Dugdale et al. IEP /SWFCA Study

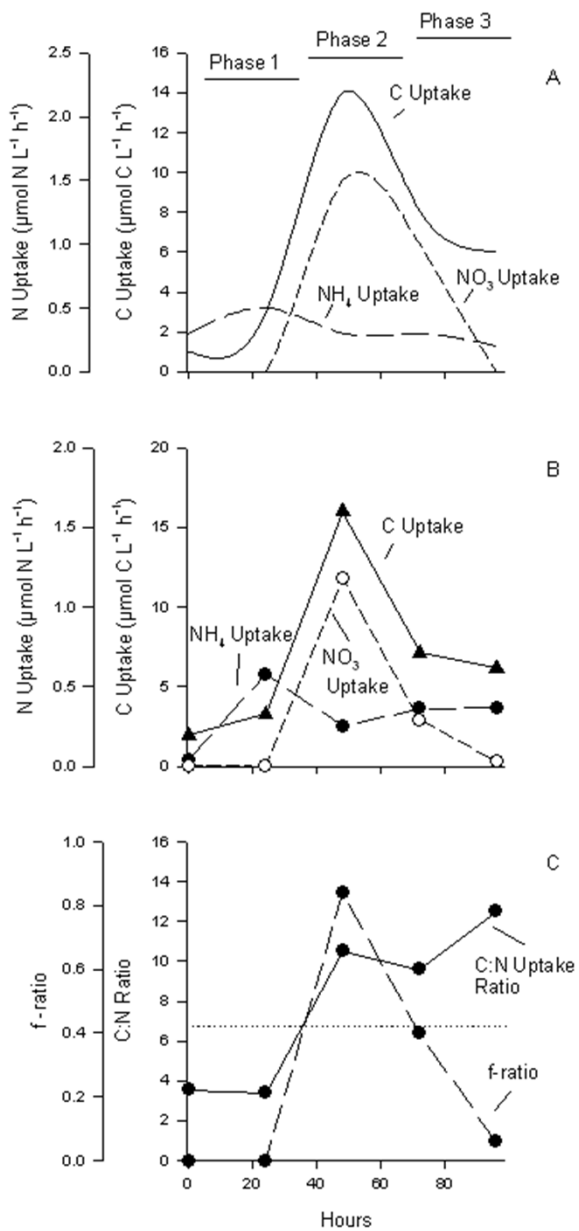
DASH: How do interacting dynamic and stationary habitat components affect phytoplankton physiological status and ability to form blooms in the low salinity zone?

Purpose is to determine the conditions for phytoplankton bloom development in the LSZ in spring and fall and link the physiological status of phytoplankton in the LSZ with dynamic and stationary habitat elements found there (e.g. river flow, nutrient loadings and nutrient concentration) using high resolution temporal and spatial sampling of nutrients, phytoplankton, carbon and nitrogen uptake rates and quantum yield.

Task 1 High resolution (space and time) surface mapping surveys of nutrients and phytoplankton quantum yield in the LSZ – continue SWAMP type and Fall Habitat studies

Task 2 Quantum yield determinations in experimental enclosures using type I (unimpaired), II and III (impaired) water (during simulated bloom sequences.

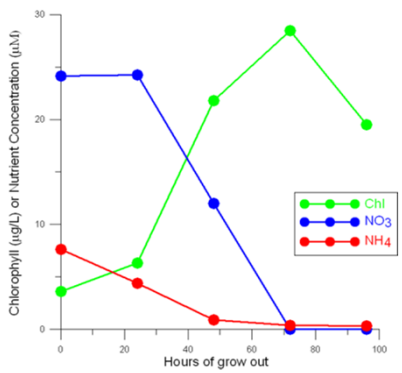
Continue to test our conceptual model and with spring and fall cruises to Suisun Bay



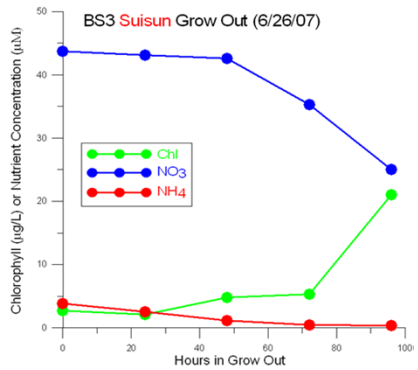
During **Phase 1**, phytoplankton N demand is satisfied by NH_4 but with low rates due to poor irradiance. NO_3 uptake is low or near zero due to NH_4 inhibition. With improved irradiance NH_4 uptake rates increase causing NH_4 to decrease to < 4 µmol L^{-1} and NO_3 uptake is enabled. During **Phase 2** there is continued phytoplankton growth, and NH4 concentration is reduced to ≤ 1 µmol L^{-1}; allowing rapid uptake of NO_3 coupled with high C uptake and a rapidly developing bloom. During **Phase 3,** phytoplankton become N-limited, relying primarily on recycled NH_4.
B) Data from Central Bay enclosures during September 2005 showing the same sequence and C) C:N uptake ratios and f-ratio (% NO_3 uptake) that results

