Longfin Smelt

Construction and Maintenance of Water Conveyance Facilities

The discussion of potential effects to delta smelt from construction and maintenance of the water conveyance facilities under Alternative 4A is also relevant to longfin smelt, although the potential for longfin smelt to overlap construction and maintenance periods is even more limited than for delta smelt (Table 11-8).

Impact AQUA-19: Effects of Construction of Water Conveyance Facilities on Longfin Smelt

The potential effects of construction of the water conveyance facilities on longfin smelt would be the same as described for Alternative 4 because they include the same construction activities for the water conveyance facilities. This section provides additional detail on underwater noise impacts which are also applicable to Alternative 4.

Table 11-8 presents the life stages of longfin smelt and the months of their potential presence in the north, east, and south Delta during the proposed in-water construction window (June 1–October 31). Construction of the barge landings, CCF cofferdams, CCF siphons, and HOR operable barrier in the south Delta and east Delta would be the primary locations where longfin smelt could be affected by pile driving, as longfin smelt are only expected to occur at the intake construction sites during the early portion of the in-water work window. As discussed for delta smelt, implementation of Mitigation Measures AQUA-1a and AQUa-1b would minimize potential adverse effects associated with pile driving noise outside the work window.

NEPA Effects: As concluded for Alternative 4, Impact AQUA-19, the effect would not be adverse for longfin smelt.

CEQA Conclusion: As described in Alternative 4, Impact AQUA-19, the impact of the construction of water conveyance facilities on longfin smelt would not be significant except for construction noise associated with pile driving. Implementation of Mitigation Measures AQUA-1a and AQUA-1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

Impact AQUA-20: Effects of Maintenance of Water Conveyance Facilities on Longfin Smelt

NEPA Effects: Once constructed, Alternative 4A structures and facilities will require ongoing periodic maintenance that includes in-water work activities with the potential to affect delta smelt. These activities include periodic cleaning and replacement of screens, trash racks, and associated machinery and dredging to maintain intake capacity. These activities will produce disturbance and underwater noise, and may generate turbidity or other water quality effects. In general, the likelihood of adverse effects on delta smelt from maintenance activities would be avoided and minimized through the same methods and rationale described for Impact AQUA-1. The potential effects of water conveyance facilities maintenance under Alternative 4A would be the similar to those described for Alternative 4, Impact AQUA-20. As concluded in Alternative 4, Impact AQUA-20, the impact would not be adverse for longfin smelt.

CEQA Conclusion: Once constructed, Alternative 4A structures and facilities will require ongoing periodic maintenance that includes in-water work activities with the potential to affect delta smelt. These activities include periodic cleaning and replacement of screens, trash racks, and associated machinery and dredging to maintain intake capacity. These activities will produce disturbance and underwater noise, and may generate turbidity or other water quality effects. In general, the likelihood of adverse effects on delta smelt from maintenance activities would be avoided and minimized through the same methods and rationale described for Impact AQUA-1. As described in Alternative 4, Impact AQUA-20, the impact of the maintenance of water conveyance facilities on longfin smelt would not be significant and no mitigation is required.

Operations of Water Conveyance Facilities

Impact AQUA-21: Effects of Water Operations on Entrainment of Longfin Smelt

Water Exports from SWP/CVP South Delta Facilities

For larval longfin smelt, entrainment risk was simulated using particle tracking modeling for wetter and drier starting distributions. Alternative 4A would result in reduced longfin smelt larvae entrainment compared to the NAA_ELT. Average particle entrainment by the south Delta facilities was 1.4–1.6% under Scenario H3_ELT, which does not include enhanced spring outflow, and was lower than the 1.5–1.9% entrainment under NAA_ELT (Table 11-4A-4). Under Scenario H4_ELT for Alternative 4A, which includes enhanced spring outflow, larval longfin smelt entrainment would be lower than H3_ELT and therefore even less than NAA_ELT, because of the enhanced spring outflow criteria that results in a further reduction in south Delta exports.

