Enhanced Delta Smelt Monitoring
2021 Phase 3 Sampling
Preliminary Analysis

DRAFT

U.S. Fish and Wildlife Service

September 17, 2021

Overview

On June 28, 2021, the Enhanced Delta Smelt Monitoring (EDSM) program started 2021 Phase 3 sampling program for juvenile and sub-adult Delta Smelt. In order to improve our ability to make inferences about the population, sampling effort is being focused on eight geographic areas where Delta Smelt are likely to be caught based on historical data. Sampling locations are generated using a generalized random-tessellation stratified (GRTS) design [Stevens and Olsen, 2004] with stratification and equal probability sampling. Trawling gear similar to that used in the California Department of Fish and Wildlife's Spring Kodiak Trawl Survey is used to conduct multiple tows per location.

Everything presented here is preliminary and subject to correction, revision, and improvement. The following points should be taken into consideration when interpreting the results:

1. Delta Smelt captured outside of the live box or cod end of the net could not be assigned to a specific tow and were excluded from this analysis. These fish are included in the daily catch summary and are indicated by a Gear Condition Code of 9. Delta Smelt captured in highly impaired samples, e.g., samples with large net blockages of debris or vegetation, were also excluded from this analysis. These fish are included in the daily catch summary and are indicated by a Gear Condition Code of 3.

2. The **Week** designations used here were defined out of convenience and are subject to change.

3. Current sampling is limited to areas of the Bay-Delta that can be safely navigated by EDSM vessels, which means areas with a minimum depth of approximately 8 feet. The abundance estimation method used here assumes that the density of fish in unsampled areas (i.e., those with depth less than 8 feet) is the same as in sampled areas (i.e., those with depth greater than or equal to 8 feet).

4. The methods of analysis used here remain in development.

Results

Table 1: Delta Smelt catch summary and abundance estimates by week. An asterisk (*) is used to emphasize weeks when no Delta Smelt were caught and a dash (-) is used to indicate that sampling did not occur or that a quantity could not be calculated. In order to avoid confusion, weekly totals are only calculated when sampling has occurred in every stratum. Sample volumes are in cubic meters.

					Estimate and 95% CI		
Stratum	**Number of Sites**	**Number of Tows**	**Number Caught**	**Total Sample Volume**	**Abundance**	**Lower Bound**	**Upper Bound**
Week 1: June 28 - July 1, 2021							
Suisun Bay	6	22	0	95,360	0*	-	-
Suisun Marsh	6	23	0	104,651	0*	-	-
Lower Sacramento	6	24	0	96,389	0*	-	-
Cache Slough LI	6	24	0	97,124	0*	-	-
Sac DW Ship Channel	6	24	0	97,760	0*	-	-
Lower San Joaquin	6	22	0	87,752	0*	-	-
Total	36	139	0	579,035	0*	-	-
Week 2: July 6 - 9, 2021							
Suisun Bay	6	24	0	113,618	0*	-	-
Suisun Marsh	6	22	0	99,286	0*	-	-
Lower Sacramento	6	24	0	101,528	0*	-	-
Cache Slough LI	6	24	0	83,216	0*	-	-
Sac DW Ship Channel	6	22	0	81,096	0*	-	-
Lower San Joaquin	6	24	0	95,989	0*	-	-
Total	36	140	0	574,734	0*	-	-
Week 3: July 12 - 15, 2021							
Suisun Bay	5	20	0	92,392	0*	-	-
Suisun Marsh	6	24	0	107,773	0*	-	-
Lower Sacramento	6	24	0	107,644	0*	-	-
Cache Slough LI	6	24	0	83,423	0*	-	-
Sac DW Ship Channel	6	22	0	82,293	0*	-	-
Lower San Joaquin	6	24	0	103,373	0*	-	-
Total	35	138	0	576,897	0*	-	-
Week 4: July 19 - 22, 2021							
Suisun Bay	6	24	0	115,008	0*	-	-
Suisun Marsh	6	24	0	91,799	0*	-	-
Lower Sacramento	6	24	0	109,336	0*	-	-
Cache Slough LI	6	21	0	74,791	0*	-	-
Sac DW Ship Channel	6	24	0	73,566	0*	-	-
Lower San Joaquin	6	24	0	102,468	0*	-	-
Total	36	141	0	566,968	0*	-	-
Week 5: July 26 - 29, 2021							
Suisun Bay	3	12	0	61,616	0*	-	-
Suisun Marsh	6	24	0	102,621	0*	-	-
Lower Sacramento	6	24	0	106,677	0*	-	-
Cache Slough LI	6	24	0	88,898	0*	-	-
Sac DW Ship Channel	6	24	0	91,731	0*	-	-

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					Estimate and 95% CI		
Stratum	**Number of Sites**	**Number of Tows**	**Number Caught**	**Total Sample Volume**	**Abundance**	**Lower Bound**	**Upper Bound**
Lower San Joaquin	6	24	0	112,341	0*	-	-
Total	33	132	0	563,885	0*	-	-
Week 6: August 2 - 6, 2021							
Suisun Bay	5	16	0	71,091	0*	-	-
Suisun Marsh	3	8	0	34,010	0*	-	-
Lower Sacramento	6	22	0	89,827	0*	-	-
Cache Slough LI	6	24	0	72,187	0*	-	-
Sac DW Ship Channel	6	24	0	82,829	0*	-	-
Lower San Joaquin	5	20	0	78,444	0*	-	-
Total	31	114	0	428,388	0*	-	-
Week 7: August 9 - 12, 2021							
Suisun Bay	0	-	-	-	-	-	-
Suisun Marsh	6	24	0	86,504	0*	-	-
Lower Sacramento	5	18	0	77,458	0*	-	-
Cache Slough LI	6	24	0	81,633	0*	-	-
Sac DW Ship Channel	6	24	0	80,764	0*	-	-
Lower San Joaquin	6	24	0	117,382	0*	-	-
Total	29	114	0	443,741	-	-	-
Week 8: August 16 - 20, 2021							
Suisun Bay	6	24	0	91,592	0*	-	-
Suisun Marsh	6	24	0	96,997	0*	-	-
Lower Sacramento	6	24	0	105,556	0*	-	-
Cache Slough LI	5	20	0	66,130	0*	-	-
Sac DW Ship Channel	4	8	1	29,628	1,421	196	5,140
Lower San Joaquin	0	-	-	-	-	-	-
Total	27	100	1	389,903	-	-	-
Week 9: August 23 - 26, 2021							
Suisun Bay	6	24	0	115,838	0*	-	-
Suisun Marsh	6	22	0	94,741	0*	-	-
Lower Sacramento	6	24	0	114,861	0*	-	-
Cache Slough LI	6	24	0	82,363	0*	-	-
Sac DW Ship Channel	6	24	0	89,702	0*	-	-
Lower San Joaquin	6	22	0	105,923	0*	-	-
Total	36	140	0	603,428	0*	-	-
Week 10: August 30 - September 2, 2021							
Suisun Bay	5	18	0	75,745	0*	-	-
Suisun Marsh	5	20	0	79,864	0*	-	-
Lower Sacramento	6	24	0	94,820	0*	-	-
Cache Slough LI	6	22	0	84,642	0*	-	-

