



Total Dissolved Gas Levels Below Foster Dam and Implications for Chinook Salmon and Steelhead Populations

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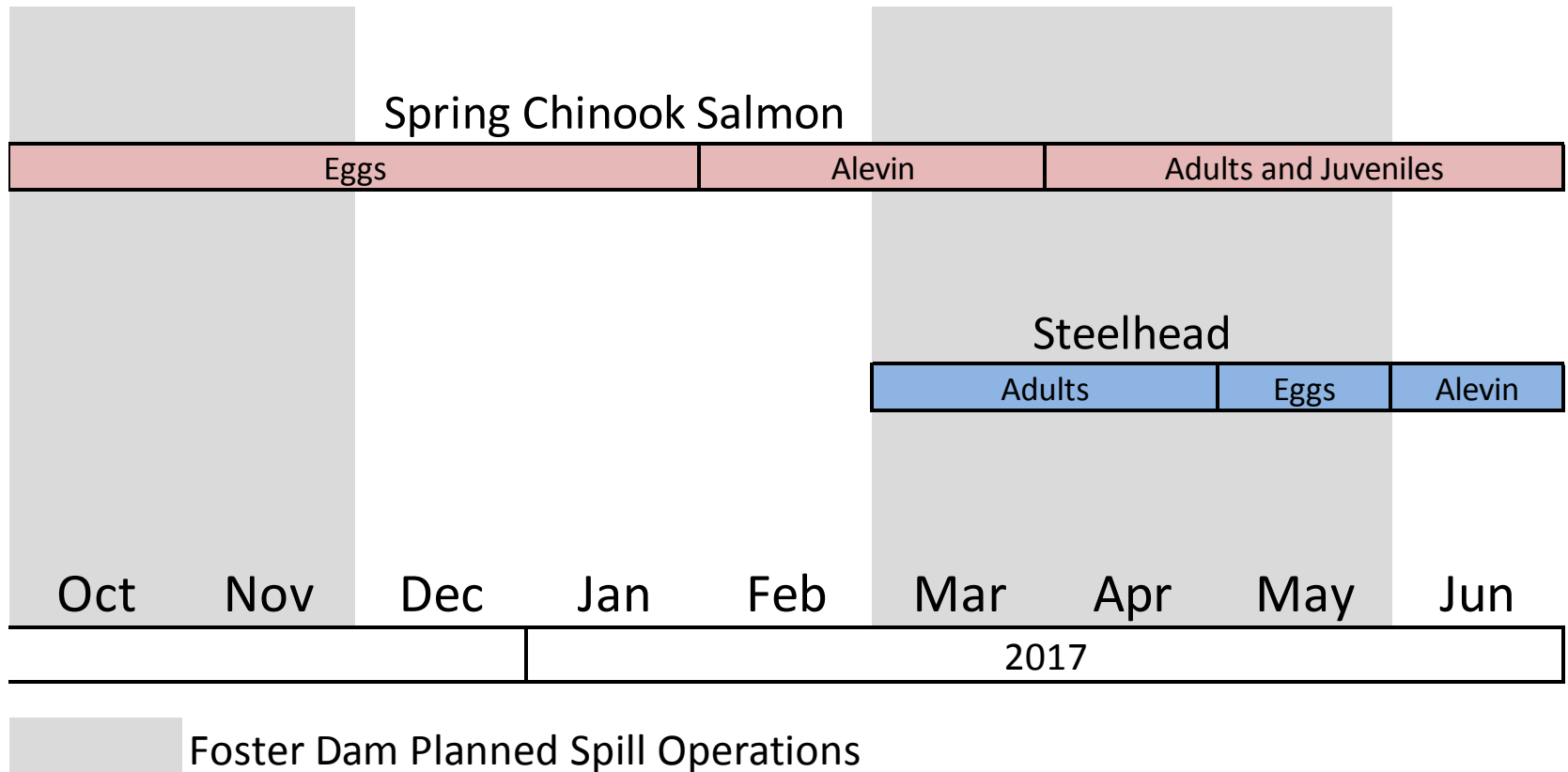
▶ Goal