Use enclosures to track phytoplankton from water of different conditions

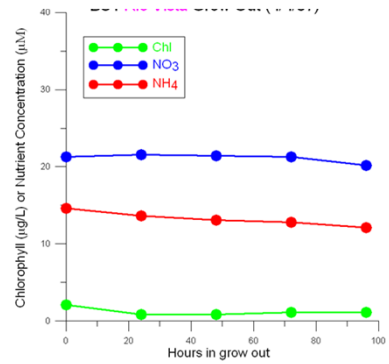
Type I conditions
Unimpaired cells
Central Bay



Type II conditions
Medium impaired cells
Suisun Bay



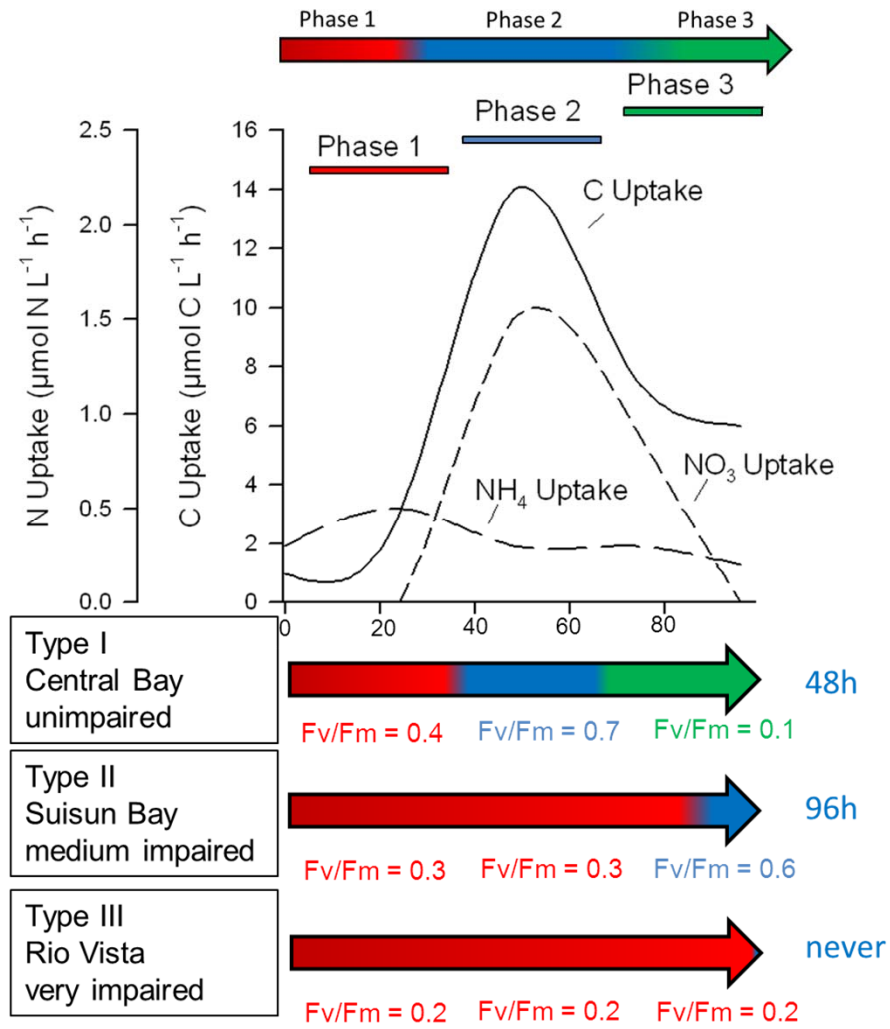
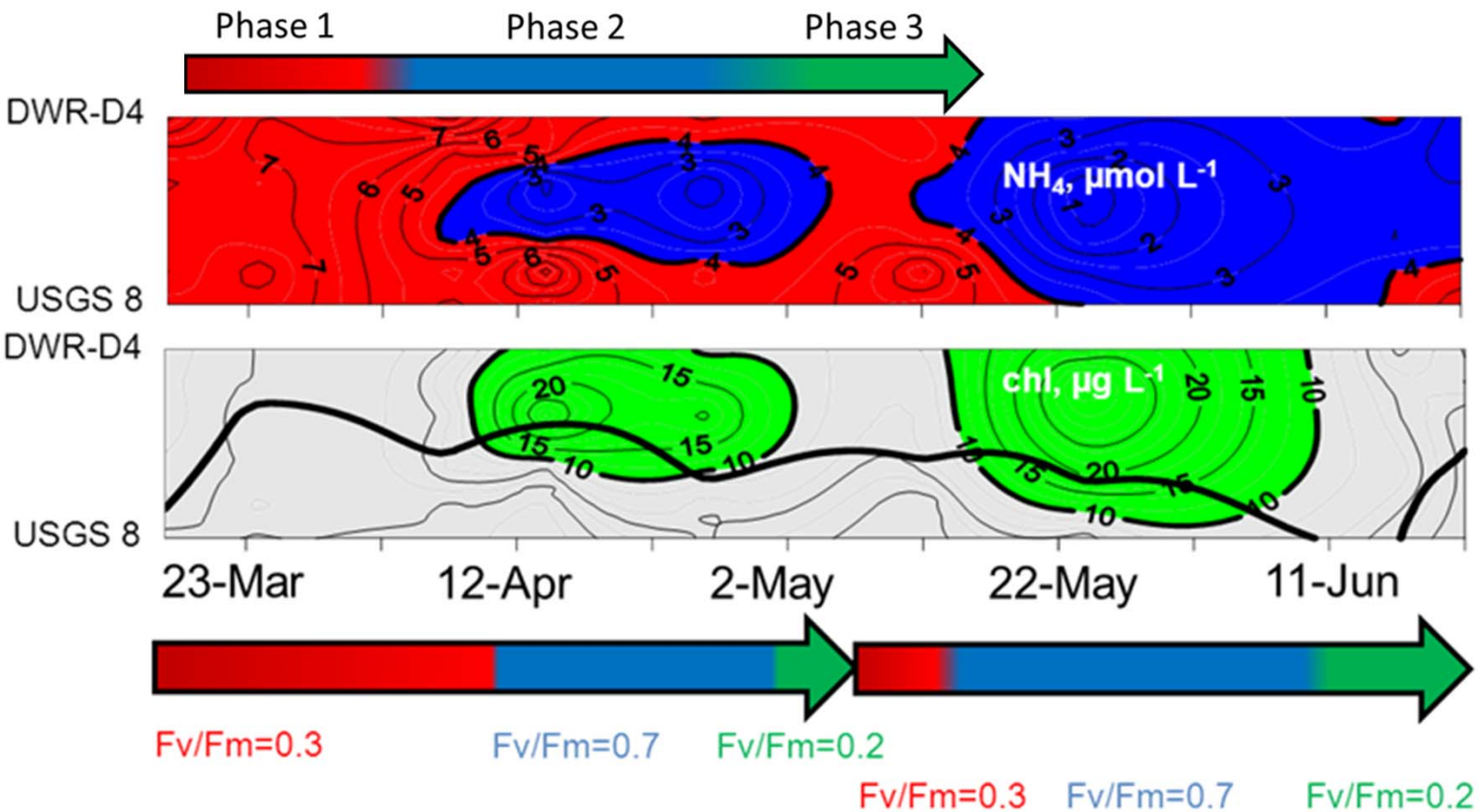
Type III conditions
Very impaired cells
Rio Vista



Type I, cells in good physiological state with NH_4 drawdown to <4 µmol L^{-1} in 24 h, NO_3 draw down (uptake) starting after 24 h and peak chlorophyll after 72 h.
Type II, delayed response, with NO_3 drawdown (uptake) starting after 48 h and chlorophyll accumulation at 96 h.
Type III. Impaired cells with little change in any parameter (NH_4 drawdown, NO_3 drawdown or chlorophyll accumulation over the 96 h enclosure experiment.

Hypothesized changes in quantum yield in <u>enclosures</u> accompanying Phases 1, 2, 3 sequences.: assumes different Fv/Fm when NO3 use vs NH4 use.

Starting conditions determined by state of water (unimpaired or impaired)



Hypothesized changes in quantum yield (arrows) and N use along Suisun Bay transects accompanying Phases 1, 2, 3 sequences: assumes different Fv/Fm when NO3 used vs NH4.