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October 8, 2009

Ms. Karen Scarborough
Undersecretary of Resources
Resources Agency
1416 Ninth Street, Suite 1311
Sacramento, CA 95814

**Subject:** **Sacramento Regional County Sanitation District Technical Comments on Chapter 3: Draft Conservation Strategy August 3, 2009**

Dear Ms. Scarborough:

The Sacramento Regional County Sanitation District (SRCSD) provides wastewater collection and treatment services to 1.3 million residents of the greater Sacramento area. SRCSD has designed, constructed and operates its treatment system in accordance with a National Pollutant Discharge Elimination System (NPDES) permit, issued by the State of California with approval by United States Environmental Protection Agency (USEPA), providing protection of beneficial uses of the Sacramento River and Sacramento-San Joaquin Delta in accordance with the federal Clean Water Act and the California Water Code.

SRCSD is providing the following technical comments on the August 3, 2009, *Chapter 3: Draft Conservation Strategy (Chapter 3)*. These technical comments are in addition to those comments SRCSD previously provided on October 5, 2009. We appreciate the modifications that have been made in the current version of the Other Stressors section to address a number of our concerns, but we still have a number of remaining concerns with the information presented in Chapter 3 and request additional changes be made to address these issues. The focus of this comment letter is to provide SRCSD's specific technical comments using the requested "Bay Delta Conservation Plan Review Document Comment Form." SRCSD is also providing comments on the DRERIP Evaluations for reducing ammonia and endocrine disrupting compound (EDC) discharges.

An overarching concern we have that must be addressed throughout the various sections of Chapter 3 is the fact that it is uncertain at this point in time whether ammonia or EDCS are having an adverse affect on covered fish species. Section 3.4.3 has been correctly modified to indicate this fact, however, Section 3.2 contradicts this information by implying that a conclusion has already been made that these contaminants are having an adverse effect. The BDCP would benefit by correcting these inconsistencies and inaccuracies throughout the document.

It is also our understanding that the BDCP has formed additional technical workgroups and subgroups that are evaluating the effects of implementing the various conservation measures, including other stressors. SRCSD is again requesting to be included as a member of these workgroups to provide technical expertise in wastewater treatment and water quality.

SRCSD hopes that providing you comments at this stage in the development of the BDCP is beneficial and prevents inaccurate information and foregone conclusions from moving forward that will not withstand scientific and technical scrutiny, nor demonstrate a benefit to the ecosystem. We look forward to continued involvement in development of a BDCP that will result in the recovery of the Delta ecosystem.

Please contact me at 916-876-6092 or Linda Dorn at 916-876-6030 if you have any questions.

Sincerely,

Terrie Mitchell
Legislative and Regulatory Affairs Manager

Attachment-Bay Delta Conservation Plan Review Document Comment Form
Attachment –SRCSD May 20, 2009 Comments on the Scientific Evaluation Worksheet for Action OSCM 1 and OSCM 2

cc: BDCP Steering Committee Members
Lester Snow, DWR
Dorothy Rice, SWRCB
Pamela Creedon, CVRWQCB
Paul Cylinder, SAIC
Rick Wilder, SAIC
Cliff Dahm, CalFED
Debbie Webster, Executive Officer, Central Valley Clean Water Association
Mary Snyder, District Engineer, SRCSD
Stan Dean, Director of Policy and Planning, SRCSD

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| | | | | **Section 3.2. The BDCP Approach to Conservation: An Overview** | |
| 1. | 3-12 | 3.2.4 | 36, 41 | **Quote:** "*A number of factors have been identified that adversely affect covered species through their impact on the species themselves, prey resources or habitat conditions…..These other stressors include toxic contaminants… low dissolved oxygen….*"<br><br>**Comment**: From the quote above the conclusion appears to have already been made that adverse population effects are occurring from toxic contaminants. Whereas in the OSCM1 and OSCM2 the conclusion has been made that a phased approach needs to occur to determine if ammonia and endocrine disrupting compounds (EDCs) are having adverse population level effects. Considering the uncertainty regarding the effects from ammonia and EDCs the phased approach is preferable to a foregone conclusion that is not substantiated by current scientific understanding. | |
| 2. | 3-14 | 3.2.4 | 2, 4, 6 | **Quote:** "*Certain measures are intended to reduce inputs of pesticides, herbicides and other agricultural chemicals by…reducing the load of toxic contaminants in urban runoff to the Delta…by reducing ammonia and endocrine disruptor discharge from wastewater treatment plants* ***that may be having adverse effects on the food web and covered species****…reducing inputs of methylated mercury…*"<br><br>**Comment:** The quote above makes the conclusion that reducing inputs of toxic contaminants, pesticides, herbicides, ammonia and EDCs is what certain measures are intended to do when the benefit of doing so is hypothetical. What are the specific adverse effects that are being claimed for the food web and covered species? Where are these adverse effects documented? Are these connected to population level effects? Are these hypothetical effects or observed effects? Again, this passage conflicts with statements regarding Other Stressors where these effects are stated to be hypothetical. The preferred discussion should include the phased approach to determining if there are any adverse effects first before embarking on reducing inputs. | |
| | | | | **Section 3.3 Biological Goals and Objectives** | |
| 3. | 3-28 | 3.3.2.1 | 16 | **Quote:** "*Goal ECSY2: Increase aquatic primary and secondary production in the Delta and Suisun Marsh to increase the abundance and availability of food for native aquatic organisms.*"<br><br>**Comment:** This ecosystem goal concludes that improving food web processes will improve food web processes without answering first if Delta fish are food limited? – Page 3-83 states that it has not been demonstrated that food abundance affects the population of Delta smelt – it is stated that there is a suggestion that longfin smelt may be food limited. | |
| 4. | 3-35 | 3.3.2.1 | 10 | **Quote:** "*Goal ECSY4: Reduce the adverse effects of contaminants* on the Delta's aquatic ecosystem."<br><br>**Comment:** It is stated that a variety of contaminants are known or believed to have direct lethal and sublethal effects on fish and the food web processes – that reducing loads of contaminants is expected to increase the survival and abundance of covered fish species. What are the specific ambient water quality data and associated analyses that support this statement? If fact, a review of the information presented in the Other Stressors section reveals that little is definitively known regarding such effects in the Delta. **Impacts of other stressors are largely hypothetical, and are not based on observed impacts on covered fish**. | |
| 5. | 3-35 | 3.3.2.1 | 19 | **Quote:** "*Objective ECSY4.1 – Contribute to specific actions which have a demonstrated positive effect in improving the aquatic ecosystem by reducing loads of contaminants*"<br><br>**Comment:** What are the specific contaminants and the specific actions? How does load reduction change ambient concentrations in the Delta? What are the positive effects that have been demonstrated? | |
| 6. | 3-36 | 3.3.4 | 32 | **Quote: "***Objective NACO1.2 –Increase the extent and spatial distribution of tidal marsh within the Planning Area and Suisun Marsh to support habitat and food production for associated native species.*"<br><br>**Comment:** What effect will this action have on methylmercury production? | |

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| 7. | 3-37 | 3.3.5 | 17, 29-30 | **Quote:** "*Goal GECF1: Increase abundance of covered fish by reducing sources of unnatural mortality"* ***Objective GECF1.1:*** *Reduce entrainment mortality of covered fish species at non- project diversions.*<br><br>**Comment:** Shouldn't the objective for this goal read "Reduce entrainment mortality of covered fish species at **project and** non- project diversions." | |
| | | | | **Section 3.4 Conservation Measures (introduction)** | |
| 8. | 3-46 | 3.4 | NA | **Item from Table 3-3:** "WOCML1: Construct a new water diversion facility…"<br><br>**Comment:** The proposed Peripheral canal is buried in this table as a conservation measure, but is there agreement amongst the BDCP Steering Committee that the peripheral canal is a conservation measure? | |
| 9. | 3-50 | 3.4 | 10 onward | **Quote:** *The BDCP conservation measures were developed on the basis of …a broad range of technical experts…."*<br><br>**Comment:** The passage describes a process by which the conservation measures were evaluated by "experts" using the DRERIP models. Technical experts of many principal stakeholders were purposely excluded from this process. Consequently, scientific evaluation of many of the measures was not as balanced as it should have been. SRCSD's comments on the DRERIP analysis are attached. | |
| | | | | **Section 3.4.1. Water Operations Conservation Measures** | |
| 10. | 3-50 | 3.4.1 | 1, onward | **Comment:** Water Operations Conservation Measures has a very confusing introduction – not clear – again, no measure to address ongoing losses of fish. | |
| 11. | 3-57 | 3.4.1.2 | 19 | **Quote:** "…there is a positive relationship between the magnitude (average monthly) of reverse flows within Old and Middle Rivers and the occurrence of pre-spawning adult delta smelt in SWP and CVP fish salvage during the winter months (Kimmerer 2008, USFWS 2009). Further, particle tracking model simulations predict that there is a greater risk that planktonic early lifestages of covered fish species (e.g., larval delta smelt) will be vulnerable to entrainment at the SWP and CVP export facilities when reverse flows within Old and Middle Rivers increase"<br><br>**Comment:** Shouldn't conservation measures addressing observed effects to covered species be given higher priority and urgency than measures to address hypothetical effects? | |
| 12. | 3-58<br>3-59 | 3.4.1.2 | 40-42<br>7-15 | **Quote: Hypotheses:** Revised operations of Delta Cross Channel gates are hypothesized to increase the survival of juvenile Chinook salmon and possibly other covered fish species by: (1) increased exposure to unscreened water diversions within the Delta channels; (2) exposure to seasonally elevated water temperatures and potentially toxic contaminants; (3) increased residence time and longer migration routes leading to longer exposure to environmental conditions within the Delta and increased vulnerability to predation mortality; (4) delayed migration as a result of altered hydrologic conditions in Delta channels as a result of SWP and CVP export operations; and (5) direct losses as a result of entrainment, predation, or salvage mortality at the south Delta SWP and CVP export facilities (Baxter et al. 2008);<br><br>**Comment:** These observed effects should be listed first, ahead of exposure to elevated temperatures and potentially toxic contaminants, which are hypothetical effects. | |
| 13. | 3-62 | 3.4.1.2 | 17-22 | **Quote:** "Factors that may to contribute to the relationship between Delta outflow (as well as X2 location) and juvenile fish abundance are heavily debated, but may include increased productivity and availability of high quality habitat within Suisun Bay (**although new research does not support this hypothesis [Kimmerer et al. 2009**]), downstream transport of fish, food, and organic matter, reduced temperature and/or **ammonia concentrations** with lower X2, inundation of backwater and floodplains with high flows, and the distribution of the earlier lifestages of fish into habitats that are located further downstream with decreased vulnerability to direct and indirect effects of south Delta SWP and CVP export operations."<br><br>**Comment 1**: Kimmerer et al. (2009) evaluated the relationship of the physical volume of "preferred" habitat (defined by | |

