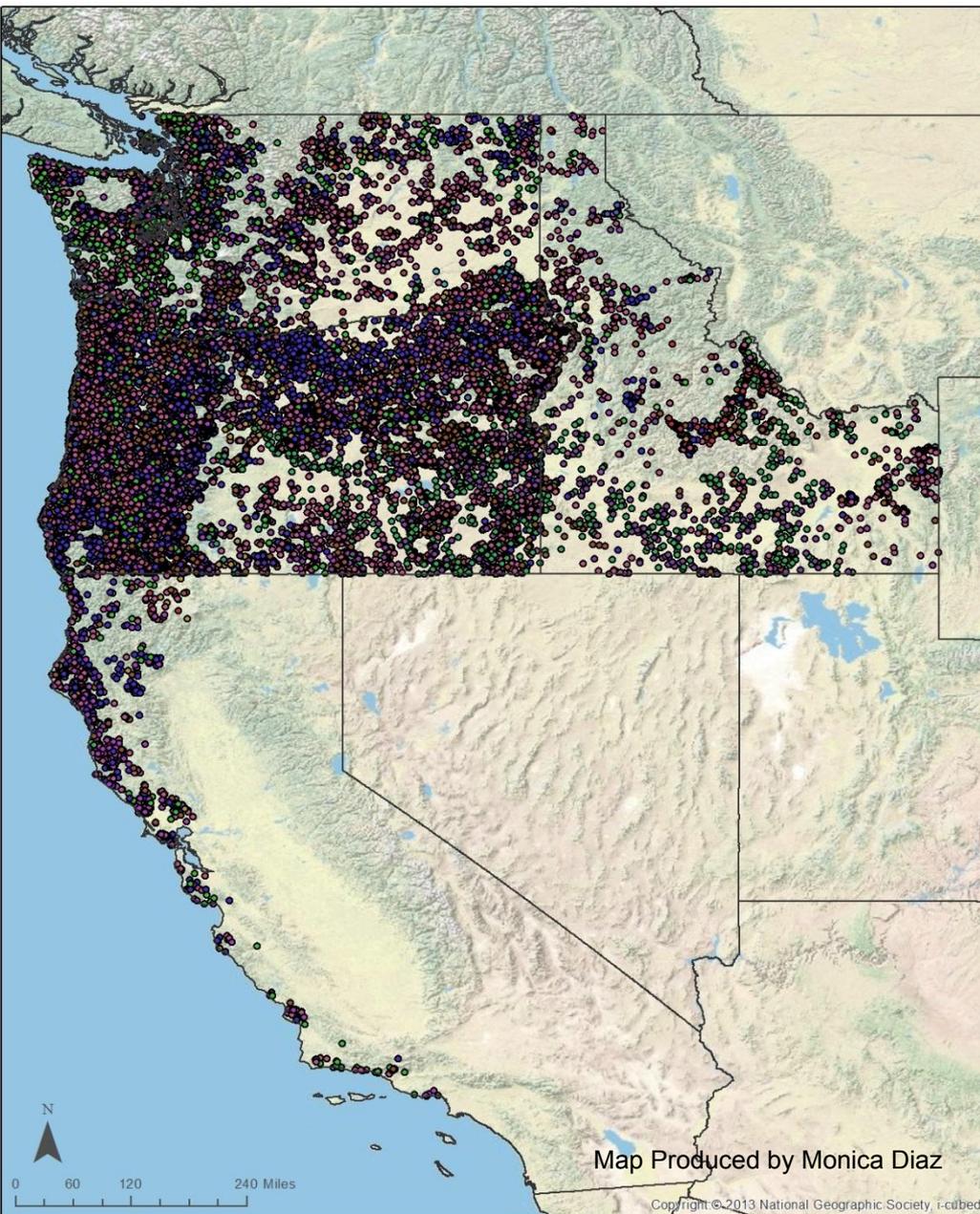
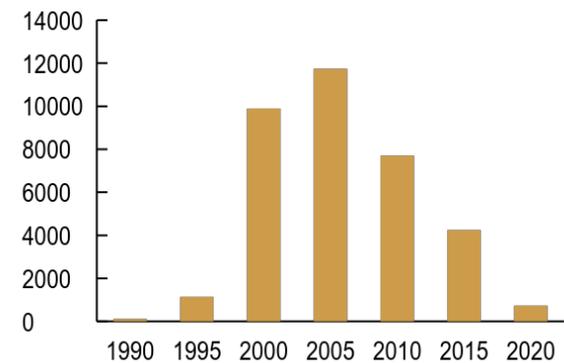
Maps courtesy of Carol Volk and Thom Whittier