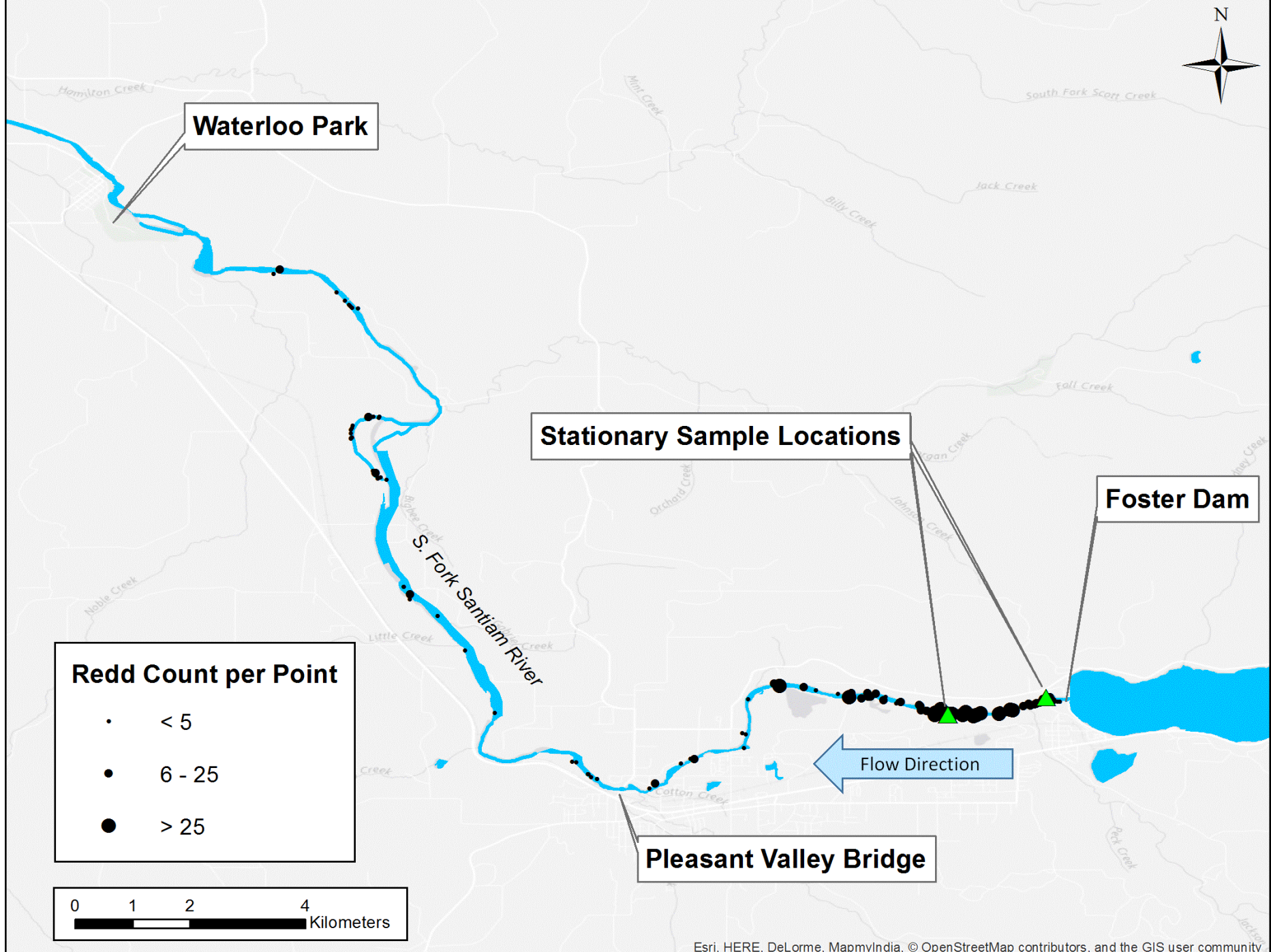
- Estimate exposure of eggs, alevin, juvenile, and adult Chinook salmon (*Oncorhynchus tshawytscha*) and steelhead (*O. mykiss*) lifestages to total dissolved gas (TDG) downstream of Foster Dam

▶ Objectives

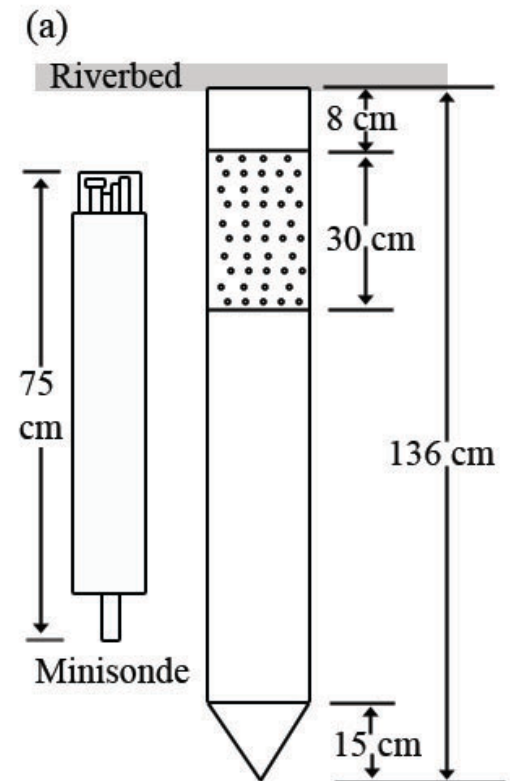
- Evaluate TDG exposure to spawning grounds downstream of Foster Dam
 - TDG in surface water
 - Depth compensated TDG in the hyporheic zone
 - Dissipation of TDG downstream
- Evaluate the relationship between Foster Dam operations and TDG levels
 - Help to inform other Willamette dam operations based on TDG exposure