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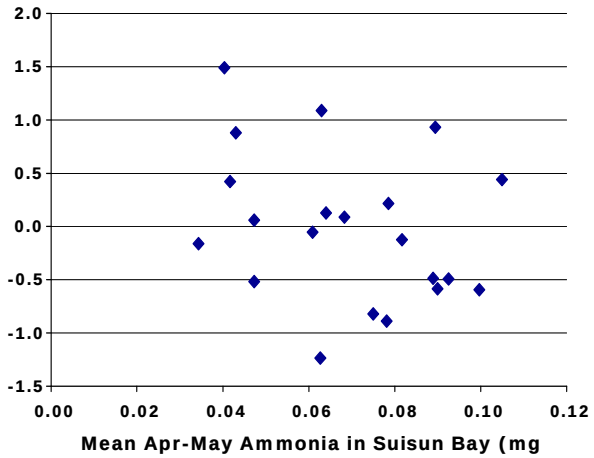
| | | | | depth and salinity) and fish abundance. They did not evaluate productivity or any other biological or physical determinants of habitat quality.<br><br>**Comment 2:** The quoted passage alludes to a hypothesis that relationships between Delta outflow and fish abundance are an artifact of variable ammonia dilution. This hypothesis relies upon the assumption that ammonia indirectly affects delta smelt abundance through diatom inhibition. If the hypothesis was true, a relationship should exist between delta smelt cohort success and concentrations of ammonia at the locations and times of year when ammonia inhibition is hypothesized to reduce the frequency or magnitude of diatom blooms. Owing to the presence of *Corbula* in the brackish estuary and low salinity zone, the key remaining window for diatom blooms is widely acknowledged to be in the Spring (April-May). However, as shown in the diagram below, annual cohort success for delta smelt, defined as the annual residuals of the stock-recruit relationship:<br><br>Summer Townet Index= *a*(Previous Year's Fall Midwater Trawl Index) + *b*<br><br>is *not* related to mean April-May ammonia concentrations in Suisun Bay (regression line is not significant, p = 0.19).<br><br>  <br><br><br>Some have further argued that ammonia inhibition of diatoms could be operating in the background to depress *summertime* abundance of diatoms in Suisun Bay further than would be occurring owing to *Corbula* grazing alone. However, as shown in the diagram below, annual cohort success for Delta smelt since 1987 has had no relationship with mean summer (Jun-Aug) ammonia levels in Suisun Bay either (regression line is not significant, p = 0.52) . | |

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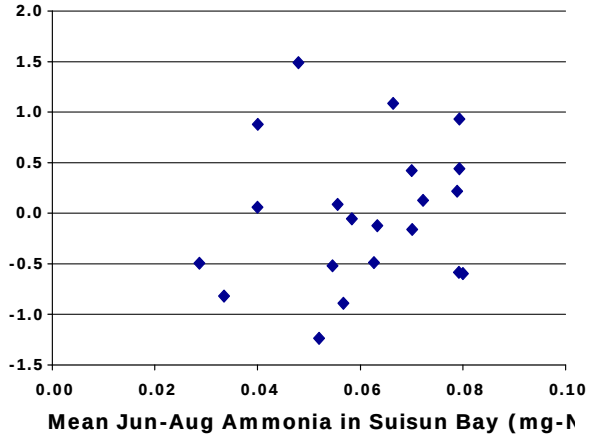
| | | | |  <br>**Comment 3:** SRCSD cautions the use of this study (Kimmerer et al. 2009) due to fact that the majority of the habitat evaluated in this study was in the San Francisco Bay, which could skew the data towards Bay conditions, and not represent the Delta. | |
| | | | | ***Section 3.4.2. Physical Habitat Conservation Measures*** | |
| 14. | 3-87 | 3.4.2 | 27, 42 | **Quote:** *"A primary conservation goal of the BDCP is to restore 80,000 acres of tidal marsh and associated aquatic estuarine habitats, …and 10,000 acres of new floodplain."*<br><br>**Comment:** What will be the methylmercury load increases associated with these marsh and floodplain projects? Won't these increases pose problems with the Delta mercury TMDL that is under development by the Central Valley Regional Water Board? | |
| 15. | 3-95 | 3.4.2.2 | 3, 15 | **Quote:** *"Freshwater tidal marsh habitats will be restored and enhanced to provide the following ecological benefits for covered fish species (see Appendix 4 X, DRERIP Evaluations): …*<br>*• reduction of contaminants through filtering contaminants from Delta waterways or chemical transformation of contaminants to less toxic or non-toxic substances"*<br><br>**Comment**: It is stated that contaminants will be filtered or transformed by freshwater tidal marsh habitat restoration. What are the specific contaminants in question and what are the specific benefits attributed to tidal marsh effects on these contaminants? How is the methylation of mercury in wetlands and associated bioaccumulation problem addressed? | |
| | | | | ***Section 3.4.3 Other Stressors Conservation Measures*** | |
| 16. | 3-127 | 3.4.3 | 7-16 | **Quote:** "phytoplankton community in the Delta and Suisun Bay has shifted over the past few decades … although changes in productivity could be masked by concomitant changes in Corbula grazing depending on the location in the Delta and Suisun Bay."<br><br>**Comment**: Potential Corbula effects on covered POD species (by consuming vast quantities of phytoplankton) need to be recognized and considered as a separate conservation measure, or the significance of this omission should at least be recognized if no measures are being proposed to reduce this factor. Corbula impacts on the phytoplankton population in the Delta are direct, significant, and well known. BDCP conservation measures ignores the simple and strong causal relationship between Corbula and reduced plankton biomass, while focusing vastly disproportional efforts on much more complex series of food-web linkages that are only suspected to contribute to the POD. | |

