

Investigating the Relationship Between Instream Flow, Hydrologic Connectivity, and Habitat Quality in Off-Channel Habitats

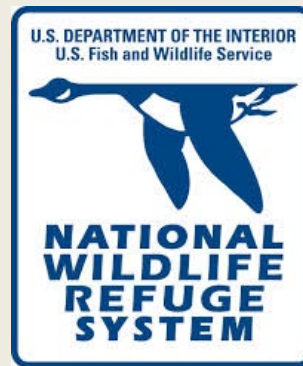
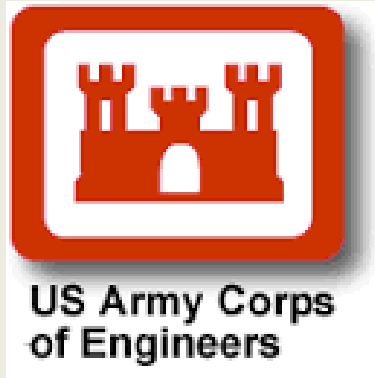


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ODFW Native Fish Investigations Program

Jeremy Monroe © FI

Acknowledgements

To our many private landowners and:



AND MANY OTHERS!



What do we do?

- Post-delisting Monitoring Plan
 - USFWS
- Floodplain Study (2008 Biological Opinion)
 - US Army Corps of Engineers
- Support partnering studies (e.g., SWIFT) and provide data, consultation support





Film by Freshwaters Illustrated

Habitat Loss
(from Sedell &
Froggatt 1984)

~75% Reduction in
shoreline



Factors Implicated in Decline



Reasons for decline

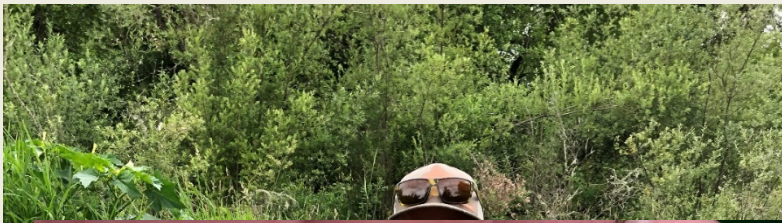


- Half of the fish in the Willamette are non-native
- Largemouth bass, bluegill (and other sunfish)

- Post-delisting Monitoring: 2020 is year 6 of 9
- Chub are doing very well – ongoing conservation
 - Private lands (43% of populations)
- Nonnatives in chub habitat
 - Green sunfish, Ludwigia



2019: Discovered our the first
mainstem Willamette



An aerial photograph showing the confluence of the Willamette River and the McKenzie River. The Willamette River flows from the bottom center towards the top left, while the McKenzie River flows from the top center towards the bottom right. A red outline highlights a specific area on the left bank of the McKenzie River, just upstream of the confluence. The surrounding landscape is a mix of green forest, brown agricultural fields, and a residential area in the bottom left corner.

350 adult chub!

McKenzie River

Willamette River

Fall Creek Spillway “Ponds”



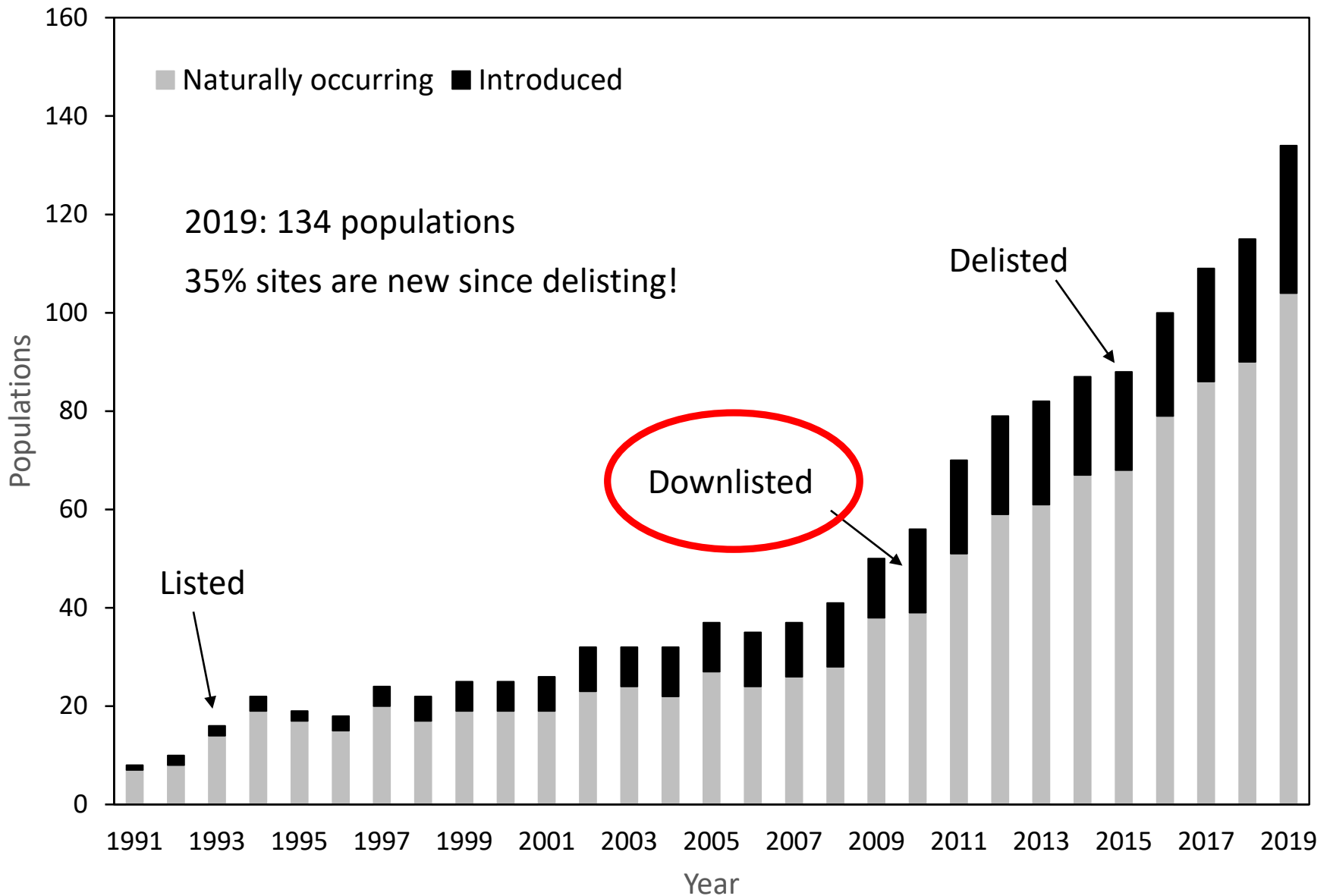
2018:

- Chub 3,380 (95% CI: 2,990-3,830)
- Speckled dace: 3,090 (2,400-4,090)
- Yellow bullhead: 9

2019:

- Chub 1,020 (95% CI: 610-1,470)
- Speckled dace: 1,530 (1,010-2,350)
- Yellow bullhead: 34

