April 3, 2013

# U.S. Fish and Wildlife Service Staff BDCP Progress Assessment

In April 2012, the Fish and Wildlife Service (FWS) submitted our "red flag" comments regarding the previous draft of the Bay Delta Conservation Plan (BDCP). These comments were developed by agency staff to identify those issues that may require significant changes to the BDCP and would need to be resolved prior to formal submittal of the draft plan. Since then, FWS has worked closely with the State and its consultants on the details of the revised BDCP. The following is a staff re-assessment of the materials provided to FWS in the December 2012 Administrative Draft BDCP document and Section 5.5, which was submitted to FWS in February 2013. Additional draft materials were subsequently submitted to FWS on March 1st. We have conducted an initial review of the March 1st materials to confirm that all of the following comments are still applicable, but because of the large size of the BDCP and our desire to provide this review in a timely fashion there may be issues with the March materials that we have not fully sorted out yet.

We would like to acknowledge the very significant improvements and progress that have been made in the development of the effects analysis and the plan itself over the past year. DWR has substantially amended the proposed plan by reducing the number of planned intakes and overall capacity, and the new project description includes a set of operating criteria (called the "high outflow scenario" in the BDCP) developed with FWS advice that improves on the historical baseline flows. The changes in the "high outflow" operating criteria are in direct response to our previous comments and are critically important to providing for covered species needs.

Goals and objectives are another area where the BDCP has made a great deal of progress. The draft is not perfect, and we note below that a few very important fixes are needed, but in general the goals and objectives articulated in the plan are conceptually sound and appropriate for an HCP of this magnitude and proposed duration. Goals and objectives are the foundation on which the BDCP must be built, so the cooperative progress that has brought them to their current state is very significant.

Our staff have experienced excellent cooperation and coordination with the project consultants (ICF International) along with the other planning agencies. There has been significant improvement in the expanded analytical methodologies used in the effects analysis, and many technical and policy issues have been resolved or partly resolved. Many other technical and plan component issues are currently in active discussion, and we are optimistic they can be resolved with additional time, technical resources, and independent peer review. We look forward to continuing our close collaboration with all of the involved parties to resolve remaining issues and complete this planning process.

This document is an update to the "red flags" document we provided to DWR in April 2012. The first section provides an assessment of the progress that has been made in addressing the April 2012 FWS "red flags," and reflects our review of the December 2012 draft BDCP document, which in many cases was also informed by the Delta Science Program Independent Panel (DSP IP) review last summer. We have numbered the issues and, where appropriate, edited the update to reflect our initial review of the March 2013 BDCP. The format below shows our comments from last April *in italics*, followed by our updated assessment of these issues. We made a few very minor edits to the original comments for clarity. Because our review has been informed by the Delta Science Program independent panel's "phase II review" findings, we have also commented on the degree to which the current BDCP is responsive to the panel's recommendations.

The second section of this document describes several new comments and issues resulting from our review of the current draft of the BDCP (the December 2012/February 2013 version of the document or Admin Draft). These new major concerns highlight key areas of the BDCP that will need to be addressed between now and the time the plan and accompanying materials are submitted to us as a complete application under section 10 of the ESA. We have provided, where possible, suggestions for addressing these comments and are committed to working closely with our State and Federal partners to find resolutions to these issues. We view these comments as critical to the completion of a successful planning effort and generally they should be viewed as very important for resolution, preferably prior to issuance of the public draft.

We are providing detailed technical comments and edits in "track changes" format for several chapters of the BDCP directly to the State and its consultants. We did not provide "track changes" edits to sections 3.4 (decision tree element), 3.6, 6.4, or 7.3.4, each of which is the subject of a comment in this document. We believe it would be more efficient to discuss resolution of issues in those sections with our partners as we move ahead.

In summary, we note very substantial progress has been made, and we look forward to continue to work collaboratively with all parties towards timely completion of this ambitious plan.

PART I: UPDATE TO "RED FLAGS" DOCUMENT

**Issue Area 1: Incomplete conceptual foundation for the Effects Analysis**

**1.1. The effects analysis deals with the critical concept of uncertainty inconsistently and does not effectively integrate, use, and report uncertainty in the Net Effects.**

<u>Original comment:</u> *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 within 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.*

March 2013 Update: The revised documents have improved treatment of uncertainty in some areas, but this comment remains a critical issue. The assessment of restoration effects remains incomplete and optimistic, as we describe as a separate issue. Elsewhere, most of the treatment of uncertainty remains informal and qualitative, including descriptions of alternative hypotheses, sentences stating the degree of uncertainty where professional judgment is relied upon for the Net Effects, etc. The Service thinks the following additional specific changes should be incorporated to better address uncertainty in the EA:

1. We are satisfied with the structure and general approach of the HSI-related analysis, but deployment of the model is restricted in scope and represents only one possible choice of input values. In order to more fully explore the possible range of outcomes, additional input value choices should be (including minimum, median, and maximum values – in addition to those values included until now). In other words, the HSI procedure should be repeated with less (and more) optimistic estimates of restoration/creation performance (similar to the fall X2 analysis in Appendix 5C). Note: the GAM analyses that underlie some of the predicted delta smelt responses to habitat gradients were already "liberal" in that they used presence-absence instead of density (Kimmerer et al. 2009). Therefore, approximations to these curves for the HSI should not extend outside the GAM data because doing so generates a modeled species response that is inconsistent with the actual trawl data.

2. The HSI-based analysis does not appropriately allow for habitat restoration to have net negative effect on covered fish species, which is a possible outcome. The HSI-based approach rates outcomes on a scale from 0 to 1. In the context of the "net effects," this means that no project or CM will ever be detrimental; the worst case is no effect. Given uncertainties about the paths and outcomes of restoration and

habitat creation, the analysis should acknowledge that some projects might be detrimental to the overall outcome (see comments, below, regarding unintentional deep-water habitat creation like Franks Tract and Mildred Island). Additionally, where variability could be introduced into the HSI analysis we sometimes find the estimates to be biased upward in favor of habitat restoration success in the future (for example, the HSI-estimated egg-larvae life stage suitability curve using the GAM-based method is up to 50% more optimistic than the sample-based data would suggest it should be – see Figure E.4-4).

3. Use of a more sophisticated splittail Habitat Suitability Index; the current one only uses depth as a determinant of splittail habitat suitability. We do not find the argument compelling. Splittail migrate to different habitats to complete different parts of their life cycle, so there must be additional factors that define habitat suitability for fish of different ages. There is information on splittail temperature limits, salinity distributions, seasonal timing of occupancy of particular regions, etc. in the literature.

