From: Michael Chotkowski
To: dan_castleberry@fws.gov
Subject: red flags documents
Date: 04/09/2012 04:45 PM
Attachments: DFG Red-Flag Issues_Comp_4.4.12.pdf
EPA_BDCP_HCP_RedFlags.docx
NMFS draft List of Unresolved Issues MT Final 4-2-12.docx
FWS March 2012 BDCP Effects Red Flags 2012 03 31 updated.pdf

Dan - here's a set of final red flags documents, excepting BR's. I've asked Federico for a replacement copy.

I've got several updated issue papers in my inbox. if you have no objection, I'd like to read through them and get organized before sending you the lot. Probably means sending them tomorrow - hope this works for you.

Mike

DFG Red-Flag Issues_Comp_4.4.12.pdf

EPA_BDCP_HCP_RedFlags.docx NMFS draft List of Unresolved Issues MT Final 4-2-12.docx

FWS March 2012 BDCP Effects Red Flags 2012 03 31 updated.pdf

April 4, 2012

DFG April 2012 BDCP EA (Ch. 5)
"Red Flag" Review
Comprehensive List

This Red Flag review updates and replaces the March 2012 partial/preliminary list. Some of the issues identified here have already been presented to, and are being addressed by ICF. Review of the outstanding Chapter 5 appendices may result in additional red flag issues to be added to this list.

STURGEON

Methodological

- The logic of section 5.5.5.4 (Net Effects) is difficult to follow and does not attempt to prioritize Plan outcomes relative the magnitude of their likely impacts on sturgeon production. The largely Best Professional Judgment discussion seems to miss rough quantification opportunities that might be derived from flow abundance-relationships, adult migration straying rates into the Yolo Bypass, and known survival and harvest rates (as they might, for example, relate to illegal harvest reduction). The conclusions in the paragraph beginning on line 29 seem essentially unsupported.

- The assessment effects seems to turn the notion of uncertainty upside down. In general, the Plan reduces winter-spring outflow, and in some regards Sacramento River Flow. There is a strong historical association between flow conditions and sturgeon production, which the EA seems to dismiss, citing a lack of understanding of the mechanisms underlying the association. This would seem to be a very risky approach from a species conservation point of view, given that the anticipated offsets to the potential flow impact are Plan attributes that address "stressors" that have not been clearly associated with variation in production (e.g. food supply).

- The EA seems to suggest that a reduction in entrainment of juvenile sturgeon at the south Delta offsets (justifies) the effects of reduction in winter-spring outflows. While the statement that "Entrainment of juvenile sturgeon at the south Delta pumping facilities, however, is considered an important stressor for this life stage." may be true, it is not considered to be a more important stressor on sturgeon than reduced winter-spring outflow. Entrainment of juvenile white sturgeon at the south Delta pumping facilities is not a significant stressor, when compared to the loss of winter-spring outflow. Although entrainment of green sturgeon is a somewhat different matter, reducing it in exchange for reducing winter-spring outflow is still not preferred.

- There is a general tendency section 5.5.5.1 (Beneficial Effects) to overstate Plan benefits. An example, can be found in the sentence beginning at line 8 on page

5.5-114, which concludes that Plan-related changes in DCC operations will reduce entrainment and improve the ability of adult sturgeon to cue in on Sacramento River flows. These conclusions seem to ignore that adult sturgeon are rarely entrained, and that overall the Plan substantially reduces lower Sacramento River flows.

Flows

- River flows are important to sturgeon production in the Sacramento River system and Delta, and PP operations are predicted to result in significant occurrences of river flow reduction during the sturgeon spawning and early rearing periods. Reductions are most pronounced in the mainstem Sacramento River downstream of the Fremont Weir and the proposed northern delta intakes, but occurrences of substantial flow reductions are also predicted in more upstream river reaches.

  As identified in the December, 2011 version of Appendix C, the PP is predicted to expose green sturgeon larvae to substantial reductions in July-September Feather River flows in most years. In addition, predicted juvenile white sturgeon migration period flows at Verona are sometimes lower under PP operations, and white sturgeon larval transport flows at Wilkins Slough fall more frequently below thresholds in dry years.

  The collective predicted negative river flow effects of the PP create the risk of a depressive effect on sturgeon production that may not be overcome by more favorable PP aspects (e.g. reduced entrainment, increased food production supply). This suggests the need to modify the PP to reduce the magnitude and frequency of river flow reduction occurrences, in both upstream and downstream areas.

SALMONIDS

Effects Analysis

- Combining all salmonids into one net effects analysis is not appropriate and “averages” out the adverse effects of individual runs. The net effects analysis needs to differentiate between Sacramento and San Joaquin river salmonids; salmon and steelhead; and individual runs of salmon (i.e. winter-run, spring-run, fall and late fall-run).

- Analysis of the reduction in Sutter Bypass floodplain acreage has not been addressed in the effects analysis. This issue has been raised previously and still not been responded to. Data shows that there could be a significant reduction in floodplain habitat in the lower Sutter Bypass based on the preliminary proposal due to lowering the river stage at Verona, which will lead to a direct reduction in Butte Creek spring-run Chinook salmon rearing habitat (and splittail).

- The rationale for the degree of certainty seems unfounded for some of the stressors (e.g. transport flows, flow regulation, and flow-associated habitat (5.5-55-59)). The tables show a high degree of uncertainty regarding the effects of flow on salmon on the basis that there is no quantitative analysis or little applicable literature, which is unjustified.

- Table 5.5-16 is contradictory to the statements made at spring-run egg mortality and winter-run redd dewatering.

Implementation

- The decision on phasing of proposed North Delta Diversions (NDD) intakes needs to be determined. From a fishery management perspective it would be best to build some (e.g., two) of the intakes and operate them prior to building the rest. This phasing approach would allow us to learn and potentially correct any unforeseen issues.

- The timeline to complete the required environmental documentation and permitting for Conservation Measure 2 is much longer than necessary to complete this critical measure. It should not require more than three to five years to complete environmental compliance and an additional two years to acquire the necessary permits.

Upstream

- The preliminary proposal shows a reduction in the end of September storage (cold water pool storage) which is unacceptable and needs to be addressed.

- Winter-run redd dewatering and lower weighted usable spawning habitat in the Sacramento River under the preliminary proposal is not acceptable. This would lead to a significant decline in the population (as estimated by the JPE).

- Spring-run egg mortality in the mainstem of the Sacramento River is near 100 percent during dry and critical dry years. This type of egg mortality could lead to the extirpation of spring-run Chinook salmon from the mainstem of the Sacramento River during one drought cycle.

North Delta Flow

- Reduction in flows below proposed NDD could have significant impacts on the transport flows for juvenile fish species and the upstream migration cues of adults.

- The net effects analysis shows that there would be increased reverse flows in the Sacramento River below the proposed NDD due to the preliminary proposal (5.3-

4, line 10-13), this is not protective and doesn't appear to account for real time operations to minimize these effects.

SJR Flows at Antioch (5.3.1.2.9)

- The continuation of zero and (-) SJR flows at Antioch is not protective of San Joaquin Basin fish. While the PP_ELT and PP_LLT show an increase in OMR and SJR flows due to a reduction in south Delta exports, the continuation of low flows in August and September followed by 0 cfs in October and November and (-) 2000 cfs in December is not protective. Positive SJR flows during this time are important and necessary to cue upstream adult migration, reduce straying, and to help address water quality concerns (e.g., DO and temperature).

Entrainment Issues

- Increasing entrainment in the south delta compared to EBC in dry and critical years is a concern and should be avoided. Due to the lack of discussion on this issue, it leads the reader to believe that there will be more water export than existing conditions under the preliminary proposal.