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| 17. | 3-127 | 3.4.3 | 15-18 | **Quote:** "Appendix 5 of US EPA (1999) reported that some data indicate that un-ionized ammonia can have adverse effects on aquatic life at concentrations as low as 0.001-0.006 mg/L. Mean unionized ammonia concentrations from 2000-2008 at the two monitoring locations in the Sacramento River immediately downstream of SRCSD's discharge point exceeded the lower end of this range (River Mile 44: 0.0021 mg/L, SRCSD unpubl. data; Hood: 0.0032 mg/L, DWR unpubl. data)."<br><br>**Comment**: The concentrations of un-ionized ammonia in the above passage should not be used as threshold toxicity values based on the discussion in the comments below. USEPA did not use these values for threshold toxicity values for the reasons detailed in the comments below and in regards to the BDCP covered species, this passage is misleading for at least 4 reasons:<br><br>1. Histopathologic ("sub-lethal") effects of ammonia are the only type of effect that would be associated with the extremely low concentrations of un-ionized ammonia in the range cited in this passage (0.001-0.006 mg N/L). As regards ammonia, sub-lethal effects are often transitory in nature and/or not associated with reduced growth, survival, or reproduction. As such, they are inappropriate gauges of population level risks to fishes or invertebrates in complex environments. USEPA (1999) concluded in Appendix 5 that histopathological effects (the topic of Appendix 5) *were not used for derivation of EPA chronic or acute criteria because*:<br><br>"1. Fish recover from some histopathological effects when placed in water that does not contain added ammonia.<br>2. Some histopathological effects are temporary during continuous exposure of fish to ammonia.<br>3. Some histopathological effects have occurred at concentrations of ammonia that did not adversely affect survival, growth, or reproduction during the same exposures."<br><br>2. This range (0.001-0.006 mg/L) was extracted from the second sentence of Appendix 5 of US EPA (1999), but is not placed in the context of the detailed taxon-specific information presented in the rest of Appendix 5. The exact quote from Appendix 5 is "The available data indicate that ammonia can have adverse effects on aquatic life at relatively low concentrations approaching 0.001 to 0.006 mg NH3/L. In the appendix, "no effects" concentrations are provided for a variety of endpoints (growth, hatching, tissue or organ alterations) involving tests with 8 fish species (pink salmon, atlantic salmon, rainbow trout, channel catfish, green sunfish, smallmouth bass, and fathead minnow). Additionally, only one of the no-effects concentrations presented in the appendix is in the range in the BDCP text (0.002, for pink salmon at pH 6.4). All of the other no-effects concentrations cited in the EPA appendix are outside the range and all but two of the thresholds (including all of those for rainbow trout) are 1-2 orders of magnitude higher (e.g., $\geq$ 0.02 mg/L) than the pink salmon value.<br><br>3. It is inappropriate to use "no effects" concentrations to predict adverse effects.<br><br>4. Rather than speculating about the potential sensitivity of covered species, Chapter 3 should acknowledge the relationship between experimentally derived effects concentrations for Delta smelt (and other covered taxa) and real-world ambient conditions in the Delta as follows:<br><br>(a) Regarding conditions in the Sacramento River downstream from SRWTP discharge (Hood and River Mile 44), much more pertinent and balanced observations would be that the *mean* ambient concentration of un-ionized ammonia cited for Hood (0.0032) is *more than an order of magnitude lower* than the no-effects concentration (96h NOEC) for Delta smelt recently presented at the August 2009 CVRWQCB Ammonia Summit (0.066 mg N/L) and 46 times lower than the currently estimated LC50 for Delta smelt (0.147 mg N/L) (I. Werner [2009] http://www.waterboards.ca.gov/centralvalley/water_issues/delta_water_quality/ambient_ammonia_concentrations/18aug09_ammonia_summit/werner_pres.pdf).<br><br>(b) Regarding conditions in the rest of the freshwater Delta *and* Suisun Bay *not a single* available measurement of un-ionized | |

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| | | | | ammonia obtained at USGS, IEP, and DWR monitoring stations during the POD (2000 onward) has exceeded ***any*** of the currently proposed effects thresholds (LC50, LOEC, NOEC) for Delta smelt (I. Werner [2009], reference cited above; D. Engle [2009] http://www.waterboards.ca.gov/centralvalley/water_issues/delta_water_quality/ambient_ammonia_concentrations/18aug09_ammonia_summit/engle_pres.pdf).<br><br>(c) Werner currently estimates that the 96h LC50 for Delta smelt for total ammonia is between 11-12 mg N/L (I. Werner, http://www.waterboards.ca.gov/centralvalley/water_issues/delta_water_quality/ambient_ammonia_concentrations/18aug09_ammonia_summit/werner_pres.pdf). This indicates that Delta smelt are about as sensitive to ammonia as salmonids (rainbow trout are the most sensitive salmonid included in the EPA 1999 database and the Species Mean Acute Value (SMAV) for rainbow trout is 11.23 mg N/L). With a SMAV of 17.34 mg N/L (EPA 1999), chinook salmon are less sensitive to ammonia than rainbow trout. The observations (1-2 above) that un-ionized ammonia concentrations occurring in the real-world Delta are protective of Delta smelt should apply to covered salmon species as well. | |
| 18. | 3-127 | 3.4.3 | 41-44 | **Quote**: : "Werner et al. (2008b) found that water samples near the Sacramento WWTP effluent reduced 4-day larval delta smelt survival in 2006, but did not affect survival even after 7 days in 2007, and concentrations of ammonia/um in water samples were below US EPA effect concentrations (e.g., LC50)."<br><br>**Comment**: The statement above should be edited as follows:<br>"Werner et al. (2008b) found that water samples near the Sacramento WWTP effluent did not affect survival even after 7 days in 2007, and concentrations of ammonia/um in water samples were below US EPA effect concentrations (e.g., LC50)."<br><br>The quoted passage is incorrect. Delta smelt toxicity in 2006 was not evaluated by Werner *et al.* (2008) in samples collected near SRWTP. The closest station to SRWTP tested in 2006 was at the tip of Grand Island near Rio Vista (Station 711). Smelt testing with Sacramento River samples from Hood began in 2007.<br><br>Delta smelt toxicity test data in 2006 were also concluded to be questionable by the author (page 83) "*Overall, it was determined that the static renewal testing protocol in 2-liter beakers did not yield satisfactory survival of delta smelt larvae, and a flow-through system was subsequently constructed and used in 2007."* | |
| 19. | 3-128 | 3.4.3 | 37-41 | **Quote:** "*Hyalella azteca*, a resident amphipod in the Delta, was the most sensitive invertebrate species to ammonia/um evaluated for the 1999 US EPA criteria. However, aside from a family of mussels that are not found in the San Francisco Estuary, invertebrates are generally less acutely sensitive to ammonia/um than fish."<br><br>**Comment**: The statement above should be edited as follows:<br>"*Hyalella azteca*, a resident amphipod in the Delta, was the most sensitive invertebrate species to ammonia/um evaluated for the 1999 US EPA criteria, and ammonia/ium concentrations in Delta waters are well below EPA chronic criteria which are protective of *H. azteca*. However, aside from a family of mussels that are not found in the San Francisco Estuary, invertebrates are generally less acutely sensitive to ammonia/um than fish."<br><br>The edit above adds balance to the presentation of facts regarding the potential for toxicity to invertebrate species from ammonia in the Delta. | |

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| 20. | 3-128 | 3.4.3 | 41-44 | **Quote:** "A recent pilot study suggests that, in combination with other chemicals (i.e., pesticides), ammonia at elevated levels may reduce the survival of prey species for delta smelt and longfin smelt, *Eurytemora affinis,* although no evidence was found to support this (Teh et al. 2008)."<br><br>**Comment**: The above statement should be edited as follows:<br>It has been hypothesized that, in combination with other chemicals (i.e., pesticides), ammonia at elevated levels may reduce the survival of prey species for delta smelt and longfin smelt, *Eurytemora affinis,* although no evidence was found to support this (Teh et al. 2008)."<br><br>No data in this cited study "suggests" ammonia interactions with other chemicals. The edit provided will clarify the fact that this was simply posed by the author as a hypothesis. | |
| 21. | 3-129 | 3.4.3 | 10-12 | **Quote:** "Further, Lehman (2008) indicated that the Microcystis bloom she documented in 2004 "probably did not cause acute toxicity to aquatic food web organisms in the San 11 Francisco Estuary" (p. 201), although no conclusive evidence was found to support this."<br><br>**Comment**: The BDCP authors do not acknowledge recently published indication that toxicity from dissolved microcystin is not a direct threat to key zooplankton in the SFE. This conclusion is based on sensitivity studies for *Eurytemora affinis* and *Pseudodiaptomus forbesi* in Ger et al. (2009):<br><br>Ger K. A., S. J. Teh, and C. R. Goldman (2009) Microcystin-LR toxicity on dominant copepods *Eurytemora affinis* and *Pseudodiaptomus forbesi* of the upper San Francisco Estuary. Science of the Total Environment 407:4852-4857.<br><br>The study concluded that 48-hr exposures to microcystin had no subsequent effect on population growth rates of the two copepod taxa (copepods were tracked for 33 days post-exposure). | |
| 22. | 3-129 | **3.4.3** | 38 | **Quote:** *OSCM2. Determine whether endocrine disrupting compounds have adverse direct and/or indirect effects on BDCP covered species and, if adverse effects are found, assist wastewater treatment plants in identifying funding sources to reduce the load of endocrine disrupting compounds in effluent discharges.*<br><br>**Comment**: SRCSD appreciates the recognition that it is currently not known if EDCs have adverse effects on covered species, and that there needs to be additional research to make a determination about potential adverse effects from EDCs, if any. However if further scientific studies conclusively determine adverse effects on covered species than this CM could apply to all sources of EDCs. Ignoring the many possible sources and types of EDCs (e.g., pyrethroids, DDT, vinclozolin, endosulfan, toxaphene, dieldrin, DBCP, PCBs, dioxins, and phenols) increases the likelihood that this CM will fail to improve conditions in the Delta for covered species if EDCs are adversely affecting covered species. | |
| 23. | 3-130 | **3.4.3** | 6-8 | **Quote:** "The BDCP Implementing Entity will assist local sanitation districts in identifying sources of funding for these conservation measures."<br><br>**Comment**: Identifying is not funding. It is not clear how identifying funding sources will count as mitigation credit for the BDCP, if that is an intended purpose. | |
| 24. | 3-130 | 3.4.3 | 13-17 | **Quote:** *A workshop with these participants will be conducted within 2 years of BDCP Implementation to evaluate existing information on EDCs, identify data and science gaps, evaluate the contribution of sources of EDCs in the Delta that come from wastewater effluent, and determine what, if any, research is necessary to determine the effects of discharged EDCs from local sanitation districts on covered fish species.*<br><br>**Comment**: Again, it is not currently known that EDCs are having any adverse effect on the Delta, but if the workshop evaluation identifies further research is necessary than this CM could apply to all sources of EDCs, not just wastewater. | |