4. The Net Effects summary graphs should include "uncertainty bars" that are larger when uncertainty is higher and smaller when uncertainty is lower so that both expected magnitude and confidence in the conclusion are simultaneously conveyed. The Delta Science Program independent panel's 2012 report suggested some ways to approach this.

We have also provided extensive track change edits and bubble comments in both Chapters 3 and 5 that we think will improve the document further and provide a basis for discussions to resolve these issues. Adoption of these recommendations will help the EA better respond to Recommendation 13 of the June 2012 DSP Review Panel.

**1.2. A key missing piece from the Analytical Framework document is how the Effects Analysis will be framed in the context of fish population dynamics.**

<u>Original comment:</u> *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.*

<u>March 2013 Update</u>: Chapter 5 has made some improvements in its depiction and use of fish population dynamics, but this remains a critical issue. One example is the use of the longfin smelt model provided to ICF by USFWS last fall. The track changes edit of the Fish

Life Cycle Models Appendix 5G pdf provided by ICF seems to have entirely edited out the descriptions of the Maunder and Deriso (2011) and Miller et al. (2012) statistical life cycle models. We want to clarify that we did not ask for such a change to be made and do not think it is necessary or appropriate to strike descriptions of these analyses from the supporting materials for Chapter 5.

We will use this opportunity to clarify that the IEP monitoring program has decades of relative abundance data for covered fish species – some examples of which are summarized in Table 2A.1-1. These data sets are the bases for the Maunder and Deriso and Miller et al. analyses, as well as all other population assessments that have preceded them. The Service thinks the following additional specific changes should be incorporated, preferably into Appendix 5G, and then used to provide an objective foundation for the Net Effects:

1. 20 mm, Summer Townet Survey, Fall Midwater Trawl, Spring Kodiak Trawl, and Suisun Marsh abundance indices for delta smelt
2. Normalized salvage density time series for delta smelt
3. Scatterplots showing the relationships among these indices
4. Description of what is implied by these relationships and objective summaries of the factors that the following authors have explored to explain them (Stevens and Miller 1983; Jassby et al. 1995; Kimmerer 2002; Bennett 2005; Kimmerer et al. 2009; Mac Nally et al. 2010; Thomson et al. 2010; Maunder and Deriso 2011; Miller et al. 2012)
5. 20mm, Fall Midwater Trawl, Bay Study Midwater Trawl, Bay Study Otter Trawl, Spring Kodiak Trawl, and Suisun Marsh abundance indices for longfin smelt
6. Normalized salvage density time series for longfin smelt
7. Scatterplots showing the relationships among these indices
8. Description of what is implied by these relationships and objective summaries of the factors that the following authors have explored to explain them (Stevens and Miller 1983; Jassby et al. 1995; Kimmerer 2002; Rosenfield and Baxter 2007; Kimmerer et al. 2009; Mac Nally et al. 2010; Thomson et al. 2010)
9. Fall Midwater Trawl, Suisun Marsh, Chipps Island, and USFWS Beach Seine abundance indices for splittail
10. Salvage density time series for age-0 and age-1 and older splittail – *these should not be normalized as they are an abundance index of themselves*
11. Scatterplots showing the relationships among these indices
12. Description of what is implied by these relationships and objective summaries of the factors that the following authors have explored to explain them (Meng and Moyle 1995; Sommer et al. 1997; Kimmerer 2002; Moyle et al. 2004; Feyrer et al. 2006; Kimmerer et al. 2009).

These fixes will broadly help to address the 2012 independent panel review recommendations, including 1, 3, 5, 10, 13, and 15. These fixes would also provide the Service with the basic status and population dynamic trends for the covered species which we need to include in permit documents.

**Issue Area 2: Inadequate conceptual models and analysis of**

**estuarine fish habitat, and consequent project issues**

**2.1. 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.**

Original comment: *The draft Appendix E states that BDCP's habitat restoration has two objectives1[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 quality 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 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*

[1] 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.

*benefits. Particularly by the late long-term, there is a lot of the subtidal habitat types in the model outputs2[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 larger populations of 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.*

March 2013 Update: The BDCP has benefited from the addition of a version of operations (the "high outflow scenario") that includes improved Delta outflow during the spring and fall months to benefit delta smelt, longfin smelt, green sturgeon, and other species. The Service worked with DWR on this version of operations and believe it would provide better conservation outcomes for covered fish species than the other three versions presented in the project description. With regard to off-channel habitat restoration, the revised Chapter 5.5 has improved regarding its acknowledgement about the uncertainty in landscape restoration; however, critical issues in the original critique that are central to the success of the BDCP remain inadequately addressed.

Scientific literature cited in the plan, new analyses provided by DWR, and conclusions of the independent scientific review panel have reinforced our concern that the BDCP restoration plan has not been carefully thought out and has uncertain prospects for benefiting native aquatic estuarine species, particularly delta smelt and longfin smelt.

Given the occurrence and apparently favorable growth rates of delta smelt occupying the Cache Slough complex, the Service expects benefits from the creation of new open intertidal and tidally flushed habitat in that region. However, we are concerned about the effects of marsh creation in other areas, and about the net effect of the restoration proposal as a whole, given its large spatial scale.

(1) It is unclear how much food production will be available for export from new tidal marsh areas, because the percentage capture of that production into benthos by exotic bivalves that are likely to infest newly restored areas is hard to predict and might be high (Lucas and Thompson 2012). Since we expect that the benefit of these new marsh areas to the smelts would arise from export of plankton into river channels, benefits of new habitat might not scale up in proportion to the geographical area of new marshes if those marshes evolve in a way that is particularly adverse to plankton production and export processes.

[2] 2 It may be possible to manage subsided lands to encourage natural processes 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 extend far beyond the 50-year proposed term of the BDCP.

(2) New modeling presented to a BDCP audience on March 5th, 2013 by John De George of RMA, and informal comments by USGS staff to us, suggest that tidal energy will be strongly limiting in BDCP tidal marsh restoration, with the available tidal prism spread over a much larger area by the late long-term if the proposed acreages are fully implemented. The attenuation of tidal exchange in individual restoration areas might tend to reduce the export of plankton and reduce turbidity; both of these effects would increase with the total area of newly created marsh, and might tend to reduce the value of early restoration areas as new ones are added elsewhere.

