



2019-21 South Delta HABs: See what we are learning with FlowCAM Analysis

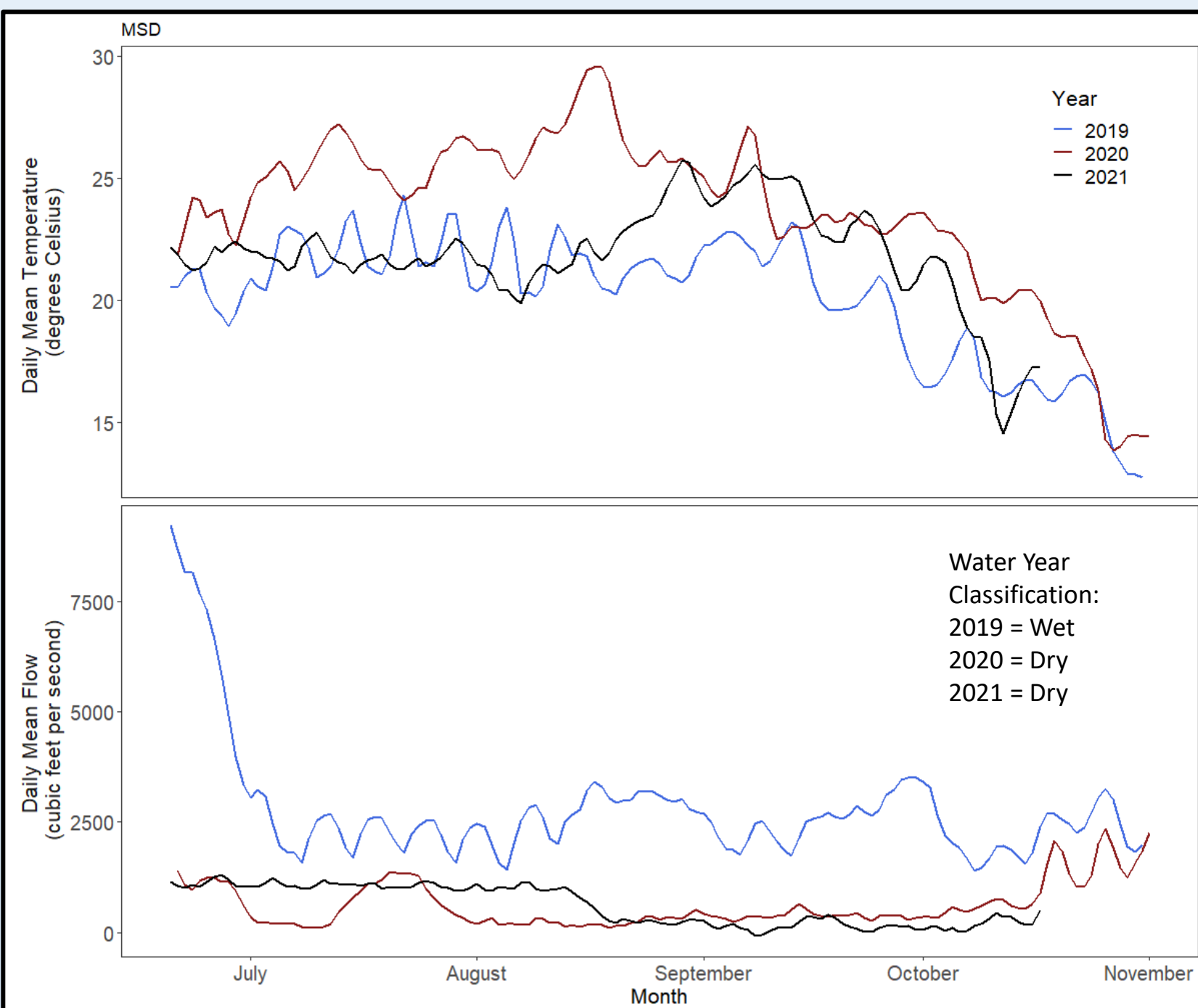
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Background

- Harmful Algal Blooms (HABs) are large overgrowths of cyanobacteria in aquatic ecosystems that have the potential to produce dangerous toxins affecting wildlife, pets, and humans. (1,3)
- Since 2017, DWR North Central Region Office (NCRO) has recorded a surface *Microcystis* bloom visual index value in the Sacramento – San Joaquin Delta during water quality (WQ) station visits every 3 – 4 weeks using DWR Environmental Monitoring Program's (EMP) *Microcystis* Qualitative Scoring guide from 1-5.



