Action Effectiveness Monitoring and Research Spectacular

Science Work Group Meeting - March 26, 2019

Lower Columbia Estuary Partnership

Overview

- 2019 AEMR Status
  - Programmatic AEMR Overview
  - Sites and Metrics
- AEM Metrics and Data
- Discussion

Programmatic Action Effectiveness Monitoring

Columbia Estuary Ecosystem Restoration Program (CEERP) Objectives

- Obj. 1. Increase the capacity (quality) of estuarine and tidal-fluvial ecosystems
- Obj. 2. Increase the opportunity for access by aquatic organisms to and for export of materials from shallow water habitats
- Obj. 3. Improve ecosystem realized functions for juvenile salmonids

Action Effectiveness Monitoring Levels

Level 1 – Intensive

E.g. fish density, growth, genetics, diet

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Level 2 – Extensive

E.g. channel cross-sections, salmonid prey, plant species composition

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Level 3 – Basic (or Standard) Measurements *E.g. water surface elevation, water temperature, sediment accretion, photo points*

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\# Monitored Metrics

\# Restoration Projects

Level 3 Monitoring (Basic)

- Before/After Sampling Design
- Metrics
  - Hydrology and Water Quality
    - Water surface elevation and water temperature (All Sites)
  - Sediment accretion (All Sites)
  - Photo points (All Sites)
- Frequency
  - 1 year pre-restoration
  - 1 through 5 year post restoration

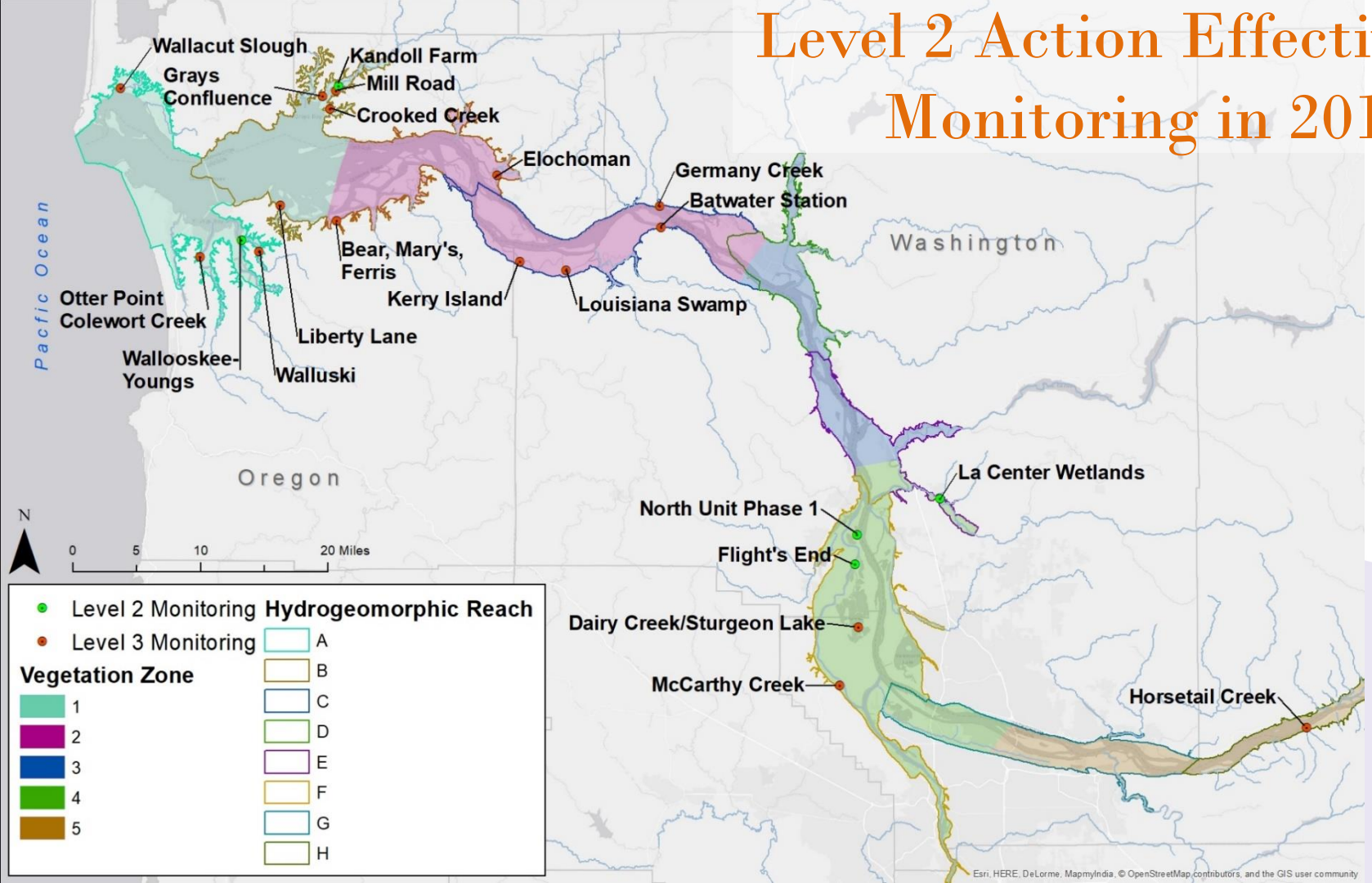
Level 2 Monitoring (Extensive)

- Before/After Reference Impact Sampling Design
- Metrics
  - Vegetation Composition and Cover
  - Salmonid Prey
  - Channel Cross Sections
  - Fish Status
- Frequency
  - 1 year pre-restoration
  - 1, 3, 5, 10 year post restoration

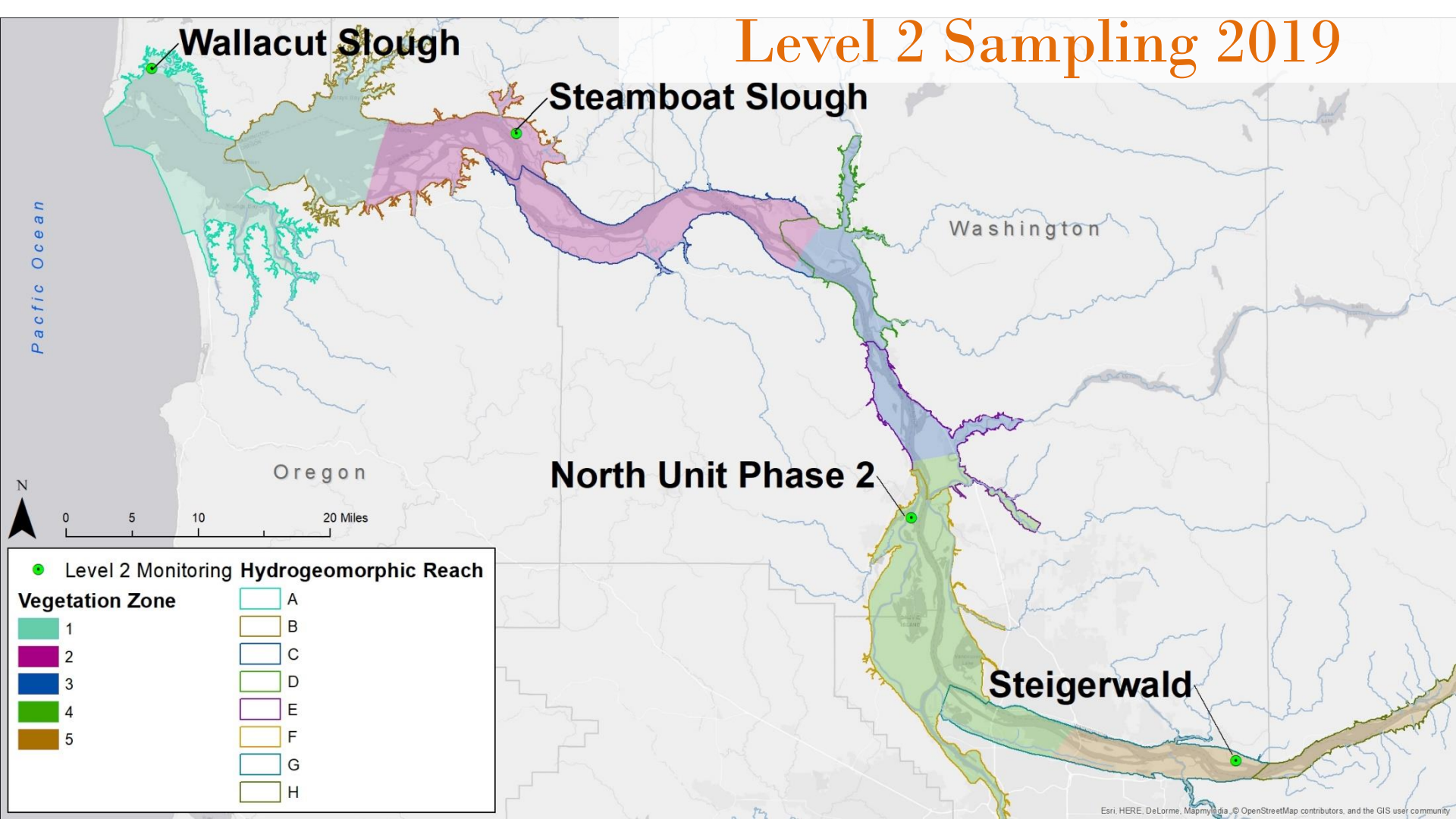
Level 1 Monitoring (Intensive)

- Metrics
  - Chinook Diets
  - Chinook Genetics
  - Stable Isotopes
  - Fish Community
  - Fish condition index
  - Fish length/weight
  - Salmonid Prey (Neuston, Benthos, Terrestrial)
- Frequency
  - 2016 & 2017

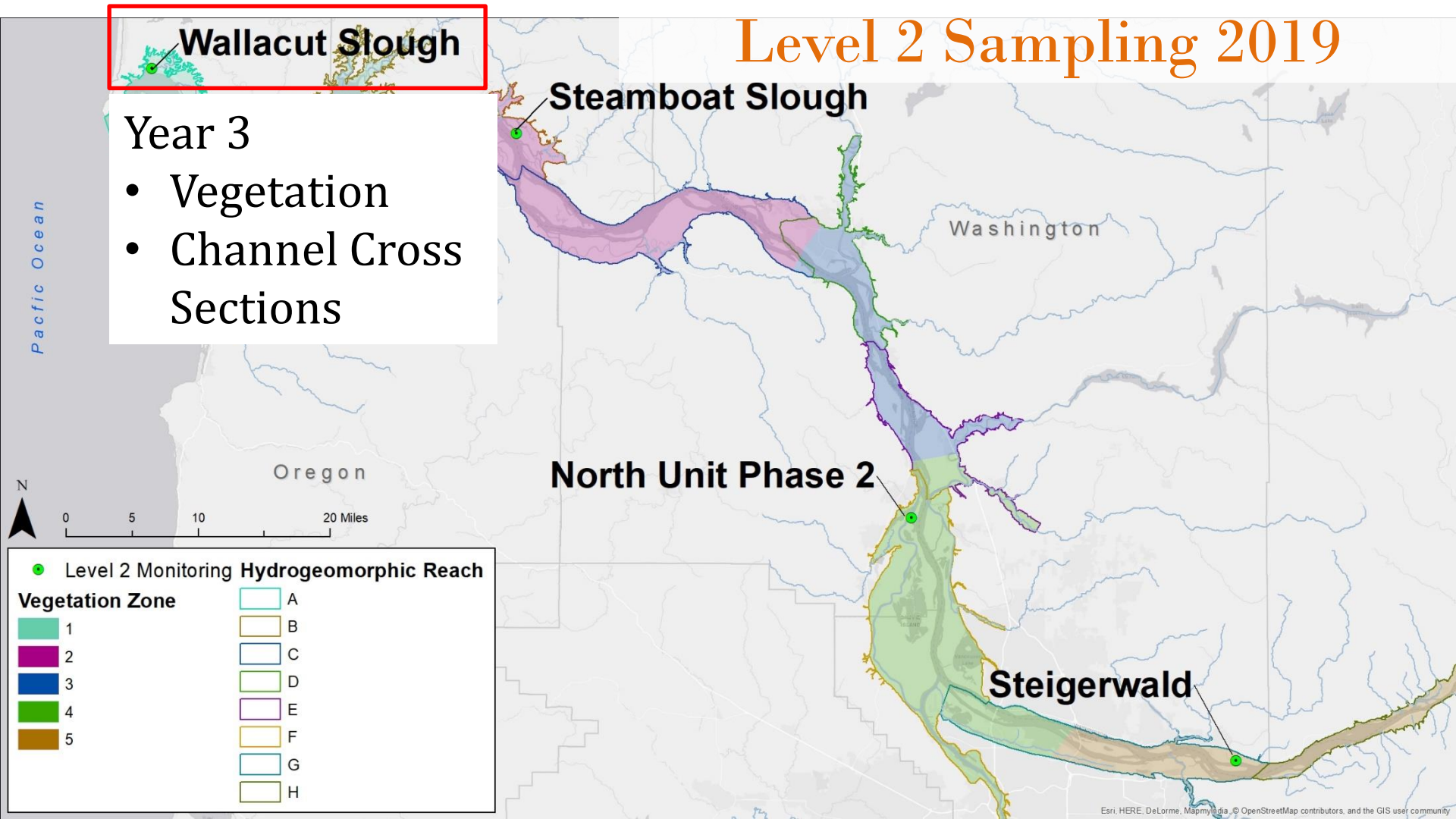
Level 2 Action Effectiveness Monitoring in 2018