(3) The effects analysis acknowledges that a portion of the Sacramento River sediment supply will be diverted at the North Delta intakes, and that that diversion might be detrimental to native fishes, estimating the average effect to be minus 8-9% of sediment. It is hard to draw definitive conclusions about the ultimate effect of this change, but an average loss of 8-9% of the sediment supply that would ordinarily pass into the Delta and Suisun Bay likely implies higher average water clarity throughout the year. Besides potentially negative effects on delta smelt and longfin smelt and their habitat, which benefit from turbid water, clearer water would encourage growth of exotic aquatic plants and related effects in many areas of the North and West Delta.

(4) The independent science panel review recommended caution and thorough planning with respect to restoration activities (recommendation #6). It said, in part:

> Considerable uncertainty exists, however, about the likelihood of one of the co-equal goals, i.e., the conservation of the Bay-Delta system. Among the principal issues are the sequencing and scale of the implementation of the planned conservation measures. The Plan recommends a large number of conservation measures, but provides no explanation as to how and when they would be implemented, what the particular sequence would be and the intervals between implementation of conservation measures. The Plan also proposes to increase restored tidal and other habitats at a large scale. In terms of general approaches, large-scale efforts at protection and restoration are theoretically positive but on-the-ground implementation can be difficult and is fraught with uncertainty. (Panel report, pp. 18-19)

The panel proposed specific fixes in several areas (page 19). The new draft effects analysis addresses some of these fixes, but in our view further follow-up is needed on these issues to clarify what the BDCP intends to do to fill the gaps identified by the panel. The plan's ultimate conclusions regarding the outcome of creating such large new areas of tidal marsh remain more positive and certain than the literature and scientific authorities suggest they should be.

(5) We were disappointed not to see the in-depth evaluation of unintentional wetland "restoration experiments" that we requested last spring. We continue to advise our partners that this is a necessary analysis. Key references for Bay-Delta shallow water habitat issues and fish food include: Turner and Kelley 1966; Meng et al. 1994; Aasen 1999; Meng and Matern 2001; Matern et al. 2002; Lucas et al. 2002; Reed 2002; Sommer et al. 2002; Mueller-Solger et al. 2002; Brown 2003; Feyrer and Healey 2003; Feyrer et al. 2003;

[Crain et al. 2004; Feyrer 2004; Grimaldo et al. 2004 *in* Feyrer et al. 2004]; Sommer et al. 2004; Dean et al. 2005; Feyrer et al. 2005; Nobriga et al. 2005; Wright and Schoellhamer 2005; Brown and May 2006; Grosholz and Gallo 2006; Hobbs et al. 2006; Lopez et al. 2006; Brown and Michniuk 2007; Feyrer et al. 2007 [2 splittail papers in TAFS]; Cloern 2007; Cohen and Bollens 2008; Hestir et al. 2008; Lehman et al. 2008; [RL] Miller et al. 2008; Moyle 2008; McLain and Castillo 2009; Lehman et al. 2010 [Liberty Island]; Moyle et al. 2010; Howe and Simenstad 2011; Santos et al. 2011; Gewant and Bollens 2012; Grimaldo et al. 2012; Lucas and Thompson 2012; Greenfield et al. 2013. There is also a substantial relevant literature from other systems.

Many of these papers are cited in the draft BDCP documentation, but the analysis is not incisive. We certainly agree that there is considerable uncertainty regarding wetland restoration performance in the estuary (see above); however, as this extensive list of publications implies, there is already a lot that has been learned that can help distinguish potentially "good" restoration approaches from very likely "bad" ones, particularly in terms of the consequences to native fishes. The additional insight would help calibrate the BDCP net effects, or at least provide an additional, objective window into the realism of its conclusions. These authors also provide key analyses of wetland function and species occupancy that can inform relatively detailed conceptual models. We can provide ICF with copies of these papers if necessary.

The Service also recommends the following specific changes:

i. The documents accurately characterize delta smelt spawning habitat in descriptions of the species biology, but the Chapter 3 conservation measures and the Chapter 5 Habitat Suitability Indices and Net Effects make unsupportable or ambiguous linkages between habitat restoration and likely spawning habitat. Fix: Incorporate red line strikeout edits and either (1) show through modeling what subset of "tidal habitat restoration" will have sandy beaches with a turbid, active overlying water column, or (2) avoid the speculation that habitat restoration will create spawning habitat and the speculation that spawning habitat is limiting delta smelt recruitment.

ii. The documents accurately characterize longfin smelt spawning habitat in descriptions of the species biology, but the Chapter 3 conservation measures and the Chapter 5.5 Net Effects make unsupportable or ambiguous linkages between habitat restoration and likely spawning habitat. Fix: Incorporate red line strikeout edits and either (1) show through modeling what subset of "tidal habitat restoration" will have sandy beaches with a turbid, active overlying water column, or (2) avoid the speculation that habitat restoration will create spawning habitat and the speculation that spawning habitat is limiting recruitment. The stressor reduction target for longfin smelt spawning habitat proposes as a target, a condition that already occurs currently. "Increase overlap of suitable spawning substrate, flow, salinity, and water temperature in the lower Sacramento and lower San Joaquin Rivers such that spawning, as indicated by the presence of early larval longfin smelt in DFG larval smelt surveys, occurs in at least three of the following locations in all years: Lower Sacramento, Cache Slough ROA, Lower San Joaquin, Suisun Bay, and Suisun Marsh ROA. Increasing the extent of suitable spawning habitat for longfin smelt will contribute to an increase in spawning success, thereby contributing to an increase in juvenile and, over-time, adult longfin smelt abundance." Thus, as written this target is already achieved. Fix: first, acknowledge that spring Delta outflow is a well-established driver of longfin smelt abundance, and formulate a stressor reduction target that provides spring Delta outflow in accordance with the Service's standing recommendation. Second, provide a plausible prediction of marginal longfin smelt benefits that will be realized by enhancing extent of spawning habitat or delete the corresponding stressor reduction target.

iii. It is possible that increases in QWEST associated with CM1 and SAV removal associated with CM13 might (jointly) lead to higher spawning success of both smelt species in the mainstem of the San Joaquin River where some spawning is thought to occur presently; we have suggested revisions that can articulate this potential benefit and should be considered when the adaptive management plan for these actions is developed.

iv. The current state of science regarding splittail spawning habitats is misapplied; splittail are not known to spawn in tidal environments. Fix: Do not claim that any BDCP action other than CM2 will provide spawning habitat for splittail.

v. Chapter 3.3 issue: CM18 (Conservation hatchery) is linked to wild population goals and objectives for delta and longfin smelts. This is inappropriate and contrary to the Service's present policy for these species. Fix: CM18 will need new objectives designed specifically for it.

