Nutrient Stakeholder & Technical Advisory Group (STAG) Meeting

23 September 2015

1:00 PM – 5:00 PM

Central Valley Regional Water Board

Agenda Item #1

Introductions & Announcements

Review Agenda

Establish Quorum

Brock Bernstein

Agenda

Item 1 – Introduction & Announcements

Item 2 – Administrative Subcommittee Report Out

Item 3 – Update on Modeling Science Work Group

Item 4 – Update on Drinking Water Science Work Group Effort

Item 5 – Macrophyte White Paper

Item 6 – Finalize Governance and Ground Rules document

Item 7 – BREAK

Item 8 – Cyanobacteria Knowledge Gap document

Item 9 – Nutrient Research Ranking Process

Item 10 – Proposal for Ammonia Paradox and Ecological Stoichiometry Workshop

Item 11 – Next Steps and Wrap Up

Establish Quorum

- Identify STAG members
- Identify Voting Members
- Establish Quorum

Agenda Item #2

Administrative Subcommittee Report Out

No slides just verbal update

Lynda Smith

Agenda Item #3

Update on
Modeling Science Work Group

Christine Joab

Status Update

- 2nd in person meeting – September 10
- Discussing first white paper draft & Recommendations
- Work Group members & White Paper authors:
  - Phil Trowbridge (Main author, SFEI)
  - Mike Deas (Chair, Watercourse Engineering, Inc.)
  - Eli Ateljevich (DWR) & Eric Danner (NOAA)
  - Joe Domagalski (USGS) & Chris Enright (DSC)
  - Bill Fleenor (UCD) & Marianne Guerin (RMA)
  - Lisa Thompson (Regional San) & David Senn (SFEI)
- Next meeting – October 14
- Presentation of draft White Paper - next STAG meeting

Agenda Item #4

Update on
Drinking Water Science Work Group

No slides just verbal update

Elaine Archibald

Agenda Item #5

Macrophyte White Paper Presentation

Dr. Kathy Boyer

Factors Controlling Submersed and Floating Macrophytes in the Delta

Kathy Boyer[1] and Martha Sutula[2]
[1]Romberg Tiburon Center, San Francisco State University
[2]Southern California Coastal Water Research Project

Key Questions:

1) How do SAV and FAV support or adversely affect ecosystem services and related beneficial uses?

2) What is known about the spatial and temporal trends of this vegetation in the Delta?

3) What is the relative importance of nutrients versus other factors in promoting observed trends in SAV and FAV in the Delta?

Review focused on six species:

Key Question:
What is known about the spatial and temporal trends of this vegetation in the Delta?

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What is known about the spatial and temporal trends of this vegetation in the Delta?

Egeria ~2000 hectares in 2007 and 2900 hectares in 2014

Water hyacinth covered ~200 hectares between 2004-2008 and 800 hectares in 2014.

Ludwigia spp. (water primrose). *Ludwigia* spp. (unknown proportion of *L. peploides* and *L. hexapetala*, and and possibly *L. grandiflora*) are now equal in floating coverage to water hyacinth (800 hectares each estimated in 2014).

Hydrocotyle (native, pennywort) was much more common than *Ludwigia* during the period of 2004-2008, but now least common of the FAV.

Stuckenia pectinata (native, pondweed) expanding in Suisun and W. Delta

Ceratophyllum (native, coontail) common; unknown trends in coverage

Key Question: How do SAV and FAV support or adversely affect ecosystem services and related beneficial uses?

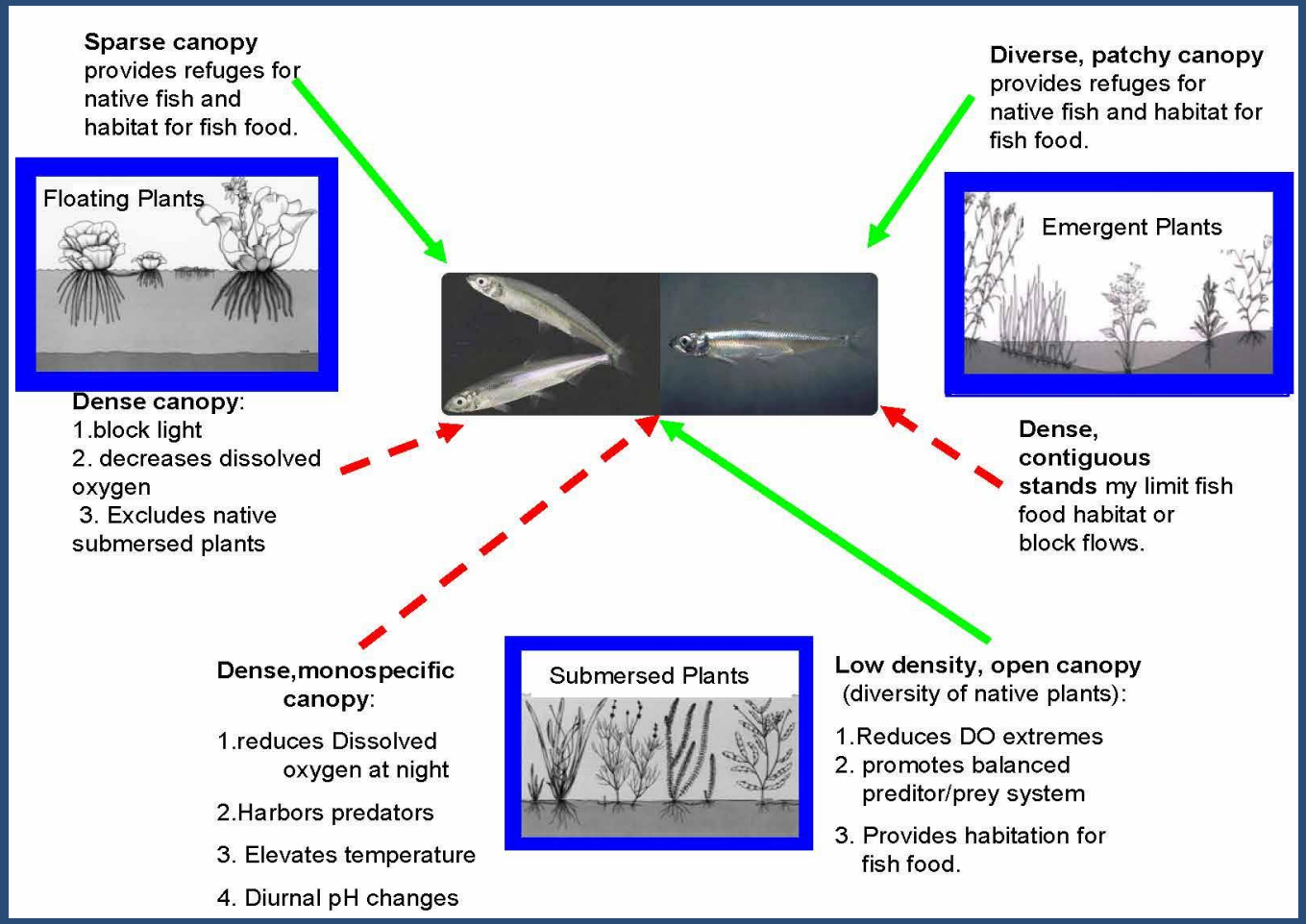
Key Question: How do SAV and FAV support or adversely affect ecosystem services and related beneficial uses?

