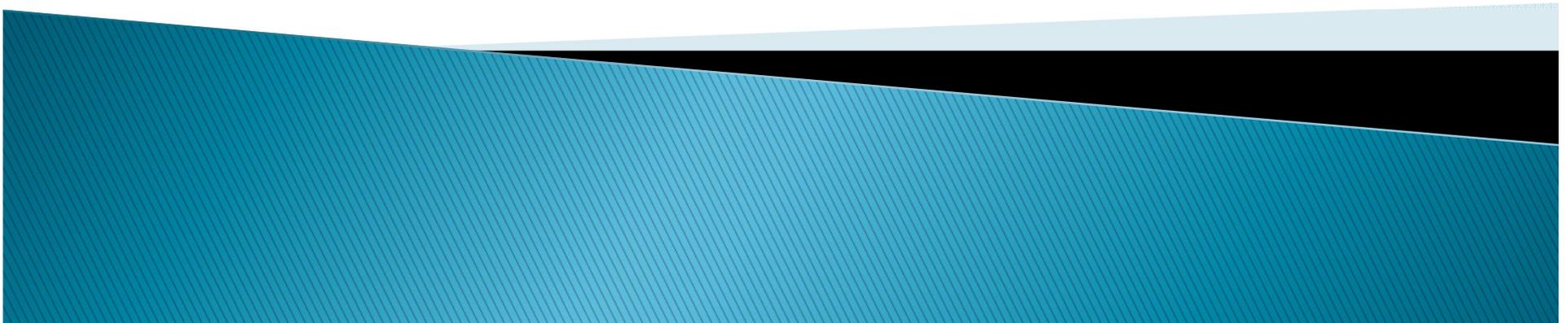


# Delta Harmful Algal Blooms (HABs) CWF Impacts

Erik Ringelberg



# Current Conditions

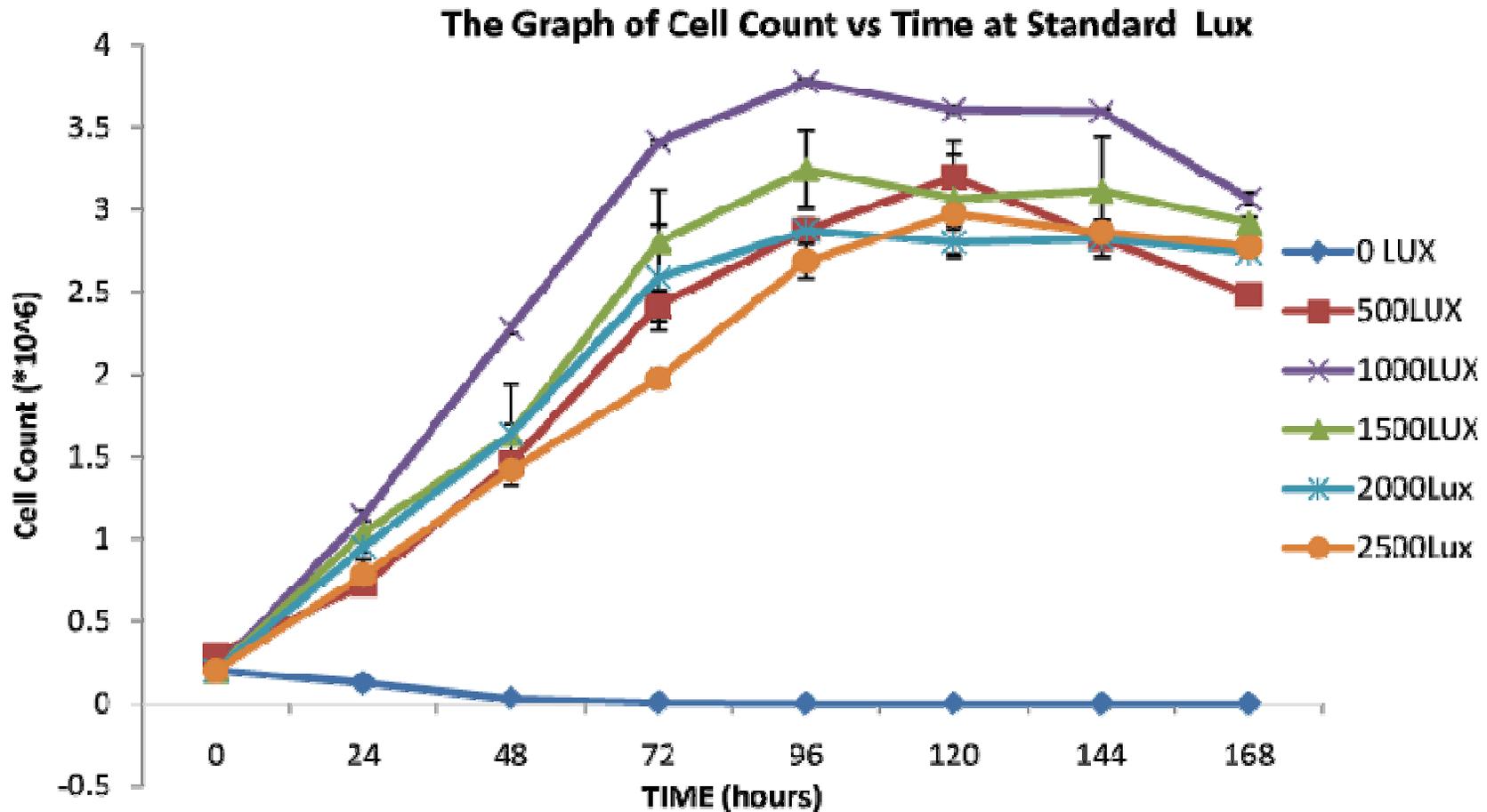
Region dominated by Sacramento River Flows, existing South Delta diversions can use both Sacramento River flows and San Joaquin.