As we have tried to make clear in this update, the uncertainties associated with restoration are of such importance that the success of the BDCP as a Delta conservation effort may hinge on the realism of plan expectations and effectiveness of the BDCP adaptive management program. Moreover, these uncertainties must be viewed as uncertainties for water operations, which are also a driver of covered aquatic species abundances. The effects analysis should more clearly acknowledge these uncertainties to motivate the intensive further study that will be required. The State should not assume the habitat restoration components of the plan will succeed in full, because they may not. We endorse NMFS's recommendation that alternative plausible levels of success for habitat restoration be evaluated in the effects analysis. The BDCP will have to jointly adaptively manage both restoration and water operations to have the best chance of favorable conservation outcomes for covered species and their habitats.

The Service is providing numerous track change edits and bubble comments that we think will improve the document further. If any track-changes comment appears to conflict with the written comments above, the written comments take precedence.

Addressing the Service's concerns described above should also improve the BDCP's responsiveness to Recommendations 1, 2, 5, 6, 8, and 16 in the June 2012 DSP Review Panel report.

We look forward to working with DWR and our other partners to resolve these issues.

**2.2. 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.**

Original comment: *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.*

March 2013 Update: This is a resolved issue.

**2.3. The effects analysis underemphasizes Bay-Delta water flows as a system-wide driver of ecosystem services to the San Francisco Estuary.**

Original comment: *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 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.*

March 2013 Update: The EA has improved discussions of the effects of flow on covered fishes, their habitat and their survival. It also has a set of longfin smelt spring outflow population simulations and delta smelt fall outflow habitat simulations per our previous recommendations. However, issues resulting from disagreements about the importance of water flows for fish species remain in the draft, including the subjective quality of some of the net effects conclusions, the framing of the effects analysis itself, and some of the biological objectives and stressor reduction targets. As the Service will have to determine which version or versions of water project operations meet statutory criteria for permit issuance, satisfactory resolution of this critical issue for the permit application will require framing the effects analysis appropriately. It will need to clearly articulate that each of the four versions of operations in the current project description has associated with it a distinct effects analysis based on specific assumptions about the importance of water flows through the Delta to covered species that depend on flow. These analyses have substantially different implications for the likelihood that the four operations alternatives will achieve plan biological objectives. These analyses should be presented separately, including analysis-specific net effects presentations, to show how each set of assumptions about the importance of flow leads to different conclusions about the likelihood that each of the four operations alternatives can succeed in achieving the plan's biological objectives. Until the Service can distinguish the effects analysis underlying the "high outflow scenario," which is based on technical advice we provided DWR, this comment will remain a critical issue. The Services discussed this issue with DWR and their consultant, ICF, in early August 2012, and provided them a short white paper on about August 6$^{th}$, 2012 describing how the the effects analysis should be framed.

The Service also recommends the following changes:

1. Do not confound Delta outflow's influence on delta smelt or longfin smelt recruitment with "transport flows," which is a speculative and unlikely mechanism given the very massive tidal flow connection between Suisun Bay and the western Delta. Delete the analysis of "transport flows" or change it to an analysis of low-salinity zone habitat suitability consistent with Bennett et al. (2002), Hobbs et al. (2006), Hobbs et al. (2010), and Kimmerer et al. (2009).

2. The critical habitat analysis in Appendix 5-I needs to acknowledge the potential negative effect on critical habitat of lower Delta outflow during the summer months per the DOI issue paper dated October 2010.

The Service has provided additional track change edits and bubble comments that we think will improve the document further. If any track-changes comment appears to conflict with the written comments above, the written comments take precedence.

**2.4. The Low Salinity Zone (LSZ) is a dynamic habitat defined by the tides and freshwater flow that requires a globally tailored conservation strategy.**

<u>Original comment:</u> *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.*

<u>March 2013 Update</u>: Status linked to related preceding item: partly addressed, with some issues outstanding. Two follow-up issues under this heading have arisen because the current review includes the whole BDCP and not just water operations and the effects analysis.

(1) The absence of the longfin smelt population growth objective that we have been discussing with our State partners for several months is a critical issue. The Service worked with the California Department of Fish and Wildlife on this objective in the fall of 2012 as a way to require measurable progress toward recovery while allowing the permittee(s) flexibility in how the objective is achieved. In the absence of the objective, it is not clear that the BDCP will need to show progress toward longfin smelt recovery on any timetable. Our understanding is that CDFW has been asked to review the objective now, and its absence from the plan is temporary. We look forward to working with CDFW and DWR on resolution of this issue.

(2) The lack of a "stressor reduction target" for flow for longfin smelt is a critical issue. More than forty years of science has clearly established that Delta outflow is a primary driver of longfin smelt abundance (e.g. Thomson et al. 2010). The Service believes that both tidal marsh habitat improvements and adequate Delta outflow are needed for the plan to achieve a contribution to recovery for this species. The BDCP should include flow as a "stressor" to recognize that conservation of this species involves managing water operations to assure adequate Delta outflow.

**2.5. 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.**

Our update on this issue is divided into two parts, each associated with part of the original comment.

**2.5.a.** Original comment: *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 (~ $24^{0}$ 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.*

March 2013 Update: The project description has been updated since the last review to include the "high outflow scenario" that was developed with the Service's advice. This version of operations addresses concerns we have expressed about the adequacy of Delta outflow to support delta smelt and longfin smelt. We continue to have important concerns about the restoration prospects for smelts and representation of the issue in the effects analysis in the eastern and southern regions of the Plan Area. Because delta and longfin smelts are generally pelagic fish, they are not expected to extensively rear in many restored tidal habitats except under very specific circumstances where there is somewhat deep (> 1, but < 4 meters), cool, and very turbid open water (examples: Liberty Island, Suisun Bay, Sherman Lake). These conditions cannot be created everywhere. Current scientific understanding suggests that some regions of the Plan Area are unlikely to be good places for delta and longfin smelt – especially if the only practical option is to flood subsided Delta islands; existing examples include the interiors of Franks Tract and Mildred Island.