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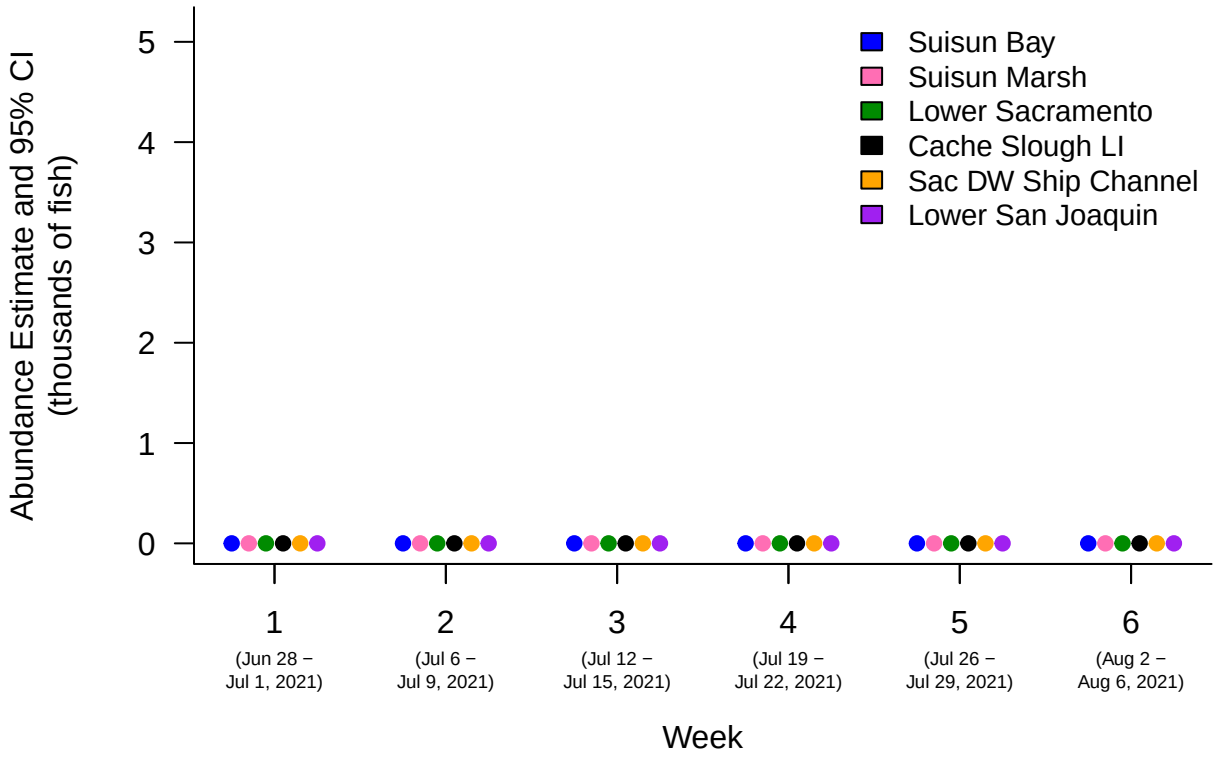
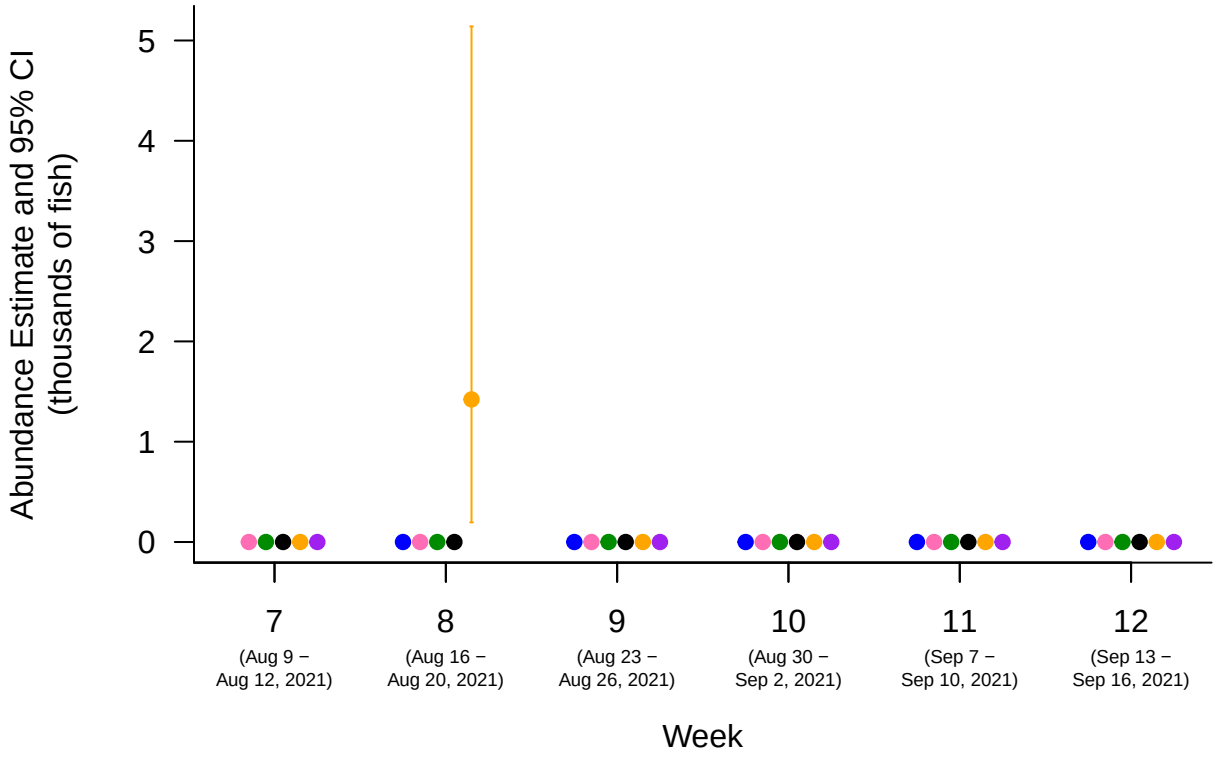
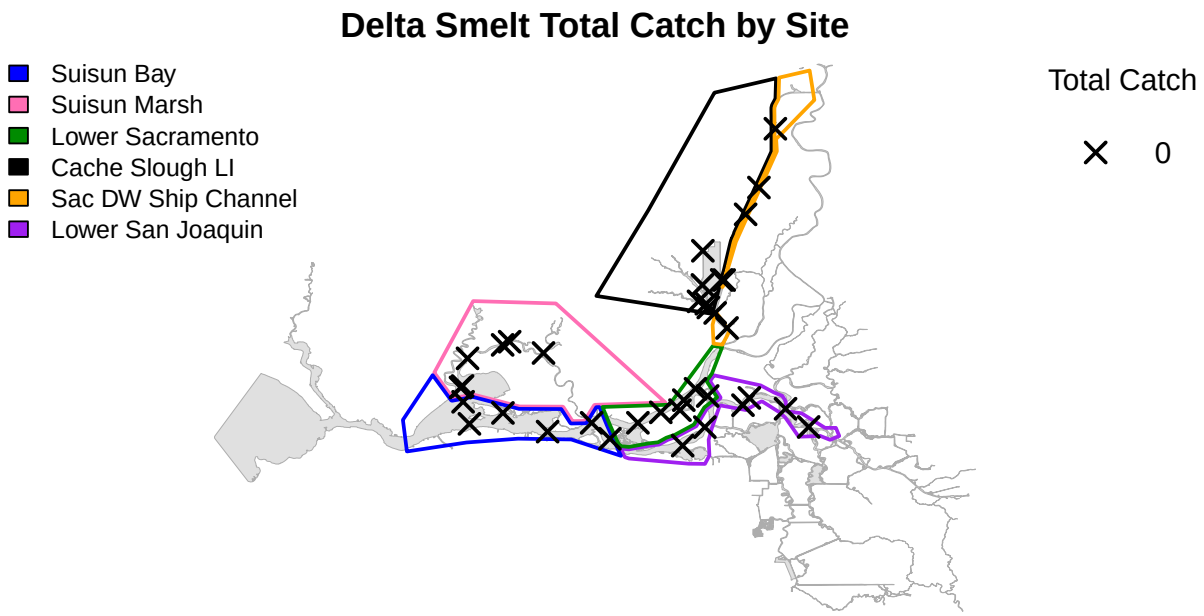
					Estimate and 95% CI		
Stratum	**Number of Sites**	**Number of Tows**	**Number Caught**	**Total Sample Volume**	**Abundance**	**Lower Bound**	**Upper Bound**
Sac DW Ship Channel	6	24	0	98,133	0*	-	-
Lower San Joaquin	6	22	0	86,810	0*	-	-
Total	34	130	0	520,013	0*	-	-
Week 11: September 7 - 10, 2021							
Suisun Bay	6	24	0	101,710	0*	-	-
Suisun Marsh	6	24	0	96,608	0*	-	-
Lower Sacramento	6	24	0	90,930	0*	-	-
Cache Slough LI	6	24	0	83,388	0*	-	-
Sac DW Ship Channel	2	8	0	34,085	0*	-	-
Lower San Joaquin	6	24	0	90,686	0*	-	-
Total	32	128	0	497,407	0*	-	-
Week 12: September 13 - 16, 2021							
Suisun Bay	6	24	0	111,946	0*	-	-
Suisun Marsh	6	22	0	102,781	0*	-	-
Lower Sacramento	6	24	0	96,520	0*	-	-
Cache Slough LI	6	24	0	80,901	0*	-	-
Sac DW Ship Channel	6	24	0	79,889	0*	-	-
Lower San Joaquin	6	24	0	110,071	0*	-	-
Total	36	142	0	582,109	0*	-	-

