United States Department of the Interior

FISH AND WILDLIFE SERVICE
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In Reply Refer To:
81420-2008-F-1481-15

SEP 18 2019

To: Area Manager, Bureau of Reclamation, Mid-Pacific Region, Bay-Delta Office, Sacramento, California

From: Regional Director, U.S. Fish and Wildlife Service, Pacific Southwest Regional Office, Sacramento, California

Subject: Proposed Change to Action 4 of the 2008 Biological Opinion for the Coordinated Long-Term Operation of the Central Valley Water Project and State Water Project

This memorandum is in response to the Bureau of Reclamation's (Reclamation), 2019, memorandum requesting reinitiation of consultation with the U.S. Fish and Wildlife Service (Service) on the effects of a proposed change to implementation of the 2008 Biological Opinion for the Coordinated Long-Term Operation of the Central Valley Water Project (CVP) and State Water Project (SWP) (2008 BiOp). Specifically, Reclamation proposes to modify the requirements outlined in Component 3, Action 4 (Action 4) of the Reasonable and Prudent Alternative (RPA) from the 2008 BiOp (Proposed Action). This Proposed Action is identified as a part of Reclamation and California Department of Water Resources' (DWR) implementation of the Fall X2 adaptive management program. At issue are effects of this Proposed Action on the threatened delta smelt (*Hypomesus transpacificus*) and its designated critical habitat. This request is separate from the ongoing reinitiated consultation on the 2008 BiOp as a whole.

In reviewing this project, the Service has relied upon: (1) Reclamation's, 2019, letter and the attached *Effects Analysis for the Delta Smelt Fall Habitat Action in 2019*; (2) the Service's 2008 BiOp including Action 4 and its adaptive management provisions; and (3) other information available to the Service.

This document modifies the 2008 BiOp to address effects of the Proposed Action on delta smelt and its designated critical habitat within the limited context of the adaptive management provisions of Action 4 for September and October of 2019. Unless otherwise noted, all of the other information and requirements in the 2008 BiOp remain in place.

Consultation History

April 15, 2019 — Meeting with Reclamation and Solicitor's Office regarding potential request to modify RPA Action 4 for 2019

April 17, 2019	Meeting with Reclamation, California Department of Fish and Wildlife (DFW), DWR and National Marine Fisheries Service (NMFS) to discuss options for modifying Action 4 for 2019
May 3, 2019	Meeting with Reclamation and State Water Contractors to discuss Fall Action
May 29, 2019	Meeting with Reclamation and State Water Contractors to discuss Fall Action
August 1, 2019	Meeting with Reclamation and Solicitor's Office to discuss modification to Action 4 for 2019
September 4, 2019	Request for Reinitiation received from Reclamation

Regulatory Context

The objective of Action 4 is to improve fall habitat conditions for delta smelt through increasing Delta outflow during fall (2008 BiOp p. 282). The location, extent, and function of the Low Salinity Zone (LSZ) where most juvenile delta smelt rear is indexed by X2 (2008 BiOp p. 147). X2 is scaled as the distance in kilometers (km) from the Golden Gate Bridge where salinity near the bottom of the water column is two parts per thousand (Jassby et al. 1995, 2008 BiOp p. 149). The 2008 BiOp states that Action 4 is accomplished by managing X2 through increasing Delta outflow during fall when the preceding water year is wetter than normal (2008 BiOp p. 369). During September and October in years when the preceding precipitation and runoff period was wet or above normal, Reclamation and DWR shall provide sufficient Delta outflow to maintain monthly average X2 no greater (more eastward) than 74 km in wet water years and 81 km in above normal water years (2008 BiOp p. 282).

RPA Action 4 addresses effects to delta smelt during the rearing period and to designated critical habitat from the coordinated operations of the CVP and SWP, which were found to have reduced habitat quality and quantity by altering the extent and location of the LSZ in wet and above normal years (2008 BiOp p. 243). At all times of year, the location of X2 influences both the quality and quantity of habitat available for delta smelt to successfully complete their life cycle (2008 BiOp p. 191). In general, delta smelt habitat quality and surface area are greater when X2 is located in Suisun Bay than when it is located near the Sacramento-San Joaquin river confluence; both habitat quality and quantity diminish the more frequently and further the LSZ moves upstream, toward the confluence of the Sacramento and San Joaquin rivers.