Tidally controlled-twice a day tidal signal from the Pacific, through San Francisco Bay, Suisun, and up the rivers and sloughs. Varies from river to more lake- at Sacramento and Verona.

Relatively high energy tidal flow upriver can dominate Sacramento River outflow and lead to retention and slower flushing.

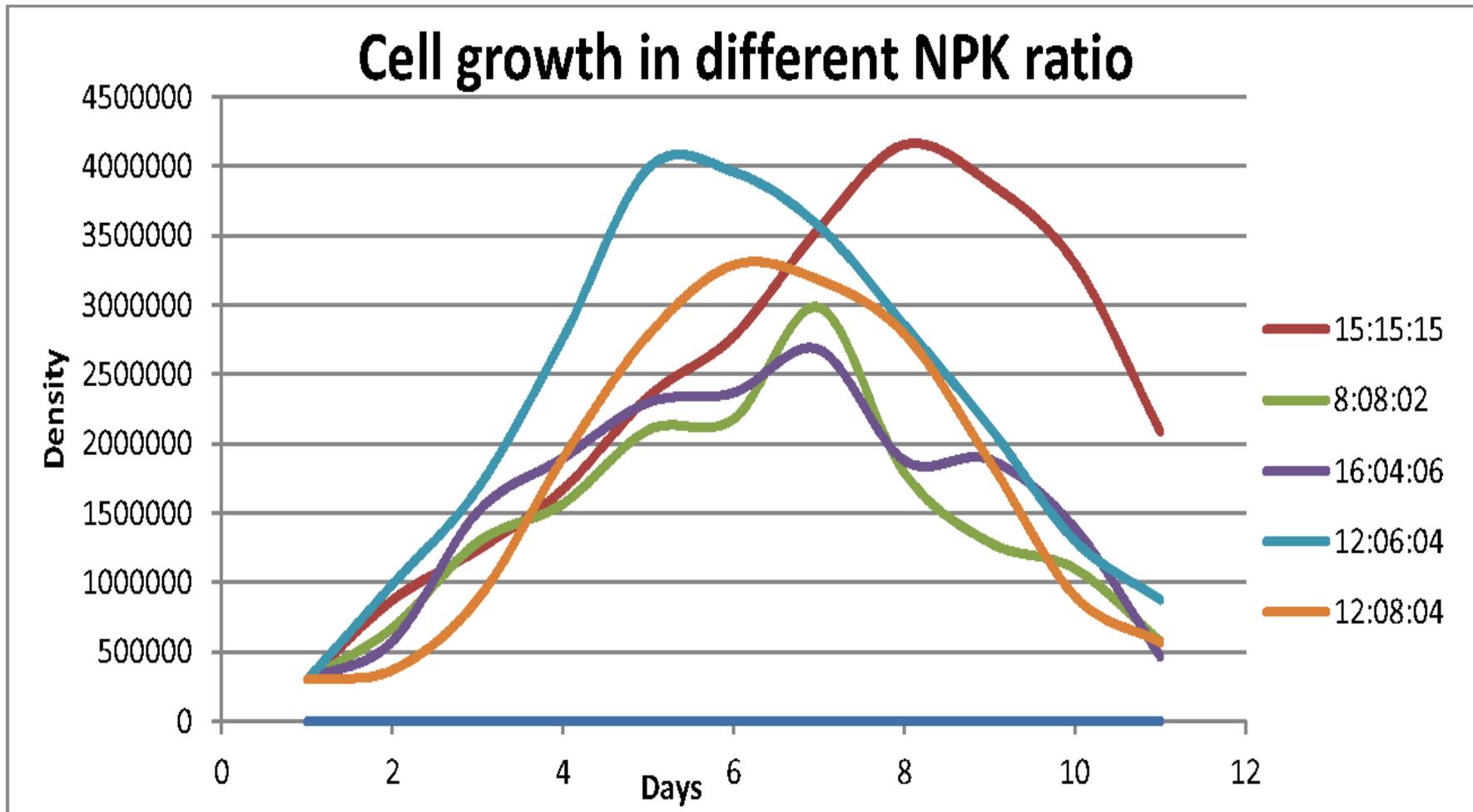
Existing conditions allow 'freshening' of entire northern and central Delta parts of the system before export pumps.