Monitoring Schedule





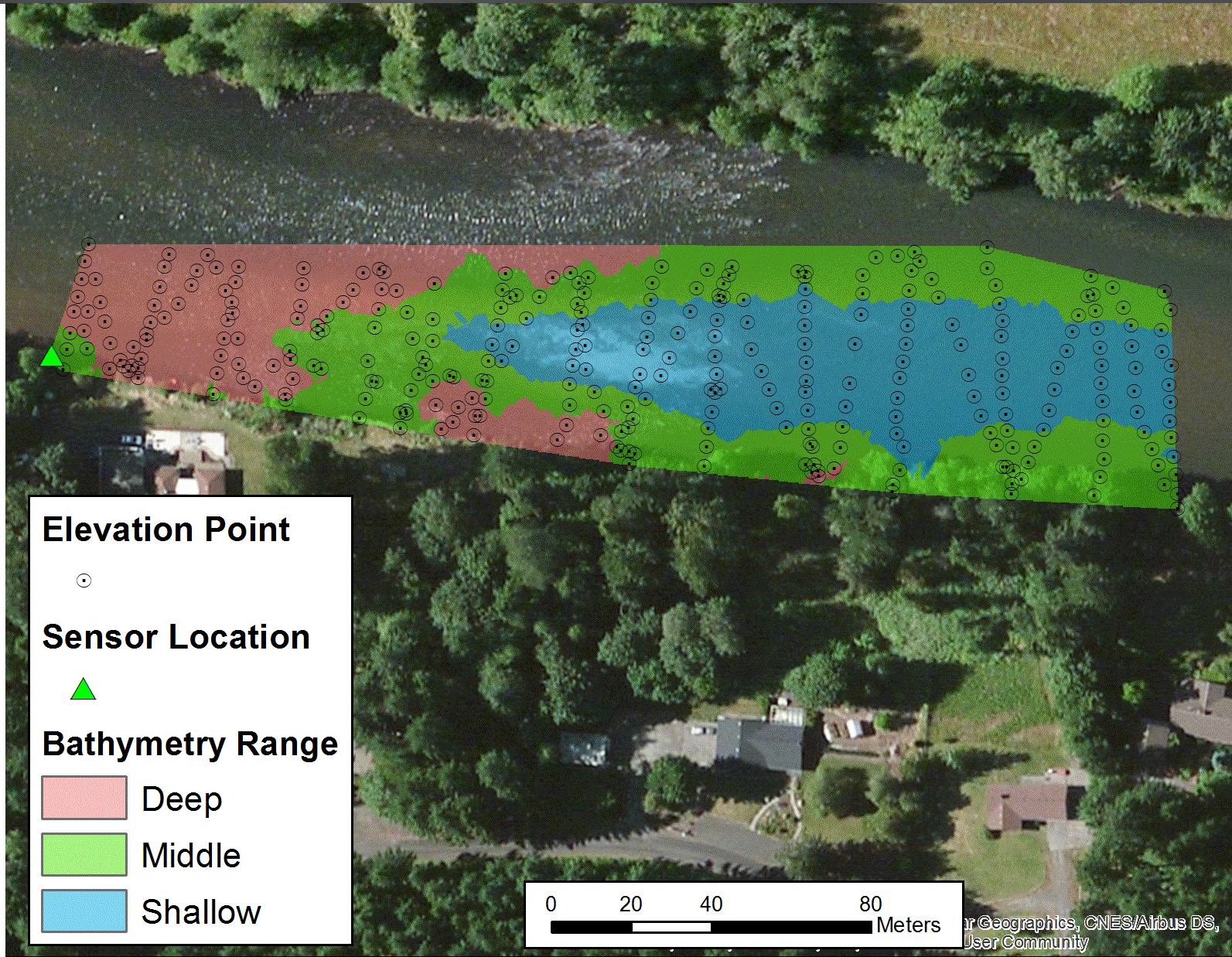
Piezometer Installation



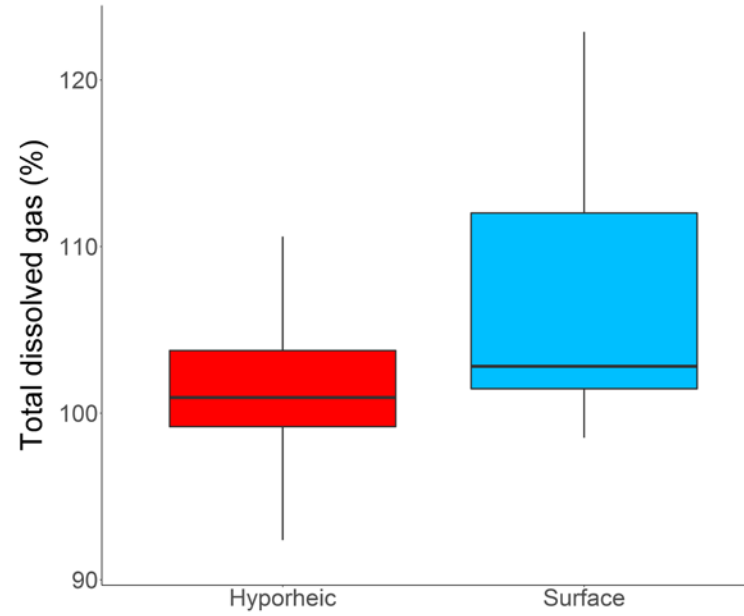