Number of Populations



BiOp Studies: Background



- Initiated in 2009; ACOE BiOp
- Coincided with Oregon chub downlisting

Goal

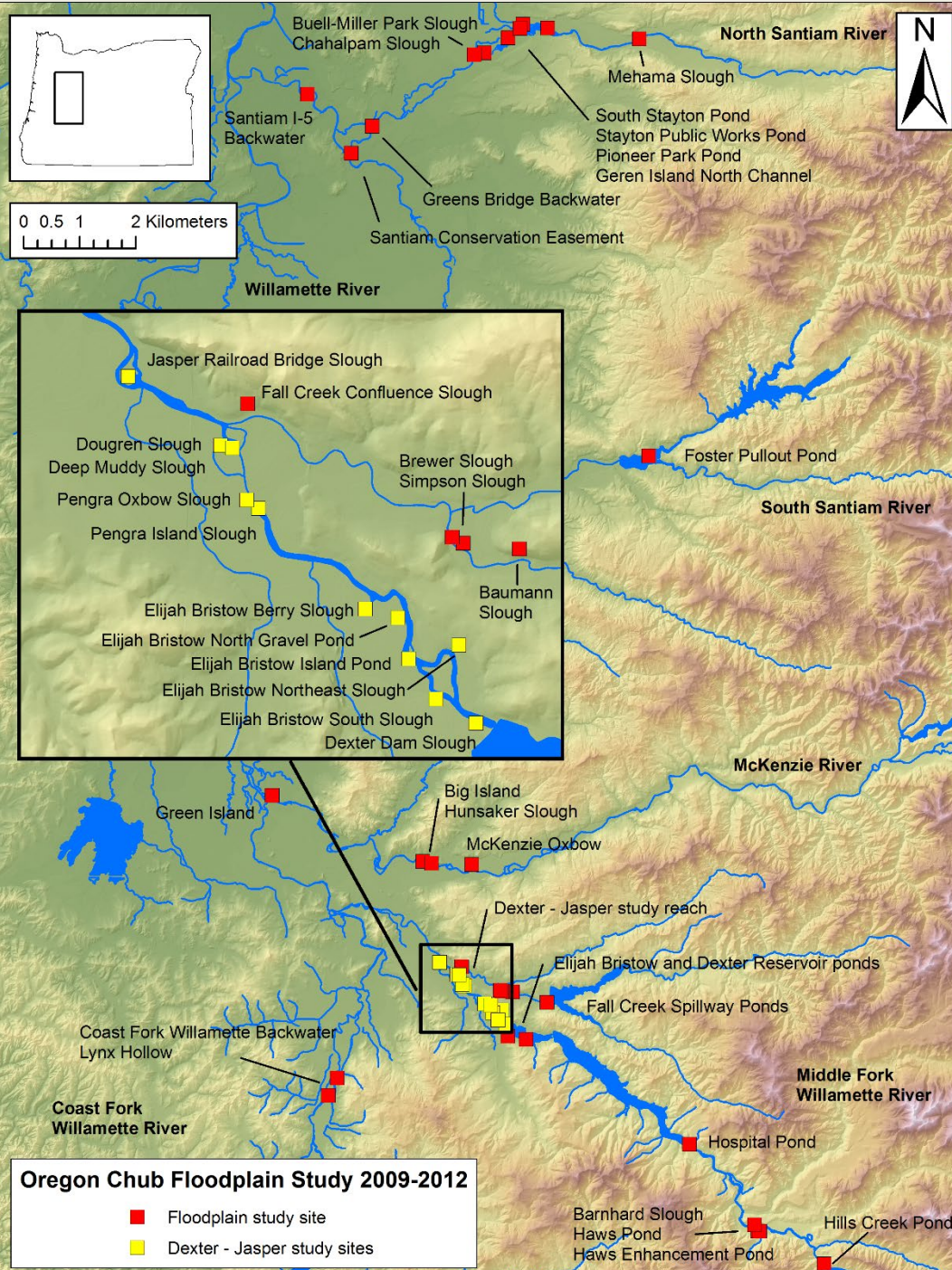
Describe relationships between

- River flows,
- Habitat characteristics,
- Temperature regimes,
- Timing, frequency, duration, magnitude of connection, **and**
- Fish assemblage structure in off-channel habitats

Study Locations

- 2019:
39 sites located on Army Corps of Engineer land, or potentially influenced by Willamette Project Dams
22 in the Middle Fork
11 in the Santiam
4 in the McKenzie
2 Coast Fork Willamette

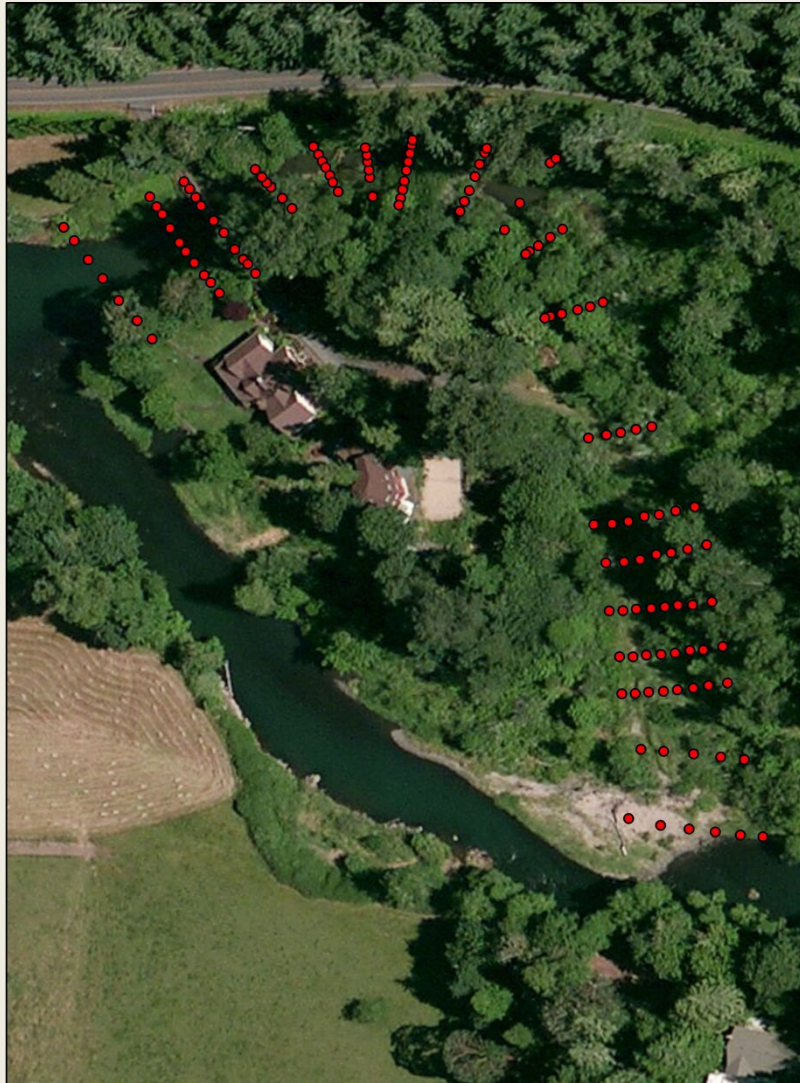
- 2018: Two new locations
Mainstem Willamette
Near Rickreall Creek/Salem



