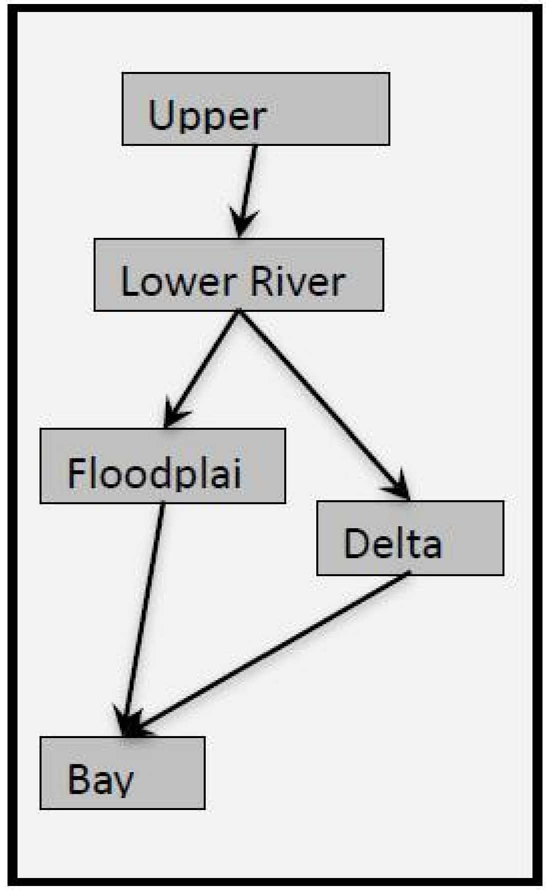
Comments on the Draft NMFS Effects Analysis

Page #	Quote Text Referenced	Comment
Life Cycle Models 2.5.9, p.19	"Both the IOS model and the WRLCM provide a holistic evaluation in their examination of the effects of the action because both models consider the collective effects of disparate action components. Given the unique set of results provided by the life cycle models, they are presented here instead of being integrated into, and possibly attributed to, an individual PA component…" "…However, as discussed in Section 2.1 Analytical Approach, this comparative analysis should not be conflated with an analysis of the full effects of proposed project operations on species. Section 2.8 Integration and Synthesis discusses how NMFS considers the life cycle model results, in addition to other information, in evaluating the operational effects of the PA to species in aggregate with the effects of components of the baseline."	This language provides a lot of leeway for conclusions to be drawn. Hard to evaluate the LCM and IOS holistic results without knowing how NFMS will weigh individual lifestage or month/habitat effects. Can NMFS provide any guidance regarding how it interprets WRLCM results? It would be helpful if that guidance was included in the administrative record.
Life Cycle Models 2.5.9.2.1.1 Results of the Scenario	Overall, the WRLCM results indicate higher abundances and lower CRR for the COS relative to the PA. Mean	What is the threshold for a concerning difference between the PA and COS in terms of mean abundance? CRR? Since CALSIM II and other models were used as

Evaluation p. 8	abundance is 3.05 percent less for the PA relative to COS through the modeled time series	data inputs into the WRLCM, and each of these models have inherent error, that error is compounded when used in the WRLCM. It seems this compounding of error should be considered when interpreting results.
Life Cycle Models 2.5.9.2.1.1 Results of the Scenario Evaluation p. 9	The CRR is a key metric to understand population dynamics, since it characterizes the ability of a population to replace itself. In the model runs, estimates of the difference in CRR for 1,000 paired runs of the WRLCM indicate that there is a 0.993 probability that CRR would be higher for the PA than the COS over the 82-year model period. There is, therefore, a consistent difference over the model period. However, the mean CRR of the PA is only 0.55 percent greater than the mean CRR of the COS	Contradictory results between abundance metric and CRR. We suspect this is due to differences in the shape of the posterior distributions. We would speculate PA is characterized by CRR that is marginally greater than COS in most years, but significantly smaller in a few years. Would be useful if the CRR distributions for the COS and PA were presented
Life Cycle Models 2.5.9.2.1.1 Results of the Scenario Evaluation p. 10	Figure 2.5.9-5	%Difference trends toward positive over sequence of years, then "resets" in 1-2 years (e.g. ~1950-52; 1961-63; 1985-87). What causes these downturns to affect PA more than COS? Also, does starting year matter? The first year post-burning period for the simulation is the worst in the record for PA relative to COS. After that year the PA recovers faster relative to the COS for ~20 years. Would you get the same mean % difference if the simulation began at a different point in the 82-year sequence?
Life Cycle Models 2.5.9.2.1.2 Dynamics Leading to Differential Abundance and	During Critical water year types, the model shows that the PA has a decreased median survival, specifically in August (a reduction of 5.6	What percent of the population (eggs) is still in the gravel in August? Is this consistent with how findings for upper sac effect? Are these modeled equivalently?

Productivity p. 10	percent).	
Life Cycle Models 2.5.9.2.1.2 Dynamics Leading to Differential Abundance and Productivity p. 10-15	Figures 2.5.9-7 thru 2.5.9-11	These figures show outmigration % survival from different habitats in different months, but there is no indication as to whether a significant portion of the population is being affected.
Life Cycle Models 2.5.9.2.1.2 Dynamics Leading to Differential Abundance and Productivity p. 14	As with the other habitats, smolt survival for the PA is lower than the COS for smolts originating in the Yolo Bypass habitat for all months and water year types, except for January through March of wet years, when the PA survival is slightly greater. The differences in survival between the PA and COS for smolts originating in the Yolo Bypass habitat are greatest in the month of April, when survival for the PA decreases 4.6 to 8.4 percent relative to the COS.	How is Yolo Bypass handled? May and most of April should be dry on the bypass in all but the wettest years. This should apply to both alternatives. Is presence of winter run on the Yolo Bypass in April and May supported by data? And what is causing the difference in survival? I would like clarification on how the "Floodplain" was handled in the model. Figure 7 on Page 11 of Appendix H (Model Description for the Sacramento River Winter Run Life Cycle Model) is a diagram showing the connectivity among habitats for winter-run Chinook fry:

		 Note that there is no connection between the Floodplain and Delta. However, Transition 13 states that survival from the floodplain (i.e. Yolo Bypass) is "composed of three components: A) survival rate from the Floodplain to the Delta; **B) survival through the Delta to Chipps**; and C) survival from Chipps Island to Golden Gate…mean monthly survival rate for smolts **originating from the Floodplain through the Delta to Chipps Island as calculated by the Newman equation.**" (p. 13 of Appendix H). It seems the WRLCM is applying the Newman Delta survival parameter to the Floodplain fish even though these fish should not be transiting the Delta (according to Figure 7). This would explain why survival differs between the PA and COS as it is effectively replicating the differences in Delta survival.

Life Cycle Models 2.5.9.2.1.2 Dynamics Leading to Differential Abundance and Productivity p. 13	Overall, the results show similar survival for smolts originating from the Delta habitat for both the PA and the COS (Figure 2.5.9 10). Smolts that originate in the Delta have slightly lower median survival for the PA during most months and water year types. All survival differences for the PA relative to the COS are less than 3 percent, except for the month of April, when median survival for the PA is 4.8 to 9.4 percent less than for the COS. The difference in smolt survival for the PA relative to the COS reflects differences in flow in the Delta region. For the PA, higher south Delta export levels influence in-Delta flows, reducing survival relative to the COS; therefore, smolts that originate from the Delta habitat may have slightly higher survival for the COS than the PA (Figure 2.5.9 10).	The use of the Newman model to parameterize through Delta survival is heavily caveated in Appendix H ("Caveats" p.24-25), but no mention of those caveats with respect to these results. These caveats would also apply to fish originating from the Upper and Lower Sac habitats that also have to migrate through the Delta. "The Newman survival results are based on a statistical model and environmental covariates that occurred over the time-frame 1979-1995. Furthermore, the Newman model was developed using fall-run juvenile Chinook salmon reared in hatcheries and released in April and May, which is later than the peak outmigration for winter-run Chinook salmon."
Life Cycle Models, p. 23	First, the ePTM is currently undergoing development and is not ready for incorporation into the WRLCM at this time. Second, the STARS model does not include exports as a covariate,	Use of Newman 2003 instead of more recent Perry survival model or Delta Passage Model, just because exports are a covariate, seems contrived. Note that DPM uses exports as a covariate. Since Newman 2003, many scientific studies indicated minimal effect of exports on survival of juvenile salmon in the Delta. One of which was

