Water-quality diversity and the effects of surface-water connection in off-channel features of the Willamette River, Oregon, 2015-16

Casie Smith[1], JoJo Mangano[1], Stewart Rounds[1], Norm Buccola[2], Dave Piatt[1]

[1] U.S. Geological Survey

[2] U.S. Army Corps of Engineers

U.S. Department of the Interior
U.S. Geological Survey

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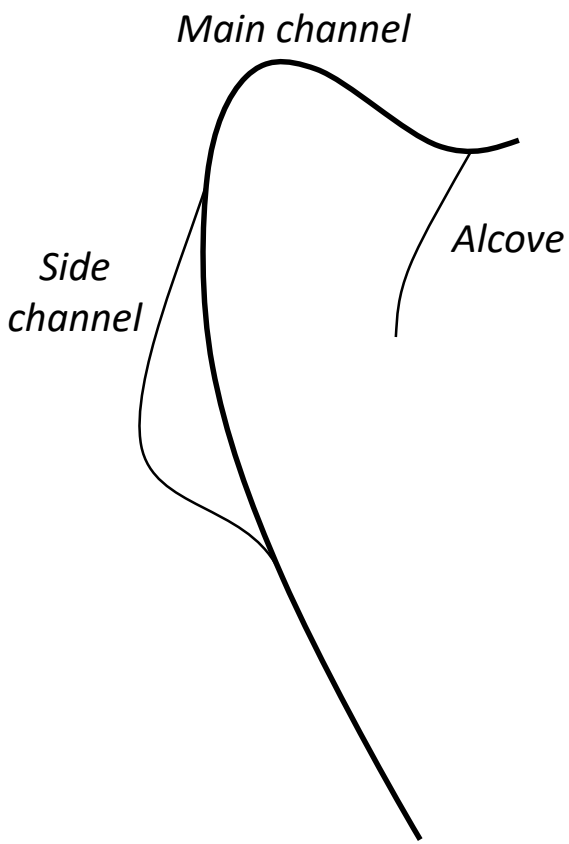
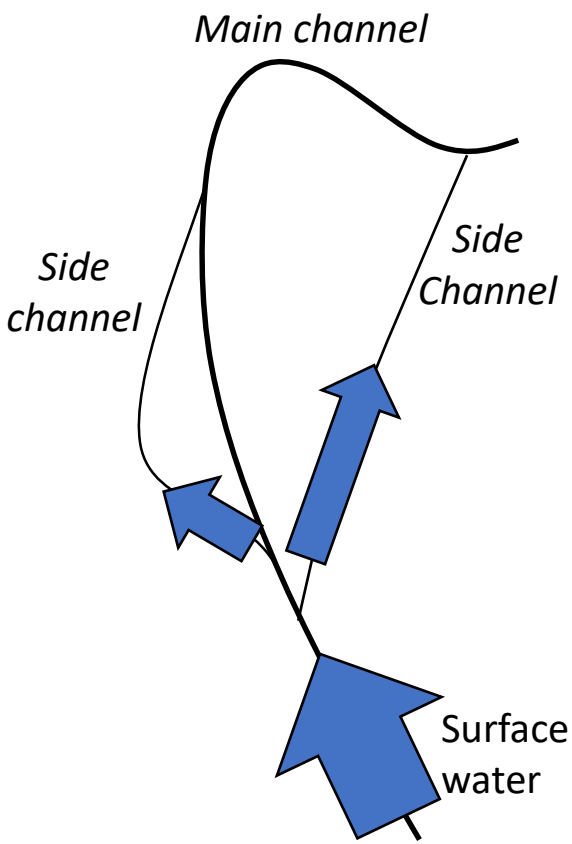
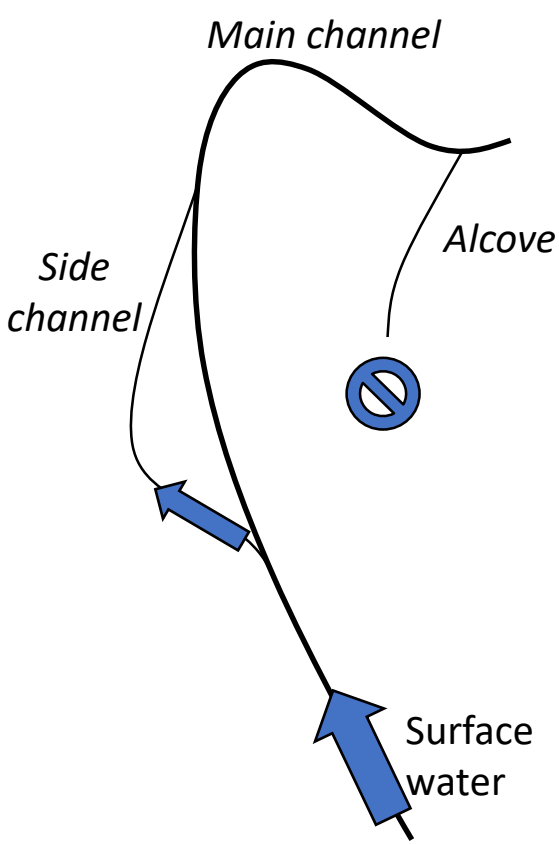


More flow in main channel



Less flow in main channel



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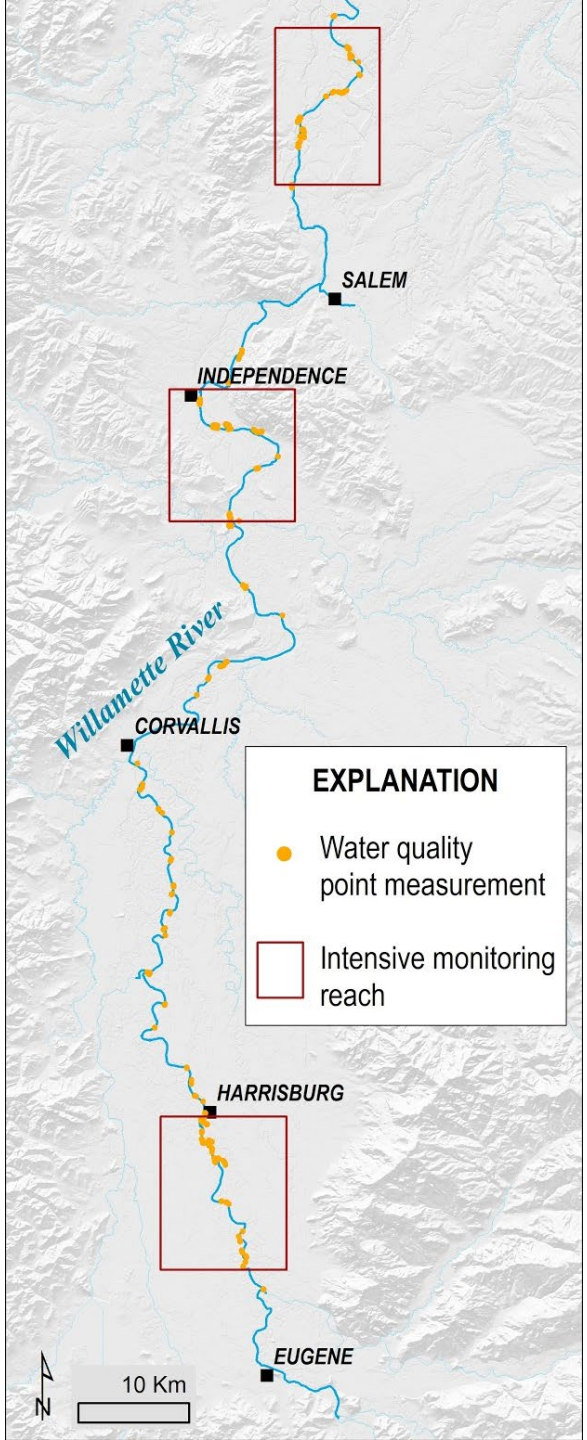
Study Objective