Looking at the proposal as a whole, estimates of tidal marsh restoration acreages may be overstated simply because the physical characteristics of the Estuary cannot support the objective. As discussed in comment 2.1, upstream areas in the Estuary (east of the major constriction at Carquinez Strait and other locations) may not receive sufficient tidal energy to be tidal habitat; this outcome would greatly reduce the expectation of benefit to the smelts if our belief that benefits arise primarily where tidal fluxes mix fish prey items into open-water river channel areas is well-founded (see Lehman et al. 2010). We are concerned that actual acreages that are restored – indeed, that *can* be restored, if there is to be an expectation of marginal benefits to native aquatic species accruing at each step – will be only a small fraction of what the BDCP proposes. This is not necessarily a fatal problem: given the uncertainties of restoration, it may prove most beneficial to attempt restoration on a smaller (but still large) scale. The remedy for this issue in the present draft is to more accurately characterize these effects and the challenges they pose, to lay a foundation for the intensive study and adaptive management that will be required during implementation.

The Service also suggests the following additional specific changes should be incorporated to better address Recommendations 2, 3, 4, 6, 13, and 15 of the June 2012 DSP Review Panel report :

1. Sensitivity analysis of the Habitat Suitability Indices including the variance that arises using alternative input assumptions as described in our detailed comments above.

2. Use of a more sophisticated splittail Habitat Suitability Index; the current one only uses depth as a determinant of splittail habitat suitability. We do not find that to be a compelling argument. Splittail migrate to different habitats to complete different parts of their life cycle, so there must be additional factors that define habitat suitability for fish of different ages. There is information on splittail temperature limits, salinity distributions, seasonal timing of occupancy of particular regions, etc. in the literature.

3. The Net Effects summary graphs should include “uncertainty bars” that are larger when uncertainty is higher and smaller when uncertainty is lower so that both expected magnitude and confidence in the conclusion are simultaneously conveyed. The 2012 independent science panel report has some useful advice on this.

As a supplemental response on this item, the Service has provided additional track change edits and bubble comments that we think will improve the document further.

**2.5.b.** Original comment: *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.*

March 2013 Update: The proposed conveyance capacity has been reduced to 9,000 cfs and the revised EA has a greatly improved scientific discussion of turbidity, including the requested estimate of sediment that would be removed by diverting water directly from the Sacramento River. These changes are helpful responses to our prior concern, which was echoed in Recommendation 12 of the independent science panel's June 2012 report.

This remains an important issue, because we are concerned that an average loss of 8-9% of sediment will have greater negative effects on delta smelt and longfin smelt and their habitats downstream of the diversions than are acknowledged in the effects analysis and net effects, and will likely encourage the growth of exotic aquatic plants in the lower Sacramento River and in off-channel tidal marsh areas. This issue is also discussed in comment 2.1 above.

As a supplemental response, the Service has provided additional track change edits and bubble comments that we think will improve the document further, particularly in Chapter 5.5 where we think that based on the collective discussion and analysis in the EA, the likelihood of generally lower turbidity in the Sacramento River and North Delta in the future is stronger than the draft document suggests.

**2.6. 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.**
Original comment: *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.*

March 2013 Update: Chapters 3 and 5 have greatly improved scientific discussions of invasive vegetation. These changes are helpful responses to our prior concern about the effects analysis, which was echoed in the independent science panel's recommendations 6, 8, and 16 from the June 2012 report.

We suggest avoiding claims that particular projects or ROAs will contribute (by themselves) to population level goals and objectives for delta and longfin smelt. There are likely thresholds in the extent of tidal marsh habitat that needs to adjoin areas of open-water in order for the marsh to subsidize the open-water instead of generating circumstances where the productivity is consumed within the marsh or quickly consumed by bivalves (clams) as it is dispersed from the marshes and other shallow areas. Such thresholds would depend on a number of factors and might be hard to predict. This possibility, and the potential path-dependence of the outcome of restoration, represent two key uncertainties that we hope the BDCP Adaptive Management Program can address.

As a supplemental response, we have provided track change edits and bubble comments that we think will improve the document further, particularly in Chapter 3 and 5.5.

**2.7. Chapter 5 is deficient in its descriptions of channel margin, riparian, and floodplain habitat restoration outside of Yolo Bypass**.

Original comment: *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.*

March 2013 Update: NMFS independently articulated these concerns last year, and we defer to their analysis of the response in the new draft BDCP (see NMFS memo comment 1.14).

**2.8. 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.**
Original comment: *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.*

March 2013 Update: Chapters 3 and 5.5 have improved scientific discussions of residence time in the southern Delta and its likely connection to invasive vegetation and *Microcystis* blooms. These changes are helpful responses to our concern about the effects analysis, which was echoed in the DSP Science Panel Recommendations 6, 7, 8, and 13 in their June 2012 report.

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

### 3.1. The effects analysis did not use the available splittail life cycle model at all to support its Net Effects conclusion.

Original comment: *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.*

March 2013 Update: During our conversations with DWR and the consultant last fall, Service staff agreed that it was not necessary to use the splittail life cycle model in a predictive mode because that exercise had been completed to the extent it could be in the paper in which it was published. We appreciate the model description added to Appendix 5G.

### 3.2. The effects analysis did not use the best available longfin smelt statistical models to support its net effects conclusion.

Original comment: *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.*

March 2013 Update: There has been a great deal of new data analysis on the topic of longfin smelt response to Delta outflow that has occurred since last spring in response to the "CS5" exercise, though we acknowledge this work remains to be published. The Service provided ICF with these new analytical tools last fall and one of them has been incorporated into the EA as an additional or alternative means of evaluating the expected long-term impact of BDCP influence on the spring Delta outflow "mechanism(s)" that is part of the well-established relationship between longfin smelt recruitment and Delta outflow.

We also provided ICF with a linear regression tool, but we did not see results based on it in the revised EA. This is an important issue because both its linear and nonlinear regressions should be used in the EA, as they are based on different plausible assumptions about how to represent current and potential longfin smelt population dynamic responses to flow variation and food web restoration. These are important approaches to present as part of the foundation for the adaptive management studies of outflow that are under development.

These adjustments will help address Recommendations 10 and 17 in the 2012 independent panel's review.

**3.3. The effects analysis continues to insist on an analytical approach to entrainment that does not reflect the best available science.**

Original comment: *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 historicallylow 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.*

March 2013 Update: The original issue has been sufficiently addressed. We have provided additional track change edits and bubble comments that we think will improve the document further in Chapter 5.5. However, an important related issue remains. The stressor reductions targets for entrainment of the two smelt species propose to have proportional entrainment "at a level below the average" observed from 1995-2012. Achievement of these targets is already assured by the existing USFWS BiOp, and should be improved upon in a dual conveyance scenario. Furthermore, there is no rationale to explain why positive effects of achieving low rates of entrainment will not affect the fish populations until "year 40" [delta smelt] or "over time" [longfin smelt]. Since reducing cumulative entrainment of these species to no more than 5% of the population is already a BDCP biological objective, a more sensible stressor reduction target would be framed in terms of variables that affect entrainment risk.