Bathymetry Mapping

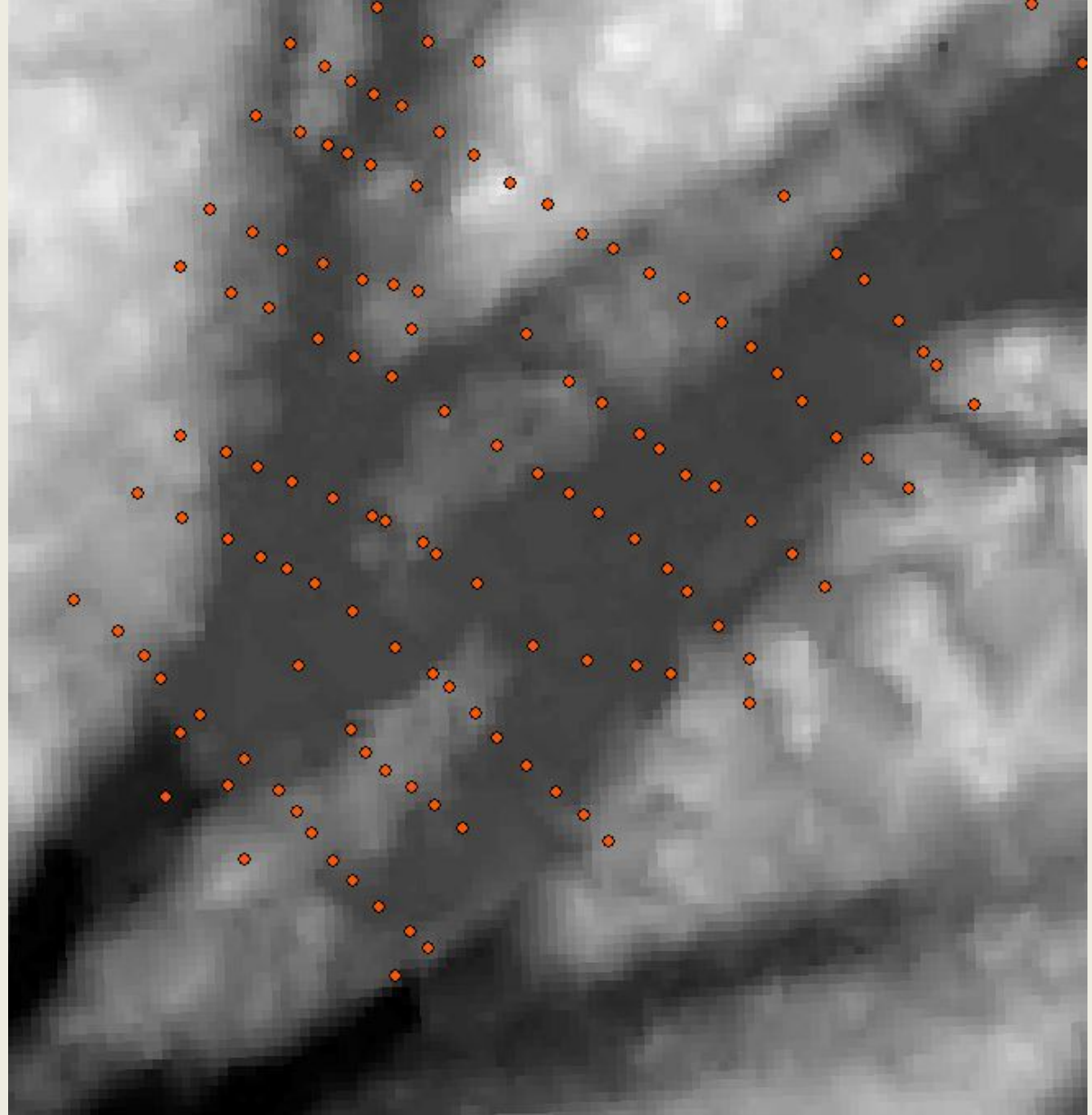


Bathymetry mapping

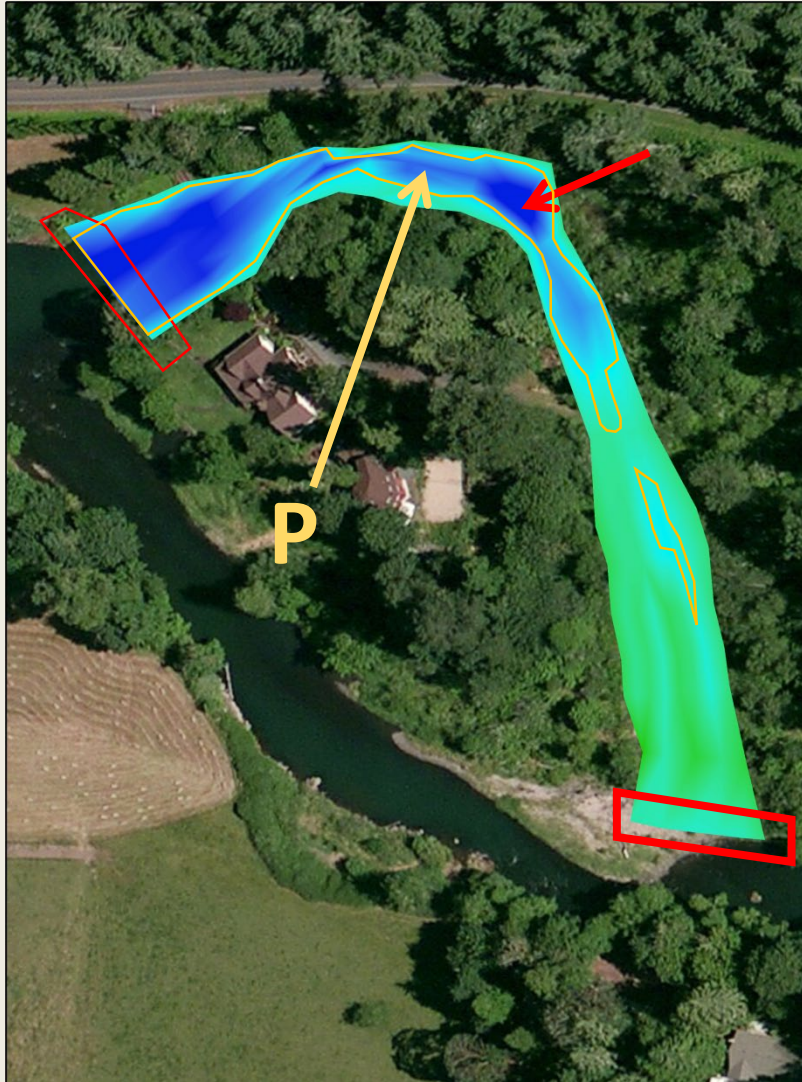


Bathymetry

- “Real world” elevation
- Assess hydrologic connectivity



What is it good for?



- With piezometer:
- Points of connection
 - Area
 - Volume
 - Average depth (Volume/Area)
 - Max. depth
 - River – off-channel habitat relationship
-
- A photograph of a piezometer installed in a river. The piezometer is a vertical metal pipe with a sensor at the bottom, surrounded by a filter. The river is surrounded by tall grasses.

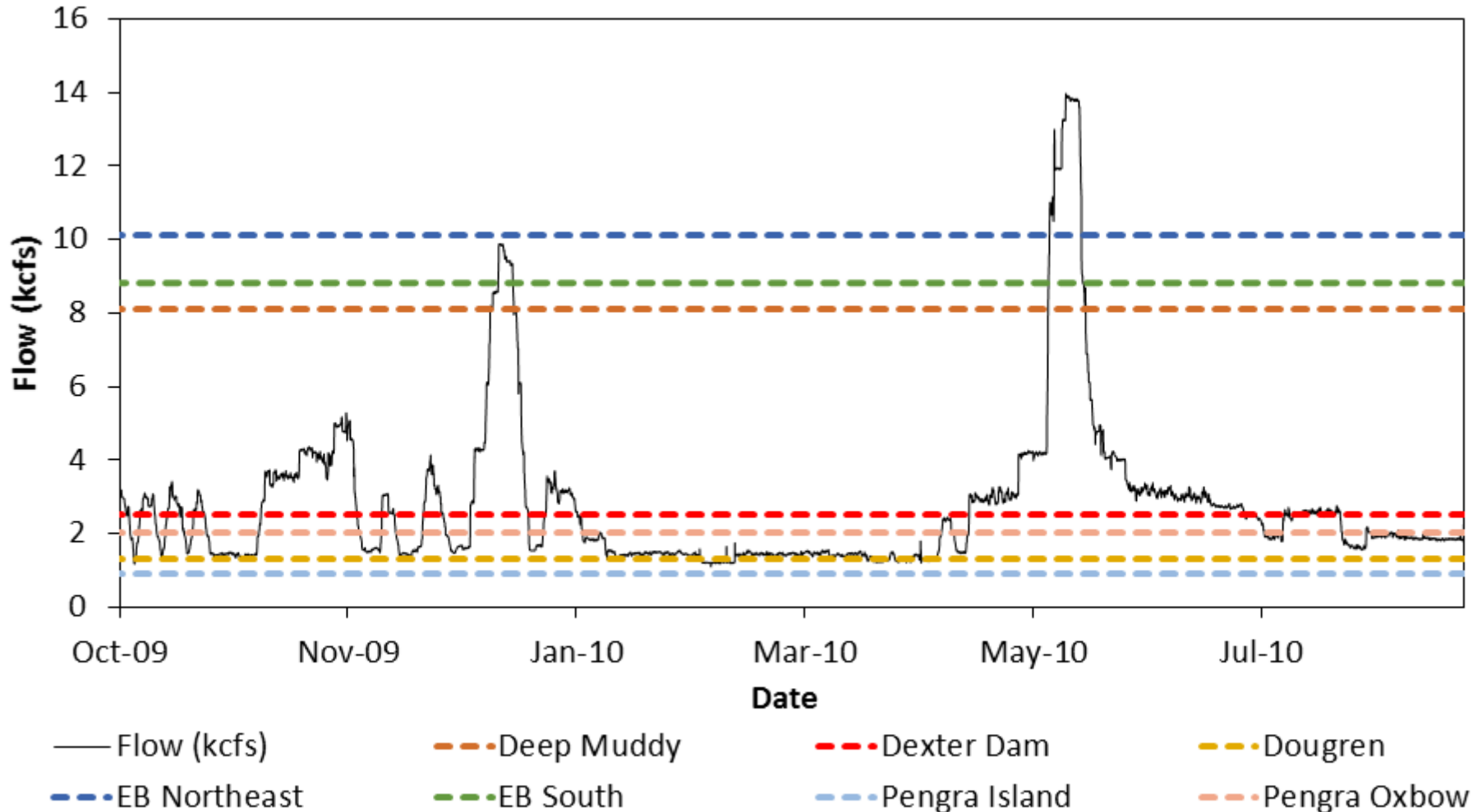
Connectivity



What do we mean?