- Characterize water-quality conditions in the Willamette River and off-channel features (River Mile 65 to RM 175) in the summers of 2015 and 2016

- Assess the effects of flow on water-quality conditions in off-channel features



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Methodology

- Deployed continuous water quality monitors
  - Measured water temperature, dissolved oxygen, specific conductance
  - 5 in off-channel features, 1 in main channel

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- Deployed temperature sensors
  - Approximately 25 locations

Photo by USGS

Methodology

- Deployed continuous water quality monitors
  - Measured water temperature, dissolved oxygen, specific conductance
  - 5 in off-channel features, 1 in main channel
- Deployed temperature sensors
  - Approximately 25 locations
- Collected point measurements
  - In alcoves, side channels, and along the main channel
  - During multiple seasons

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Key Findings

1. Main channel typically is well mixed, with warm water temperatures and elevated dissolved oxygen in summer months.

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Key Findings

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2. Off-channel features have diverse water quality.
    a. One of the driving processes is upstream surface-water connection with the main channel
    b. Many with cool water temperatures have very low dissolved oxygen

Key Findings

1. Main channel typically is well mixed, with warm water temperatures and elevated dissolved oxygen in summer months.

2. Off-channel features have diverse water quality.
   a. One of the driving processes is upstream surface-water connection with the main channel
   b. Many with cool water temperatures have very low dissolved oxygen

3. Site-specific characteristics drive processes that affect water-quality conditions.

Off-channel features have diverse water quality.