# Algal Ecology



*SJC- Pal S. W., N. K. Singh and K. Azam. 2013. Evaluation of Relationship between Light Intensity (Lux) and Growth of Chaetoceros muelleri. School of Marine Studies, Faculty of Science, Technology and Environment, University of the South Pacific, Fiji. (Figure Microalgae response to light.)*

# Algal Ecology



SJC- Kassim, Z., Akbar J., Lim K. C., Nur F. Z. and Nur H. A. 2014.  
Sustainable Technique for Selected Live Feed Culture in: "Sustainable  
Aquaculture Techniques", Hernandez- Vergara and Carlos Ivan Perez-Rostro  
eds,

# Algal Ecology

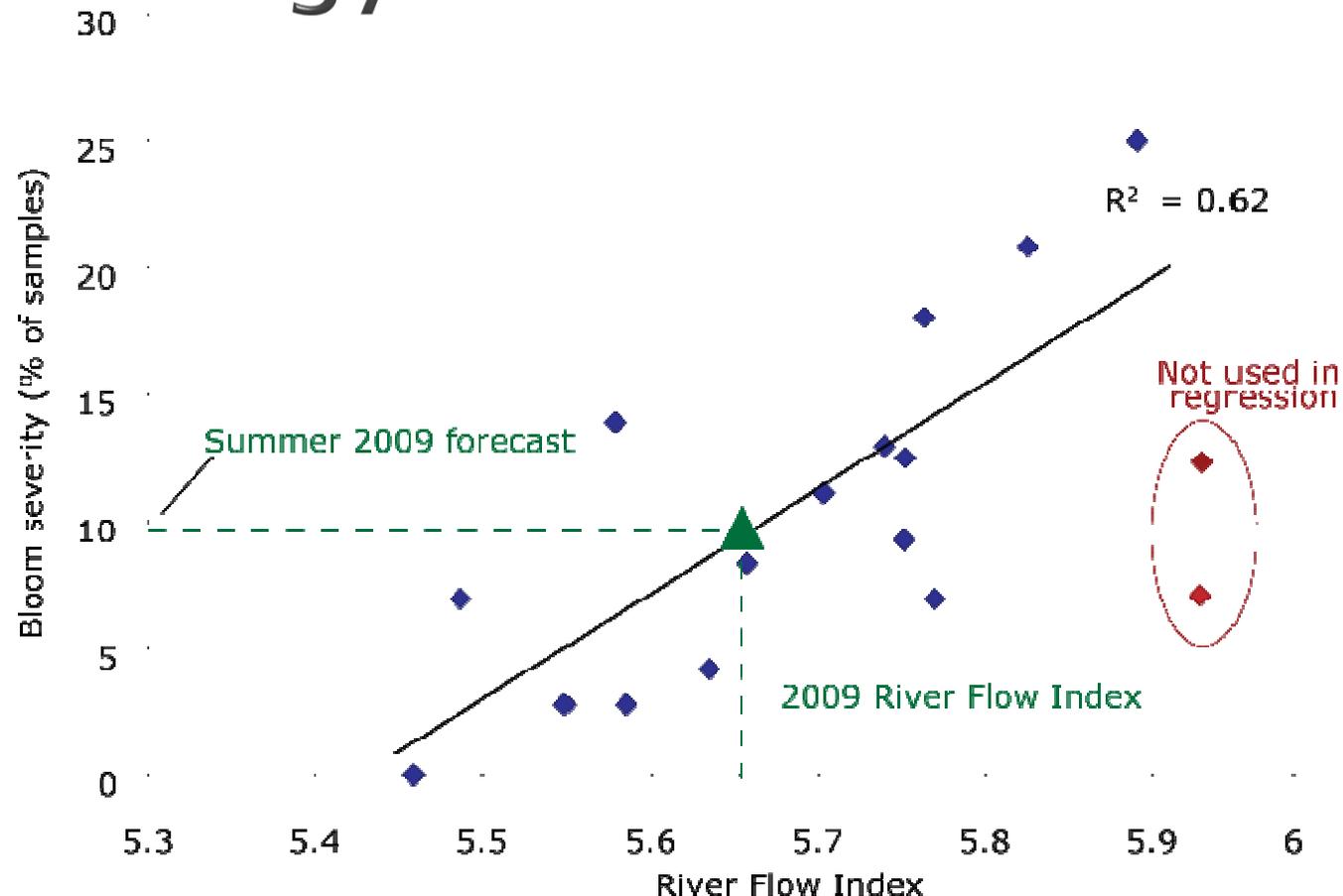


Figure 1. Regression relationship between river flow index at Point of Rocks, Potomac River, MD and Bloom Severity Index as % of samples in a summer season where bloom levels of *Microcystis* were detected. 2008 Summer Forecast is shown here.

X-axis: River Flow Index =  $\log_{10}(\text{Cumulative } 1 / \text{ month flow in cubic feet} / (1 \times 10^3))$

Y-axis: Bloom Severity Index = % Summer Potomac samples at bloom level

SJC- Tango, P. 2009. USGS. (Microcystis) Growth Model, Potomac Algal

Bloom

# Recent Conditions

The existing CVP/SWP operations are not responsible for drought conditions. CVP/SWP operations do however influence flows, temperatures and the resulting river water quantity and quality during droughts.

CVP/SWP influences those conditions through holding water back in the rim dams, the timing of releases for fisheries (mitigation for CVP/SWP impacts), and, the variation in releases from individual rim dams.



# Recent Conditions

North Delta (ND) points of diversion would add significant complexity to CVP/SWP influences on water quality. By removing the high water quality from the Sacramento River much higher in the watershed, it changes the relative influence of the other sources and reduces the dilution effect and assimilative capacity of the Sacramento River downstream diversions.

Operation of the proposed ND diversions would also change the residence time of the remaining flows, increasing the time it takes for these flows to reach San Francisco Bay.



# Petition

New diversions intended to take off higher quality water (EC/TDS/Br/Cl) much further upstream.