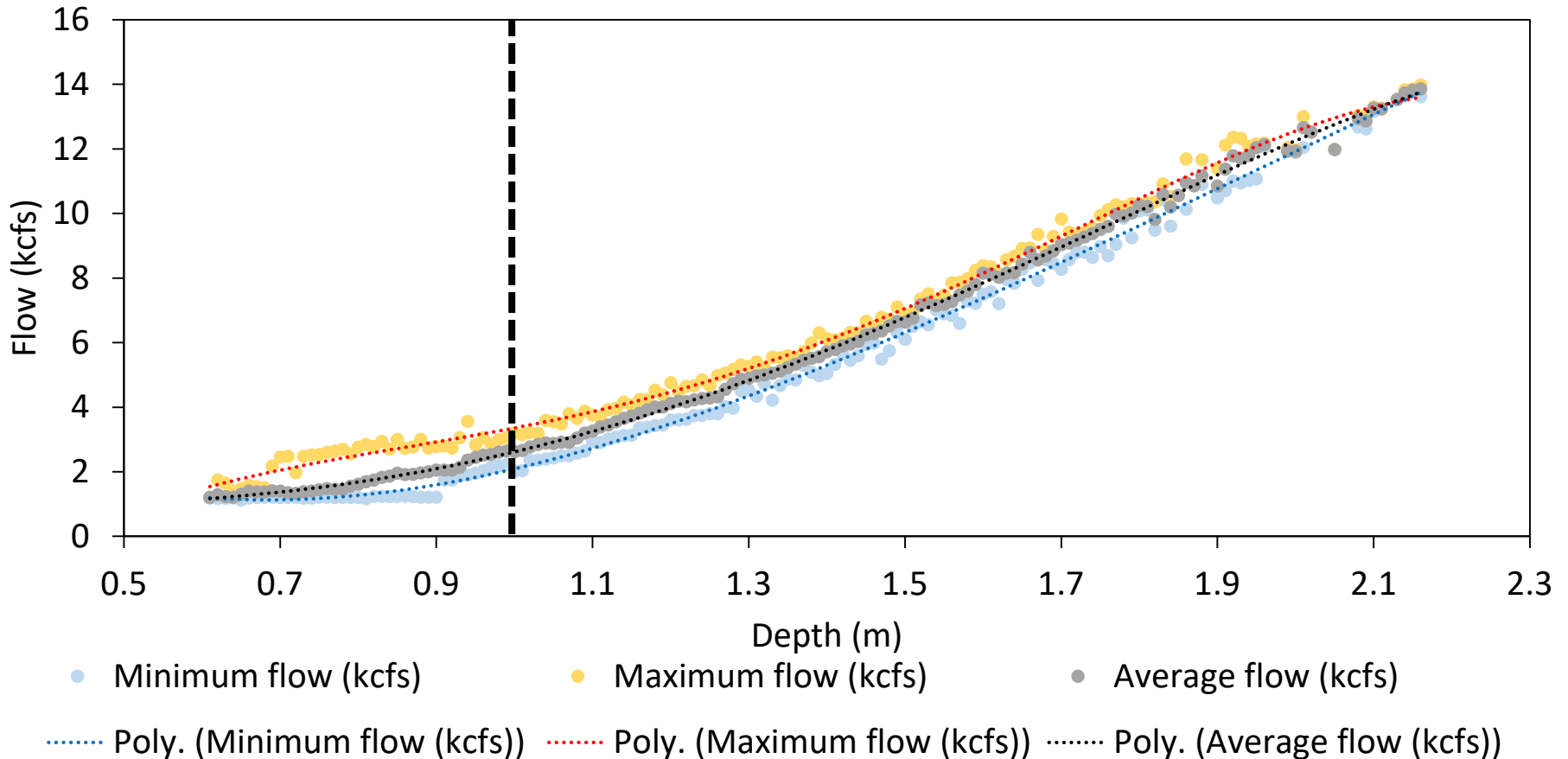
- Open water, direct connection to surrounding waterbodies

Connectivity and flow



- Flows required to connect sloughs – Middle Fork Willamette
- Variable, but we can determine when sites connect

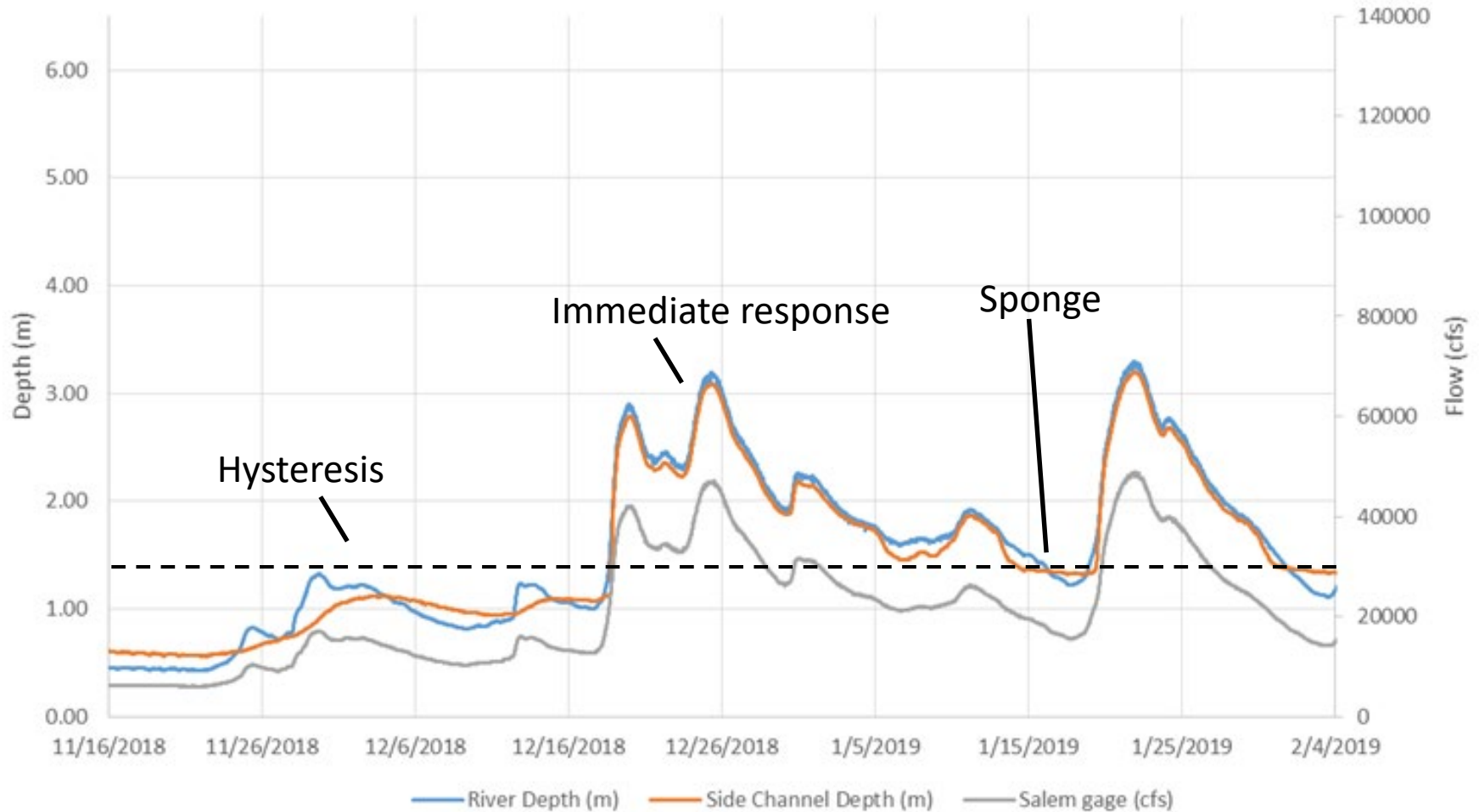
Connectivity, better?



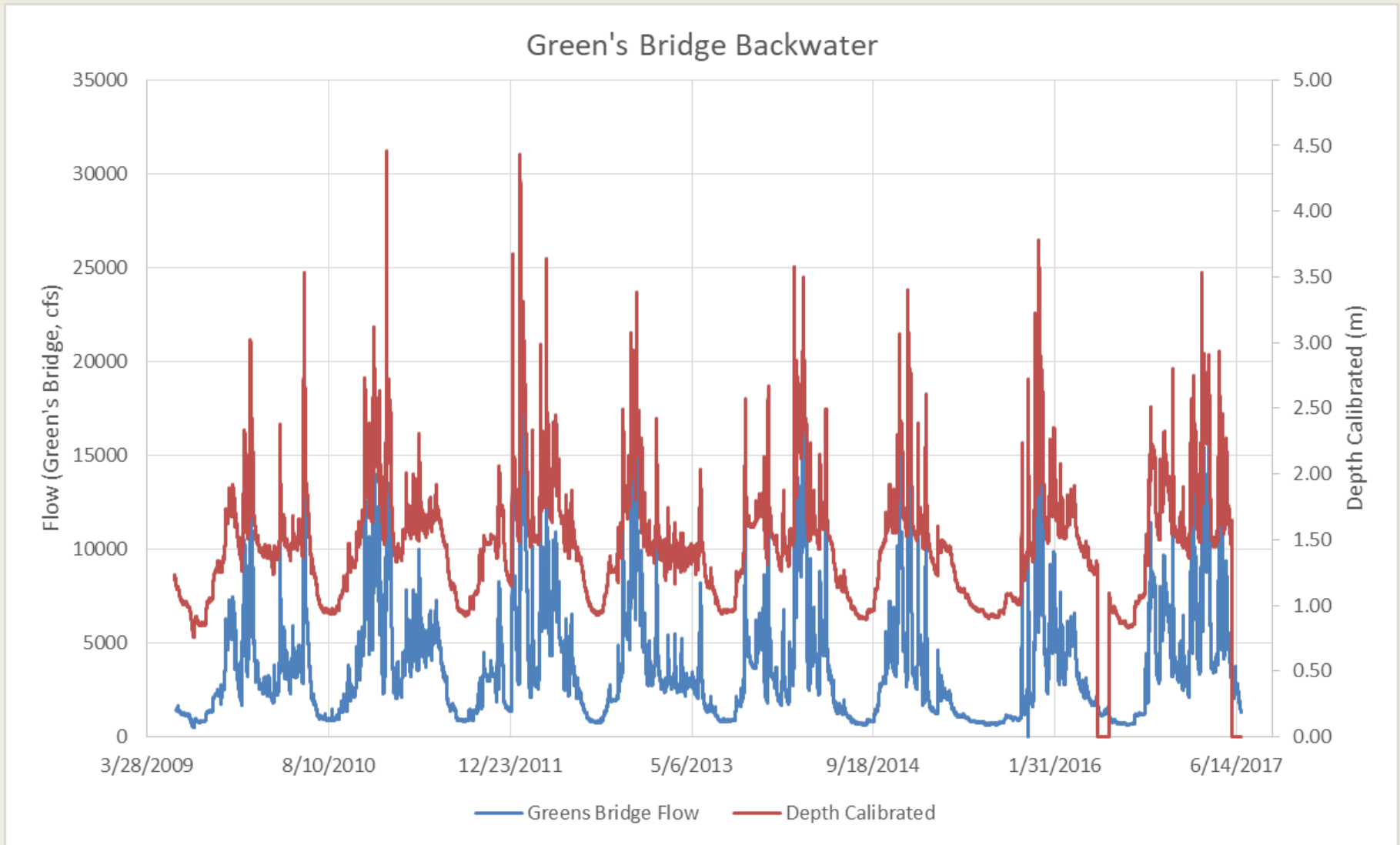
- At point of connection height of 1.002 m, the flow necessary to connect the site:
 - Min.: 2.104 kcfs
 - Avg.: 2.629 kcfs
 - Max.: 3.368 kcfs