SMELT(S)

(Delta Smelt, Section 5.5.1)

Methodological

- The paragraph beginning at the bottom of page 5.5-24 (and at other locations in Section 5.5.1) notes that there is no change anticipated in Fall abiotic habitat when comparing the PP with EBC1 (existing condition, sans the Fall X2 RPA action). This may be a problematic PP outcome in the context of a NCCP. Reasonable arguments have been made that recent changes in Delta water management have substantially degraded Fall abiotic habitat conditions, particularly in Falls following Above Normal and Wet water years (roughly half of all years, historically), contributing to the POD condition for delta smelt. This suggests that the "no change" outcome produced by the PP would make it difficult to demonstrate a PP contribution to species recovery.

- The paragraph beginning at line 16 on page 5.5-17 introduces the approach of examining Plan Fall abiotic habitat effects based on Feyrer et al. (2011). The text then goes on to identify several "concerns" DWR and applicants have regarding the approach. This expression of concern is reasonably presented, other than the fact that the similar concerns of other parties regarding the investigations critical of Feyrer et al. are not presented. The overarching "red flag" here is that the key technical concerns surrounding this aspect of the effects analysis are not be addressed in a systematic way, other than through non-collaborative production of "combat science." This approach is not effectively reducing uncertainty about Plan outcomes, and places a particular burden on permitting agencies who will have no choice but to assess the uncertainties and conservatively mold the permits around their perception of uncertainty.

Plan Concerns

- As Figure 5.5-1 clearly shows, the role up for delta smelt is about balancing the uncertain benefits of food, predation, and tidal habitat benefits against the uncertain negative effects of Fall abiotic habitat degradation. This is not a very comfortable assessment for such a key species. Some improvement of the Fall habitat situation would go a long way towards improving the ability of the project to achieve the conserve standard for an NCCP.

- Table 5.5-4 (and other similar tables) shows essentially no existing habitat in the southern Delta. This is counter-intuitive, given that the same southern Delta had lots of smelt in it in the early 1970s. This is part of a general problem that the southern Delta may be getting short shrift in considering potential restoration potential.

(Longfin smelt)

- Population effect of reduced winter-spring outflow identified in the effects analysis.

- On line 11 of page 5.5-48 the text raises the notion of "bottlenecks" between lifestages. The examination of existing data does not suggest the existence of such a population dynamics effect. Age 2 fish appear to be suffering the greatest effects of food limitation, but it is still the case that there is roughly a linear stock-recruitment relationship between the two age classes. It should not be assumed that benefits to one lifestage will not be realized in subsequent stages.

- The conclusion of "no net effect" with "low certainty" found at line 4 on page 5.5-50 does not quite capture the essence of the accompanying analysis. Although the statement is not entirely unreasonable, it does not capture the notion of species RISK when an easily foreseeable negative outcome is matched against a pretty speculative benefit. Whereas it may suffice in the EA to have a best guess as to the net effect of the project, I think the NCCP will have to grapple with the downside risk of a likely flow impact, which is to be offset by reasonable, but highly uncertain speculation about food supply improvements.

- Section 5.5.2 devotes considerable space to discussing the expansion of subtidal ("suitable") habitat and its potential benefits. Given the severe decline in species abundance it seems highly unlikely that expanding the amount of this very general habitat type will benefit the species. To be fair, the Plan characterizes this attribute as only a slightly positive benefit.

Conservation Measure #1 – Water Facilities and Operations

CM1 estimates aquatic life benefits that are not scientifically supported, omits costs and benefits to aquatic life from CM actions, and claims benefits that are not likely to be achieved. CM1 promises results that are unlikely or physically impossible. The inevitable trade-offs needed to achieve multiple goals are not identified (at least not in this CM). Real evaluation of the CM is not possible in the absence of operational descriptions so the role of outflow manipulation, as included in CM1, is unclear. Successful optimization of coordinated water operations requires explicit estimates of aquatic life benefits and costs, as well as water supply reliability costs and benefits.

Aquatic life benefits from northern intake bypass flows are not clear or appear to be minimal. It appears that there is minimal improvement in fish entrainment and loss from operating a new Delta Conveyance because the times and conditions when entrainment effects of present facilities are greatest concern will continue to occur after the Delta Conveyance facilities are operating (since use of the northern intakes will be limited to times of higher Sacramento River flows). At such times, entrainment at south Delta facilities has historically been low. South Delta intake facilities will continue to operate at times when Sacramento River flows are not at higher levels, including conditions when entrainment effects of the south Delta facilities are greatest for T & E species. The northern intakes will only be operable at times when entrainment and loss with the existing facilities have been of less concern.

Estimated environmental benefits from dual diversion points (north and south Delta) will potentially be reduced by issues that are not addressed in CM1. The current trash racks, fish screens and diversion facilities in the south Delta are not proposed to be changed. Invasive aquatic weeds and deferred maintenance have greatly impaired the effectiveness of the fish screens for much of the last 20 years. Redirecting diversions to these facilities will expose fish to the threats of salvage operations and ineffective screens. In addition, the impact of an invasion of Dreissenid mussles into the Delta, specifically to the southern Delta, is not addressed in CM1. The invasion of these mussels is very probable and the southern Delta provides suitable habitat for Dreissenid mussels. Impacts from these mussels on freshwater diversions in the Great Lakes and Lake Mead is informative.

Reoperation of reservoirs may have negative impacts on upstream availability of cold water, in-stream flows and other essential aspects of riverine habitat. In addition, CM1 does not contain a plan for how reoperation of reservoirs for pulse flows will be coordinated. A trade-off implied in the described benefits of the new northern facilities are pulse flows resulting from coordinating reservoir releases with reductions in exports at the northern facilities to produce 'pulse flows' to guide migrating fish. The CM does not identify the potential impacts to aquatic life that may result from re-operation of the reservoirs. Identifying these impacts requires coordination with the operators of these facilities. Such reservoir-based production of pulse flows has been accomplished on the San Joaquin River as part of the Vernalis Adaptive Management Program (VAMP). VAMP required considerable planning and negotiation. CM1 does not identify such a watershed-wide water management approach. Outlining coordination methods for pulse flows would increase the understanding of how pulse flows will occur and their potential impacts, and would improve the probability that pulse flows will have their desired effect while identifying and addressing any potential negative impacts.

Also not addressed in CM1 (or in CM13) is the potential spread of harmful algal blooms (HABs) resulting from reducing exports from the south Delta. CM1 cites reduced exports from the south Delta as a positive benefit of this CM, but it will also provide better conditions for HABs. The balance between multiple ecological impacts needs to be considered.

The claimed benefits of rearing habitat and migratory corridors for lampreys and adult salmon are not supported. [3.4.2.2." ammocoetes may forage for many years in the Plan Area before beginning to metamorphose and migrate towards the sea."]. The information available to us suggests that larval lampreys are found in the Delta only as a result of high flow washouts from upstream. Adult salmon migration will not be improved up the Sacramento by pulse flow associated with operation of the new northern facilities because they are guided by the unique chemical scent of their natal waters, not by pulse flows. ["Most or all of the covered fish species (the juvenile and adult lifestages of Chinook salmon, steelhead, delta smelt, longfin smelt, sturgeon, lamprey, and splittail) are expected to use hydrodynamic cues (e.g., channel flow direction and magnitude) to help guide their movement through the Delta."].

Similar benefits claimed for the migration of adult salmon up the San Joaquin River are more likely since river flows in the season of adult upmigration have in recent years been less than a fifth of the concurrent export rates. Thus, any San Joaquin River water that could reach the bay would likely improve adult upmigration by providing the chemical cues they need but currently do not receive. However, in many years, San Joaquin River inflows are so low in the season of adult migration that reducing exports may not be adequate to establish such a migratory corridor.

Several statements seem to overestimate benefits. For example:
- *"Operation of the new north Delta diversions is expected to substantially improve flow patterns in the south Delta by reducing exports from the south Delta and timing flows in the north Delta to improve Old River and Middle River positive (i.e., northerly) flows."*

Reducing exports in the south Delta will make flows in Old and Middle rivers less negative, but flows in the Sacramento River cannot affect flows in Old and Middle rivers.

