Nutrient and Chlorophyll Variation in the Yolo Bypass and Sacramento River

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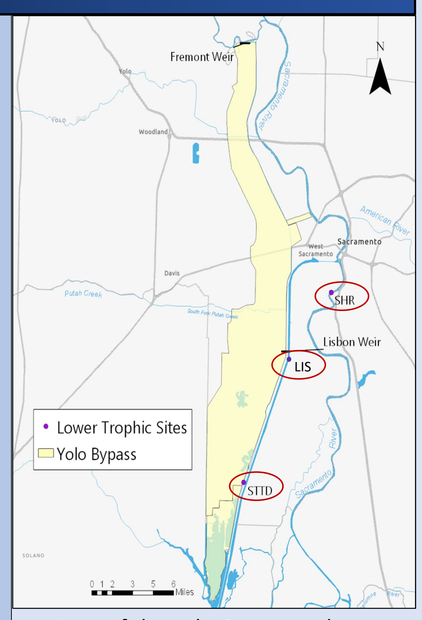
Introduction

The Yolo Bypass Fish Monitoring Program collects water samples at two sites within the Yolo Bypass's Toe Drain Canal (LIS and STTD), and an adjacent site in the Sacramento River (SHR). Samples are analyzed for chlorophyll-a and key nutrients to phytoplankton production, including dissolved orthophosphate, dissolved nitrate-nitrite, dissolved silica, and dissolved ammonia.
It is important that the Yolo Bypass phytoplankton population have the proper building blocks for their growth and productivity, as they fuel the fisheries food web.

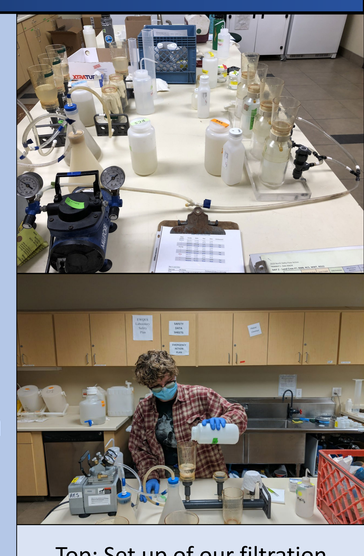


Map of the Yolo Bypass and Sacramento River. The three water sampling sites are circled in red.

Methods

Field and Lab: Water is collected every two weeks using a Van Dorn and filtered in the lab using standard protocols for each analyte. Once filtering is complete, the samples are analyzed by the DWR Bryte Chemical Laboratory.

Statistical Analysis: Sample results for water years 2017-2019 contained non-detect values. For analysis, these values were replaced with values from a uniform distribution, and all values were log-transformed. The results were modeled using a two factor ANOVA to assess how location and seasonality influenced nutrient and chlorophyll values.



Top: Set up of our filtration stations in the lab
Bottom: Using filtering equipment to filter for chlorophyll-a

Results

1. What is the importance of each analyte?

2. How do chlorophyll-a and nutrient concentrations vary over time at the three sites?

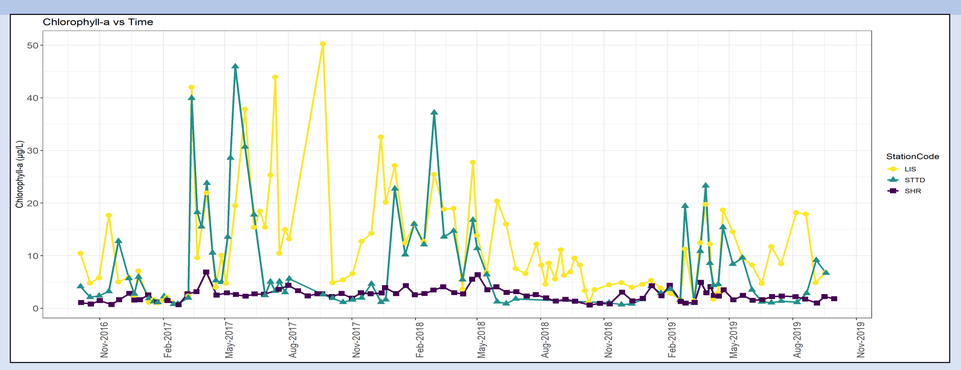
Note: Dashed lines represent the range of possible values for instances where the raw value was a non-detect.

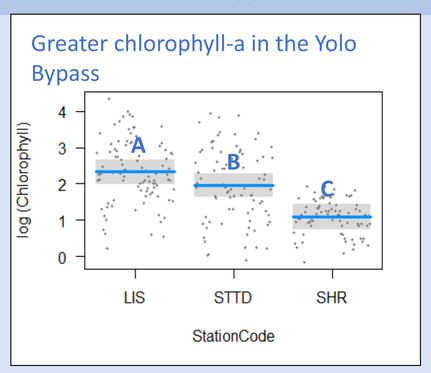
3. How do chlorophyll-a and nutrient concentrations vary by station?