	thus could not inform how differences in levels of exports under the COS and PA scenarios affect smolt survival in the delta. Therefore, the Newman survival model was used for this version of the WRLCM because it was the most complete model available that was sensitive to changes in exports.	part of NMFS' conceptual model: Effects of exports outside the facilities likely diminish with distance (Cavallo et al. 2015) NMFS should clearly acknowledge the more recent scientific findings regarding delta survival for migrating juvenile salmon, and how those findings differ from Newman 2003.
Life Cycle Models 2.5.9.2.1.3 Assessment of Population Decline Criteria p. 16-18	*General comment about this analysis given we have not seen this approach before. Specific comments to follow.*	This is a new analysis adopting one of the five criteria for assessing the risk of extinction presented in Lindley et al. 2007. It is unclear why only this one criterion was evaluated.
Life Cycle Models 2.5.9.2.1.3 Assessment of Population Decline Criteria p. 17	The criteria have two components: a downward trend in abundance and a critical run size (i.e., < 500 spawners). A downward trend in abundance is estimated as a 10 percent or greater decline in run size (i.e., abundance) per year. And while Lindley *et al.* (2007) notes that salmonid populations near a carrying capacity of 500 spawners with only modest intrinsic growth rates are typically at a low probability of extinction, it is incorrect to equate outputs of the WRLCM to actual numbers of fish in the Sacramento River. Without actual numbers of fish, it is only appropriate to apply the WRLCM to	The criteria is being applied only in part (the description of the criteria from Lindley et al. 2007 is quoted below, bolding is mine).The analysis is only using the 10% decline criteria and is ignoring the critical run size component (>500 spawners, but this number is arbitrary as is acknowledged in Lindley et al. 2007) because the WRLCM is not calibrated to forecast population abundances. At the very least the BO should acknowledge that their metric will be biased high relative to that proposed in Lindley et al 2007 because not all of the population declines of >= 10% will occur when the population is below 500 spawners (or whatever critical abundance threshold is applied). For the cases where the decline is >= 10%, what proportion of the time does that occur when the population is in a low abundance state? The 500 spawners threshold doesn't really have a numerical foundation, Allendorf (1991?) kind of made it up as an abundance number below which he considered a population small enough to be susceptible to demographic stochasticity. The fact that the WRLCM does not produce actual

	provide guidance on the relative probability of a population decline and not whether abundance exceeds the critical run size.	numbers of fish should not prevent the analysis from considering the intent of the 500 spawner abundance threshold. In fact, scenario testing could identify what the WRLCM "abundance" number that equates to the 500 spawner threshold below which demographic stochasticity becomes a concern for population viability. (We understand that scenario testing may not be possible at this time but the uncertainty should be acknowledged.) As is pointed out in Lindley et al 2007 and the BO, only modest growth rates are required to have low probability of extinction when salmon populations are near carrying capacity of 500 spawners. Do the CRRs (i.e. growth rates) for the COS and PA qualify as "modest"? Lindley et al. 2007, p. 4, states as follows: "The population decline criteria are intended to capture demographic risks. The rationale behind the population decline criteria are fairly straightforward– severe and prolonged declines to small run sizes are strong evidence that a population is at risk of extinction. **The criteria have two components– a downward trend in** **abundance and a critical run size (< 500 spawners).** Note that spawning run size is distinct from *Ne*. Although it is not clear how Allendorf et al. (1997) chose 500 as the threshold spawning run size, we adopt this threshold to maximize consistency with their criteria. **We also note that typical salmonid populations** **near a carrying capacity of 500 spawners require only modest intrinsic growth rates to have low** **probability of extinction, given typical levels of variation** **in population growth** (D. Boughton, NOAA

		Fisheries, Santa Cruz, CA; in preparation)."
Life Cycle Models 2.5.9.2.1.3 Assessment of Population Decline Criteria p. 17	This analysis is also run for three additional time lags such that the relative change in abundance is measured over 1, 4, 12, or 20 year periods.	What is the reasoning for the different time lags? Winter run are dominated by the age-3 year class (1 year in freshwater, 2 years in the ocean). Trends from one year to the next say next to nothing about the population dynamics. There will undoubtedly instances where the population declines from one year to the next because a bad year in the CalSim model followed a good year. The 12 year time lag will be dominated by a cohort (12 is divisible by 3, so it's basically the CRR for the 4th generation), but time lags of 4 and 20 are tracking different cohorts
Life Cycle Models, p. 17	Table 2.5.9-1 shows the relative probability of events in which the spawning abundance declines by more than 10 percent over several time periods. The general pattern shows a higher number of events for the PA relative to the number of events for the COS over the 75-year timeframe. This is consistent for spawner abundances at lags of 4 and 12 years, with a shift toward more events for the PA relative to the COS at a lag of 20 years than the other time periods.	It is unclear when the CRR is increasing under PA relative to COS, how the spawner abundance is reducing.
Life Cycle Models 2.5.9.2.1.3 Assessment of Population Decline Criteria **Table**	**Relative probability of events in which there is a decline in spawner abundance of <u>more than</u> 10 percent at time lags of 1, 4, 12, or 20 years for the COS and PA.**	1) What is the uncertainty in these proportions? 2) The proportions reported in the Table are conditional on one or both of the COS and PA populations meeting the decline in spawner abundance greater than 10% criteria. At the 1-year time lag the 10%

2.5.9-1. p.17		decline criteria is evaluated 74,000 times for the paired COS and PA scenarios (1,000 simulations for 75 CalSim years). If out of the 74,000 year-to-year comparisons in population abundance the decline is 10% or greater in half of them, then the results in the Table should give us pause. If declines of 10% or greater are uncommon, then the differences between the scenarios will be made to look more significant than they are. To calculate the true proportion you need to multiply through by the proportion of year-simulation cases where the population declined by >= 10% **3) The results should give the context of what fraction of the cases are represented in the Table AND the uncertainty estimates should take account of this conditional probability.**
Life Cycle Models 2.5.9.3 Summary	This 3 percent difference is not large in magnitude, but it does not support an opposite trend – that abundance would increase for the PA. Considering these results together, NMFS believes that the effects of the operations of the PA would not increase abundance or productivity of winter-run Chinook salmon, but assumes that results would be similar to those of current operations.	Not state here or elsewhere what the model's "detection limit" is, or what NMFS constitutes as a ESA-significant difference given known uncertainty in the model inputs like CalSim. Is it normal for a BO to assess whether a PA will <u>increase</u> a population? "PA would not increase abundance or productivity of winter-run Chinook salmon" "Productivity" is the CRR metric in the WRLCM analysis. I don't think I saw an absolute mean value, just the relative CRRs for the COS and PA. That said, the PA was marginally greater than COS which is not consistent with the statement that the "PA would not increase…productivity of winter-run Chinook Salmon"
Delta Effects p. 79-80	• Measured cumulative loss to date since October 1 for winter-run Chinook salmon (based on length-at- date criteria) is greater than the	Given what has been said about Performance Measures being aligned with historical Loss, I think these cumulative Loss thresholds will need to be revised otherwise the triggers will be greater than cumulative allowed loss for a year. We have not had an opportunity to review the Performance Measures that are proposed for

	percentage below of a loss threshold calculated as 2 percent of the JPE: • January 1 – 15: 2 percent (0.04 percent of JPE) • January 16 – 31: 4 percent (0.08 percent of JPE) • February 1 – 14: 6 percent (0.12 percent of JPE) • February 15 – 28: 9 percent (0.18 percent of JPE) • March 1 – 15: 21 percent (0.42 percent of JPE) • March 16 – 31: 26 percent (0.52 percent of JPE) • April 1 – End of OMR: 30 percent (0.60 percent of JPE)	inclusion in the project description. We object to the adoption of Performance Measures until we have had an opportunity to review. What we understand to be included in the Performance Measures is concerning.
Delta Effects 2.5.5.8.3.1.1.1 Juvenile Salvage Estimates using the Salvage-Density Method	The results of the salvage-density method showed that, based on modeled south Delta exports, annual loss of winter-run Chinook salmon at the south Delta export facilities would be 7 percent (in Above Normal water year types) to 38 percent (in Critical water year types) higher under the PA than the COS.	The results should place the Loss estimates in the context of the allowed Take and/or JPE. These percent differences for the PA look significant, but would they exceed the 2% of JPE allowed under the BO? And the methods do not account for how the COS or PA would be operated if cumulative loss was approaching the annual limit. Assuming the median Total Fish Loss of 2,228 and median JPE of 354,164 the loss ratio would go from 0.28% to 0.67% (AN) - 0.87% (C). (My quick math ignores water year effects on export operations that may make WRCS more/less susceptible to being entrained at the export

		facilities.)
Delta Effects p.195-211	Table 2.5.5-26-60	It would be helpful if NMFS could place the results within the context of the ITL %. E.g. For Table 2.5.5-26, what is the % loss of JPE for each water year type for the COS and PA? Does the PA exceed the 1% ITL under any WYs that the COS does not? …And I'm not sure 1% is even the correct ITL to use because the data set the model is based off uses LAD run assignment, in which case the ITL is 2%. The 1% ITL applies to genetic confirmed natural production WR. For Spring run, Steelhead, and Sturgeon we will need proper monitoring to estimate their own JPE. Otherwise, Performance Measures will be linked to static ITLs that are 1) arbitrary and 2) do not respond to changes in population size and therefore would penalize operations if/when the populations recover
Delta Effects p. 88	The results of the salvage-density method showed that, based on modeled south Delta exports, mean loss at the south Delta export facilities would be substantially higher under the PA than the COS in all water year types for CV spring-run Chinook salmon	If spring run are determined to be this sensitive to operations, we would hope NMFS would adopt genetic monitoring for them at the facilities similar to winter run. The agencies currently use LAD for assigning spring run at the facilities and late-fall are used as a proxy for measuring loss.
Delta Effects p. 88-90	As discussed previously for winter-run Chinook salmon juveniles, there are many issues that influence the movement and vulnerability of juvenile CV spring-run Chinook salmon to entrainment, salvage, and loss at the fish collection facilities for the CVP and SWP…	The five paragraphs starting on page 88 are full of speculation as to why Spring run have lower survival in the Delta and how they become entrained at the facilities. There are no references to analyses or citations and the discussion does not compare the relative effects of the PA and COS. The central points of the discussion are almost entirely the same as those in the winter run section. In both cases there is the stated