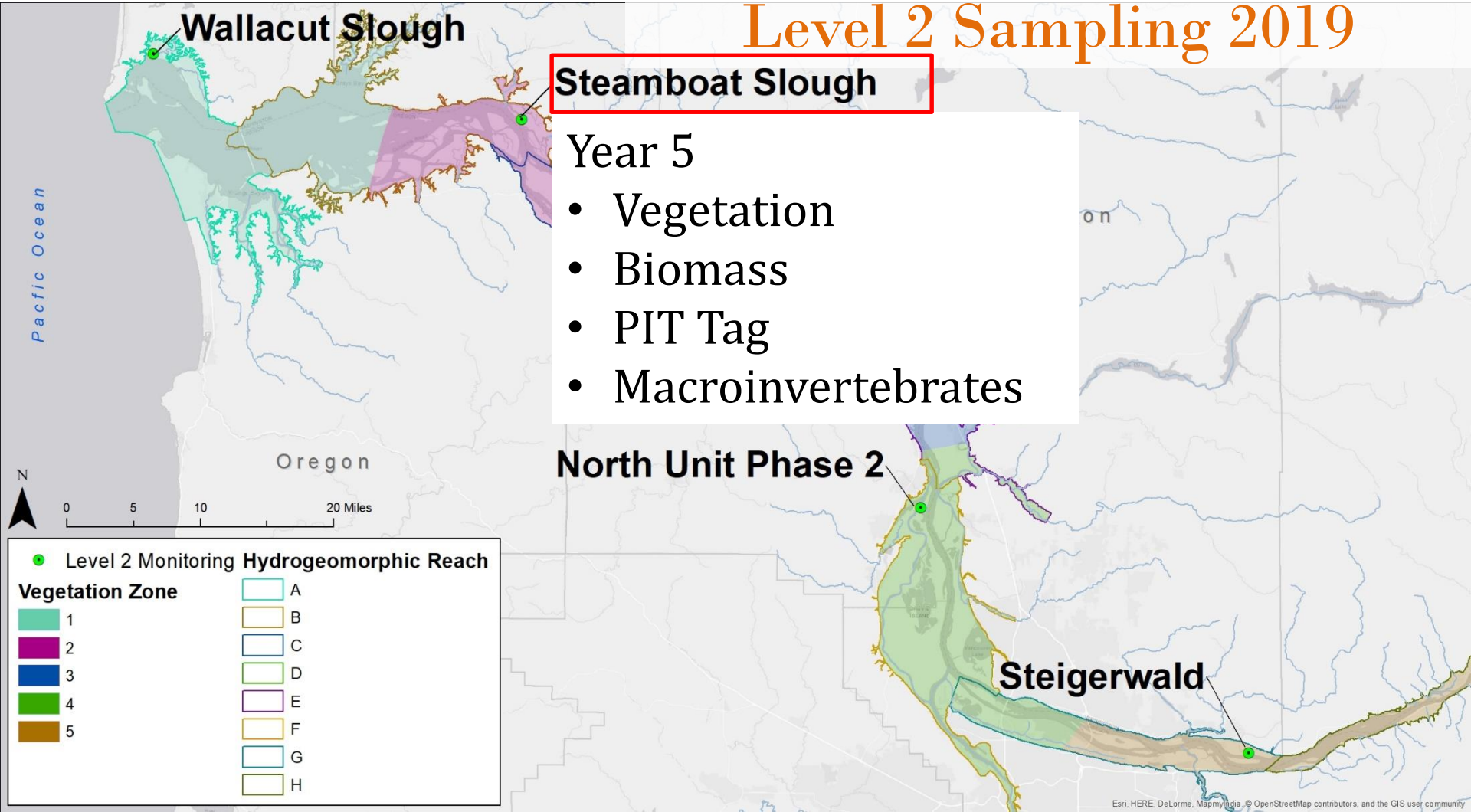
Level 2 Sampling 2019



Level 2 Sampling 2019



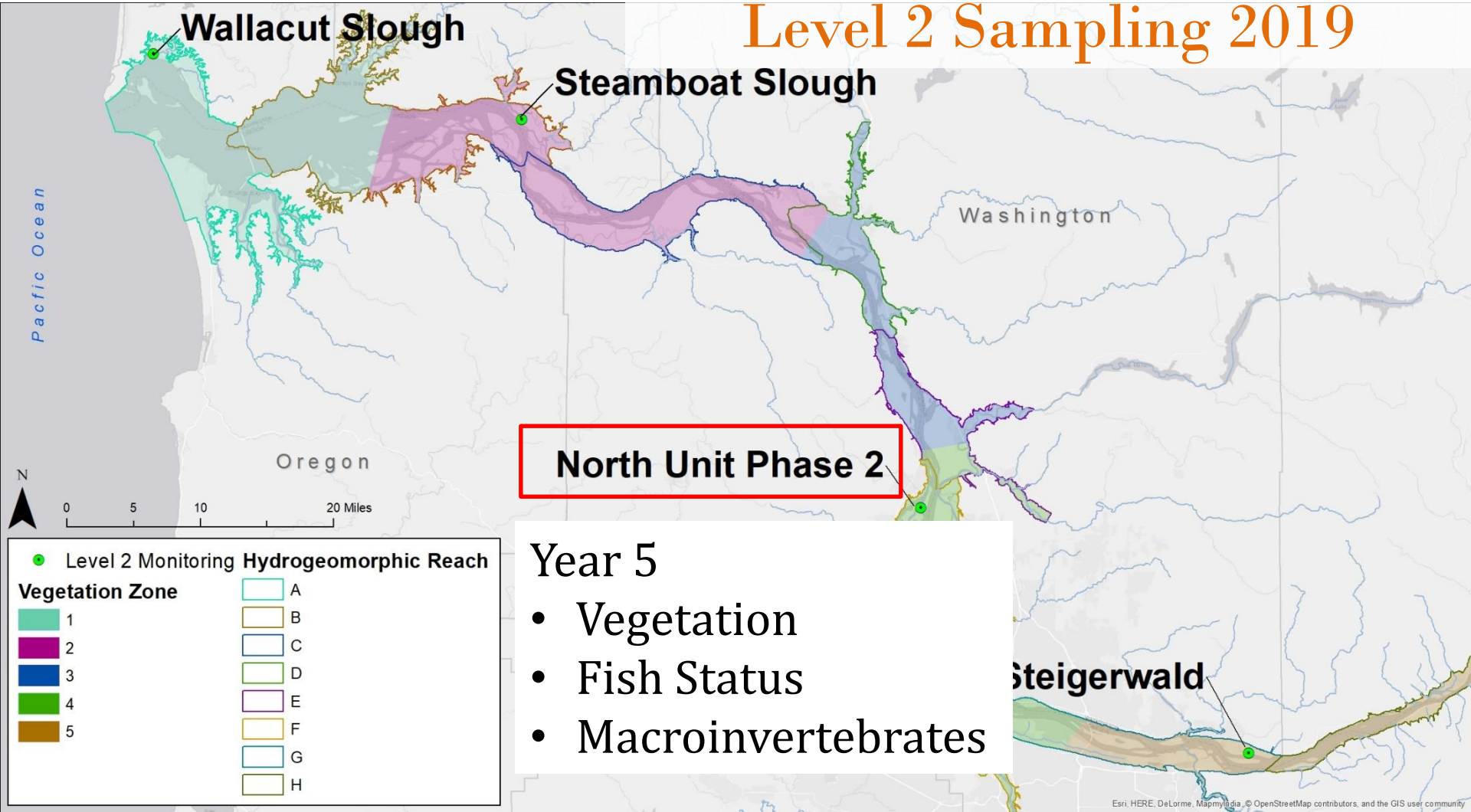
Level 2 Sampling 2019



Year 5

- Vegetation
- Biomass
- PIT Tag
- Macroinvertebrates

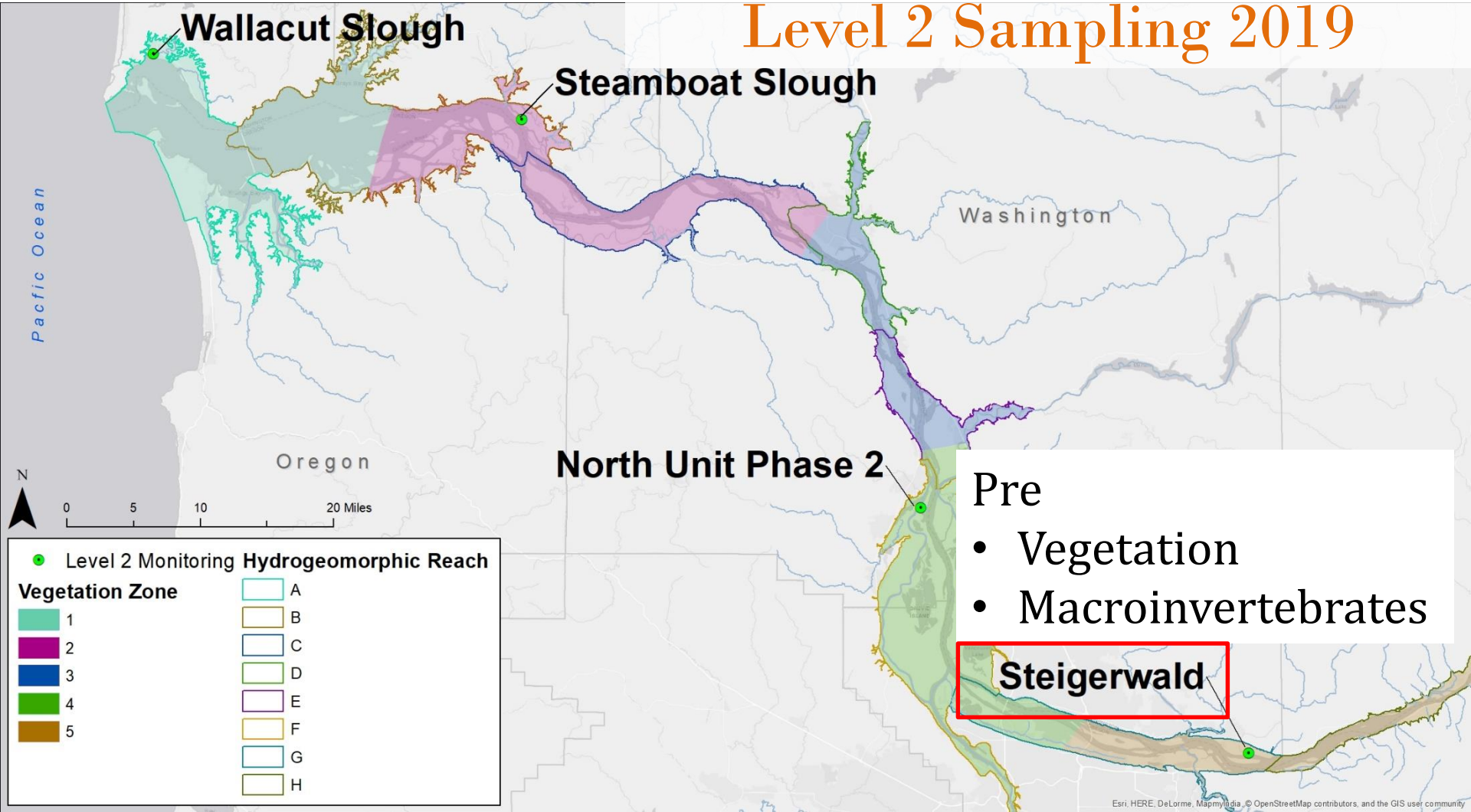
Level 2 Sampling 2019



Year 5

- Vegetation
- Fish Status
- Macroinvertebrates

Level 2 Sampling 2019



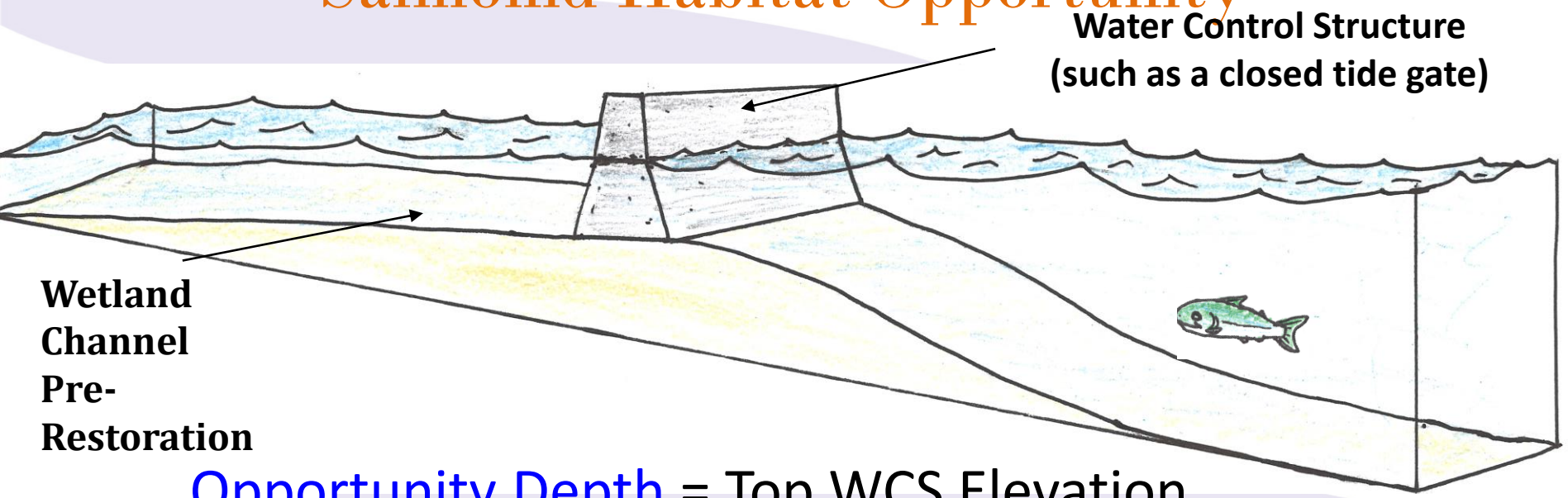
Pre

- Vegetation
- Macroinvertebrates

Analysis

- Water Temperature – Monthly Average for the 7 day moving average maximum temperature (7-DMAM
- Water Surface Elevation - # of days site exceeded 2-year food elevation
- Vegetation - Composition, Abundance, Species Richness, Species Diversity, Average Marsh Elevation

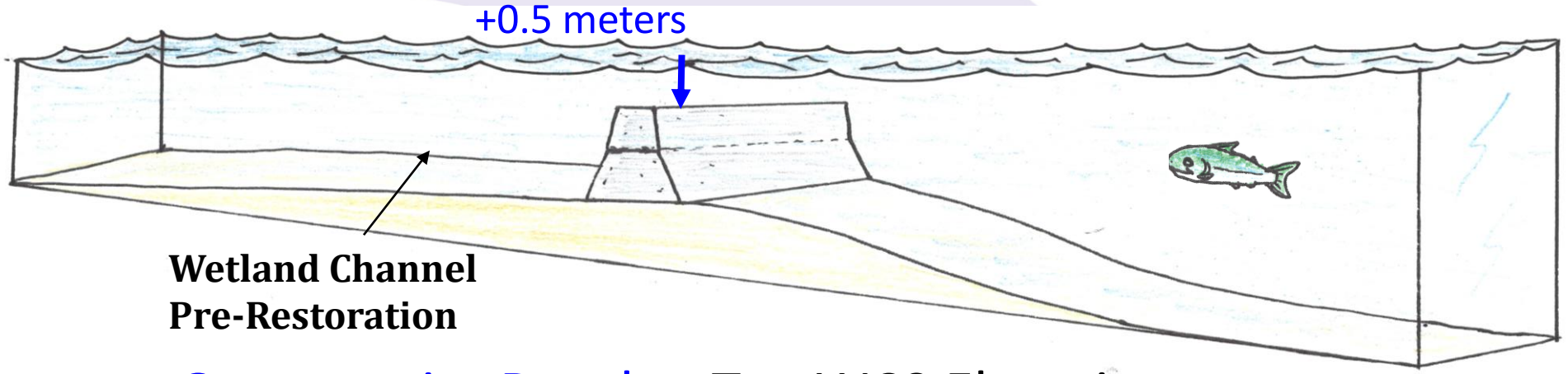
Salmonid Habitat Opportunity



Opportunity Depth = Top WCS Elevation
+ 0.5 m

Opportunity Temp = Good ≤ 17.5 C
Fair 17.5-22 C
Poor >22 C

Salmonid Habitat Opportunity



Opportunity Depth = Top WCS Elevation
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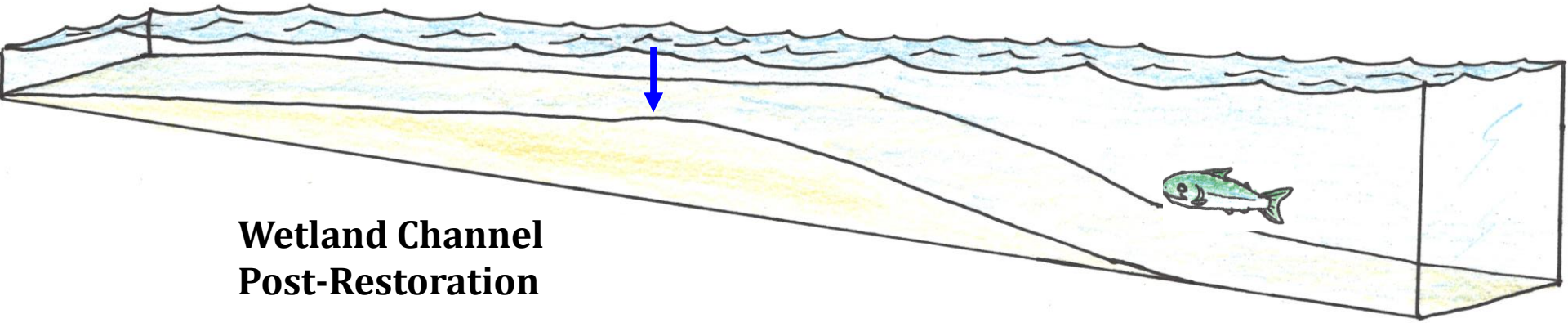
Fair 17.5-22 C
Poor >22 C