Table 11-4A-4. Percentage of Particles (and Difference) Representing Longfin Smelt Larvae Entrained by the South Delta Facilities under Alternative 4A (Scenario H3_ELT) and Baseline Scenarios

	Percent Particles Entrained			Difference (and Relative Difference)	
Starting Distribution	EXISTING CONDITIONS	NAA_ELT	H3_ELT	H3_ELT vs. EXISTING CONDITIONS	H3_ELT vs. NAA_ELT
Wetter	1.7	1.5	1.4	-0.31 (-19%)	-0.16 (-11%)
Drier	2.1	1.9	1.6	-0.53 (-25%)	-0.32 (-17%)

Note: 60-day DSM2-PTM simulation of wetter and drier starting distributions. Negative values indicate lower entrainment under the alternative compared to the baseline scenario.

For juveniles and adults, entrainment at the south Delta facilities (entrainment index based on the salvage-density method[1], averaged across all water year types) under H3_ELT would be 37% lower

[1] Although the salvage-density method gives estimates of entrainment loss or salvage in numbers of fish and there are a number of factors included in the calculations such as multipliers applied for prescreen loss and normalization to population size, it is most appropriate to view the results comparatively, i.e., to compare relative differences between scenarios as opposed to examining the estimates of total number of fish lost to entrainment or salvaged. In essence, the salvage-density method provides an entrainment index that reflects export pumping

for juveniles and 52% lower for adults compared to baseline conditions (Table 11-4A-5). Scenario H4_ELT would result in even greater reductions in entrainment, due to higher spring outflows and the associated reduction in south Delta exports. Under all Alternative 4A scenarios, the predicted average adult and juvenile entrainment would be less in all five water year types.

Table 11-4A-5. Longfin Smelt Entrainment Index at the SWP and CVP Salvage Facilities—Differences (Absolute and Percentage) between Model Scenarios for Alternative 4A (Scenario H3_ELT)

		Absolute Difference (Percent Difference)	
Life Stage	Water Year Types	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Juvenile (March–June)	Wet	-34,106 (-53%)	-37,987 (-56%)
	Above Normal	-785 (-17%)	-1062 (-22%)
	Below Normal	-486 (-16%)	-484 (-16%)
	Dry	8,921 (2%)	-38,267 (-7%)
	Critical	-198,499 (-35%)	-173,992 (-32%)
	All Years	-86,038 (-32%)	-108,770 (-37%)
Adult (December–March)	Wet	-72 (-56%)	-78 (-58%)
	Above Normal	-251 (-39%)	-302 (-43%)
	Below Normal	-815 (-42%)	-907 (-45%)
	Dry	-320 (-27%)	-336 (-28%)
	Critical	-6,112 (-25%)	-3,991 (-18%)
	All Years	-1,854 (-51%)	-1,924 (-52%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

Water Exports from SWP/CVP North Delta Intake Facilities

As described under Alternative 1A for Impact AQUA-22, longfin smelt are not known to spawn in the reach of the Sacramento River where the north Delta diversions will be built. Therefore, entrainment of longfin smelt at the proposed north Delta intakes would be extremely low because this species is only expected to occur occasionally in very low numbers this far upstream on the Sacramento River.

Predation Associated with Entrainment

Pre-screen predation losses of longfin smelt at the SWP/CVP south Delta water export facilities are believed to be high and proportional to entrainment. It is assumed that pre-screen predation losses of longfin smelt would be similar to delta smelt based on their similar size, shape, and pelagic nature. Predation losses of both juvenile and adult longfin smelt under Alternative 4A would be no greater than baseline and may be lower, given the much lower entrainment losses at the south Delta facilities (32–37% lower for juveniles and 51–52% lower for adults) compared to NAA (Table 11-4A-5). Predation loss at the proposed north Delta intakes would be unlikely because longfin smelt do not generally occur that far upstream on the Sacramento River. Under the range of flow operating

weighted by each covered species' seasonal pattern of abundance in the Plan Area, as reflected by historical salvage data.

scenarios for Alternative 4A, entrainment-related predation loss would be reduced relative to NAA_ELT, with the greatest decreases in entrainment occurring under Scenario H4_ELT.

