Monitoring, Modeling and Prediction Project (MMP), a project with the objective of predicting the likelihood of enhanced chlorophyll (bloom) occurrences in the Bay/Delta ecosystem

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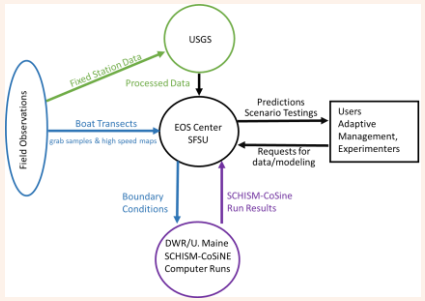
Field observations made in spring 2021 along with 3-D coupled hydrodynamic-ecosystem model SCHISM-CoSiNE modeling indicate that chlorophyll blooms occur associated with low salinity (~1), resembling an entrapment zone

- The MMP project is an interdisciplinary, multi-institutional project, supported by CA DFW as part of Prop.1. that aims to improve understanding of food production for Delta Smelt by improving the existing ability to predict phytoplankton blooms
- The project combines multidimensional modeling, high-resolution nutrient and chlorophyll observations and phytoplankton productivity rate data



- Objectives are to:

1) make field observations to determine the effects of flow and nutrients on production of food in regions of the Bay/Delta critical to higher trophic levels.

2) improve the SCHISM-CoSiNE model with high frequency data from fixed stations and enhanced spatial coverage;

3) develop links with potential users and assess ability for an operational biogeochemical model

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Field Observations

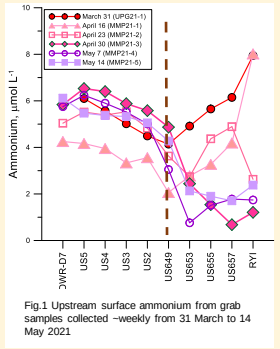


Fig.1 Upstream surface ammonium from grab samples collected ~weekly from 31 March to 14 May 2021

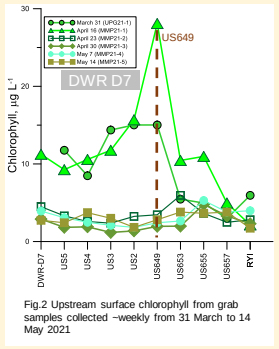


Fig.2 Upstream surface chlorophyll from grab samples collected ~weekly from 31 March to 14 May 2021

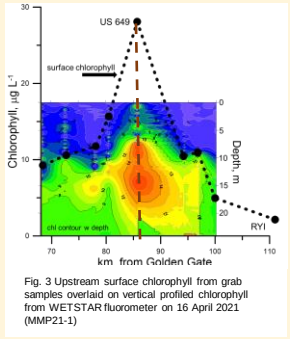
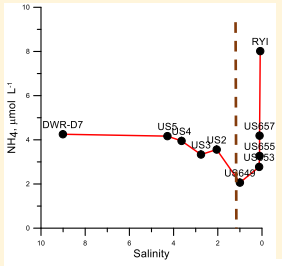


Fig. 3 Upstream surface chlorophyll from grab samples overlaid on vertical profiled chlorophyll from WETSTAR fluorometer on 16 April 2021 (MMP21-1)

In spring 2021 a bloom developed between late March and April peaking at US 649 (Fig. 2) near the confluence. Accompanied by lower ammonium levels (Fig. 1). Bloom was also manifested below the surface (Fig. 3)



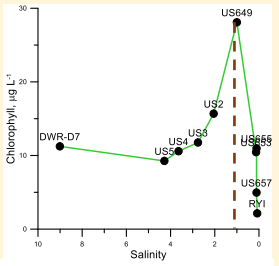


Fig. 4 Ammonium and chlorophyll vs salinity from 16 April 2021 (MMP21-1) following upstream

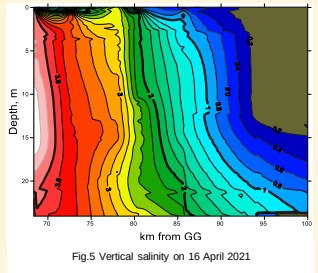
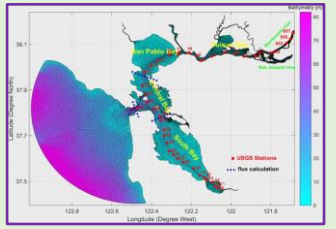


Fig.5 Vertical salinity on 16 April 2021

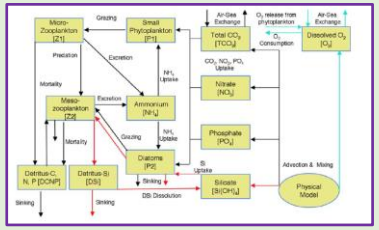
The high chlorophyll and low ammonium at US 649 occurred with salinity of 1 (Fig 4) at a front as indicated by the vertical profiles of salinity (Fig. 5)

Modeling

SCHISM Model



CoSiNE Model



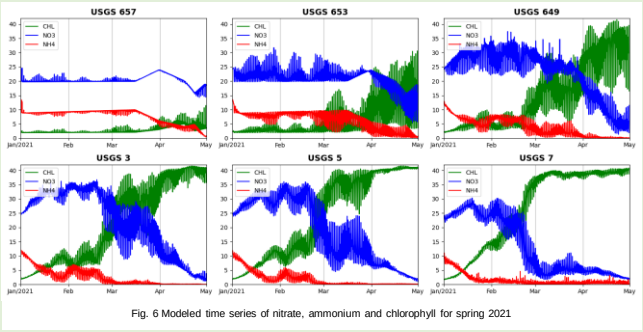


Fig. 6 Modeled time series of nitrate, ammonium and chlorophyll for spring 2021

Model reflects the sequence of ammonium decline, followed by nitrate and then chlorophyll increase (Fig. 8) as observed in the field (e.g. Wilkerson et al. 2015)

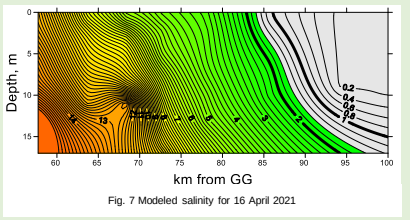


Fig. 7 Modeled salinity for 16 April 2021

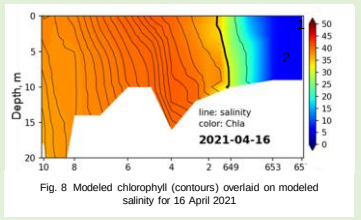


Fig. 8 Modeled chlorophyll (contours) overlaid on modeled salinity for 16 April 2021

Modeled salinity (Fig. 7) for 16 April 2021 matches observed (Fig. 5). The model also reflects the development of bloom going downstream from salinity of 1 (Fig. 8).

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