Freshwater habitat project tracking

10⁵ projects

20 years

17 action types



Other habitat monitoring programs that are potentially of use in salmonid management

- USFS PIBO and AREMP
- WA Department of Ecology
- OR and ID Department of Environmental Quality
- USGS Water quality
- BLM stream surveys

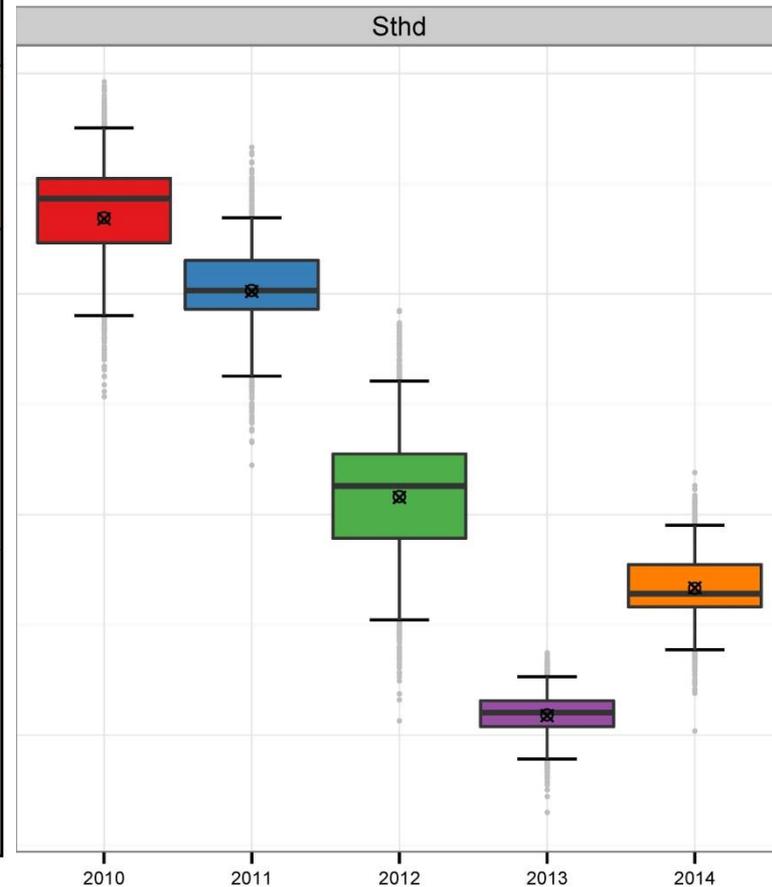
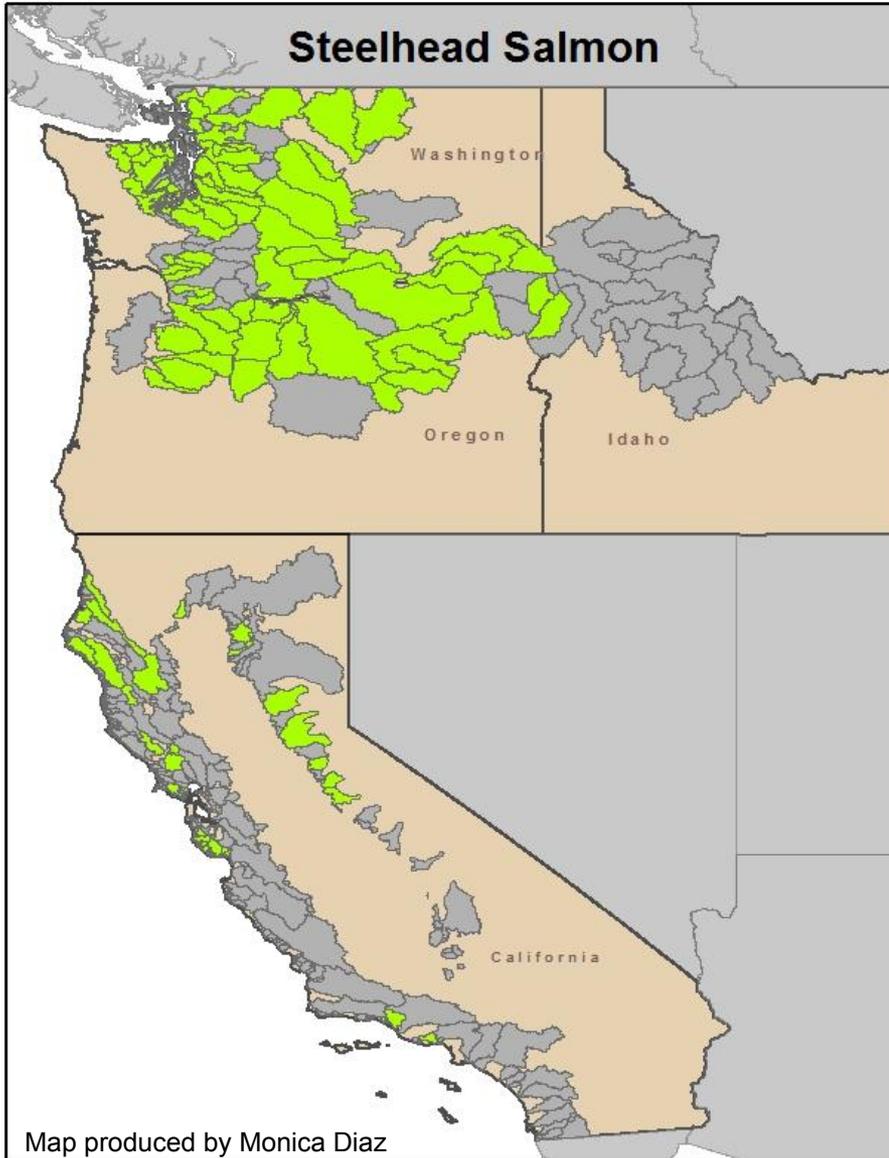
Gaps in Monitoring Data – spatial, temporal, and content