Aquatic vegetation can have many values

- carbon storage
- uptake of nutrients
- oxygenation of waters
- trophic support through direct consumption by grazers or contributions to the detrital food web
- provision of surfaces for algal and invertebrate attachment (also providing trophic support)
- predation refuge for small fish

But…
Excessive biomass of several invaders leads to problems

DRERIP conceptual model: loss of beneficial uses



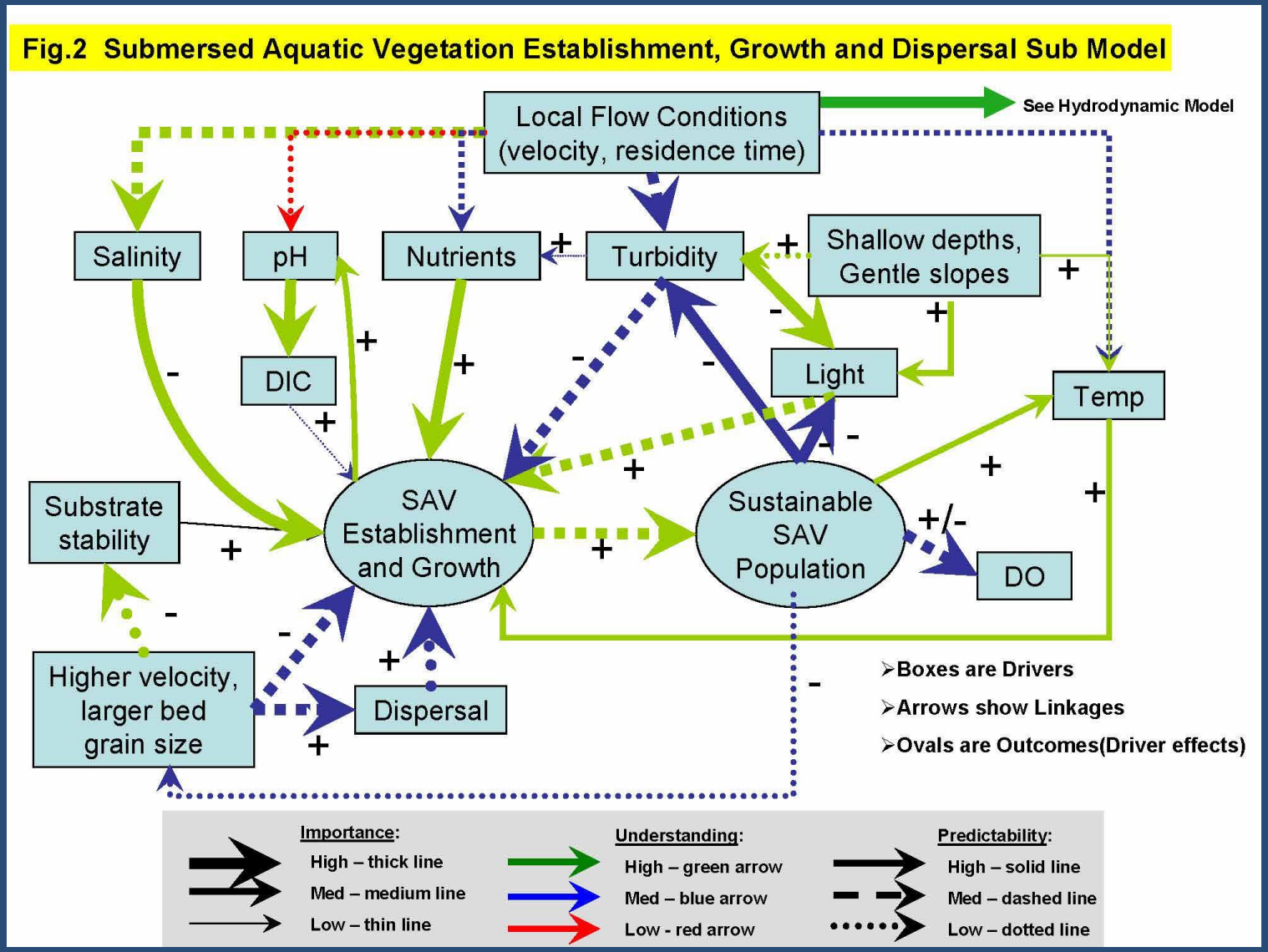
Arrows show direction and primary effect caused by interaction of each "ecological type" of aquatic plant on fish (red, dashed = negative effect, green, solid = positive effect. From Anderson 2008

Dense *Egeria* resists fish movement, can have low DO and swings, and supports few native fish; but unknown benefit of native SAV to native fish – turbidity as predation refuge is a hypothesis