		assumption that: "Increased exports has negative far-field migratory impacts as well, particularly in the Old and Middle River corridors which would negatively affect CV spring-run Chinook salmon in those corridors" Winter run and spring run (excluding SJ experimental spring run) should not be exposed to these "far-field" migratory impacts in the Old and Middle River corridors if they are migrating down the Sacramento River. Some percent may be entrained into the interior Delta which then may find themselves near Old and Middle River, but it needs to be stated that this is a fraction of the total out-migrating population.
Delta Effects p. 30	Based on the results of the Perry Survival Model, winter-run Chinook salmon juveniles and yearling spring-run Chinook salmon are the two groups of salmonids that will be affected most by the PA. Those fish that migrate through the Delta during October and November will see the largest differences in through-Delta survival, routing into the Delta interior, and travel times. Based on the results of the modeling for the October and November period, the PA will decrease through-Delta survival compared to the COS, increase the number of fish routed into the Delta interior compared to the COS, and increase the through Delta travel time of fish compared to the COS. It	Highlighting the key result/conclusion from the Perry analysis. Differences between the PA and COS affect winter run and spring run in the fall when Fall X2 is implemented in the COS but not in the PA. DCC operations differ as well because Fall X2 is not included in both. (Moreover, there is a fall habitat action in the PA and that needs to be accounted for in the analysis.) Also, the Perry Survival model evaluates what survival is through the Delta, however not all fish migrate through the delta. Nowhere is it stated whether the Fremont Weir action is implemented for the Perry analyses. I assume it is in whatever form it has been modeled for CalSim. The Perry analysis considers through-delta survival for Sacramento River fish starting at Freeport, but fish can also bypass the delta altogether in years when the weir overtops (or gates are operated in the improved weir). This should improve survival from Sacramento to the Chipps Island for fish that go over the Fremont Weir, but it may come at a survival cost for fish that remain in the Sacramento if Fremont Weir flows reduce ae Freeport flows below some threshold (~30,000 cfs.?). Whether there would be a differential effect between the PA and COS is unclear without understanding how CalSim treats Fremont Weir.

	should be noted that these differences are driven in part by the operations of the DCC gates, which respond to the differences in river flow between the two scenarios as described above. Operations of the gates in real time, based on observations of fish in monitoring programs, may differ from the operations of the gates in the modeling, and thus provide equal or better protection than exhibited in the modeling. Finally, since the Perry Survival Model does not use any specific relationships between exports and survival, the model is relatively insensitive to the effects of changing exports. Likewise, the Perry Survival Model does not specifically use any data from studies conducted in the San Joaquin River side of the Delta, and therefore should not be used to interpret survival, routing, or travel times for salmonids entering the Delta from the San Joaquin River side of the Delta.	
Delta effects, p. 130.	"Operations of upstream reservoir releases and diversion of water from the south Delta have been manipulated to maintain a "static" salinity profile in the western Delta near	What evidence is being relied on to support this statement?? What is meant by "static"? The water projects and government regulation aren't controlling salinity and outflow all year and

	Chipps Island."	in all water year types, so what time or season is this statement referencing? Recent studies show that this is not true in every month of the year. The water projects are contributing more flow than would occur in pre-project conditions in September. October is a transition month- with projects sometimes increasing or decreasing salinity- depending on the year. It should also be acknowledged that other changes are also occurring in the system, like changes in upstream uses. (See e.g., Hutton et al. 2017.)
Delta effects, p. 130	"The CVP and SWP's long-term water diversions also have contributed to reductions in phytoplankton and zooplankton populations in the Delta itself as well as alterations in nutrient cycling within the Delta ecosystem."	We are unaware of any study that supports the conclusion that project operations have had a population level effect on zooplankton and phytoplankton. There is no citation provided.
Delta effects, p. 130	"…RPA provided a 'Fall X2' standard which requires that the location of the low-salinity zone… be located no greater than…74 and 81 km from the Golden Gate bridge in September, October and November." "Currently, in addition to D-1641, Reclamation operates to reduce entrainment risk and for Delta Smelt fall habitat in wet and above normal water years through releases of water from storage for Fall X2. The USFWS recommended in its designation of critical habitat for Delta Smelt	This statement is factually incorrect. The Fall X2 RPA does not require that X2 be at any particular location in November. In November, the projects are not allowed to increase storage unless X2 is downstream of that year's September-October target. The critical habitat designation does not make this statement. This statement originated in D-1641 and is a goal that the Water Board was trying to achieve. Reclamation does not operate to avoid entrainment risk of Delta Smelt in the fall. DS OMR requirements do not start until mid-December. Salmon OMR requirements start in January. Reclamation does not meet Fall X2 solely through reservoir releases, as it may also limit diversions.

	that salinity in Suisun Bay should vary according to water year type.”	
Delta effects, p., 131.	“Reclamation proposes to manage for Delta Smelt habitat in fall of above normal and wet years….”	Reclamation also proposes to manage Delta Smelt habitat in below normal years through SMSCG operations as part of the summer-fall action.
Delta effects, p. 131	“Reclamation would coordinate with USFWS to assess the potential for updating the habitat index to incorporate biotic elements, particular food….”	What is meant by “updating the habitat index”? Reclamation proposes to provide overlapping components of species habitat in the same geographic area, but not necessarily to change a statistical “index.”
Delta effects, p. 131.	“Iterative analysis using DSM2 model would be required to identify associated changes in Delta outflow and reservoir releases required to support changes in outflow. The analysis has not been completed and, therefore, the effects of this operation have not been incorporated in the CALSIM II model.”	FWS is evaluating using UNTRIM. NMFS should coordinate with FWS.
Delta effects, p. 131.	“The ROC on LTO states that the PA would result in X2 being essentially the same as current operations in drier years, but greater (more upstream) than the current operations scenarios in wet and above normal years.”	Since the summer-fall action was not included in the CALSIM modeling, the modeling does not accurately reflect the proposed summer-fall action. This should be acknowledged in the BO. The description of the summer-fall action has changed in the PA. This analysis needs to be updated.
Delta effects, p. 133	“A change in Delta outflow or location of the low salinity zone can affect adult CCV steelhead and juvenile and adult sDPS green sturgeon during the fall, as adult CCV stellhead are	What magnitude of change would have to occur to trigger such a response? Is that within the potential magnitude of change being proposed? What would happen if steelhead migrated earlier? There is no citation supporting the conclusion that this is a potential concern for steelhead. There is no cited study or analysis of the effect of

	migrating upstream at this time and sDPS green sturgeon may be migrating or rearing in the Delta. Increased Delta outflow may stimulate adult steelhead to initiate upstream migration earlier as it may resemble a precipitation even in the upper watershed.	a specific change of flow on sturgeon rearing. What type of change in flow would be a concern? Is the relevant flow comparable to the project related change in flow?
Delta effects, p. 133	"…shifting the low salinity zone upstream for 2 month of the year is not likely to substantially alter food resources…."	The PA isn't shifting X2 upstream. The CALSIM results did not model the action.
Delta effects, p. 136	"Reclamation proposes to repair or replace the West Sacramento lock system to hydrologically reconnect the SDWSC with the mainstem of the Sacramento River from mid-spring to late-fall for the purpose of flushing food production into the north Delta to benefit Delta smelt and to provide an alternate migration pathway for fish…."	Does Reclamation have the authority to do this?
Delta effects, p. 139	"The purpose of gate operation is to decrease the salinity of the water in Montezuma Slough to meet salinity standards set by the SWRCB and Suisun Marsh Preservation Agreement."	The Suisun Marsh Agreement does not set salinity standards.
Delta effects, pp. 140-142	Suisun Marsh Salinity Gate operation	The project description has been updated since this analysis was written. We thought the 60-days included the days when it would otherwise be operated. Did not think it was additive.
Delta effects,	Salvage density method	It should be explained that even the PA results in