- *"Implementation of CM1 will also produce a variety of important benefits that are not closely tied to the protection and recovery of covered species and natural communities. These include restoring and protecting ecosystem health…"*

Conservation Measure #4 - Wetland restoration

Regarding the statement: "Restore tributary stream functions to establish more natural patterns of sediment transport", no description is given of how sediment from tributary streams will be made available for transport. The clearing of the Delta as a result of sediment trapping behind dams has been a large issue for salt pond restoration lower in the estuary. Wetland restoration, especially 65,000 acres, is likely to require a more positive sediment budget than the Delta currently receives. Restoration in some areas is likely to lead to sediment trapping that will deprive other areas of sediment. Combined with sea level rise, restoration may not be possible at the depths proposed or for the plant communities intended.

Conservation Measure #12 – Methylmercury Management

The Problem Statement should briefly describe the diverse sources of mercury into the Delta. CM12 states that mercury in the Delta has been brought there by tributaries that drain "former mining operations in the mountains." And while the measure goes on to reference Cache Creek and the Mokelumne-Cosumnes watersheds, it should explain that the former originates in the Coast Range (the source of cinnabar ore) and the latter originate in the Sierra Nevada (the region where mercury from the Coast Range was brought to amalgamate gold). While these "legacy sources" have delivered massive quantities of mercury to the Delta, new and ongoing mercury discharges/emissions from regional and international sources continue adding to the contaminant burden. These sources include oil refineries in the Benicia-Martinez area, wastewater treatment plants, rural and urban runoff, and international sources, i.e., coal-fired power plants in China[1]. The air deposition of mercury into the Delta occurs in wet and dry phases, and while the fraction of mercury delivered by this route is small compared to waterborne inputs and *in situ* deposits, wet phase inputs might be more reactive and lethal than the other forms of mercury[2]. CM 12 should acknowledge that the sources of mercury into the Delta are diverse, and that controlling the formation and transport of MeHg will be a long-term if not permanent management challenge.

The framework for Project-Specific Mercury Management Plans should be clearer.
For each restoration project, CM12 proposes to prepare a project-specific mercury plan. This seems like a sound approach, but the document should explain how costs will be covered for site characterization. Moreover, CM12 should describe potential roles for DTSC and EPA under their respective State and federal hazardous waste programs (e.g., site characterization, evaluating remedial approaches, cost recovery from potentially responsible parties). The document rightly explains that CM12 will be developed and implemented consistent with the Delta methylmercury TMDL , but fails to mention the ongoing mercury research being done in the Delta by the USGS California Water Science Center[3]. The reconnaissance and characterization work envisioned under CM12 should be closely coordinated with USGS.

Investments should be made in research about the permanent sequestration of mercury.
The measures outlined under CM12 do not seem terribly promising. The actions proposed under *Minimize Microbial Methylation* (e.g., management of water depths and the permanent maintenance of "shallow ponded areas with extensive open expanses to promote frequent wind-driven oxygenation") seem unrealistic, economically infeasible, and unsustainable. Next, under the *Photodegradation* section, the document succinctly explains the chemical processes, but this approach seems to merely transfer mercury from one medium to another without actually solving the problem. To wit: "Once photodegraded, mercury will either be volatilized to the air (Amyot et al. 1994), hydrologically transported, or will become available for methylation once again." The *Remediate…with Iron* section describes an approach that might be consistent with USGS' studies of Low Intensity Chemical Dosing (LICD). Under this approach, MeHg in the water column is treated with Aluminum and Iron coagulants, and the MeHg precipitates out of solution along with dissolved organic carbon (DOC). If this treatment method were to be combined with the restoration of tule-based wetlands, the relatively inert flocculent of mercury and carbon could be permanently sequestered in accreting layers of tidal marsh. The sunken Delta provides ~3.4 B cubic yards of "accommodation space" within which to store carbon and mercury, and the liability presented by subsided Delta islands could be turned into an asset if the space is used for restoring wetlands and trapping these compounds that are harmful to atmosphere and water quality.

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[1] Steding and Flegal. 2002. *Journal of Geophysical Research – Atmospheres* http://www.agu.org/pubs/crossref/2002/2002JD002081.shtml

[2] Wood et al. (2006) concluded that wet deposition contributes ~1% of all Hg entering the Delta. Although this amount may seem insignificant, it is possible that the Hg deposited by wet deposition is more reactive than other sources and therefore may be more easily converted to MeHg and bioaccumulated. In Alpers et al. 2008. Mercury conceptual model. Sacramento (CA): Delta Regional Ecosystem Restoration Implementation Plan. http://www.science.calwater.ca.gov/pdf/drerip/DRERIP_mercury_conceptual_model_final_012408.pdf

[3] http://ca.water.usgs.gov/mercury/index.html

Conservation Measure #14 - Stockton Deep Water Ship Channel Dissolved Oxygen Levels

As with the likely increase in HABs discussed under CM1 and CM13, altered flow regimes due to decreased reliance on the southern delta diversion site is likely to increase residence times in south Delta channels. As suggested under CM1, this may have beneficial impacts on food production in south Delta channels, but this increase in food and longer residence time is likely to increase the incidence or degree of low dissolved oxygen in the Stockton Deep Water Ship Channel. Thus, **CM15 needs to address not only protecting DO levels as they presently occur, but more importantly, as they are likely to be as a result of the suite of conservation measures proposed in the plan.**

The role of DWR and other BDCP project applicants with respect to the San Joaquin River, Stockton Deepwater Ship Channel, Low DO TMDL should be clearly described. This information should include organization names and the actions they take and facilities they own and/or operate as a responsible party to the Low DO TMDL. For example, identify the organizations that are completing the "downstream studies," provide a status update on the completion of the downstream studies and integration with the upstream studies, and describe the current ownership status of the aerator facilities and describe how it may affect operation.

All methods for increasing DO levels in the SDWSC should be described. Costs and benefits of actions to increase DO levels should be estimated and compared. Operating the aerator is not the only way to increase oxygen levels in the channel. Increasing water velocity by adjusting water project operations and releases is another way to increase oxygen levels in the channel, especially during critical periods for aquatic life.

Conservation Measure #15 - Predator control

Expected predation at the new intakes is addressed primarily thought targeted efforts to reduce the striped bass population. Since striped bass are an abundant and wide-ranging species, predator control would have to be instituted throughout their range in order to reduce their impact at areas, like the new intakes, that afford enhanced foraging opportunities for them. Similar efforts elsewhere have had limited success. Such a program would also engender both regulatory and popular resistance as striped bass are a prominent feature of the sportfishing uses of the estuary.

Pikeminnow are a native fish and, as such, seems an unsupportable candidate for targeted destruction.

A more productive approach to reducing predatory impacts at the new facilities would be to incorporate and enhance those behaviors that have permitted coexistence of these predator and prey species for the last 150 years (eons in the case of pikeminnow), i.e., salmonids tend to migrate downriver at night when visual predators like striped bass and pike minnow are least effective; salmon migrate in large groups so that predators become satiated; and salmon may hide in shallow water during daylight hours where predators cannot as effectively forage. Reducing illumination at the intakes during nighttime hours was effective at Red Bluff Diversion Dam. Additional tools that might reduce predation include: provision of shallow, weed-free habitats for salmon to hide in during the day near the intakes; and, perhaps, evening releases of minnows to divert predator attention. Such behavioral tools are more likely to succeed and less likely to produce conflict with other users of aquatic resources. For localized predator control, improved fishing access at the intakes could reduce predation rates in the short term during periods of salmon outmigration.

Conservation Measure #20 – Recreational Users Invasive Species
&
Conservation Measure #13 – Invasive Aquatic Vegetation Control

These two conservation measures accurately describe the difficulties posed by the many exotic species that have invaded the Plan Area. Introduced weeds occupy areas that might otherwise be suitable for target species, provide habitat for invasive fish that prey on target species, and greatly alter the foodweb upon which target species depend. **CM #20 is solely concerned with reducing the spread of new introduced species into the Plan Area and does not address the impacts of species already here or expected to invade soon.** CM #13 is does address the spread of new species as well as plants already in the Plan Area and the reducing the area occupied by those that are seen to have the greatest effect on target species.