Lower density of invasive SAV or FAV could be beneficial to fish

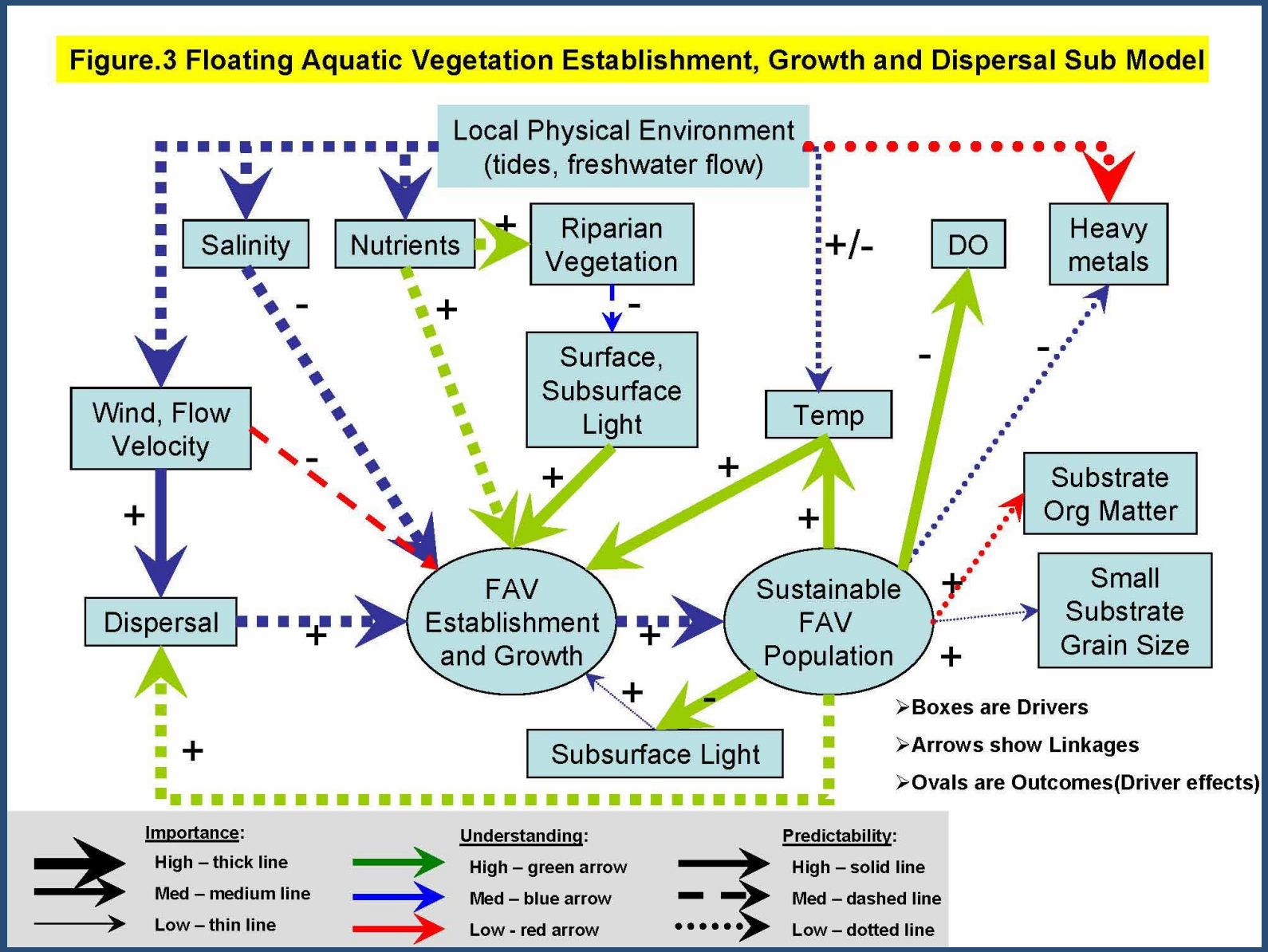
Key Question: What is the relative importance of nutrients versus other factors in promoting observed trends in SAV and FAV in the Delta?

DRERIP conceptual model: SAV



From Anderson 2008

DRERIP conceptual model: FAV



From Anderson 2008

Key Question: What is the relative importance of nutrients versus other factors in promoting observed trends in SAV and FAV in the Delta?

Light, Salinity, Temperature (high and low), DIC, Competition…

vs. Nutrients

Can changes in water column nutrient concentrations or ratios explain recent patterns of expansion of invasive SAV and FAV?