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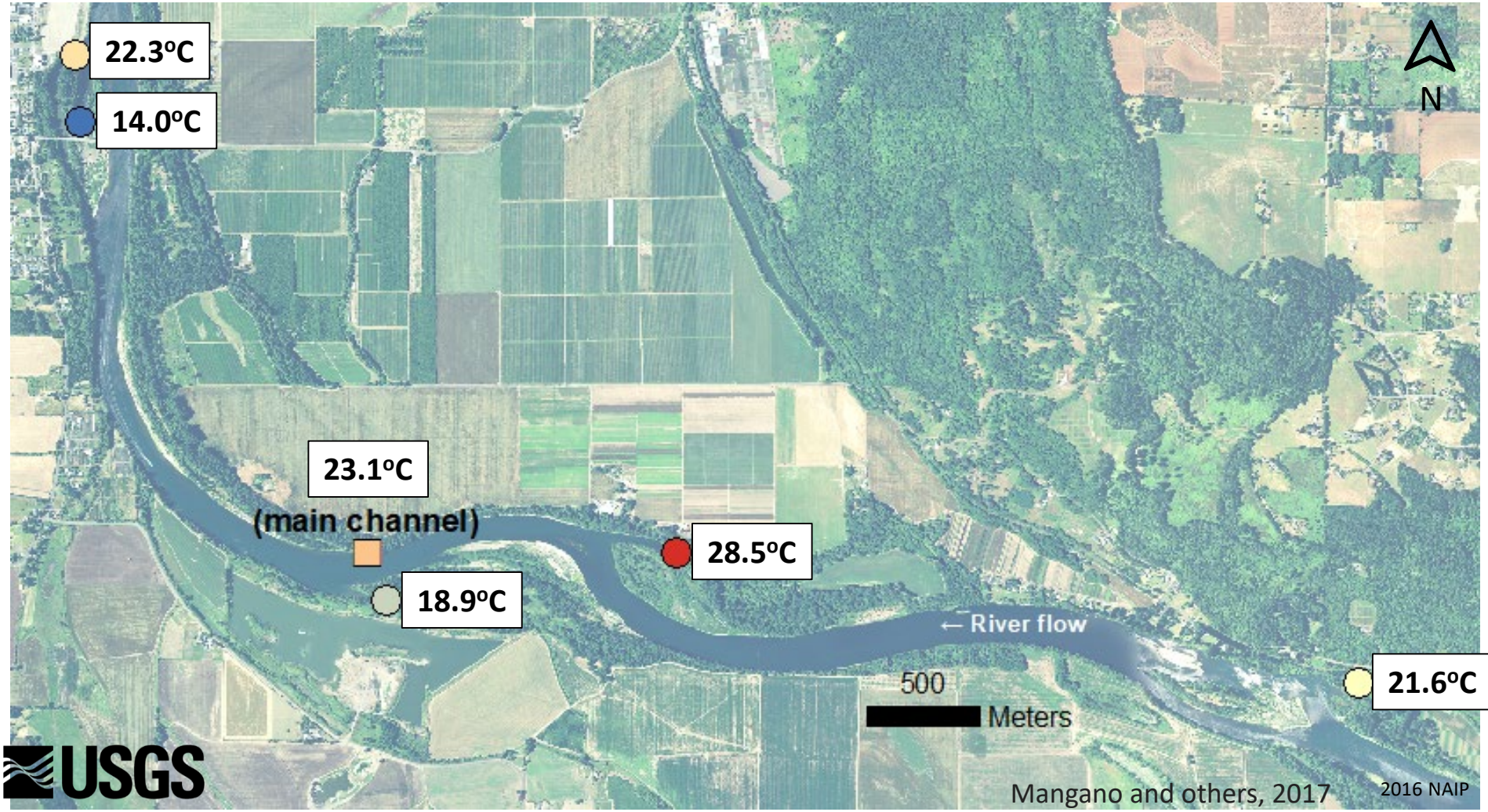
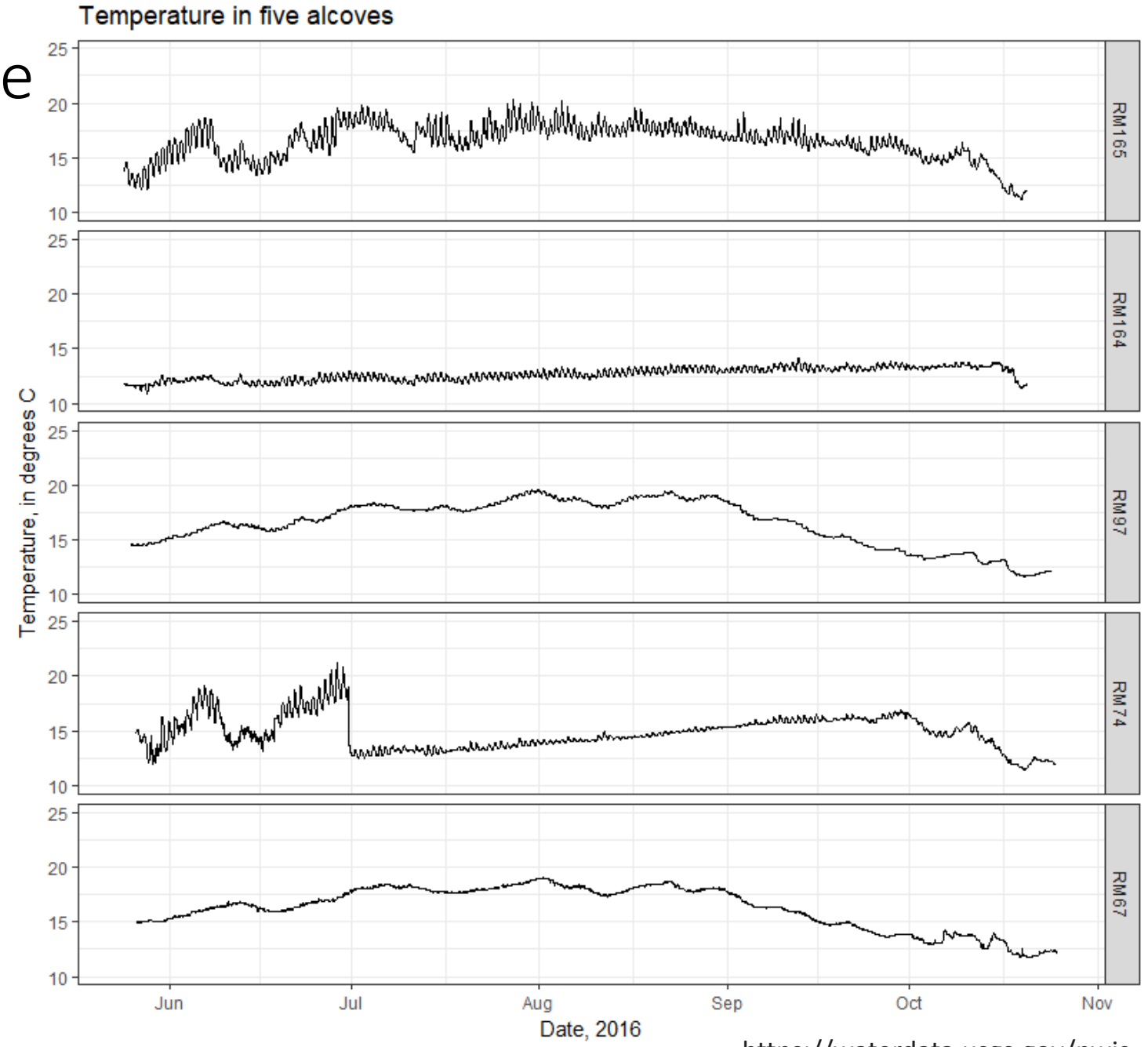


Water-temperature diversity



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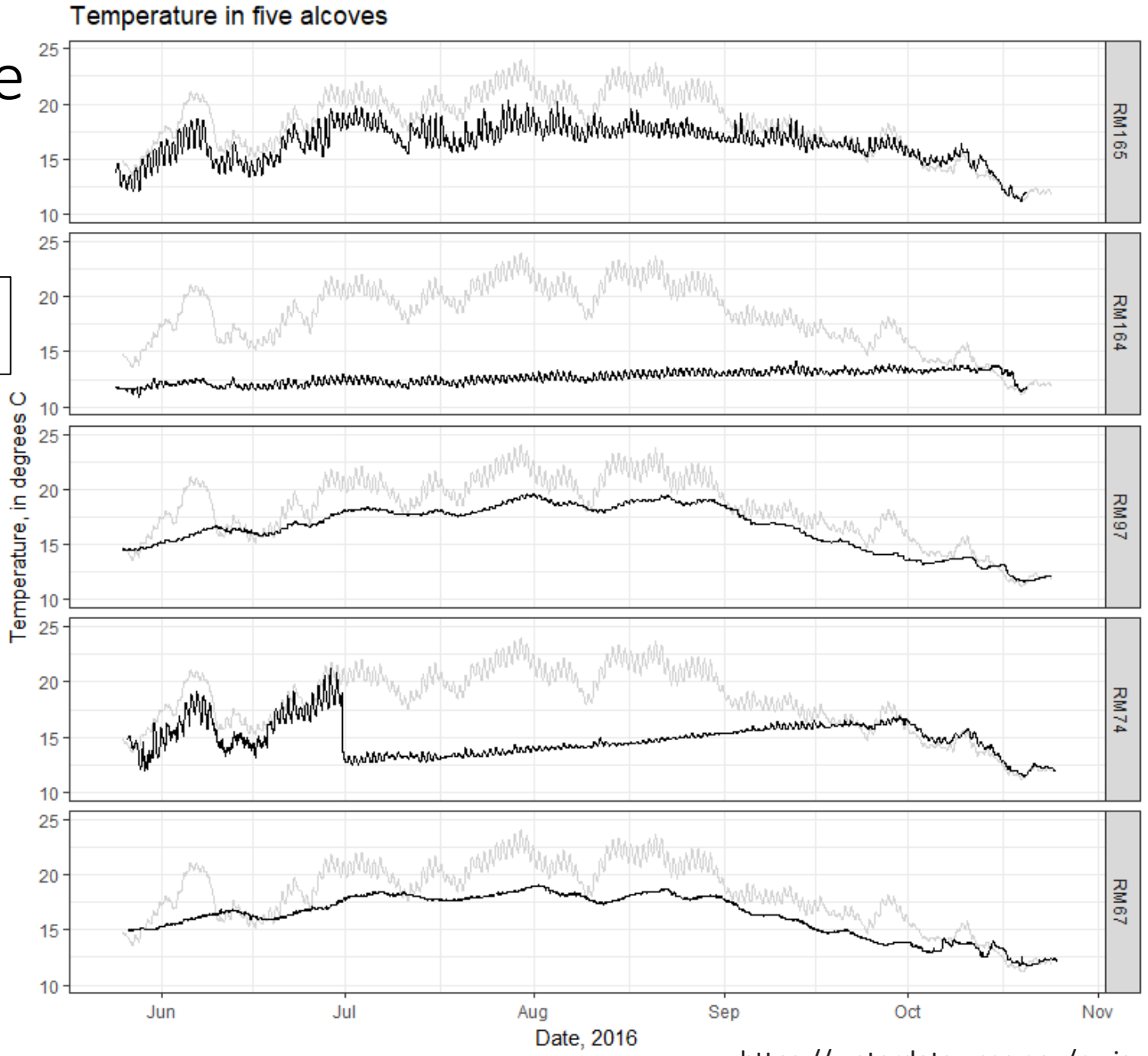
https://waterdata.usgs.gov/nwis