**3.4. We think that the delta smelt state-space model is a useful framework to explore hypotheses about what drives delta smelt abundance.**

Original comment: *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.*

March 2013 Update: The track changes edit of the Fish Life Cycle Models Appendix 5G pdf provided by ICF seems to have edited out the descriptions of the Maunder and Deriso (2011) and Miller et al. (2012) statistical life cycle models. Here, we clarify that we did not ask for such a change to be made, and do not think it is either necessary or appropriate to strike descriptions of these analyses from the supporting materials for Chapter 5. It was mutually agreed that the Maunder and Deriso model was not a suitable *forecasting* tool in its current state, but the EA should retain a description of what it is and the findings of their exploration of the input data. The same is true for the statistical models of Miller et al. 2012, Thomson et al. 2010, and Mac Nally et al. 2010, because it is the findings that these different analytical approaches have in common, including the difficult bioenergetic situation that delta smelt face from late spring through early fall, that may emerge as robust and valuable conclusions of the modeling exercises carried out to date.

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

### 4.1. 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.

Original comment: *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.*

<u>March 2013 Update</u>: The revised Chapter 5.5 has improved regarding its acknowledgement about the drivers of the estuarine food web (clams and nutrients). The changes would have represented a larger improvement if they had included a more detailed analysis of unintentional restoration experiments (see update to comment 2.1 above). Such an analysis would have helped address Recommendation 8 of the 2012 independent review panel report, and helped avoid logic problems like those discussed below.

The Conservation Measure 4-based approach to solving food web issues for smelts is only weakly supported in the scientific literature. The document itself states (Appendix 5E):

> To be used in the analysis, sufficient data had to be available to describe the condition at the scale of the geographic subregion, and it was necessary to be able to forecast conditions in the future with and without the BDCP either through modeling or conclusions. For example, planktonic food is an important factor in defining habitat for delta smelt (Bennett 2005) that likely relates to the presence of certain species of zooplankton (Criterion 1**). However, there is not sufficient data to characterize zooplankton abundance or community structure at the scale of the subregion (Criterion 2), nor is there an ability to project zooplankton response to future conditions [emphasis added]**.

The proposed use of turbidity as a substitute for food is also not supported by best available science:

> To incorporate a measure relating to feeding, turbidity was used as an indicator of feeding potential in the subregions and in restored habitat (the potential of the restoration to add to the food supply in the Delta was treated as a separate analysis in Section 5E.4.3). Delta smelt abundance is strongly correlated with high turbidity, and it is believed to relate to the ability of fish to find and capture prey (Bennett 2005) (Criterion 1). There is sufficient information collected as part of the regional fish monitoring programs to characterize turbidity in the subregions (Criterion 2). At the present time there is no model available to project turbidity in the future, although there is reason to expect that turbidity in the Delta may decline in the future (Ruhl and Schoellhamer 2004). Recognizing the strong association with delta smelt presence,

turbidity was used as a factor in the delta smelt model, but turbidity was assumed not to change over the BDCP period (Criterion 3).

We remain skeptical of the use of turbidity as a substitute for smelt food supply, and more skeptical of the conclusion that this supply will remain unchanging into the future given the acknowledgment that turbidity values in the Estuary are expected to decline through time. The EA itself suggests sediment supply will be reduced by 8-9% by the North Delta diversions. For additional advice, see Recommendation 8 from the June 2012 DSP review panel (Accurately characterize food resources and food webs).

The Habitat Suitability Analysis does not include an accurate estimate of food/prey availability and fate for either of the smelts for existing or proposed future conditions. The phytoplankton productivity estimate taken from Lopez et al. (2006) is an instantaneous productivity rate the authors themselves describe as not reflective of general habitat and hydrodynamic conditions in the Delta. A more accurate analysis of the productivity of Delta tidal environments would include analysis of the transport and fate of productivity in the Delta environment. Specifically, Lopez et al. (2006) underscore the evidence that much of the productivity in the Delta is being shifted to the benthos by exotic bivalves and away from the pelagic environment. The authors emphasize that analysis of instantaneous productivity estimates might, therefore, not yield meaningful answers if the role of the bivalves is neglected. The article includes the passage: "The unexplained patchy distribution of *Corbicula fluminea* in the Sacramento-San Joaquin Delta implies high uncertainty in the outcomes of creating new aquatic habitats (Lucas and others 2002)." The Effects Analysis assumes an increase of 40% in productivity available to the pelagic food web as the result of the proposed restoration program**.** Given the findings of Lopez et al. and others (e.g. Nixon 1988, Cloern 2007, Lucas and Thompson 2012), we believe the actual improvement in system-wide productivity increase to the pelagic food web is very uncertain and might be substantially less than 40%. As with some other comments (e.g., update to comment 2.5.a above), the remedy to this issue is to more objectively assess the effects.

As a supplemental response, the Service has provided numerous track change edits and bubble comments that we think will improve the document further.

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

**5.1. A key point of continuing analytical confusion is the use of multiple baselines**.
Original comment: *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.*

March 2013 Update: As a result of this comment, ICF is developing a scope to conduct a new "aggregate" analysis that meets the needs of FWS and NMFS. FWS intends to continue to work with them and the other agencies to complete this analysis and incorporate it into the effects analysis of the proposed project prior to submitting the section 10 application.

**5.2. CALSIM II demand representation in 2060 studies should have some justification.**

Original comment: *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.*

March 2013 Update: ICF responded to this comment by noting that water demand in the export area was expected to top out at a 2020 level. However, this important issue remains unresolved because we could not find where in the documentation that it is stated explicitly that it is an analytical assumption of the BDCP EA that demand growth upstream of Freeport will top out at a 2020 level. Fix: please clarify that it is a modeling assumption that a 2060 climate will interact with a 2020 level of water demand in the Late Long-Term.

**5.3. 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.**

Original comment: *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.*

March 2013 Update: This specific representation issue appears to have been sufficiently addressed in the EA. Full resolution of issues related to evaluation of habitat restoration in the EA is contingent on implementation of fixes that are discussed above.

Resolution of the issue will help address Recommendations 5 and 6 of the June 2012 independent review panel report.