~ 0.5 mg/L DIN

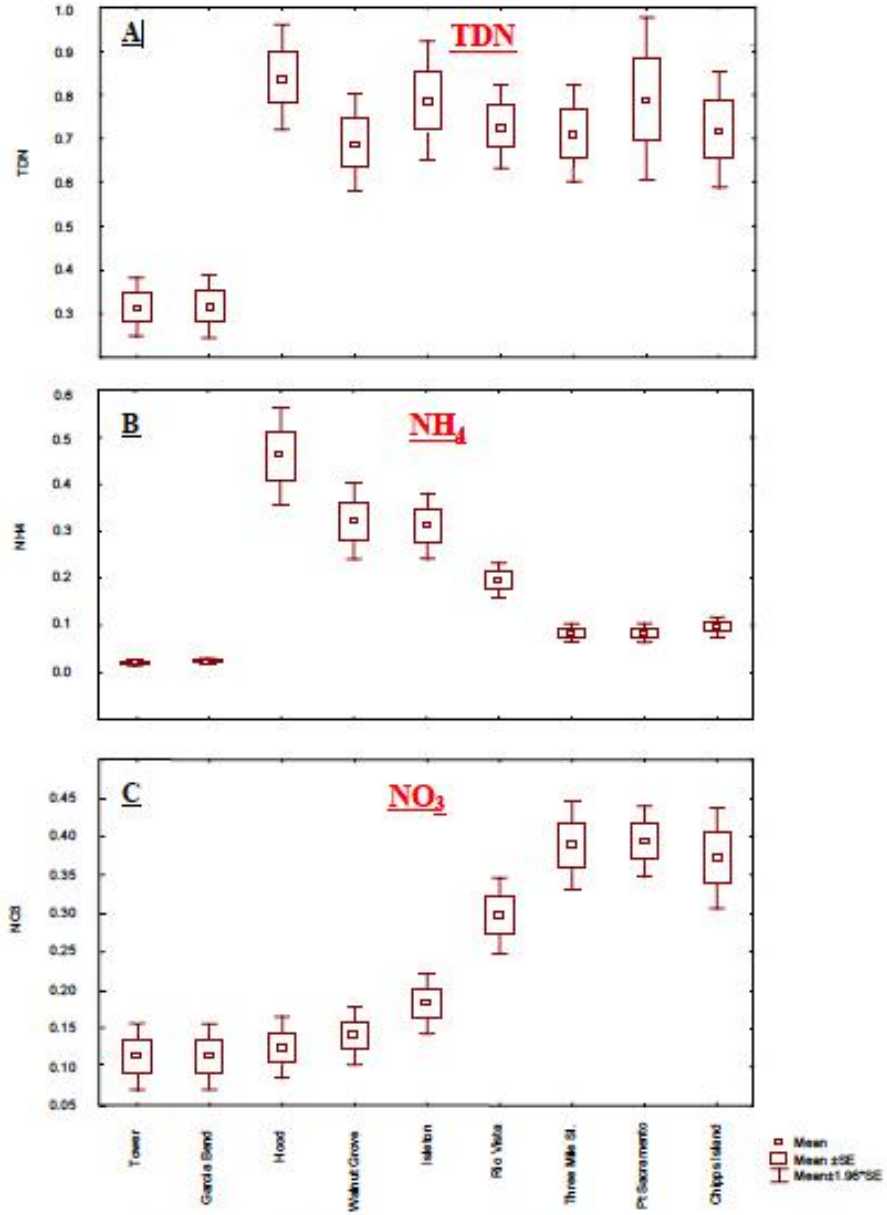


Figure 2. A. Mean annual total dissolved nitrogen (TDN) concentrations on the Sacramento River between Tower Bridge and Chipps Island. The SRWTP discharges between Garcia Bend and Hood. B and C Ammonia (NH_4) and nitrate (NO_3) concentrations over the same river reach. All nitrogen concentrations are as mg N/L