RPA Action 4 is structured as an adaptive management action. The discussion of Action 4 provides that the Service will review new scientific information and make changes to the action when the best available information warrants a change. Additionally, the Service will review implementation of the action and the effectiveness of the adaptive management program ten years from the signing of the 2008 BiOp. The Service has begun efforts to undertake the 10 year review, including forming a stakeholder advisory group and engaging the Delta Science Program to facilitate the review. The Service encourages the independent review of the action and its

effectiveness, and for the Collaborative Science and Adaptive Management Program (CSAMP) to be involved in structuring the review to be implemented and facilitated by the Delta Science Program.

2011 Implementation of the Fall X2 Action

WY 2011 was classified as a wet year in the Sacramento Valley. The daily average X2 values from DAYFLOW for September and October 2011 were 75 km and 74 km, respectively (https://data.ca.gov/dataset/dayflow). Therefore, the implementation criteria of Action 4 were substantially met in 2011.

The Fall Midwater Trawl (FMWT) delta smelt abundance index increased more than tenfold in 2011 over its prior year value (http://www.dfg.ca.gov/delta/data/fmwt/indices.asp). Reclamation in cooperation with the Interagency Ecological Program (IEP) implemented the fall low salinity habitat (FLaSH) investigations in the fall of 2011 to explore hypotheses about the role of low-salinity habitat to the biology of delta smelt (Brown et al. 2014).

Similar to the approach taken in the FLaSH investigations, the IEP's Management Analysis and Synthesis Team's (MAST) updated conceptual model was used to generate hypotheses about the factors that may have contributed throughout 2011 to that year's increase in delta smelt abundance (IEP MAST 2015 p. 109). The authors of the MAST report surmised that the increase in abundance of delta smelt could be attributed to favorable conditions supporting each successive life stage, including the subadult stage (fall season), which benefited from "good food availability and from favorable habitat conditions in the large, westward LSZ" (IEP MAST 2015 p. 144).

2017 Implementation of the Fall X2 Action

In 2017 (the next wet water year after 2011), Reclamation reinitiated consultation proposing to modify the Fall X2 action provided for in the Reasonable and Prudent Alternative of the 2008 BiOp. Reclamation proposed to maintain X2 at 74 km in September, but at 81 km for the month of October. To support the reinitation, Reclamation provided an analysis of the effects of moving X2 to 81 km in October 2017. Based on the large inflection point in predicted surface area of high suitability habitat between X2 at 80 versus 81 km in the model results, Reclamation amended its request to maintain X2 at 80 km in October 2017. The Service amended the 2008 BiOp to allow coordinated operations of the facilities to achieve an average X2 location of no greater than 80 km in the month of October 2017. (Service, 2017. Memo to Area Manager, Bureau of Reclamation, Mid-Pacific Region, Bay Delta Office, from Regional Director, US Fish and Wildlife Service, Pacific Southwest Regional Office, Subject: Proposed Change to Action 4 of the 2008 Biological Opinion for the Coordinated Long-Term Operation of the Central Valley Water Project and State Water Project.). According to the DAYFLOW database, X2 averaged 75 km in September and 76 km in October of 2017 and was therefore, closer to the 2008 RPA than what had been proposed in the requested modification (https://data.ca.gov/dataset/dayflow). The 2017 FMWT index was 2, which was a new record low at the time. The record low FMWT index had been foreshadowed by record low Spring Kodiak Trawl and 20-mm Survey indices earlier in the year. Further, the Service's Enhanced Delta Smelt Monitoring program had detected a

potential period of rapid delta smelt mortality in Summer 2017 ahead of implementation of the Fall X2 action. Thus, the minor modification to the RPA that was ultimately implemented was not the cause of the low 2017 FMWT index.

2019 Proposed Action

In Reclamation's request for reinitiation, Reclamation and DWR propose to operate their facilities in 2019 to achieve an average X2 location no greater (more eastward) than 80 km in September and October. Operations for November would remain unchanged from those described for RPA Action 4 in the 2008 BiOp (as modified). Since September 1, daily X2 estimates have been 72-74 km.