Delta Smelt Abundance Estimates Over Time

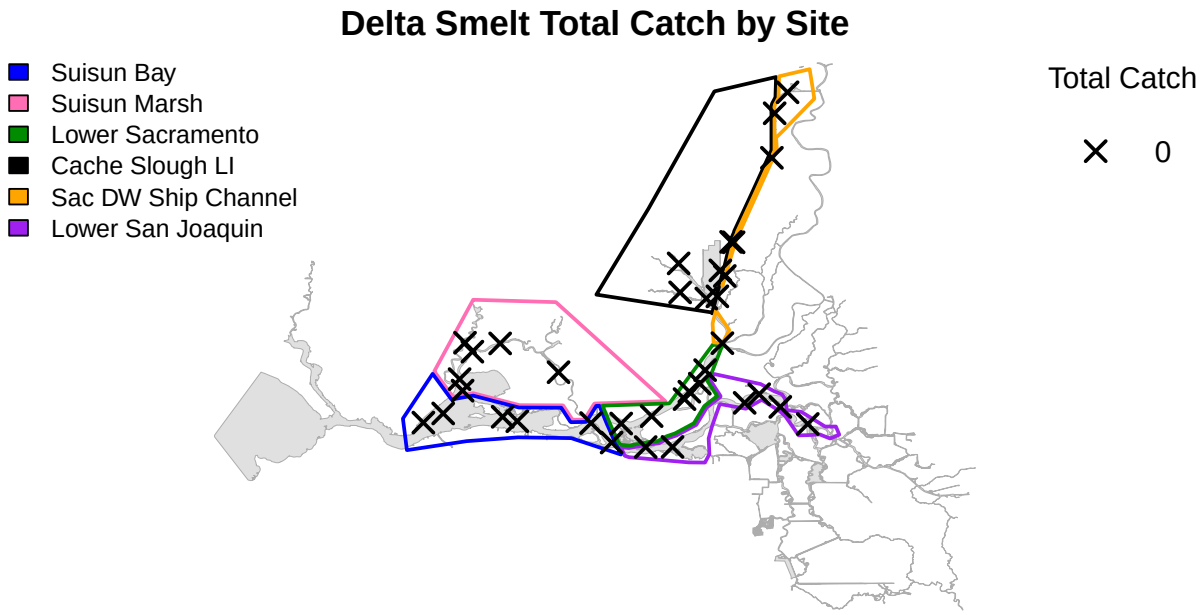




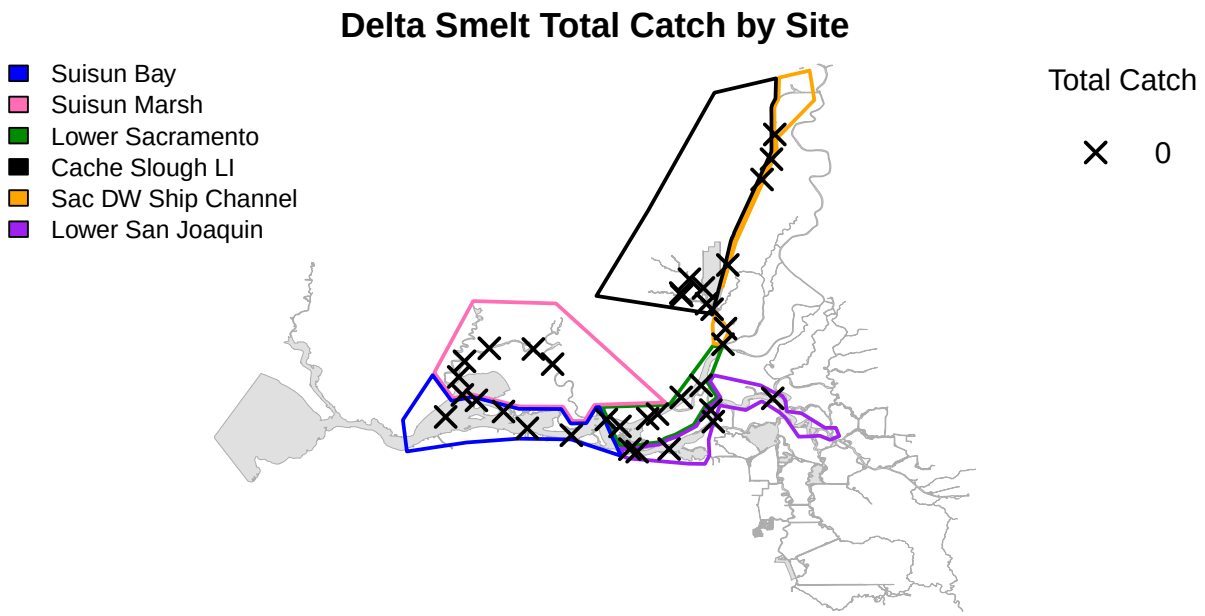
Week 1 (June 28 – July 1, 2021)



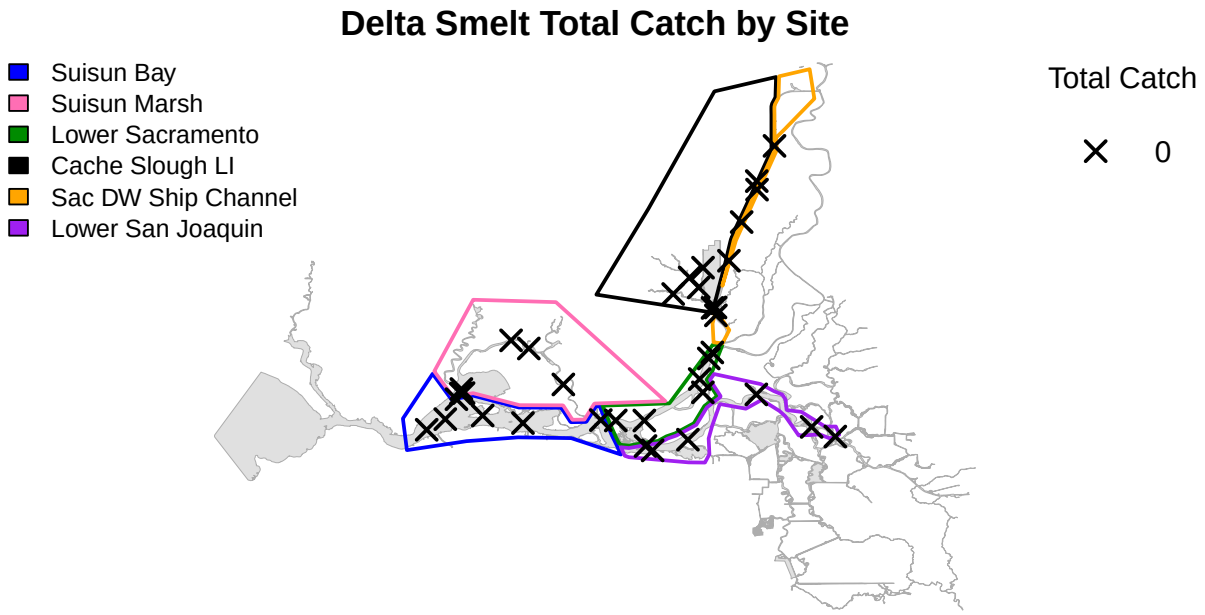
Week 2 (July 6 – 9, 2021)