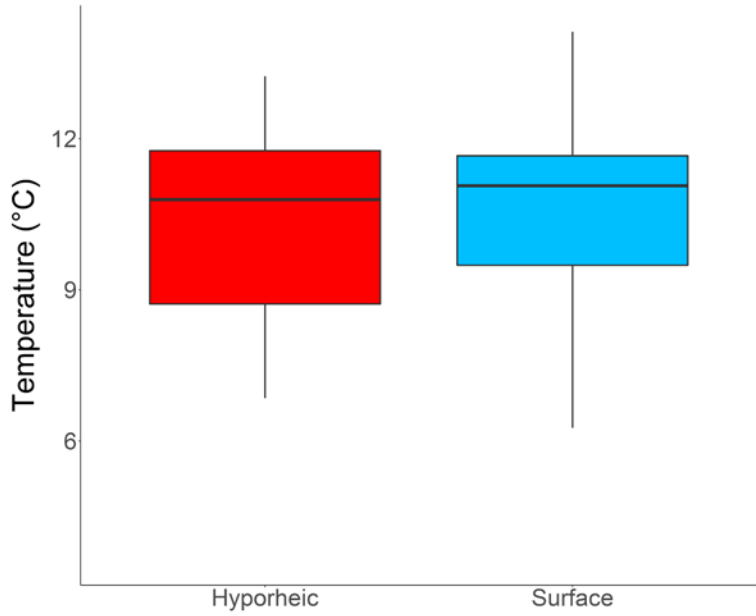
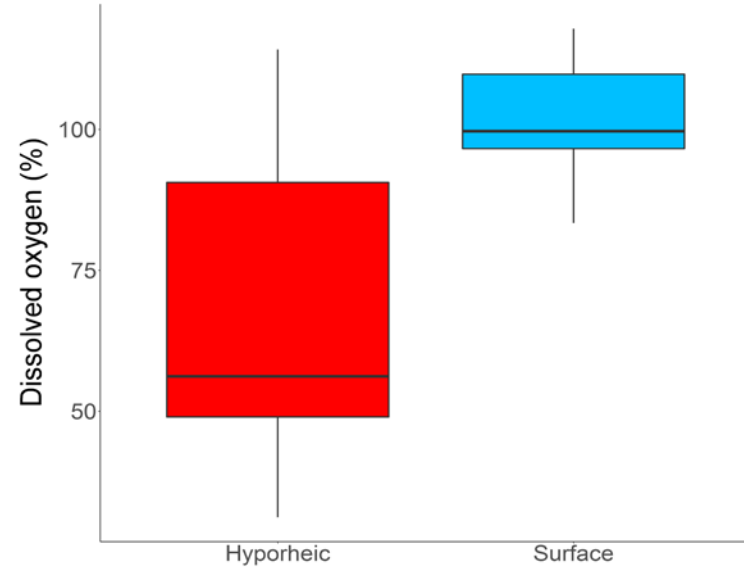
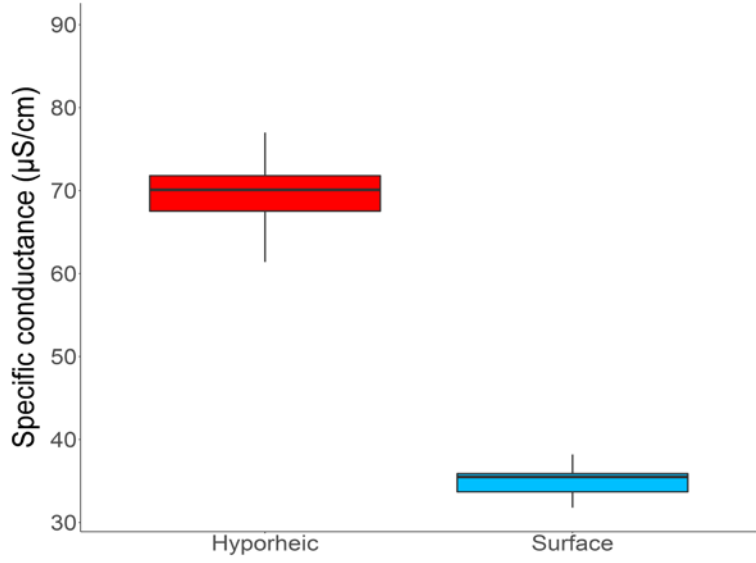
Water Quality Sensors