p. 195-196	results	loss of only a fraction of the JPE.
See e.g., p. 197	Salvage density method results	Do not believe it is informative to split out the effects of the SWP as compared to the CVP.
Delta exports, p. 218.	Table 2.5.5-66- entrainment	**We are not shifting operations from the SWP to the CVP. We object to the inclusion of this provision.** **We do not agree that so-called preferential pumping would improve survival.**
Delta effects, p. 227	"…theortetically increasing the area of productive mixing in the western Delta between fresh and saline waters. This will lead to increasing amounts of primary and secondary productivity, which in turn enhances the forage base for juvenile salmonids." "…outflow will improve water quality and conditions supporting the mobility and survival of adult and juvenile salmonids." "…provide suitable salinity conditions supporting juvenile and adult physiological transitions…."	There is no citation provided to support this assumption based on the food supplies preferred by species. No citation has been provided to support assumption that proposed DS outflow would result in any change in salmon prey populations. No citation has been provided to support assumption that fall habitat (its salinity- not outflow) would result in any difference in salmonid survival. No citation has been provided to support assumption that location of X2 has any relationship to the ability of salmonids to complete physiological conditions.
Delta effects, p. 232	"…minor deficit for contaminants in the water body…."	What evidence is NMFS relying on to determine that DWSC sediment is contaminated?
Delta effects, p. 213.	"Release of additional water from upstream to augment."	It is unclear what is meant by additional water. That is not how the action is described. "Additional water" as compared to what?
Delta effects, p. 235	"At the SWP, both adult and juvenile fish are entrained into the CCFB	**We object to this description of project effects to the extent it suggests SWP are larger than CVP effects.**

	when the radial gates are open and may be detained in this waterbody for a considerable amount of time. Smaller fish may be salvaged at the SDFPF, as they can pass through the trash racks, while larger fish are prevented from entering the salvage process due to the narrow spacing of the metal bars on the trash rack screen. Larger fish can only escape the CCFB if they swim back out of the radial gates and reenter the Delta via West Canal and Old River. Although the physical effects related to the operations of the SWP and CVP are large, the impacts to the migratory corridor element of the PBFs is considered medium due to the distribution of green sturgeon in the Delta."	
Upper Sacramento River Effects, p. 41	BiOp misstates that current RPA. "The current RPA requires Reclamation to consider a number of actions in drought (or low Shasta storage conditions) to help conserve and/or build Shasta storage for better cold water pool management. One of these actions requires Reclamation and DWR to make releases first from Folsom Reservoir and	**The current BiOp does not require that water for meeting in-Delta regulatory requirements must come from the state project first.** This is an apparent reference to the current BiOp at p. 596. In the BiOp, there is an action plan for when Shasta storage is below 1.9 MAF that includes multiple actions, and prioritization of other non-federal reservoirs is only considered if other regulatory requirements are not being met and exports have already been cut to essentially health and safety levels. This "reprioritization" as described in the NMFS BiOp violates the COA, which is a Congressionally authorized agreement between the state and federal government. Just as the

	then from Oroville Reservoir to meet Delta outflow or other legal requirements before making releases from Shasta Reservoir." "…Reclamation confirmed verbally that further preferential drawing from Oroville Reservoir on a regular basis beyond that outlined in the 2018 COA would be unlikely, although such an action (along with other actions) may be considered in extreme dry periods under a drought contingency plan."	settlement contracts cannot be violated, nor can the COA. The only occurrence of "reprioritization" during the extreme drought was a result of a voluntary agreement with the state. We appreciate and agree with Reclamation's statement that any shifting of regulatory burdens to the state beyond that already included in the 2018 COA amendment is unlikely. We do not anticipate agreeing to an even larger share of the regulatory burden. It should be further noted that Oroville and the Feather River are outside of this consultation.
Baseline effects, p. 3.	"Land use changes to support and protect California's rapidly increasing human population combined with substantial and widespread water development, including the construction and operation of the CVP/SWP, have been accompanied by significant declines in nearly all species of native fish (State Water Resources Control Board 2017)."	This is not true in regard to all or nearly all species. There are many species in the Delta with large and increasing populations. The Water Board did not provide a reference to support its conclusion so it should not be cited as fact.
Baseline effects, p. 5.	"Still, with so little freshwater habitat now available in the Central Valley, habitat heterogeneity has decreased, and we expect salmonid population diversity and resilience	Believe the statement regarding vulnerability to climate change and change in resiliency is in relation to historic conditions. Would be helpful to indicate what time period is being compared to.

	has decreased (**Figure 2.4.1-3**), and vulnerability to climate variability and change has increased (Herbold et al. 2018)."	
Baseline Effects, p. 6.	"Upstream water diversions combined with water exports in the Delta have reduced January to June outflows by an estimated 56 percent (average), and annual outflow by an estimated 52 percent (average). In the driest condition, in certain months outflows are reduced by more than 80 percent, January to June flows are reduced by more than 70 percent and annual flows are reduced by more than 65 percent (State Water Resources Control Board and California Environmental Protection Agency 2017)." "…it is not surprising that native fish and wildlife in the Bay-Delta watershed have been significantly impacted by removing over half of the water."	The Water Board is making a comparison to unimpaired flow. Their comparison fails to account for historic water use by native plants, and evaporation on the valley floor. Water would never have left the Delta in the same quantity as arrived in the upstream basins. The BiOp's statement is misleading as the species would never have experienced Delta outflow comparable to what arrives in the upper basins.
Baseline effects, p. 7	*"River flows and water quality declined…"*	This statement is misleading because water quality (salinity) in the Delta improved with the operation of the water projects, making conditions fresher overall as compared to 1920 and 1930s. Again, what is the baseline that is being compared to? Water quality declined where and compared to what? The blanket statement that river flows have declined is incomplete or misleading as well. For example, the Sacramento River has more flow

		than it normally would in the summer and fall of drought years because of storage releases. However, river flows are less at other points in time. The statement should be specific as to what comparison is being made.
Baseline effects, p. 9	Figure 2.4.1-5	This figure seems to suggest that without the SWP-CVP, the ocean would never intrude into the Delta. That isn't correct. In dry years and drier time of year, the ocean would intrude if the projects were not managing outflow. What time period or season are these figures representing?
Baseline effects, p. 30	WR Extinction Risk	It would be helpful to also explain that the population has rebound since its listing, even though there has been a recent decline during the drought.
Baseline effects, p. 53	"The harvest biological opinions referenced above that considered potential prey effects to Southern Residents have all concluded that harvest actions cause prey reductions, but were not likely to jeopardize the continued existence of ESA-listed Chinook salmon or Southern residents." "Although precise estimates of exploitation rates for all Central Valley Chinook salmon population typically is equal to or exceeds the estimated escapement of fall-run Chinook salmon in the Sacramento River as rep[resented SI used for fisheries management each year."	It seems inconsistent to conclude no jeopardy for fishing when exploitation of fall -run rates exceed escapement. The permitted fishing exploitation rates are much higher than allowable take from CVP-SWP operations.
Cumulative effects	Discussion of wastewater treatment plants	The discussion should have considered the potential effect of wastewater treatment plant discharges, particularly discharges of ammonia,

		on productivity and *Microcystis*. The discussion seems to focus exclusively on direct toxicity to species. See e.g., Glibert et al. 2011. It should also have acknowledged that the Regional San treatment plant is being upgraded and the ammonia discharge will be reduced significantly within the permit term.
Cumulative effects	Fishing	It seems that ocean fishing should be included in cumulative impacts discussion.
Effects_Stressor Descriptions v2, Page 25, ¶2	"Historically, the San Joaquin River has been an important source of nutrients to the Delta."	It is well documented that the San Joaquin River is at times a large source of nutrients to the Delta. Importance is more subjective. The nutrient load from the SJR is large relative to its size, but the Sacramento River remains the largest source of nutrient loads to the Delta. Dahm, C.N., A.E. Parker, A.E. Adelson, M.A Christman, and B.A. Bergamaschi. 2016. Nutrient dynamics of the Delta: effects on primary producers, San Francisco Estuary & Watershed Science: 14(4) Suggest modifying this sentence to: "Historically, the San Joaquin River has been ~~an important~~ a relatively large source of nutrients to the Delta."
Effects_Stressor Descriptions v2, Page 25, ¶2	"The resultant loss in nutrients has likely contributed to an overall decrease in fertility of the Delta, limiting its ability to produce food (NMFS 1997)."	Most, if not all literature describes the Delta as being light limited, not nutrient limited, with grazing by clams as the secondary control on productivity (e.g. Dahm et al 2016). The large extent of invasive aquatic weeds in the south and central delta is evidence that nutrient loss to exports has not limited the fertility of the Delta and its ability to produce food; it's just not producing food that is efficiently used by salmonids. Suggest deleting this sentence.
Effects_Environmental Baseline v11, Pages 17-19	Section 2.4.2.3 Water Quality	This section describes many of the contaminants that have been detected throughout the Central Valley; however, the text describes the effects on covered species as generally unknown. While there remains a lot of uncertainty regarding contaminant effects on salmonids and sturgeon,