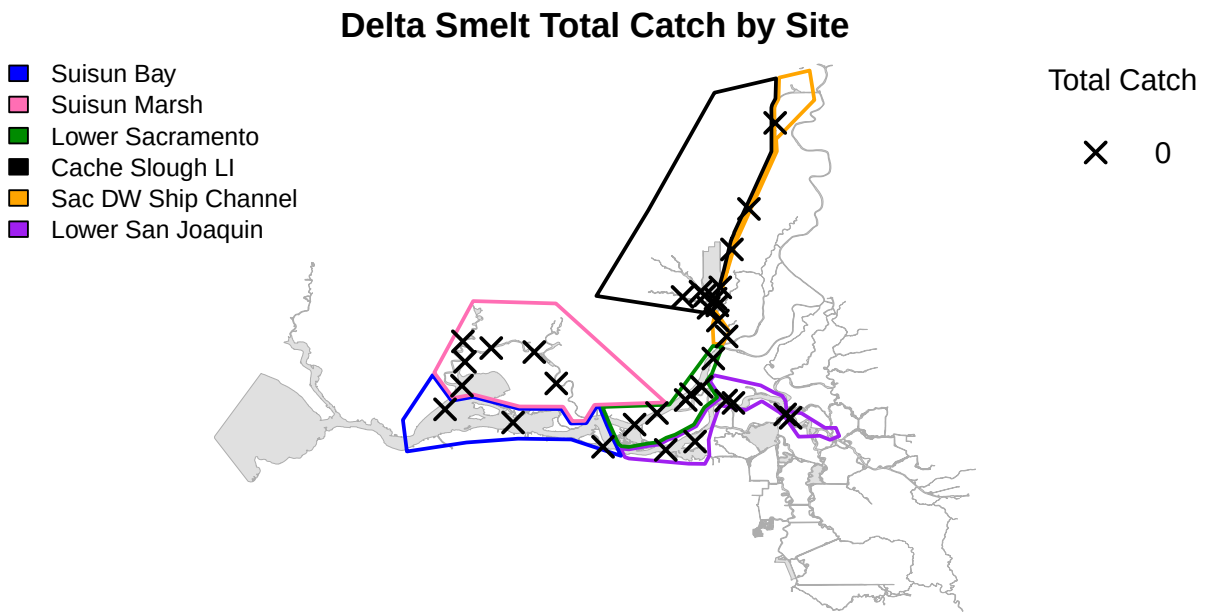
Week 3 (July 12 – 15, 2021)



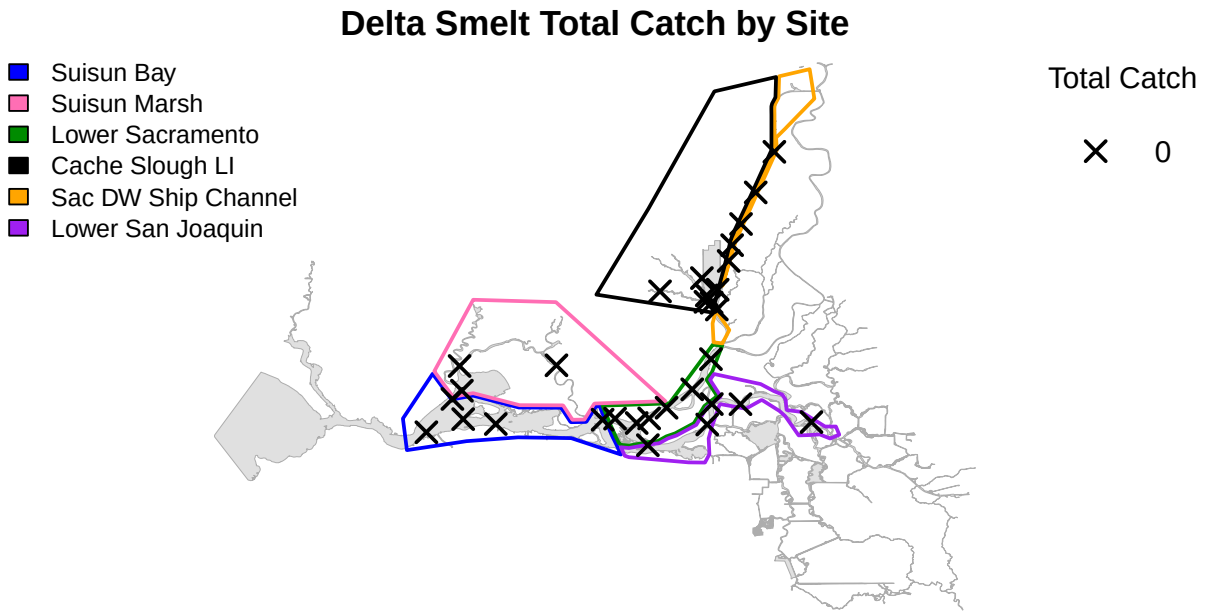
Week 4 (July 19 – 22, 2021)