- Population
 - Emphasis on adults, with secondary effort on emigrants
 - Stage specific abundance and survival of juveniles
 - Ecological processes
- Habitat
 - Stream habitat monitoring by widely disparate methods
 - Geographic coverage is expanding
 - Summer low-flow, wadeable streams

Do We Need to Monitor Populations and Habitat Everywhere?

- Can we leverage what we know about populations, population processes and fish-habitat relationships to develop management support products based on current monitoring programs?

Steelhead abundance at Lower Granite Dam



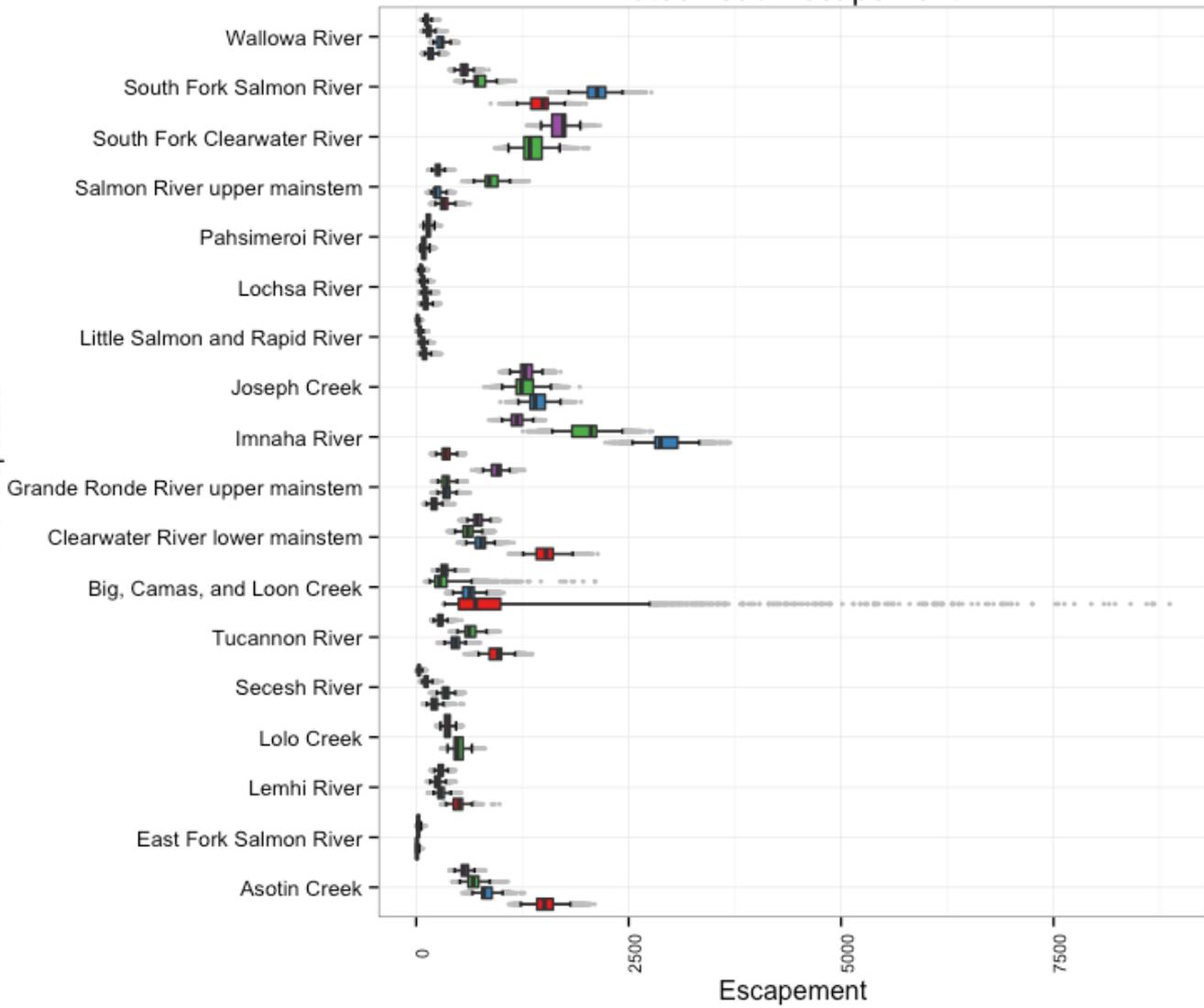
Tag at Lower Granite Dam, detect across Snake River basin