The proposed actions have possible downsides that should be explicitly recognized:

1. **Use of herbicides to control SAV is associated elsewhere with increased occurrence and abundance of harmful algal blooms.**
2. Most SAV in the Delta are spread by hydrodynamic processes – i.e. pieces break off and float into new areas. In years of high river flow, floating plants are found throughout the Plan Area. Therefore, **the inspection of boats in the Delta is unlikely to have any impact on the spread and abundance of weeds already in the Plan Area.**
3. Actions to control SAV repeatedly refer to prioritizing "upstream" source populations; in a tidal estuary, the concept of "upstream" has limited utility and could lead to inappropriate priorities.

Neither CM addresses the role of invasive species in the overall BDCP effort. (Perhaps this is done elsewhere?) Some questions could be addressed with information currently available include:

1. What physical aspects of Cache Slough and the freshwater portions of Suisun Marsh prevent the dominance of introduced SAV in these areas? How do areas proposed for restoration compare in these aspects and can restoration be done in a way that inhibits the domination of SAV in newly flooded areas?
2. Is spongeplant likely to make fish screens and trash racks at south Delta diversions less effective? What structural or operational changes will be needed?
3. Are quagga mussels likely to make fish screens and trash racks at south Delta diversions less effective? What structural or operational changes will be needed? What changes/technology have been instituted in large water diversions in the Great Lake that might be transferable?
4. What ecological impacts of quagga mussels and spongeplant can be reasonably expected in the Plan Area?
5. What are the most likely other invaders of this estuary, based on recent invasions in other estuaries that are connected to ours by commerce?

Programs like those described in the CM's cannot be expected to prevent invasion over the 50 year duration of the Habitat Conservation Plan. They can be a valuable tool in allowing time to prepare for likely impacts and in delaying the financial and economic impacts that future invasives might produce. Containment and eradication programs around the world give little reason to expect long-term embargo of aggressive invaders like dreissenid mussels and South American spongeplant that are already in California.

Conservation Measure 22 Avoidance and Minimization of Take of Covered Species

CM22 lacks the level of detail necessary to support CM1. DWR is proposing to build and operate the new Delta Conveyance facilities and detailed information is being provided for this CM. Avoidance and minimization actions related to take of covered species that may occur as a result of CM 1 actions should be identified in a level of detail that supports lead federal agency decision making. That level of detail does not appear to be provided in this document at this time.

NMFS List of Issues Unresolved in BDCP Administrative Draft

(4/2/2012)

This is NMFS' official list of "red flag" issues related to the administrative draft effects analysis for the BDCP. This document replaces in total our preliminary draft document distributed previously. We consider the following to be serious issues that may have the potential to trigger a finding of insufficiency if not resolved prior to final submittal, and/or resolution of the issue may have a significant effect on conclusions, and therefore the overall design of the project. We have also included recommendations for addressing these issues, where appropriate, and we are available and would like to work towards solutions to these issues. We understand that ICF may be already working to resolve a number of these issues, and/or that resolution may be contained in a portion of the documents that have not yet been provided for review.

A more thorough set of "line-by-line" review comments on Chapters 3 & 5 are also being provided to ICF and the IMT.

- **Hood Diversion Bypass Flows**

  The Effects Analysis of the Preliminary Proposal (PP) raises concerns over reduced flows downstream of the North Delta diversions, especially in winter and spring months. These flows relate to:

  A. Increased frequency of reversed Sacramento River flows at the Georgiana Slough junction. The January 2010 PP rules included a provision that north Delta pumping would not increase these reverse flows. Calsim II results provided by CH2M-Hill indicate that the PP will increase the percent of time Sacramento River flows are reversed, causing increased entrainment of juvenile salmonids into the Central Delta. If the frequency of reverse flows increases due to the PP, then the diversion amounts allotted under the PP could not be implemented. The DSM2 analysis of reverse flows in the DPM suggests that tidal marsh restoration in the Delta will nearly offset both the effects of sea-level rise and large water diversions from the Sacramento River, a conclusion which needs much more explanation in the EA (see comment on tidal marsh effects).

  B. Long-term viability of sturgeon populations. There are concerns that Sacramento River flow reductions will impact the reproductive success of white and green sturgeon, which have been documented to produce strong year classes mostly in years with high flows in April and May (AFRP study). We do not know if this has been addressed in revised Appendix C.

  1. Further explanation and analysis of the reverse flow issue.

  2. Work with the Services to find a diversion scheme that is still likely to be permittable after adequate modeling and analysis has been conducted.

- **Salmonid Net Effects**

  All salmonid species are grouped together, with no separate evaluations for the separate ESUs of Chinook salmon or for steelhead. It is important for the net effects analysis to describe individual ESUs/species, and provide full consideration of the life-history diversity and timing exhibited by each ESU/species. We also need the Sacramento River populations and San Joaquin populations for Spring-run Chinook, Fall-run Chinook, and Central Valley steelhead summarized by river basin, prior to the roll-up by ESU/DPS. Steelhead life-history and ecology especially warrant a separate evaluation. "Net effects" is useful for comparing alternative operations, but will not provide the robust effects analysis needed for ESA purposes (see comment on ESA baseline).

  Separate all Chinook by ESU, by San Joaquin and Sacramento populations, and separate steelhead in all analyses and discussion.

- **ESA Baseline, Future Conditions, and Climate Change**

  In order to conduct the ESA jeopardy analysis on the PP, the baseline condition and projections of future baseline conditions, including effects of climate change, need to be re-written to be consistent with the 2009 Biological Opinion and current case law. ESA regulations define the environmental baseline as "the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process." Implicit in this definition is a need to anticipate the future baseline, which includes future changes due to natural processes and climate change. For the ESA jeopardy analysis we add the effects of the proposed action to the environmental baseline to determine if there will be an appreciable reduction in the likelihood of survival and recovery of the species (by reducing its reproduction, numbers or distribution).

Upstream effects associated with climate change need to be in the baseline and future conditions, with any effects of the project (in the Delta or associated with upstream operations) added to that future condition to determine jeopardy. A project proposed in this type of baseline conditions needs to more than offset its effects in order to alleviate a jeopardy finding.

- **Analysis of Water Temperature Impacts**

Lethal and sub-lethal water temperature thresholds need to be examined at a finer scale. Currently the effects analysis relies heavily on a Reclamation water temperature model which can only estimate monthly values, which have limited value for predicting project effects on fish. In addition, the effects analysis has only presented frequencies of temperature threshold exceedances, while the magnitude and duration of exceedance is also very important. We do not know if this has been addressed in revised Appendix C.

1. Provide tables and probability plots of magnitude and duration of temperature exceedances at certain upstream locations, by water year type and month.
2. Technical discussion with Reclamation and CH2MHill about how to post-process data.
3. Investigate the use of SWFSC's Sacramento River temperature model to predict project effects and make hindcasts of empirical temperatures.
4. Investigate the use of the new American River temperature (and storage and flow?) model

- **Assumption of Habitat Restoration CM Success**

In several places, the EA assumes that adverse impacts of the PP will be offset by unsubstantiated benefits of habitat restoration. The EA assumes that all restoration will be successful and work as predicted, with little or no evidence to support this prediction and no attempt to analyze the potential outcomes of less than perfect success.

1. It is imperative to avoid language such as "This conservation measure will...", because the anticipated CM outcomes are based on conceptual thinking, not execution. To be able to comprehensively think through the adaptive management and monitoring plan, implementers need to try to anticipate a range of responses that must be managed in order to be prepared for the uncertainty of the response.
2. Alternative outcome scenarios should be evaluated to bracket the range of possible outcomes from proposed habitat restoration.

- **Overreliance on Real-time Operations and Adaptive Management**

In several places, the EA assumes that adverse impacts of the PP will be fully resolved through the implementation of real-time operations and adaptive management. This may not always be possible. For example, long-term trends towards reduced carryover storage may not be able to be mitigated using real-time operations. How adaptive management might work in this situation has not been fully assessed. There are going to be limitations on what adaptive management and real time operations can accomplish.

