

Comments from Chris Foe at Central Valley Regional Water Quality Control Board on nutrient loading

Comment #1

I question whether using nutrient concentrations from Rio Vista and Jersey Point is appropriate for estimating export loads from the Delta to Suisun and San Francisco Bay. I admit that there is no perfect location for calculating export loads. I prefer the channel off Mallard Island (Chippis Island). Some pros and cons for using the channel site. First, R2 and R5 agreed in their respective mercury control plans to set the compliance point at Mallard. It seems strange that SFEI would now develop a different strategy for nutrients without at least discussing what was wrong with how mercury loads were calculated. Second, day flow uses Mallard Island to estimate water volumes exported from the Delta to San Francisco Bay (DTO). Third, the channel off Mallard is by definition the eastern boundary of Suisun and Grizzly Bays. There are also several cons for using the channel off Mallard Island. First, the site is several miles west of the R2/R5 boundary and so does not likely provide the best estimate of export from R5 to R2. Second, accurate load estimates must account for both advective (river) and dispersive (tidal) flux. Dispersive flux increases seaward in the estuary and Mallard Island is further west than Rio Vista and Jersey Point. DTO is only a measure of advective flux. Dispersive flux will decrease net transport from R5 to R2 but the value is likely small (<10%) and difficult to calculate. Lester Mckee did a nice analysis of the effect of dispersive flux on particulate mercury export from R5 to R2. Your report should acknowledge, regardless of where you calculate export, that it likely overestimates loads because it does not include dispersive flux.

Your study estimated exports from the Delta using the method of Jassby and Cloern. The Jassby Cloern method involved adding advective transport past Rio Vista and Jersey Point. A potential problem with this method is that both sites are located in the middle of the delta. In fact, Rio Vista may be as much as 10 to 30 days water travel time to the channel off Mallard Island at moderate to low flow. This could significantly change nutrient forms and loads.

I was curious to determine how different the load estimates might be using the Jassby/Cloern and Mallard Island methods. To calculate loads I used nutrient concentrations for both sets of export locations from Foe et al. (2010) and coupled these up with monthly estimates of water volume from the Day Flow Model. Detailed calculations are summarized in the attached spreadsheet. The summary table shows that the export load of total dissolved nitrogen is similar at both locations. This suggests that not much biological uptake of nitrogen is occurring in the Central and Western Delta. However, annual mean ammonia loads at Mallard are half those estimated by the method of Jassby and Cloern. Nitrate loads are 50% greater at Mallard Island. This is not surprising as the extra travel time allows more nitrification to occur. The Jassby and Cloern method underestimates soluble reactive phosphorus by about a factor of 1.3. Overall, I do not think these differences change your basic conclusion that the Central Valley (half the land mass of the State of California) is the dominant source of nutrients to Suisun Bay.

Comment #2

A stated goal of this report is to “*identify major data needs and important uncertainties*”. I have not been following the overall strategy of the San Francisco Bay Nutrient Program. However, categorizing and summing known sources, as was done in this report, is not a robust method of quantifying uncertainties and identifying unknowns. More robust methods are to construct mass balances and determine whether inputs and exports balance. A second method that I mentioned in an earlier comment letter is to regress nutrient concentrations against salinity. This is a powerful way to determine whether changes in nutrient concentrations are the result of dilution or whether they result from new unidentified sources or sinks. The conclusions of this report would be strengthened if it included some independent methods to confirm results.

Comment #3

As I understand it, most POTWs in R2 only perform secondary treatment. I did not see any estimates of organic nitrogen loads in the report. I recommend that some TKN (organic nitrogen + ammonia) measurements be made at each plant to see how well each plant is performing. It is possible that some plants are discharging a significant portion of their nitrogen load as urea.

Comment #4

The Suisun Marsh wetlands are on the Clean Water Act 303(d) list as impaired because of low dissolved oxygen and nutrients. Fall flood up of seasonal wetlands leads to the discharge of sulfide rich water laden with decaying organic matter into Suisun Bay Sloughs. This anoxic discharge may contain high concentrations of N and P. Water quality measurements should be made to determine nutrient loads from Suisun Marsh. In the interim this report should acknowledge that nutrient loads from the 115,000 acres of Suisun Marsh remain a data gap.