Relationship between river and off-channel habitat

GAWA Side Channel Depth, River Depth, Salem Gage

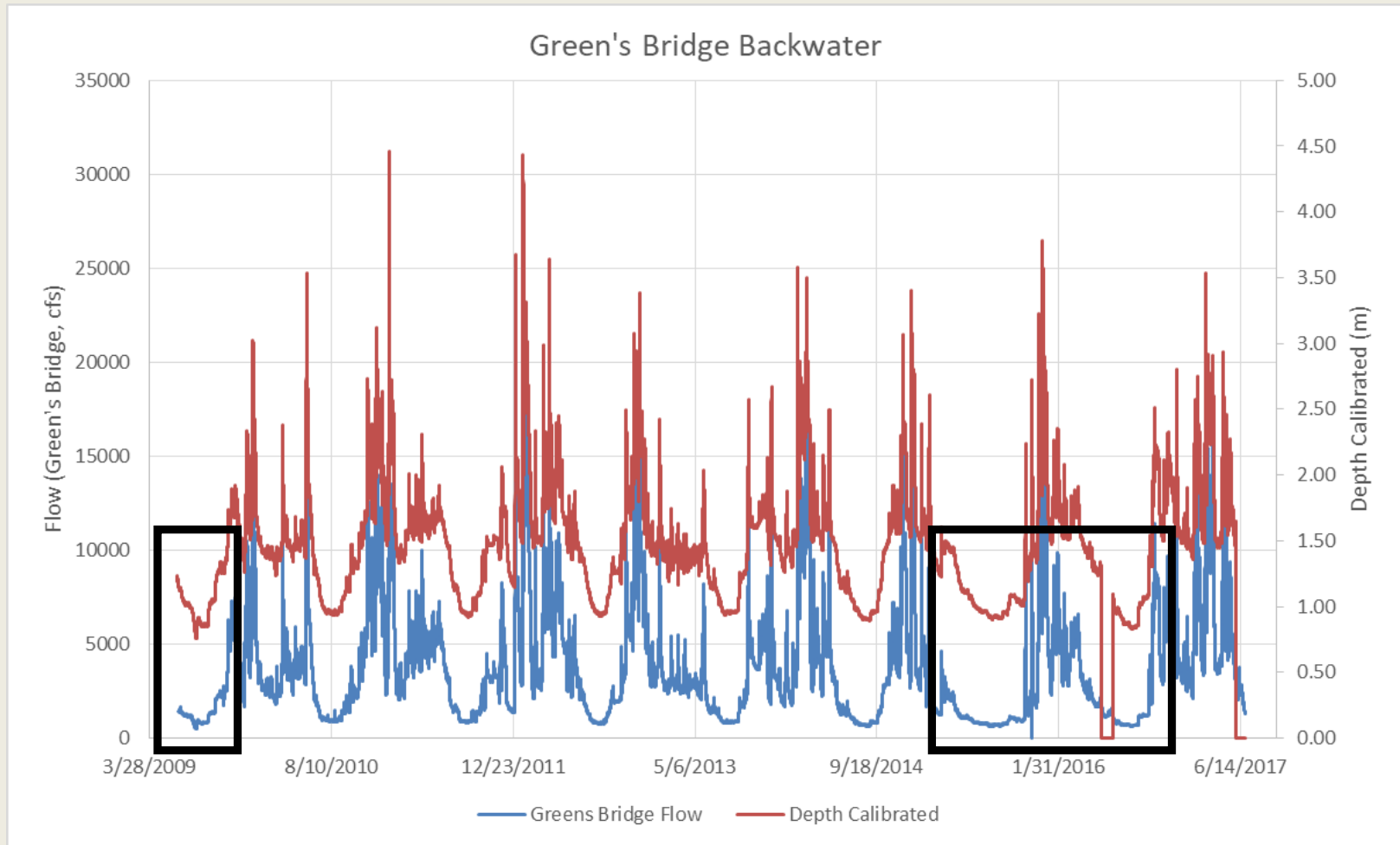


Habitat dataset: Now current