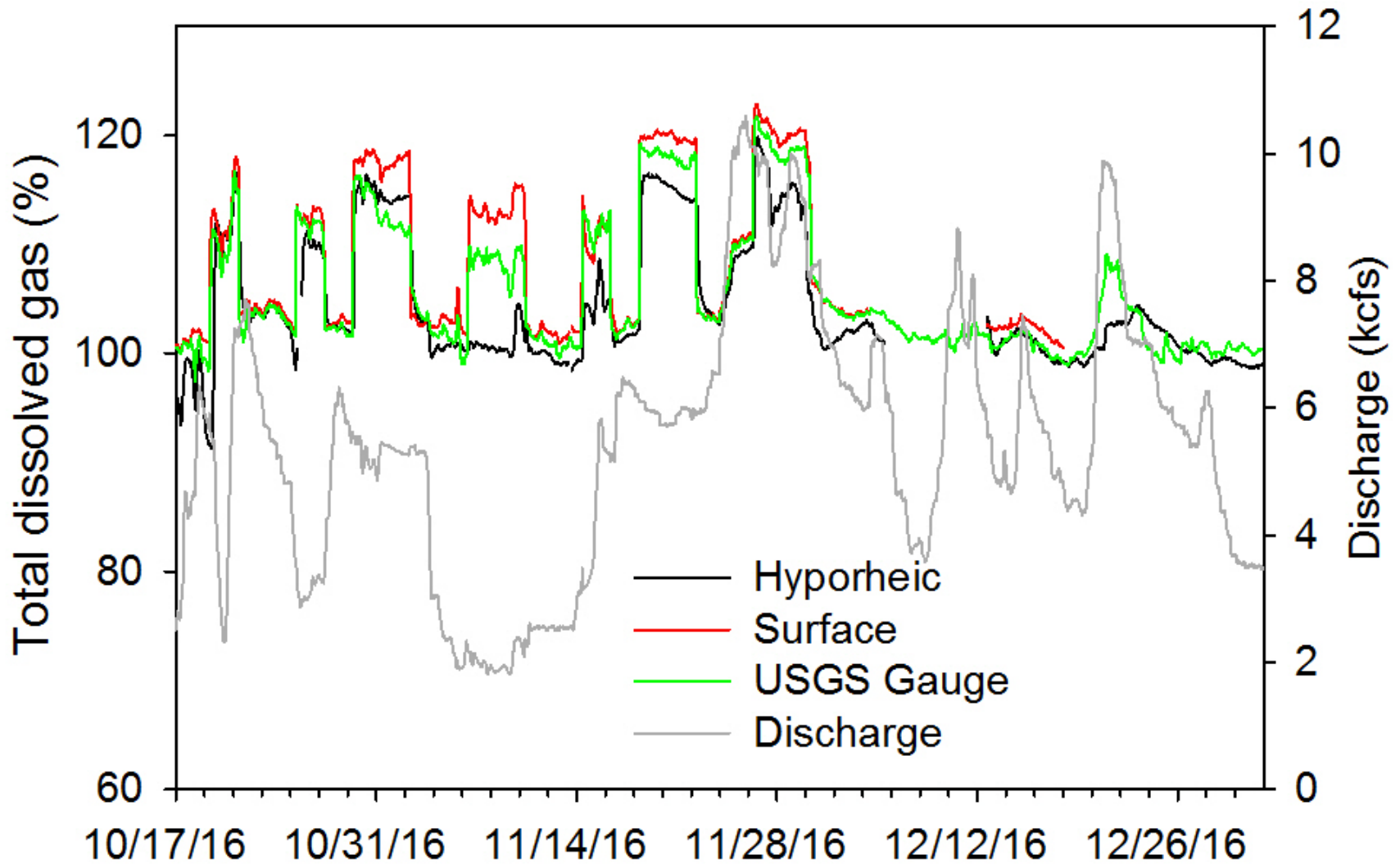
Lower Site Bathymetry



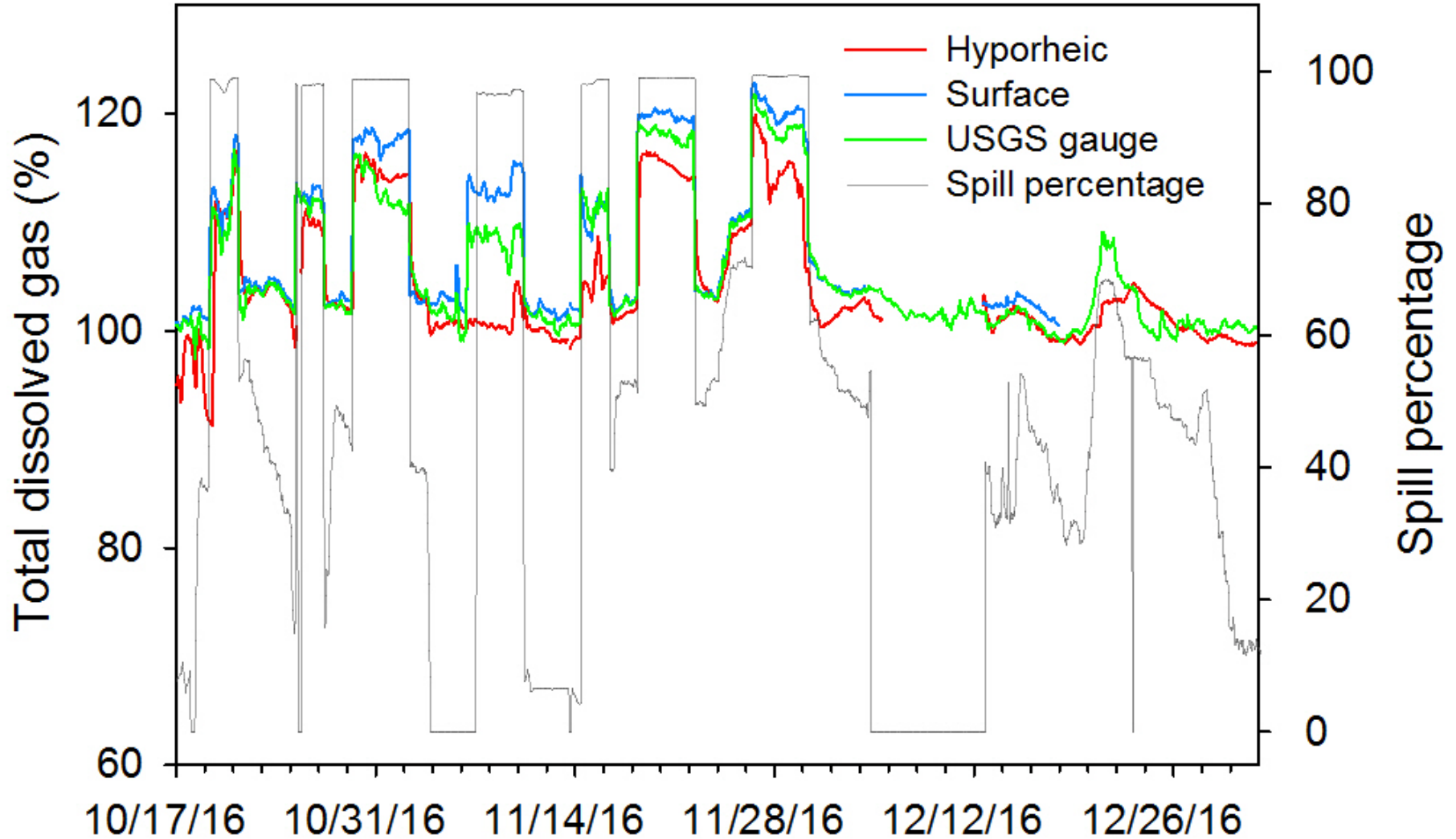
