Delta Smelt Analyses

Marin Greenwood
ICF

Delta Smelt Analyses

Overview of *4.1 Take of Delta Smelt*

- Construction Effects
- Maintenance Effects
- Operations Effects
- Mitigation Measure Effects
- Monitoring Effects
- Take Analysis
- Analysis of Potential for Jeopardy

Delta Smelt Analyses

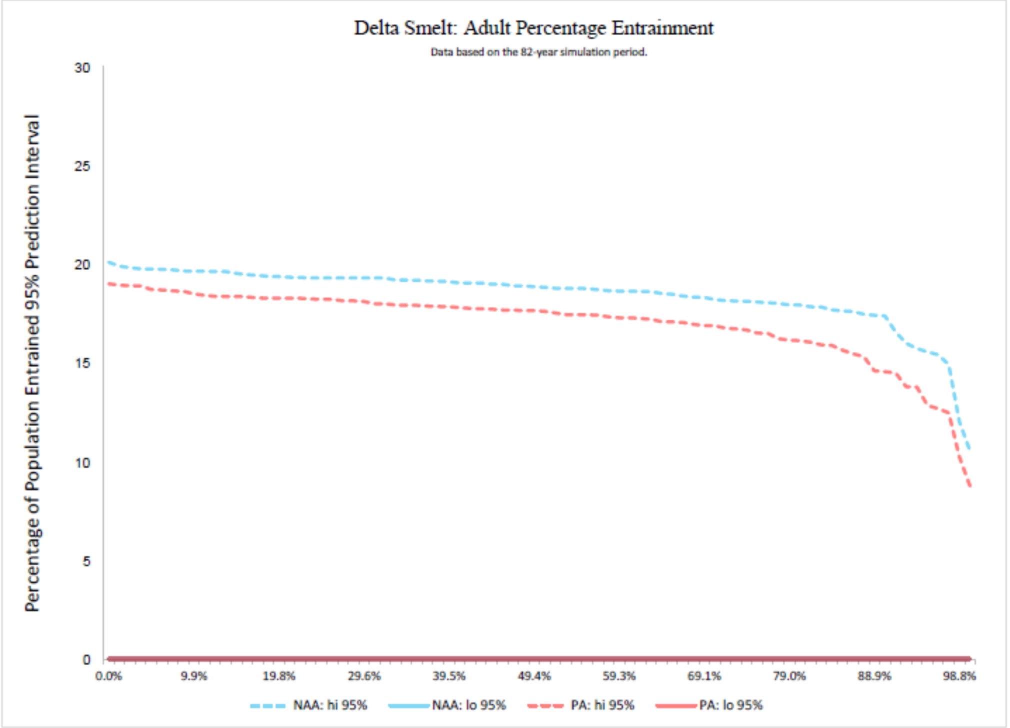
4.1.3 Operations Effects

- *4.1.3.2 North Delta Exports*
  - Phase 2A charge question: "…how appropriate are beach seine surveys…to characterize the proportion of the total Delta Smelt population in the vicinity of the north Delta diversions? Could these datasets be analyzed differently to better support the effects analysis?"
  - Main inference about proportion of population is from striped bass egg and larval survey (Section 4.1.3.2.1.4.1 *Population-Level Effects*)
  - Also added in consideration of Kodiak trawling at Sherwood Harbor (RM 55) and Ryde (RM 24) as closest locations to NDD (RM 38-41), in comparison to other Kodiak trawl stations

Delta Smelt Analyses

4.1.3 Operations Effects

- *4.1.3.3 South Delta Exports*
  - Phase 1 recommendation: "…obtain the full set of regression statistics…so that true prediction intervals can be constructed"