Salmonid Habitat Opportunity

+0.5 meters



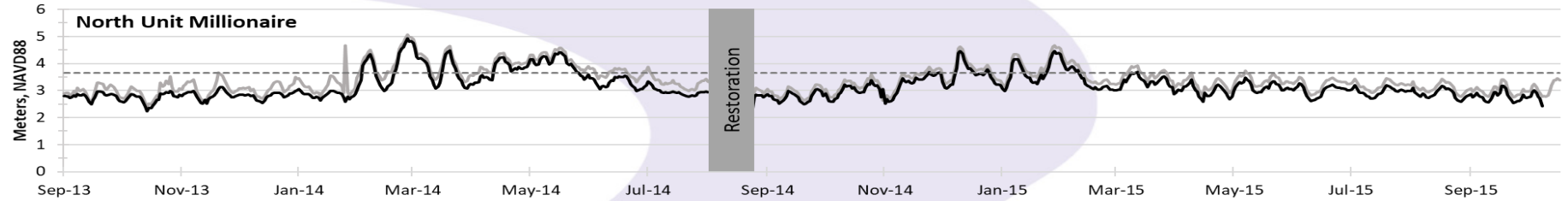
Wetland Channel
Post-Restoration

Opportunity Depth = Top WCS Elevation
+ 0.5 m

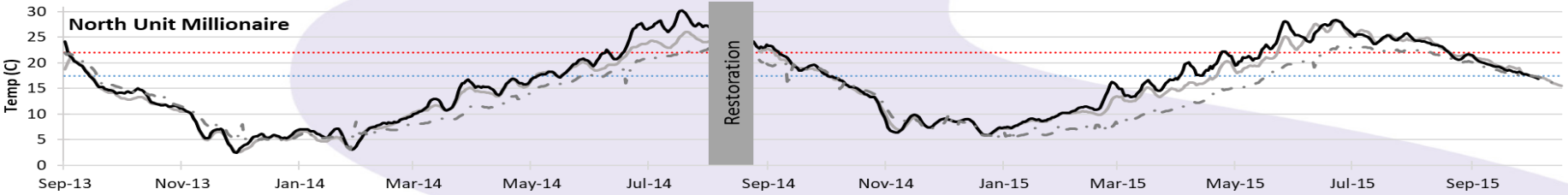
Opportunity Temp = Good ≤ 17.5 C
Fair 17.5-22 C
Poor >22 C

Opportunity

Habitat Access = Water Surface Elevation



Habitat Quality = Water Temperature



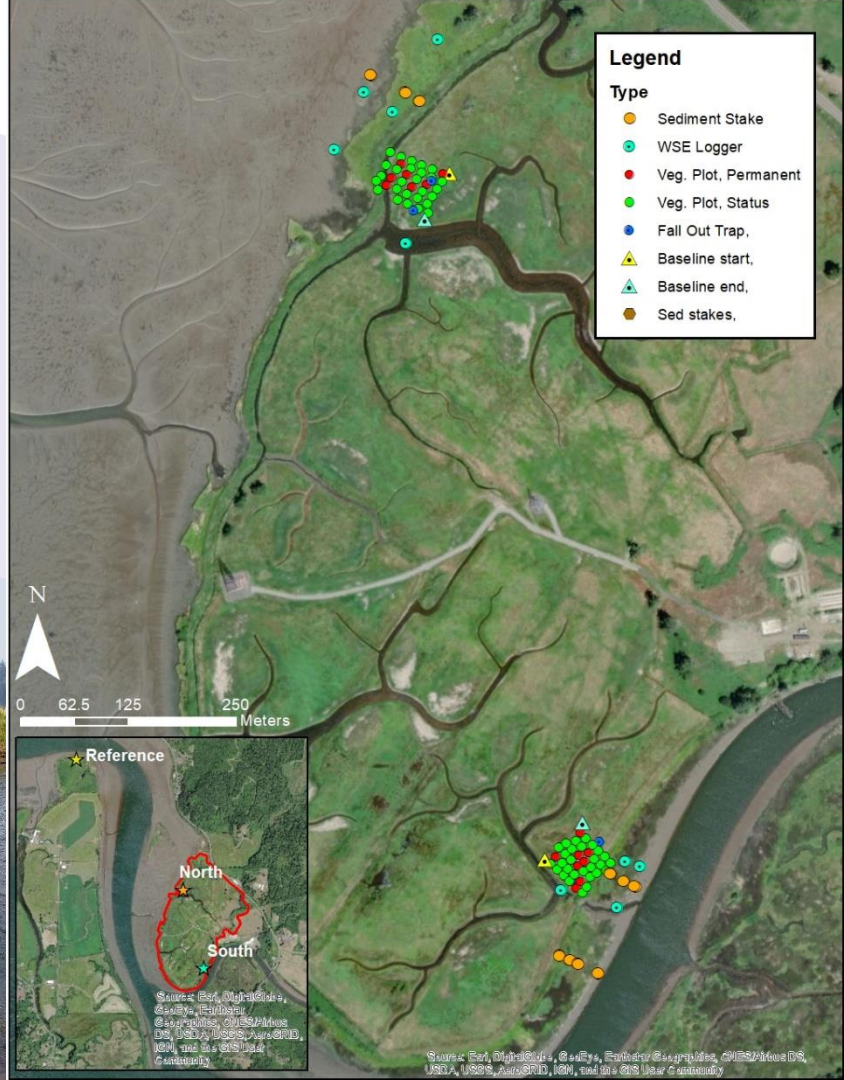
Habitat Access + Habitat Quality = Opportunity

Water surface elevation and water temperature used together tells a more complete story

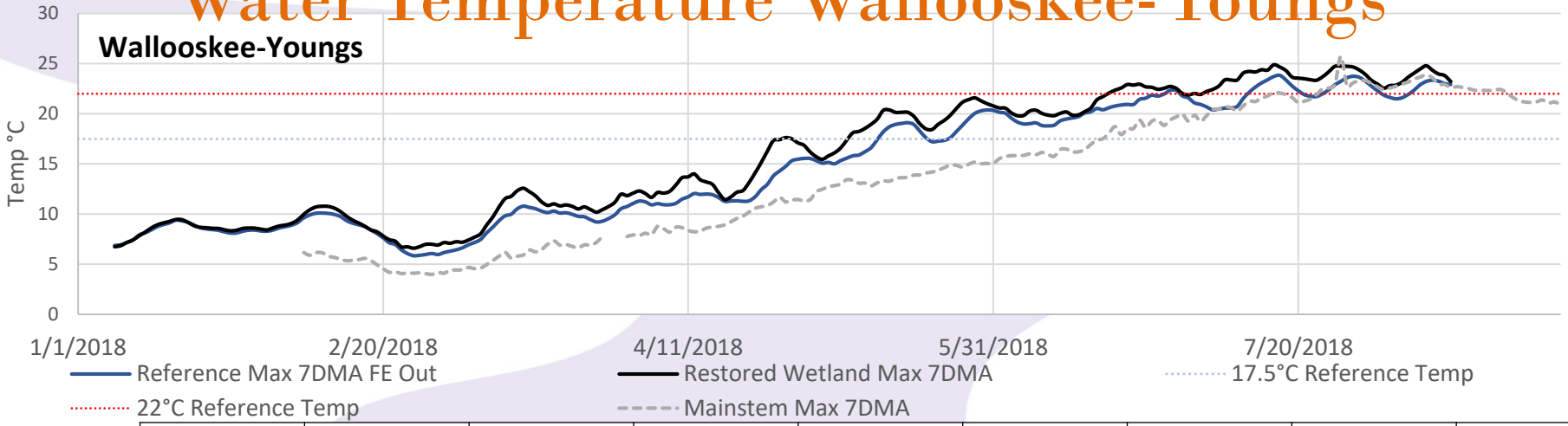
Results

Wallooskee-Youngs

- Pre-restoration Monitoring: 2015
- Post-restoration Monitoring: 2018
- Reach A

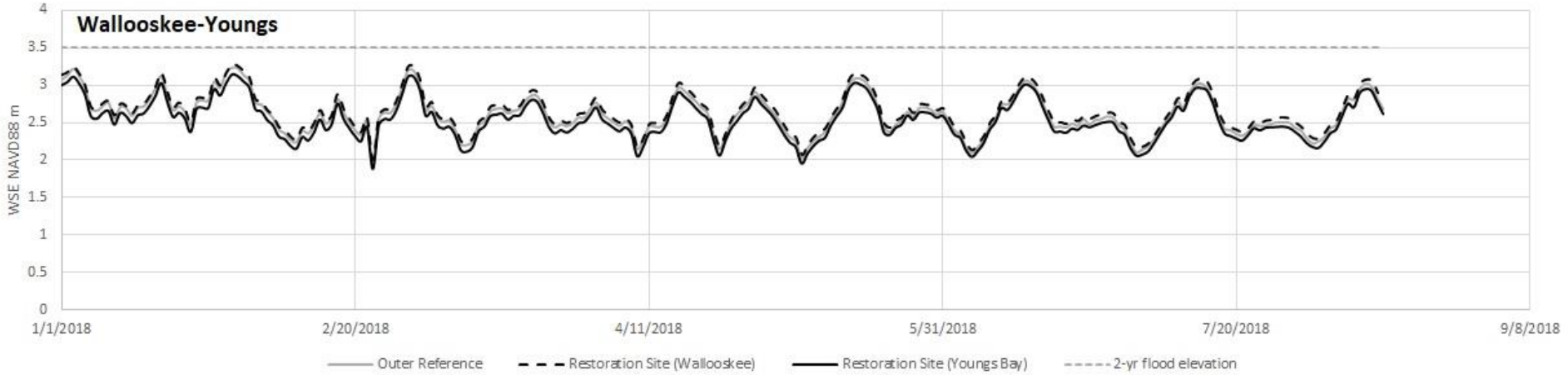


Water Temperature Wallooskee-Youngs



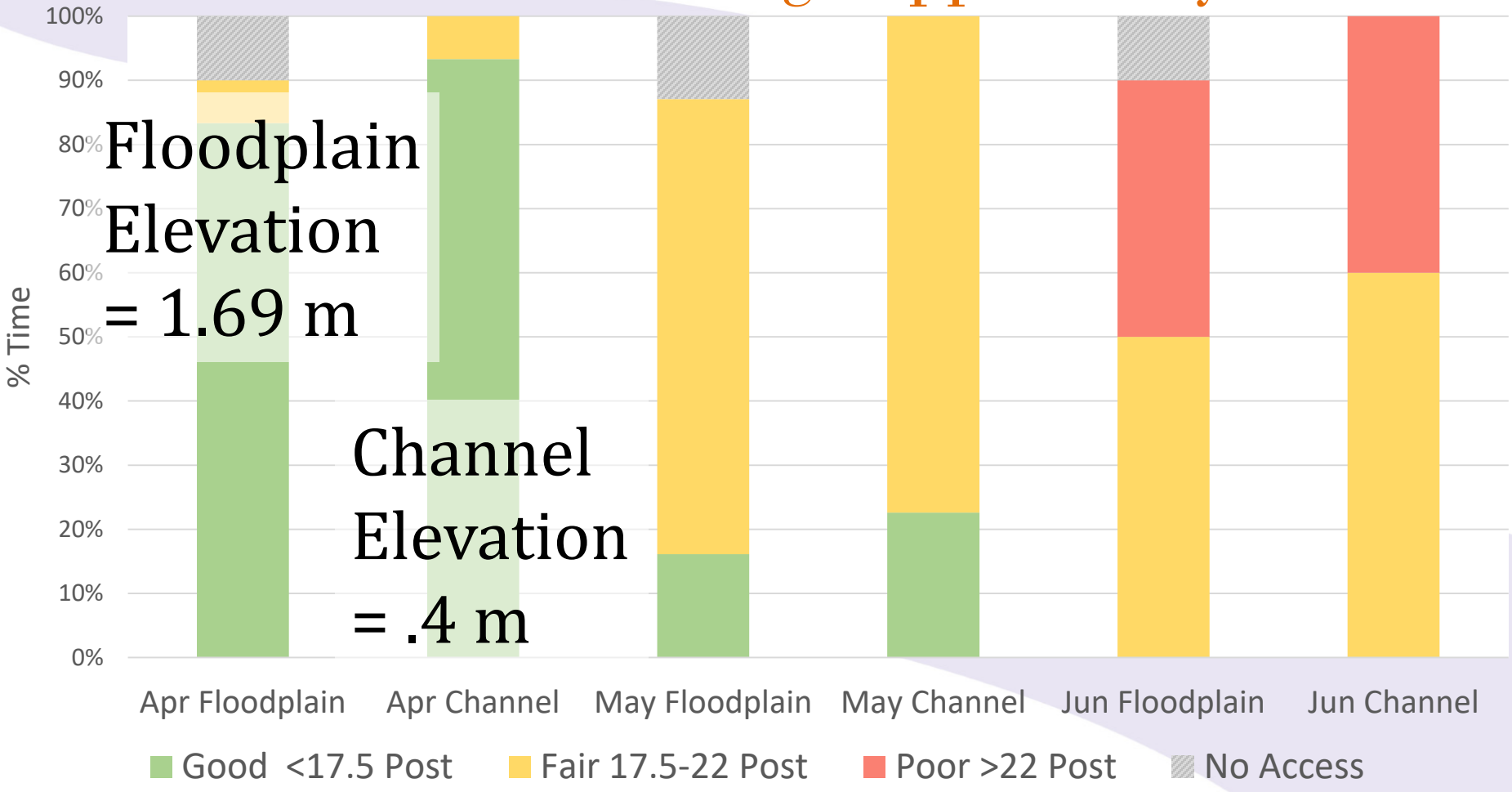
	Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Restored Wallooskee	n (days)	31	28	31	30	31	30	31	13
	Mean	8.2	8.1	9.5	12.6	18.0	20.5	22.3	22.4
Reference Wallooskee	n (days)	31	28	31	30	31	30	31	13
	Mean	8.1	7.7	8.9	11.9	17.2	19.6	21.3	21.5
Main Stem	n (days)		22	28	30	31	30	31	14
	Mean		5.1	5.9	9.4	13.7	17.3	21.5	23.0

Water Surface Elevation Wallooskee-Youngs

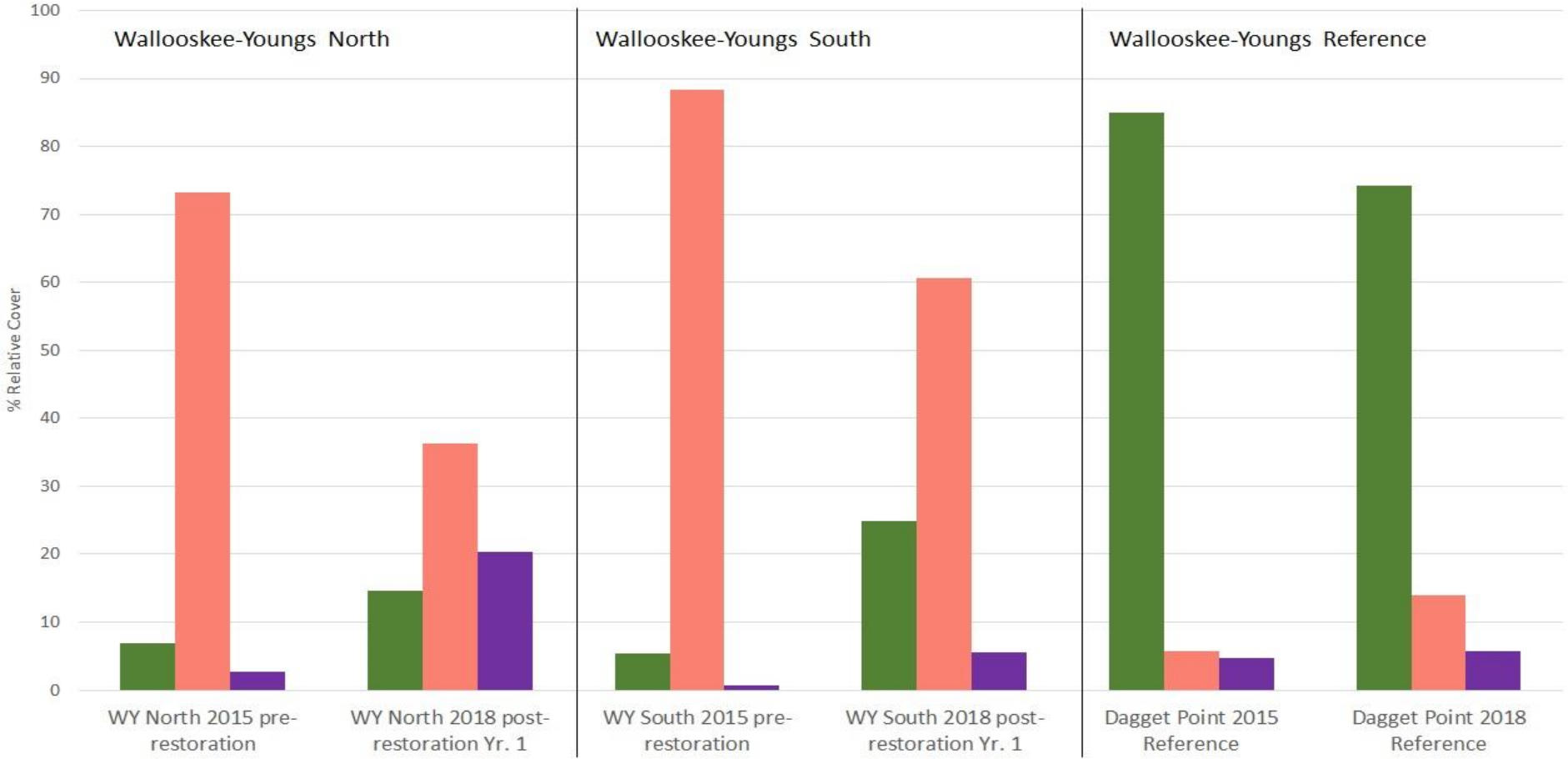


	Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Restored	n (days)	31	28	31	30	31	30	31	14
	Mean Max	2.76	2.48	2.54	2.51	2.52	2.50	2.45	2.56
	Days Exceeded 2 yr Flood Elevation	0	0	0	0	0	0	0	0
Reference	n (days)	31	28	31	30	31	30	31	14
	Mean Max	2.86	2.57	2.62	2.59	2.59	2.55	2.50	2.62