~ 0.05 mg/L DIP

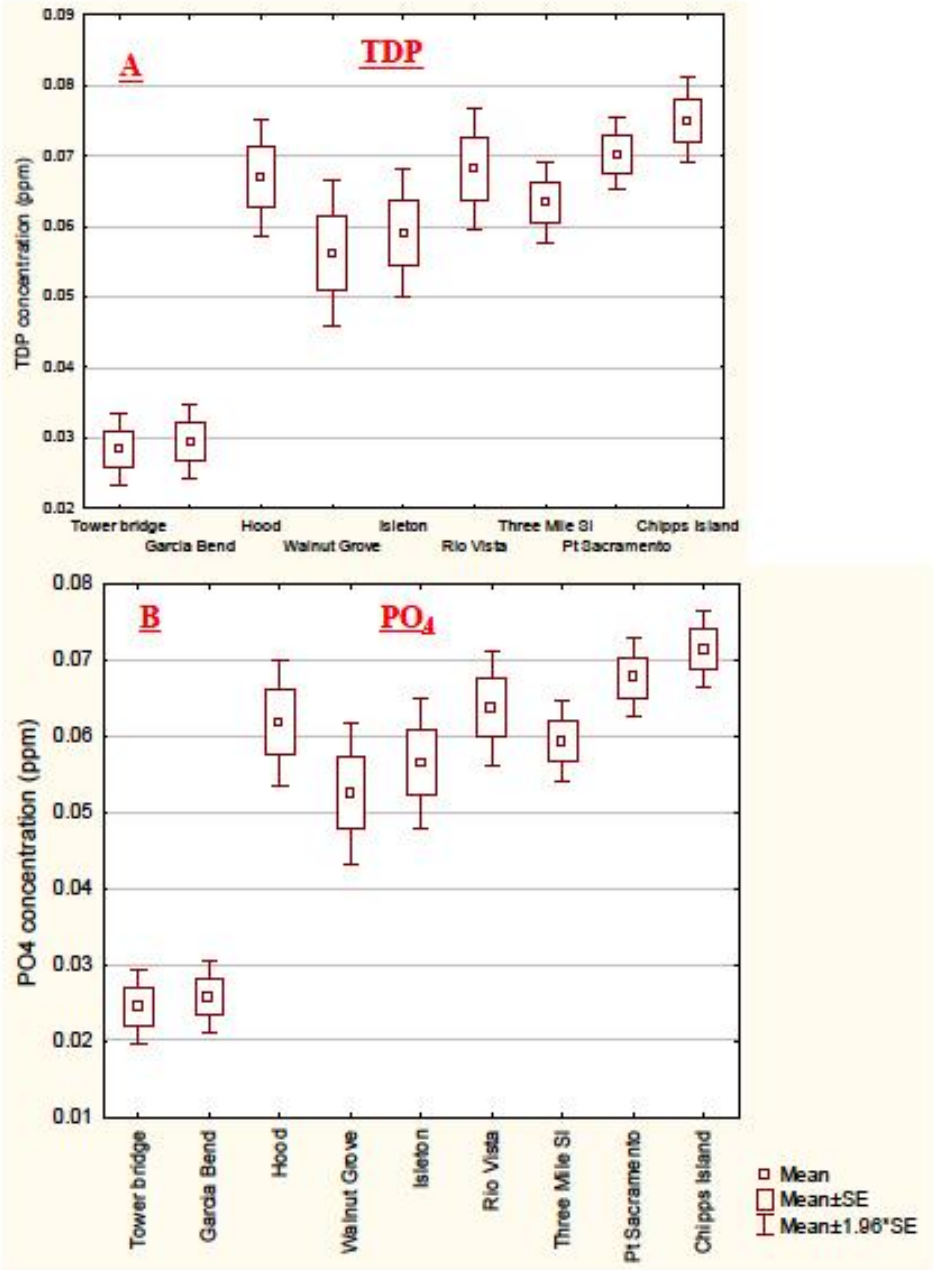
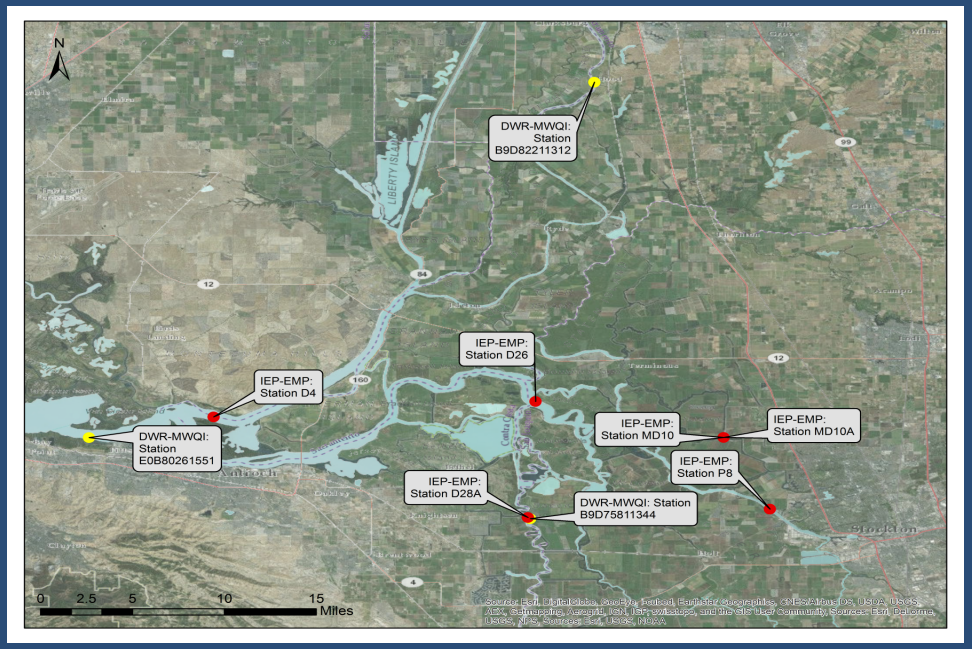
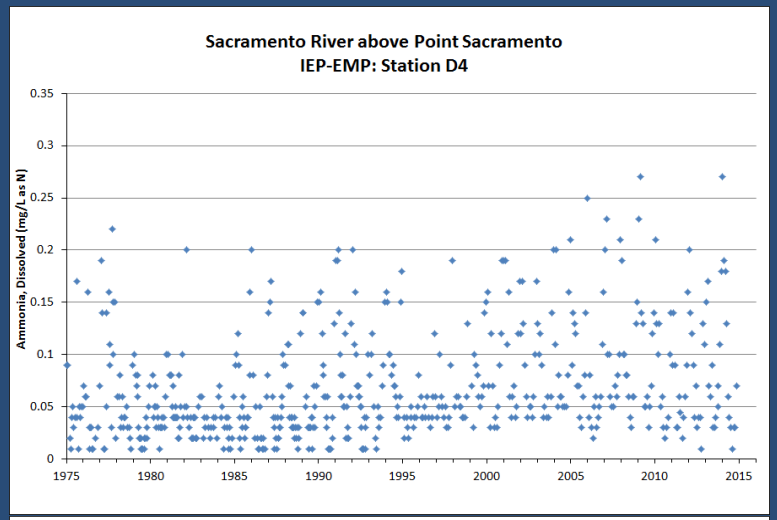
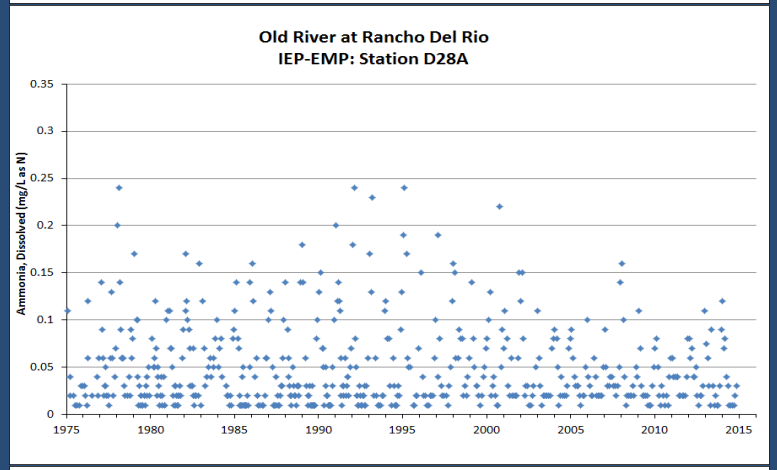


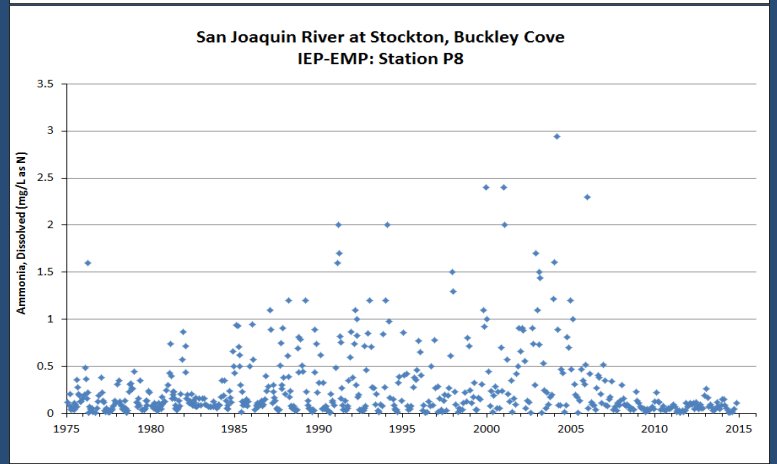
Figure 3A. Mean annual total dissolved phosphorus (TDP) in the Sacramento River and delta. B. Same values for soluble reactive phosphorus (PO_4).