Water-temperature diversity

Alcove temperature
Mainstem temperature



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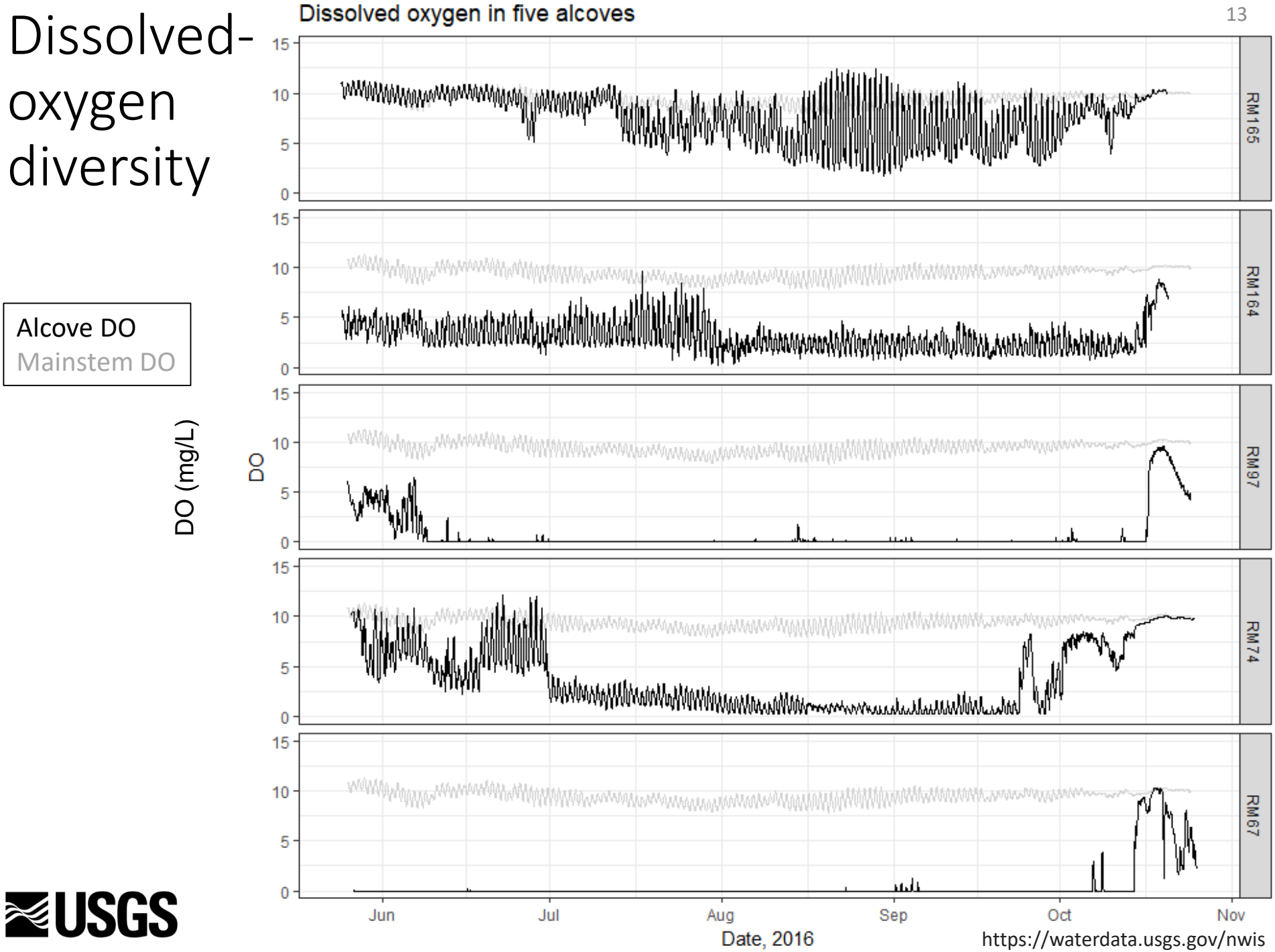
Dissolved-oxygen diversity