		there is a lot more known than is indicated by the text in this section. Other sections of the Effects Analysis include much greater detail on these potential contaminant effects including the discussion on Clifton Court Forebay weed control in the Delta Effects section beginning on page 117 and in the Cumulative Effects section. This and those sections would benefit from inclusion of more recent research. Suggest adding a new paragraph(s) in this section with some information on what we do know about contaminant effects. The Delta Effects and Cumulative Effects sections are one source of information. A more recent contaminant synthesis is provided by Fong et al 2016. For example, Fong et al report, “Salmon abundance is declining, and several important stressors have been identified. Both pesticides and copper exposure can affect fish migration and orientation. The most commonly observed links with these behavioral disruptions include cholinesterase (ChE) inhibition, altered brain neurotransmitter levels, and sensory deprivation (Scott and Sloman 2004). Scholz et al. (2000) also concluded that exposures to low concentrations of diazinon likely increased the straying of the adult hatchery Chinook salmon over the control group. Furthermore, juvenile salmonids exposed to pesticides during development may fail to imprint to their natal waters, which can lead to increased adult straying (NMFS 2009). Chlorpyrifos exposure directly affects the nervous system (Baldwin et al. 2009) and the olfactory system (Maryoung et al. 2015). There is evidence that behavioral effects of pesticides affect salmon populations in other ecosystems. For example, cypermethrin prevented male Atlantic salmon from detecting and responding to the reproduction-priming pheromone prostaglandin, which is released by ovulating females (Moore and Waring 2001). Copper concentrations of 2 µg L□1 significantly affect the olfactory system in juvenile salmonids (see video3, Sandahl et al. 2007; Grossman 2016),

		increasing predation risk and impairing osmotic homeostasis (Grosell et al. 2002). This is of concern because dissolved copper concentrations detected in water samples from Cache–Lindsey Slough and Rough and Ready Island were above threshold. Also, copper causes cholinesterase (ChE) inhibition, so its effects may be additive when present with OPs. In addition to behavioral effects, OPs have been shown to affect the immune system in Chinook Salmon, increasing their susceptibility to disease (Eder et al. 2008). Histopathological abnormalities and reduced growth have been reported for both invertebrate and fish species (Baldwin et al. 2009; Hasenbein et al. 2015b). Impaired gonadal or thyroid hormone levels in salmon have also been observed (Scott and Sloman 2004). And, "Multiple studies have found sublethal, lethal, chronic, and acute toxicity of Bay–Delta waters to model test species of phytoplankton, invertebrates, and vertebrates (Jassby et al. 2003; Johnson et al. 2010; Blaser et al. 2011; Brooks et al. 2012; Scholz et al. 2012). Multiple-species studies that evaluated Bay– Delta ambient water samples, or conducted *in situ* exposures (referenced in Table 1), have repeatedly identified a broad set of mechanistic, systemic (immune, neurological, endocrine), histopathological (tissue damage), and whole-organism effects (e.g., growth, development, deformities). Endocrine disruptive effects have been measured in samples from Sacramento River tributaries and in the Bay– Delta (Schlenk et al. 2012; Brander et al. 2013; Cole et al. 2016)." And, "…several studies (see Table 1) have highlighted pyrethroid pesticides as responsible for toxicity, endocrine disruption, and neurological impairments in both fish and their prey (Brander et al. 2013, 2016b; Hasenbein et al. 2015c; Jeffries et al. 2015b; Weston et al. 2015a)." And, "Exposure and bioaccumulation of polybrominated diphenyl ethers (PBDEs), PCBs, and legacy pesticides can result in these

		contaminants being transferred maternally from females to eggs, which affects egg size, fecundity, brain and liver development, impaired growth, and survival (Ostrach et al. 2008). These compounds are widespread in the Bay–Delta, and studies have demonstrated their effect on fish health and development (Spearow et al. 2011; Durieux et al. 2012).” Fong, S., L. Stephen, I. Werner, J. Davis, and R.E. Connon. 2016. *Contaminant Effects on California Bay-Delta Species and Human Health*, San Francisco Estuary & Watershed Science: 14(4).
Effects_Environmental Baseline v11, Pages 17-19	Section 2.4.2.3 Water Quality	Section 2.5.5.8.5.3.5.3.1 Copper-based herbicides and algaecides beginning on page 117 of the Delta Effects Section includes a very detailed description of research on copper effects on salmonids and includes the results of an olfactory experiment (Baldwin et al. 2003) examining the effects of low dose copper exposure on coho salmon (*O. kisutch*) and their neurophysiological response to natural odorants. “The inhibitory effects of copper (1.0 to 20.0 ppb) were dose dependent and were not influenced by water hardness. Declines in sensitivity were apparent within 10 minutes of the initiation of copper exposure and maximal inhibition was reached in 30 minutes. The experimental results from the multiple odorants tested indicated that multiple olfactory pathways are inhibited and that the thresholds of sublethal toxicity were only 2.3 to 3.0 ppb above the background dissolved copper concentration.” This baseline water quality section should include greater detail on this contaminant effect along with reference to available data indicating that ambient copper concentrations in the Central Valley often exceed this level. For example, Fong et al 2016 state, “Dissolved copper concentrations up to 4.64 and 4.93 µg L□1 were detected in freshwater water samples from Cache–Lindsey Slough and Rough and Ready Island,

		respectively, and elevated dissolved copper concentrations of 37.2 and 58.9 µ g L□1 have also been detected at Suisun Bay and Carquinez Strait, respectively (Werner et al. 2010a).
Effects_Cumulative Effects, Page 3, section 2.7.3	The Wastewater Treatment Plants description only discusses wastewater treatment plants as a source of ammonia.	Wastewater treatment plants can also be a source of numerous other contaminants including pesticides, pharmaceuticals and personal care products and some discussion of those should be added. In addition, the NPDES permit for the Sacramento Regional WTP includes an Exception to the State Water Board's Thermal Plan because the discharge currently exceeds the temperature objectives for estuaries. This temperature exceedance should also be mentioned in this section.
Effects_Delta Effects V14-6.2.19, Page 19-21, Delta Passage Model	Delta Passage Model results indicate the difference in through Delta survival between COS and PA for all runs of Chinook in all water year types to be less than 1% with only one exception, Late-fall run in dry years (-1.115% difference). The model outputs are also reported to 4 significant figures	Unless NMFS really has confidence that this model is accurate to 4 significant figures, suggest the results be reported to 1 or 2 significant figures at most. Reporting results to 4 significant figures implies the model is far more accurate than it is. Also, based on the accuracy of the model, suggest modifying the descriptors of comparisons between COS and PA. For example, if there is little confidence that the model can distinguish survival differences less than 1% then when the PA and COS differ by less than 1% the text should say something like through Delta survival under the PA and COS are essentially the same, or the model is unable to detect any difference between the PA and COS.
Effects_Delta Effects V14-6.2.19, Page 22, 1st ¶	"Given that the majority of results for Chinook salmon through-Delta survival have shown that survival under the PA conditions are less than under the COS conditions, it would be reasonable to conclude that CCV steelhead smolts emigrating through the Delta at the same time and under the same conditions assumed for the PA would	Given that steelhead smolts are larger and stronger swimmers and the differences between Chinook smolt survival under the PA and COS are so small, perhaps smaller than the ability of the model to distinguish, it may not be reasonable to assume that steelhead smolts would have reduced survival under the PA. Suggest modifying this statement to reflect confidence levels in the results or to state the DPM model does not apply to steelhead and is not used to assess impacts to survival.

	also have reduced survival under the PA"	
Effects_Delta Effects V14-6.2.19, Page 22, last ¶	The comparison of COS and PA estimates of survival are described for "Delta origin winter-run Chinook salmon smolts"	Since winter-run originate in the Sacramento River, what is a "Delta origin winter-run smolt? I think you mean Delta-reared winter-run smolt. Suggest changing for greater clarity. Since this ¶ is only describing results for a portion of the winter-run population (the portion that rears in the Delta), suggest adding language to quantify what portion of the population may actually be included in these estimates (e.g. the paragraph says "up to 9.4 percent difference in below normal years" Suggest adding <u>This would affect approximately x% of the total winter-run smolt population</u>
Effects_Delta Effects V14-6.2.19, Page 80, OMR Flows	Section describes the differences in OMR between the PA and COS indicating that flows are often more negative under the PA.	That OMR flows are more or less negative under the PA versus the COS may be less informative than the absolute values of OMR under each scenario compared to the timing when fish are present. In other words, Table 2.5.5-21 shows that OMR may be about 4,000 cfs more negative under the PA than under the COS in wet years. However, if under the COS OMR flows are generally positive during this time period in wet years and the 4,000 cfs difference under the PA only makes them slightly negative the impact on salmon may be minimal. Suggest including information on the absolute values of OMR flows under each scenario for the difference time periods and water year types.
Effects_Delta Effects V14-6.2.19, Page 129, last sentence	"Current estuarine areas are degraded as a result of the operations of the CVP and SWP." And, "…as the location of the low salinity zone (X2) was modified to control Delta water quality, and competing species' needs (*i.e.*, Delta smelt), the Delta served more as a migratory corridor…"	Current estuarine areas are degraded as a result of numerous things including reclamation of marshland, loss of tidal and floodplain habitat, contaminants from urban and agricultural activities, non-native predators, invasive aquatic vegetation, etc.... Operation of the CVP and SWP and its effect on the physical location of the low salinity zone is only one of many factors that effected the Delta's ability to serve as transitional habitat versus a migratory corridor. Suggest revising this language to acknowledge multiple factors effecting habitat suitability.