Temporal trends in ammonium



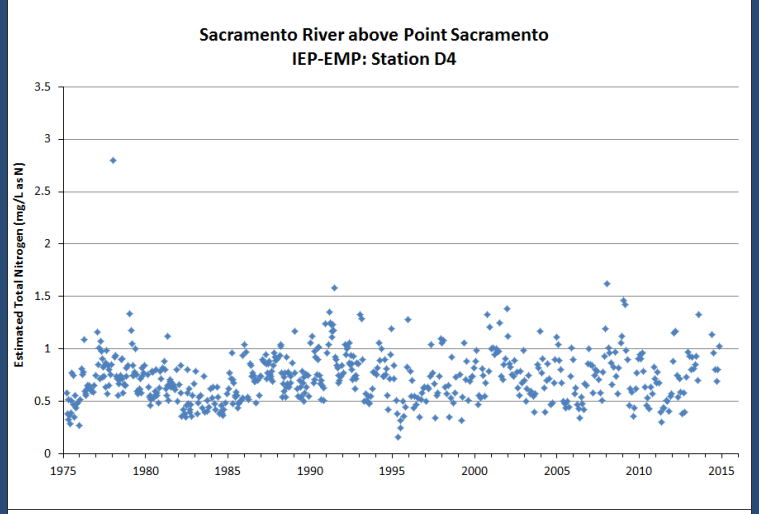


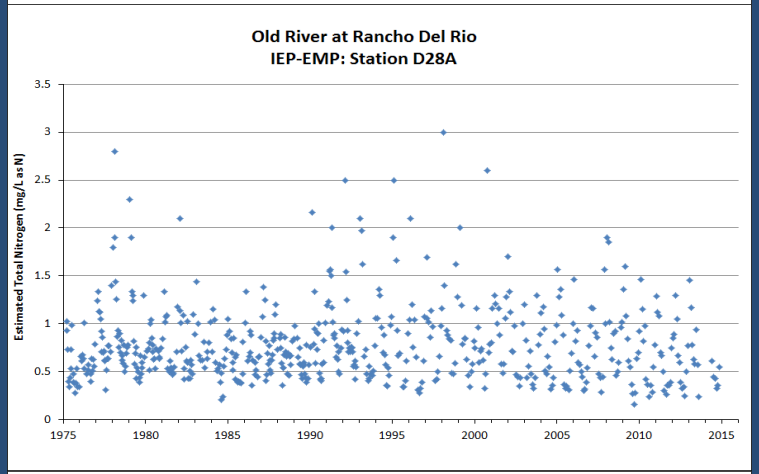


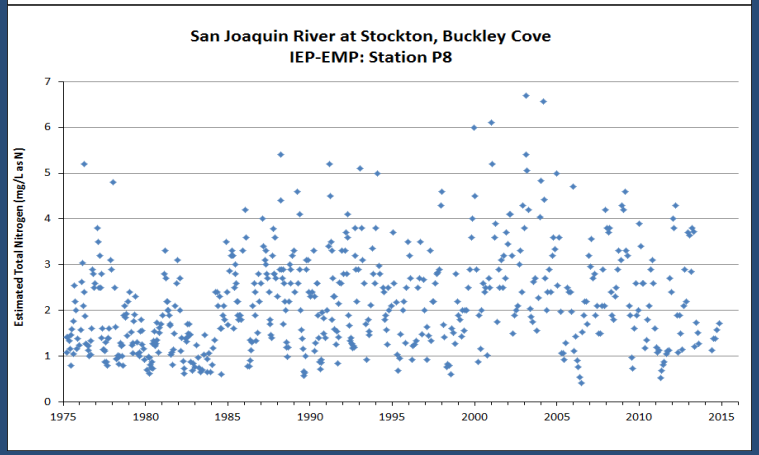


Figures developed by Larry Walker Associates for use by the Delta NNE Science Work Groups
July 29, 2015