Wallooskee-Youngs Opportunity

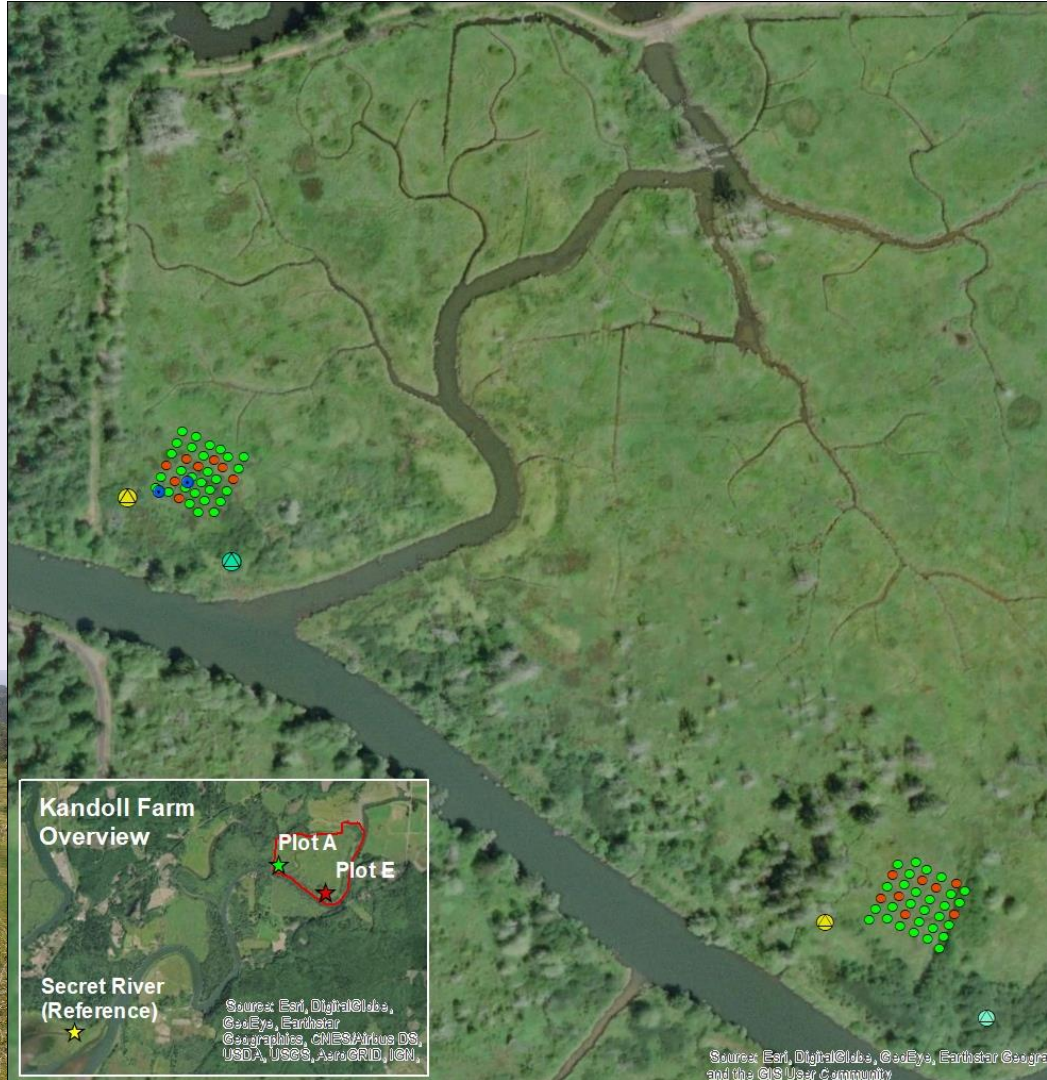


Wallooskee-Youngs Vegetation

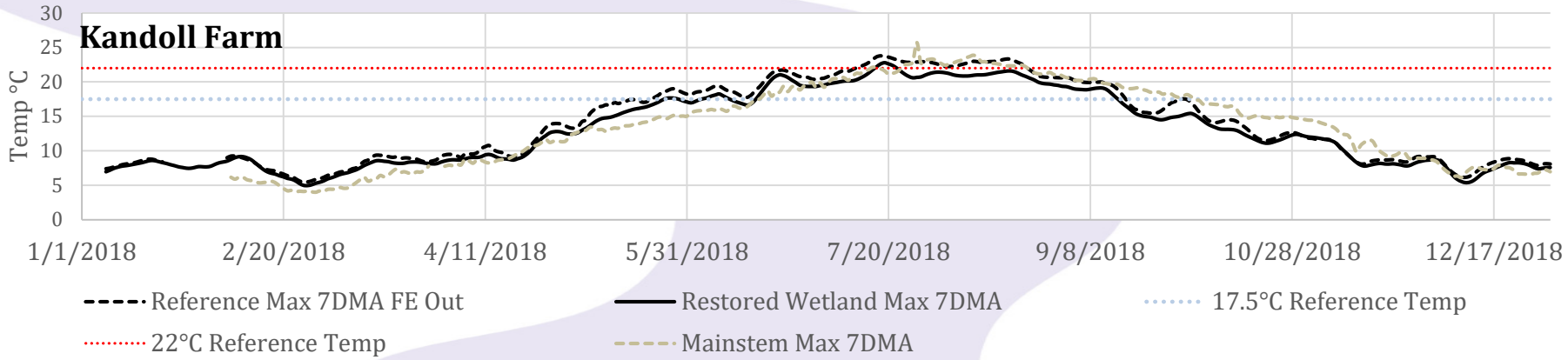


Kandoll Farm Phase2

- Pre-restoration Monitoring: 2013
- Post-restoration Monitoring: 2014, 2016, 2018
- Reach B

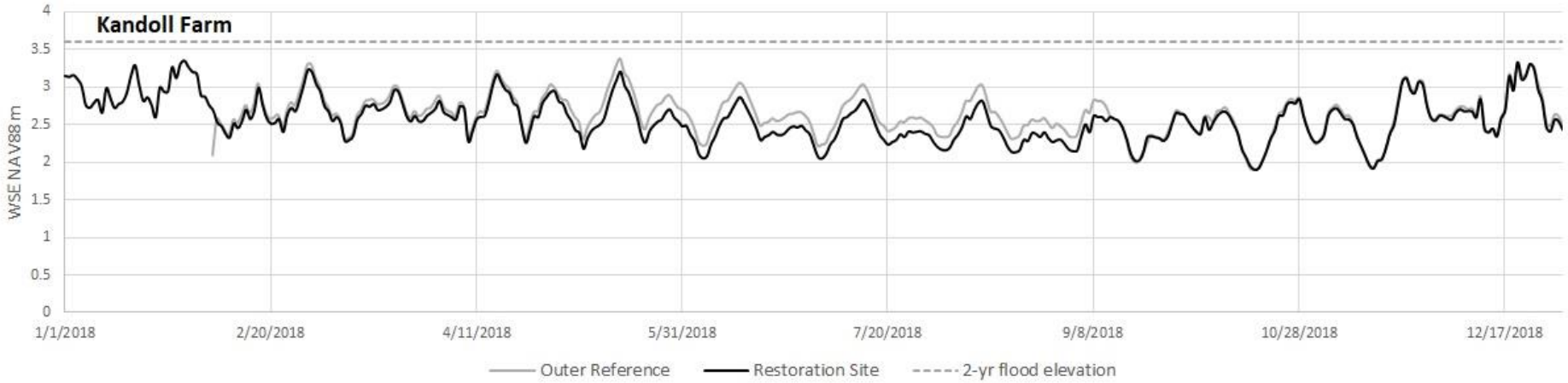


Water Temperature Kandoll Farm



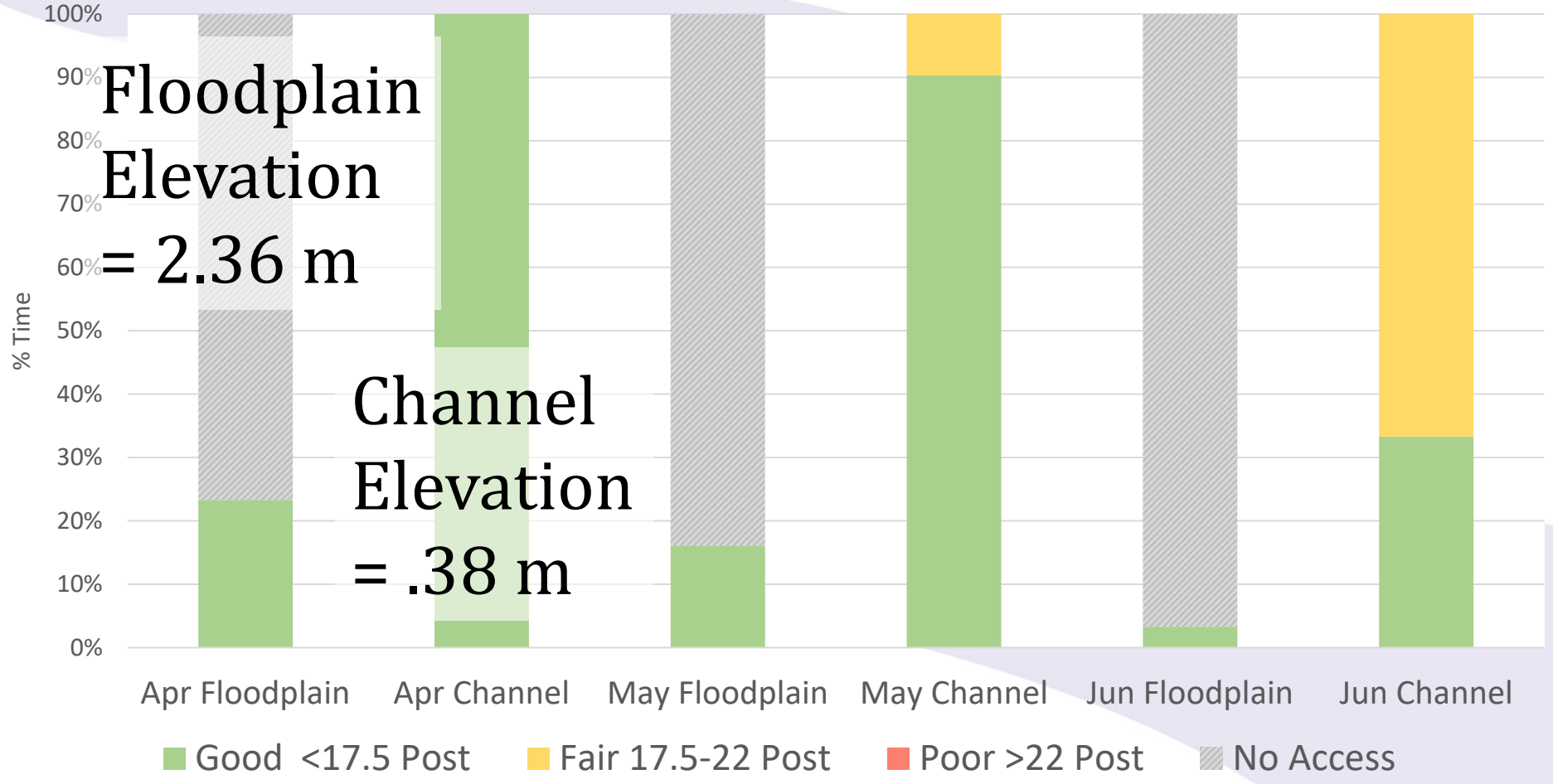
	Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Restored	n (days)	31	28	31	30	31	30	31	31	30	31	30	31
	Mean	7.7	7.0	8.0	10.2	15.8	18.7	21.0	20.6	16.6	12.5	9.0	7.2
Reference	n (days)	21	23	31	30	31	30	31	31	29	31	30	31
	Mean	8.0	6.9	8.5	11.0	17.2	19.9	22.5	22.1	17.9	13.1	9.3	7.8
Main Stem	n (days)		22	28	30	31	30	31	31	30	31	30	31
	Mean		5.1	5.9	9.4	13.7	17.3	21.5	22.4	19.4	15.8	11.2	7.2

Water Surface Elevation Kandoll Farm

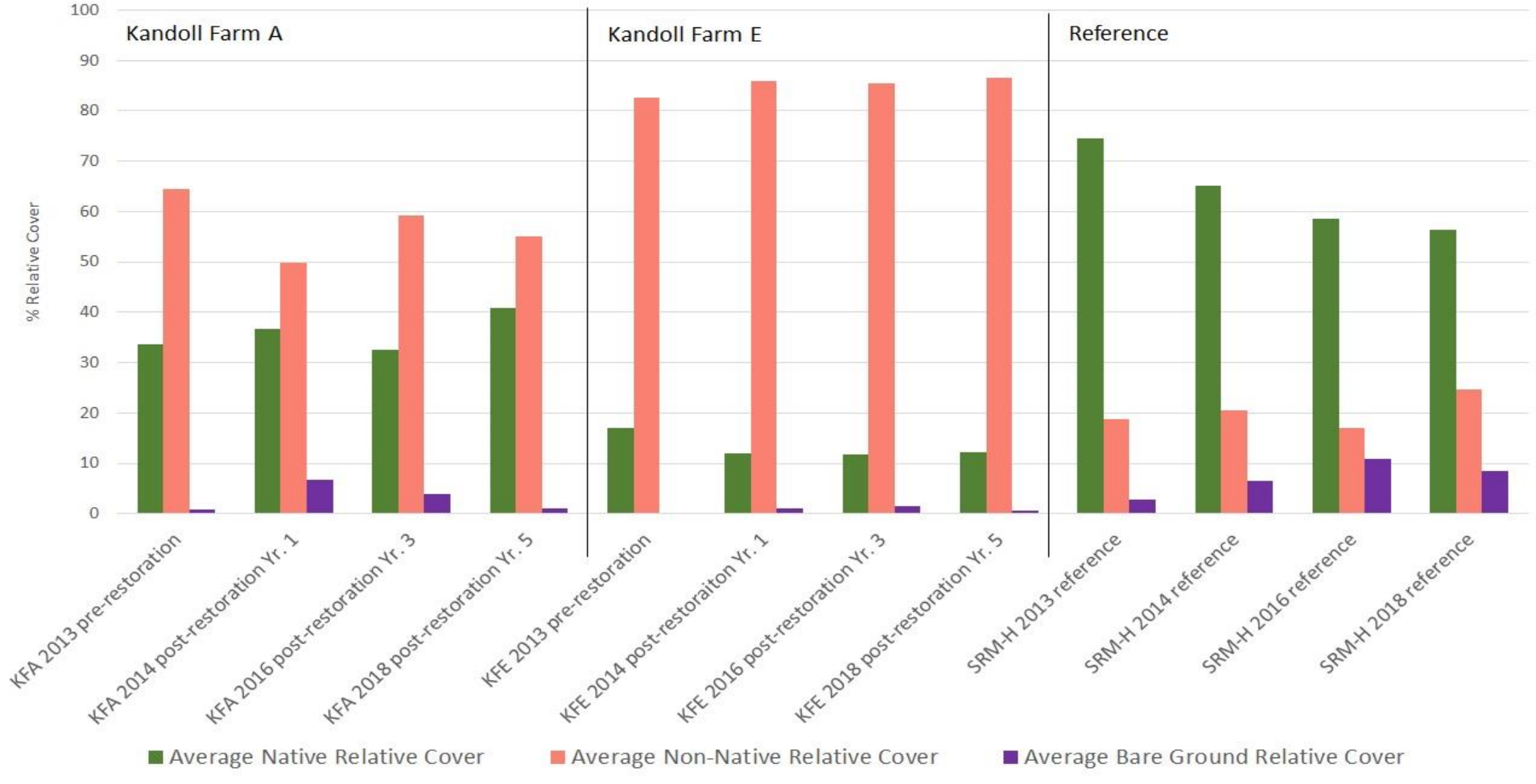


	Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Restored	n (days)	31	28	31	30	31	30	31	31	30	31	30	31
	Mean Max	2.97	2.67	2.69	2.71	2.61	2.44	2.40	2.37	2.38	2.43	2.52	2.72
	Days Exceeded 2 yr Flood Elevation	0	0	0	0	0	0	0	0	0	0	0	0
Reference	n (days)		23	31	30	31	30	31	31	29	31	30	31
	Mean Max		2.64	2.76	2.76	2.78	2.63	2.58	2.56	2.45	2.46	2.54	2.75