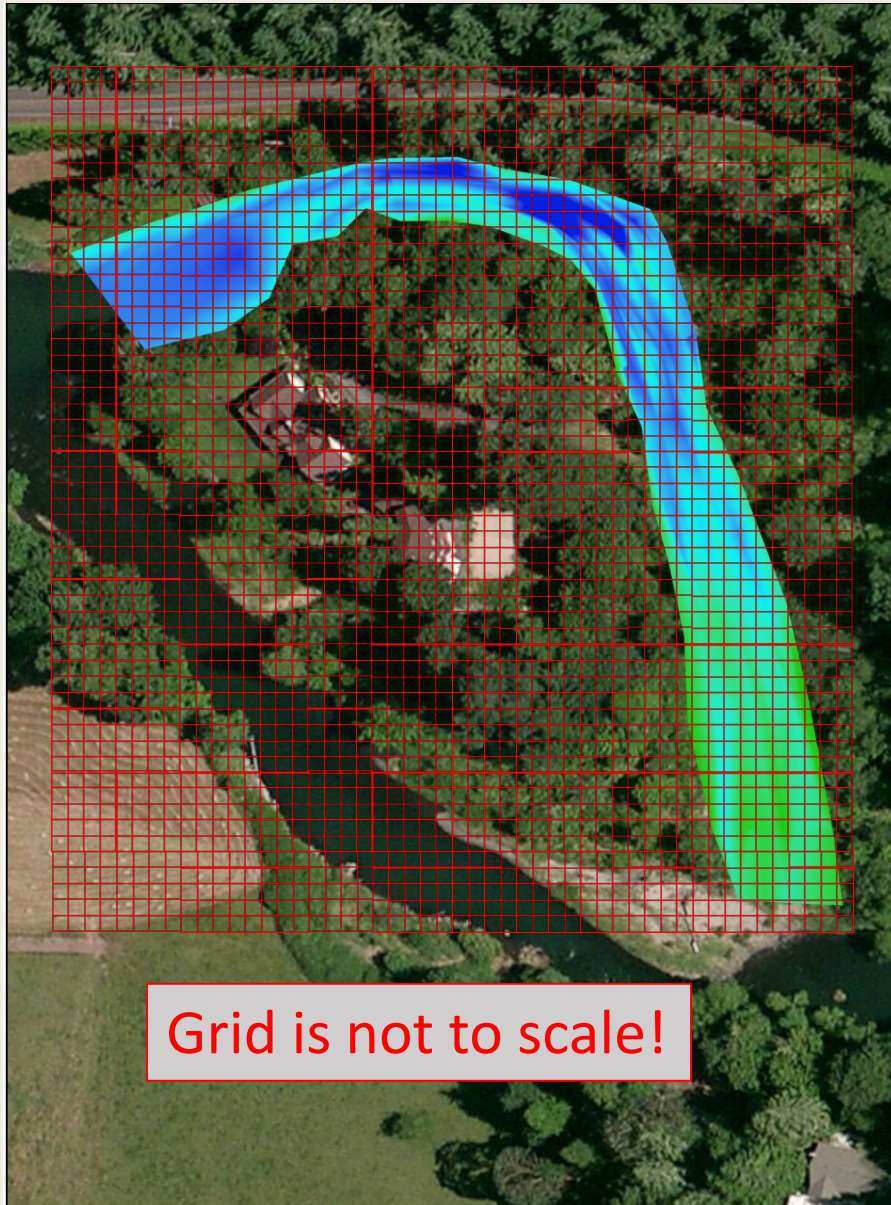
Interpretation

- Focus on two periods
 - 2009 Big Cliff event
 - Droughts: 2015, 2016



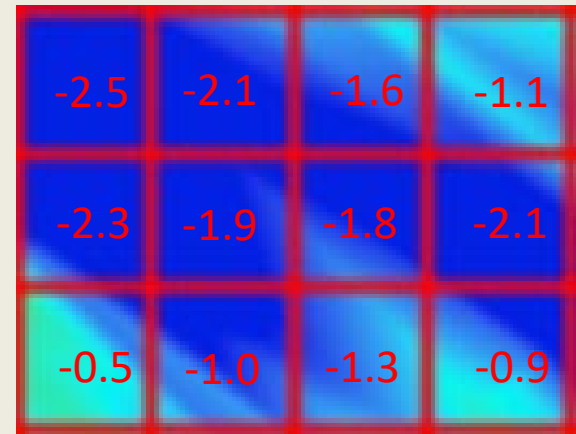


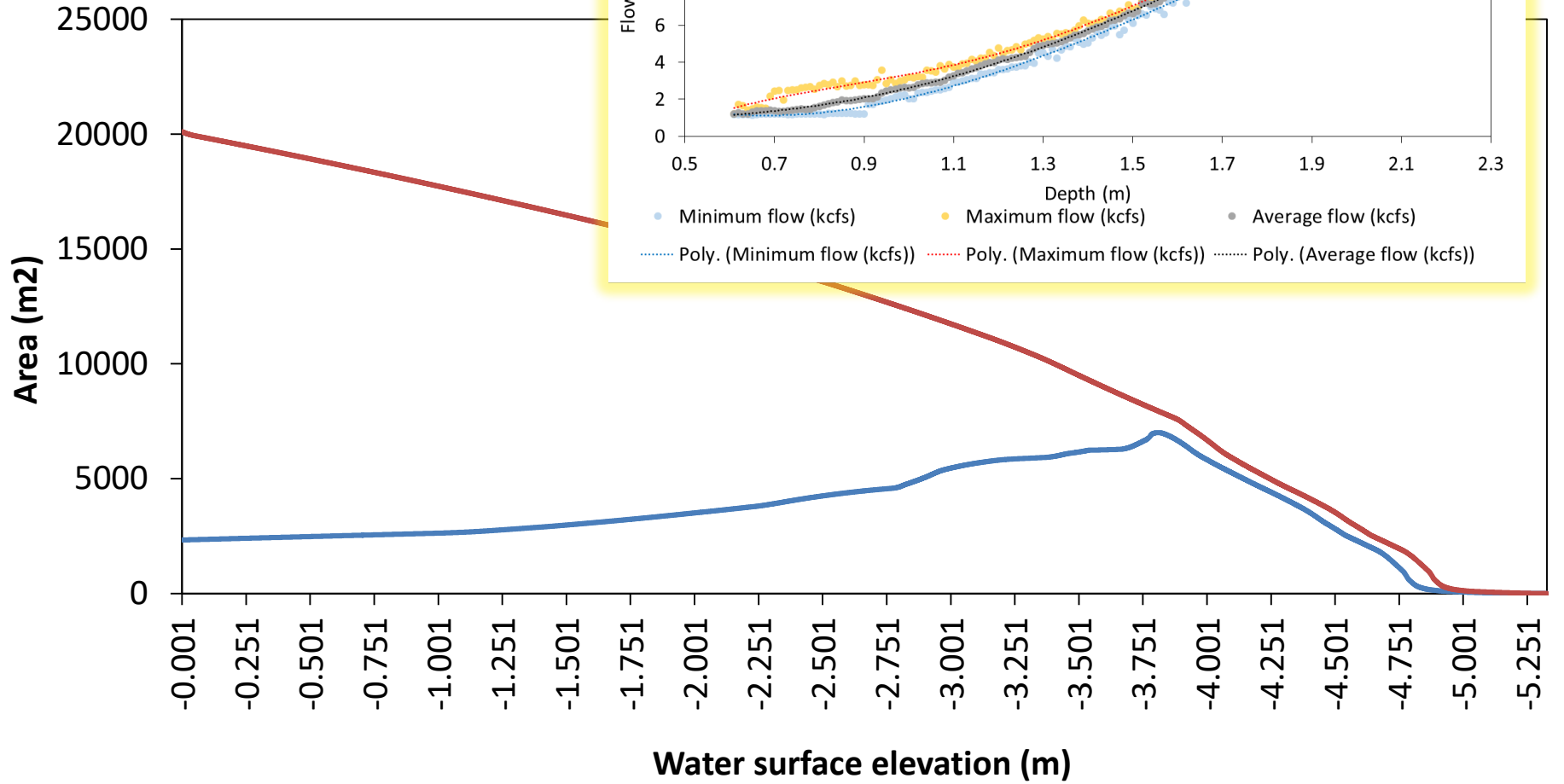