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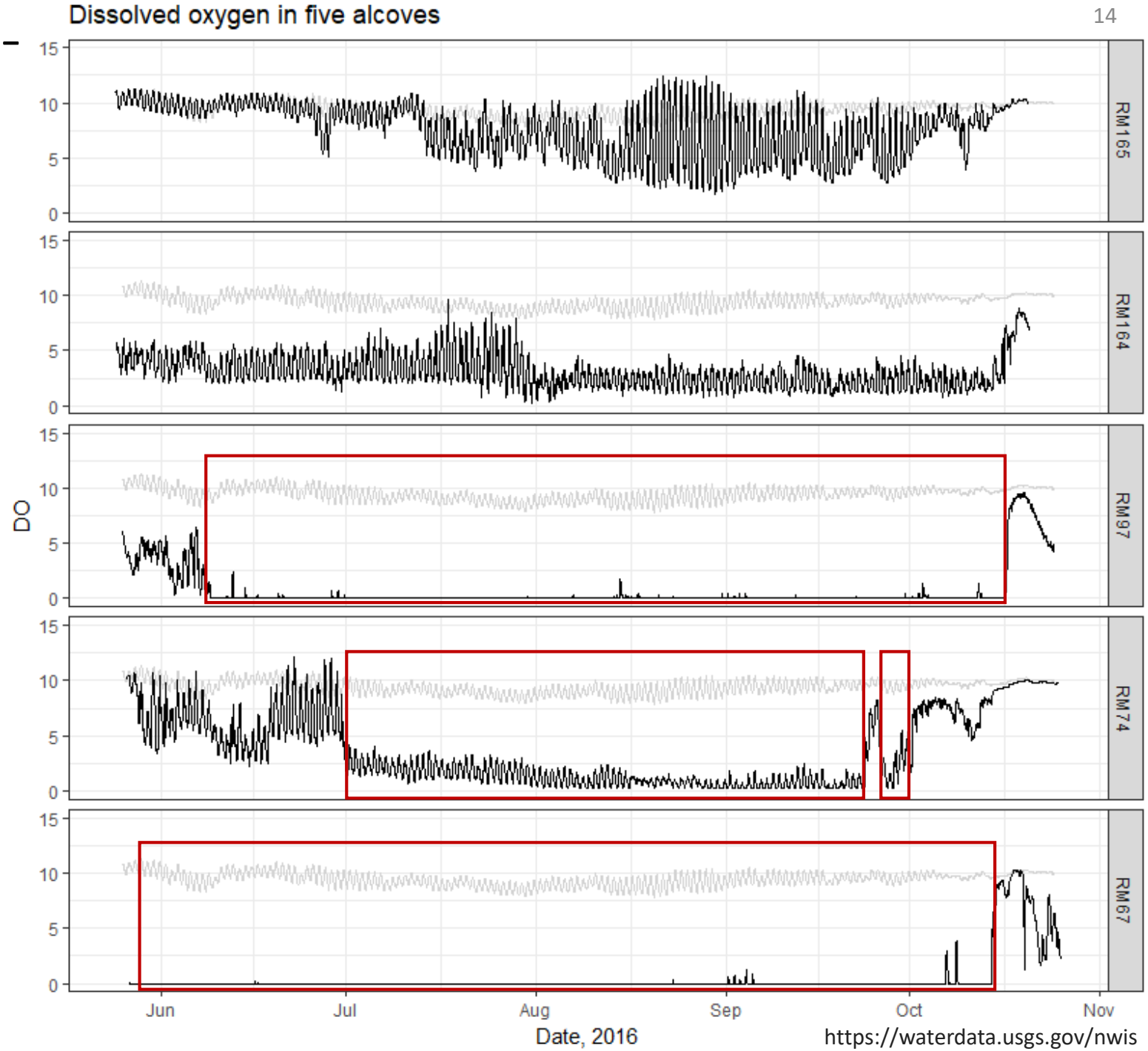
Dissolved-oxygen diversity

Alcove DO
Mainstem DO
Disconnected



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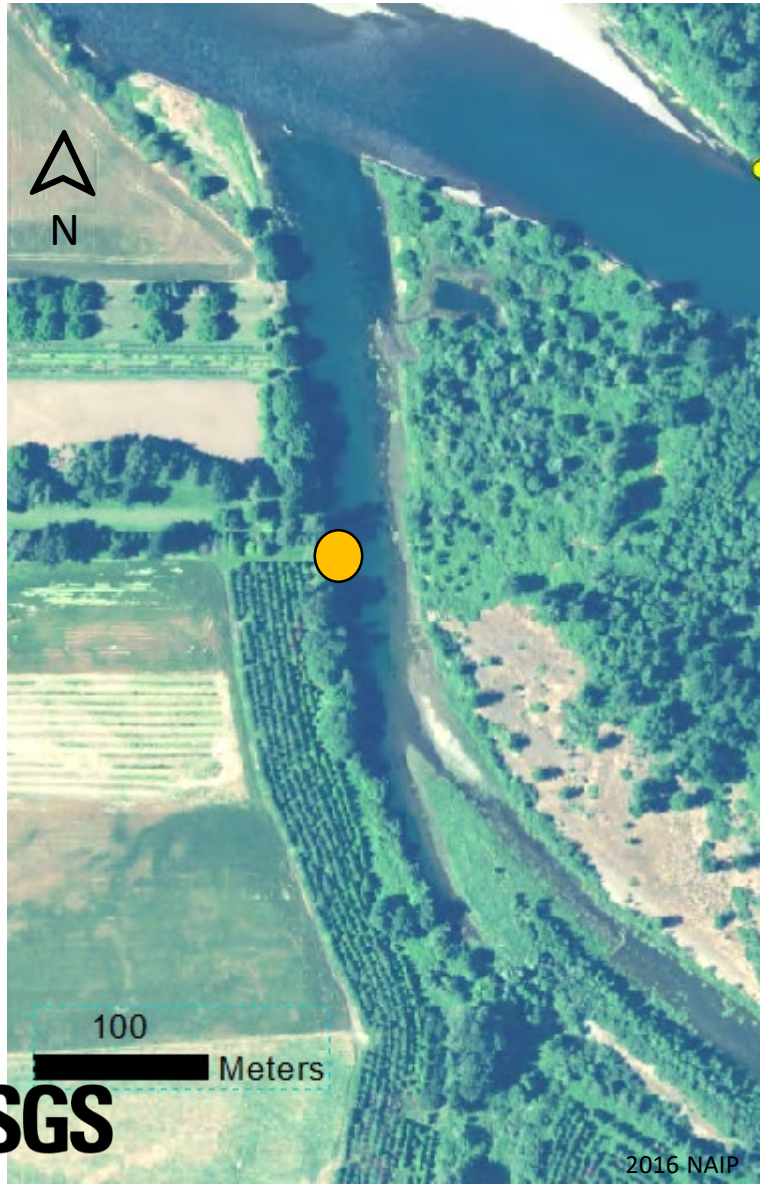
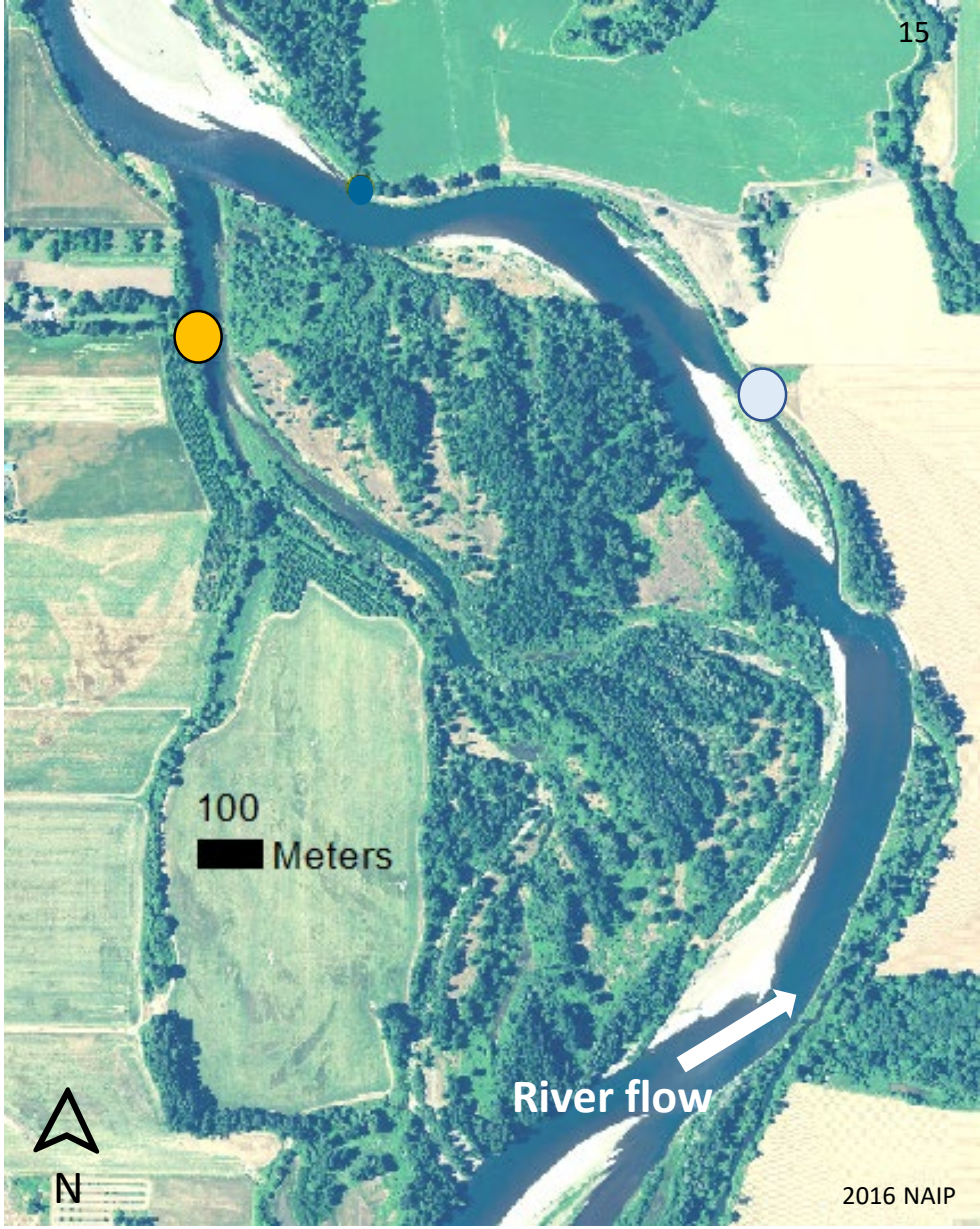
Example Alcove