Water Quality Results

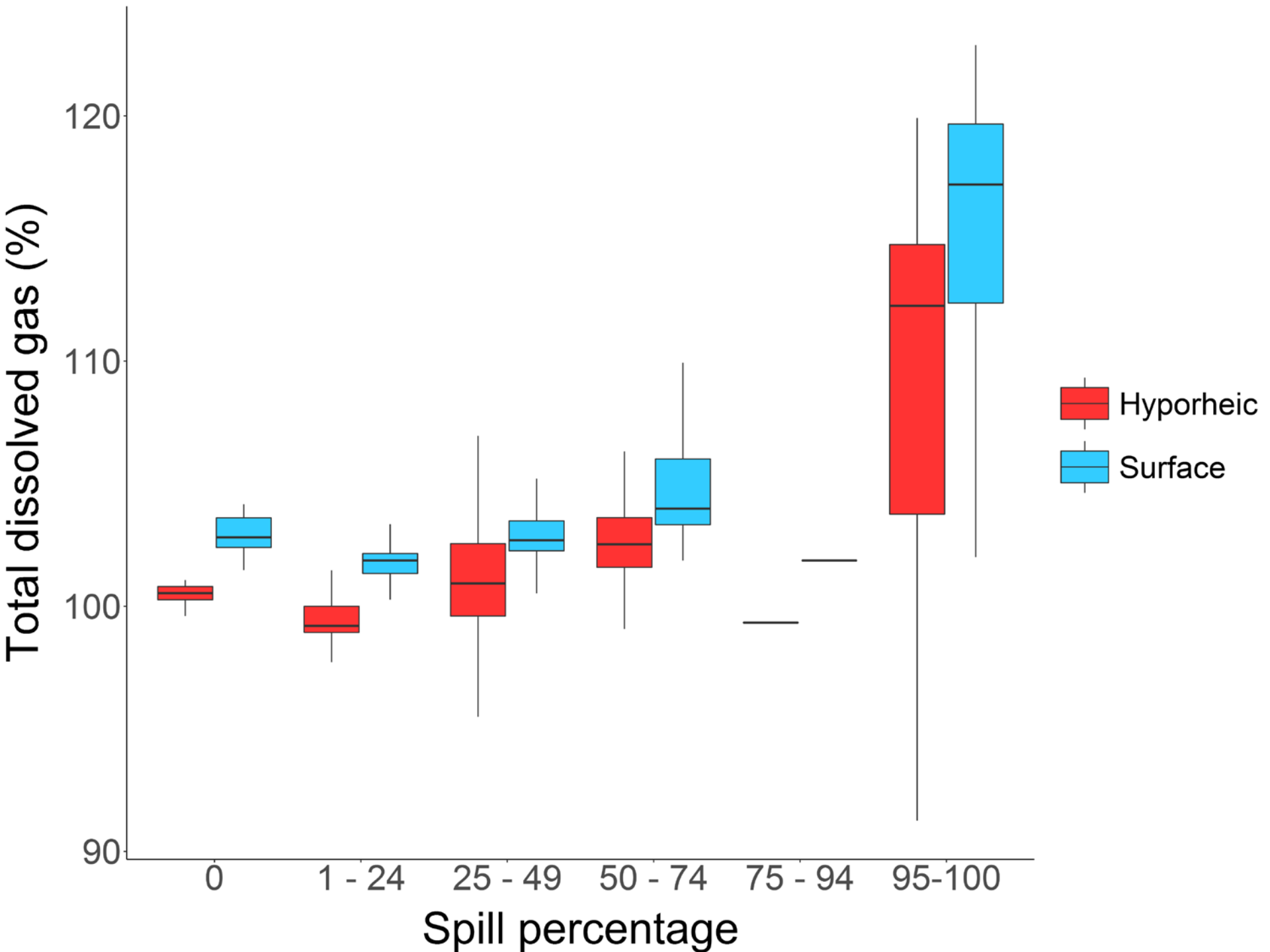


Total Dissolved Gas (%)