- In 2019, NCRO expanded *Microcystis* sampling in support of the South Delta Temporary Barriers Project to include collecting surface net tows for HAB and phytoplankton taxa identification at four sites (OH1, MHO, GLE, ORM) during months of peak visual index periods (July – September). (2)
- The South Delta receives water primarily from the east via the San Joaquin River but has further complicated hydrology due to local land use and its close proximity to the State and Federal Water Projects.
- Flow recorded at Mossdale Bridge (MSD) along the San Joaquin is a good indicator of water input into the South Delta and downstream flow direction. (Figure 1 and 2)

Figure 1: Flow and Temperature of San Joaquin River at Mossdale Bridge

Research Questions

What is the biovolume of *Microcystis* found near during the months of July through October?

Is there a connection between *Microcystis* Biovolume and the HAB visual index?

How does the biovolume of *Microcystis* in the South Delta compare to EMP's Inner Delta Monitoring Stations?

Study Area & Methodology

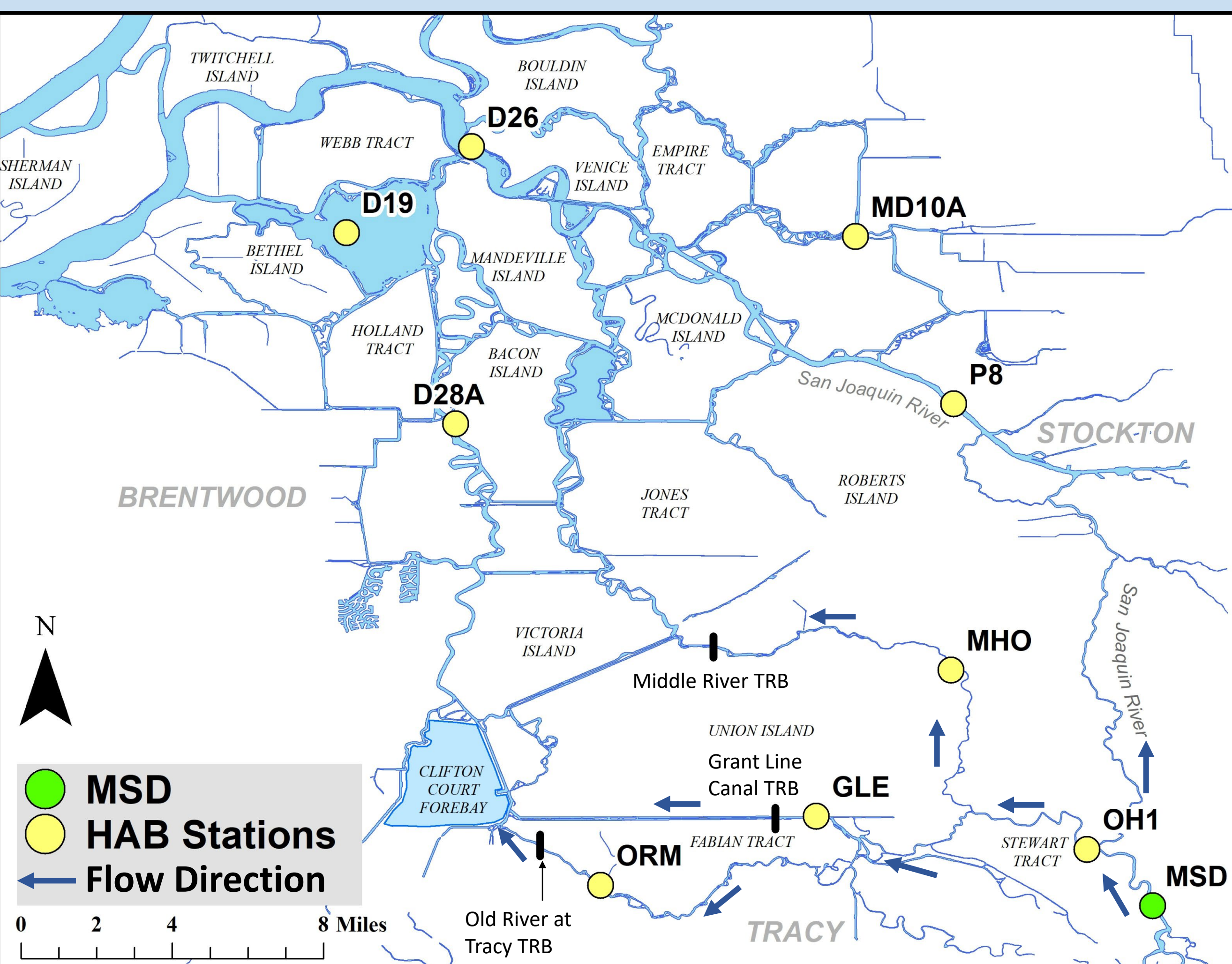


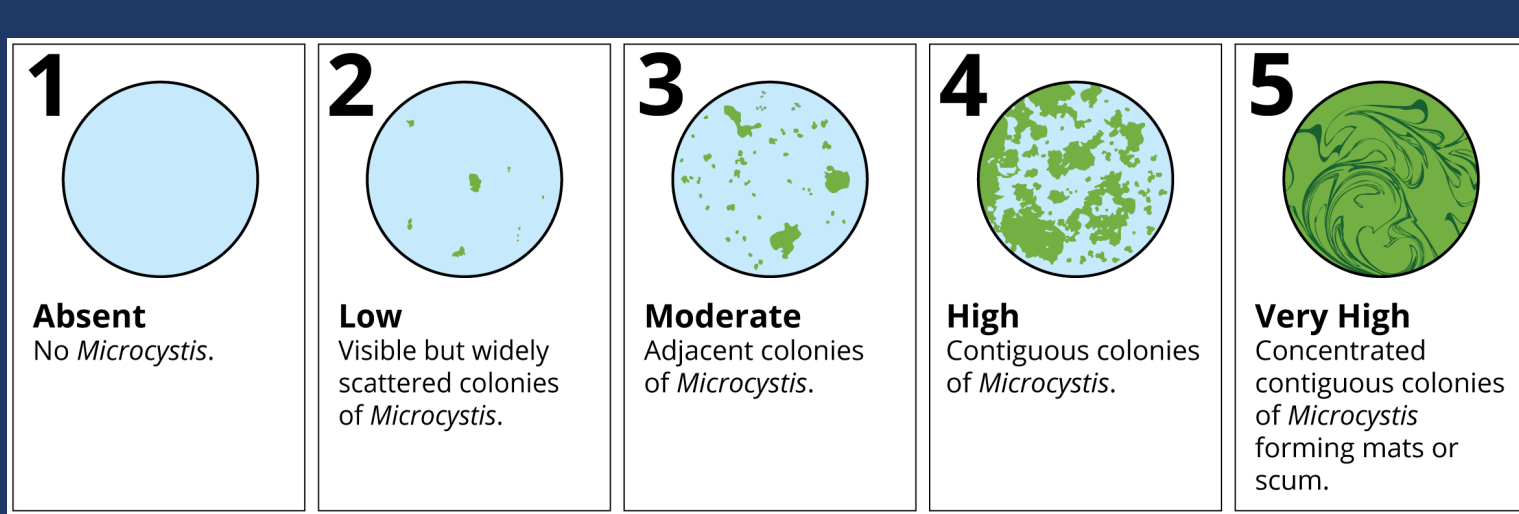
Figure 2: North Central Region Continuous Water Quality + EMP Monitoring Stations