Kandoll Farm Opportunity

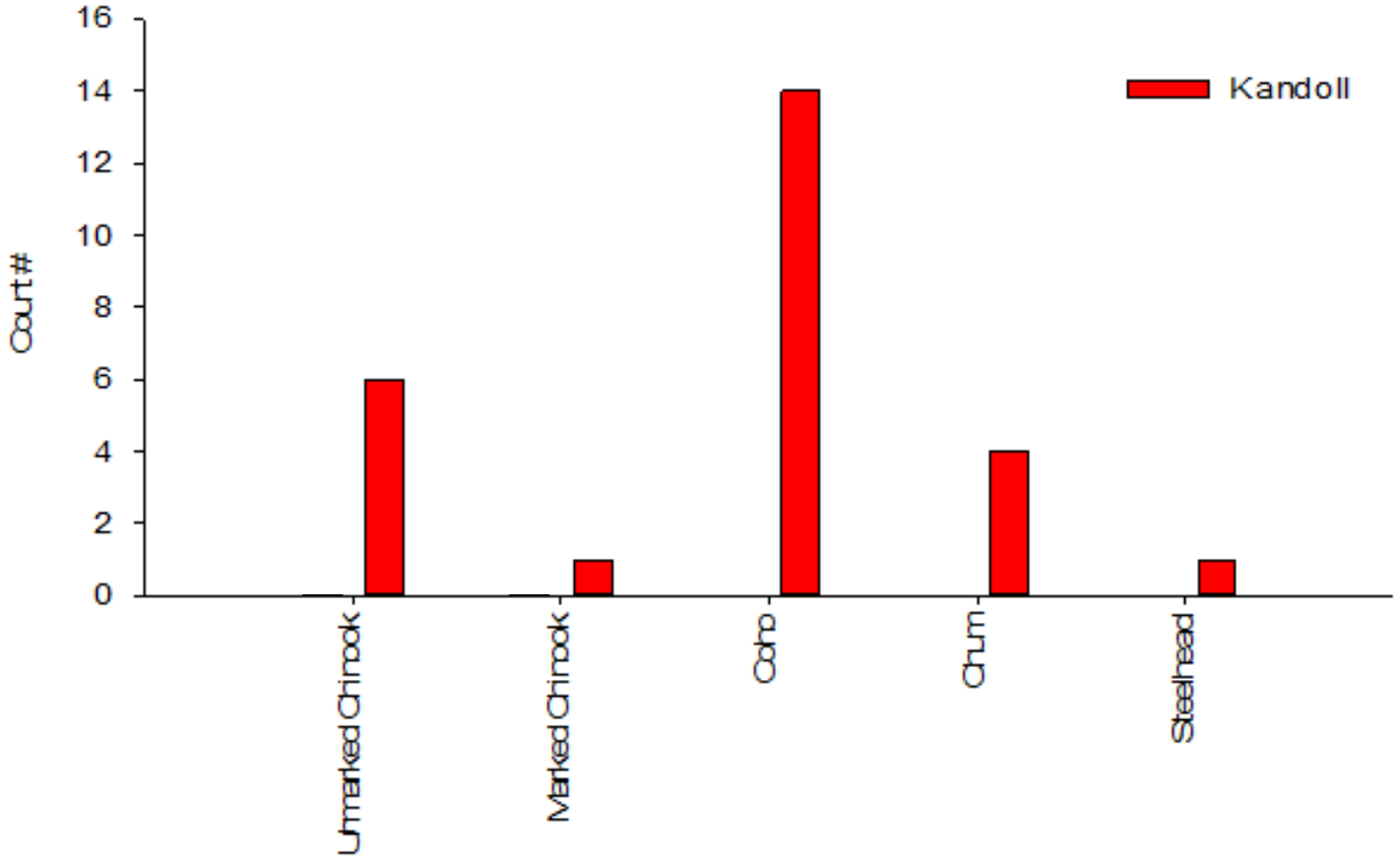


Kandoll Farm Vegetation



Kandoll Farm Fish Status

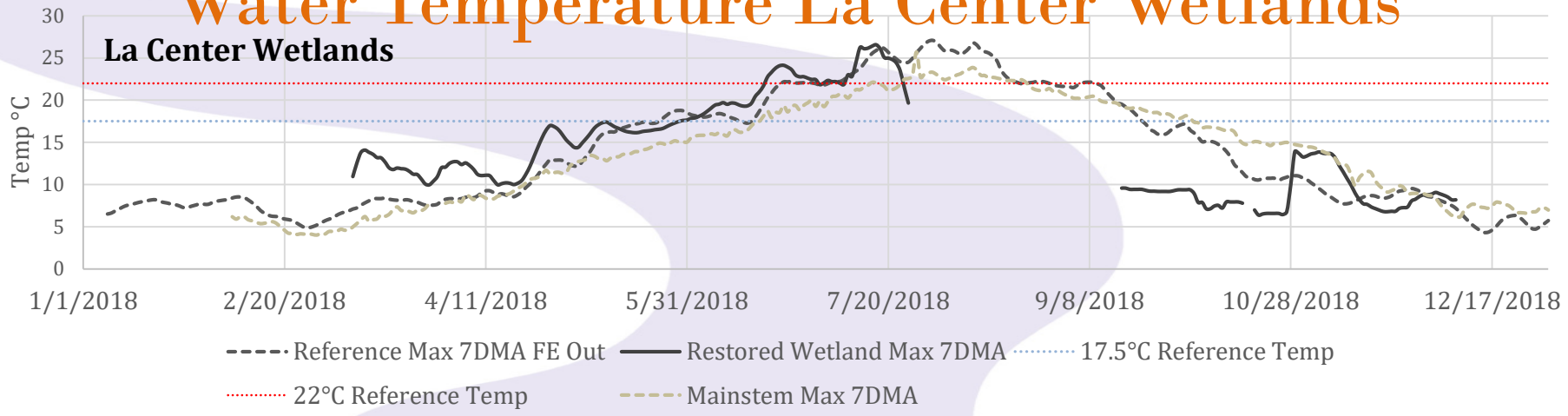
Kandoll Farm Fish Status



La Center Wetlands

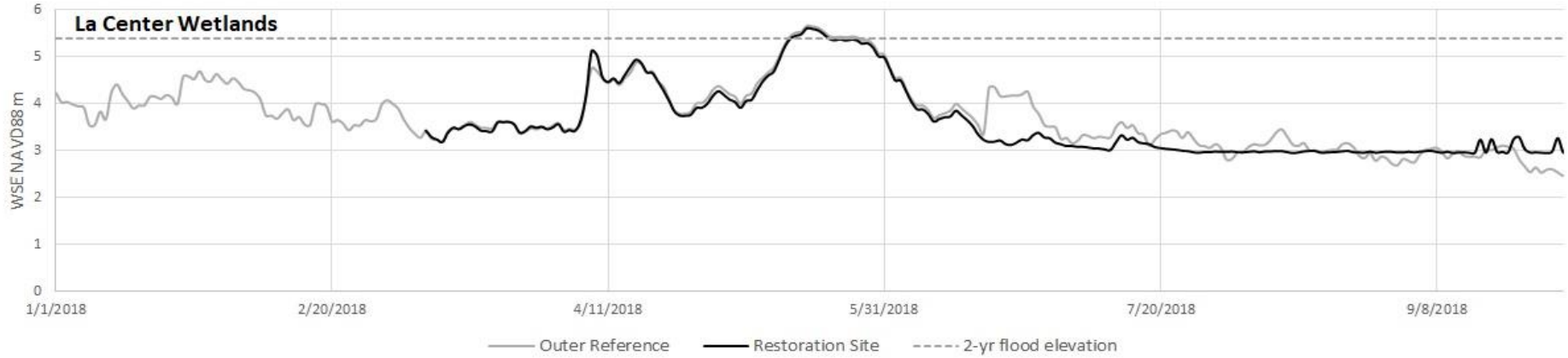
- Pre-restoration Monitoring: 2015
- Post-restoration Monitoring: 2016, 2018
- Reach F

Water Temperature La Center Wetlands



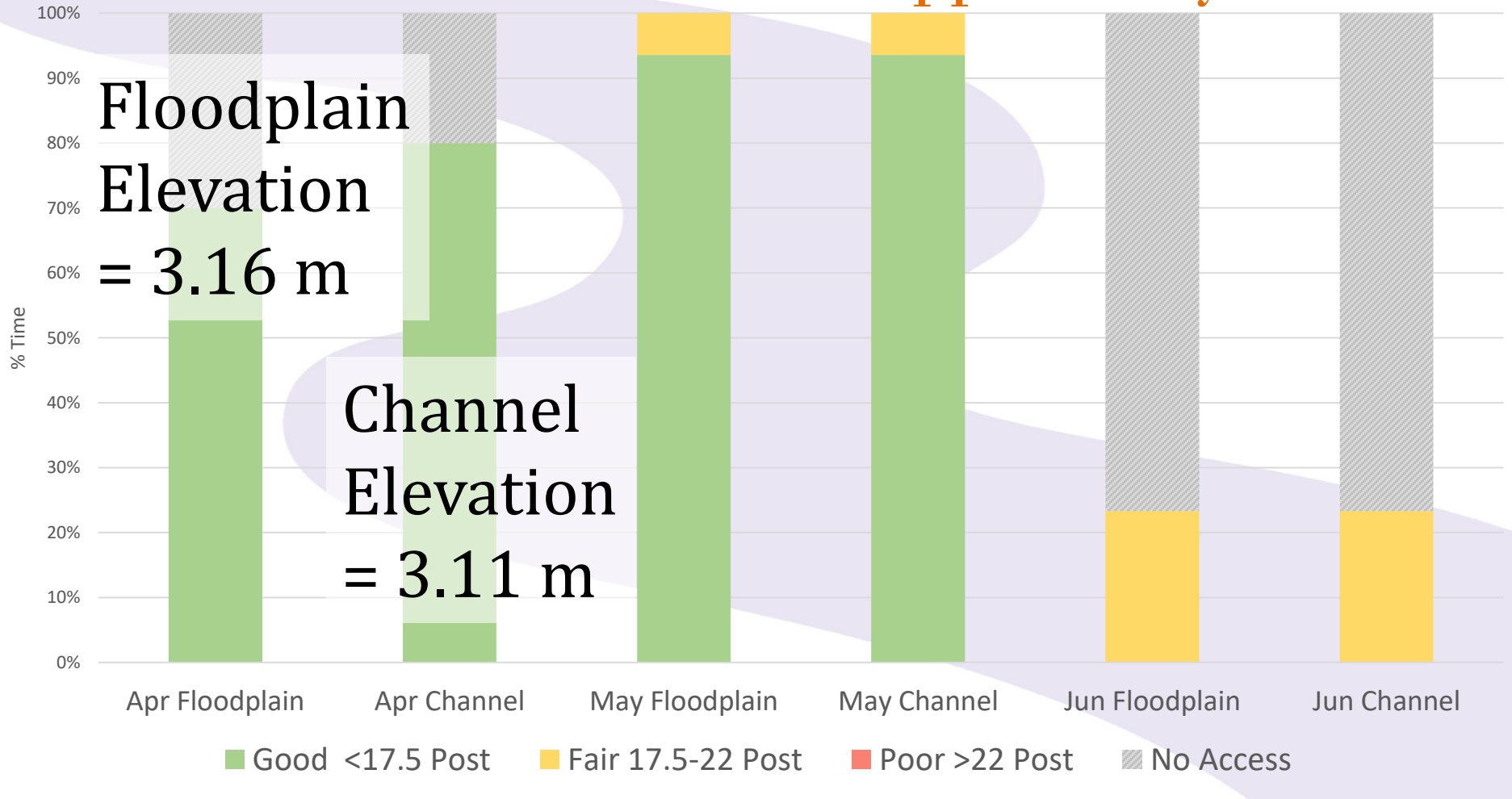
	Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Restored	n (days)			23	30	31	30	14		5	12	27	2
	Mean			12.0	12.6	16.7	21.3	24.0		9.3	9.1	9.5	8.2
Reference	n (days)	31	28	31	30	31	30						16
	Mean	7.5	7.8	11.2	15.6	20.0	22.6						6.7
Main Stem	n (days)	31	28	31	30	31	30	31	29				
	Mean	7.4	6.6	7.8	10.1	16.8	19.8	24.2	22.7				

Water Surface Elevation La Center Wetlands

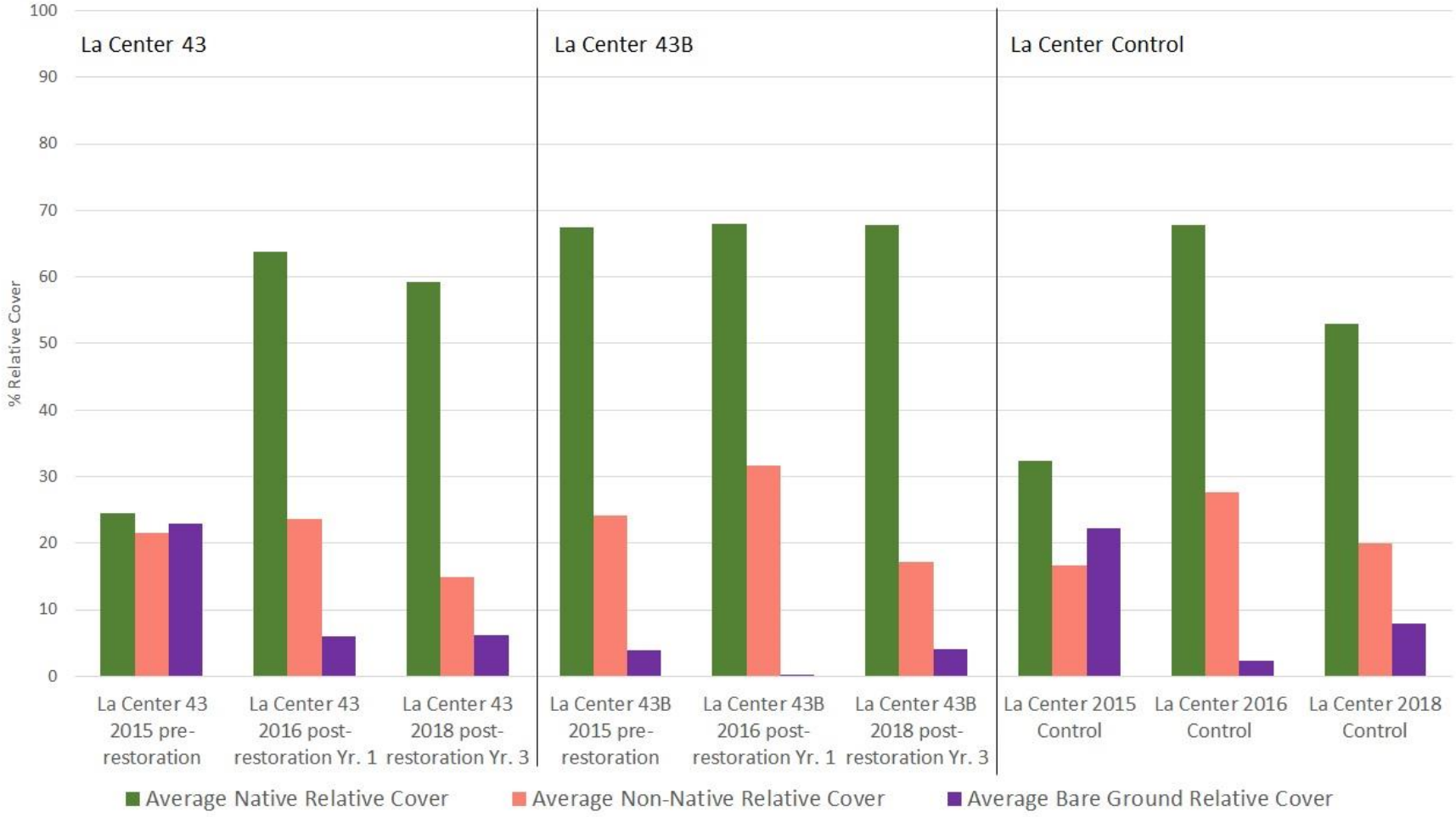


	Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Restored	n (days)			23	30	31	30	31	31	30	4
	Mean Max			3.47	4.20	4.96	3.63	3.09	2.99	3.03	3.03
	Days Exceeded 2 yr Flood Elevation	0	0	0	0	8	0	0	0	0	0
Reference	n (days)	31	28	31	30	31	30	31	31	30	4
	Mean Max	4.16	3.86	3.53	4.19	5.04	4.01	3.31	3.04	2.86	2.58