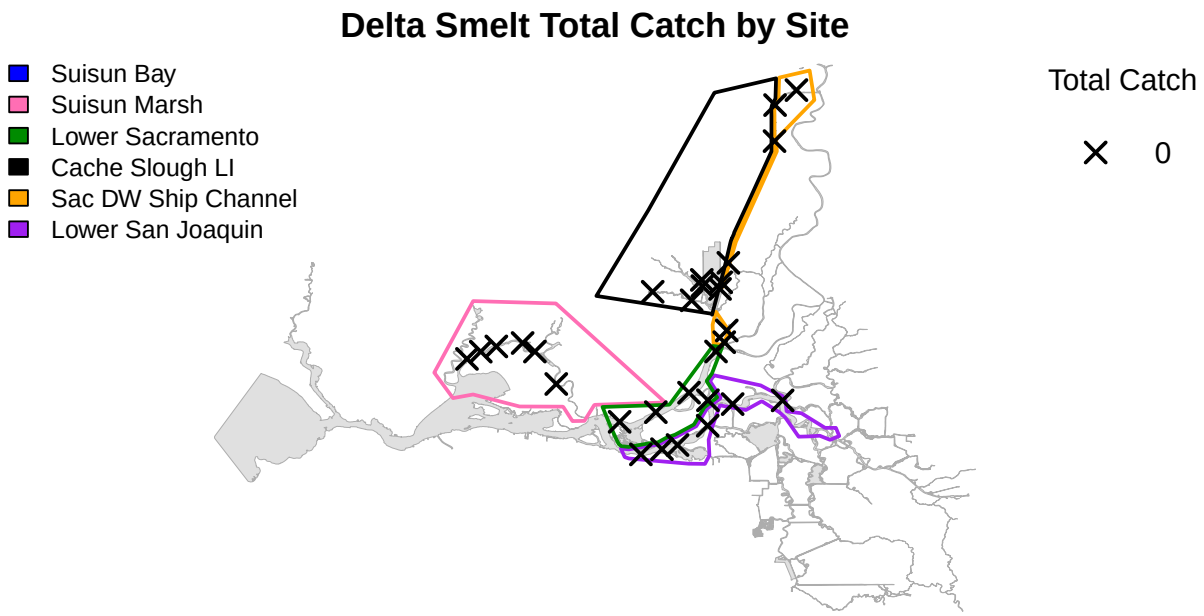
Week 5 (July 26 – 29, 2021)



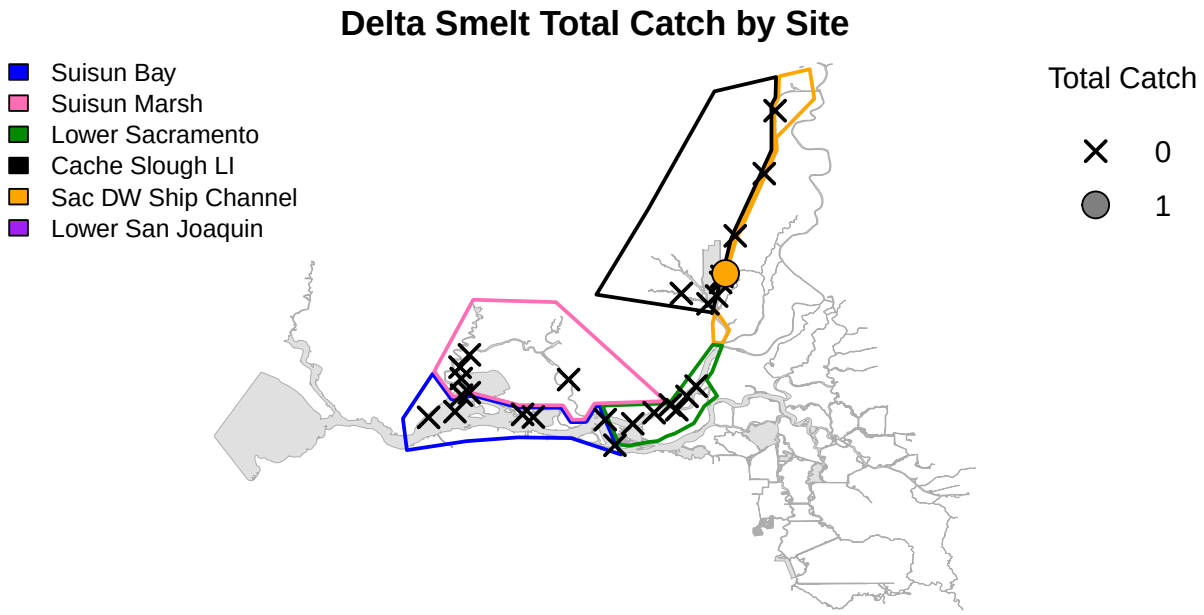
Week 6 (August 2 – 6, 2021)



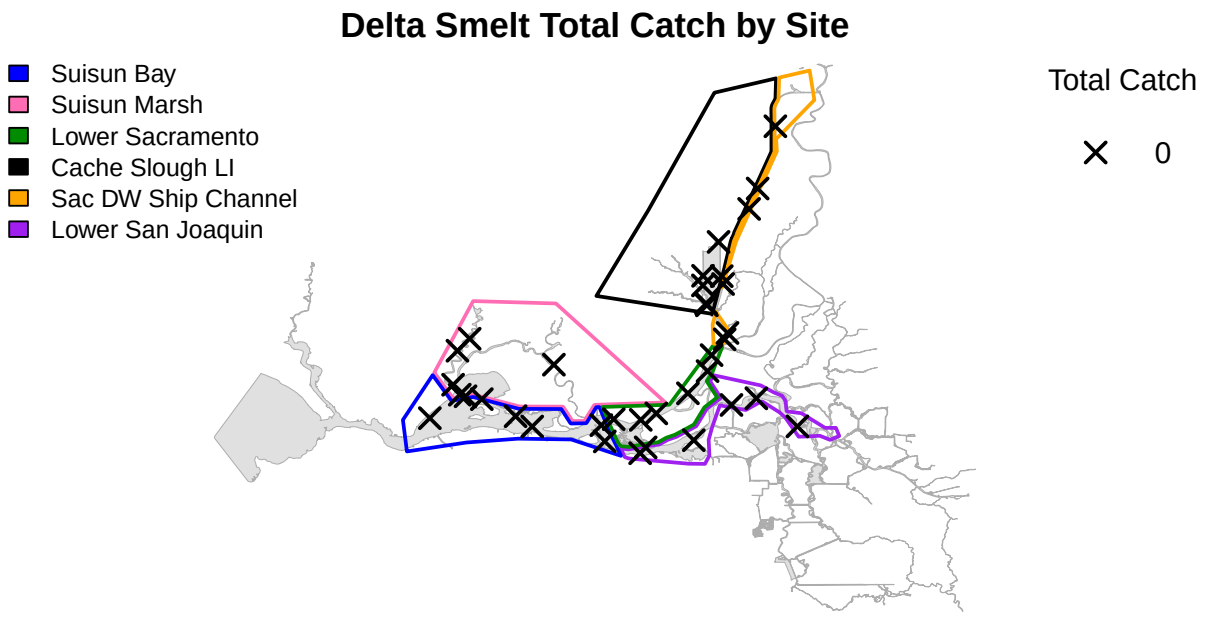
Week 7 (August 9 – 12, 2021)