NEPA Effects: Entrainment and entrainment-related predation of juvenile and adult longfin smelt would be reduced substantially under Alternative 4A compared to NAA_ELT across all water years (Table 11-4A-5). Entrainment and associated predation loss of longfin smelt at the proposed north Delta intakes would be unlikely since longfin smelt are not expected to occur in that area of the Sacramento River. Alternative 4A would not have an adverse effect on entrainment and entrainment-related predation and would likely provide a benefit to the species because of substantial reductions in juvenile and adult entrainment at the south Delta facilities.

CEQA Conclusion: Entrainment and entrainment-related predation of all life stages of longfin smelt at the south Delta facilities would be reduced under Alternative 4A compared to Existing Conditions. Particle entrainment, representing larval longfin smelt, was lower under Alternative 4A for both drier and wetter starting distributions (refer to *BDCP Appendix 5.B* for further details). Entrainment loss would be substantially lower for both juvenile (32% less) and adult longfin smelt (51% less) (Table 11-4A-5). Entrainment to the north Delta intakes would be unlikely because longfin smelt are not expected to occur in the vicinity of the intakes. Therefore, Alternative 4A would not have a significant impact on entrainment and entrainment-related predation and would likely provide a benefit to the species because of the substantial reductions in south Delta entrainment.

Impact AQUA-22: Effects of Water Operations on Spawning, Egg Incubation, and Rearing Habitat for Longfin Smelt

Background on the general distribution of longfin smelt and the evidence for relationships between longfin smelt abundance with freshwater outflow is provided in detail in the discussion for Alternative 4. The mechanisms of this correlation are not well understood, and efforts are underway to determine what flow-related factors, if any, have a causal relationship with longfin smelt abundance, and how that relates to the various life stages present in the Delta in the winter and spring months. Additionally, sample biases related to when and where longfin smelt are sampled may influence these correlations, and the regional contribution to the overall longfin smelt population is unknown; this is a large focus of the study plan resulting from the Settlement Agreement between DFW and DWR/State Water Contractors related to longfin smelt. However, at this time, the best available relationship between longfin smelt abundance and changes in water facility operations is based on Kimmerer et al. (2009), the application of which shows that outflow in January through June correlates to longfin smelt abundance. As such, the X2–longfin smelt abundance relationship provided by Kimmerer et al. (2009) was used to evaluate the effects of the alternatives on longfin smelt, following the historical observation that lower X2 (farther downstream) correlates with increased recruitment (represented by abundance indices in trawl surveys), although it is not understood if or how this would affect spawning, egg incubation, and/or rearing longfin smelt. Consistent with the adaptive management and monitoring program described in Section 4.1, Alternative 4A would implement investigations to better understand all factors affecting longfin smelt abundance. However, for purposes of this impact assessment, the relationships between X2 and longfin smelt abundance developed by Kimmerer et al. (2009) were used to determine how the changes in winter-spring X2 position described above might influence longfin smelt abundance the following fall.

Table 11-4A-7. Differences in Mean Monthly Delta Outflow (cfs) between NAA_ELT and Alternative 4A Scenarios H3_ELT and H4_ELT, by Water Year Type, for Winter-Spring (December–June)