Photos by: Chris Beasley QCI

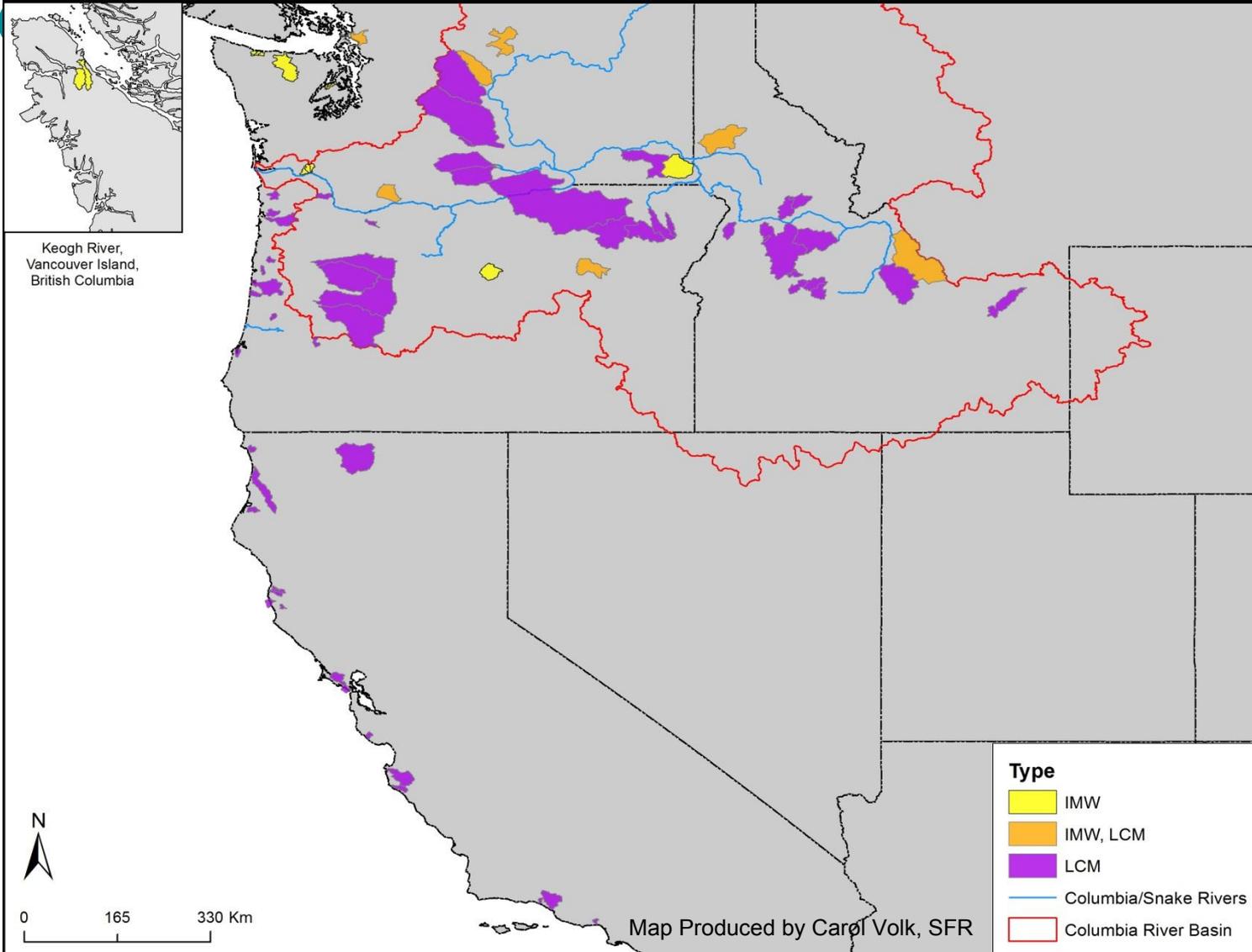
Steelhead Escapement

TRT Population

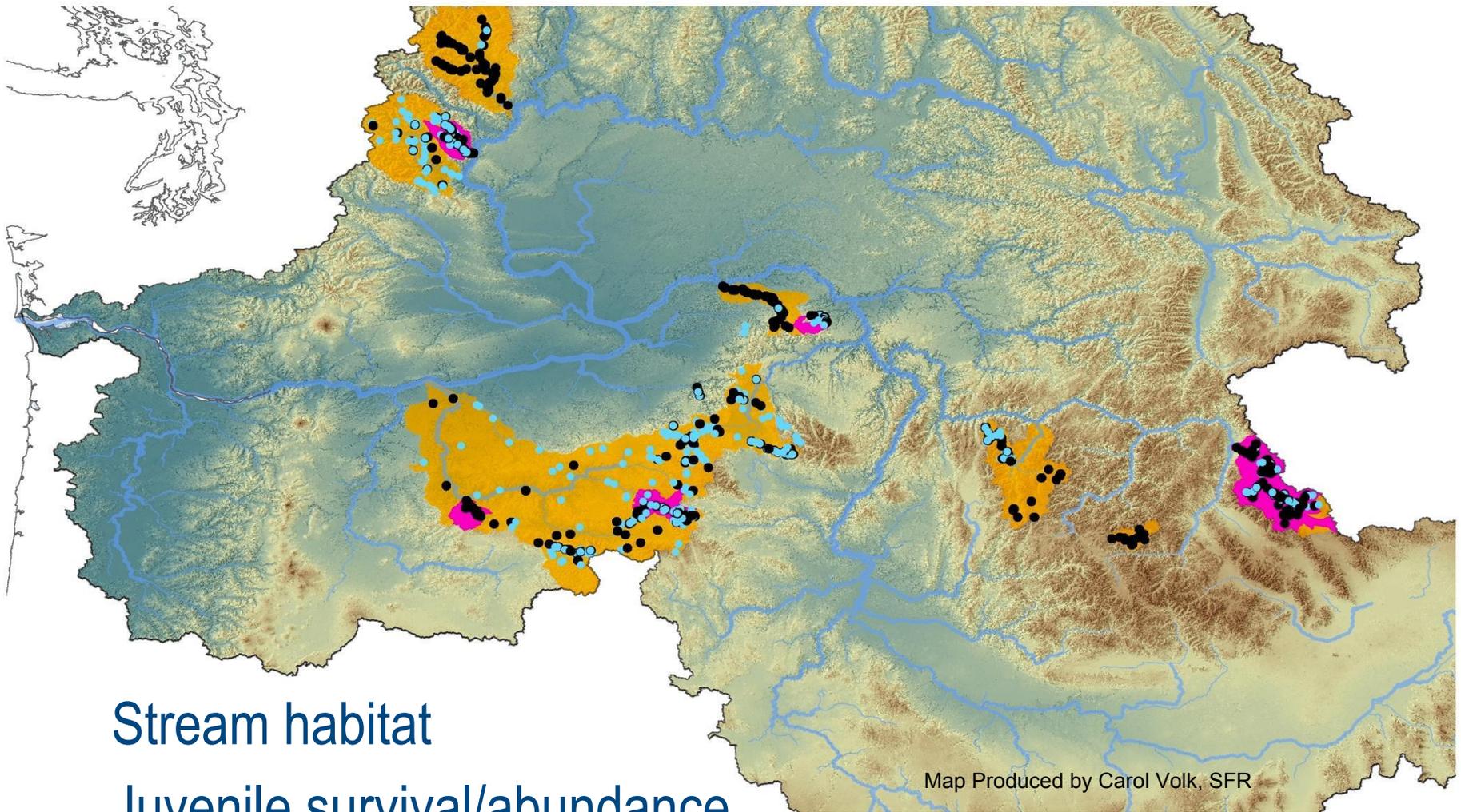


Year ■ 2010 ■ 2011 ■ 2012 ■ 2013

Intensively Monitored Watersheds, Life Cycle



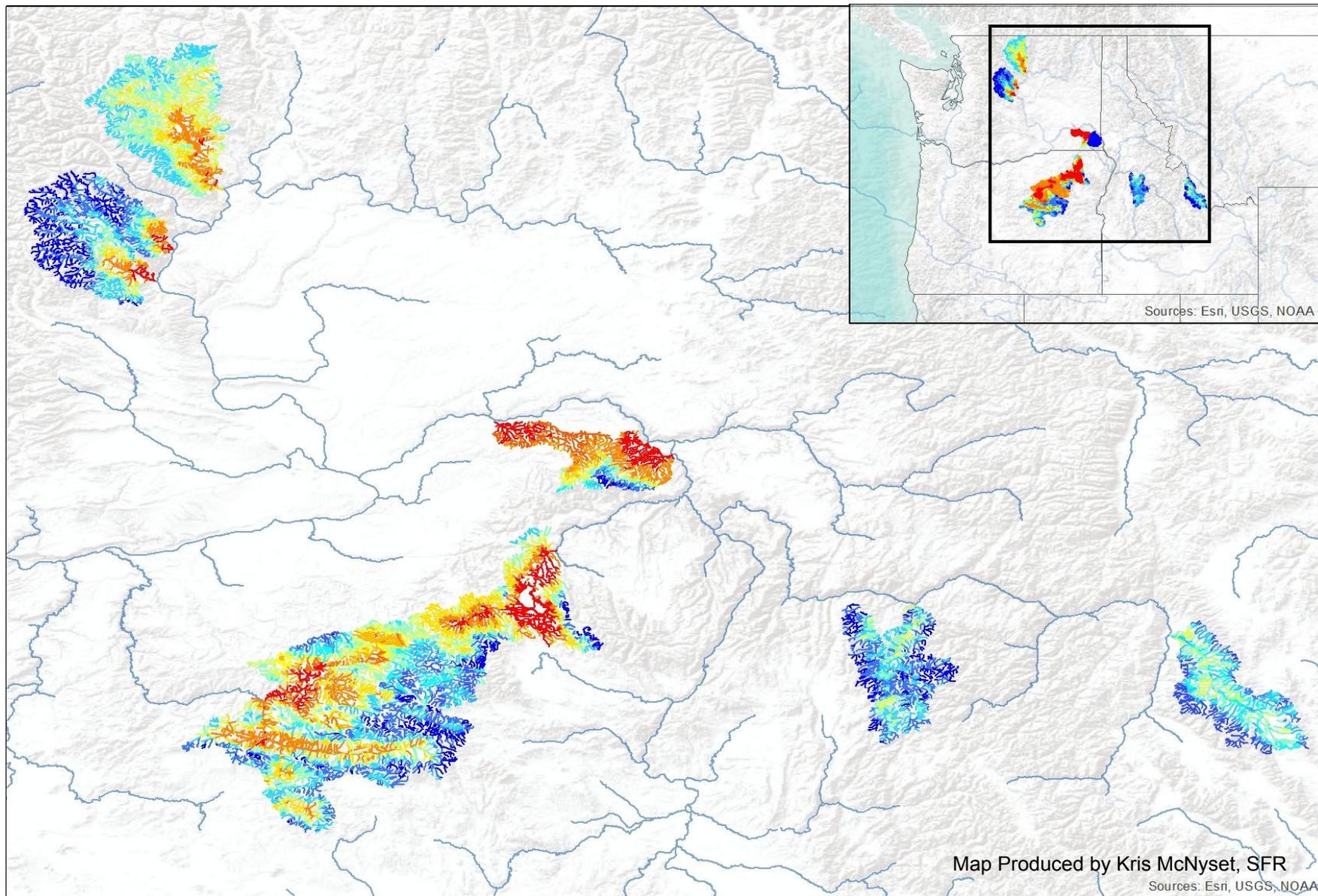
Columbia Habitat Monitoring Program



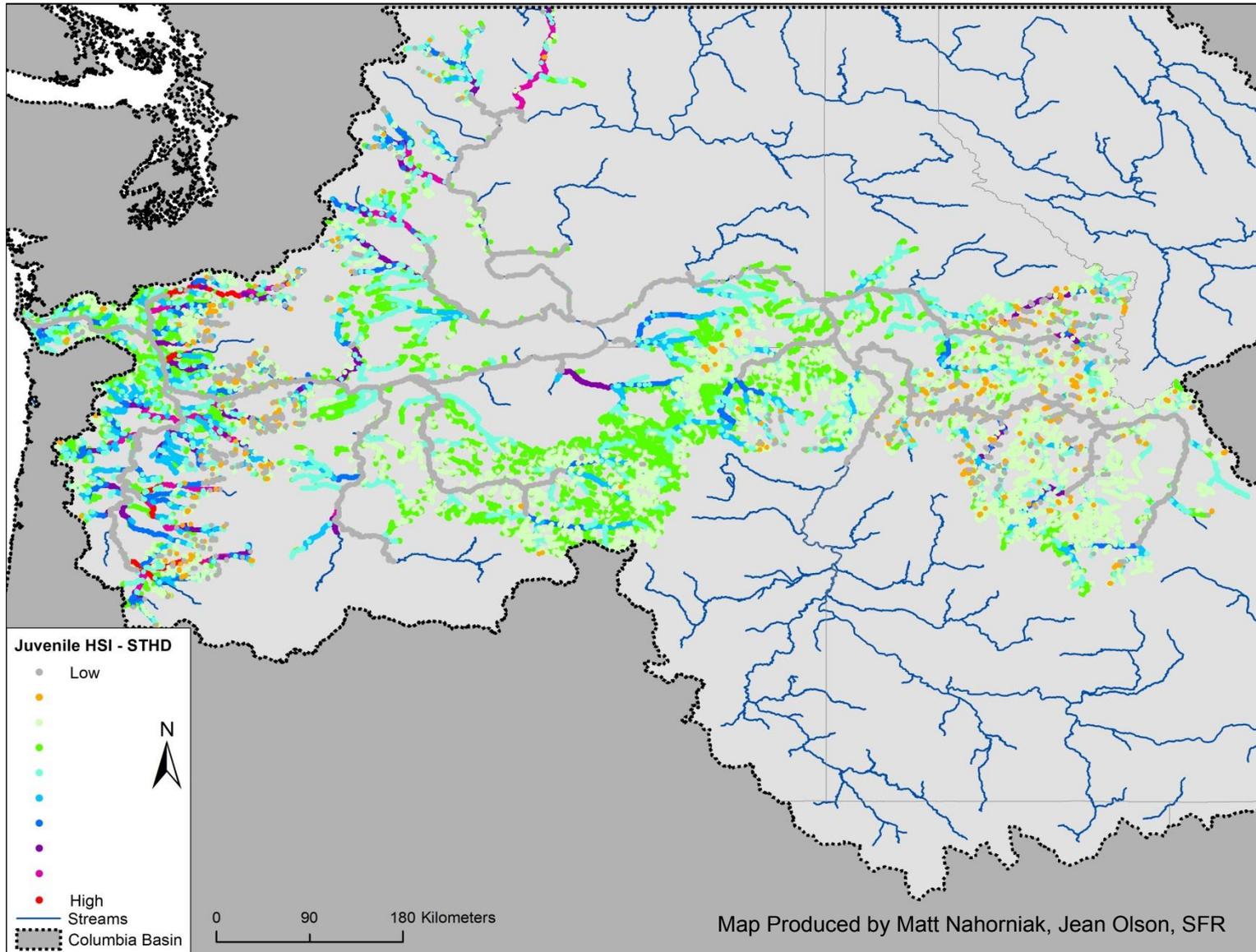
Stream habitat
Juvenile survival/abundance

Map Produced by Carol Volk, SFR

Spatially and Temporally Continuous Predictions of Stream Temperature



Estimated rearing capacity – juvenile *O. mykiss*



Strengths, Challenges and Opportunities