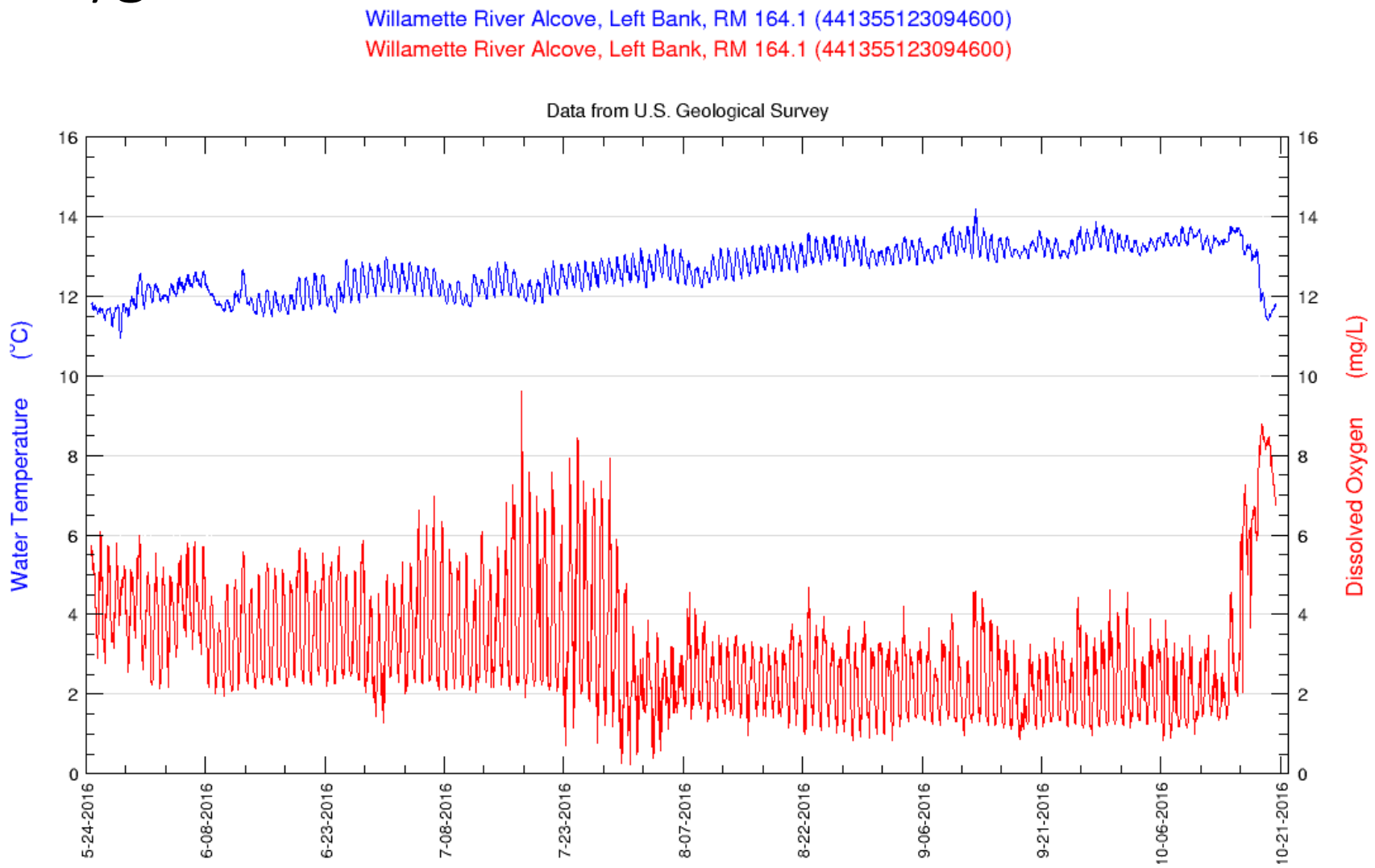
1. Blue Ruin- RM 164.1





Photos by USGS

Blue Ruin Water Temperature and Dissolved Oxygen



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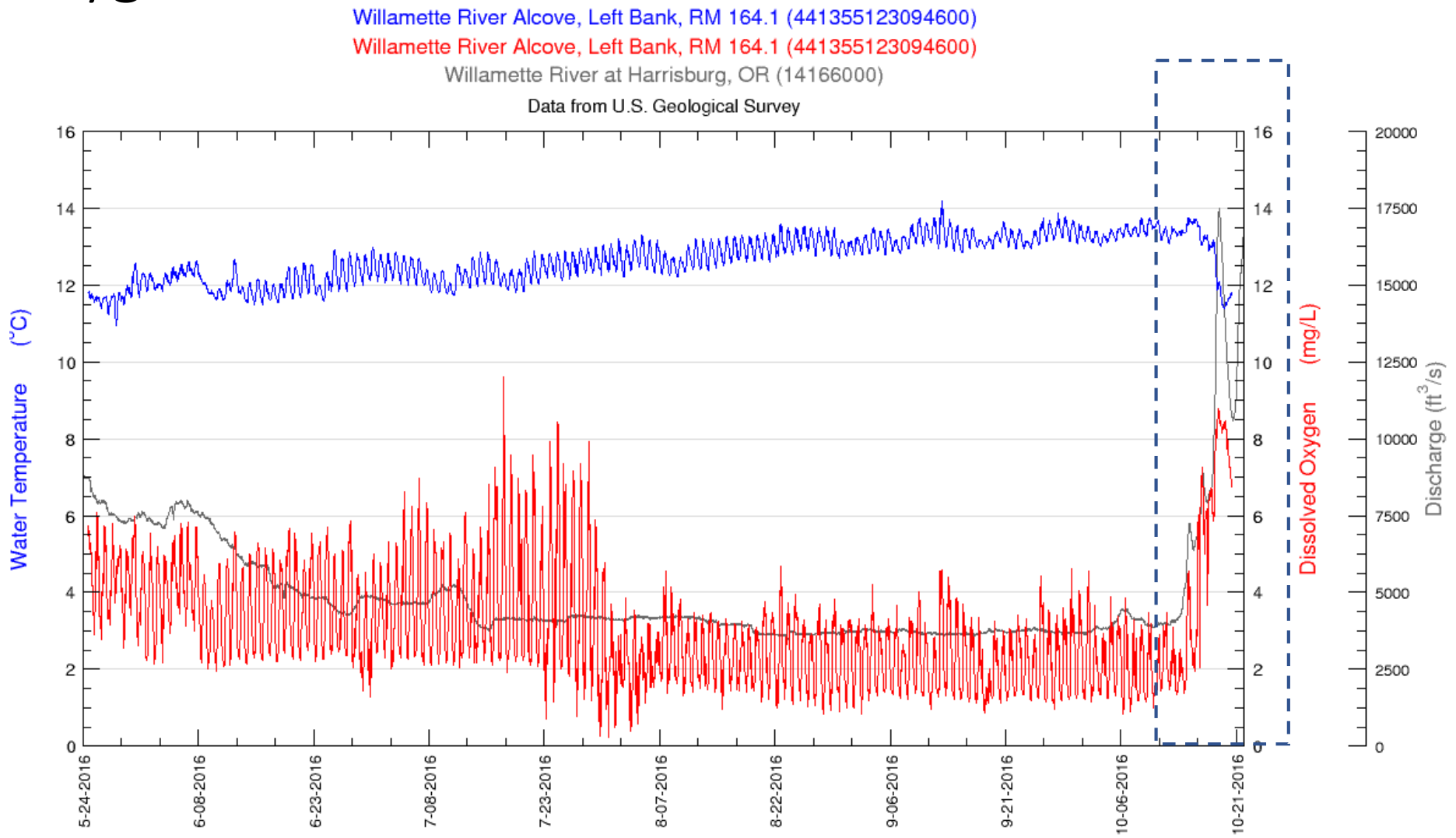
Blue Ruin Water Temperature and Dissolved Oxygen