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| 25. | 3-131 | **3.4.3** | 17-19 | **Quote:** "Wastewater treatment plants can be large sources of EDCs (Sumpter and Jobling 1995, Chambers and Leiker 2006, Barber et al. 2007), although other sources exist, including pesticides (see OSCM4 for pesticide reduction actions)."<br><br>**Comment**: It is good to see that the possibility of other sources are briefly mentioned here It should be recognized that this CM will apply to any and all EDC sources that contribute significantly to any identified EDC problem in the Delta, if a problem exists. | |
| 26. | 3-131 | **3.4.3** | 38-40 | **Quote:** "Endocrine disruption has been observed in fish exposed to some wastewater effluents throughout the world (Sumpter and Jobling 1995, Jobling et al. 1998, Pait and Nelson 2002, Chambers and Leiker 2006, Barber et al. 2007, Kidd et al. 2007)."<br><br>**Comment**: Currently there is no evidence that EDCs have adverse effects on covered species in the Delta, additional research is necessary to make a determination about potential adverse effects from EDCs, if any. The fact that endocrine disruption has been associated with WWTP discharge does not mean that all WWTPs discharge causes endocrine disruption. It should also be recognized that the potential for endocrine disruption from WWTP effluent varies with the level and type of treatment, which most likely differs substantially in the delta from those in the referenced studies. | |
| 27. | 3-132 | **3.4.3** | 11-12 | **Quote:** "In Central Valley stream sampling, up to 38% of male fall-run Chinook salmon showed signs of endocrine disruption in the form of sex reversal (Williamson and May 2002)."<br><br>**Comment**: The above passage should be amended as follows:<br><br>"In Central Valley stream sampling, up to 38% of male fall-run Chinook salmon showed signs of endocrine disruption in the form of sex reversal (Williamson and May 2002)…; <u>although salmon are transient in the Delta and may receive EDC exposures from areas other than the Delta.</u><br><br>It should be noted that salmon spend very little time in the Delta as adults or smolts as they migrate to/from spawning streams. The text added to this passage would qualify this statement appropriately. | |
| 28. | 3-132 | **3.4.3** | 11-34 | **Comment**: Please provide complete citations at the end of each chapter for all referenced sources. These were not available for review. | |
| 29. | 3-132 | **3.4.3** | 35-36 | **Quote:** "Adaptive Management Considerations. If EDCs discharged from local sanitation districts are found to have adverse effects on covered fish species in the Delta, the BDCP…"<br><br>**Comment**: The passage above should be amended as follows:<br>"Adaptive Management Considerations. If EDCs discharged from local sanitation districts <u>or other sources</u> are found to have adverse effects on covered fish species in the Delta, the BDCP…"<br><br>The CM should consider the possibility of other EDC sources before choosing to discount them. | |
| 30. | 3-135 | **3.4.3** | 32-39 | **Quote:** *"The BDCP Implementing Entity will reduce the load of pesticides and herbicides entering Delta waterways from in-Delta sources by implementing two related actions: (1) support efforts by the Central Valley Regional Water Quality Control Board (CVRWQCB) under its Irrigated Lands Regulatory Program to reduce inputs of toxics from agricultural return flows into the Delta, and (2) fund conservation easements, cost-sharing programs, and provide other positive incentives to groups of farmers, large individual farmers, reclamation districts, and irrigation/ drainage districts to develop targeted voluntary agricultural chemical management plans or other actions to reduce the amounts of pesticides and herbicides reaching Delta waterways."*<br><br>**Comment**: It is not clear whether this CM is really directed at pesticide and herbicide loadings, as indicated in the introduction, or just at a single type of source. | |

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| 31. | 3-129 to 3-132 | OSCM2 | NA | **General Comment:** This CM would benefit by taking into account some of the updated information provided in DRERIP OSCM2 – Reduce the Load of Endocrine Disrupting Compounds (revised 5-27-09). | |
| 32. | 3-170 | 3.4.3 | 35 | **Quote:** "*OSCM24: Reduce the effects of predators on covered fish species by conducting localized predator control of high predator density locations."*<br><br>**Comment:** Why doesn't this measure include predator control in the vicinity of the South Delta pumps, a location where predation losses are extreme (e.g. 75 percent loss rates per the 2009 salmonid biological opinion, and as many of 97% of Delta smelt lost in Clifton Court Forebay according to a 2009 Cal. Fish & Game mark and recapture study using larval and adult Delta smelt). This measure does include locations where "salvaged" fish are discharged into Delta waters. What specific steps are being taken to implement this measure in the near term? | |
| 33. | 3-171 | 3.4.3 | 38 | **Quote:** "*OSCM25: Improve the survival of outmigrating juvenile salmonids by using non-physical barriers to re-direct them away from channels in which survival is lower"*<br><br>**Comment:** This measure is proposed to occur at the intake to Clifton Court Forebay and CVP pumping plant, among other locations. This measure should be highlighted as an important near term measure to mitigate significant observed and future project operational losses of covered fish species. | |

**ATTACHMENT: SRCSD MAY 20, 2009 Comments on the Scientific Evaluation Worksheet for Action OSCM1: *Reduce Ammonia Discharges***

GENERAL COMMENT

The DRERIP evaluation is populated with references to non-peer-reviewed, unpublished, and/or non-publicly-available information (such as personal communications) - some of which are listed in Table 1. Also, many of the cited publications are missing from the References Cited section. Consequently, it would be difficult for the BDCP Other Stressors Working Group and Steering Committee, or outside evaluators or policy makers, to gauge whether many of the conclusions and scores in the evaluation are justifiable.

**Table 1. Examples of non-transparent sources and references missing from the "References Cited" section in the OSCM1 Worksheet. Many missing references are cited on multiple pages but are listed in the table according to their first appearance in the document.**

| Page | Problematic Reference |
|---|---|
| 3 | Durand 2008 (missing reference)<br>"Fullerton correlations" (non-transparent) |
| 4 | Kimmerer pers. comm. (non-transparent)<br>Alpine & Cloern 1992(missing reference) |
| 5 | Cloern et al. 1985(missing reference)<br>Cloern 2001(missing reference)<br>Cloern 1996(missing reference)<br>Thompson 2005(missing reference) |
| 6 | Dugdale et al. 2007(missing reference)<br>Wilkerson et al 2006(missing reference)<br>David Fullerton (unpublished data)(non-transparent)<br>"Per discussion with Wim Kimmerer…"(non-transparent) |
| 7 | "Dave Fullerton presented data showing …"(non-transparent)<br>"Alex Parker's sampling of ammonium…"(non-transparent)<br>Jassby 2008(missing reference) |
| 8 | "Widespread phytoplankton toxicity….was found at Delta sites monitored by the Irrigated Lands Program." (non-transparent, no report cited)<br>Kimmerer & Orsi 1996(missing reference)<br>Kimmerer 2005, unpublished (non-transparent)<br>Thompson pers. comm. (non-transparent)<br>"Based on Chris Foe's dissertation…" (non-transparent) |
| 9 | Bennett et al. 2008(missing reference)<br>Herbold (pers. comm.) (non-transparent)<br>Kimmerer 2002b(missing reference)<br>Rosenfield 2008(missing reference) |
| 10 | Lucas et al. 2002(missing reference) |
| 11 | "Preliminary analyses by the Dugdale-Wilkerson laboratory indicate …"<br>Kimmerer 2006, unpublished |
| 16 | Camargo & Alonso 2006(missing reference)<br>Lehman, pers. comm. (non-transparent)<br>Takamura et al. 1987(missing reference)<br>Lehman et al. 2008(missing reference)<br>Fullerton, field data (non-transparent)<br>"Thompson considers the strong spatial gradient…." (non-transparent) |
| 17 | Johnson, Fullerton ambient data (non-transparent) |
| 18 | UCD-ATL, unpublished data (non-transparent) |
| 20 | Van Nieuwenhuyse 2007(missing reference)<br>Dahlgren data (non-transparent)<br>Dahlgren data (unpublished - down to Freeport) (non-transparent) |
| 22 | "Stuart Siegel's draft model for ammonia was circulated to the group" (non-transparent) |

SPECIFIC COMMENTS

***Comment related to Outcome P1*** (*Reductions in total ammonia in the Sacramento River will increase Delta smelt and longfin smelt abundance by increasing diatom production and abundance in the freshwater portion of the estuary (Lower Sacramento River))*

1. The DRERIP evaluation understates the role of benthic grazing in the freshwater portion of the estuary. In two places in this section of the evaluation (pages 7 & 8) the evaluation states:

   *"The importance of Corbicula's grazing on primary producers in shallow areas is also not well known."* Omitted from the DRERIP evaluation is peer-reviewed published evidence that grazing by *C. fluminea* causes shallow habitats in the freshwater Delta to function as net sinks of phytoplankton (Lopez at al. 2006)[1]. Quote from the abstract of Lopez et al. (2006): "*Distribution of the invasive clam Corbicula fluminea was patchy, and heavily colonized habitats all supported low phytoplankton biomass and production and functioned as food sinks."*

   Hypothesized dividends in diatom production following proposed reductions in ammonium are expected to be largely diverted to benthic consumers (*Corbula*) in the brackish estuary and low salinity zone. In the same way, grazing by *Corbicula* in the freshwater estuary is likely to diminish the extent to which increases in diatom production can subsidize the pelagic food web.