Effects_Delta Effects V14-6.2.19, Page 130, 1st full ¶	"The CVP and SWP's long-term water diversions also have contributed to reductions in the phytoplankton and zooplankton populations in the Delta itself as well as alterations in nutrient cycling within the Delta ecosystem."	Reductions in phytoplankton are generally linked to increased grazing by invasive clams (e.g. Nichols et al 1990; Greene et al 2011; and Kimmerer and Thompson 2014) and to alterations in nutrient forms and ratios (e.g. Glibert et al 2011; Dugdale et al 2007) neither of which are a result of CVP and SWP diversions. Nichols, F.H., J.K. Thompson, and L.E. Schemel. 1990. Remarkable invasion of San Francisco Bay (California, USA) by the Asian clam *Potamocorbula amurensis*. II. Displacement of a former community, Marine Ecology Progress Series, 66:95-101. Greene, V.E., L.J. Sullivan, J.K. Thompson, and W.J. Kimmerer. 2011. Grazing impact of the invasive clam *Corbula amurensis* on the microplankton assemblage of the northern San Francisco Estuary, Marine Ecology Progress Series, 431:183-193. Kimmerer, W.J and J.K. Thompson. 2014. Phytoplankton Growth Balanced by Clam and Zooplankton Grazing and Net Transport into the Low-Salinity Zone of the San Francisco Estuary. Estuaries and Coasts. DOI 10.1007/s12237-013-9753-6. Dugdale, R.C., F. P. Wilkerson, V. E. Hogue and A. Marchi. 2007. The role of ammonium and nitrate in spring bloom development in San Francisco Bay. *Estuarine, Coastal and Shelf Science* 73: 17-29. Glibert, P.M., D. Fullerton, J.M. Burkholder, J.C. Cornwell, and T.M. Kana. 2011. Ecological stoichiometry, biogeochemical cycling, invasive species, and aquatic food webs: San Francisco Estuary and comparative systems. *Reviews in Fisheries Science*, 19(4):1-60
Effects_Delta Effects V14-6.2.19, Sections 2.5.5.10.1.1.3	Neither of these sections describe any of the potential benefits of these food subsidy actions	Suggest adding a statement similar to that for tidal habitat restoration on page 143 to describe potential benefits to the species from these actions, "Tidal habitat restoration is expected to benefit

Sacramento Deep Water Ship Channel Food Study 2.5..5.10.1.1.4 N Delta Food Subsidies / Colusa Basin Drain and Suisun Marsh…food subsidy studies		juvenile winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and southern DPS green sturgeon in several aspects, including increased food availability and quality, and refuge habitat from predators. These benefits can be manifested by higher growth rates in fish utilizing these habitats and increased survival through the Delta."
Upper Sacramento Effects, p.14	Assumed the modeling represents a scenario of limited effects of climate change to the species; NMFS layers additional qualitative evaluations onto quantitative analyses to reflect greater projected changes in temperature and sea level rise in CMIP5 modeling.	Comparison of SMIP3 and CMIP5 indicate similar projected temperatures (~2.7 deg F) and sea level rise at 2030. It is unclear how NMFS is assuming CMIP5 is showing greater warming and sea level rise.
Upper Sacramento Effects, p. 19	The high frequency of precipitous drops in the COS Keswick releases in December do not accurately reflect current operations.	Need citation
Upper Sacramento Effects, p. 39	A reasonable approximation of the effects of operational decisions, including fulfilling underlying contractual obligations, that are being made regarding spring operations for both the COS and the PA. Table 2.5.2-6 and captures modeled volumes of storage draw down to meet contracts which can	This assumes all the CVP deliveries to settlement and service contractors rely on the stored water releases from Shasta, when historically, some or most of the demands (in spring months) are met through unregulated flows downstream of Keswick. This is a very conservative assumption by NMFS. Furthermore, if diversion of unregulated flow assumption is made under COS, as it should be, then the incremental improvements in Shasta shown in CalSim II for PA compared to COS should be realized. It appears NMFS is not recognizing improved storage levels associated with efficient winter/spring delta exports and changes in the

	be considered when assessing impacts of deliveries on summertime temperature management actions.	proposed fall habitat action in the PA.
Upper Sacramento Effects, p. 41	Reclamation shall meet and confer with USFWS, NMFS, DWR, CDFW, and Sacramento River Settlement Contractors on voluntary measures to be considered.	It is unclear that the volunteer measures are same as what is being referred in the previous sentence. If it is, State Water Project PWAs should be explicitly identified to be part of the discussion.
Upper Sacramento Effects, p. 41	The CalSimII modeling indicates that Sacramento River flows at Keswick Dam are increased in the late spring (May), but because Delta outflow remains constant, this increase in Keswick release is done to meet agricultural demands and south-of-Delta exports rather than to meet Delta outflow requirements.	This is incorrect. Delta outflow during spring varies depending on the antecedent salinity conditions. South of Delta exports are constrained by SJR i-e ratio in COS, and by OMR in PA.
Climate Change, p. 1	However, based on results from the application of RCP 4.5 and RCP 8.5 in California's Fourth Climate Change Assessment (4th CA Assessment) (He et al. 2018, Pierce et al. 2018), NMFS expects that climate conditions will follow a more extreme trajectory of higher temperatures and shifted precipitation into 2030 and beyond. As provided by the 4th CA Assessment, NMFS assumes that temperatures would increase up to 1.9	4th CA assessment indicates 2.5 to 2.7 deg F increases from 2006 to 2039, which is in line with 1.25 to 2.5 deg F at 2030 under AR4, which was assumed in the PA modeling. Therefore, both AR4 and 4th CA assessment have similar projected increases in temperatures at 2030. It appears NMFS is comparing two different points in time in deciding projected increases in air temperature, and characterizing the modeled effects as "lower effect". http://www.climateassessment.ca.gov/state/docs/20180827-SummaryBrochure.pdf pg 5

	°C (**3.4 °F**) between 2020-2059 and precipitation changes would range from -6% to +24% in the same period (He et al. 2018). Sea level rise is expected to range up to 15 cm (6 in) in 2030 and 10-38 cm (4-15 cm) in 2050 (Pierce et al. 2018).	
Climate Change, p. 1	There is a notable difference in the projected air temperature increases between the modeling used for the BA and the 4th CA Assessment. The updated projected temperatures increase more than 30% more than what is characterized in the shorter-term for 2025 in the BA; the difference in projections is nearly a full degree Celsius for the longer-term at 2100. These increases in air temperature can be expected to directly affect cold water pool and reservoir temperatures because of shifts to warmer storms, earlier snow melt, and increased or earlier solar warming of water in the reservoir. This would affect reservoir stratification and cold water pool setup, possibly beyond what can be predicted based on current understanding. Additionally, in-river summer water temperatures are already at levels that present	It is important to explicitly identify which point in time NMFS' is considering when describing the effects. If it is 2030, it is unclear what evidence shows significant increase in projected warming between what was assumed in the PA modeling and the 4th CA Assessment. If the analysis and statements refer to a time period further in the future than 2030 (analysis period), NMFS need to state that clearly and distinguish the anticipated effects at 2030 from the future estimated effects. Otherwise, it appears NMFS is comparing two different points in time and conflating them with differences between AR4 and the 4th CA Assessment. If the analysis point of time is 2030, then there is no reason for NMFS to consider the PA modeling is reflecting a "lower effect" just because it was based on AR4 projections. As indicated earlier, both AR4 and CA 4th Assessment indicate similar projected increases in the temperatures at 2030.

	challenges in managing to protect the species. Considering the 4th CA Assessment, NMFS expects that in-river temperatures will be even greater than what was presented in the BA modeling; this will increase the management challenges in late-summer and fall months as reservoir cold water pools deplete over summer in efforts to keep downstream temperatures within a suitable range. NMFS cannot quantify the effect of this on species, but will assume that the provided modeling represents a scenario of lower effect and will layer additional qualitative evaluations of increased climate effects to the species based on the updated assessments.	
Climate Change, p. 2	The BA modeling and the 4th CA Assessment projections of sea level rise are similar for 2030, but have greater differences for later projections. The higher projection of sea level rise in the 4th CA Assessment in the long-term 2100 scenario can be expected to increase salinity and tidal forcing in the estuary and Delta, which will reduce the effects of riverine flow. The difference in the 4th CA	This is contradicting the first paragraph which says the SLR projections for 2030 are similar in AR4 and CA 4th assessment (6 inches). Not sure why the modeled effects would be considered to be "lower" at 2030 if both AR4 and CA 4th assessment are projecting similar sea level rise estimates.