Examine recent (five to ten years) real-time management of the cold water pool in Shasta Reservoir to determine both the effectiveness of real-time operations and a range of adaptive management options.

- **North Delta Diversion Effects**

Mortality rates from predation and other screening effects are difficult to predict, as there is a high level of uncertainty associated with predation and other effects on juvenile salmonids. The estimate of <1% loss at all 5 screens is not sufficient without giving additional consideration to higher estimates of mortality (GCID empirical studies showed a 5% per screen loss rate, much higher than the <1% used in the DPM).

1. Bracket the analysis of screen related mortality around a 5% per screen loss assumption.
2. Investigate the use of DWR's hydrodynamic model to assess local flow alterations at the proposed diversion structures, including the creation of predator holding areas. Specific questions are whether the model can simulate on-bank structures and the additional hydrodynamic effects of active pumping.

- **Predator Control Conservation Measure**

We agree that predation is a significant risk factor to the listed species, but the assumed positive results of this CM are questionable and unsupported (see F.5.4.1.4 in Appendix F). As an example, localized control of striped bass may not be feasible as this species exists throughout the Plan area and are highly mobile. Few specific details have been presented on how the CM will be implemented, and an aggressive predator removal program could result in significant incidental take of listed species. Due to the high level of uncertainty, we find it very unlikely that we could rely on this measure for any benefits during the permit process.

Remove this CM measure from the plan, and move it to an experimental research program and link to adaptive management. Reflect this appropriately in the EA.

- **Delta Passage Model**

DPM is used as the sole predictor of smolt survival in baseline and PP scenarios. However, the assumptions, inputs, and results are still being validated and reviewed. The datasets used in this model are very limited and largely based on results from hatchery late-fall run Chinook, which are then being applied to other runs of Chinook.

Continue refinement and development of DPM. Weigh validity of results against those of other models and relationships. The use of Newman, 2003 may be another tool to use for assessing the survival of fall and spring run smolts through the Delta.

- **Deficient Analysis of Fry Passage/Survival**

Because the DPM model is only for smolt sized fish, the salmonid analysis is insufficient as it provides no information on fry-sized salmonid passage/survival**.**

Add qualitative analysis of fry survival based on best available data. Perhaps add time/added mortality to a modified version of an updated DPM model.

- **PTM Runs Inadequately Capture Altered North Delta Hydrodynamics**

PTM model runs did not include conditions in which ND diversions would be at the upper limits of allowable pumping (high proportion of total river flow). The technical memo from NMFS and USFWS highlighted the issue and the resolution to the problem. We will need additional modeling runs to adequately assess ND diversion impacts on salmonid travel time and route entrainment.

Do additional PTM analysis following guidelines outlined in NMFS/USFWS memo.

- **D1641 Export/Inflow Ratio**

Combined north and south Delta exports under the PP exceed the current D-1641 Delta Export/Inflow standard. (The PP calculation method measures Sac River inflow below the North Delta diversions and does not include ND diversions as part of total exports).

1) *Provide summary analysis of differences between PP and EBC by month and water year type using alternate E/I calculations.*
2) *Show resulting flow data for both calculation methods.*

- **Yolo Bypass**

Yolo Bypass has great potential for fisheries benefits, but the current EA may be overstating the benefits without adequate studies or data to support these conclusions. Without project specific plans to help quantify the effects, concerns remain about issues such as sturgeon passage, juvenile salmonid survival under lower flow regimes, ability to get juveniles into the floodplain through notch and reduction of flows in the mainstem Sacramento River to accommodate additional flooding in Yolo Bypass. Also, some races/runs of salmon may not have access to Yolo Bypass.

Provide project specific plans and consider the risks of managing the floodplain under lower flows related to issues above.

- **Channel Margin Habitat**

  Altered flows resulting from the North Delta diversions may result in reduced water levels affecting the percentage of time that current wetland and riparian benches are inundated.

  Compare anticipated water levels under future scenarios with those in the design documents of restored wetlands and riparian benches to analyze potential dewatering of those features.

- **Construction and Maintenance Impacts**

  The EA does not adequately address the potential for adverse impacts on sturgeon, fall-run Chinook adults, and steelhead adults, which are generally present in the project area during the proposed in-river work windows described for construction and maintenance of North Delta facilities.

  Discuss ways of minimizing impacts and implementing mitigation for species not protected by work windows.

- **Tidal Marsh Impacts on Riverine Flow**

  The effect analysis assumes that restored tidal marsh will act to decrease flow reversals, which has not been well explained. It seems that tidal marsh restoration was modeled as a single configuration; there has been no description of that configuration to indicate how they were implemented in the hydrodynamic models. Therefore, there is a lot of uncertainty regarding model results.

  Document changes to hydrodynamic models that were implemented to characterize tidal marsh restoration.

- **Cumulative Effects Show Long-Term Viability Concerns for Salmon**

  The analysis indicates that the cumulative effects of climate change along with the impacts of the PP may result in the extirpation of mainstem Sacramento River populations of winter-run and spring-run Chinook salmon over the term of the permit.

  1) Incorporate operational criteria into the PP that will protect and conserve suitable habitat conditions in the upper river for the species under the 50 year HCP (these operational criteria should be designed to meet the performance criteria in the NMFS BiOp RPA).

  2) Convene a 5-agency team of experts specialized in Shasta operations and temperature management to develop the above described operational criteria.

- **Holistic Estuarine Evaluation**

  The effect analysis should examine synergistic and cumulative ecological impacts associated with reducing inflows to an estuary that is already severely degraded, and discuss the importance that water quantity, quality, and the natural hydrograph have to the ecosystem, as well as the direct impacts on native fish species. So far, the impacts to fish have mostly been examined in a piecemeal fashion (e.g., examining impacts of flow reduction on adult homing).

  Incorporate a holistic evaluation of impacts on the estuarine ecosystem. Include discussion of the importance of water quantity, quality, and the natural hydrograph to the ecosystem, and the direct impact that changes to these conditions have on native fish species.

- **Burden of Proof**

  Deference should be given to known population drivers and documented relationships (e.g., sturgeon recruitment relationship with flows is well documented, though the exact mechanism is not completely understood). Since flow is a key component of habitat for aquatic species, do not assume that it can be substituted for by other actions.

  Do not assume that incremental benefits in a conservation measure will compensate for known population drivers related to flow.

- **Incomplete Analyses and Documentation**

  The full appendices were not released concurrently with Chapter 5 which makes review of the results problematic.

  Provide all appendices/analysis simultaneously so Services can have all pertinent information used in Effects Analysis summaries without having to backtrack weeks later.

- **Insufficient Biological Goals and Objectives**

  The conservation measures are sometimes defining the BDCP species objectives, which is insufficient. 30% juvenile through-Delta survival is not a suitable goal for a 50 year conservation plan.

  The BDCP objectives should be biological, species-level outcomes.

- **OMR Flows Unimproved in Drier Water Years**

  Improved OMR flows under the PP occur during wetter years when OMR is less of an issue for covered fish. PP OMR flows are often worse than, or similar to, EBC in drier years. Sacramento Basin fish are most vulnerable to entrainment into the central Delta in drier years when Sacramento River flows have the potential to reverse and OMR levels are below -2,500 cfs. San Joaquin basin fish are best protected by increased Vernalis flows and/or a HORB which the PP does not address.

  1. Analyze the risk in different water year types and with different flow levels in the Sacramento River.

  2. Implement Scenario-6 to help address the adverse impacts seen under the PP.

- **Non-Physical Barriers**

  Assessment of non-physical barriers is inadequate, and the potential negative effects of predation associated with non-physical barriers haven't been assessed.

  Include analysis of potential adverse effects of non-physical barriers.

- **Carry-over of OCAP RPA's on technological improvements to the South Delta Facilities**

  By not carrying forward technological fixes in the South Delta called for in the OCAP RPAs into the Conservation Measures, we would expect the effects analysis to specifically flag this and analyze it as a degradation to future conditions (as compared to the baseline which should include the RPA improvements).