Month	Water-Year Type	NAA_ELT vs. H3_ELT	NAA_ELT vs. H4_ELT
January	Wet	-2,114 (-2.3%)	-2,143 (-2.4%)
	Above Normal	-2,256 (-4.6%)	-1,507 (-3.1%)
	Below Normal	112 (0.5%)	98 (0.4%)
	Dry	751 (5.1%)	1,033 (7%)
	Critical	-138 (-1.1%)	-237 (-2%)
	All	-837 (-1.9%)	-691 (-1.5%)
February	Wet	-1,048 (-1%)	-1,595 (-1.5%)
	Above Normal	271 (0.4%)	-1,018 (-1.6%)
	Below Normal	-2,540 (-6.8%)	-1,359 (-3.6%)
	Dry	-1,347 (-6.4%)	-1,397 (-6.7%)
	Critical	30 (0.2%)	107 (0.85%)
	All	-1,018 (-1.8%)	-1,178 (-2.1%)
March	Wet	-1,113 (-1.4%)	1,155 (1.4%)
	Above Normal	-1,144 (-2.1%)	222 (0.4%)
	Below Normal	-1,901 (-8.4%)	1,909 (8.5%)
	Dry	-2,234 (-11.5%)	-623 (-3.2%)
	Critical	-352 (-2.9%)	-167 (-1.4%)
	All	-1,387 (-3.2%)	563 (1.3%)
April	Wet	-5,630 (-10.3%)	-633 (-1.2%)
	Above Normal	-5,805 (-18.6%)	71 (0.2%)
	Below Normal	-2,792 (-13.2%)	4,872 (23%)
	Dry	-1,507 (-11.2%)	-202 (-1.5%)
	Critical	-246 (-2.8%)	-51 (-0.6%)
	All	-3,478 (-11.7%)	590 (2%)
May	Wet	-4,587 (-12%)	206 (0.5%)
	Above Normal	-3,126 (-13.5%)	1,560 (6.7%)
	Below Normal	-1,140 (-7.7%)	1,810 (12.3%)
	Dry	-325 (-3.3%)	352 (3.6%)
	Critical	-254 (-4%)	-182 (-2.9%)
	All	-2,215 (-10.5%)	653 (3.1%)
June	Wet	-311 (-1.7%)	-609 (-3.4%)
	Above Normal	648 (6.4%)	509 (5%)
	Below Normal	757 (9.4%)	269 (3.3%)
	Dry	319 (4.5%)	345 (4.8%)
	Critical	-14 (-0.3%)	-13 (-0.2%)
	All	193 (1.8%)	1 (0%)
December	Wet	-1,728 (-3.5%)	-2,143 (-2.4%)
	Above Normal	-36 (-0.2%)	-1,507 (-3.1%)
	Below Normal	-174 (-1.3%)	98 (0.4%)
	Dry	500 (5.9%)	1,033 (7%)
	Critical	-216 (-3.9%)	-237 (-2%)
	All	-505 (-2.1%)	-691 (-1.5%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

Under Scenario H3_ELT, which does not include enhanced spring outflow, modeled average Delta spring outflow is often lower than NAA_ELT. The spring outflow under H4_ELT, which includes enhanced spring outflow, was greater than NAA_ELT in a number of years, as illustrated by differences in water-year-type average Delta outflow (see Table 11-4A-7 above). Based on Kimmerer et al. 2009, the longfin smelt abundance for H3_ELT ranged from a reduction of 19-22% compared to Existing Conditions, to a reduction of 11% to an increase of 7% compared to NAA_ELT (Table 11-4A-8). For H4_ELT, which includes enhanced spring outflow and climate change effects, the predicted longfin smelt abundance ranged from a reduction of 10% to 12% compared to Existing Conditions to an increase of 18% to 22% when compared to NAA_ELT, based on the X2-abundance equations in Kimmerer et al. (2009). In addition, the method does not articulate the potential changes in spawning, egg incubation, or rearing habitat as a result of changes in X2 because no specific correlations between these life stages and X2 has been established. Studies examining the relationship between flow and longfin smelt abundance would be undertaken as part of the Adaptive Management and Monitoring Program in order to address the current uncertainty that exists surrounding the mechanism through which higher Delta outflow improves the production and survival of early life stages of longfin smelt. Results of these investigations will continue to be reviewed and considered in the coming years, in making management decisions regarding outflows necessary for longfin smelt.

NEPA Effects: Under Alternative 4A, water operations would result in a potential decrease in longfin smelt abundance if spring outflows are not at least as high as the NAA_ELT, based on the application of the Kimmerer et al. 2009 flow-abundance regression. As such, Scenario H3_ELT has the potential to be adverse. However, as described above and in Section 4.1, Alternative 4A operations will be subject to adjustment via adaptive management, which is intended to allow for further evaluation of spring outflow, and adjustments necessary to ensure that longfin smelt are not adversely affected by project operations. Scenario H4_ELT generally increases abundance and therefore would not be adverse. Further, Mitigation Measure AQUA-22d would ensure January through June delta outflows do not result in changes in longfin smelt abundance. Therefore, under Alternative 4A, this impact would not be adverse.