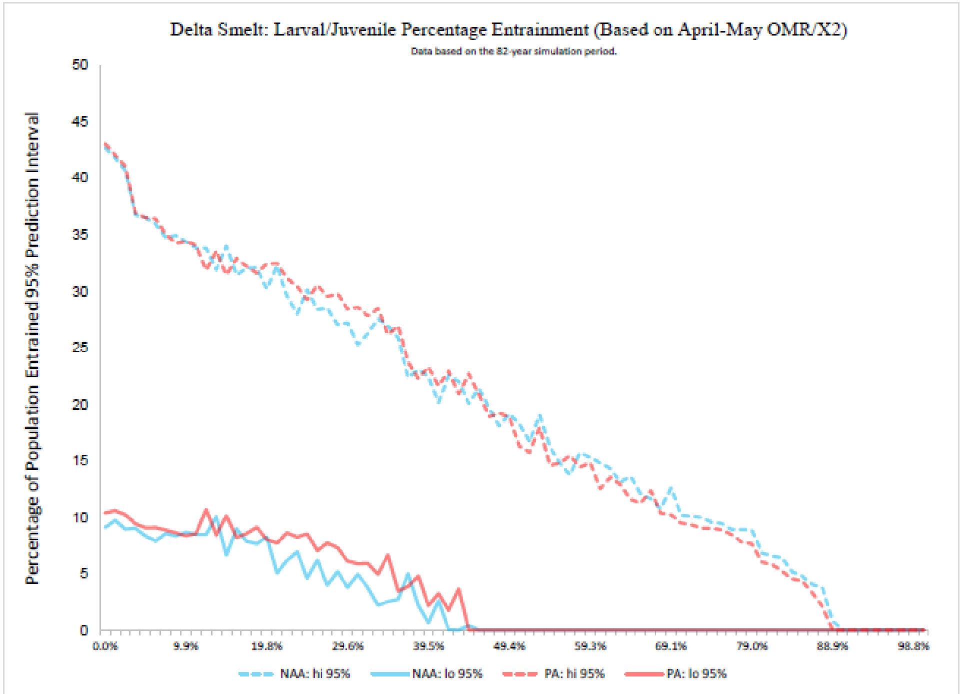
Note: Data are sorted by mean estimate, with only 95% prediction intervals shown. The lower bound of the 95% prediction interval is zero in all cases (following adjustment from negative values; see Section 6.A.3.1 *Percentage Loss Equations* in ICF International (2016, Appendix 6.A *Quantitative Methods for Biological Assessment of Delta Smelt*).

Figure 4.1-11. Exceedance Plot of Adult Delta Smelt Percentage Entrainment

Delta Smelt Analyses

4.1.3 Operations Effects

- *4.1.3.3 South Delta Exports*
  - Phase 1 recommendation: “…obtain the full set of regression statistics…so that true prediction intervals can be constructed”



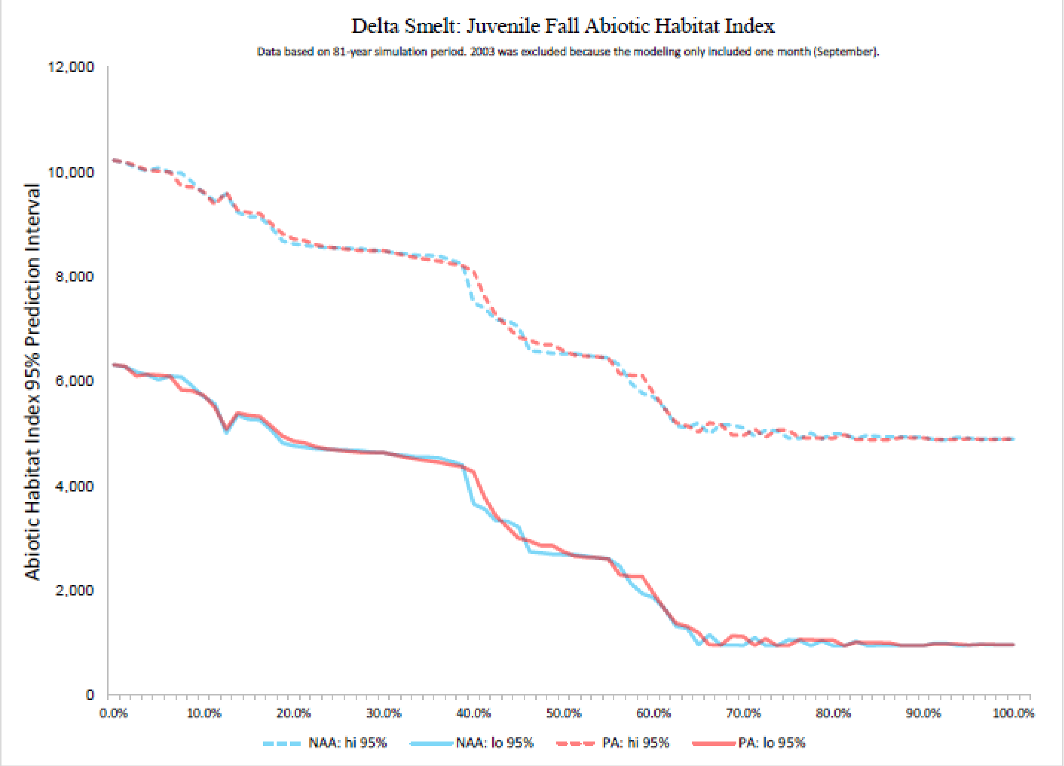
Note: Data are sorted by mean estimate, with only 95% prediction intervals shown. When necessary, the lower bound of the 95% prediction is adjusted to zero from negative values (see Section 6.A.3.1 Percentage Loss Equations in ICF International (2016, Appendix 6.A *Quantitative Methods for Biological Assessment of Delta Smelt*).