Study Area

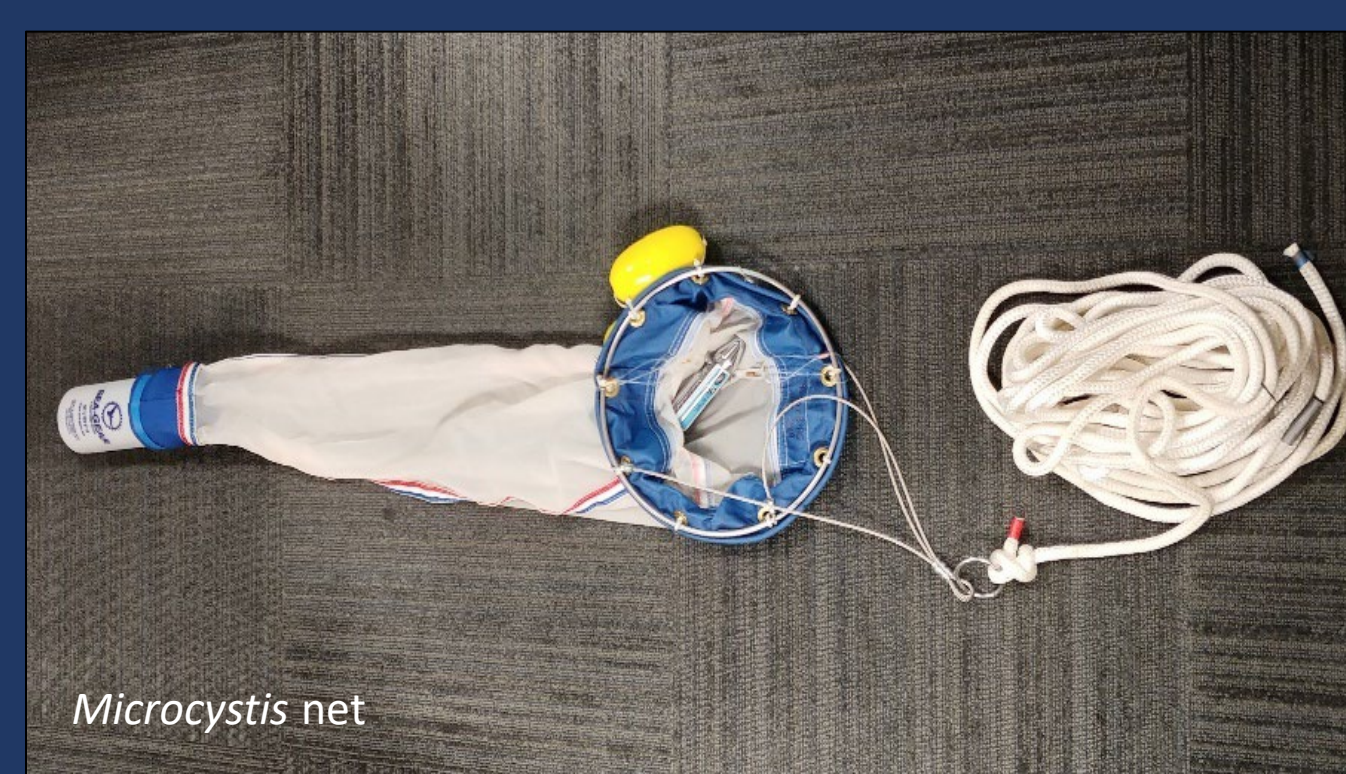
- NCRO WQ monitoring stations with surface net tow sampling (OH1, MHO, GLE, ORM) are in the South Sacramento-San Joaquin Delta.
- These stations are located near seasonal (May-Nov) temporary rock barriers (TRB) that are installed to trap tidal water upstream for local water users. (Figure 2).
- We are comparing our South Delta Stations with 5 inner Delta EMP Stations (P8, MD10A, D26, D19, D28A)

Visual Scoring

The *Microcystis* visual qualitative index, adopted from the IEP EMP, offers comparability with other IEP long-term Delta surveys. Visual scoring is taken every 3 – 4 weeks during water quality station visits