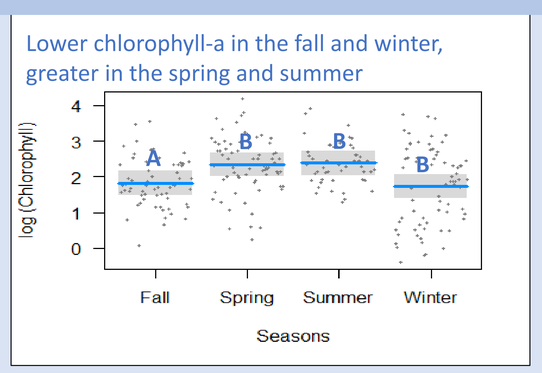
Note: Different letters identify statistically significant ($p<0.05$) differences from a Tukey post-hoc test

4. How do chlorophyll-a and nutrient concentrations vary by season?

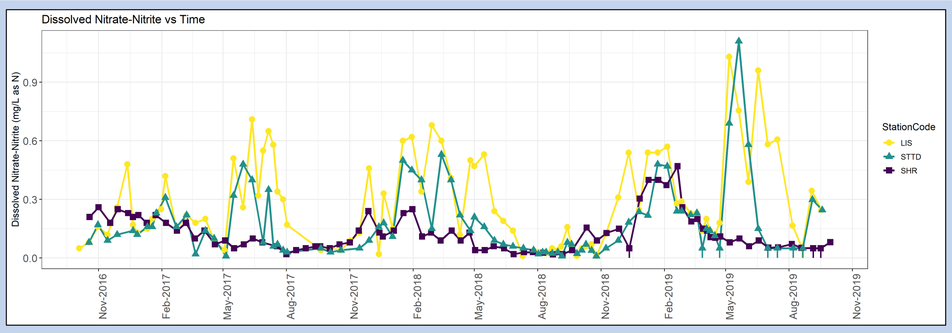
Chlorophyll-a: an indicator for phytoplankton biomass

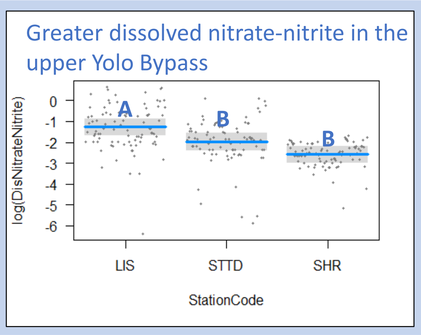


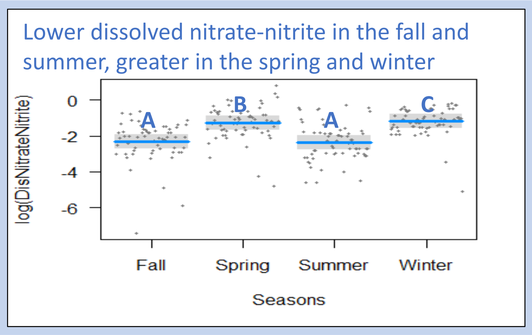




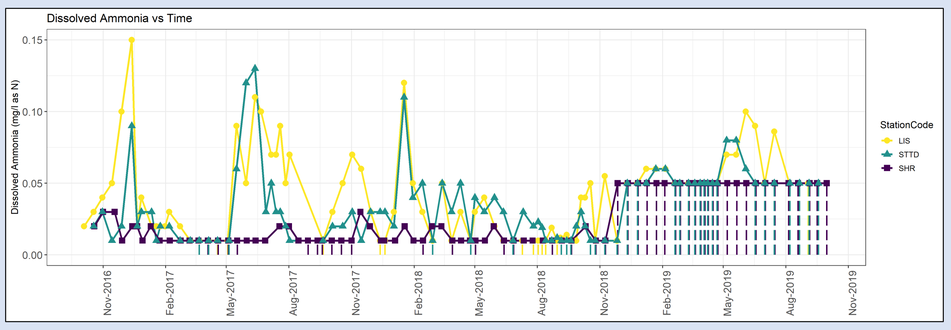
Dissolved Nitrate-Nitrite: one of the most important nitrogen sources for phytoplankton growth