- Have developed very good partnerships with state and tribal agencies through the status review and TRT processes.
- Have some good data management tools in place; have been successful and encouraging partners to do the same.
- Have uniform and accepted population definitions (from TRT process) so we are speaking the same language.
- Some deep pockets have resulted in very intensively monitored populations and a huge monitoring infrastructure locally.
- Science centers have hired staff with the necessary analytical skills to use all of these data.
- Building management decision support tools / models (IMWs, LCMs, network scale data products) region-wide
- The scope of the problem is enormous and LOTS of people are involved.

Strengths, Challenges and Opportunities

- Some areas lagging either due to lack of funding or difficulties coordinating among lots of partners.
- Habitat monitoring not as extensive in time or space as population monitoring.
- Some agencies (e.g. Bonneville Power Administration) seem to be developing monitoring fatigue -- tension between spending on monitoring and actions.
- Ocean monitoring is still very limited.
- Getting broad-scale monitoring going in CA.
- Integrating more complex ecological interactions into monitoring and evaluation.
- The scope of the problem is enormous and LOTS of people are involved.

Strengths, Challenges and Opportunities

- Technology always improving - better tags and remote sensing tools.
- Some large scale datasets becoming more available more cheaply (e.g. historical Landsat imagery).
- Technology and knowledge transfer from well monitored to less well monitored areas.
- Development of new approaches to deal with dynamic systems and small populations.
- Development of new analytical approaches to bring science into large-scale natural resource management issues.
- The scope of the problem is enormous and LOTS of people are involved.