Figure 4.1-15. Exceedance Plot of Larval/Juvenile Delta Smelt Percentage Entrainment, Based on Mean April–May Old and Middle River Flows and X2

Delta Smelt Analyses

4.1.3 Operations Effects

- *4.1.3.5.1 Abiotic Habitat*
  - Phase 1 recommendation: "…obtain the full set of regression statistics…so that true prediction intervals can be constructed"



Note: Data are sorted by mean estimate, with only 95% prediction intervals shown.

Figure 4.1-27. Exceedance Plot of Mean Fall Abiotic Habitat Index, Based on the Method of Feyrer *et al.* (2011).

Delta Smelt Analyses

4.1.3 Operations Effects

- *4.1.3.5.1 Abiotic Habitat*
  - Phase 1 recommendation: "…the abiotic station index of Bever et al. 2016 should be modified to include salinity and current speed, but not turbidity"
  - Response: Recognition of Bever et al. (2016) was added, but full analysis not done:

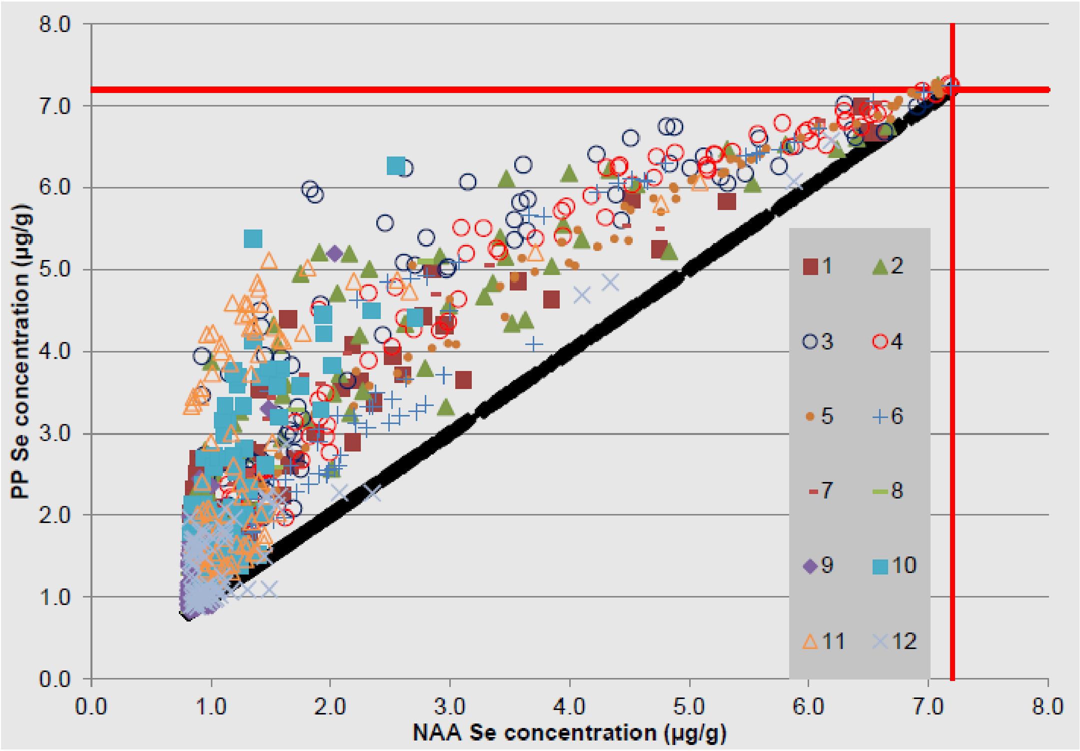
First, the inclusion of fall X2 water operations criteria for both the NAA and PP results in little difference in expected abiotic habitat, as illustrated above for the method based on Feyrer et al. 2011. Second, the additional abiotic variable highlighted by Bever et al. (2016) as an important component of habitat is current speed, which would be essentially unaffected by operations, even if operations were markedly different; see Figure 11D-F of Bever et al. (2016). This is because of the considerable tidal influences on current speed in the low salinity areas of greatest importance to Delta Smelt, e.g., during a typical summer tidal cycle, the flow near Pittsburg can vary from 330,000 cfs upstream to 340,000 cfs downstream.[22]