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Example Alcove

2. Murphy Bar Alcove- RM 97.7

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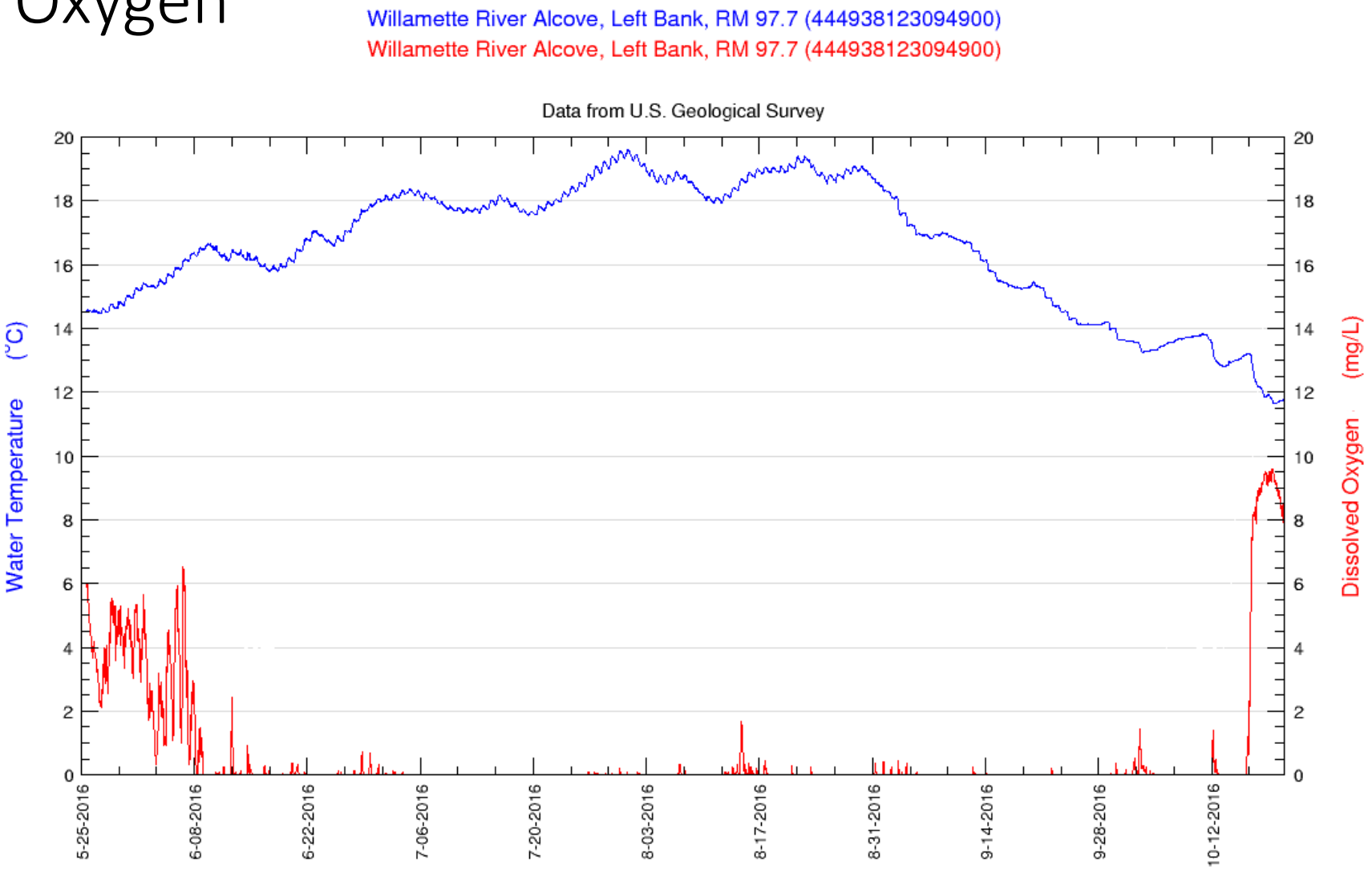
Murphy Bar Water Temperature and Dissolved Oxygen