	Assessment is especially apparent. No large-scale tidal restoration is included in the proposed action as designed to address this. It is, therefore, conceivable to expect modifications to proposed operations due to higher frequency of water quality excursions influenced by increased saltwater intrusion. There is also expected to be less seaward flow in highly tidal areas and tidally-influenced areas like the south Delta. Therefore, what was analyzed in the modeling of the biological assessment is considered by NMFS as the scenario of lower effect and consistent with the 4th CA Assessment for 2030; however, it is considered as an absolute lower effect for late 2000s when the assessment projects much greater increases than those captured in the modeling of 2030 in the BA.	
Environmental Baseline, p. 7	The CVP/SWP is one of the world's largest water storage and conveyance systems with both the federal and the state portions of the projects capable of storing and exporting millions of acre-feet of water away from the Delta each year.	Figure 2.4.1-4 is misleading in this context. This figure does not capture the large CVP's (>2 MAF) deliveries upstream of the Delta. This figure is also misleading
Environmental	The Delta also has been	This implies CVP/SWP have

Baseline, p. 7	physically modified with development of the CVP/SWP. The Public Policy Institute of California summarized the changes and resultant impact on native fish as follows: "After the SWP began operations in the late 1960s, the combined effects of CVP and SWP impoundments and diversions—along with those of hundreds of other water users—became clearly apparent. River flows and water quality declined, threatening both economic and environmental uses; and the ecological balance of the Delta became disastrous to native fish species (Moyle and Bennett 2008);(Lund et al. 2007),(Lund et al. 2010). The conversion of the 700,000-acre tidal freshwater marsh to a network of rock-lined channels had severely limited available habitat for fish, and dramatic reductions in the quantity and quality of Delta inflows further degraded that habitat. As the SWP increased its exports in the 1980s—almost doubling direct extractions from the Delta—conditions reached a crisis point (Figure 1.4)" (Figure 2.4.1-6) (Hanak et al. 2011).	modified/channelized Delta when in fact the Delta was converted from marsh to islands and channels well before CVP/SWP came online. Figure 2.4.1-6 is a 2011 reference that was not peer reviewed, and unfortunately, it implies a direct attribution between CVP/SWP exports versus the fish abundance changes. NMFS should acknowledge that the quoted PPIC reference does not do any attribution analysis between exports and fish abundance changes. Lastly, there is more recent scientific peer-reviewed literature attributing the fish population changes to factors other than exports, which should be acknowledged in here.

Delta Effects, p. 77	OMR Management	Proposed OMR limits and language do not reflect the latest project description for integrated early - winter pulse protection and turbidity bridge avoidance.
Delta Effects, p. 81	In addition, the modelled OMR flow patterns depict more negative values for OMR in the months of January, February, March and June. Furthermore, more negative OMR flows are modelled to occur in October of wet and above normal water year types with a difference of approximately 1,500 cfs under the PA as compared to the COS conditions. A similar response is modelled for January of above and below normal water year types in which the PA is approximately 700 cfs more negative than the modelled COS flows for OMR. In drier water year types, the modelling indicated that OMR flows in February and March are anticipated to be 1,000 to 1,600 cfs more negative (below normal to critical water year types) with the differences becoming greater as water year types become drier.	The COS model representation of OMR was based on expert judgement in 2009 before the 2008 and 2009 BiOps were fully implemented. The text should recognize that the COS model representation of the OMR requirements in the 2008 USFWS BO and 2009 NMFS BO are far more restrictive than what occurred historically. And, therefore, the modeling results under PA appear to be more negative than COS, when it is expected that the proposed OMR criteria in the PA for Dec – Mar would result in similar OMR values as COS. This is similar to NMFS assessment of HORB on page 128, where NMFS recognized that COS modeling did not include the HORB, when historically HORB was installed in the spring months. This comment also applies to the Salvage Density Results.
Delta Effects, p. 83	NMFS provides a quantitative analyses of entrainment differences between COS and PA using the salvage density methodology, and a qualitative discussion of	The reason for using 1995-2009 instead of 2009 – 2018 data needs to be stated. Use of data from 1995-2009 does not reflect a change in delta entry timing for various species (e.g. winter run have started entering delta earlier and exhibit bimodal peaks in recent years)

	potential predation differences between COS and PA. The salvage-density method relies on historic export rates and observed loss of salmonids and sturgeon at the CVP and SWP collection facilities (for water years 1995-2009).	Also, the results of density model used to estimate salvage/loss of salmonids need to describe the limitations of the analysis (linear model with more exports = more salvaged/loss fish, and no consideration of real time operations) and include a description of how real time operations would limit salvage loss as these would kick in if a threshold was triggered to limit salvage/loss.
Delta Effects, p. 93	The PA component may only occur once during this period. If the required conditions exist, Reclamation and DWR will reduce exports for 14 consecutive days to achieve an OMR index flow that will be no more negative than -2,000 cfs over the 14-day averaged flow.	The BA description indicates this to be -3500 cfs. At a May 21, 2019, consultation meeting on the Delta, Reclamation confirmed the OMR limit during a "First Flush" event should be -2,000 cfs.
Delta Effects, p. 97	Therefore, the proposed end of OMR management poses a greater risk to San Joaquin River CCV steelhead than the current management of OMR flows under the COS if CCF temperatures are not controlling. There is the potential to end OMR flow management prior to the completion of the San Joaquin River basin's steelhead outmigration, and place these fish at greater risk of entrainment at the export facilities or alterations of their migratory routing, leading to increased transit times and distance, resulting in reduced survival.	This descriptions should recognize the following in characterizing the risk: ■ The PA end of OMR is extended from June 15 to June 30, and the temperature offramps are same. ■ Delta smelt OMR may still continue through June 30. 95% of other salmonids may not exit the delta causing OMR to be at -5000 cfs until June 30.

Delta Effects, p. 97	If daily turbidity levels exceed 12 NTU, the 3-day average OMR index values will not be more negative than -2,000 cfs until the 3-day average turbidity at OBI falls below the 12 NTU threshold. This PA component will be implemented from February 1 to March 31, even if the first flush action has not occurred earlier in the year. This PA component will not be required on or after April 1.	Need to be consistent with project description
Delta Effects, p. 97	This PA component has the potential to be beneficial to listed salmonids or sDPS green sturgeon if the turbidity criteria are exceeded and the OMR flows are capped at being no more negative than -5,000 cfs during the turbidity bridge event.	Need to be consistent with project description
Delta Effects, p. 128	Buchanan 2019	Seems like the uncertainty is significant in the noted benefits of HORB.
Delta Effects, p. 131	Reclamation proposes to manage for Delta Smelt habitat in the fall of above normal and wet years by releasing additional Delta outflow to move the low salinity zone to beneficial areas to target creation of fall Delta smelt habitat in September and October following above normal and wet years. Fall Delta smelt habitat would be measured using the	This is inconsistent with the description of the action. Outflow augmentation is one potential tool for the summer-fall habitat management.

	physical and biological features of critical habitat; mainly Secchi depth, chlorophyll, water temperature, and salinity. Reclamation would coordinate with USFWS to assess the potential for updating the habitat index to incorporate biotic elements, in particular food (zooplankton prey density), in order to better capture the potential benefits from actions such as operation of the Roaring River Distribution System west-side drain. Achievement of these targets would be assessed using current multi-dimensional Delta models, applying the observed outflow and operations, in addition to other necessary inputs to be developed by Reclamation and DWR.	
East-side tributaries	Comment applying to the entire analysis.	Effects of operations in the Stanislaus River for steelhead are only looked at under the PA and negative impacts are concluded. However, analyses should be describing the differences of impacts of the PA compared to the COS. The COS has impacts and the PA's impacts may not be changing much from current COS impacts. The results section for impacts to steelhead and spring-run, and sturgeon for the Stanislaus and San Joaquin River need to be comparing impacts that differ between the PA and COS, current language is focused on the PA.
East-side tributaries p. 30	Table 2.5.7-10 looks at steelhead life stages and the stressors associated	But how do these stressors change under the PA vs COS?

	with the PA component of seasonal operations and the SRP	
East-side tributaries p. 31	The suitability of modeled temperatures under the PA for each CCV steelhead life stage is summarized below.	But how do these temperature changes under the PA compare to the COS?
East-side tributaries p. 35	Life stage-specific responses to specific stressors related to the PA are summarized in and described briefly in this section	But how do these stressors change under the PA vs COS?
East-side tributaries p. 46	**2.5.6.1.6.3 CV Spring-run Chinook Salmon Risk**	These results should be comparing the PA to the COS
Delta Effects, p. 11	Table 2.5.5-1 Water Transfers analyzed for predation	What is the justification for this stressor resulting in predation? What evidence is there that this stressor results in predation?
Delta Effects, p. 12	Table 2.5.5-1 End of OMR Management analyzed for predation	What is the justification for this stressor resulting in predation? What evidence is there that this stressor results in predation?
Delta Effects, p. 12	Table 2.5.5-1 Additional Real-time OMR Management analyzed for predation	What is the justification for this stressor resulting in predation? What evidence is there that this stressor results in predation?
Delta Effects, p. 12	Table 2.5.5-1 Storm Related OMR Flexibility analyzed for predation	What is the justification for this stressor resulting in predation? What evidence is there that this stressor results in predation?
Delta Effects, p. 12	Table 2.5.5-1 Minimum Export Rate analyzed for predation	What is the justification for this stressor resulting in predation? What evidence is there that this stressor results in predation?
Delta Effects, p. 15	Near-field effects on fish at the export facilities are just one element of project-related mortality	The point above this states that effects of outside the facilities diminish with distance. If the effects of the facilities diminish with distance then it is not possible that more negative OMR flows

	in the Delta; more negative OMR flows are a proxy measure for changed hydrodynamics within the Delta. Those hydrodynamic effects are likely to increase residence time in the Delta, even for fish not entrained into the fish salvage facilities, increasing their exposure to predation and other stressors within the central and south Delta.	increase residence time in the Delta. Remove statement and logic from analysis or provide robust citation
Delta Effects, p. 16	Section 2.5.5.1.1 Routing at junctions on the mainstem Sacramento River and San Joaquin River	Section should include discussion of Sacramento River, not just the San Joaquin River
Delta Effects, p. 22	Given that the majority of results for Chinook salmon through-Delta survival have shown that survival under the PA conditions are less than under the COS conditions, it would be reasonable to conclude that CCV steelhead smolts emigrating through the Delta at the same time and under the same conditions assumed for the PA would also have reduced survival under the PA conditions compared to the COS, although the magnitude of the difference is uncertain due to differences between Chinook salmon and CCV steelhead.	More context needs to be added around this, survival for the Chinook runs was minimally less under the PA compared to COS, less than 1.1% and event positive under some scenarios for winter-run.
Delta Effects, p. 27	Section for 'Winter-run Exposure and Risk': The	The Perry Survival Model was based on