Phytoplankton

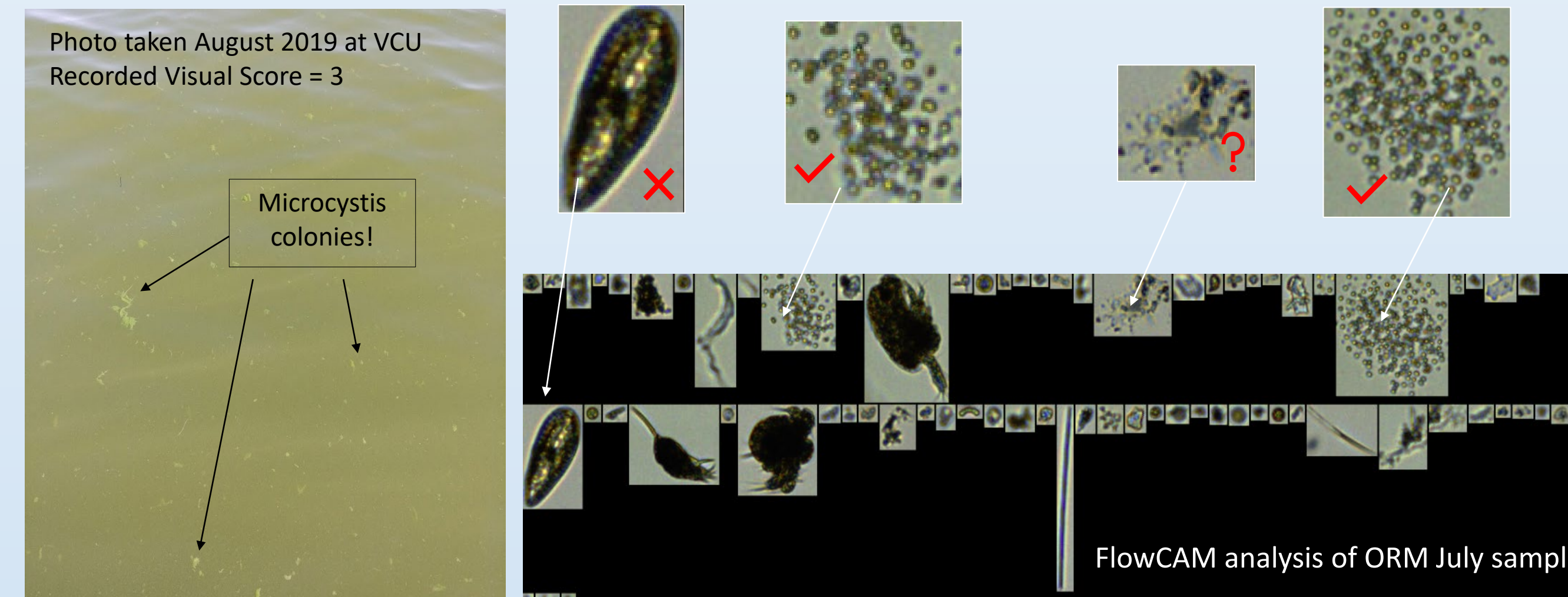


An 80 μ m mesh plankton net was used to collect *Microcystis* samples 0 – 0.3 m below the surface using the tow net method. A van dorn was used to collect a phytoplankton sample 1 m below the surface.

Methodology

FlowCAM Analysis

- FlowCAM analysis has been conducted for the sample years 2019-2021 at station ORM and *Microcystis* biovolumes have been calculated following the IEP EMP model.
- We calculate a biovolume of *Microcystis* by identifying the photos taken from net tow samples and then enumerated for total biovolume for each site per sampling event. FlowCAM analysis is still being conducted on surface tow net samples from the other 3 sites, but already there have been microscopic *Microcystis* colony sightings as early as July.



Continuous Data Relationships

- We examined the visual relationships of *Microcystis* biovolume with co-located continuous flow and water quality measurements of temperature to better understand spatial and temporal drivers of HABs in the South Delta (Figure 3).