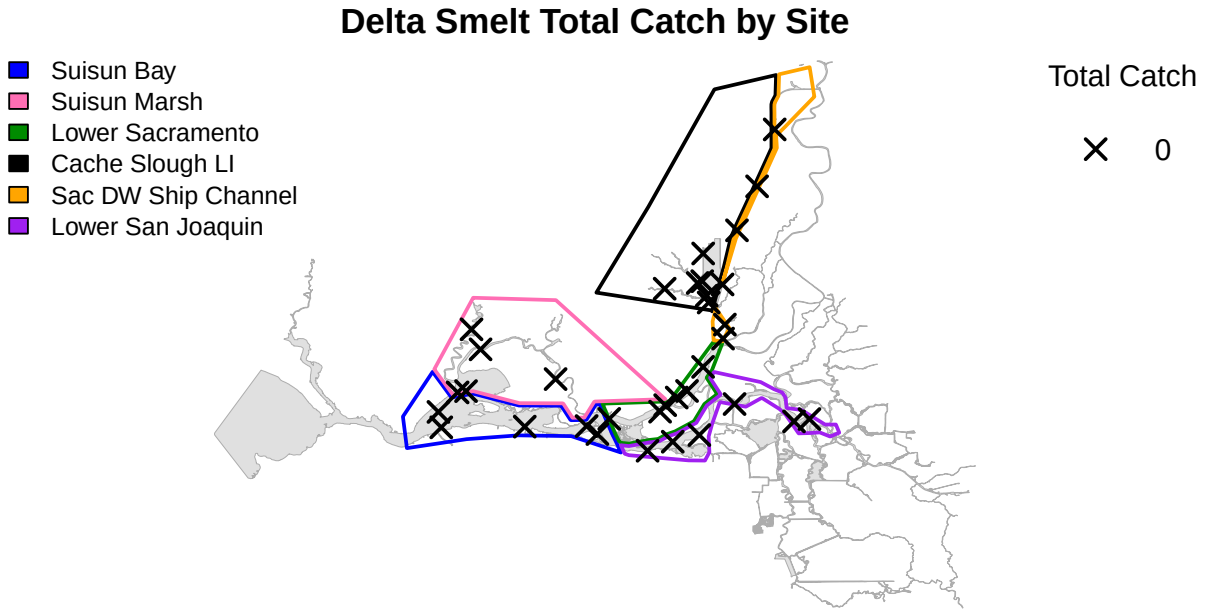
Week 8 (August 16 – 20, 2021)



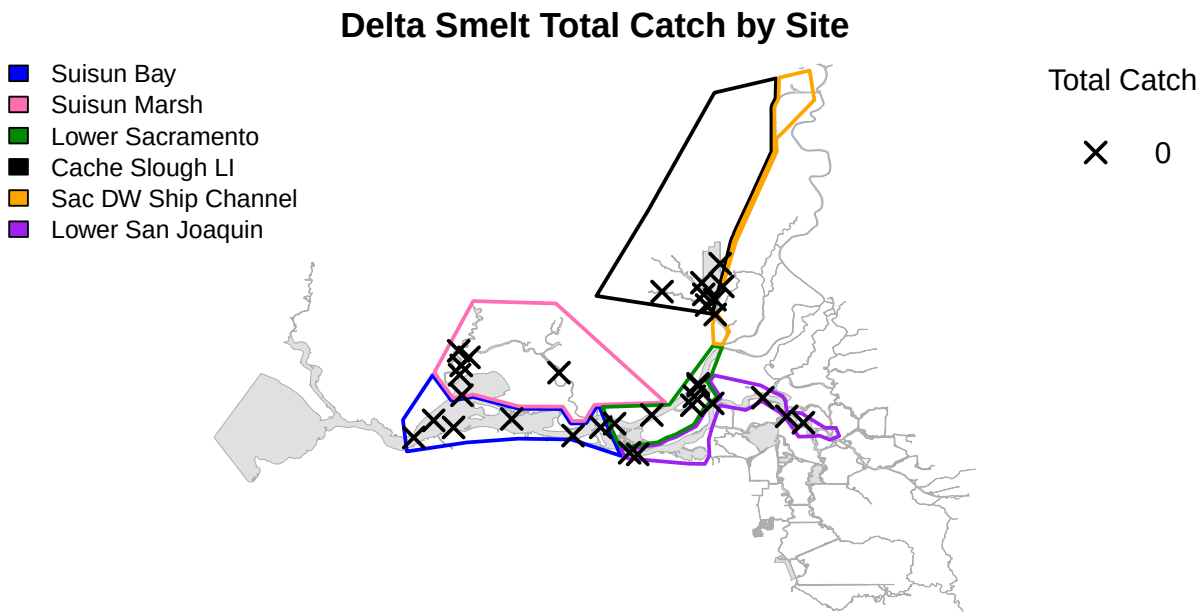
Week 9 (August 23 – 26, 2021)