Table 11-4A-8. Estimated Differences Between Alternative 4A (Scenarios H3_ELT and H4_ELT) and Baseline for Longfin Smelt Relative Abundance in the Fall Midwater Trawl or Bay Midwater Trawl Based on the X2-Relative Abundance Regression of Kimmerer et al. (2009)

	Fall Midwater Trawl Relative Abundance		Bay Midwater Trawl Relative Abundance	
Water Year Type	EXISTING CONDITIONS vs. Alternative 4A	NAA_ELT vs. Alternative 4A[1]	EXISTING CONDITIONS vs. Alternative 4A	NAA_ELT vs. Alternative 4A[1]
Scenario H3_ELT				
All	-1,502 (-17%)	-475 (-6%)	-4,686 (-19%)	432 (3%)
Wet	-3,195 (-17%)	-909 (-5%)	-10,611 (-19%)	2,268 (7%)
Above Normal	-1,684 (-17%)	-685 (-8%)	-5,014 (-20%)	-700 (-4%)
Below Normal	-855 (-19%)	-331 (-8%)	-2,168 (-22%)	-717 (-11%)
Dry	-396 (-17%)	-134 (-7%)	-904 (-21%)	-235 (-7%)
Critical	-65 (-6%)	-7 (-1%)	-132 (-8%)	-74 (-5%)
Scenario H4_ELT				
All	-622 (-7%)	404 (5%)	-2,120 (-9%)	1,167 (6%)
Wet	-1,882 (-10%)	404 (2%)	-6,625 (-12%)	1,210 (3%)
Above Normal	-50 (0%)	949 (10%)	(0%)	2,960 (13%)
Below Normal	176 (4%)	699 (18%)	510 (5%)	1,812 (22%)
Dry	-187 (-8%)	75 (4%)	-414 (-9%)	180 (5%)
Critical	-52 (-5%)	6 (1%)	-107 (-6%)	10 (1%)

Shading indicates relative abundance decrease of 10% or greater under H3_ELT.

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

[1] Note that longfin smelt abundance has been declining and is expected to continue to decline under the NAA such that increases in longfin smelt abundance shown in the comparison of NAA_ELT vs. Alternative 4A may not reflect absolute increases of longfin smelt abundance.”

CEQA Conclusion: Under Alternative 4A scenario H3_ELT, average Delta outflow during winter/spring generally would be similar to Existing Conditions during December-March, with some exceptions by water year type, and lower in April–June (Table 11-4A-9). Under Scenario H4_ELT, average Delta outflows generally would be similar to Existing Conditions, but would be lower in June.

Table 11-4A-9. Differences in Mean Monthly Delta Outflow (cfs) between Existing Conditions and Alternative 4A Scenarios H3_ELT and H4_ELT, by Water Year Type, for Winter-Spring (December–June)