  Add south Delta technological improvement RPA's to Conservation Measures

- **Feasibility of 65K acres of Habitat Restoration**

  Recent evaluation of land available for habitat restoration indicates potential roadblocks to acquiring all the land proposed in the PP. DWR's own analysis suggests that 65K acres is very unlikely.

  Analyze the potential effects of partial implementation of habitat restoration and incorporate alternative actions or measures to compensate for this possibility.

FWS BDCP Effects Analysis red flags for March, 2012

Elements marked by an asterisk are provisional, and may change after review of the outstanding Chapter 5 appendices.

Issue Area 1: Incomplete conceptual foundation for the Effects Analysis

***The effects analysis deals with the critical concept of <u>uncertainty</u> inconsistently and does not effectively integrate, use, and report uncertainty in the Net Effects.** The BDCP Independent Science Advisors, the National Research Council review panel, the Delta Science Program panel, and we have all commented on the inherent uncertainty in the scientific understanding of certain aspects of the Bay-Delta ecosystem. This extends to difficulty predicting how the ecosystem might respond to BDCP implementation. Uncertainty needs to be used objectively and consistently, and the appendices and Net Effects need to develop and propagate uncertainty through the threads of the effects analysis. Highly important variation in the value and uncertainty of individual conservation measure features will occur over space and time as a function of implementation strategy and other factors. Many of the current conservation measures and issues are, or appear to be, overly simplified or otherwise superficially analyzed. The list includes OMR management, fish-habitat relationships, the habitat-for-flow trade-off, predator suppression, nuisance vegetation suppression, and others. Each of the foregoing issues raises uncertainties that propagate through the threads of analysis and must be reckoned with in the "net" conclusions. To the extent we can form our own conclusions about the Net Effects without having access to all the revised documents, it appears that inconsistency in dealing with uncertainty has resulted in conclusions that overly optimistically predict Preliminary Project benefits for almost all of the target fish species almost everywhere. As such, we are reluctant to rely on the conclusions of the present effects analysis. We await receipt of the outstanding appendices, and look forward to working closely with our partners to provide technical assistance as these matters are resolved.

***A key missing piece from the Analytical Framework document is how the Effects Analysis will be framed in the context of fish population dynamics.** We expected this to occur in the draft Technical Appendix on the subject of fish populations, but that document did not fully analyze long-term and recent population trends in the target fishes. There is clear evidence that most of the covered fish species have been trending downward. The document should clearly and accurately lay out what is known of the foundations of each species' population dynamics (e.g., density-dependent under some circumstances?, trends in carrying-capacity?, etc.) as mechanistically as possible and discuss how BDCP actions will influence these processes. Because the conceptual foundations presented to date do not frame the effects in the context of historical and present-day fish population dynamics and the most parsimonious explanations of their causes, it is unclear how the net effects should be interpreted. We await receipt of the life cycle modeling appendix to complete our review of this issue, and look forward to continuing to work with our partners to help ensure that the best available science is used in the effects analysis.

Issue Area 2: Inadequate conceptual models and analysis of estuarine fish habitat, and project issues resulting from same

***The objectives for restoring habitat addressed in the Chapter 5's Restoration Appendix are simply described, but it is not clear whether the plan will or can achieve them.** The draft Appendix E states that BDCP's habitat restoration has two objectives[1]. The first is to "increase the amount of available habitat for covered fish species." This first objective is reasonable, but does not clearly articulate that new habitat needs to be *good* habitat. We know quite a bit about what determines habitat value to covered fish species. This knowledge is partly reflected in the habitat suitability indices that are currently under development, but is often discounted elsewhere in the Chapter 5 documents. The habitat for BDCP target fishes, and all estuarine fishes for that matter, is fundamentally created by the interaction of tidal and river channel flows with the broader estuary landscape. The Preliminary Project proposes to extract larger volumes of fresh water from the Delta than are currently exported against a backdrop of rising sea level and a re-design of the estuary landscape that will change tidal flows. Whether this can be accomplished while other parts of the plan simultaneously contribute to recovery of covered species is an unanswered question of central importance. Fully incorporating existing science on the interplay of freshwater flow and the Plan Area landscape and its constituent species would provide more accurate and defensible conceptual models for the Effects Analysis. We also suggest consulting the Department of Interior Adaptive Management Technical Guide and other adaptive management resources on the role of (potentially conflicting or alternative) conceptual models in the adaptive management process. We look forward to working with our partners and providing technical assistance toward the resolution of this issue.

The second objective is "to enhance the ecological function of the Delta." This formulation is not clear. The Delta provides multiple ecological services, and alterations to different parts of the Delta may potentially contribute to them in different ways. There have been several large-scale, unintentional or quasi-intentional "wetland restoration projects" in the Bay-Delta since 1920. These

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[1] We note that these objectives are more akin to goals. They are not at present specific enough to function as objectives in the context of performance evaluation or adaptive management.

include Franks Tract in the 1930s, Mildred Island in the early 1980s, Liberty Island in the latter 1990s, and Napa River marsh in the past decade to name a few. There is also the seasonal fish habitat generated by large-scale floodplain restoration along the lower Cosumnes River that started in the mid-1990s. The draft appendix never mentions these events or synthesizes what is known about them. This is a critical aspect of the analysis, and needs to be done credibly. We believe these "unintended experiments" provide useful lessons in what we may expect from actions on similar spatial scales in similar circumstances in various restoration scenarios.

A close look at the estimated elevations of restored habitats shows that much of the acreage is not at intertidal elevation and thus will not readily produce the dendritic channel mosaics on a tidal marsh plain that are frequently espoused in the appendix for their fish production benefits. Particularly by the late long-term, there is a lot of the subtidal habitat types in the model outputs[2]. We do not know if unintentional habitat restorations that have occurred have increased the productivity of the Delta beyond what it would have been without them. In a pure carbon-productivity sense they might have – because productivity is just creation of biological carbon per unit of time. However, these and other "wetland restorations" have not noticeably increased the capacity of the Delta to produce BDCP-covered native fishes. As achieving this is a key premise of the BDCP, understanding these examples and learning from what has happened in each case is a matter of great importance. We look forward to providing assistance to our partners as these comments are addressed.

***The modeling shows a gain of shallow, intertidal habitats in the Plan Area by the early long-term, which is a goal of the BDCP. However, it also shows that there is a net *loss* of intertidal habitat and a large increase in deep water habitat by the late long-term.** The Bay-Delta is not currently limited in terms of deep water habitats, and some relevant historical experience suggests deeper off-channel habitats are likely to be more favorable habitat to exotic species than to natives, so an increase in the depth of restored habitats does not appear to be a desirable outcome. Thus the benefits attributed to creating the proposed habitat acreages may be quite optimistic. We look forward to providing technical assistance on this issue; a good start would be a more in-depth investigation of the expected depth distribution in potentially restored areas in the early and late long-term time periods.

***The effects analysis underemphasizes Bay-Delta water flows as a system-wide driver of ecosystem services to the San Francisco Estuary.** While climate and associated hydrology affect the magnitude of watershed runoff, system hydrodynamics downstream of the big dams (e.g., exports, OMR flows, X2, gate operations, etc.) are largely driven by coordinated water operations. All of these

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[2] It may be possible to manage subsided lands to raise them back to sea-level so that they can support self-sustaining intertidal marshes. However, that process can be very slow and the full realization of potential physical morphology could take many decades.

influence the habitats and population dynamics of listed species. It is critical that the BDCP effects analysis identify changes in operations that will importantly alter hydrodynamics, and address in depth the dependency of the ecosystem and its constituent species on flows. Reduction of flows (in full consideration of timing, magnitude, variability) is the most fundamental cause of stress and driver of change to the fishes and food web that have adapted to the tidal and freshwater mixing environment that is the Bay-Delta ecosystem. In addition, some of the other stressors listed and assumed to be addressed through the conservation measures are either directly or indirectly influenced by Delta inflows, exports, and outflows. Until the roles of flows and flow alteration, for which there is substantial literature, are adequately represented in conceptual models and developed in the effects analysis, we are reluctant to rely on its conclusions. We look forward to providing technical assistance on this issue as it is resolved.