Proposed/modeled operating parameters mirror drought conditions on the Sacramento River. (DWR-515).

- 6,000 cfs, 300 cfs would be diverted, leaving 5,700 cfs in the river.
- 15,000 cfs, 3,000 cfs would be diverted, leaving 12,000 cfs in the river.
- 22,000 cfs, 9,000 cfs would be diverted, leaving 13,000 cfs in the river.

These flows are directly equivalent to the range of flows at Freeport during critically dry year (mean 9,345 cfs 1922) to a dry year (mean 16,003 cfs 1989). (II-28, ICF 2016, Pg. 2-3).

# Petition

Water quality is maintained or modified by the operations of CVP/SWP rim dams, and at the proposed new point of diversion.

The relative proportion of flow from each of these sources and the operations of the Delta Cross-Channel (DCC) provide the mixing and dilution of these source waters and agricultural and urban water returns. Each of these factors influence water quality and the associated circulation of water within the Delta and have direct and indirect effects on water quality, and that water quality's influence of the formation and maintenance of HABs.



# Project Influences on HABs

The Petition identifies the potential for HAB influence, but claims that it is unlikely. This conclusion is unsupported by both the weight of scientific evidence and even media reports.

- ▶ Petitioners reject the availability of algal models, despite their common use in US and Canada for similar systems, and the existence of Delta models.
- ▶ HAB models could and should have been developed to support the Petition/disclose injury from HABs.



# Conclusions

- Petition fails to adequately identify the potential of North Delta diversions and their operation to promote and/or influence HAB formation.
- North Delta diversions have a high likelihood to injure beneficial uses as a result of HABs.
- Under the operational range provided by the Petitioners, conditions by which similar flows and reduced dilution potential as occurred in drought years would be matched or exacerbated. The Petitioners would bear the responsibility for monitoring the conditions they create and mitigating impacts.
- At minimum, need conditions to support and expand the existing USGS/Delta RMP HAB monitoring network, and establish operational rules for the North Delta diversions that avoid HAB effects.