***Comments related to Outcome P2*** (*Reductions in total ammonia in the Sacramento River will increase Delta smelt and longfin smelt abundance by increasing diatom production and abundance in the low-salinity portion of the estuary (confluence))*

1. *P2A. Effect of reducing ammonium on diatom production.*
   The score of "3" assigned to Magnitude for P2a should be lower owing to the apparent strong depressive effect of *Corbula* on phytoplankton biomass in the lower Sacramento River. Publicly available monitoring data for chlorophyll-a in the lower Sacramento River (see Figure 1) strongly indicate that the crash in phytoplankton biomass after the arrival of *Corbula* extended upstream in the lower Sacramento River at least as far as Decker Island (Three Mile Slough) - i.e., throughout the low salinity zone. Expectations that diatom biomass will increase in the confluence region in response to a decrease in ammonium levels - despite the strong effect of clam filtration of tidally exchanged water - are unrealistic.

[1] Lopez et al. (2006) Ecological values of shallow-water habitat: Implications for the restoration of disturbed ecosystems. Ecosystems 9: 422-440.

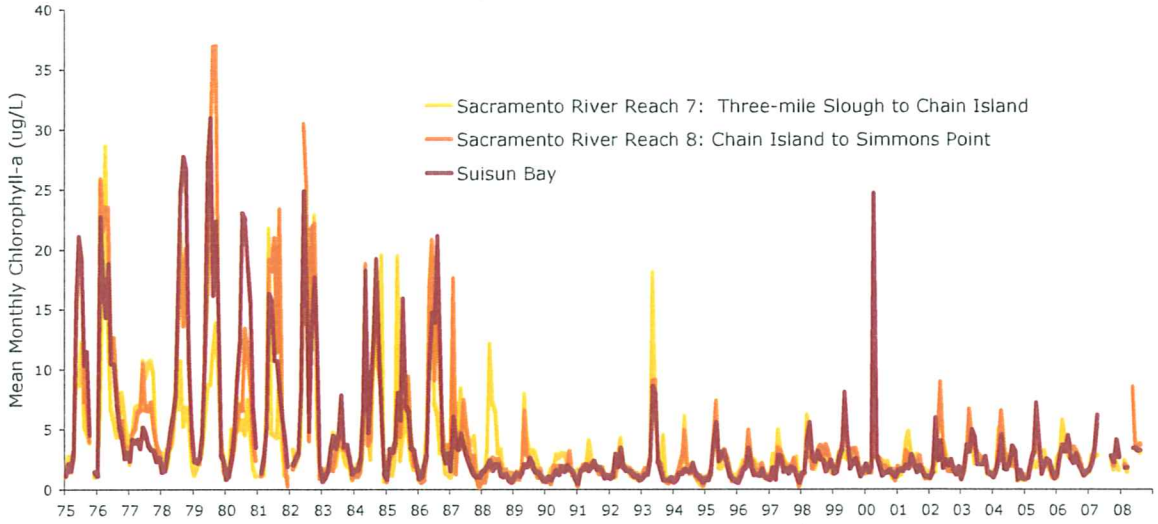


Figure 1. Time series for mean monthly chlorophyll-a from long-term monitoring stations in the lower Sacramento River and Suisun Bay. Monthly means were generated from daily station means for surface grab samples (up to 2 m depth). Data from the IEP/EMP, DWR-MWQI, and the USGS were combined.

2. *P2c and P3c. Effect of increasing zooplankton abundance of fish abundance (in both the low salinity zone and the brackish estuary).*

The *magnitude* and *certainty* of outcomes that rely on linkages between fish populations at the top of the food chain and ammonia/diatom related phenomena at the bottom of the food chain should be scored lower than they are in the DRERIP evaluation. In the POD debate, there is a popular assumption that it would be possible to achieve an increase in diatom biomass in critical rearing habitat for Delta smelt during April and May by lowering ammonia levels at that time of year, and that such an increase in the frequency or magnitude of diatom blooms in pertinent habitat would have population level benefits for Delta smelt. For both outcomes P2c and P3c, the evaluation states the following:

> "According to Herbold (pers. comm.), April/May and August may be a particularly important bottleneck for Delta smelt. Delta smelt often occur in this part of the estuary in April, May and August. Benthic biomass and grazing rates may be low enough to allow a bloom only in April and maybe May if light, residence time and ammonium levels are favorable. Increasing the base of their foodweb has the potential to have a sustained minor population effect, but the effect would be limited to short but critical periods in April and May of some years."

However, data on fish abundance and ambient levels of ammonia and chlorophyll-a do not support the hypothesis that Spring phytoplankton abundance in the brackish estuary is well-linked to Delta smelt recruitment. If ammonia inhibition of diatom blooms in the Spring (April-May) is having population level effects on Delta smelt through the foodweb, then annual cohort success for Delta smelt should be related to ammonia concentrations in this part of the estuary during April and May. However, this is not the case. As shown in Figure 2 below, annual cohort success for Delta smelt, defined as the annual residuals of the stock-recruit relationship:

$$\text{Summer Townet Index} = a(\text{Previous Year's Fall Midwater Trawl Index}) + b$$

is *not* related to mean April-May ammonia concentrations in Suisun Bay (a regression line for the data in the graph is not shown, but is not significant, $p = 0.19$).

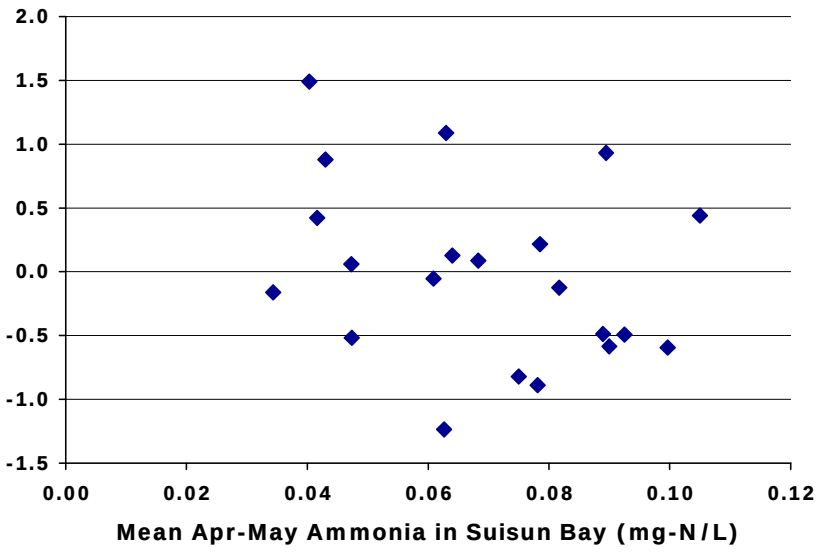


Figure 2. Residuals of the stock-recruit relationship for Delta smelt for 1987 plotted against mean April-May ammonia concentrations in Suisun Bay. Data are from surface grab samples collected at USGS and IEP-EMP monitoring stations.

Additionally, as shown by analogous data in Figure 3, there is no relationship between mean April-May chlorophyll-a concentrations in the brackish estuary and the annual variation in recruitment success for Delta smelt.

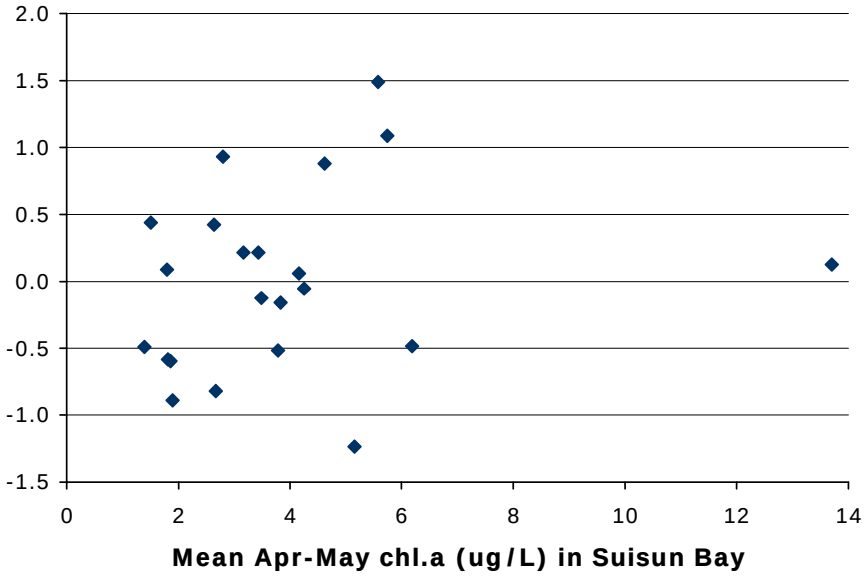


Figure 3. Residuals of the stock-recruit relationship for Delta smelt for 1987 plotted against mean April-May chlorophyll-a concentrations in Suisun Bay. Data are from surface grab samples collected at USGS and IEP-EMP monitoring stations.