***The Low Salinity Zone (LSZ) is a dynamic habitat defined by the tides and freshwater flow that requires a globally tailored conservation strategy.** It is widely recognized that estuarine habitat suitability is driven by the interaction of a flow regime with a brackish, tidally influenced landscape. Changing this interaction by reducing outflow can set a series of ecosystem changes in motion that degrade expected ecological services. In the Bay-Delta, both the flow regime and the landscape are highly altered, and the Preliminary Project proposes new changes. It is well established that variation in Delta outflow or X2 is correlated with many important ecosystem processes and the abundance or survival of estuarine biota. It is also well established that the most important mechanisms and seasons for species that use the LSZ vary. Chapter 5 does not directly grapple with the conservation implications of these and other relevant facts, arguing that the *mechanisms* causing flow effects on certain fish species are not "well-understood". But the phenomena of species-flow responses are well-developed in the scientific literature. Unless there are concerns about the adequacy of the underlying data, which there may be, flow relationships developed in the scientific literature should be used as the initial basis to predict the effects of changes in flow regime. The effects of flow regime on species and ecosystem processes in the LSZ have been an important subject of study for a long while, and, in addition to their role in the water operations consultations form part of the basis for regulatory processes underway or contemplated by the State Board and EPA. We look forward to working with our partners on resolving the framing of the LSZ habitat analysis.

***The Low Salinity Zone (LSZ) is the primary habitat for delta smelt and the primary rearing habitat for larval longfin smelt and juvenile to adult splittail.** The Preliminary Proposal modeling indicates that Delta outflows during February-June will more frequently be near the minima required by the SWRCB under D-1641. This will represent a substantial negative project effect on longfin smelt. The effects analysis and Net Effects only partly address this issue, reporting that Preliminary Project is expected to provide a large, positive impact to food resources that will offset the negative impact to "transport flows". But there are multiple mechanisms by which

Delta outflow can affect longfin smelt recruitment; transport flow is only one of them. Transport flows might be managed via gates or other engineering solutions. The other mechanisms for which there is stronger scientific support are kinetic energy mechanisms (low-salinity zone habitat area and retention from gravitational circulation in the estuary). The problems that reduced outflow creates by changing these processes do not have reasonable engineering solutions, and at present appear to be manageable only via outflow. Thus, although some of the potential impact of outflow reductions is reported, the analysis is too narrowly focused.

Both projected sea level rise and the Preliminary Proposal are also anticipated to cause the average location of X2 to move upstream during the summer and fall. The modeling indicates that intra-annual variability would be lost for several months in the late summer and fall in all water year types; even wet years would functionally become dry years for a third of delta smelt's life cycle. The effects analysis acknowledges this result, but the Net Effects concludes that habitat restoration and food web enhancement will greatly offset this loss of habitat value. The conclusion is in part speculation and in part does not reflect current scientific understanding.

This has several implications for delta smelt. First, under the preliminary project delta smelt habitat would less frequently lie in Suisun Bay and Marsh during summer and fall. The habitat suitability modeling shows that this would limit the capacity of tidal marsh restoration in the Suisun region to contribute to delta smelt production. Second, lower summer outflows would increase the length of time that seasonal delta smelt habitat constriction occurs and overlaps with physiologically stressful water temperatures. This means that more food production would be required to maintain current delta smelt growth and survival rates, even in areas where temperatures remain suitable. In areas where temperatures exceed physiologically suitable levels during the summer ($\sim 24^0$ C), no amount of food production will increase growth or survival rates. Third, the restricted distribution of delta smelt during most summers and essentially all falls would increase the chance that a localized catastrophic event could pose a serious threat to the survival of the delta smelt population.

Turbidity is another important component of delta smelt habitat suitability. Section C.4.1.4 ("Turbidity") states: "[f]irm conclusions regarding changes in turbidity in the BDCP Plan Area are difficult to make." But some large-scale changes in sediment fluxes might affect turbidity on scales important to smelt, and should be straightforward to analyze. The Sacramento River is the most important contributor of sediment to the Bay-Delta. According to the Effects Analysis it contributes an estimated 80% of its load during high flow events. The North Delta diversions in the Preliminary Project have the ability to take up to 15,000 cfs during high flow events. For a 70,000 cfs event, this could be 20% of the Sacramento River water including its suspended sediment load. The effects analysis makes no attempt to analyze how much sediment loss per year that would represent and whether it would change the ratio of supply to loss of sediment from the estuary. The same calculations should be done for the south Delta to give the results full context.

In summary, the current Effects Analysis does not appropriately deal with critical issues involving the role of the Low Salinity Zone as habitat for longfin smelt, delta smelt, and splittail. Until it addresses the right questions regarding flow, LSZ location, and turbidity, we are reluctant to rely on its conclusions. We look forward to working with our partners as these issues are resolved.

***There is no reason to expect that invasive vegetation will not proliferate in the East and South Delta ROAs, and no reason to expect a meaningful increase in south Delta turbidity if vegetation could be successfully controlled.** There should not be an a priori assumption that SAV can be controlled via ecologically sound methods in the east, central and south Delta. These are comparatively low turbidity, high vegetation areas already, under the existing hydrodynamic regime. There is nothing in the Preliminary Proposal that would dramatically change channel geometry, increase SJR flows, or increase sediment inputs that could be expected to change the turbidity of the entire southern half of the Delta.

***Chapter 5 is deficient in its descriptions of channel margin, riparian, and floodplain habitat restoration outside of Yolo Bypass**. The Yolo Bypass tends to benefit native fishes because (1) it floods frequently with major inundation events; (2) it floods during times of year that BDCP target fishes can, and have evolved to, use it; and (3) upon drying it leaves very little permanent habitat for non-native fishes to colonize and reproduce in, because most non-native fishes are late spring/summer spawners. The original habitat analysis attributed seasonal floodplain benefits along the San Joaquin River that we do not believe are plausible; however, we understand there is now general agreement on this point and we will not comment on it further. However, the Sacramento River from Sacramento to about Rio Vista is also highly constrained, in this case by levees rather than regulated hydrology, and there are strict flood control capacity requirements that are enforced by USACOE. The effects analysis does not describe how this constrained reach of the river can support the proposed changes, where they will be, or assess their feasibility.

***Increased residence times and reduced flushing of the Delta by Sacramento River water appear likely to result in interior-Delta channels that are further dominated by agricultural runoff, invasive aquatic vegetation, warmer temperatures, and increased algal productivity with its associated dissolved oxygen swings.** These environmental conditions favor non-native/invasive species (e.g. *Egeria densa*, largemouth bass, water hyacinth, *Microcystis*) and disfavor native fishes. The Delta is already more biologically similar to a lake than it once was, due to the historical accumulation of human modifications. We expect that by reducing Delta flows, the Preliminary Project would likely facilitate the spread of habitat conditions that are unfavorable to delta smelt, and and less favorable to other target fish species survival and recovery.

Issue Area 3: The Effects Analysis relies on selective use and interpretation of statistical and mathematical models

***The effects analysis did not use the available splittail life cycle model at all to support its Net Effects conclusion.** There is a published stage-based life cycle model for splittail where the effects of various environmental variables were examined for their effects on long-term trajectory of population abundance. This model helped frame the preferred time-interval for floodplain activation necessary to ensure splittail persistence in the Central Valley. This available approach to an Effects Analysis for a listed species of native fish was not discussed in the present Effects Analysis.

***The effects analysis did not use the best available longfin smelt statistical models to support its net effects conclusion.** The newest published statistical analyses of longfin smelt are quasi-life cycle models that account for prior abundance and spring flow influences (among other factors) on this species. These models were discussed and discounted as not being 'life cycle models'. Dismissing them because they are not 'life cycle models' is unhelpful: they are the best available scientific tools to evaluate project effects on longfin smelt. The older regression models that were used in the effects analysis are published, but can easily be shown not to perform as well as the newer models. The older models also average the flow influence on longfin smelt across half a calendar year, which likely affects conclusions about the reduction in springtime outflow seen in modeling outputs for the Preliminary Proposal. We look forward to working with our partners and providing technical assistance as this issue is resolved.