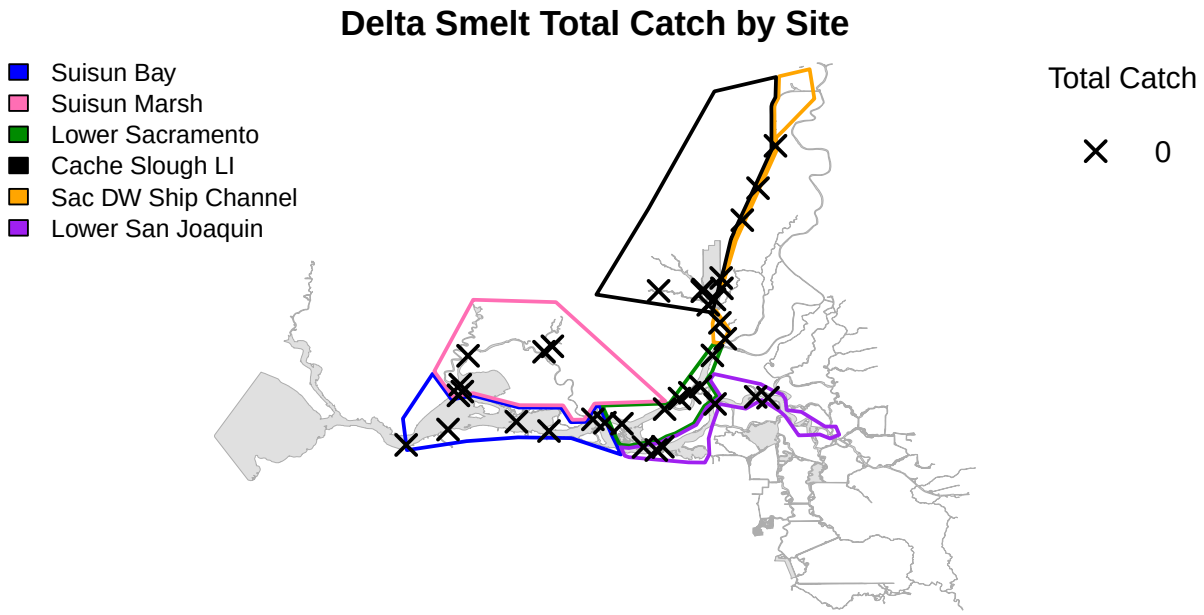
Week 10 (August 30 – September 2, 2021)



Week 11 (September 7 – 10, 2021)



Week 12 (September 13 – 16, 2021)



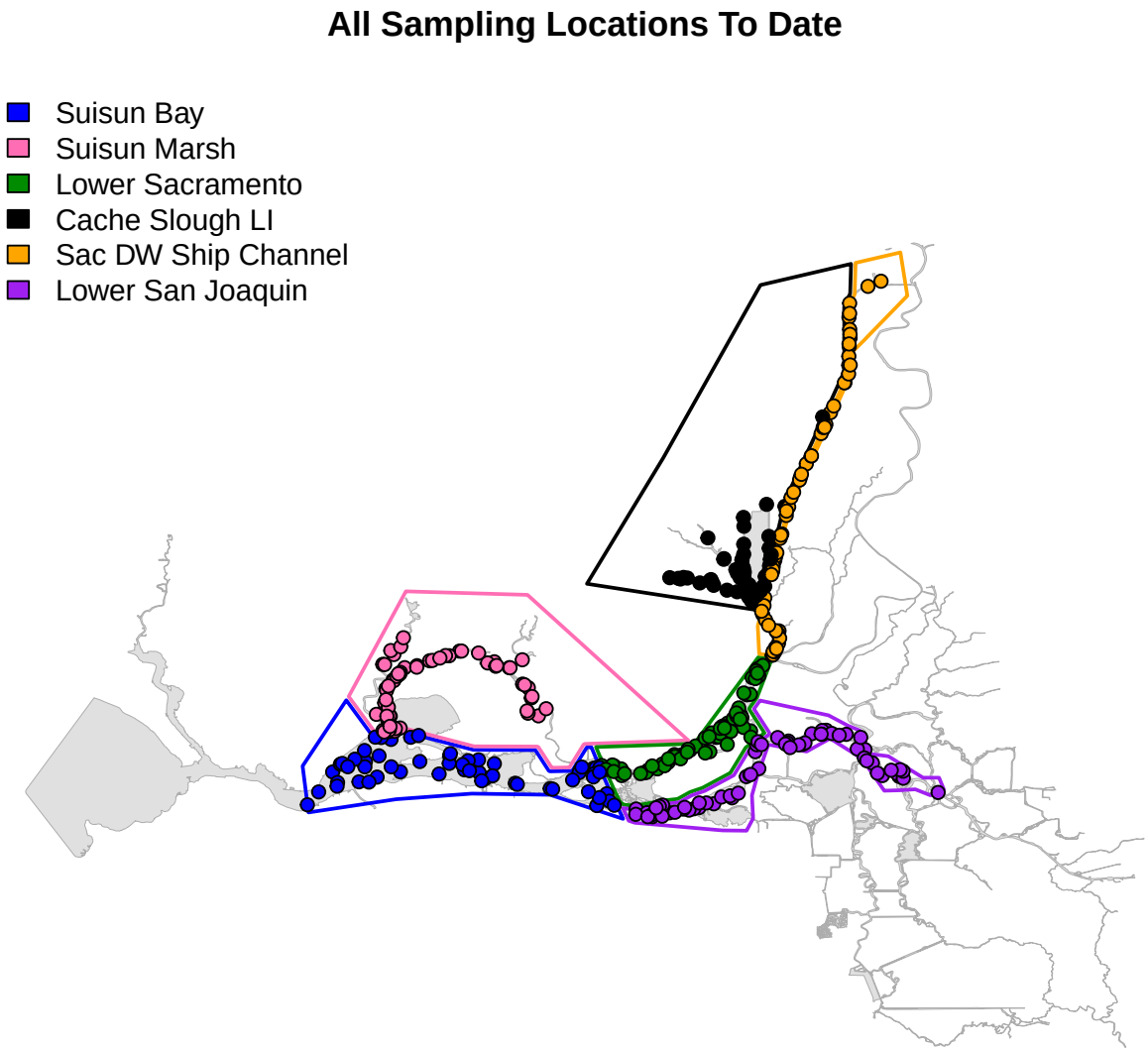


Table 2: Estimates of water volume (cubic meters) between 0.5-m and 4.5-m depth, by stratum.

Stratum	Volume
Cache Slough LI	33,420,492
Lower Sacramento	88,162,170
Lower San Joaquin	122,096,565
Sac DW Ship Channel	30,411,491
Suisun Bay	285,840,678
Suisun Marsh	76,278,718

References

D. L. Stevens and A. R. Olsen. Spatially balanced sampling of natural resources. *Journal of the American Statistical Association*, 99(465):262 – 278, 2004.