La Center Wetlands Opportunity



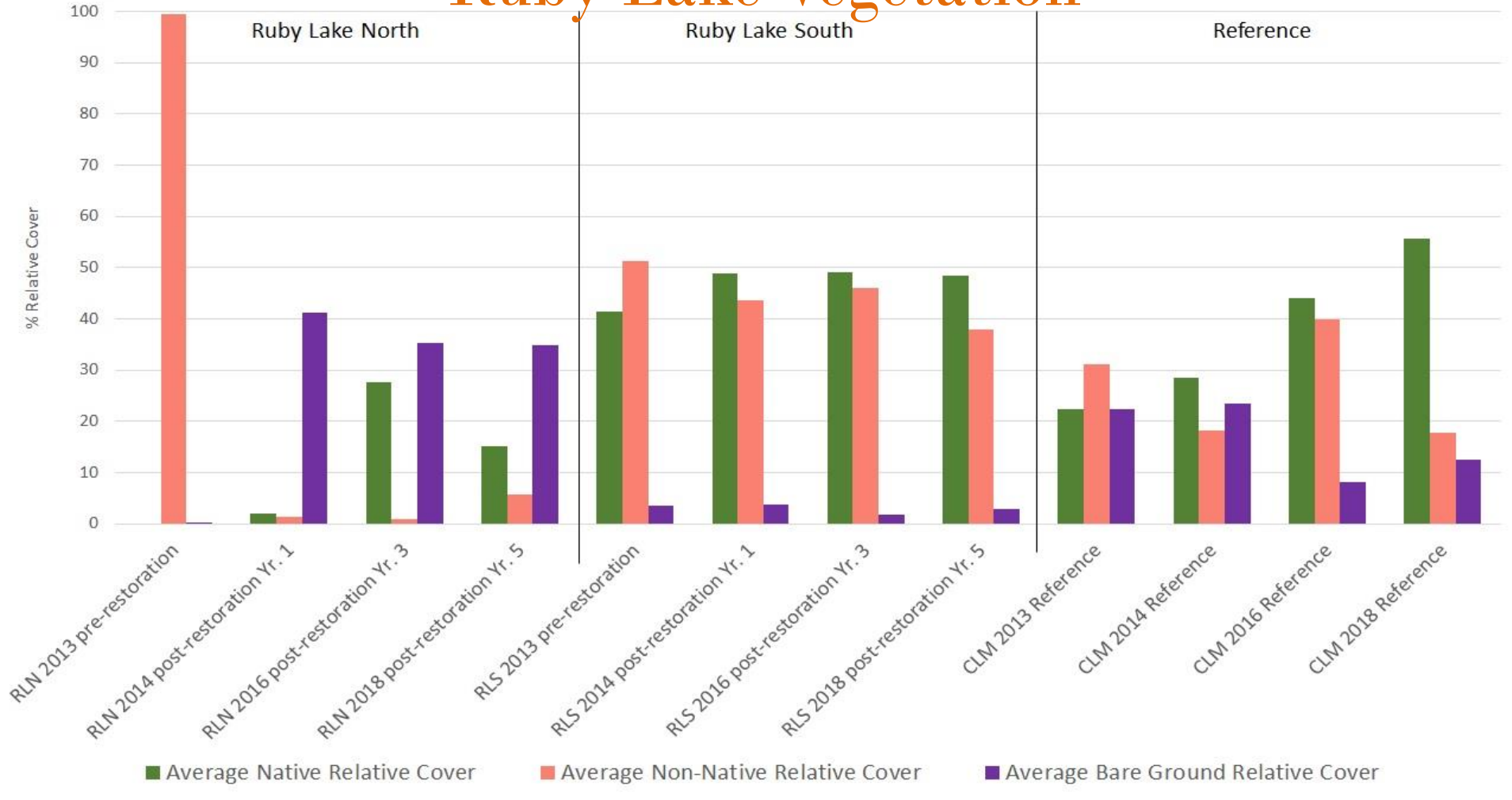
La Center Wetlands Vegetation



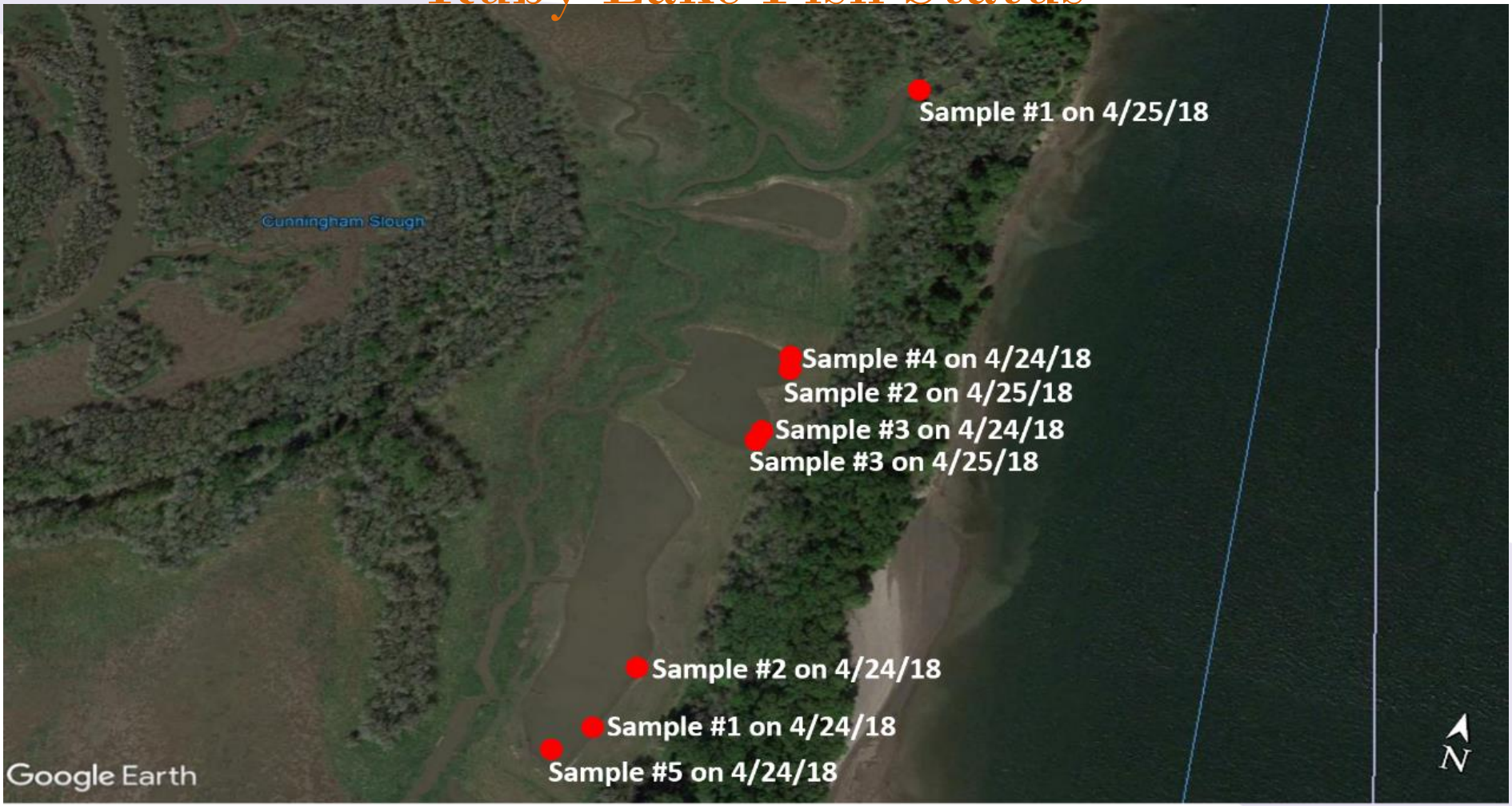
North Unit Phase 1 (Ruby Lake)

- Pre-restoration Monitoring: 2013
- Post-restoration Monitoring: 2014, 2016, 2018
- Reach F