Back to bathymetry

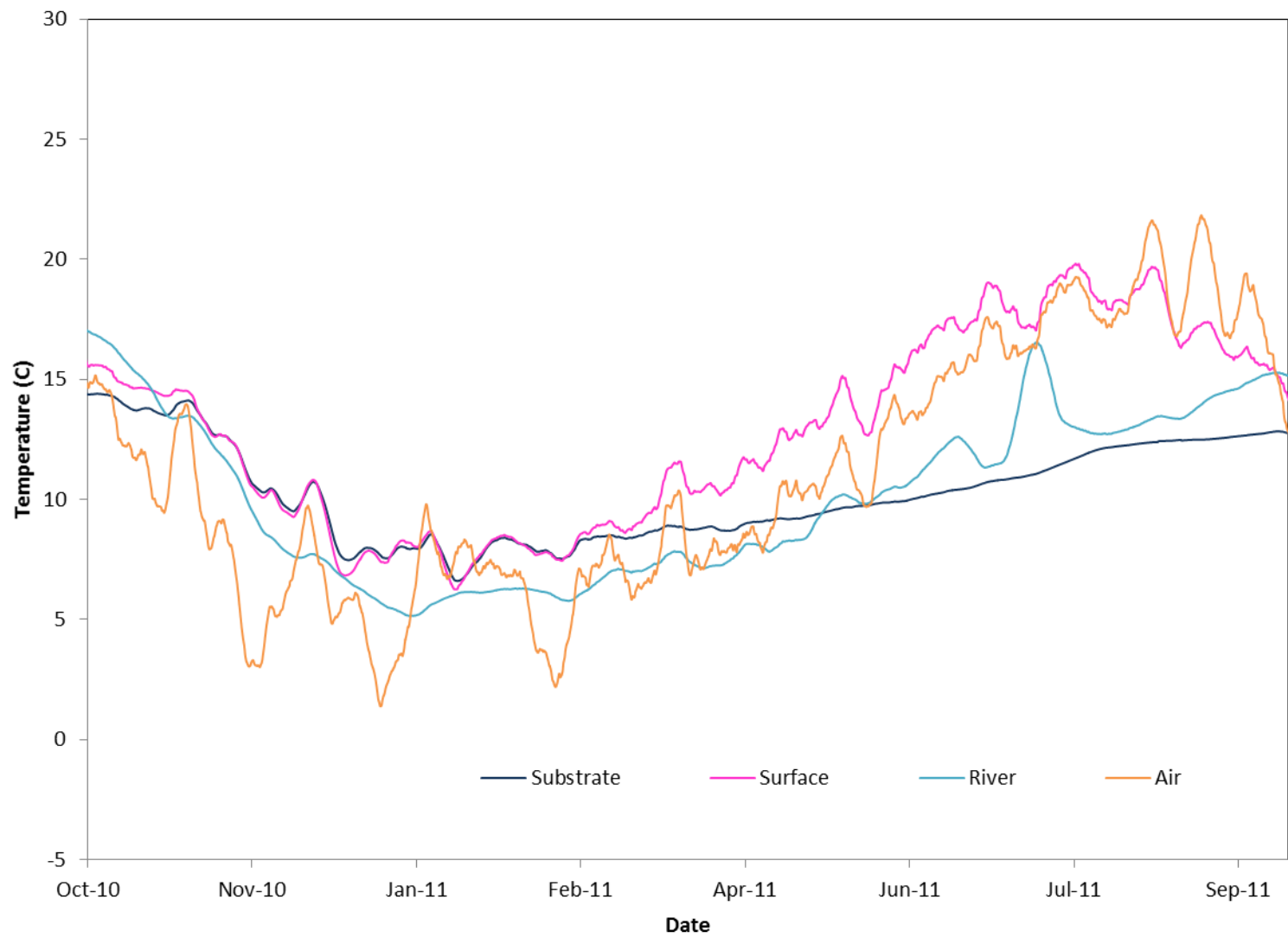


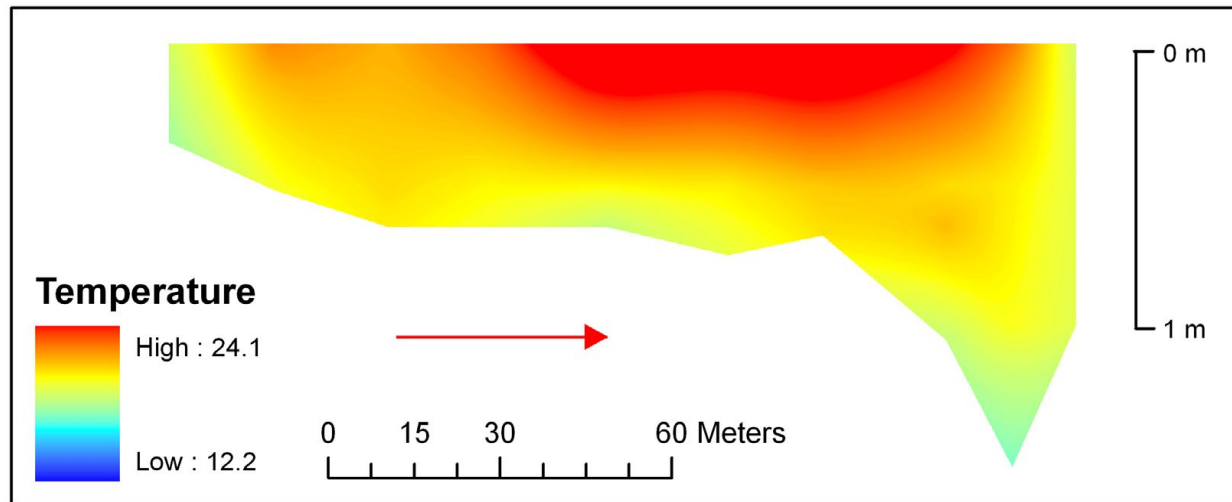
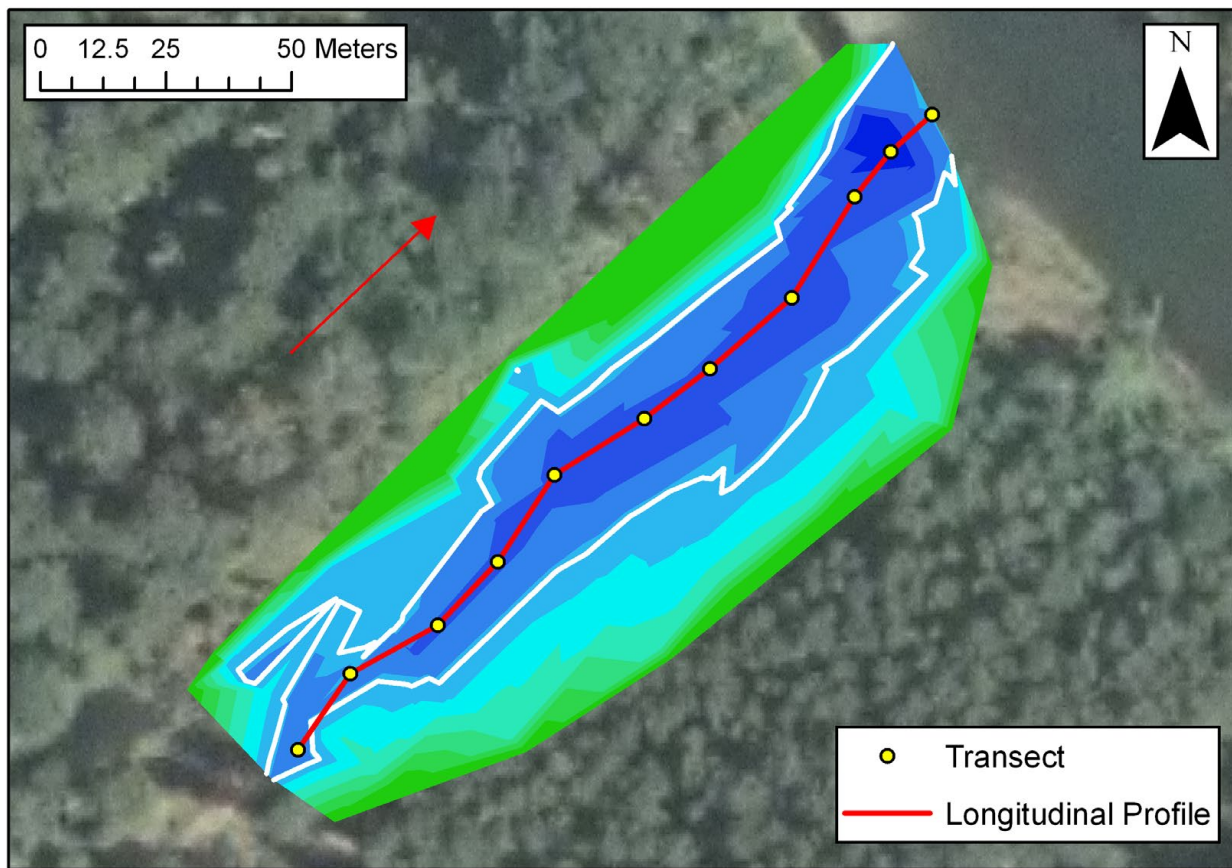
Convert TIN map to raster grid