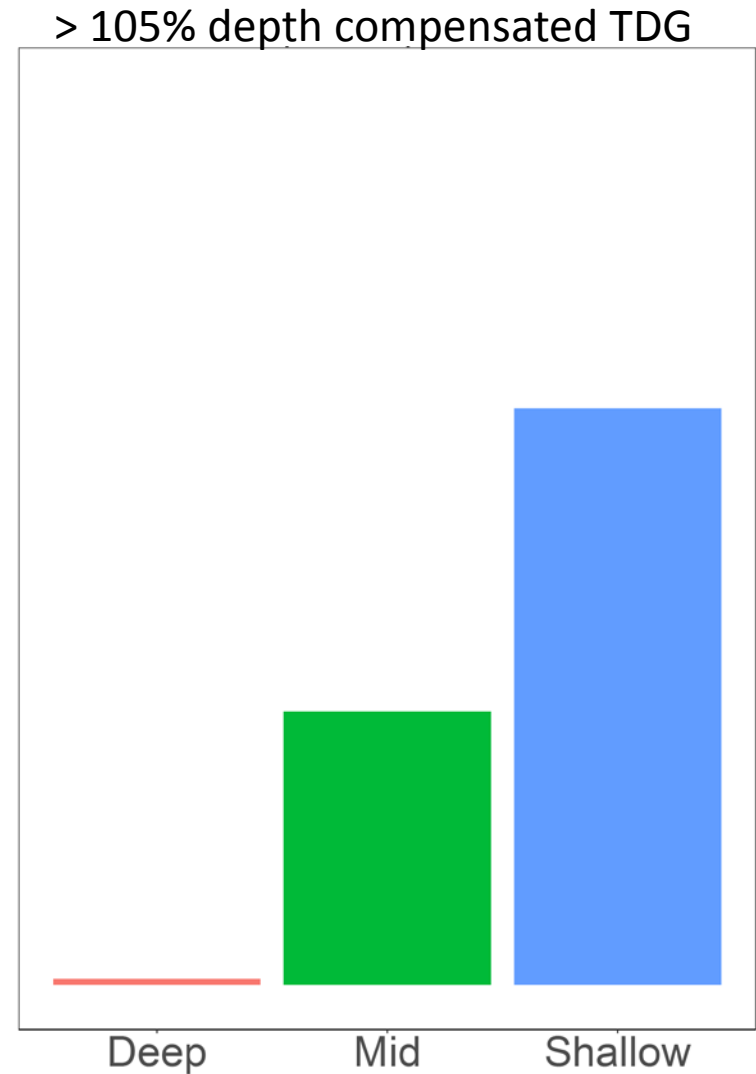
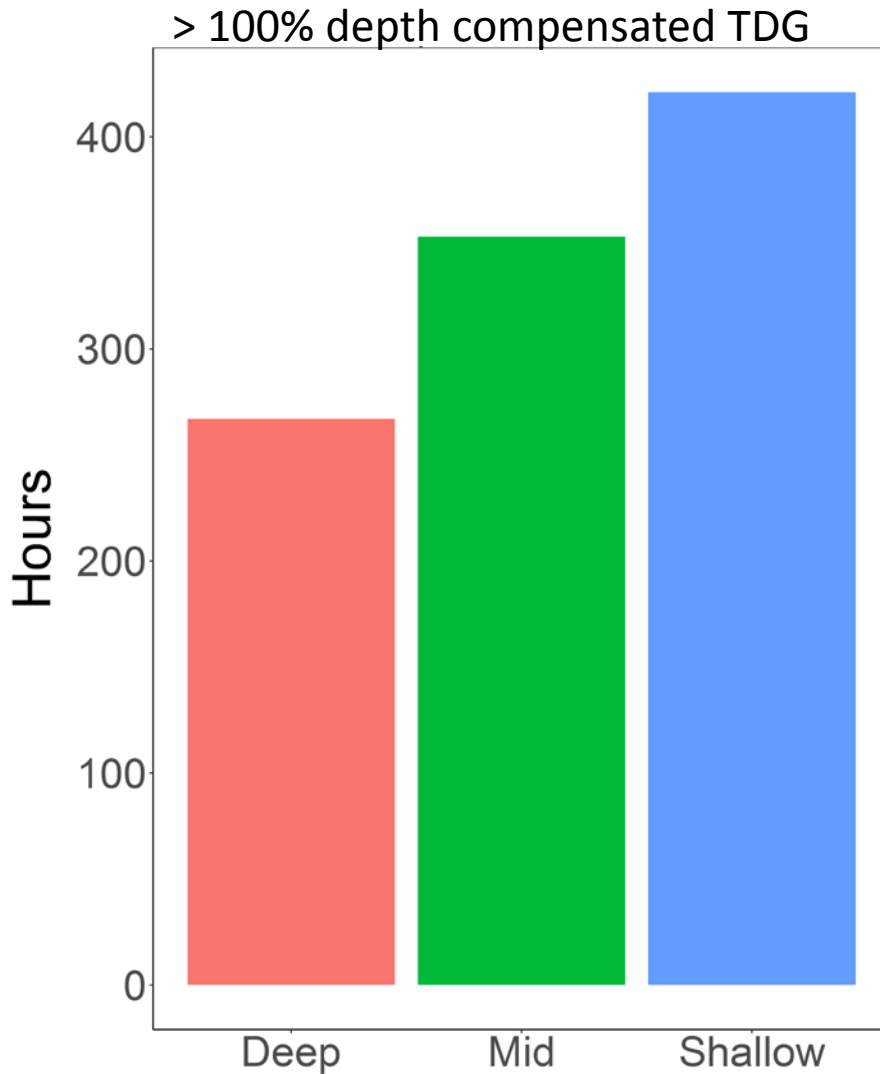