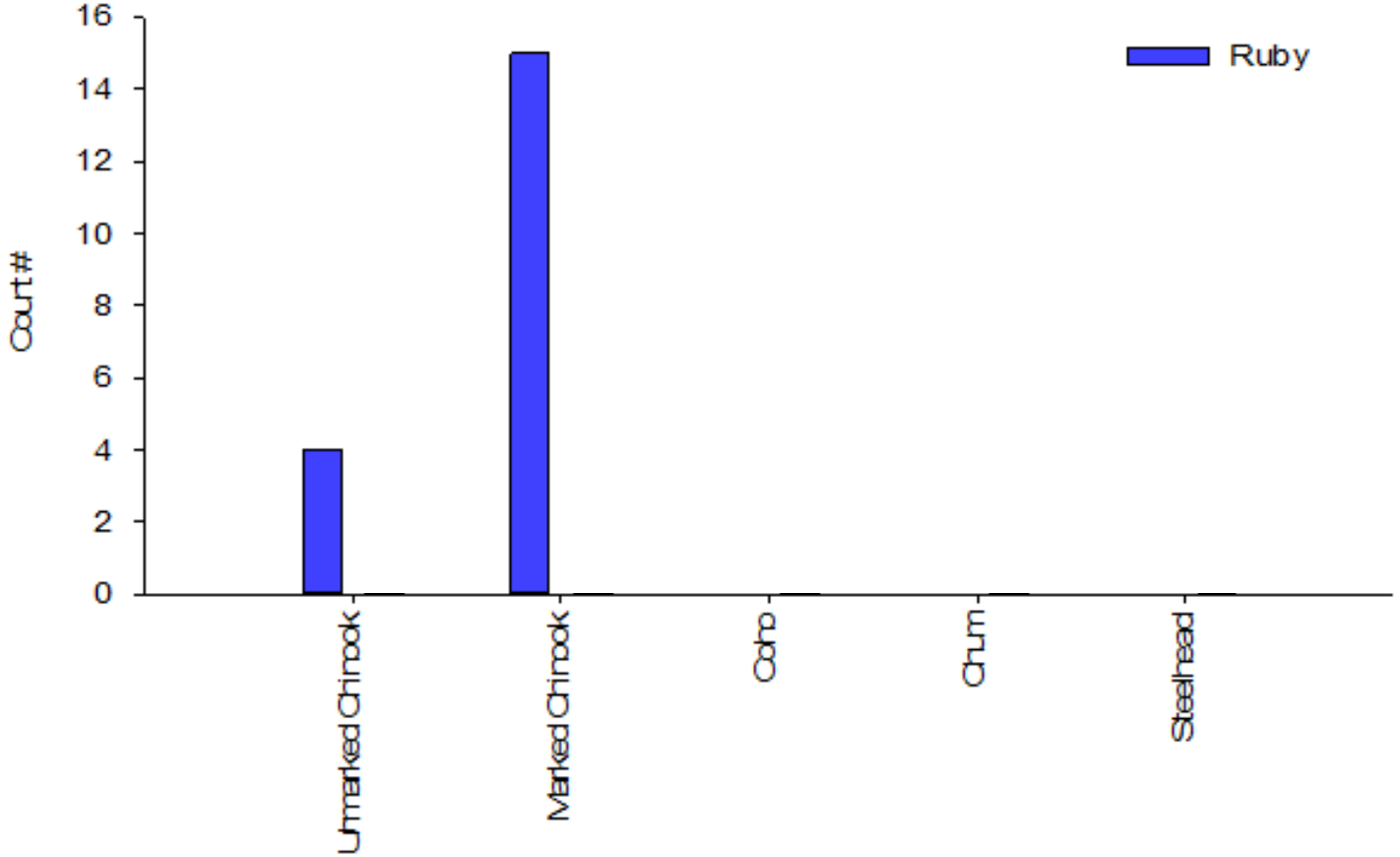
Ruby Lake Vegetation



Ruby Lake Fish Status

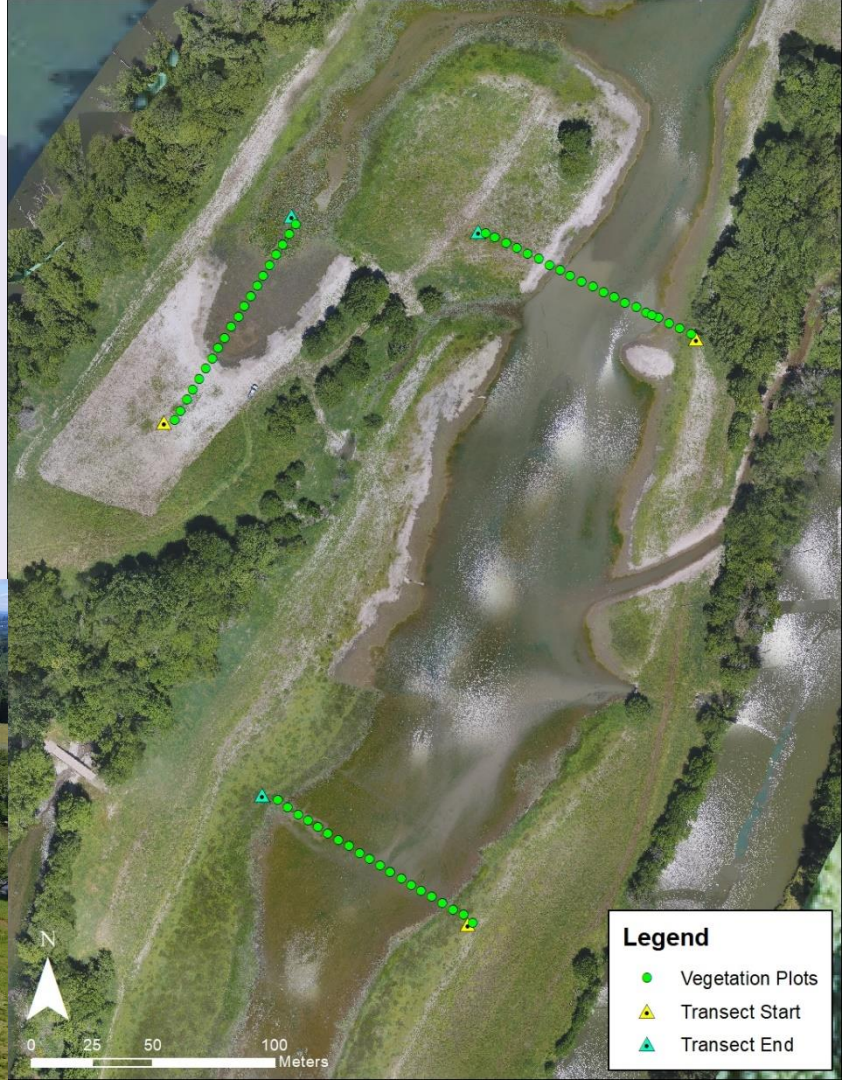


Ruby Lake Fish Status

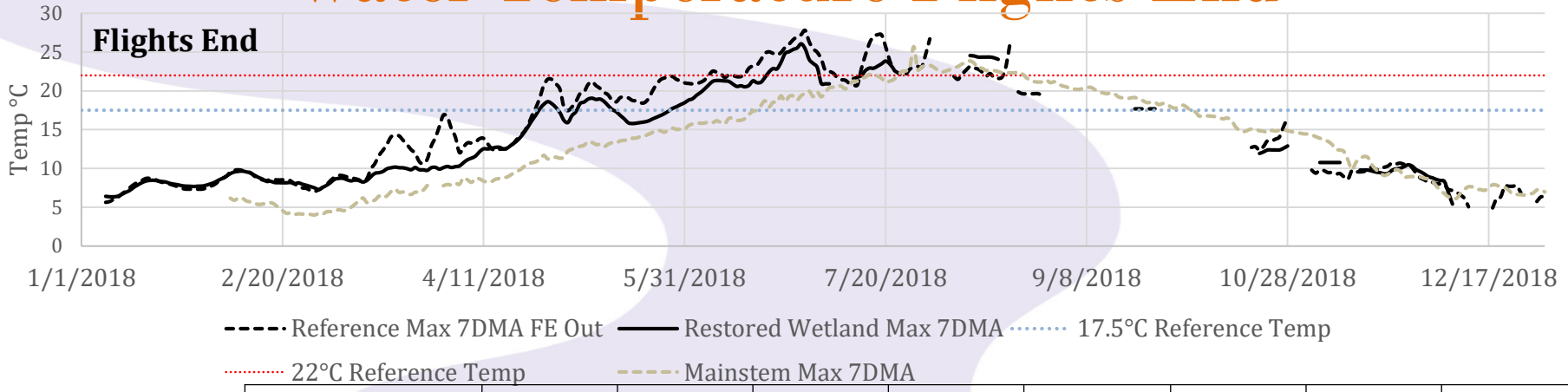


Flights End

- Pre-restoration Monitoring: 2017
- Post-restoration Monitoring: 2018
- Reach F



Water Temperature Flights End

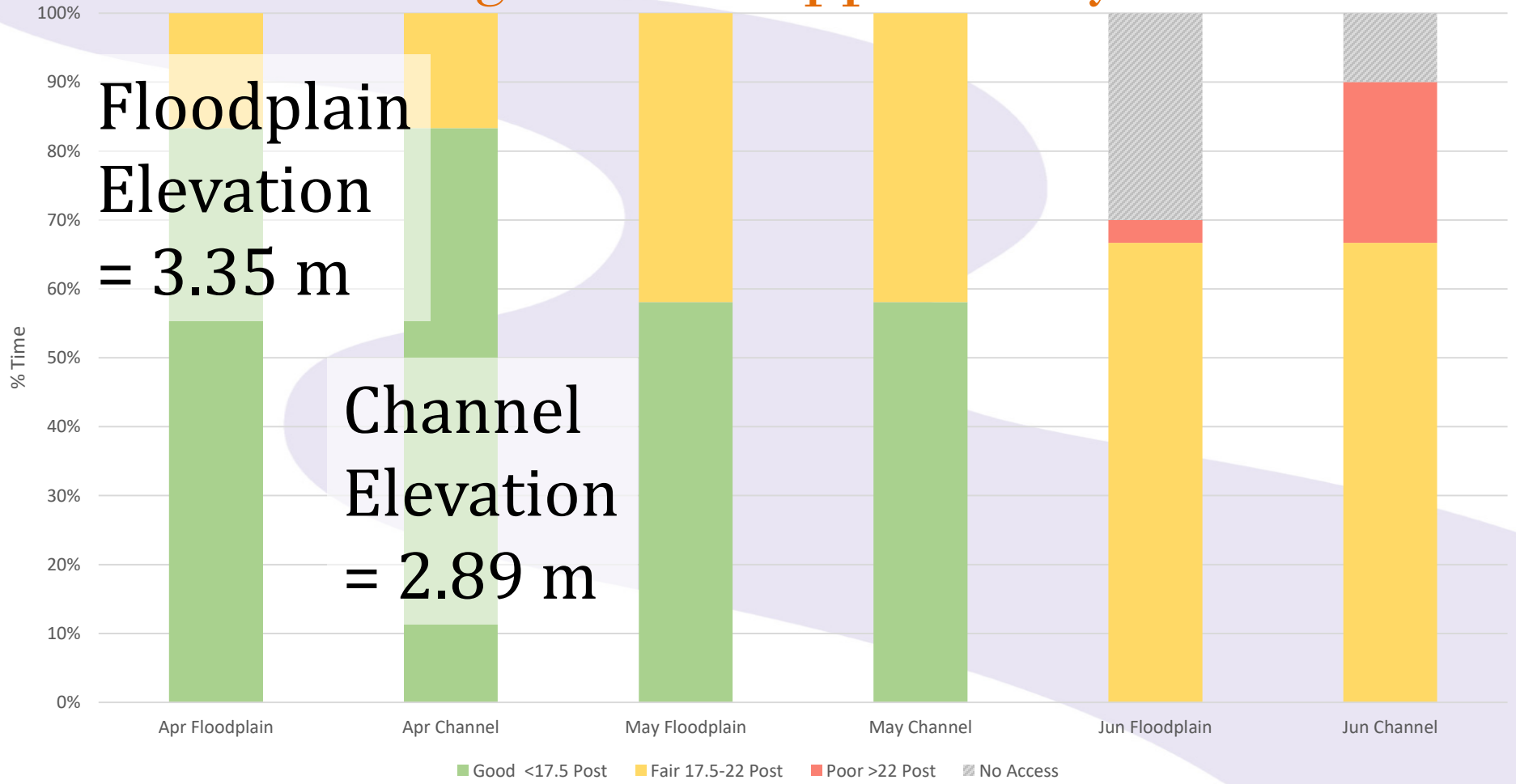


	Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Restored	n (days)	31.0	28.0	26.0	30.0	31.0	27.0	7.0	3.0
	Mean	7.5	8.1	9.3	13.7	17.5	20.6	22.6	24.4
Reference	n (days)	31.0	28.0	28.0	30.0	31.0	30.0	11.0	8.0
	Mean	7.3	7.9	11.9	15.2	19.7	23.0	24.3	22.6
Mainstem	n (days)		22.0	28.0	30.0	31.0	30.0	31.0	31.0
	Mean		5.1	5.9	9.4	13.7	17.3	21.5	22.4

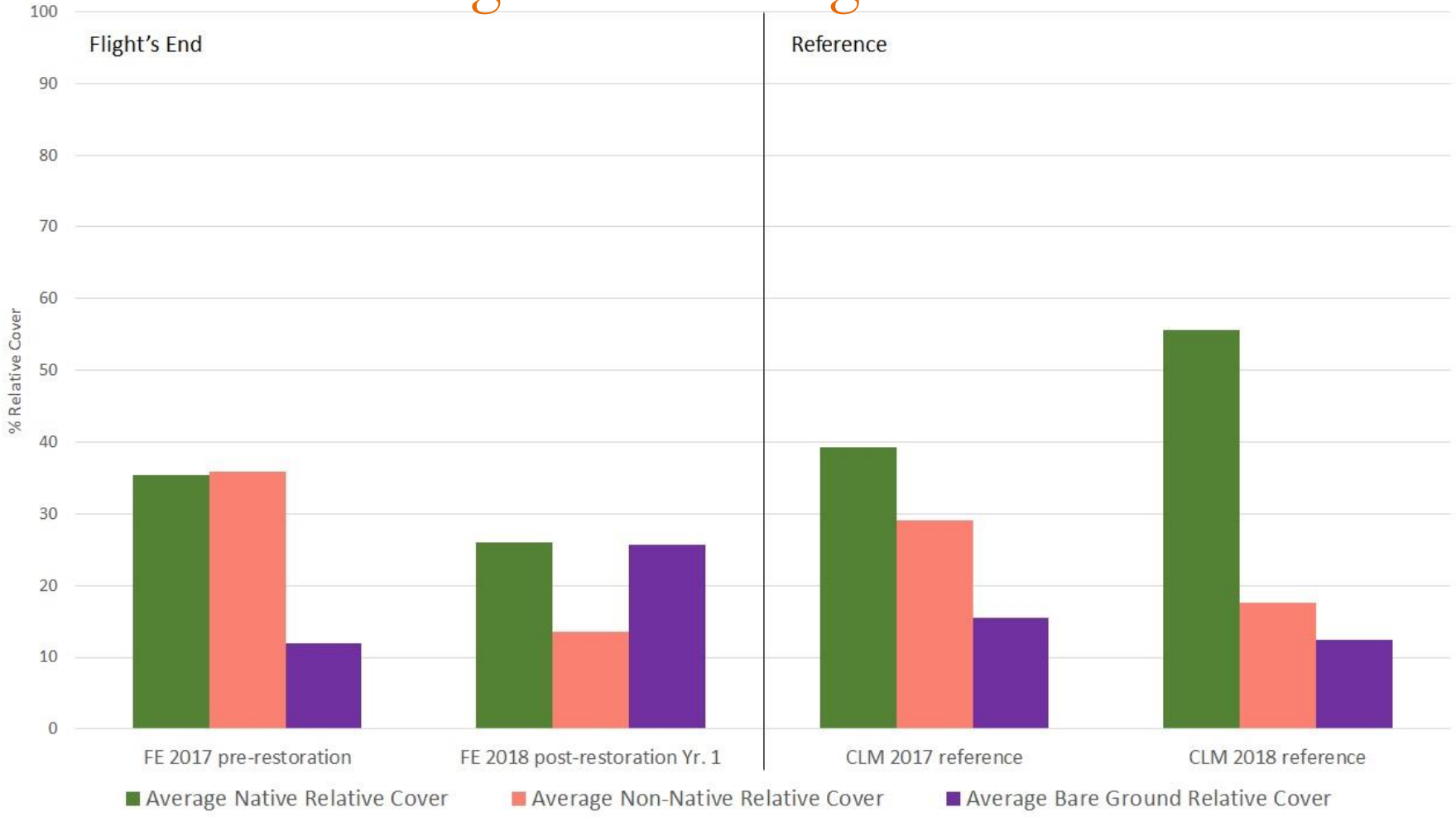
Water Surface Elevation Flights End

	Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Restored	n (days)	31	28	31	30	31	30	31	31	30	31	30	31
	Mean Max	3.64	4.29	5.23	5.02	5.03	4.37	2.99	2.94	2.91	2.96	3.11	3.08
	Days Exceeded 2 yr Flood Elevation	0	5	22	28	28	14	0	0	0	0	0	0
Reference	n (days)	31	28	31	30	31	30	31	31	30	31	30	31
	Mean Max	3.70	4.27	5.18	5.04	5.05	4.46	3.23	3.02	2.94	2.98	3.23	3.17

Flights End Opportunity



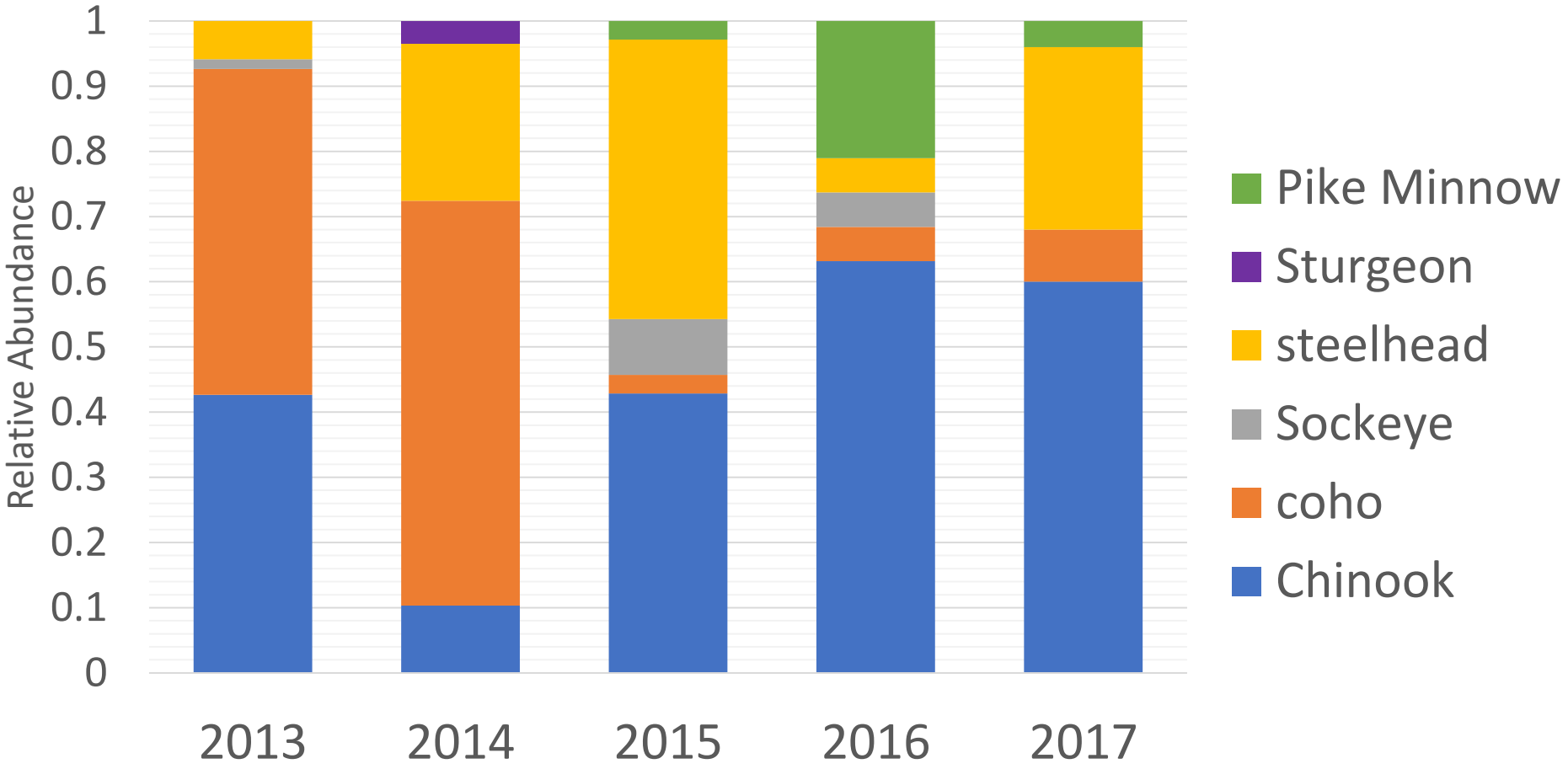
Flights End Vegetation



Horsetail Creek PIT tag Array

- Spring Chinook
  - Snake River Basin and Middle Columbia
- Hatchery Summer Steelhead
  - Snake River Basin

Horsetail Creek PIT tag Array




Great Ideas of
Monitoring

What Is the Question?

- What is the story you are trying to tell?
- What data or analysis helps you tell that story?