***Comments related to Outcome P5*** (*Reduction in direct toxic effects on zooplankton species).*

**Quote from DRERIP worksheet:** "*Werner et al., Final Report, 2008 found that growth of H. azteca was correlated with ammonia/ium at some Delta stations."*

1. The rationale for the weights assigned to *Certainty (3)* and *Magnitude (2)* for Outcome P5a appear to strongly rely on a conclusion from Werner et al. (Final Report, 2008) that chronic effects (growth) to *H. azteca* were "correlated" with ammonia/ium. However, correlation should not be interpreted as causation. Werner's tests were conducted using ambient water samples in which any number of other contaminants could have contributed to the observed toxicity. *H. azteca* is also known to be highly sensitive to pyrethroids, which are associated with urban areas and discharges (not necessarily from WWTPs).
2. Werner et al. (2008) did not confirm ammonia toxicity to *H. azteca* with pH manipulation toxicity identification evaluations (TIEs). TIE treatments in samples exhibiting toxicity did identify chronic and acute effects due to organophosphate and pyrethroid insecticides. Moreover, it was determined on page 31 (Section 4.1.2.2) of the report that the chronic (growth) toxicity endpoint was "*not a sensitive indicator of toxicity due to the variable size of the organisms, and the variability in food content between Delta water samples from different sites*." Therefore, conclusions regarding the potential effects of ammonia on amphipod growth in Werner et al. (2008) are questionable and contradict conclusions in the same report based on statistical evaluation in Section 4.1.2.6 - Effect of Ammonia on *H. azteca* Survival and Growth.
3. Finally, although *H. azteca* is included in the invertebrate database for the EPA 1999 ammonia criteria and is an organism commonly used for sediment toxicity tests, *H. azteca* are not zooplankton. They are benthic invertebrates. There are currently no peer reviewed studies regarding toxicity of ammonia for the Delta zooplankton taxa of concern (such as the key copepod species). *Hyalella* test results should not be used to make conclusions about zooplankton sensitivity to ammonia in the Delta.
4. *The scores assigned to certainty and magnitude for outcome P5a should be down-graded to reflect these significant issues.*

   *"Buhl (2002): Synergistic effects of ammonia mixing with other toxicants could increase the risk for aquatic invertebrates."*
5. The evaluators should be explicit about which "other toxicants", and which concentrations, are referred to in Buhl (2002). Are these "other toxicants" present in the Delta at concentrations that could cause these synergistic effects?

***Comments Related to Outcome P6*** (***Reduction in direct toxic effects on fish species)***

1. The DRERIP analysis has been superceded by new information about Delta smelt sensitivity to un-ionized ammonia and meta-analyses of large ambient data sets (>10,000 water samples) for total and un-ionized ammonia from the freshwater and brackish portions of the estuary that were presented at the Central Valley Regional Water Quality Control Board's August 2009 *Ammonia Summit*. Consequently, the score of "3" for *Magnitude* greatly overestimates the potential for adverse effects from ammonia/ium for Delta smelt. Ambient concentrations of total ammonia in the Delta and Suisun Bay are well below the USEPA (2006) chronic effects criterion and the USEPA (1999) acute effect criterion, and un-ionized ammonia concentrations do not exceed currently estimated effects thresholds for covered fish species. For example, the mean ambient concentration of un-ionized ammonia below the SRWTP (Hood/Greenes Landing) for POD years (0.0032 mg N/L) is *more than an order of magnitude lower* than the no-effects concentration (96h NOEC) for Delta smelt recently presented at the Ammonia Summit (0.066 mg N/L un-ionized ammonia) and 46 times lower than the currently estimated LC50 for Delta smelt (0.147 mg N/L un-ionized ammonia)[2] .

[2] I. Werner [2009]
http://www.waterboards.ca.gov/centralvalley/water_issues/delta_water_quality/ambient_ammonia_concentrations/18aug09_ammonia_summit/werner_pres.pdf

Furthermore, *not a single available measurement* of un-ionized ammonia obtained at USGS, IEP, and DWR monitoring stations throughout the freshwater and brackish estuary during the POD (2000 onward) has exceeded ***any*** of the currently proposed effects thresholds (LC50, LOEC, NOEC, LC10) for Delta smelt.[2,3]

Werner (2009)[2] currently estimates that the 96h LC50 for Delta smelt for total ammonia is between 11-12 mg N/L. This indicates that Delta smelt are about as sensitive to ammonia as salmonids (rainbow trout are the most sensitive salmonid included in the EPA 1999 database and the Species Mean Acute Value (SMAV) for rainbow trout is 11.23 mg N/L). With a SMAV of 17.34 mg N/L (EPA 1999), Chinook salmon are less sensitive to ammonia than rainbow trout. Un-ionized ammonia concentrations occurring in the real-world Delta are protective of Delta smelt should apply to covered salmon species as well.

**Quote from DRERIP worksheet**: *"Passell et al. 2007 concluded that NH3 toxicity must be considered seriously for its potential ecological impacts on the Rio Grande and as a mechanism contributing to the decline of the Rio Grande fish community in general and the Rio Grande silvery minnow specifically."*

2. Ammonia concentrations presented in Passell *et al.* (2007) are much greater than those found in the Delta and are not relevant to this discussion. The authors report dissolved un-ionized ammonia concentrations compared to State of New Mexico acute and chronic concentration values of 0.30 and 0.05 mg/L NH3-N, respectively.

**Quote from DRERIP worksheet:** *"Reported unionized ammonia concentrations in the Sacramento River immediately below the SRWTP are 0.0085 ± 0.005 and could exceed chronic safe values for delta smelt. During January-June 2008, maximum unionized ammonia concentrations measured at Hood and Grand Island (POD site 711) were 0.019 mg/L and 0.021 mg/L, respectively (Werner I., UCD-ATL, unpublished data)."*

3. This assertion is misleading because chronic toxicity data for delta smelt do not currently exist. Also, the value provided for the Sacramento River below the SRWTP is not referenced, and is higher than the mean concentration obtained when publicly available data from stations below the SRWTP are used.

   Concentrations for unionized ammonia calculated from publicly available data for pH, water temperature and total ammonia from POD years (Table 2, see below) reduce the relevancy of the concentrations cited in the evaluation in at least 2 ways:

   - Werner's (?) unpublished value for un-ionized ammonia in the river at some unspecified location below the SRWTP (0.0085 mg-N/L) is four times higher than the mean un-ionized ammonia concentration measured at River Mile 44 (0.0021 mg-N/L) – which is only 2 miles downstream from the SRWTP discharge.
   - Chronic toxicity derives from long-term exposure. Consequently, mean ambient conditions should be given more weight than isolated maximum concentrations. The mean for 104 monthly and bi-monthly un-ionized ammonia measurements at Hood taken during the POD years (0.0032 mg N/L) is much lower than the maximum concentration cited in the evaluation for Hood (0.019 mg/L).

**Quote from DRERIP worksheet:** *"Dodds and Welch (2000) suggest that chronic effects of unionized ammonia on fish may occur at concentrations as low as 0.005 mg/L, which is below average concentrations in the Sacramento River below the WWTP."*

4. This statement is incorrect. Publicly available data for the POD years (2000-2008; summarized in Table 2 below) contradict this statement. Average concentrations of un-ionized ammonia in the Sacramento River (0.0021 mg-N/L at River Mile 44 and 0.0032 mg-N/L at Hood) are not greater than Dodds and Welch's proposed chronic effects threshold of 0.005 mg-N/L.

**Quote from DRERIP worksheet:** *"The USEPA (1999) reports that some data have indicated that unionized ammonia can have adverse effects on aquatic life at concentrations as low as 0.001–0.006 mg/L".*

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[3] D. Engle [2009] http://www.waterboards.ca.gov/centralvalley/water_issues/delta_water_quality/ambient_ammonia_concentrations/18aug09_ammonia_summit/engle_pres.pdf

5. With regard to the BDCP covered species, this sentence is misleading for at least 3 reasons:

a. This range (0.001-0.006 mg/L) was extracted by the authors from the second sentence of Appendix 5 of US EPA (1999), but is not placed in the context of the detailed taxon-specific information presented in the rest of Appendix 5. In the appendix, "no effects" concentrations are provided for a variety of endpoints (growth, hatching, tissue or organ alterations) involving tests with 8 fish species (pink salmon, atlantic salmon, rainbow trout, channel catfish, green sunfish, smallmouth bass, and fathead minnow). Only one of the no-effects concentrations presented in the appendix is in the range in the quoted sentence (0.002, for pink salmon at pH 6.4). All of the other no-effects concentrations cited in the EPA appendix are outside the range and all but two of the thresholds (including all of those for rainbow trout) are 1-2 orders of magnitude higher (e.g., $\geq$ 0.02 mg/L) than the pink salmon value.

b. Histopathologic ("sub-lethal") effects of ammonia are the only type of effect that would be associated with the extremely low concentrations of un-ionized ammonia in the range cited in the sentence (0.001-0.006 mg N/L). As regards ammonia, sub-lethal effects are often transitory in nature and/or not associated with reduced growth, survival, or reproduction. As such, they are inappropriate gauges of population level risks for fishes or invertebrates in complex environments. USEPA (1999) concluded in Appendix 5 that histopathological effects (the topic of Appendix 5) *were not used for derivation of EPA chronic or acute criteria because*:

> "1. Fish recover from some histopathological effects when placed in water that does not contain added ammonia.
> 2. Some histopathological effects are temporary during continuous exposure of fish to ammonia.
> 3. Some histopathological effects have occurred at concentrations of ammonia that did not adversely affect survival, growth, or reproduction during the same exposures."

c. Rather than implying that the range in the quoted sentence is pertinent to covered fish species, the evaluation should acknowledge the relationship between experimentally derived effects concentrations for Delta smelt (and other covered taxa) and real-world ambient conditions in the estuary as described in Comment #1 above.