PART II: NEW ISSUE AREAS ARISING FROM REVIEW OF DECEMBER 21, 2012 AND MARCH 6, 2013 BDCP DRAFTS

**Issue Area 6: Plan adaptability**

**6.1 Clarify the role of biological objectives as the basis for adaptive management of BDCP conservation measures.** Biological goals represent the ultimate conservation outcomes toward which the Plan strives. In some cases, achievement of ultimate goals lies within the power of the BDCP; in others the achievement of goals depends in part on factors that are outside the control of the water projects. Objectives are lower-level outcomes within each goal that are achievable by the BDCP and essential to achieving the overarching goal.

BDCP conservation measures are designed to achieve the biological objectives of the Plan. Because of this, BDCP adaptive management must be structured to provide for adjustment of the conservation measures to achieve the objectives as efficiently as possible.

The document is generally clear that the BGOs will be used to guide the implementation of conservation measures. However, the plan needs to clearly articulate that achieving biological objectives is the whole basis of the conservation plan. Achieving and continuing to achieve objectives will be necessary for progress toward the biological goals and recovery of covered species, and may be required for compliance with the HCP permit. There are several passages in Section 3.6 and elsewhere that need to be edited to clarify the role of the biological objectives.

**6.2. The BDCP must set forth governance and adaptive management plans that will facilitate adaptive management.** A core feature of the management problem the BDCP is designed to address is uncertainty. Three years ago, the Federal Agencies issued a white paper on application of the Services' 5-point policy for HCPs to the BDCP. It articulated the role of two permitting strategies developed in the 5-point policy: prescriptive plans and outcome-based plans.

> "The BDCP is a complex, landscape scale, long-term HCP with a high degree of uncertainty as to how close the initial conservation measures will come to achieving the plan's biological goals and objectives. It falls into the category of plans that will be a mixture of the two strategies, with initial prescriptions associated with

> adaptive management, and specific biological outcomes defining the ultimate success of the plan. This type of plan will allow management flexibility so the permittee may institute actions necessary to achieve the plan's goals while providing boundaries for future expectations and commitments. In addition, a results-based plan will address uncertainty in the ecosystem and provide the conservation assurances required by the Act. The Services will be challenged to make the findings required for permit issuance if the plan does not include clearly defined and scientifically supported biological goals and objectives, an adaptive management plan that tests alternative strategies for meeting those biological goals and objectives, and a framework for adjusting future conservation actions, if necessary, based on what is learned." (4/29/2010 memo, page 1)

In an outcome-based plan, biological objectives provide targets that conservation measures are expected to reach, thereby contributing to the conservation outcomes required by the permit. If the objectives have been appropriately crafted, their achievement assures that a project is doing what it can to contribute to the accomplishment of the ultimate biological goals of the plan. If the CMs fail to achieve the biological objectives around which they are designed, then the plan must provide the means (adaptive management) to change the conservation measures to achieve the outcomes.

We are concerned about the ability of the draft BDCP to successfully facilitate adaptive management. Our concerns span chapters 3, 6, and 7. A large number of issues our staff have identified in Section 3.6 remain unresolved. Also, discussion between the Service and DWR regarding the content of Chapter 6 is not yet complete. Because these sections are "works in progress," the following list of critical issues is not exhaustive.

(1) <u>Absence of a decision table in Chapter 7 (Governance)</u>. The most basic function of Governance is to define who makes decisions. In July 2012, the BDCP principals adopted a draft table describing how key BDCP implementation decisions are to be made, what the elevation path is if there is disagreement, and who has final authority to decide. Unfortunately, the decision table was removed from Chapter 7 shortly thereafter. In its absence, the Governance chapter does not clearly define or summarize how important classes of decisions would be made, including adaptive management changes, and leaves equally unclear who would have final authority to decide in each class of decision. Restoring the July 2012 governance decision table, or writing a new Section conveying the information in that table, is necessary to provide a clear path for decision making in the document and for plan implementation.

(2)<u>Ambiguity in roles and responsibilities in Chapter 7</u>. There remain ambiguities or apparent conflicts in roles and responsibilities in the Chapter 7, including Section 7.3.4. Clarifying the roles of the adaptive management team, the science manager, and the program manager is a critical issue, given the potential difficulty of the decisions that lie ahead. Adaptive management is fundamental to the BDCP, and the plan should be unambiguous that scientific studies, development of proposals to adjust the conservation measures based on new information, and other adaptive management functions will be managed and administered jointly by the parties that form the Adaptive Management Team, and not by the Implementation Office or its employees and officers, except to the extent that one of them (the Science Manager) is a member of the Adaptive Management Team.

(3) Ambiguous limits on adaptive management changes to conservation measures in Chapter 3. As an example, Section 3.6.3.3.2 limits circumstances in which adaptive changes to conservation measures can be implemented:

> With respect to adaptive changes to conservation measures that would result in a greater commitment of water, land, or money by the permittees, the scope and magnitude of an adaptive response will be limited to those actions reasonably likely to ensure that (1) the impacts (or levels of impacts) of a covered activity that were not previously considered or known are adequately addressed or (2) a conservation measure or suite of conservation measures that is less than effective, particularly with respect to effectiveness at advancing the biological goals and objectives, is modified, replaced, or supplemented to produce the biological benefit. (pages 3.6-26 to 3.6-27 in March 2013 BDCP draft)

A permanent adaptive change to a BDCP conservation measure will most likely be needed because (a) the conservation measure is not achieving or not on track to achieve the biological objective(s) it is designed to achieve; or (b) a different version of the conservation measure that costs less water or money to implement has been found that is equally effective or more effective at achieving the relevant biological objectives. This formulation should not be controversial: it is the basis of adaptive management in many other systems, and articulates the way the conservation measures would be managed to achieve the co-equal goals of the BDCP.

We are concerned by the ambiguity of the limits described in the quoted passage above. In our view, they can be interpreted to allow the changes (a) or (b) we have listed, but they can also be interpreted to prohibit them if they cost water, depending on whether "advancing the biological goals and objectives" and "produce the biological benefit" both mean 'achieving the objective(s).' It is also not clear what other kinds of adaptive management changes the limits might prohibit, or are intended to prohibit, since the text was presumably inserted for a specific reason. This sort of ambiguity, which has other examples, is very problematic in a plan that depends on adaptive management and is meant to provide a clear, cooperative mechanism to implement it. Left as is, these ambiguities seem likely to add new conflict on top of already-difficult management problems.