Total Dissolved Gas (%)

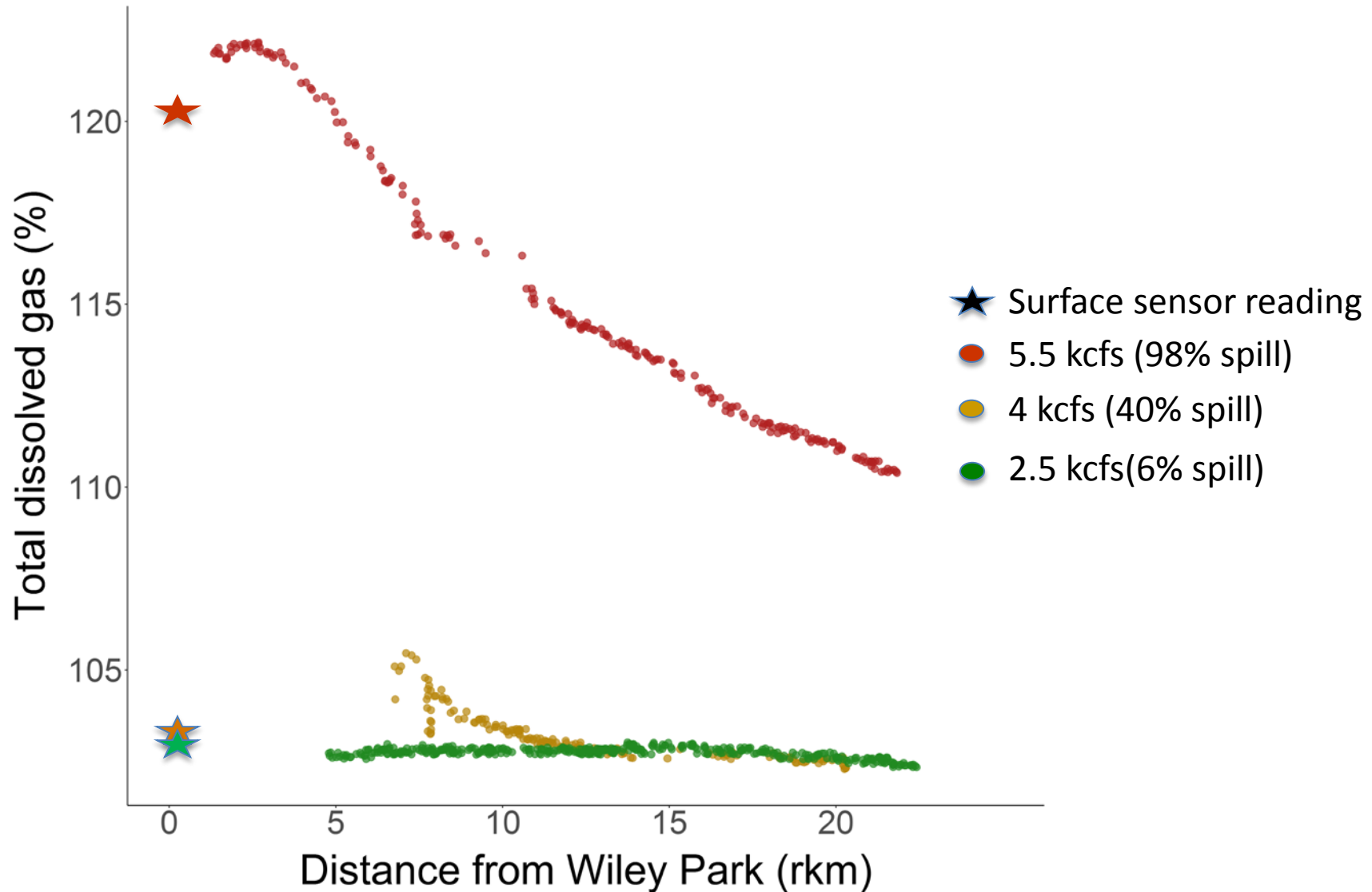




Depth Compensated TDG



Dissipation of TDG



Implications for Salmonids

- ▶ **Biological effects:**
 - GBD reported for various alevin species at dc TDG levels ranging from 101-108%
 - 105% generally adopted for regulatory purposes
 - Juveniles/adults generally tolerate 110-120% when they can depth compensate in surface water

- ▶ **Depth compensated TDG for shallow redds:**
 - > 105% for 16.6% of monitoring period
 - 52.6% of spill only
 - > 110% for 7.0% of monitoring period
 - 7% of spill only

- ▶ **Surface TDG:**
 - > 110% for 41.4% of monitoring period



Implications for Other Willamette Valley Project Dams



- ▶ Some WVP projects are larger than Foster
 - Higher spill volumes may generate higher TDG levels
- ▶ For example, surface TDG levels below Big Cliff Dam has exceeded 130% based on measurements from USGS gauges

Future Directions

- ▶ Monitor TDG levels through June 2017

- ▶ Perform drift surveys during key dam operations
 - Spring 2017

- ▶ Change location of upper site to get a more accurate representation of water quality closer to the dam



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