

Comments on P. Glibert Defense of N/P Ratios as Major Influence  
on Aquatic Ecosystems Composition in Delta  
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At the September 6, 2012 State Water Resources Control Board (WRCB) workshop, “Ecosystem Changes and the Low Salinity Zone Draft Agenda,” Dr. Patricia Glibert made a presentation on behalf of the state water contractors entitled, “Nutrient and Phytoplankton Relationships.” In that presentation Glibert again attempted to justify her position that N/P ratios in Delta waters are a major cause of the decline in some fish populations in the Delta. We have written several reports and submitted comments to the WRCB and the Delta Stewardship Council detailing the lack of technical validity of Glibert’s statistical model-based conclusion rendered on behalf of the state water contractors on this issue, including:

Lee, G. F., and Jones-Lee, A., “Comments on the Adequacy of C. Dahm’s Discussion of Delta Eutrophication Issues & Delta N/P Ratios as a Cause of Adverse Impact on Delta Fish,” Comments to Delta Stewardship Council, Report of G. Fred Lee & Associates, El Macero, CA, November 17 (2011).  
<http://www.gfredlee.com/SJR-Delta/DSC-Comments-Dahm-Eutroph.pdf>

The reality is that the state and federal water export projects, which the state water contractors have a vested interest in maintaining, are a significant and technically substantiated factor contributing to the decline of certain fish populations in the Delta. The continued defense and promotion of the state water contractors’ (Glibert’s) technically invalid evaluation approaches and conclusions drawn there from on the cause of Delta water quality problems serves only to divert attention and resources away from factors that have been documented to be influencing the decline of certain fish populations, including the operation of the water export pumps.

As we have discussed in our previous comments on this issue, several other experts on the Delta ecosystem have also been critical of Glibert’s claim that N/P ratios are a major factor causing Delta ecosystem problems. Recently, several recognized experts on Delta ecosystem decline issues published the following discussions of the unreliability of the statistical approach that Glibert used to justify her conclusion that N/P ratios in Delta waters are a major cause of the decline of some fish populations in the Delta:

Cloern, J., Jassby, A., Carstensen, J., Bennett, W., Kimmerer, W., MacNally, R., Schoellhamer, D., and Winder, M., “Perils of Correlating CUSUM-Transformed Variables to Infer Ecological Relationships (Breton et al. 2006; Glibert 2010), *Limnol. Oceanogr.*, 57(2): 665–668 (2012).

Cloern, J., “Historical Perspective on Human Disturbance in the Sacramento-San Joaquin Delta Ecosystem”, Senior Research Scientist, U.S. Geological Survey Menlo Park, CA presented at National Academies of Science (NAS) National Research Council (NRC) meeting, “Sustainable Water and Environmental Management in the California Bay-

Delta” held on July 13-15, 2010 in Sacramento, Ca, PowerPoint slides obtained from the NRC Public Access Records Office at [www.nrc.gov/reading-rm/foia/foia-privacy.html](http://www.nrc.gov/reading-rm/foia/foia-privacy.html).

In her September 6, 2012 presentation Glibert acknowledged that decreased phosphorus concentrations in the Delta waters could be responsible for decreased fish populations owing to the attendant decrease in phytoplankton production, but asserted that that could occur if the phosphorus concentrations were decreased to growth-rate-limiting levels. That reductions in P concentration result in decreases in phytoplankton production which in turn can cause reductions in fish biomass was established long ago; it has also been clearly established for decades (since the 1960s) that P concentrations need not be reduced to growth-rate-limiting levels to cause decreases in phytoplankton production or fish production; these issues have been discussed in our extensive writings on this issue. As discussed in our writings and in those of van Nieuwenhuysse (included in our report referenced above) that specifically address this matter in the Delta, a substantial reduction in planktonic algal chlorophyll occurred in the Sacramento River and Delta as the result of a decrease in phosphorus input from Sacramento Sanitation District wastewater discharges. That predictable reduction in planktonic algal production occurred despite the fact that P concentrations were well-above growth-rate-limiting levels.

Another assertion made by Glibert in her recent presentation, that the change in N/P ratios in the Delta promotes the growth of aquatic plants such as *Egeria*, also did not reflect keen understanding of the interrelationships between nutrients and aquatic life. As has long been established in the limnological literature, a decrease in phytoplankton growth (as would accompany reduction in available P load) increases the depth of light penetration; increased light penetration promotes the growth of rooted aquatic macrophytes and enables such macrophytes to develop in deeper waters which had not previously received sufficient light. Lee discussed this relationship in the following invited presentation more than 40 years ago.

Lee, G. F., “Eutrophication,” Transactions Northeast Fish and Wildlife Conference, pp. 39-60 May (1972). Available upon request as EF014 from G. Fred Lee ([gfredlee33@gmail.com](mailto:gfredlee33@gmail.com))

The apparent promotion of the growth of rooted aquatic macrophytes in the Delta is related to reduction in phosphorus that caused reduction in phytoplankton that caused increased water clarity; it is not caused by shifting N/P ratios.