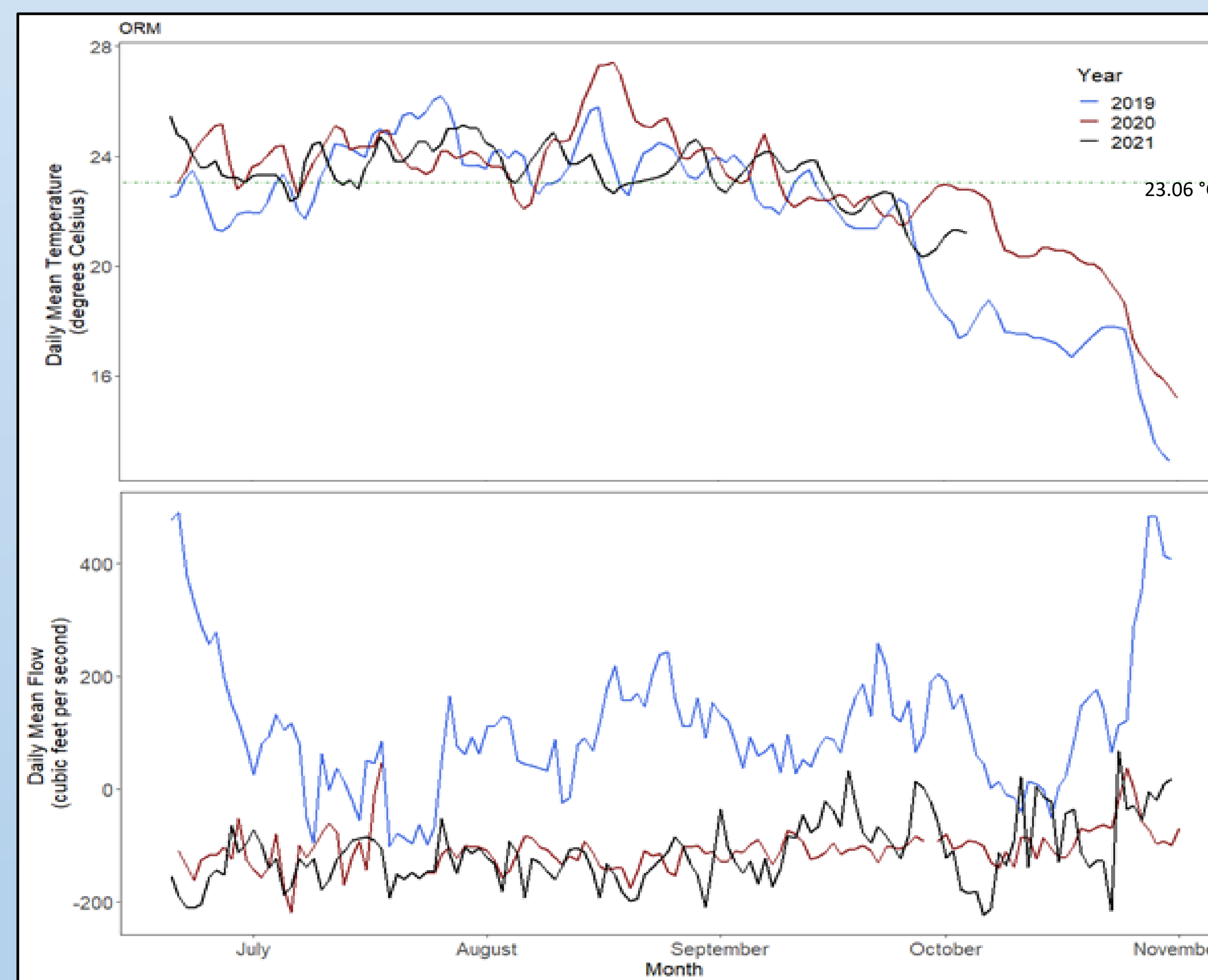


Figure 3: Flow and Temperature of Old River above Mountain House Creek Station

Discussion & Next Steps

Increasing average temperatures in the Delta could lead to more favorable conditions for *Microcystis* growth. 23.06°C is the average temperature where *Microcystis* colonies can be seen throughout the Delta without microscopic imaging (4). With this in mind, there could be benefits to utilizing water temperature as an indicator to trigger *Microcystis* tow net sampling earlier than July in order to detect when microscopic colonies begin forming.