[22] http://baydeltaoffice.water.ca.gov/DeltaAtlas/03-Waterways.pdf. Accessed: July 13, 2016.

Delta Smelt Analyses

4.1.3 Operations Effects

- *4.1.3.5.6 Selenium*
  - New section, not included in draft BA



Note: Plot only includes mean responses and does not consider model uncertainty. Black diamonds indicate a 1:1 relationship.

Figure 4.1-29. Comparison of Predicted Monthly Mean Delta Smelt Tissue Selenium Concentration at Prisoners Point for NAA and PP Scenarios, In Relation to the 7.2-µg/g Effects Threshold (Red Line).

Delta Smelt Analyses

4.1.3 Operations Effects

- *4.1.3.7 Suisun Marsh Facilities*
  - Phase 1 recommendation and response:

[27] The independent review panel report for the working draft BA recommended that the water-distribution system within Suisun Marsh be qualitatively assessed for its potential influence on the salinity, current speed, and turbidity within the high-abundance area for Delta Smelt (Simenstad et al. 2016). The analysis included herein considers the main aspects of the Suisun Marsh facilities that were identified to be of relevance to Delta Smelt by USFWS (2008). Although further analysis of the type recommended by the independent review panel report is possible, such an analysis is not included herein because of the overall similarity in Suisun Marsh facility operations between the NAA and PP.

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Delta Smelt Analyses

4.1.6 Take Analysis

- Where possible, provided estimates of % of population taken
  - *4.1.6.3.1 North Delta Diversions*
    - << 1% of larvae, based on density in NDD reach relative to downstream areas and entrainment

Delta Smelt Analyses

4.1.6 Take Analysis

- Where possible, provided estimates of % of population taken
  - *4.1.6.3.2 South Delta Exports*
    - Adults: ~1.3%; larvae/juveniles: similar to NAA

Table 4.1-49. Authorized and Actual Take (Salvage) of Delta Smelt, Together with Prior Fall Midwater Trawl (FMWT) Index, Water Years 2009-2015.

Water Year	Prior FWMT Index	Adult Delta Smelt			Juvenile Delta Smelt		
		Authorized	Actual	% of Authorized	Authorized	Actual	% of Authorized
2009	23	167	24	14%	1,293	737	57%
2010	17	123	92	75%	955	29	3%
2011	29	210	48	23%	1,630	0	0%
2012	343	2,487	203	8%	19,276	2,155	11%
2013	42	362	260	72%	2,350	1,741	74%
2014	18	155	0	0%	1,007	78	8%
2015	9	196	68	35%	504	4	1%

Delta Smelt Analyses

4.1.7 Analysis of Potential for Jeopardy

- *4.1.7.1 Cumulative Effects*
  - Phase 2A charge question: “Is climate change adequately incorporated into the cumulative analysis?”
  - Summarized results of Brown et al. (2016) climate change analysis for 2010-2039
    - No. days/yr ≥ 27°C (chronic lethal maximum): generally little difference, with exceptions
    - No. days/yr ≥ 24°C (thermal stress): generally more frequent
    - No. days/yr 15-20°C (spawning window): variable
    - Start date of spawning window: generally little difference
    - Start date of maturation window (last day of 24°C): occurs later in the year
    - Duration of maturation window: generally decreases

Delta Smelt Analyses

4.1.7 Analysis of Potential for Jeopardy

- *4.1.7.2 Potential to Jeopardize Continued Existence of the Species*
  - Take minimization measures to be applied
    - Cross-references Section 5.3.1 in Chapter 5
    - Many avoidance and mitigation measures for construction and maintenance
    - Minimization/avoidance through operational criteria (e.g., OMR flow constraints)
    - Reduced sediment effects (reintroduction, operational protection of initial pulse flows)
    - Spring outflow criteria – intended for longfin smelt, potential to benefit delta smelt (e.g., less entrainment, distribution farther downstream)
  - Loss of habitat fully mitigated
    - Cross-references Section 5.4.1 in Chapter 5
    - ~348 acres to offset construction and habitat access loss
  - Conclusion: No jeopardy

Delta Smelt Analyses

4.1.7 Analysis of Potential for Jeopardy

- *4.1.7.2 Potential to Jeopardize Continued Existence of the Species*
  - Spring outflow criteria effects

Table 4.D-5. Monthly Water-year-type Mean of Old and Middle River Flows (Cubic Feet per Second), from the 1922–2003 CalSim-II Simulation.