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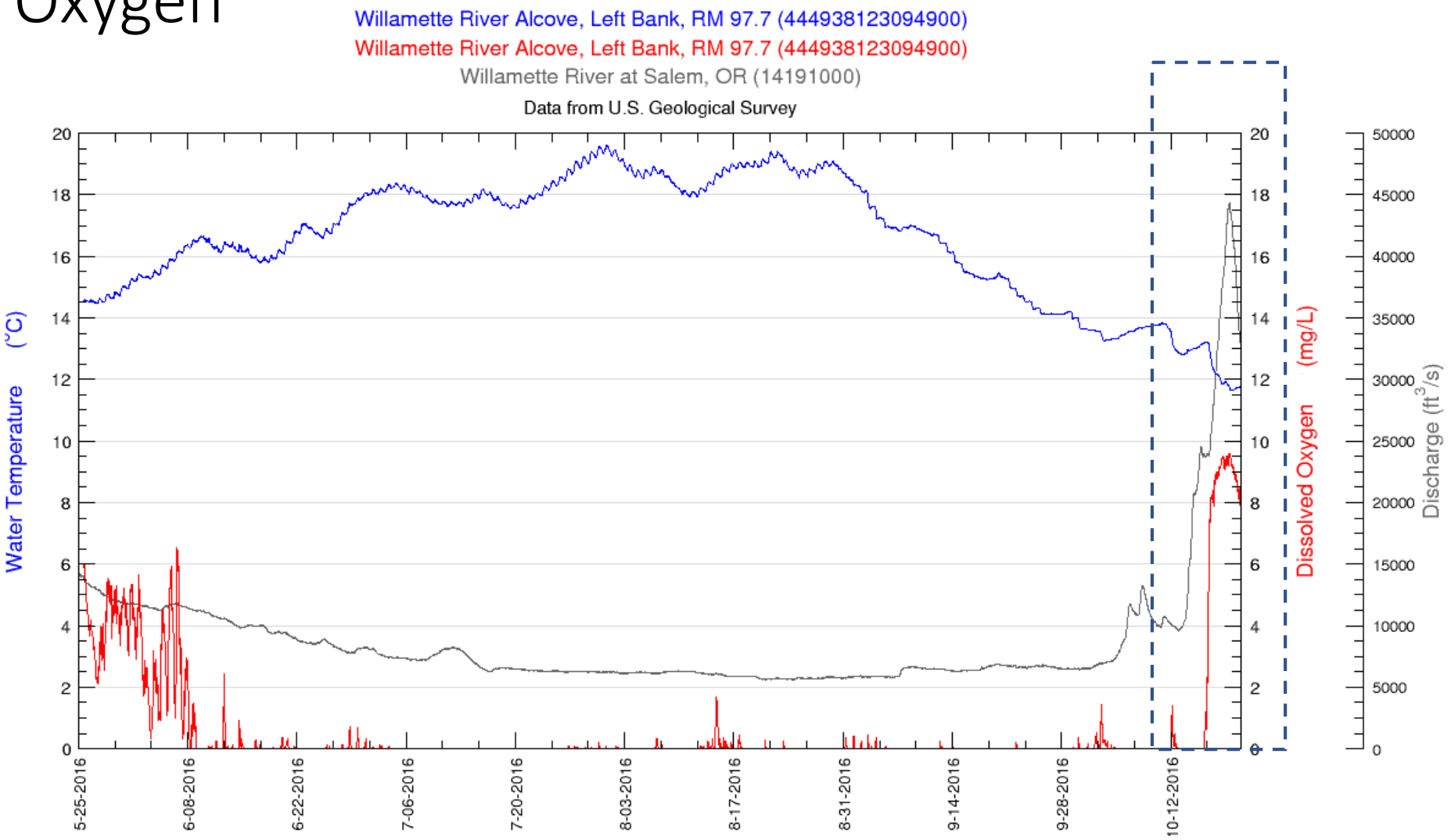
Murphy Bar Water Temperature and Dissolved Oxygen



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Measured Framework

Upstream Connection to Main Channel During Summer Low Flows	Relevant Site-specific Characteristics Observed	Water-Quality Conditions
Disconnected	Invasive plants Turbid Shaded	Cool Low oxygen
	Exposed Clear Deep	Cool Oxygenated
	Not shaded Shallow	Warm **?** Oxygen
Connected	Moderately deep Exposed Clear Submerged vegetation	Fluctuating temp Fluctuating oxygen

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Measured Framework

Upstream Connection to Main Channel During Summer Low Flows	Relevant Site-specific Characteristics Observed	Water-Quality Conditions
Disconnected	Invasive plants Turbid Shaded	Cool Low oxygen
Connected		

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Theoretical Framework

- Process-based:
  - Solar insolation
  - Groundwater/hyporheic inputs
  - Photosynthesis and respiration

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Theoretical Framework

- Next steps:
  - Quantifying the relative proportions of inputs
  - Determining the importance of site-specific characteristics on water-quality conditions

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