Reclamation's effects analysis analyzed a Proposed Action that would include X2 at a monthly average 80 km with simultaneous operation of the Suisun Marsh Salinity Control Gates (SMSCG) in September. Reclamation is no longer proposing operation of the SMSCG. Additionally DWR is anticipated to operate to meet their share of the 74 km requirement (per the DFW Consistency Determination), so X2 will be westward of 80 km this September and October. These changes are not reflected in the effects analysis provided with the reinitiation request.

Based on conversations with Reclamation, we anticipate in September X2 will move eastward of 74 km in late September, with the monthly average likely remaining west of 76 km. We expect X2 to be maintained at an average of 77-78 km over the month of October.

Reclamation has also indicated that it intends to follow the 2011 memo for November operations (Reclamation, 2011. July 21, 2010 Memo from Don Glaser, Regional Director, Reclamation Mid-Pacific Region to Regional Director, Pacific Southwest Region, U.S. Fish and Wildlife Service). The 2011 memo was prepared to operationalize the November requirement in the RPA to not gain storage. Reclamation has operated consistent to the memo in 2011 and 2017, and we agree that the 2011 memo should be used for the 2019 Fall X2 action in November 2019.

Reclamation has concluded that the Proposed Action will not adversely affect delta smelt. The effects analysis in the Proposal provided by Reclamation revisited the 2008 BiOp stock-recruitment-X2 relationship, adopting a different stock-recruit formulation, and extending the time series with several additional years of data. The effects analysis in the Proposal found that the fall X2 environment-recruitment correlation does not reliably increase the ability to predict recruitment of the juvenile life stage (Summer Townet index [STN]) from the previous year's subadult life stage (FMWT index). Reclamation noted that this finding does not invalidate work by others hypothesizing how fall X2 predicts the quality and quantity of delta smelt habitat (Feyrer et al. 2007; IEP MAST 2015). The analysis in the Proposal and work by others (MacNally et al. 2010; Thomson et al. 2010; Miller et al. 2012) have not detected a significant long-term population-level response to changes in habitat associated with fall X2. However, one recent paper has reported a correlation between fall X2 and the FMWT abundance indices for delta smelt when X2 locations $\leq$ 74 km are considered (Castillo 2019). This is likely an analog to the correlation between delta smelt habitat suitability indices and the FMWT abundance indices reported by Feyrer et al. (2011). Abundance and habitat suitability are derived from the same

data, and high abundances were historically observed to often occur in association with westward X2 locations. This is an analytically circular argument that Feyrer et al. used to demonstrate that the habitat index had ecological meaning. The habitat index was later challenged on statistical grounds (Manly et al. 2015), but Feyrer et al. (2016) showed that Manly et al's suggested alternative model produced a nearly identical time trend of declining habitat suitability as the Feyrer et al. (2011) model. Subsequently, Bever et al. (2016) improved upon the fall habitat index by linking FMWT data to a 3-D hydrodynamics model, which provided additional spatial context, but did not change the conclusion that habitat quantity and quality improve as X2 is located further west (Table 1). Thus, the best available science suggests the RPA action improves habitat, may influence abundance in real-time, but does not demonstrably affect the success of future generations of delta smelt, each of which faces its own environmental hurdles.

Effects to Delta Smelt Critical Habitat

If X2 were to actually average 80 km in both September and October of 2019, our best available information indicates that would represent a 15% to 18% decline in habitat suitability relative to a 74 km operation. Said another way, more than 80% of habitat suitability compared to a 74 km operation is maintained and able to support delta smelt. The percent difference is predicted to be a little higher if turbidity remains elevated in Suisun Bay this year. Thus far in September 2019, the Service's Enhanced Delta Smelt Monitoring (EDSM) has taken 23 Secchi disk depth measurements in Suisun Bay and marsh. The reported range is 0.24 meters to 8.05 meters; however the latter is a data entry error because the high Secchi depth does not match the associated turbidity measurement in NTU. Thus, there are 22 accurate Secchi depth measurements ranging from 0.24 to 0.80 meters with an average of 0.43 meters. The current turbidity of the Suisun Bay region is therefore closer to the high turbidity condition in Table 1. If X2 ends up west of 80 km this September-October (i.e., ~ 77-78 km), then the best available estimates of change in habitat suitability would be an approximately 8% to 13% decline (Table 1).