Month	Water-Year Type	EXISTING CONDITIONS vs. H3_ELT	EXISTING CONDITIONS vs. H4_ELT
January	Wet	3,144 (3.7%)	3,115 (3.6%)
	Above Normal	-2,744 (-5.5%)	-1,996 (-4%)
	Below Normal	-594 (-2.6%)	-607 (-2.6%)
	Dry	769 (5.2%)	1,051 (7.1%)
	Critical	693 (6.1%)	593 (5.2%)
	All	764 (1.8%)	909 (2.1%)
February	Wet	6,650 (6.9%)	6,103 (6.3%)
	Above Normal	2,112 (3.4%)	824 (1.3%)
	Below Normal	-2,040 (-5.5%)	-859 (-2.3%)
	Dry	-1,327 (-6.3%)	-1,376 (-6.6%)
	Critical	-408 (-3.1%)	-332 (-2.6%)
	All	1,718 (3.3%)	1,558 (3%)
March	Wet	1,624 (2.1%)	3,891 (4.9%)
	Above Normal	439 (0.8%)	1,806 (3.3%)
	Below Normal	-3,408 (-14.2%)	403 (1.7%)
	Dry	-2,727 (-13.7%)	-1,115 (-5.6%)
	Critical	-315 (-2.6%)	-130 (-1.1%)
	All	-647 (-1.5%)	1,303 (3%)
April	Wet	-5,164 (-9.5%)	-166 (-0.3%)
	Above Normal	-6,598 (-20.6%)	-722 (-2.3%)
	Below Normal	-3,502 (-16%)	4,162 (19%)
	Dry	-2,199 (-15.5%)	-894 (-6.3%)
	Critical	-418 (-4.6%)	-224 (-2.5%)
	All	-3,745 (-12.4%)	323 (1.1%)
May	Wet	-7,351 (-17.9%)	-2,558 (-6.2%)
	Above Normal	-4,195 (-17.3%)	491 (2%)
	Below Normal	-2,699 (-16.6%)	251 (1.5%)
	Dry	-1,076 (-10.3%)	-399 (-3.8%)
	Critical	87 (1.5%)	160 (2.7%)
	All	-3,629 (-16.1%)	-760 (-3.4%)
June	Wet	-5,682 (-24.2%)	-5,980 (-25.5%)
	Above Normal	-976 (-8.3%)	-1,115 (-9.4%)
	Below Normal	820 (10.2%)	332 (4.1%)
	Dry	806 (12.1%)	832 (12.5%)
	Critical	10 (0.2%)	10 (0.2%)
	All	-1,626 (-12.7%)	-1,818 (-14.2%)
December	Wet	-154 (-0.3%)	1,192 (2.5%)
	Above Normal	1,334 (7.4%)	1,433 (8%)
	Below Normal	1,161 (9.7%)	1,314 (11%)
	Dry	82 (0.9%)	35 (0.4%)
	Critical	-241 (-4.4%)	-320 (-5.8%)
	All	327 (1.4%)	773 (3.4%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

Average relative abundance of longfin smelt, as estimated by the Kimmerer et al. (2009) method which directly correlates winter-spring Delta outflow to longfin smelt abundance, is up to 19% to 22% lower under Scenario H3_ELT compared to Existing Conditions (17–19% lower across all water year types; Table 11-4A-8). For H4_ELT, which includes enhanced spring outflow, the longfin smelt abundance is up to 10% to 12% lower compared to Existing Conditions (5–7% lower across all water year types), based on Kimmerer et al. (2009).

Contrary to the NEPA conclusion set forth above, these results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially reduce relative abundance based on Kimmerer et al. (2009).

However, and as noted for Alternative 4, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed above and in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the second NOP for the BDPC was prepared (2009). Both the action alternative and the NEPA baseline (NAA) models anticipated future conditions that would occur at 2025, including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the NEPA analysis, which compares results between the alternative and NAA_ELT, is a better approach with respect to these issues because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis, above, the average longfin smelt abundance, based on Kimmerer et al. (2009), was up to 8–11% less under H3_ELT (across all water years: 6% decrease to 3% increase; Table 11-4A-8). Abundance relative to NAA_ELT increased up to 18% to 22% (across all water years: 5–6% increase) for H4_ELT, which includes enhanced spring outflow compared to NAA_ELT (Table 11-4A-7). These results represent the increment of change attributable to the alternative, and addressing the limitations of the comparison based on the CEQA baseline (Existing Conditions). Furthermore, the Adaptive Management and Monitoring Program included in Alternative 4A would allow for an evaluation of the necessary volume and timing of spring outflow. However, based on the Kimmerer et al. regression applied for this analysis, H3 would result in a significant impact on longfin smelt due to a substantial decrease in abundance, while H4 would have a beneficial impact because the abundance would be increased. Because of the potential for this alternative to substantially reduce longfin smelt abundance, this impact is considered significant. Implementing Mitigation Measure AQUA-22d would reduce this impact to a less-than-significant level.

Mitigation Measure AQUA-22d: Ensure January through June Delta Outflows do Not Result in Changes in Longfin Smelt Abundance

Initial operations would set delta outflow such that longfin smelt abundance would not be reduced. This could be accomplished by reducing SWP/CVP exports, transferring water from non-CVP/SWP sources to increase outflow, or using water stored in Oroville. Science developed through the Adaptive Management Program (described in Section 4.1) will be used to make appropriate adjustments to operations, including outflow, to minimize effects on longfin smelt. These operations would be implemented consistent with applicable biological opinions, incidental take statements, and other permits.