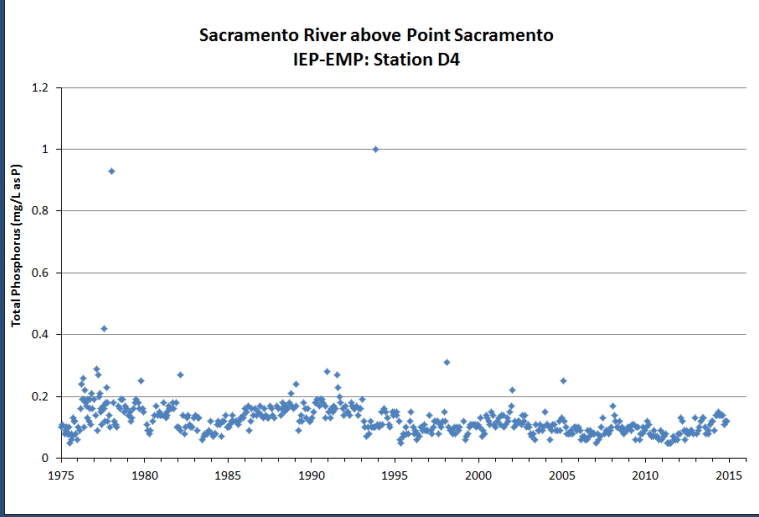
Temporal trends in total N

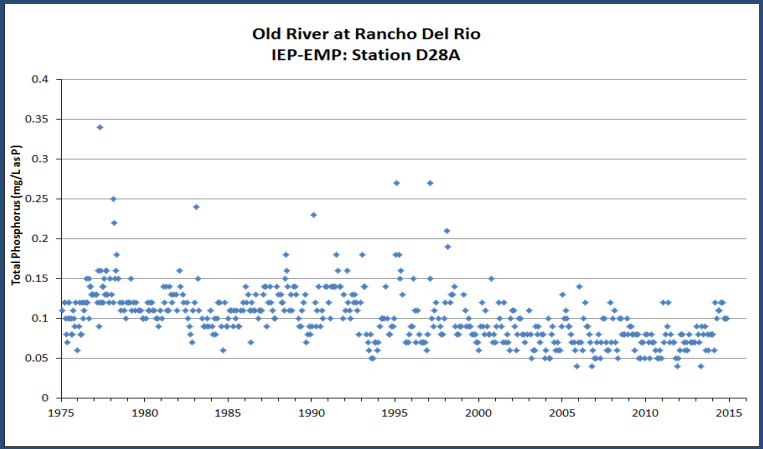


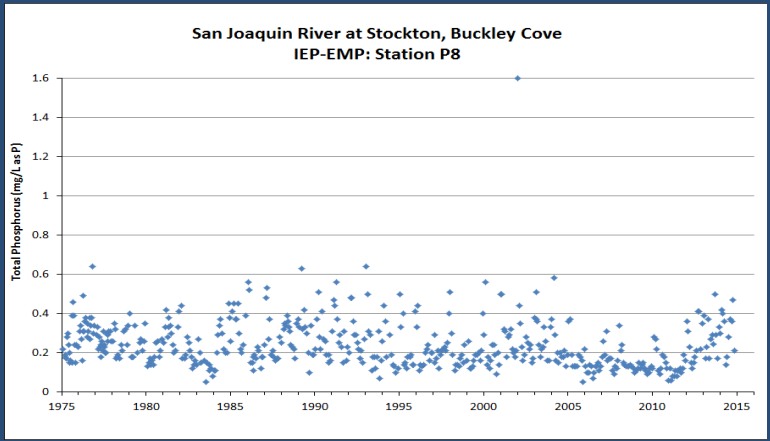




Temporal trends in total P







Key Question: What is the relative importance of nutrients versus other factors in promoting observed trends in SAV and FAV in the Delta?

Light, Salinity, Temperature (high and low), DIC, Competition…

vs. Nutrients

Can changes in water column nutrient concentrations or ratios explain patterns in expansion of invasive SAV and FAV?

No, but that does not mean that nutrient supply from water column or sediment not important –

- Fluxes from sediments (e.g., of P when overlying water has low DO or high sulfates)
- Inability of water column measures to consider uptake by macrophytes, storage, recycling

Recommendations

1) Implement routine monitoring of invasive floating and submersed aquatic vegetation.

- Need to understand trends over time
- Grant-funded efforts have been sporadic, no plan for ongoing rigorous evaluation of patterns and trends.
- Monitoring should include remotely-sensed coverage and field-based measures of biomass or, ideally, NPP, and species composition.
- Also monitor factors that control growth, including water column and sediment nutrients and other standard water quality measures (e.g., temperature, salinity, pH, dissolved oxygen), as well as flow rates.
- Early actions should include the development of a work plan to lay out the key indicators and cost estimates required for monitoring.

Recommendations

2) Develop a biogeochemical model of the Delta, focused on nutrient and organic carbon fate and transport.

- Understanding of factors controlling floating and SAV is critically hampered by the lack of information on nutrient and carbon budgets for the Delta and its subregions.
- Need to quantify storage in water, sediment, plant biomass, etc. and fluxes or exchanges between compartments.
- Use model to assess if management of nutrients is likely to aid in control of floating and SAV.
- First steps: examine existing models to determine suitability for this task, develop a work plan that lays out the modeling strategy, and conduct special studies and other monitoring needed to support model development.

Recommendations

3) Review current and potential future control strategies for invasive aquatic macrophytes in the Delta, including mechanical, chemical, biological control, and integrated control methods.

- Depending on the outcome of R2, nutrient management may be ineffective in controlling invasive floating and SAV. While monitoring, modeling and special studies are underway, this review should determine the degree to which control strategies are supporting beneficial uses and nutrient management objectives going forward.
- Begin by evaluating current and planned control strategies to determine effectiveness at both reducing live biomass and minimizing recycling of nutrients from the sediments into additional growth.

Agenda Item #6

Finalize
Governance and Ground Rules

Brock Bernstein

Proposed New Language

(Page 2 of the Governance document under "Governance Principles")

Prior Revised Language:

Policy/Science/Resource Recommendations and Decisions – The STAG will review, comment and provide recommendations on technical, policy and implementation issues. These recommendations/decisions include but not are not limited to work plans and technical work products produced by the Science Work Groups and Water Board staff. Examples include: revisions to the charge or membership of the Science Work Groups, acceptance or comments appended to the white papers, knowledge gaps documents, research plans or management strategies.

Proposed New Language:

Policy/Science/Resource Recommendations and Decisions – The STAG will review, comment on and provide recommendations on draft technical, policy and implementation issues and documents. These include but are not limited to the charges, rosters, and work plans, and technical work products (e.g., white papers, knowledge gaps documents, research plans) produced by the Science Work Groups and Water Board staff. Once the drafting and review process is complete, and the Science Work Groups present their final products to the STAG, the STAG will make a decision whether to accept the product(s) as is or to provide additional comments that will be included as an appendix and labeled as STAG input.

Agenda Item #7

10 minute

BREAK

Agenda Item #8

Cyanobacteria Knowledge Gap Document

Chris Foe

Purpose

Present & solicit comments on the draft Cyanobacteria Knowledge Gap document. Document will be brought back to you at the next STAG meeting after all comments have been addressed for STAG approval.

Outline

- Cyanobacteria Science Work Group
- Table 3
- My overall impression about what we now know as a result of the white paper and Knowledge Gap document about cyanobacteria in Delta

Table 3. Summary of management questions posed by STAG members to the Cyanobacteria Science Work Group. The Science Work Group responded with information on knowledge gaps and suggested research if the management question was to be answered.

Topic	Management Question	Knowledge Gap	Recommendation
1	Do different nutrient forms increase the growth rate of *Microcystis* and the frequency of blooms? Do ammonium concentrations, within the range observed in the Delta, influence cyanobacteria growth rates or the frequency of blooms?	Dr. Parker summarized the results of unpublished laboratory ammonium grow out experiments for the Science Work Group. *Microcystis* grew faster on ammonium than on any other form of nitrogen. A duplicate study by a separate lab is needed to confirm these results, using the range of ammonium concentrations observed in the Delta.	Once published, the *Microcystis* ammonium results should be confirmed by a second investigator using multiple growth related metrics, including cell counts, chlorophyll-a, and nutrient uptake, in both laboratory and field experiments.
2	What drivers have been found to limit maximum *Microcystis* bloom biomass and toxin levels elsewhere in the world? Can this information be used to inform a management plan for the Delta?	Cyanobacteria blooms are a worldwide phenomenon. The white paper focused primarily on drivers influencing bloom formation and size in the Delta. More information may be available elsewhere that could inform management options for the Delta.	Conduct a second literature review summarizing successful cyanobacterial control programs elsewhere in the world. Compare the magnitude of responsible drivers at these locations with those in the Delta to determine whether nutrients or another management practice might be a viable option for the Estuary.