**Table 2. Mean un-ionized ammonia concentrations in surface water samples at monitoring stations in the freshwater Delta during POD years (2000-2008)[(1)].**

| Project[(2)] | Station Code | Station Name | Number of Samples | Mean Un-ionized Ammonia (mg N/L) |
|---|---|---|---|---|
| DWR-MWQI | B0702000 | San Joaquin R. near Vernalis | 58 | 0.0005 |
| USGS | 11303500 | San Joaquin R. near Vernalis | 127 | 0.0017 |
| DWR-MWQI | B9591000 | Contra Costa Pumping Plant #1 | 51 | 0.0006 |
| DWR-MWQI | B9D75351342 | Old River near Byron | 69 | 0.0006 |
| DWR-MWQI | B9D75811344 | Old River at Bacon Island | 66 | 0.0008 |
| DWR-MWQI | KA000000 | Clifton Court Intake | 21 | 0.0007 |
| USGS | 381427121404901 | Lower Yolo Bypass near Rio Vista | 2 | 0.0004 |
| DWR-MWQI | KA000331 | H.O. Banks Pumping Plants | 100 | 0.0012 |
| USGS | 11447650 | Sacramento River at Freeport | 108 | 0.0004 |
| SRCSD CMP | Freeport | Freeport | 5 | 0.0007 |
| SRCSD CMP | River Mile 44 | River Mile 44 | 40 | 0.0021 |
| DWR-MWQI | B9D82211312 | Sacramento River at Hood | 104 | 0.0032 |

(1) All freshwater Delta stations are included in the table for which ammonia, pH, water temperature, and electrical conductivity were all measured in water samples taken during the POD years.

(2) Data are from DWR Municipal Water Quality Investigations (DWR-MWQI), US Geological Survey (USGS), and Sacramento Regional County Sanitation District's Coordinated Monitoring Program (SRCSD-CMP). Un-ionized ammonia values are unavailable for IEP-Environmental Monitoring Program stations during the period 1995-Feb. 2009 owing to cessation of measurement of field pH.

**Comments on the Draft DRERIP Evaluation Sheet for OSCM2 - Reduce the load of Endocrine Disrupting Compounds (Reduce_Load_of_Endocrine_Disrupt_Comp.pdf).**

**GENERAL COMMENTS**

1. The notion that benefits to Delta species will accrue through EDC load reductions implies that we know that EDC effects are occurring. The omission of fact that EDC effects and their sources have not been conclusively shown in the Delta, and statements suggesting this hypothesis is true, is misleading and a critical flaw in this evaluation. The **Assumptions** do not even list that EDC effects and their sources have not been conclusively shown in the Delta, whereas OSCM2 ("Determine whether endocrine disrupting compounds have adverse direct and/or indirect effects on BDCP covered species . . .") itself clearly states this uncertainty in the title. It should be clearly stated at the onset of these DRERIP comments and in the **Assumptions** that it has not yet been determined whether or not endocrine disrupting compounds have adverse direct and/or indirect effects on covered species in the Delta.

2. Overall, the generalized information is correct and reflects the current paucity of data available on EDCs in the Delta. The evaluation recognizes that there is very little site specific information for the Delta, yet concludes that there is reasonable certainty in the conclusions. It is assumed that that there is an EDC effect from all wastewater treatment plant discharge (i.e., SRWTP), because the published literature contains reports of various study locations downstream of WWTPs where there are EDC effects. However, the fact that endocrine disruption has been associated with some WWTP discharges does not mean that all WWTPs discharge effluent that causes endocrine disruption. Data suggesting that EDC effects are not unlikely, not significant, or are small part of the POD are understated.

3. It is not possible to review much of the information provided in this document due to incomplete references or referenced material that is not publicly available. References that are not readily available in the published literature should be provided in an appendix to this action evaluation. For example, there are five references to Delta specific studies with EDC components (Baxter et al. 2008, Riordan et al 2008, Brander et al 2008, Johnson pers. comm., and Lavado et al 2009). One of these (Baxter et al. 2008) was missing from the references section and the other four are not published/publicly available.

4. The costs of actions should be included in this Action Evaluation in order to weight cost-benefits. Watershed managers must consider the risks associated with actions, and low-cost/high-worth/low-risk/high-certainty actions should be recommended above those with high-cost/low-worth/high-risk/low-certainty.

5. A significant shortcoming in this action evaluation is the lack of alternative measures to reduce EDCs in the Delta, if they occur at concentrations that are adversely affecting covered species. For example, if effects from EDCs are found in the Delta from WWTP discharges, goals may be achieved in a shorter time and at a significantly lower cost/risk by implementing effective source controls for PPCPs /EDCs (e.g., medicine take back, proper disposal information programs, pesticide use restrictions).

**SPECIFIC COMMENTS**
**Date of Last Revision**

6. The date of last revision, February 19, 2009 is inconsistent with the date in the footer for this document (OSCM 2_5-27-09.doc). The footer implies more recent changes than those in the text. Please correct this inconsistency.

**Action Description and Clarifying Assumptions** "*Implement advanced treatment processes at wastewater treatment plants in the Delta to reduce the loads of endocrine disrupting compounds (EDCs) discharged into the Delta to levels that do not harm covered fish species.*"

7. If the purpose of this action really is to reduce EDC loading in the Delta, then the multiple sources of EDCs should be recognized from the onset. SRCSD suggests moving **Assumptions** (Page 5) to immediately after **Action Description and Clarifying Assumptions. Problems with Action as Written** (Page 5) should also be moved to follow the intended outcomes. This will establish the qualifying statements related to this CM at the beginning, rather than misleading the reader by presenting endocrine disruption in the Delta as fact, rather than as a hypothesis.

   On the other hand, if the intent of this CM is only to implement "advanced wastewater treatment" at WWTPs, this should be clearly stated in this first paragraph. Otherwise it is not clear until Page 5 that implementing advanced wastewater treatment is *hypothesized* to reduce these *potential* EDC loads that have not been demonstrated or shown to cause effects. It should also be stated that simply implementing a treatment without understanding the sources, effects, or the fate and transport holds no guarantee that the goal to reduce potential EDC effects will be met.

**Action Description and Clarifying Assumptions/Outcomes added by evaluation team**

8. The ancillary benefits statement "If you're removing EDCs you're also removing other harmful chemicals…" should be qualified. It is an oversimplification and generalization to assume that "advanced treatment" will reduce all harmful constituents in effluent. There are many possible treatments: some more expensive than others, some more effective than others, some remove specific constituents and some are more generalized, but selecting the right one depends on the goal. Selection of a new treatment process for a WWTP cannot be done without first identifying all goals.

**ACTION DESCRIPTION AND CLARIFYING ASSUMPTIONS/ GENERAL CONCEPTUAL MODEL SUPPORT FOR INTENDED OUTCOMES**

9. The following statement should be qualified as suggested below.

   "*Effluents from municipal wastewater treatment plants can be ~~are~~ significant sources of ammonium as well as complex mixtures of contaminants that affect reproductive endocrine function (Kidd et al., 2007; Huang and Sedlak, 2001 and references therein).*"

10. The following statement should be qualified as suggested below, since the cited authors did not evaluate the removal efficiencies of all treatment processes.

    "*One of the more potent synthetic estrogens found in surface waters is 17 alpha-ethynylestradiol (EE2), a biologically persistent analogue of estradiol that is widely used in oral contraceptives, which ~~is not~~ may not be completely removed by sewage treatment plants (Newman and Unger, 2003).*"

11. The comparability between referenced studies and Delta WWTPs should be indicated (treatment level, population serviced, dilution ratios, ranges of EDC concentrations, species investigated, etc.), perhaps with a table summarizing information (or lack thereof), and/or with a discussion of which studies are based on conditions and treatment processes most similar to those in the Delta, and which are not. This could either be done in **General Conceptual Model Support for Intended Outcomes** where studies are referenced, or identified as data gaps in the **Problems with Action as Written**. These are important factors with potentially significant differences in the potential for EDCs to occur. This information is needed in order to make informed decisions regarding this action.

12. Please provide a complete reference for Newman and Unger (2003).

13. Please clarify that the discussion of pyrethroid insecticides is intended to demonstrate that this action should be inclusive of all EDC sources. The potential for pyrethroids to act as EDCs should also be stated in comparison to environmentally relevant concentrations. Simply stating the effect levels without reference to environmentally relevant concentrations is of limited value. It should be noted that while recent studies by Weston (unpublished) have shown the presence of pyrethroids in Delta WWTP effluents, SRWTP effluent concentrations are well below the lowest cited no-effect level (1.5 ng/L) after dilution. Weston (unpublished) also showed that pyrethroids are infrequently detected in SRWTP effluents at concentrations that may cause effects (~10-100 ppt).