Restoration Measures (Environmental Commitment 4, Environmental Commitment 6, Environmental Commitment 7, and Environmental Commitment 10)

As described for delta smelt, Alternative 4A includes a greatly reduced extent of restoration measures relative to Alternative 4 and Alternative 1A, upon which the discussion of impacts for Alternative 4 is based. In particular, *Environmental Commitment 4 Tidal Natural Communities Restoration* is reduced from 65,000 acres to 59 acres, so that any impacts related restoration construction would be extremely small. The mechanisms for potential effect of habitat restoration on longfin smelt are very similar to those for delta smelt (see Impacts AQUA-7, AQUA-8, and AQUA-9), although longfin smelt would be expected to have less temporal and spatial overlap with restored areas, during and after construction, than delta smelt.

Impact AQUA-25: Effects of Construction of Restoration Measures on Longfin Smelt

Please refer to discussion of Impact AQUA-7 under Alternative 4A for delta smelt.

NEPA Effects**:** The effects of short-term construction activities would not be adverse to longfin smelt because in-water work would occur when they are not present and environmental commitments would limit the potential for construction-related effects.

CEQA Conclusion**:** As discussed for Alternative 1A, habitat restoration activities could result in short-term effects on longfin smelt but would be localized, sporadic, and of low magnitude; such effects would be avoided by limiting the frequency, duration, and spatial extent of in-water work and with implementation of environmental commitments (see Appendix 3B, *Environmental Commitments*). The potential impact of habitat restoration activities is considered less than significant because it would not substantially reduce longfin smelt habitat, restrict its range, or interfere with its movement. No additional mitigation would be required.

Impact AQUA-26: Effects of Contaminants Associated with Restoration Measures on Longfin Smelt

Please refer to discussion of Impact AQUA-8 under Alternative 4A for delta smelt.

NEPA Effects**:** Overall and consistent with the conclusion for Alternative 1A, the effects of contaminants associated with restoration measures under Alternative 4A would not be adverse for longfin smelt with respect to selenium, copper, ammonia, pesticides, and methylmercury because longfin smelt would have relatively little opportunity to bioaccumulate these contaminants (because of their diet, the duration they spend in the Delta, and their relatively short life spans) and because of implementation of *Environmental Commitment 12 Methylmercury Management*.

CEQA Conclusion**:** As noted for delta smelt and as described in more detail for Alternative 1A, methylmercury could be generated by inundation of restoration areas under Alternative 4A. However, implementation of *Environmental Commitment 12 Methylmercury Management* would help to minimize the increased mobilization of methylmercury at restoration areas. Alternative 4A is not expected to substantially increase the potential exposure of fish because elevated bioavailability likely would be localized near restored areas and over a relatively short time period. Because of the relatively small extent of restoration, the potential impact of contaminants is considered less than significant. Consequently, no mitigation would be required.

Impact AQUA-27: Effects of Restored Habitat Conditions on Longfin Smelt

The potential effects of restored habitat conditions on longfin smelt would be similar to those discussed for delta smelt (see the discussion under Impact AQUA-9), although longfin smelt occupy such areas for shorter time periods than delta smelt and therefore would not be affected to as great an extent.

NEPA Effects: The effect of restoration activities would not be adverse for longfin smelt because restoration will increase habitat availability.

CEQA Conclusion: The impacts associated with habitat restoration actions are considered less than significant because they are intended to restore suitable habitat and habitat functions lost to construction of water facilities. No additional mitigation is required.

Other Environmental Commitments (Environmental Commitment 12, Environmental Commitment 15, and Environmental Commitment 16)

As described for delta smelt, Alternative 4A includes three other Environmental Commitments, which are reduced in their extent relative to the Conservation Measures included in other Alternatives (e.g., Alternative 1A and Alternative 4). While the extent of these measures is reduced compared to these alternatives, the nature of the mechanisms remains the same.