Table 1. Estimated hydrodynamic-based station index (SI_H as described in Bever et al. 2016) for X2 locations from 74 to 81 km. The hydrodynamic-based station indices were transcribed from Table 5 of Reclamation's August 30, 2017 document prepared by ICF and titled "Request for Reinitiation of Consultation Fall X2 Effects Analysis.pdf". The authors of that document reported SI_H results for both a low and high turbidity assumption. As expected, under the high turbidity assumption, the habitat indices are higher. The percent change from 74 km corresponding to each 1 km increment of X2 is provided in parentheses and was calculated by the Service.

Average X2 location (km)	Low turbidity assumption Secchi depth = 0.63 meters	High turbidity assumption Secchi depth = 0.37 meters
74	0.39	0.62
75	0.40 (+2.6%)	0.63 (+1.6%)
76	0.38 (-2.6%)	0.61 (-1.6%)
77	0.36 (-7.7%)	0.57 (-8.1%)
78	0.35 (-10%)	0.54 (-13%)
79	0.33 (-15%)	0.50 (-19%)
80	0.33 (-15%)	0.51 (-18%)
81	0.26 (-33%)	0.42 (-32%)

Based on the operational information provided by Reclamation and using the information in Table 1, if X2 is 76 km or westward in September we would anticipate less than 2% loss of LSZ habitat from what it would have been if X2 maintained at 74 km. In October, if X2 is maintained at 77-78 km the percentage loss would be 7.7- 13% from what it would have been if X2 was maintained at 74 km. These ranges of predicted change to habitat suitability reflect the two turbidity assumptions described in the table. If turbidity is elevated in Grizzly and Honker bays, the habitat suitability indices are higher overall and the change in suitability is predicted to decrease faster once X2 begins to move east of 76 km. Multiple factors can affect local turbidity in Suisun Bay and the Sacramento-San Joaquin river confluence.

Conclusion

Reclamation has requested a modification of Action 4 for 2019 to be considered as an adaptive management action under Action 4. The Service anticipates that scheduled IEP, EDSM, and DOP monitoring and research will occur in support of the proposed adaptive management. In addition, it is the Service's understanding that DWR will conduct further experiments on the survival of captive-reared delta smelt in enclosures this fall and we look forward to discussions of the results once they are available.

The Service concludes there may be some effect to delta smelt related to the effects to Critical Habitat reviewed above. The Proposed Action could lower September-October habitat suitability by 15%-18%, but the effect is anticipated to be lower than that because X2 will likely remain west of 80 km. When the habitat attributes for delta smelt, which are landscape, turbidity, salinity, temperature and food, do not co-occur, delta smelt can suffer harm through physiological stress and contaminant exposures, and mortality due to inadequate foraging and shelter habitat that together result in poor fish health (Hammock et al. 2015) and elevated vulnerability to predators (Ferrari et al. 2014; Schreier et al. 2016). The further eastward the LSZ is located, the less likely that all of the needed habitat attributes will co-occur. Given the current rarity of delta smelt, we do not anticipate that scheduled monitoring programs will detect a change in delta smelt abundance or survival as this Proposed Action is implemented. However, we ask Reclamation to evaluate the data once they are available to determine whether a change in survival was detected. We also recommend Reclamation evaluate delta smelt vital rate data collected as part of the IEP and DOP monitoring as information becomes available. The current estimated delta smelt population sizes are so low that we do not anticipate the species will become habitat- or food-limited during this proposed change in operations. Furthermore, we do not anticipate any sustained impact to the physical and biological factors that comprise the habitat's suitability. This memo modifies the 2008 BiOp for the months of September and October 2019 to allow for Reclamation to operate its facilities to achieve an average X2 location no greater (more eastward) than 80 km in September and October, 2019.

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