Month	WYT	NAA	PP	PP_{LFS}	PP vs. NAA[1]	PP_{LFS} vs. NAA[1]	PP_{LFS} vs. PP
Jan	W	-1,901	1,753	1,753	3,654 (192%)	3,654 (192%)	0 (0%)
	AN	-3,664	-1,625	-1,690	2,039 (56%)	1,974 (54%)	-65 (-4%)
	BN	-4,380	-1,399	-1,399	2,981 (68%)	2,981 (68%)	0 (0%)
	D	-4,617	-3,202	-3,202	1,415 (31%)	1,415 (31%)	0 (0%)
	C	-4,505	-3,925	-3,925	580 (13%)	580 (13%)	0 (0%)
Feb	W	-1,743	4,141	4,215	5,884 (338%)	5,959 (342%)	75 (2%)
	AN	-3,053	-787	-763	2,265 (74%)	2,290 (75%)	24 (3%)
	BN	-3,365	-2,161	-2,144	1,204 (36%)	1,221 (36%)	18 (1%)
	D	-3,531	-2,774	-2,774	758 (21%)	757 (21%)	0 (0%)
	C	-2,867	-2,844	-2,855	23 (1%)	12 (0%)	-11 (0%)
Mar	W	-1,544	4,914	5,168	6,458 (418%)	6,712 (435%)	254 (5%)
	AN	-4,178	1,174	1,473	5,353 (128%)	5,651 (135%)	299 (25%)
	BN	-3,968	-2,665	-1,222	1,303 (33%)	2,746 (69%)	1,442 (54%)
	D	-3,076	-2,482	-579	595 (19%)	2,497 (81%)	1,902 (77%)
	C	-1,783	-1,662	-1,202	121 (7%)	581 (33%)	460 (28%)

Delta Smelt Analyses

4.1.7 Analysis of Potential for Jeopardy

- *4.1.7.2 Potential to Jeopardize Continued Existence of the Species*
  - Spring outflow criteria effects

Table 4.D-5. Monthly Water-year-type Mean of Old and Middle River Flows (Cubic Feet per Second), from the 1922–2003 CalSim-II Simulation.

Month	WYT	NAA	PP	PP_{LFS}	PP vs. NAA[1]	PP_{LFS} vs. NAA[1]	PP_{LFS} vs. PP
Apr	W	2,563	4,221	3,852	1,658 (65%)	1,289 (50%)	-369 (-9%)
	AN	655	1,014	997	360 (55%)	343 (52%)	-17 (-2%)
	BN	-25	-461	-460	-436 (-1742%)	-435 (-1740%)	0 (0%)
	D	-637	-823	-809	-186 (-29%)	-172 (-27%)	14 (2%)
	C	-848	-1,075	-1,082	-227 (-27%)	-234 (-28%)	-7 (-1%)
May	W	1,970	4,032	3,957	2,062 (105%)	1,986 (101%)	-76 (-2%)
	AN	397	869	868	472 (119%)	472 (119%)	0 (0%)
	BN	-341	-427	-428	-87 (-26%)	-87 (-26%)	0 (0%)
	D	-904	-792	-872	112 (12%)	33 (4%)	-79 (-10%)
	C	-864	-1,060	-1,060	-196 (-23%)	-196 (-23%)	0 (0%)
Jun	W	-4,290	-396	-343	3,894 (91%)	3,946 (92%)	53 (13%)
	AN	-4,537	-2,678	-2,678	1,858 (41%)	1,858 (41%)	0 (0%)
	BN	-3,454	-2,740	-2,755	714 (21%)	699 (20%)	-15 (-1%)
	D	-3,272	-2,427	-2,767	845 (26%)	504 (15%)	-340 (-14%)
	C	-1,346	-1,205	-1,298	141 (10%)	48 (4%)	-93 (-8%)