***The effects analysis continues to insist on an analytical approach to entrainment that does not reflect the best available science.** The current Draft Effects Analysis (as of September 13, 2011) downplays the potential effects of entrainment to the delta smelt population: (e.g., Section B.1.1.1), "[H]owever, analyses to date have not found correlation between entrainment and population level responses of delta smelt ..." The delta smelt population is now at historically-low abundance and population losses due to entrainment may have significant population effects depending on their magnitude and frequency. While it is true that some regression-based analyses have failed to reveal an export affect to the delta smelt population, other approaches that more effectively investigate the role of fish distribution to entrainment have revealed an important relationship between water operations and the risk of population-level entrainment effects to delta smelt. Kimmerer (2011) demonstrated that entrainment losses averaging 10% per year can be "...simultaneously nearly undetectable in regression analysis, and devastating to the population." We look forward to working with our partners to ensure that the best model-based analyses of proportional entrainment for both South- and North-Delta diversion facilities are brought to bear to resolve this issue.

***We think that the delta smelt state-space model is a useful framework to explore hypotheses about what drives delta smelt abundance.** However, the Maunder-Deriso model is a new application that needs additional collaborative work before it reaches maturity. We are concerned that the present model may have identifiability problems, as we discussed in our technical comments last fall. Until that concern is resolved, we are unsure whether the parameter estimates developed in that model represent what they are described to represent. We are also unsure why the model uses the official DFG Fall Midwater Trawl Abundance indices for delta smelt, but does not use the official DFG Summer Townet Survey or 20 mm Survey abundance indices. The rationale for this (which may be simple) is not explained. The model also assumes a specific form of density dependence between generations. We have questioned the appropriateness of this choice, because on very thin ground it limits the universe of plausible explanations for delta smelt reproductive success that can be derived from the model.

The intent of this new model was to explain a specific historical dataset, and other than some broad assumptions it does not contain much of the mechanism presented in current delta smelt conceptual models (like DRERIP, or POD conceptual model, or the Fall Outflow Adaptive Management Plan conceptual model). The published version of the model used data through 2006. The model was updated for the Effects Analysis to include data through 2010. When this was done, the model fit deteriorated dramatically relative to what was reported in the paper. While this does not (at all) cause us to think it should be discarded, it does underscore questions about the maturity of the tool. The current model's success in fitting a specific set of historical data may not translate to good predictions of the the effects of flow and habitat change. The current model may perform still more poorly when CALSIM II water operations outside the envelope of historical experience are used as input.

It is important for the Effects Analysis to acknowledge that some data that may prove to be essential to modeling delta smelt or longfin smelt dynamics have been collected only recently. There are a number of studies now underway that address questions about fall outflow processes and delta smelt ecology as a whole. The novelty of the Maunder-Deriso model, and existence of other tools and analyses taking a process-oriented approach to to predicting the effects of flow and habitat changes, make the framing of the effects analysis very important. It is equally – possibly more – important that uncertainty at all levels be properly developed and acknowledged. Achieving these things, which are important to having an effects analysis we can rely on, will require work and a willingness to adapt on the part of ICF. We look forward to continuing to work with ICF and our other partners to ensure that the best science is identified and used defensibly in the effects analysis.

Issue Area 4: The BDCP's net effects conclusions rest on an equivocal food web conceptual model

***The FWS agrees that the pelagic food web that historically supported greater abundance of estuarine fishes including longfin smelt and delta smelt has been impaired and that contributing to its restoration is a key component of a conservation strategy for the Bay-Delta.** However, food limitation is a ubiquitous feature of ecology in the Bay-Delta. It affects non-native species as well as the BDCP target species. Thus, the issue is not really "food limitation" *per se*. Rather, the issue is food web pathways and the number of steps in a food chain between primary producers (phytoplankton and plants) and the BDCP covered fishes. For the smelts, the desired food pathway would be dominated by this short food chain: diatoms → calanoid copepods and mysids → low-salinity zone fishes. The short food chain outlined above dominated the historical low-salinity zone food web. Longfin and delta smelt are highly dependent on it (and minor variations of it). The other BDCP target fishes also use it, but have more generalized diets that often include benthic organisms and riparian and floodplain insects. The draft appendix has a very long section on food web changes when a simpler summary of the major points would be more effective.

The focus of food web restoration in the effects analysis is on floodplain and tidal marsh restoration. The production of diatoms may have been limited by disconnecting floodplains from their rivers and by reclaiming tidal marshes. These are the primary hypotheses behind the BDCP habitat restoration conservation measures. However, the two best-substantiated drivers of diatom suppression are overbite clam grazing and ammonium concentrations in the estuary. The suppression of diatoms is hypothesized to have provided a competitive advantage to lower quality primary producers and primary producers like *Egeria densa* and *Microcystis* that have virtually no food web value to the BDCP target fishes. This change in the base of the food web has reduced the amount of fish production that can be supported by the historical diatom-based food chain, and forced the fish to rely on other longer and more energy-limited food pathways. Longer food chains are less productive, and do not support as many fish. Because splittail and young Chinook salmon are the covered species that most extensively utilize floodplains and tidal marsh networks, they should be expected to gain the greatest food web benefits that restoration of these habitats can provide. However, this is not what the Net Effects concluded. Rather, it concluded that habitat restoration would provide *greater* benefit for the smelts despite their limited overlap and more restricted diets.

Shortcomings in the Net Effects resulting from mischaracterization of processes limiting transfer of production in new habitat areas to native fish biomass renders the present analysis inconsistent with best available science, and we are reluctant to rely on it to judge the design of the preliminary project. As with other modeling issues, we look forward to working collaboratively with our partners as these issues are resolved.

Issue Area 5: The analysis and interpretation of BDCP are hindered by indeterminate model baselines and related issues

***A key point of continuing analytical confusion is the use of multiple baselines**. The current set-up for the BDCP employs two 'base case' model runs (EBC1 and EBC2). The EBC1 does not include the full suite of elements in the current FWS and NMFS OCAP RPAs. The EBC2 attempts to include the RPAs in their present-day form, but it does not accurately capture them all. There are numerous cases in Chapter 5 where it is not clear what Project model result is being compared to which baseline condition. This generates confusion. We look forward to continuing to work with our partners to be sure that baselines used in the effects analysis are appropriately constructed and are used clearly and correctly.

***CALSIM II demand representation in 2060 studies should have some justification.** Some explanation for, or error estimate of, assuming a 2020 level water demand for a 2060 climate change simulation should be made. Presumably portions of the State (Southern California, the American River Basin, etc.) are going to continue to grow through 2060. Some estimate in the change of cropping patterns over the 40 years (2020 – 2060) should also be made (or at least a write-up of why it cannot be made) should be included. Without clear resolution of this issue, it appears to us that the modeling may underestimate water demand in the late long-term. We are unable to provide technical assistance on this issue, but look forward to its resolution.

***The proposed restoration in each "Restoration Opportunity Area" (ROA) is only compared against the lands bounded within the ROAs, which themselves lie in larger regions**. These comparisons of present-day ROA habitat to future ROA habitat are inappropriate – especially in cases like the east and south Delta ROAs, which are currently dry land. Mathematically, if a terrestrial habitat is subsequently flooded, the improvement for target fishes increases by an infinite percentage even if the habitat performs poorly because a habitat suitability index that is even a tiny fraction of 1 is still infinitely higher than zero, which is the suitability of dry land to fishes. Habitat analyses need to be based on comparisons against currently available aquatic habitat acreages in the entire regions containing the ROAs. They also need to be synthesized and integrated into Plan Area-wide totals, with river flow and climate changes incorporated, in order for the analyses to be meaningful.