Impact AQUA-28: Effects of Methylmercury Management on Longfin Smelt (Environmental Commitment 12)

As noted for delta smelt under Impact AQUA-10, Environmental Commitment 12 is intended to minimize conditions that promote production of methylmercury in restored areas and its subsequent introduction to the foodweb, and to covered species such as longfin smelt. As described for Alternative 1A, Environmental Commitment 12 describes pre-design characterization, design elements, and best management practices to attempt to minimize methylation of mercury, and requires monitoring and reporting of observed methylmercury levels.

NEPA Effects: The effects of methylmercury management on longfin smelt would not be adverse because it is designed to improve water quality and habitat conditions.

CEQA Conclusion: Effects of *Environmental Commitment 12 Methylmercury Management* within the areas restored under Alternative 4A are expected to reduce overall methylmercury levels resulting from habitat restoration. Because it is designed to improve water quality and habitat conditions, impacts would be less than significant to longfin smelt. Consequently, no mitigation is required.

Impact AQUA-31: Effects of Localized Reduction of Predatory Fish on Longfin Smelt (Environmental Commitment 15)

Environmental Commitment 15 Localized Reduction of Predatory Fish is intended to reduce localized abundance of fish predators of salmonids in the Delta.

NEPA Effects: There is a potential for incidental benefit to longfin smelt from localized reduction of predatory fish, although the target species are salmonid predators.

CEQA Conclusion: *Environmental Commitment 15 Localized Reduction of Predatory Fish* is intended to reduce localized abundance of fish predators of salmonids in the Delta. Therefore there would be no impact on longfin smelt.

Impact AQUA-32: Effects of Nonphysical Fish Barriers on Longfin Smelt (Environmental Commitment 16)

Potential impacts on longfin smelt from the installation of an NPB at the divergence of Georgiana Slough from the Sacramento River are expected to be similar to those for delta smelt (see Impact AQUA-14), with even less potential for any effect because of even lower overlap of longfin smelt distribution with the proposed location of the NPB.

NEPA Effects: There would be no demonstrable effect of the NPB on longfin smelt because they are not likely to be in the area of the barrier and the potential for predation of longfin smelt around the barriers is low.

CEQA Conclusion: As discussed above, there would be no demonstrable effect of this conservation measure on longfin smelt. Consequently, the impact is less than significant and no mitigation would be required.

Winter-Run Chinook Salmon

Construction and Maintenance of Water Conveyance Facilities

The discussion of potential effects to delta smelt from construction and maintenance of the water conveyance facilities under Alternative 4A is also relevant to winter-run Chinook salmon because the same types of impact mechanisms would apply. However, adult and juvenile winter-run Chinook salmon would have somewhat greater potential to overlap construction and maintenance than delta smelt (Table 11-8).

Impact AQUA-37: Effects of Construction of Water Conveyance Facilities on Chinook Salmon (Winter-Run ESU)

The potential effects of construction of the water conveyance facilities on winter-run Chinook salmon would be the same as described for Alternative 4 (Impact AQUA-37). This section provides additional detail on underwater noise impacts which are also applicable to Impact AQUA-37 in Alternative 4.

Table 11-8 presents the life stages of the four runs of Chinook salmon and the months of their potential presence in the north, east, and south Delta during the proposed in-water construction period (June 1–October 31). Winter-run, spring-run, fall-run, and late fall–run Chinook salmon eggs and fry would not be exposed to underwater noise from pile driving activities because the proposed construction activities are located in areas that do not provide suitable habitat for these life stages or because these life stages would not be present during the proposed in-water construction period.

Under Alternative 4A, the potential for exposure of adult and juvenile winter-, spring-, and late fall-run Chinook salmon to pile driving noise is highest in the north Delta (Sacramento River in the vicinity of the three proposed intakes) which serves as the primary migration route utilized by adults to access upstream spawning areas, and the primary migration route for juveniles entering the Delta and estuary from upstream spawning and rearing areas. Restricting in-water pile driving to June 1 to October 31 avoids the peak migration periods of winter-, spring-, and late fall-run adults