	Perry Survival Model comprehensively looks at factors that affect survival, such as travel time, routing into the Delta interior, and operations of the DCC gates, to evaluate how changes in Delta inflow will affect smolt migratory success between the PA and COS scenarios	acoustically tagged late fall-run Chinook salmon. There should be a discussion on how the transferability of these findings to interpret. Winter-run exposure and risk are uncertain, especially for the months of Oct-March when winter-run are migrating through the Delta at a much smaller size than late fall-run. Also, the period of migration of late fall-run and winter-run through the Delta differ and this needs to be acknowledged and discussed as an uncertainty. Table 2.5.5-5 shows that the temporal occurrence of WR in the delta in Nov-Jan is medium
Delta Effects, p. 28	Based on the modeling, survival could be reduced up to approximately 10 percent (lower 25th percentile) during the October through November period in wet, above normal, below normal, and dry years.	The modelling that this is based on was done for acoustically-tagged late fall-run Chinook salmon, which do not exhibit the same behavior as winter-run. During the October through November period winter-run are small and our understanding of how these small fish migrate through and use the Delta are limited. These important life history differences should be highlighted when interpreting results of the Perry analysis.
Delta Effects, p. 28	CV spring-run Chinook salmon Exposure and Risk	Section should include a discussion on the differences in the life history of spring-run compared to late fall-run from which the Perry model is based when interpreting results. Table 2.5.5-6 shows that the temporal occurrence of CV spring-run in the Delta from Dec-March is low.
Delta Effects, p. 32	Adult CV spring-run Chinook salmon are expected to migrate upstream through the Bay-Delta region from January to June with a peak presence from February to April (Error! Reference ource not found.).	Reference is to incorrect table
Delta Effects, p. 65	**The PA component would continue SMSCG operation for up to 20 days in October to May, plus an additional 60 days**	Studies have shown that manipulation of the gates is unable to control water temperature. So this action should not be done in warm water temperature years when the water temps in the marsh are not suitable for Delta Smelt, this would be a huge water costs and even if salinities were lowered water temp would not be changed and it

	during June to September in above normal and below normal years	would be unlikely that Delta Smelt would utilize this habitat.
Delta Effects, p.78	1 percent of the CV spring-run Chinook salmon JPE (1 percent genetically confirmed or 0.5 percent of yearling spring-run surrogates);	LAD is very poor so genetic analysis needs to be implemented to match the same standard for winter-run.
Delta Effects, p. 81-82	In drier years (below normal to critical water year types) the PA typically has flows that are 1,000 cfs or greater than the COS conditions for the February ~~January~~ through June period.	None of the numbers in Jan are 1,000
Delta Effects, p. 82	For example, the velocity density plots for Old River at Highway 4, and just upstream towards the export facilities (channels 89 and 90) show a shift to more negative velocities in the March through May period for all water year types	The figures being referenced needs to be called out here.
Delta Effects, p.83	While the model is designed as a comparative tool, NMFS does use the absolute estimates of loss to put the potential effect into a population context for CV spring-run Chinook salmon and CCV steelhead, but those results should be considered a coarse screening level analysis due to limitations of the salvage-density method itself (limited historical time-frame of loss; relatively simple weighting of loss by	Acknowledge that this method is rough estimate but this is not discussed when interpreting results in section 2.5.5.8.3.1.1 and needs to be added. This should be applied to all salmon races/steelhead analyzed

	export changes and no other operational factors) and use of the average annual modeled loss rates (over the 15-year data period) scaled to both low and high population estimates	
Delta Effects, p 84	2.5.5.8.3.1.1.1 Juvenile Salvage Estimates using the Salvage-Density Method	This section needs to include how this method used to calculate this may influence results. In section 2.5.5.8.3.1 South Delta Salvage and Entrainment it was acknowledged that this is a comparative tool and NMFS does use the absolute estimates of loss to put the potential effect into a population context for CV spring-run Chinook salmon and CCV steelhead, but those results should be considered a coarse screening level analysis due to limitations of the salvage-density method itself (limited historical time-frame of loss; relatively simple weighting of loss by export changes and no other operational factors) and use of the average annual modeled loss rates (over the 15-year data period) scaled to both low and high population estimates. How does this course method influence conclusions? This should be applied to all salmon races/steelhead analyzed.
Delta Effects, p 85	Lower numbers of fish salvaged in drier years, therefore, does not necessarily indicate that restrictions on pumping are impacting a smaller proportion of fish. Often the OMR flows are more negative in dry years even if exports are reduced.	Cannot conclude this as the analysis did not account for the idea of overall lower numbers of fish. You can see from Table-1 and Table -2 that overall loss does not change much when you look at wet vs dry years. This is a conceptual model that has not be tested and this language should be removed.
Delta Effects, p 85-86	Less flow into the HOR will exacerbate the effects of exports since there is less flow moving downstream from the HOR towards the CVP and SWP intakes to offset the volume of water being diverted, and more water	What data is supporting this? There have been many acoustic tagging studies which can be analyzed in a way to look at this question. Until this is validated remove.

	will have to come from alternative sources, such as the waters of the central Delta to supply the volume of water being exported.	
Delta Effects, pp. 88-89	This is particularly important for CV spring-run Chinook salmon that originate in the San Joaquin River basin and enter the Old River channel when there is no HOR barrier present as proposed under the PA. These fish would migrate downstream in either the Old River, Middle River, or Grant Line/ Fabian – Bell channels.	While this may be true, this population is only experimental so operational decision should not be made on this at this time. Remove paragraph.
Delta Effects, pp. 88-89	The PA does not include installation of the HOR barrier, which will result in keeping less flow in the San Joaquin River corridor, thereby decreasing survival for CV spring-run Chinook salmon originating in the San Joaquin River basin and entering the South Delta and interior Delta through this route.	I thought a HOR barrier would keep more flows in the San Joaquin corridor.
Delta Effects, pp. 93	**Section 2.5.5.8.4.1.1 Integrated Early Water Pulse Protection (First Flush) Turbidity Event**	A benefit of turbidity has not been examined and should not be speculated on. Acoustic tagging studies would provide information on if fish movement is cued to pulses, but thus far data suggest this is linked to flows, not turbidity. This action should be removed.

Delta Effects, pp. 93	This PA component will be implemented following a "First Flush" event in the Delta that is triggered when there are flows greater than 25,000 cfs on the Sacramento River, as measured at Freeport on a 3-day running average coupled with a 3-day running daily average turbidity of 50 NTU at Freeport during the period of December 1 through January 31.	What data were used to suggest that salmon like 50 NTUs?
Delta Effects, pp. 94	Reclamation and DWR proposed that OMR flows will be no more negative than -5,000 cfs after January 1 if more than 5 percent of any one or more unclipped listed salmonid species (winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead) are estimated to be present in the Delta as determined by "real-time" monitoring data and the advice of a Delta-specific working group.	We already know that this is true (more than 5% of listed salmonid species in Delta) for majority of months, Dec-April/May. This will ensure that exports during these months are always limited to -5,000 cfs.
Delta Effects, pp. 98	The San Joaquin River basin is believed to have a substantially smaller population size that would be overwhelmed by the signal generated by Sacramento River basin fish in salvage.	Citation to support this statement is needed
Delta Effects, pp. 98	The disparity in population sizes is just one factor making detection, and therefore protection of San Joaquin	Yes, but this is the same for the COS, monitoring steelhead is difficult but that is not related to PA or COS, that is just difficulty in monitoring. Comment specific to PA should be removed or compared to COS.

	River basin fish difficult with this PA component.	
Delta Effects, pp. 99	In contrast, OMR flows in April and May are approximately 4,000 cfs more positive under the COS than the PA in wetter years. In drier years (below normal and dry water year types) the differences between the PA and COS were less, but were still approximately 1,500 cfs more positive under the COS conditions as compared to the PA conditions. In critical water year types, the COS was modelled to be 600-800 cfs more positive than the PA conditions	Reference to figures/tables that report these numbers should be included.
Delta Effects, pp. 108	Section 2.5.5.8.5.3.1 Deconstruct the Action-Predator Reduction Electrofishing Study (PRES)	Reclamation should talk to DWR as it relates to CCF.