14. Please include the lowest LOEC (lowest observed effect concentration) for pyrethroids in the cited studies. It is inappropriate to use a NOEC to imply a potential for effects. For example, no effect at some very small concentration (e.g., 0.00000001 ppt) doesn't mean that level is the maximum tolerable by a receptor.

15. Please provide a complete reference for Moore and Waring (2001).

16. Please provide a complete reference for Werner *et al.* (2002b). Note that there is also no citation of reference for Werner *et al.* (2002a).

17. Please provide a complete reference for Barry et al. (1995).

18. Please provide a complete reference for Reynaldi and Liess (2005).

19. Please provide a complete reference for USEPA (2005).

20. Please provide a complete reference for Jobling et al. (1998).

21. The following statement should be qualified as shown below, to be consistent with the same statement repeated under the section "Potential Positive Ecological Outcome(s) – Outcome P1: Increased reproductive success of covered fish species".

    *"A recent histopathologic evaluation of delta smelt for the pelagic organism decline study found 9 of 144 maturing delta smelt (6%) collected in the fall were intersex males (Baxter et al. 2008). This ~~is~~ may be evidence that delta smelt are being exposed to EDCs."*

22. Please provide a complete reference for Baxter et al. 2008.

23. Please provide a complete reference for Harshbarger et al. (2000)

**Action Description and Clarifying Assumptions/ Assumptions**

24. Assuming WWTPs are the largest source of EDCs is speculative and the validity of this assumption is not known. A qualitative description of the likelihood that assumptions are correct is needed, with reference to the uncertainties associated with them. For example, it is also assumed that WWTPs are a source of EDCs similar to those where adverse effects are reported in the literature. This assumption is based on published studies reporting EDC effects downstream of WWTPs, but there is lack of consideration for published studies that have not shown EDC effects downstream of WWTPs (e.g., Nichols et al. 1999[4]). The variability in reported results, the potentially large differences in EDC removal efficiencies among treatment processes, and the similarities/differences between WWTPs in the referenced studies and those in the Delta should be considered uncertainties in this evaluation.

25. Please qualify the assumption added by evaluation team as suggested below.

> "*Plant specific information is needed to fully assess the magnitude and certainty of this action for each plant. Even though EDC effects from WWTPs in the Delta have not been proven, ~~E~~for the purpose of this evaluation, the reviewers assessed the potential impact of this action ~~effect~~ if EDC effects in the Delta were hypothetically due to WWTP discharge. T~~his action was then considered for ~~targeted~~ to the Sacramento Regional Wastewater Treatment Plant since it is the largest discharger in the Delta and information on its treatment process was available to the reviewers at the time of this review.*"

Please add the following assumptions:

- It is assumed that EDCs are present in the delta at concentrations that cause adverse effects to aquatic organisms in the Delta, although this fact has not been proven.
- It is assumed that EDCs can be reduced to concentrations in the Delta that cause no adverse effects to aquatic life. This assumption is made without an evaluation describing various "advanced treatment processes".
- It is assumed that other sources do not contribute significantly to EDC concentrations that can cause adverse effects to aquatic organisms in the Delta, although this fact has not been proven.

**Action Description and Clarifying Assumptions/ Problems with Action as Written**

26. Please add the following Problems:
    - There is no specific description of the information needed from WWTPs, how it should be evaluated, and a process for implementing the action.
    - There is not a description of the various "advanced treatment processes", which treatment processes are considered "advanced" by this Action, and a review of the relative removal efficiencies of these treatments. Information that could be used in such a review is found in Stephenson and Oppenheimer (2007)[5].
    - There are no EDC goals/criteria in treated wastewater or TMDLs for receiving waters.
    - There is no description of how/when EDC goals/criteria will be determined so that appropriate treatments can be evaluated/selected/ monitored and success evaluated.

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[4] Nichols, K.M., S.R. Miles-Richardson, R.M. Snyder, and J.P. Giesy. 1999. Effects of exposure to municipal wastewater *in situ* on the reproductive physiology of the fathead minnow (*Pimephales promelas*). Env. Tox. And Chem. 18(9): 2001-2012.

[5] Stephenson, R. and J. Oppenheimer. 2007. Fate of Pharmaceuticals and Personal Care Products through Municipal Wastewater Treatment Plant Processes. Report no. 03-CTS-22UR. Water Environment Research Foundation, Alexandria, VA. 108 pp.

**Potential Positive Ecological Outcome(s) / Outcome P1: Increased Reproductive Success of Covered Fish Species**

27. The environmental relevance and comparability to the Delta should be stated for each General Observation.

28. All sides of a topic are needed for a truly balanced and informed evaluation. Therefore, additional discussion is warranted for information that "refutes or fails to support" a potential positive outcome of the Action.

    For example, additional information regarding the presentation by Riordan (2008) at the Calfed Science Conference (unpublished and unavailable for review) should mention that the observed effects were associated with flow, and were not correlated with suspected EDC concentrations.

29. Please provide a complete reference for Goodbred, Xie, Hemming, Dwyer

30. Please provide a complete reference for NOAA review paper (2002)

**Outcome P2: Reduced endocrine issues (transgender, reproductive, etc.) caused by Endocrine Disruptors in delta and longfin smelt, white and green sturgeon, salmonids, and splittail.**

31. The environmental relevance and comparability to the Delta should be stated for each General Observation, since these Observations are used as a rationale for determining Magnitude and Certainty ratings.

32. Please consider that salmonids are transitory in the Delta and reside in the ocean for the majority of their lives. This should reduce the certainty that any changes made in the Delta will affect anadromous salmonids.

33. The certainty associated with this outcome (3 – medium) is clearly overstated given the lack of Delta specific data and the uncertainty regarding the source(s) and EDC effects in the Delta. The certainty should not exceed 2 (low) for this and other EDC actions.

**Outcome P3: Reduce Effects of Endocrine Disrupting Compounds to Food Web Organisms/Invertebrates.**

34. The environmental relevance and comparability to the Delta should be stated for each General Observation.

35. Please explain the relevance of Oetken et al. (2004) discussions of TBT effects. This only seems relevant when considering EDC sources other than WWTPs.

36. Please explain the relevance of Adams et al. (2008) which discusses chronic toxicity to algae from WWTP effluent with secondary treatment (Adams et al. 2008). The text recognizes that the observed chronic toxicity was not related to EDCs. Secondary treatment plants can also vary greatly in the makeup of discharge, and it is not known if this effluent is at all similar to Delta WWTPs with secondary treatment. The bullet should be deleted if unrelated to EDCs.

37. Please provide a complete reference for Werner et al. (2008). Reference may need to be changed if Werner and Moran (2008) was intended.

38. Please explain the relevance of discussing pyrethroid effects at concentrations not relevant to those discharged in treated wastewater (Werner et al. 2008). Also refer to previous comments on pyrethroids.

39. Please provide a complete reference for Giddings et al. (2001).

40. A magnitude of effects Ranking of 1 (minimal) is recommended). The magnitude Ranking of 2 (low) seems excessive, given the insensitivity and lack of information about effects of EDCs to food web organisms/invertebrates**.**

**Outcome P4: Ancillary Benefits – if you're removing EDCs you're also removing other harmful chemicals (e.g., Methylmercury, personal care products, ammonia, antibacterial, pharmaceuticals, and pesticides.**

41. The lack of an evaluation for Outcome P4 is not helpful. As stated previously - It is an oversimplification and generalization to assume that "advanced treatment" will reduce all potentially harmful constituents in effluent. There are many possible treatments: some more expensive than others, some more effective than others, some remove specific constituents and some are more generalized, but selecting the right one depends on the goal. Considering any potential new treatment process for a WWTP cannot be done without first identifying all the goals.

42. The reader is referred to OSCM 1, 3, 4, and 5 for the information that should be provided here. However, these OSCMs do not provide any listing of the various "advanced treatments", nor do these other OSCMs provide a discussion of removal efficiencies, or any other evaluation of wastewater treatment technologies that could achieve the desired outcomes from this Action.

**Important Data Gaps in Information and/or Understanding**

43. Please include references for the studies described that show intersex in Central Valley Salmon "provided by Bruce Herbold". Also note that salmon are transient in the Sacramento River, so developmental/endocrine disruption in salmon are unlikely to be caused by Delta sources.

44. SRCSD agrees with the research needs identified in this and other sections. It would be of further help to Delta managers if the level of uncertainty and potential significance to the Action/Conservation Measures is described for each research need.

**References**

Please differentiate between the two references for Werner et al. 2008. The text is not clear which one is being cited.

Please complete the reference information for Models Used (e.g., source document, institution document was prepared for, number of pages, etc.) where missing.

Please change the author of several Model Used references from "unassigned". If information has been written then there must be an author. It is also confusing to have multiple citations for "Unassigned 2008".

Please add the following documents that are cited in the text but missing from the References (also noted in previous comments).

Newman and Unger (2003)
Moore and Waring (2001)
Werner *et al.* (2002b)
Barry et al. (1995)
Reynaldi and Liess (2005)
USEPA (2005)

Jobling et al. (1998)
Baxter et al. (2008)
Harshbarger et al. (2000)
Goodbred, Xie, Hemming, Dwyer
NOAA review paper (2002)
Giddings et al. (2001)