Next Steps: Our first priority will be to complete the FlowCAM analysis of the remaining 3 samples stations (OH1, MHO, GLE). Our hope for the future is to establish a contract with a trained taxonomist alongside EMP to establish a more comparative and accurate biovolume calculation across all DWR Delta collection sites, as FlowCAM analysis can be variable between individual users. We also hope to work alongside EMP on future HAB data synthesis efforts. We are also exploring the option of adding the collection and analysis of cyanotoxins at our current sampling locations.

Results

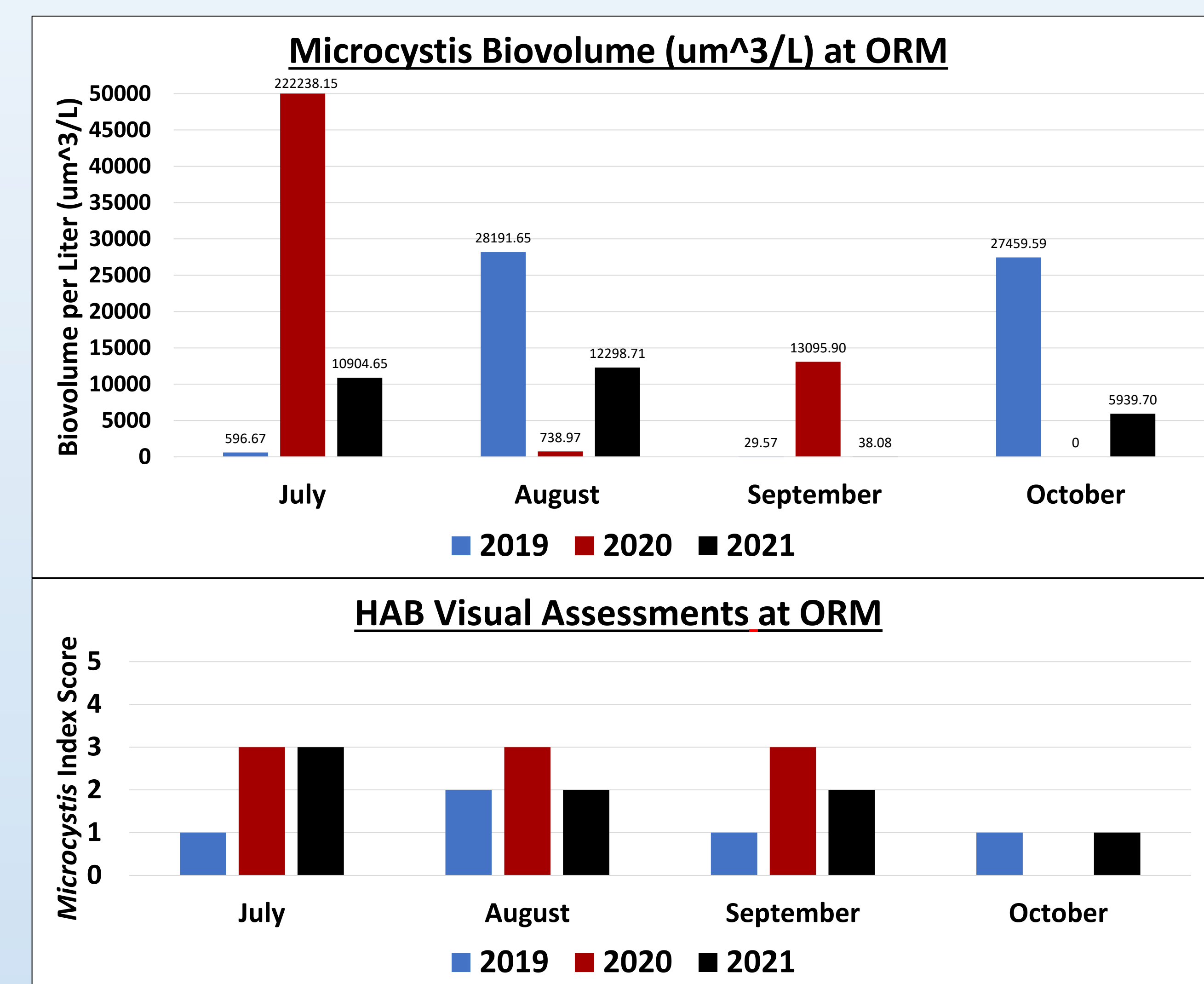


Figure 4: HAB Biovolume per month & HAB visual assessment recording

What We Have Accomplished So Far

- HAB visual scores indicate an increase in HAB activity coinciding with an increase in average temperature and a decrease of flow (Figure 3)