Table 3. (Continued)

Topic	Management Question	Knowledge Gap	Recommendation
3	What will be the effect of climate change on the frequency and size of cyanoHAB blooms?	Climate change is predicted to result in higher water temperatures and increased drought in California. The latter should reduce flow and increase water residence time and water column stability in the Delta. The white paper predicts that these factors will result in an increase in the magnitude and frequency of cyanoHAB blooms.	Use an ecosystem model to predict the relative increase in the frequency and magnitude of cyanoHAB blooms in the Delta as a result of climate change.

My Overall Impressions

- Inadequate problem definition.
- Importance of nutrient concentrations for bloom initiation & maximum bloom size unclear.
- Not intractable research questions.

Next Steps

- STAG review & provide comments by 7 October.
- Science Work Group addresses comments.
- Document brought back to STAG for final approval at next meeting.

Comments??

Agenda Item #9

Nutrient Research Ranking Proposal

Chris Foe

Goal: Consensus Vote on Proposal

Purpose

Determine whether the STAG is interested in developing a formal evaluation process to rank the nutrient research recommendations & provide a list of high priority projects to Water Board staff.

Possible Next Steps

- STAG subcommittee writes a draft document outlining the process & criteria to rank research.
- STAG reviews the draft document & votes whether to accept ranking process.
- STAG uses ranking process to prioritize research & votes whether to accept the list of high priority projects.
- The list is made available to Water Board staff in time to develop the Nutrient Research Plan.
- In this same document the STAG may wish to provide recommendations on other aspects of the nutrient research plan including how it should be developed & implemented.

What do you think?

Agenda Item #10

Proposal for
Ammonia Paradox &
Ecological Stoichiometry Workshop

Chris Foe

Goal: General Consensus Vote

Purpose

Review proposed outline for workshop, solicit advice on conducting workshop from STAG, & receive approval for formation of a joint sub-committee with the Bay Area Nutrient Management Steering Committee to develop final workshop plans.

Workshop will examine evidence for two hypotheses

<u>NH4 Paradox hypothesis</u>: Elevated concentrations of ammonium (NH_4) suppress nitrate (NO_3) uptake in some algal groups commonly present in the Delta. Lack of access to NO_3 results in a decrease in primary production rates and, if some algal functional groups are differentially sensitive to NH_4, in shifts in community composition from more to less NH_4 sensitive algal forms.

<u>Ecological Stoichiometry hypothesis</u>: Changes in the forms & ratios of nutrients affect algal community composition. These changes include increases in the proportion of NH_4 to NO_3 & of nitrogen to phosphorus. Increasing ratios (more N, less P & more NH_4 in relation to NO_3) reduces the competitive advantage of larger, faster growing algal forms, like diatoms, & selects for smaller, slower growing groups like flagellates, greens & cyanobacteria. The latter algal forms are believed to be of a lower nutritional value for herbivores, like zooplankton, resulting in a reduction in secondary production and "bottom up" ecological effects further up the food chain including decreases in fishery production.

Workshop Structure

- The workshop will take place over two days. The first day will be devoted to oral presentations by researchers. Additional oral presentations may occur during the morning of the second day. The afternoon of the second day will be a closed session for panelists and the white paper author to discuss the presentations and the contents of the white paper.

- A month before the workshop presenters will provide a PDF of their reports and other published information that they wish to have considered at the workshop. Two weeks before the workshop panel members and other presenters will forward questions to the presenters based upon the submitted reports. At the workshop each presenter will provide a 30 minute summary of their research findings either supporting or refuting both hypotheses and answering questions submitted to them previously by panelists or other presenters. Twenty minutes will be reserved after each presentation for questions from panelists and other presenters.

Stakeholder Participation

- The workshop will be advertised & open to Bay Area NMS Committee and Delta STAG members.
- One or more 30-minute periods will be set aside during the first day for Stakeholders to question presenters.
- In the morning of the second day, Stakeholders will be given an opportunity to discuss their impressions and conclusions about the workshop with the panel and white paper author.
- The public may also submit written comments to the panel after the workshop. Written comments will be answered as much as possible and attached as an appendix to the white paper.

Product

- The primary product of the workshop will be a white paper.
- The paper will describe the problem, summarize the conclusions of the reports & presentations, discussions between panel members & presenters, and areas of agreement and disagreement based upon the presentations and reports submitted for the workshop and the best professional judgment of the panel.
- The white paper will identify the types of follow-up studies needed to resolve differences and guide research to inform management on whether additional nutrient control actions might be needed in the Bay-Delta Estuary.
- The white paper would be used for development of the Delta Nutrient Research Plan.

Responsibility of White Paper Author

- Provide advice on the organization and structure of the workshop.
- Help develop an outline for the white paper.
- Write white paper & present its conclusions to stakeholder & technical groups. The white paper should represent the consensus of the panel. If there is no consensus, then the white paper should reflect the diversity of opinions among panel members. The primary responsibility of the white paper author is to capture the range of opinions, not provide the author's own interpretation of the presentations.
- A potential list of white paper authors are listed in Table 1. No final decision has been made.

Panel

- Panel of four to six individuals with specific areas of expertise. Table 2 lists some needed expertise. No decision has been made on who should be on panel.

- Role of Panel is to review oral and written material to determine areas of agreement and disagreement, identify key unresolved science questions, and recommend follow up studies to answer unresolved science issues.

- The white paper would represent the opinions of panel.

Date and Location

- Workshop in late November or early December with draft white paper for review by panel and presenters in late December. Date depends on availability of reports and schedule of presenters and panel.

- Location might be a neutral midpoint between Sacramento and Oakland, possibly the San Francisco Estuary Institute in Richmond.

Next Steps

- Advice from STAG on conducting workshop.

- Approval to form a joint sub-committee with the Bay Area Nutrient Management Steering Committee to develop final workshop plans.

Discussion??

Agenda Item #11

Next Steps & Wrap Up

No slides just verbal

Chris Foe and Brock Bernstein

End of Presentation