Response Ratios

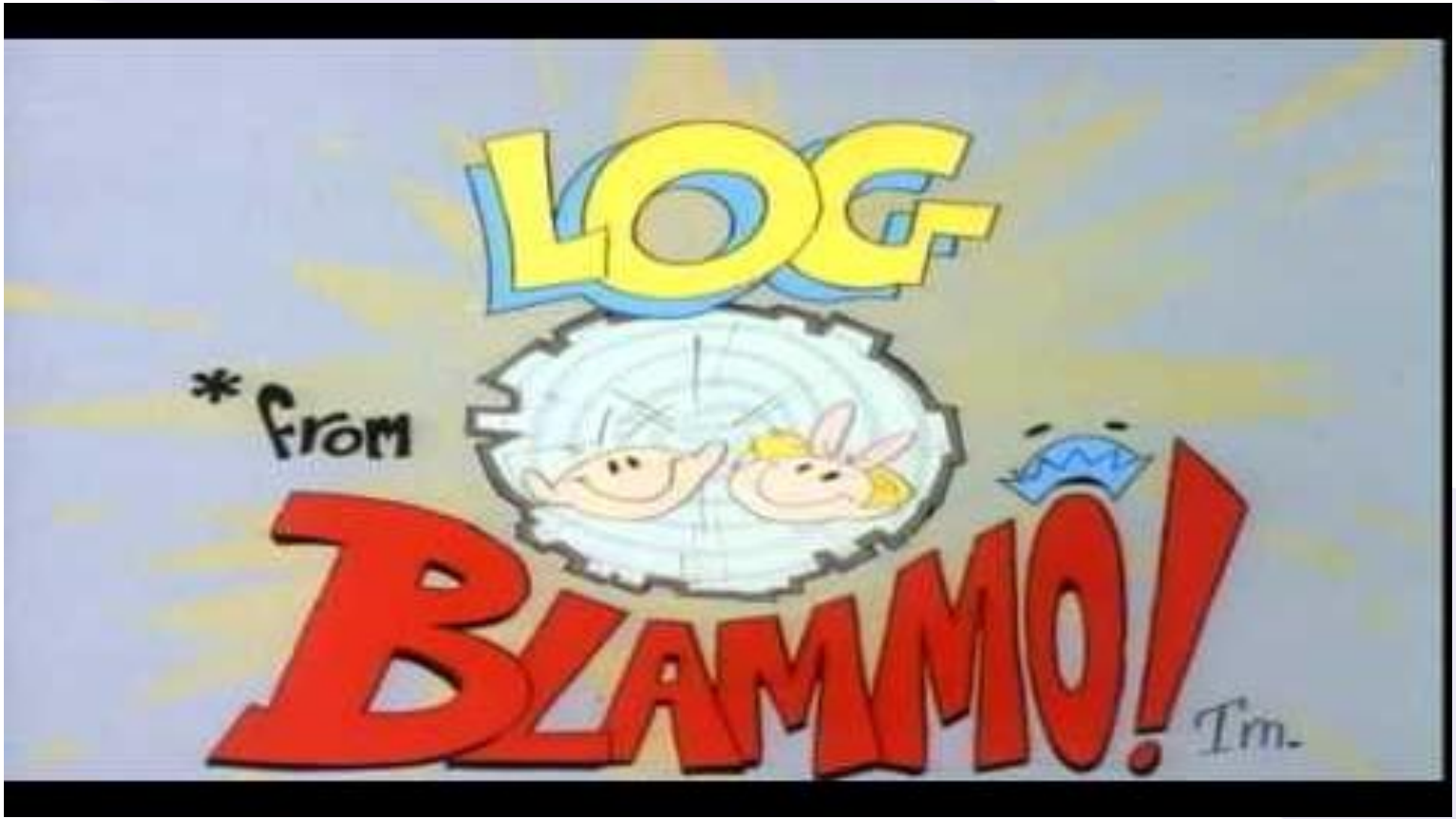
$$\frac{\text{Restoration} = 20}{\text{Reference} = 22} = .9\ RR$$

Reference is performing better

$$\frac{\text{Restoration} = 25}{\text{Reference} = 22} = 1.13\ RR$$

Restoration is performing better

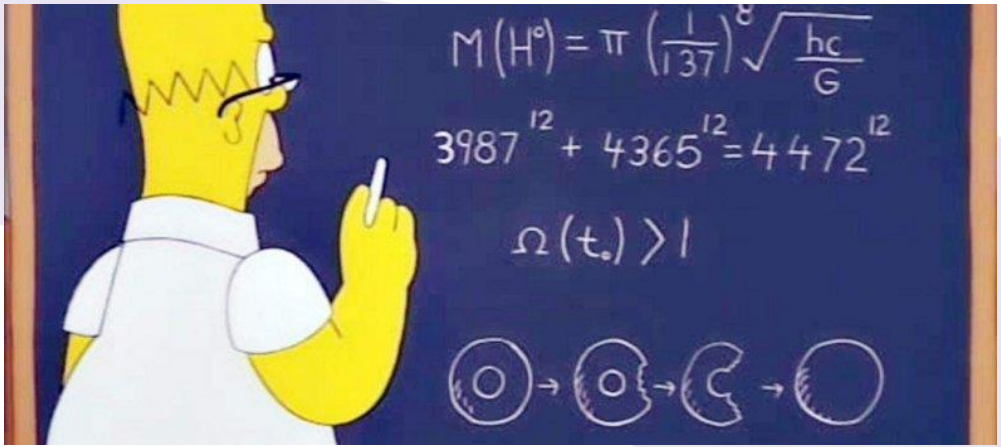
It's Log Response Ratios



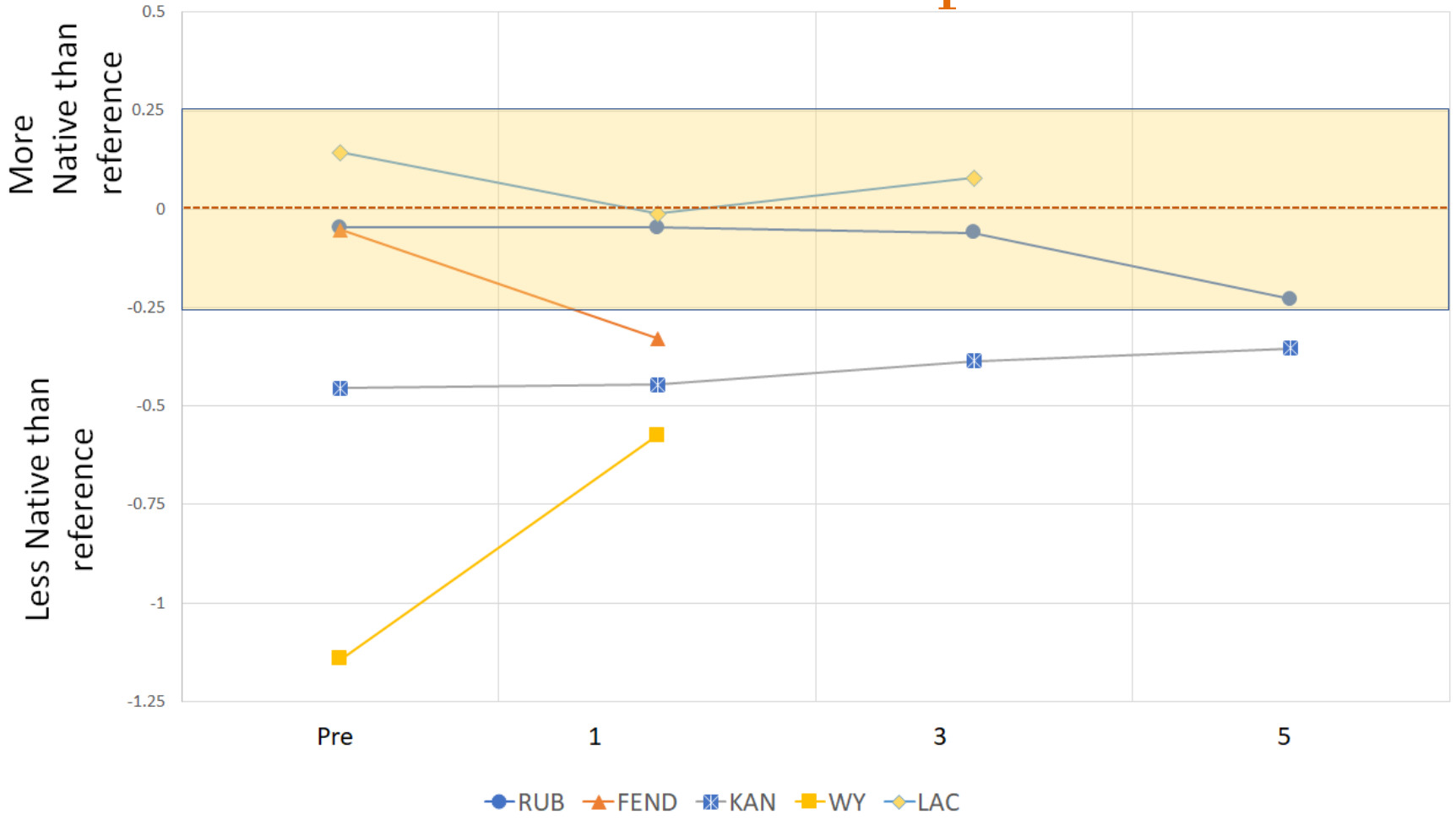
It's Log Response Ratios

.9 RR ➡ Log .9 = -.045

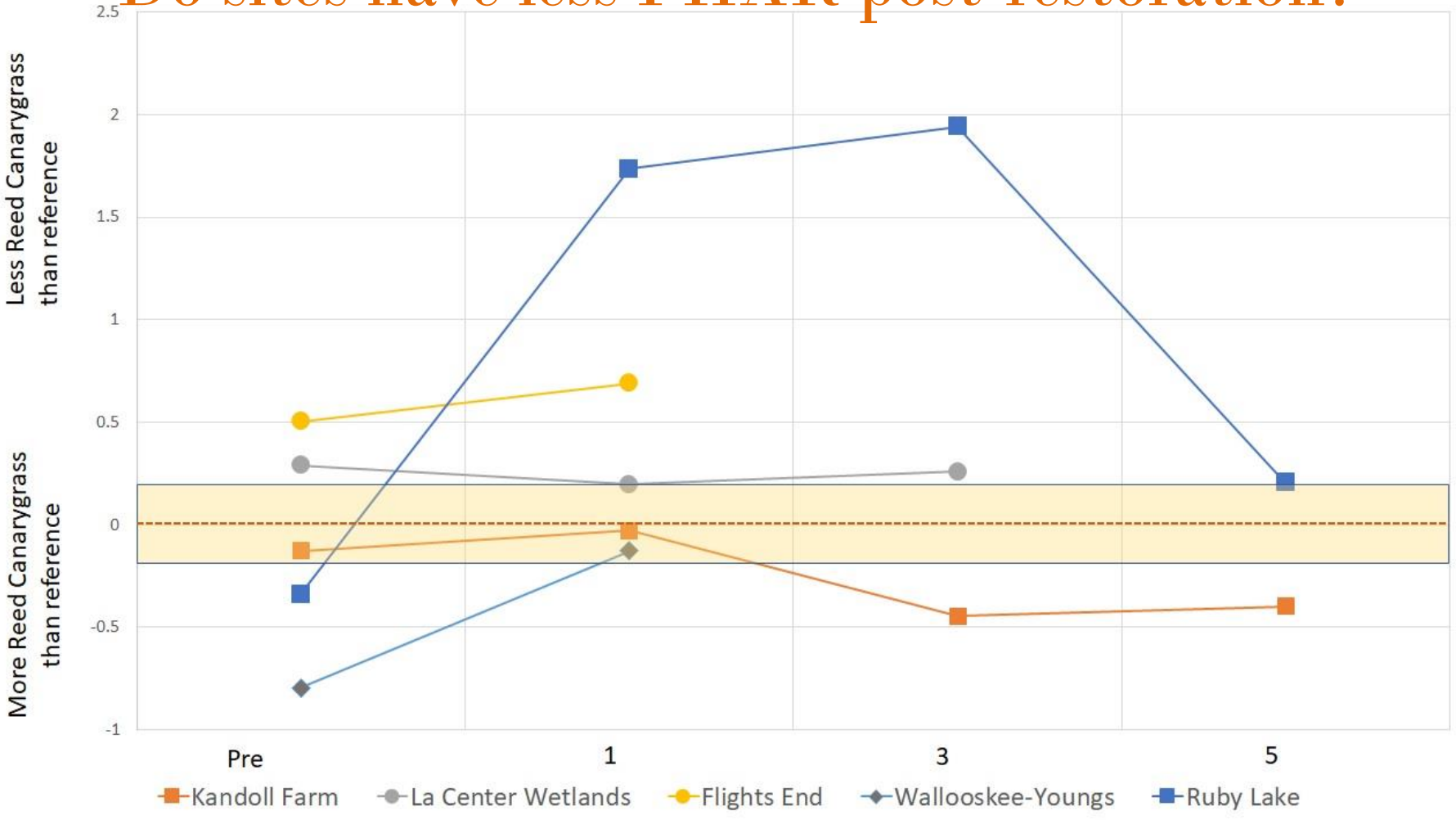
1.13 RR ➡ Log 1.13 = .05



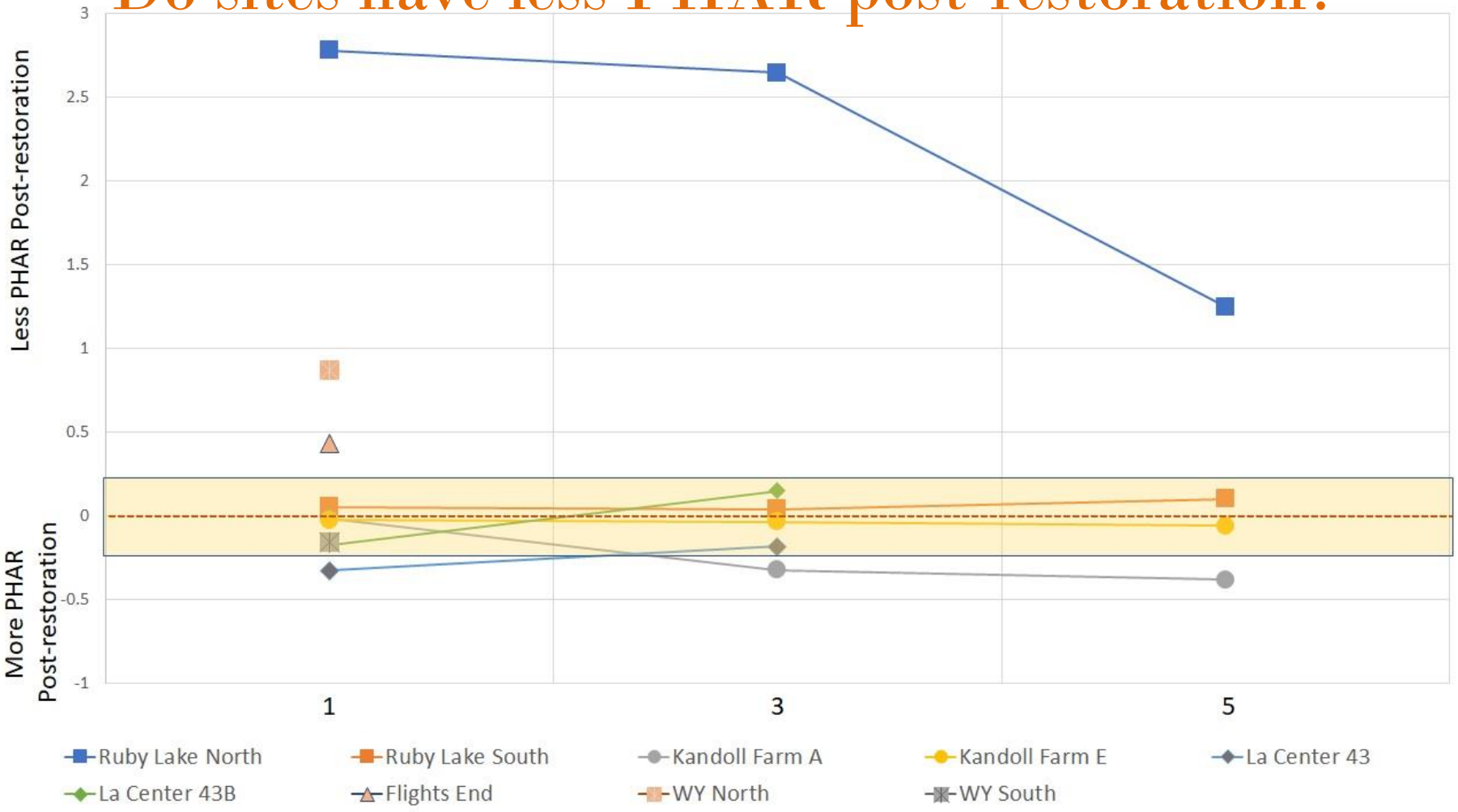
Do sites have more native cover post-restoration?



Do sites have less PHAR post-restoration?



Do sites have less PHAR post-restoration?



AEM Conclusion and Discussion

- Water Temperatures at restoration sites mirrored main stem temps, but were slightly warmer overall

- In 2018, up river sites achieved the 2 yr. flood

AEM Conclusion and Discussion

- All Level 2 sites provided some opportunity to juvenile salmonids from April through June

- Amount of opportunity differed between channel and floodplain

AEM Conclusion and Discussion

- "End points" for monitoring of restoration projects
  - What are the benchmarks we should be using to continue monitoring at restoration projects?

Questions

Thank you!

COWLITZ INDIAN TRIBE

Contact:

Matthew Schwartz

mschwartz@estuarypartnerhip.org

Sarah Kidd

skidd@estuarypartnership.org

Extra Slides


‘Sheed knows..
BLAZERS
30
Veg don’t lie.

AEM Questions and Discussion

- Level 3 monitoring metrics – What's working?
  - Are we monitoring the right ecological responses to restoration actions?
- "End points" for monitoring of restoration projects
  - What are the benchmarks we should be using to continue monitoring at restoration projects?

Equipment and Technical Support

- Technical and Field Support
  - Site sampling design
  - Data management
  - Methods
- Hydrology Monitoring Equipment
  - Hobo Onset pressure & temperature data loggers (long-term)
  - Hobo Onset temperature (only) data loggers (long-term)
  - Flow/discharge meter and rod (short-term)
- Survey and Mapping
  - RTK ProMark 200 survey and mapping units (base and rover) including tripod and monopod (short-term)
  - Auto Level including tripod (short-term)
  - Small unmanned aerial vehicle