Additional information on these issues is available in the following publications:

Jones-Lee, A., and Lee, G. F., “Eutrophication (Excessive Fertilization),” Water Encyclopedia: Surface and Agricultural Water, Wiley, Hoboken, NJ pp 107-114 (2005). <http://www.gfredlee.com/Nutrients/WileyEutrophication.pdf>

Lee, G. F. and Jones, R. A., "Effects of Eutrophication on Fisheries," Reviews in Aquatic Sciences, 5:287-305, CRC Press, Boca Raton, FL (1991). <http://www.gfredlee.com/Nutrients/fisheu.html>

More than 50 of our professional papers and reports on decades of research and practical experience in excessive fertilization of waterbodies are available on our website at

www.gfredlee.com in the Excessive Fertilization section <http://www.gfredlee.com/pexfert2.htm> including the following:

Lee, G. F., and Jones-Lee, A., "Delta Nutrient-Related Water Quality Problems," PowerPoint Slides Presented at CALFED Science Conference, Sacramento, CA, October 24 (2008). [http://www.gfredlee.com/SJR-Delta/CALFED\\_SciConf10-08.pdf](http://www.gfredlee.com/SJR-Delta/CALFED_SciConf10-08.pdf)

Lee, G. F., and Jones-Lee, A., "Synopsis of CWEMF Delta Nutrient Water Quality Modeling Workshop – March 25, 2008, Sacramento, CA," Report of G. Fred Lee & Associates, El Macero, CA, May 15 (2008). [http://www.gfredlee.com/SJRDelta/CWEMF\\_WS\\_synopsis.pdf](http://www.gfredlee.com/SJRDelta/CWEMF_WS_synopsis.pdf)

"Overview of Delta Nutrient Water Quality Problems: Nutrient Load – Water Quality Impact Modeling," Agenda for Technical Workshop sponsored by California Water and Environmental Modeling Forum (CWEMF), Scheduled for March 25, 2008 in Sacramento, CA (2008). [http://www.gfredlee.com/SJR-Delta/CWEMF\\_Workshop\\_Agenda.pdf](http://www.gfredlee.com/SJR-Delta/CWEMF_Workshop_Agenda.pdf)

Lee, G. F., and Jones-Lee, A., "Delta Nutrient-Related Water Quality Problems," PowerPoint Slides Presented at CALFED Science Conference, Sacramento, CA, October 24 (2008).  
Lee, G. F., and Jones-Lee, A., "Comments on the Adequacy of C. Dahm's Discussion of Delta Eutrophication Issues & Delta N/P Ratios as a Cause of Adverse Impact on Delta Fish," Comments to Delta Stewardship Council, Report of G. Fred Lee & Associates, El Macero, CA, November 17 (2011). <http://www.gfredlee.com/SJR-Delta/DSC-Comments-Dahm-Eutroph.pdf>

vanNieuwenhuysse, E., "Response of Summer Chlorophyll Concentration to Reduced Total Phosphorus Concentration in the Rhine River (Netherlands) and the Sacramento–San Joaquin Delta (California, USA)," *Can. J. Fish. Aquatic, Sci.* 64(11):1529-1542 (2007).  
[<http://www.ingentaconnect.com/content/nrc/cjfas/2007/00000064/00000011/art00006>]

Lee, G. F., and Jones-Lee, A., "Comments on the DSC Staff Fifth Draft of Chapter 6 Devoted to Delta Water Quality Issues in the Delta Plan," Comments Submitted to Delta Stewardship Council, Sacramento, CA, by G. Fred Lee & Associates, El Macero, CA, August 21 (2011). <http://www.gfredlee.com/SJR-Delta/DeltaPlan5DraftCh6Comm.pdf>

Lee, G. F., and Jones-Lee, A., "Comments on Revised Delta Plan Staff Draft Chapter 6 'Improve Water Quality to Protect Human Health and the Environment' as Presented in the Fourth Staff Draft of the Delta Plan," Comments Submitted to Delta Stewardship Council, Sacramento, CA, by G. Fred Lee & Associates, El Macero, CA, June 14 (2011). <http://www.gfredlee.com/SJR-Delta/DeltaPlan4DraftCh6Comm.pdf>

Rast, W., Jones, A., and Lee, G. F., "Predictive Capability of US OECD Phosphorus Loading-Eutrophication Response Models," *Journ. Water Pollut. Control Fed.* 55(7):990-1003 (1983).

<http://www.gfredlee.com/Nutrients/PredictiveCapabilityOECD.pdf>

Overall, P. Glibert's repeated attempts, on behalf of the state water contractors, to justify her opinion that N/P ratios are a major cause of Delta ecosystem changes do not reflect an understanding of the interrelationships between nutrients and aquatic life and are not based on a technically valid assessment of the causes of the changes in the some of the fish populations or aquatic macrophytes in the Delta.