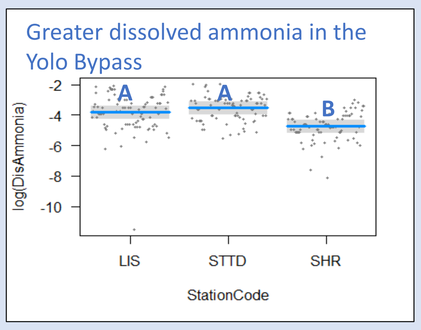






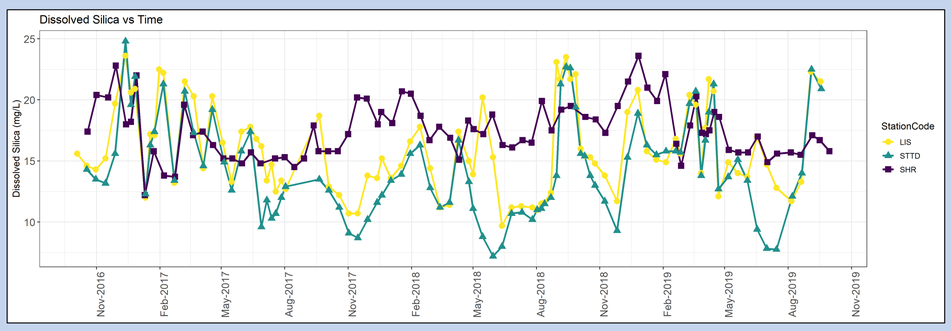
Dissolved Ammonia: a precursor to nitrate

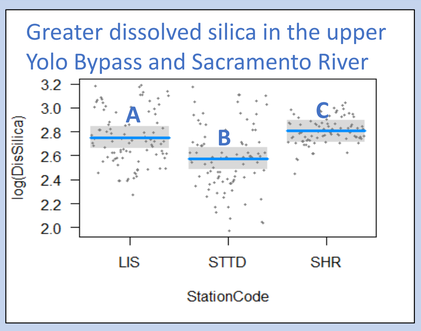




Seasonality did not have a significant effect on concentrations of dissolved ammonia.

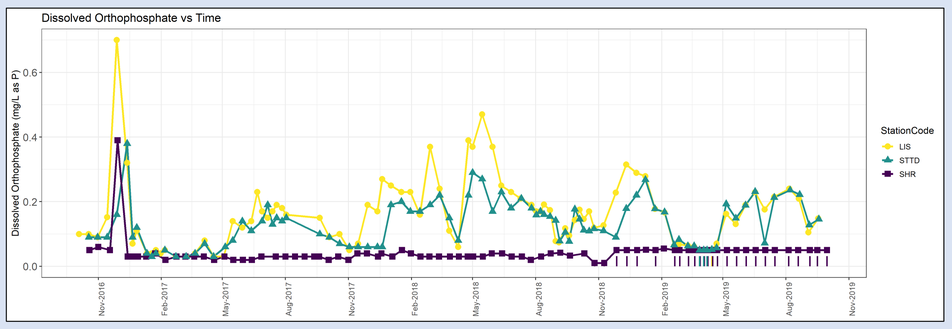
Dissolved Silica: important for the growth of diatoms, a type of phytoplankton

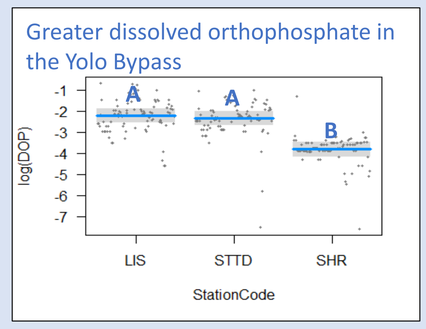


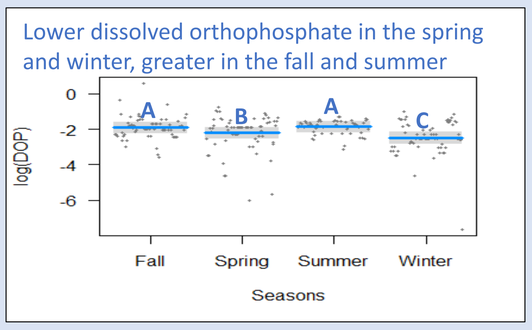


Seasonality did not have a significant effect on concentrations of dissolved silica.

Dissolved Ortho-Phosphate: cell membranes of phytoplankton contain phosphorus-based lipids





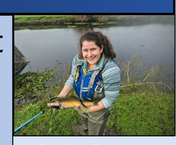


Conclusion and Next Steps

These results highlight the importance of the Yolo Bypass and its ability to provide higher concentrations of key nutrients and chlorophyll. In addition, it shows how seasonality can impact the concentrations of certain analytes and chlorophyll, especially in the spring and winter. The next step will be to assess whether flooding of the bypass effects key nutrients and chlorophyll-a levels, and if it can help explain the seasonal trends we discovered.

Acknowledgements

We would like to thank the Department of Water Resources Aquatic Ecology Unit, Bryte Chemical Lab, and the Interagency Ecological Program.



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DWR Scientific Aid