- HAB visual index scores do not appear to always correlate directly to *Microcystis* biovolume levels, especially at higher levels. This could be in part to the variability between different field staff interpretation of the HAB Visual Index. Consistent training may help consistency. (Figure 4)
- Comparing ORM to South Delta EMP monitoring sites (P8, MD10A, D19, D26, D28A) from 2019 showed consistently higher biovolume concentrations of *Microcystis* at most EMP interior Delta sampling sites. (Figure 5) (EMP 2020-21 data unavailable at time of analysis)

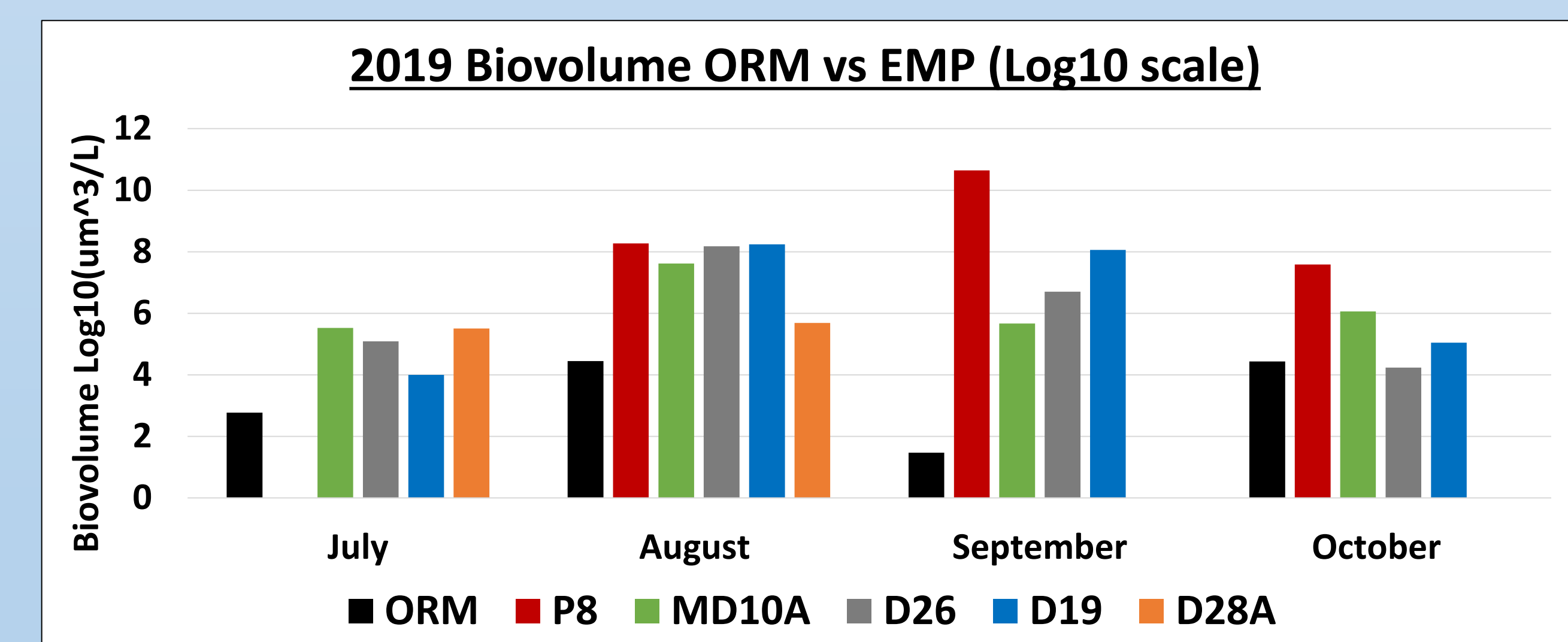


Figure 5: Comparison of Biovolume at ORM versus inner Delta EMP Stations

Acknowledgments

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References

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