(4) Lack of clarity on how AMT implements adaptive management. The Service has identified a large number of issues of varying levels of importance in Section 3.6. They include confusing language about circumstances "triggering and adaptive response" that do not align with the 9-step adaptive management model adopted by the BDCP; ambiguities in how decisions are made, including at least one example in 3.6.3.3.2 (page 3.6-27) that appears to conflict with the July 2012 Governance decision table discussed in 6.2(1) above; and other issues. It will be very important to follow-up on these issues to ensure that the adaptive management process is clearly defined and workable.

The plan also needs to clearly articulate that the science program developed to support adaptive management will be structured to facilitate participation by agency scientists, stakeholders, and a broad array of academic scientists. The current provisions for participation by stakeholder participation and science do not adequately lay out the stakeholder roles in the technical dialogue and do not clearly develop an appropriately expansive role for academic scientists. The current draft is also vague on the role of the Delta Science Program, which we believe may play a crucial role in assuring the quality and transparency of science in the BDCP.

The Delta Science Plan, which is under preparation, is likely to propose a broad collaborative science structure that includes direct science/policy discussions involving agency executives and senior academic scientists. We view this as a very good idea. We also recommend that the draft Science Plan be included in the discussion going forward, since the Delta Science Plan will become part of the management environment in which a BDCP would be implemented. Separately, a recent draft memorandum prepared by the Delta Stewardship Council's Independent Science Board expressed skepticism that the current draft BDCP governance chapter does enough to facilitate cooperation in the adaptive management program. Given the stature of that panel, its critique should also be part of the dialogue going forward.

**6.3 The Decision Tree.** The decision tree articulates the concept that four sets of operational criteria will be proposed in the project description. They include the "high outflow scenario," which was developed with the advice of the Service, and three alternatives that provide reduced Delta water flows. Given the fundamental disagreements that exist over the importance of flows for covered fish species, it is reasonable to investigate these other scenarios as initial management alternatives through the adaptive management program. However, the March 2013 language of Section 3.4 is ambiguous on the role of these alternatives in the BDCP permit.

> CM1 includes two decision trees, one for fall outflow and one for spring outflow, that specify alternative outcomes for each criterion. Because each decision tree has two possible outcomes, the decision trees lay out four possible outcomes in outflow criteria when the spring and fall outflow components are combined, as described in Table 3.4.1-1. These four outcomes would be covered by the permit. These operating

> criteria will be subject to a determination by the permitting agencies, based on best available science developed through the decision-tree process, specifying what the spring and fall outflow criteria will be at the time CM1 operations begin. (March 2013 BDCP, page 3.4-19)

We have two concerns about this passage, as written. First, the meaning of "covered by the permit" in the third sentence is ambiguous, but it could be interpreted as an expectation that the permit would include findings that the whole project description, including all four versions of water operations, satisfies statutory issuance criteria. It is not clear how the Service could make such findings at present, since the project description as a whole does not fully implement the Service's 2008 Reasonable and Prudent Alternative for CVP/SWP water operations. We interpret the sentence to mean, instead, that all four versions of operations would be analyzed prior to potential permit issuance, findings would be made with respect to each alternative version of operations based on the best available science, and the result of those analyses would be expressed in the permit.

Second, the last sentence seems to imply ("[t]hese operating criteria will be subject to a determination…") that if the initial finding is revisited prior to the start of CM1 operations, the new finding would be limited to a choice among the four original operations alternatives. It may be that this is not the intended meaning. Bullet #3 near the bottom of the page says "[a]t the time dual conveyance operations begin, the permitting agencies identify spring and fall outflow criteria sufficient to meet the biological goals and objectives," which seems clearly to articulate that the decision at the time of CM1 operations would not be constrained to a choice among the original four alternatives. If, however, the intended meaning of these passages is that the choice of operations a decade or more in the future is to be limited to a selection among the four original alternatives, regardless of the results of new scientific studies everyone agrees are important, that would be highly problematic.

We are very concerned by the ambiguity of these statements, and other statements in Section 3.4 and its tables regarding the decision tree, which seem very likely to cause conflict in the future.

**6.4 Changed Circumstances.** There are numerous problems with the latter sections of Chapter 6 (6.4 and 6.5). The list of foreseeable changed circumstances described in 6.4 needs to be expanded and the range of adaptive responses available to address those changed circumstances is far too narrow and limiting. The subject of range of adaptive responses is directly related to the subject of adaptive limits, which also have not been defined. Changed circumstances should also include a time-frame for implementation of the remedial measures. The 5-Agencies will need to review this section and come to agreement on revising its contents prior to release of the public draft of the plan. More detailed comments on the issues with this section of Chapter 6, which are intended to start a dialogue on the chapter, are provided in our "track-changes" submittal.

**6.5 Adaptive Limits.** "Adaptive limits" in the BDCP refers to the most extreme sets of practicable operational parameters that might be required of or authorized to the permittee through the working of adaptive management over the life of the permit. Some discussion of what such parameter-by-parameter limits might be has already occurred, but the neither the concept of adaptive limits nor a draft example of them is included in the current BDCP draft. Without adaptive limits, limits to the commitment of resources that might be required of the permittee(s) remain undefined.

As is clear in both the HCP Handbook and the Five Point Policy, the permittee(s) in an HCP is protected by the inclusion of adaptive limits that "clearly state the range of possible operating conservation program adjustments due to significant new information, risk or uncertainty. This range defines the limits of what recourse commitments may be required of the permittee(s). This process will enable the applicant to assess the potential economic impacts of adjustments before agreeing to the HCP." 65 Fed. Reg. 35253; see also HCP Planning Handbook at 3-24 – 3-25.

In the BDCP, adaptive limits would provide an important assurance that would protect the permittee(s) from an open-ended obligation to commit resources irrespective of circumstances. They would also provide an important level of transparency to the permittee(s) and the public regarding the commitments represented in the plan. It will be important to clarify the effect of changed circumstances (Section 6.4) on the adaptive limits.

We are also concerned that the four operational alternatives in the project description might be interpreted to represent the adaptive limits for the permit. This is not an appropriate interpretation, and it will be important to cross-check the relevant chapters to be sure it is clear that operations might be adjusted in ways that cause water yield to move up or down within the adaptive limits, depending on new scientific findings.

**6.6 Real-time operations.** Real-time operations, described in CM1, are discussed in chapter 3 under 3.4.1.4.5 and are described as being separate and distinct from the adaptive management process. Yet the document is confusing because Chapter 3 states that the purpose of the adaptive management process is to allow for adjustments to be made to conservation measures, including operational criteria. It will be important going forward to clarify the governance and management of real-time operations.

END