Each cell 0.1 m^2 , and contains elevation data



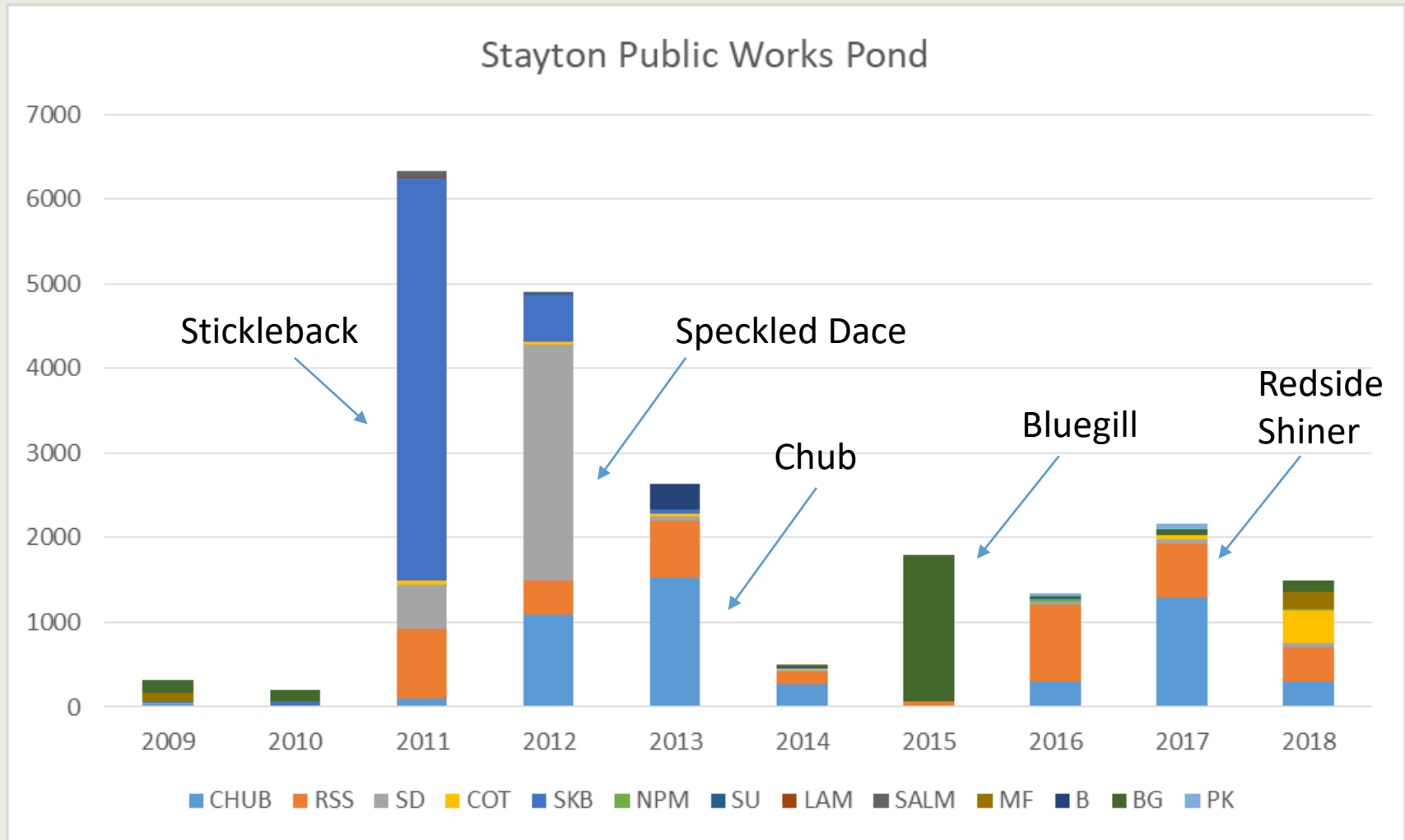




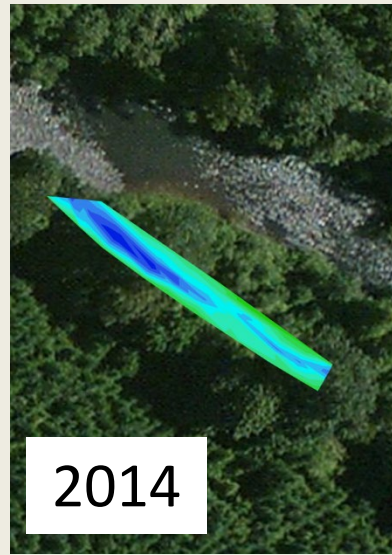
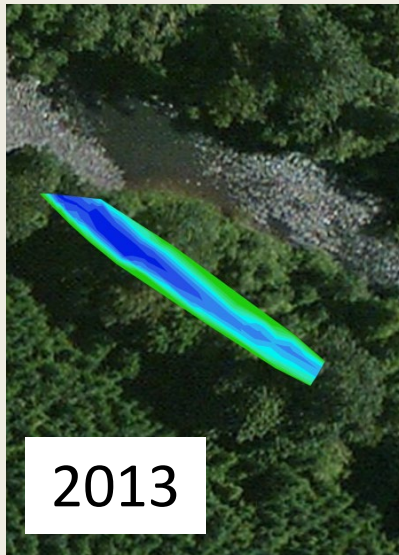
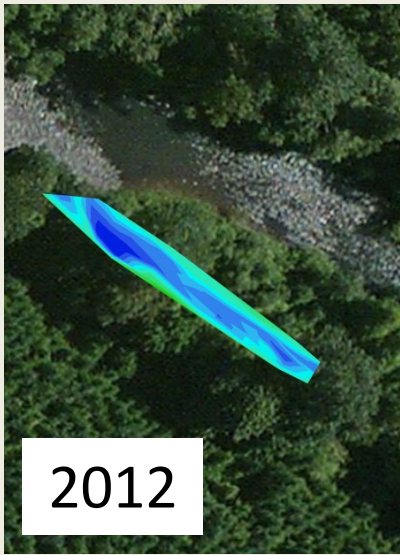




Fish assemblage, abundance dataset



Additional studies: Fall Creek Drawdown

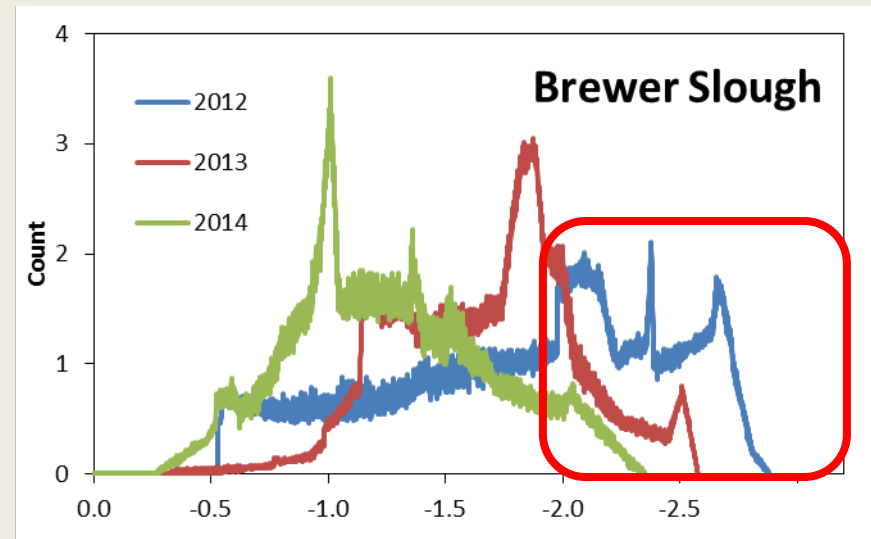


Objective:
Determine the
impact of
complete
reservoir
drawdown on off-
channel habitats

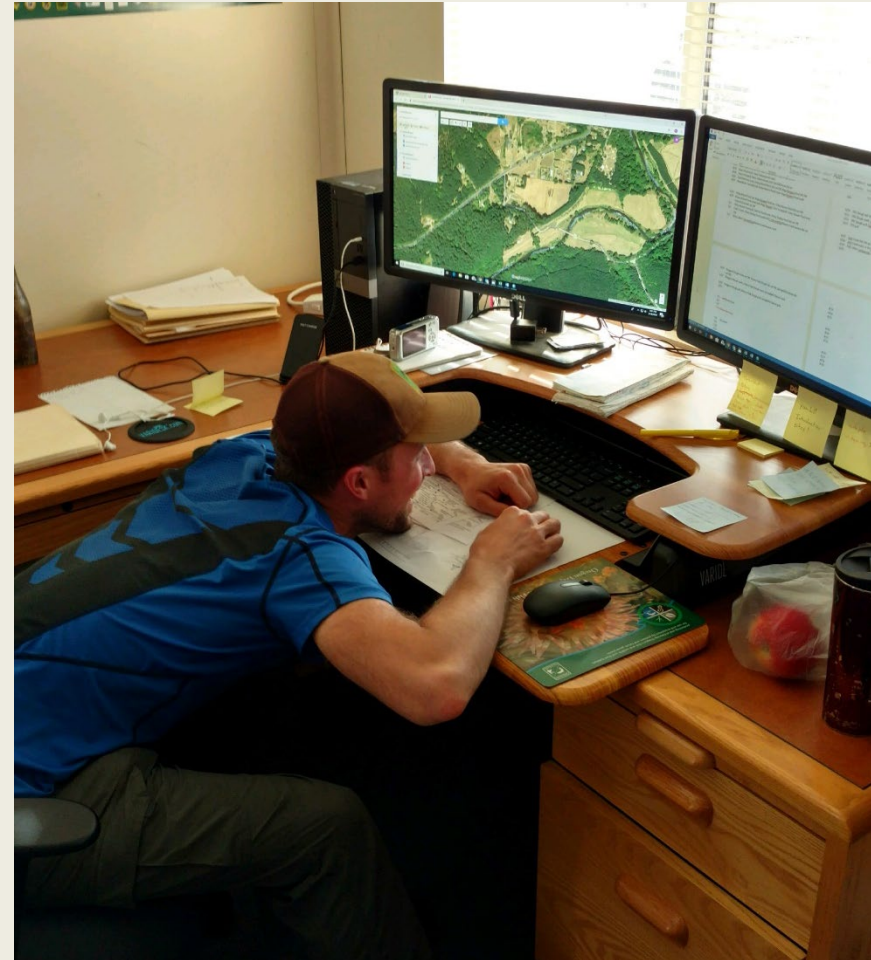
Initially: Sedimentation severely
reduced off-channel habitat

Recently: Some sites have
partially recovered

Managed flows may not have
energy necessary to move
sediment from off-channel
locations



Data Prep: '09-'19 dataset complete



- ~6 months man hours to complete
- Bathymetry maps ('12-'19): ~50% complete

Initial Findings

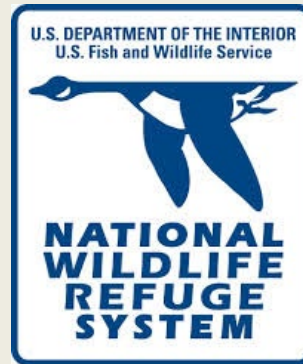
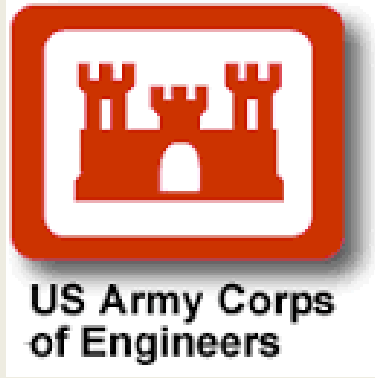
- Initial analyses
 - Positive relationship between flow and abundance
 - Strong relationship between flow and water depth, habitat quality
 - Temperature varied

Future work, conclusions

- Post-delisting Monitoring Plan
 - Concludes in 2023
 - Tools to support species
- Floodplain Study
 - Provide information to ACOE, partners
 - Manage flow, temperature
 - Support Oregon Chub, other native species in connected habitats
- Sustained recovery

Acknowledgements

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Questions?



WORLD RECORD

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