Enhanced Delta Smelt Monitoring

Preliminary Analysis

Phase 1 Sampling

DRAFT

U.S. Fish and Wildlife Service

December 29, 2017

Overview

Beginning December 2017, the Enhanced Delta Smelt Monitoring (EDSM) program started its Phase 1 sampling program for adult delta smelt. The Bay-Delta has been divided into ten geographic strata (shown in figures below). Sampling locations are generated using a generalized random-tessellation stratified (GRTS) design [1] 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 with a depth of at least 8 feet at mean tide. 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.

Change Log

Report date December 18, 2017:

- New estimates of water volumes between 0.5-m and 4.5-m depth are being used to estimate abundance; these are shown in a table at the end of this report. Previous reports used estimates of volume between 0 m and 4 m depth.
- The stratification used here is similar but not identical to the stratification used in previous phases. Of particular note is the separation of Cache Slough/Liberty Island from the Sacramento Deep Water Ship Channel and the separation of Suisun Marsh from Suisun Bay.
- We are considering alternative stratification and sample allocation schemes that would increase the probability of catching delta smelt. This could mean, for example, combining areas expected to have low densities so we can increase the number of sampling locations in areas expected to have higher densities.

Report date December 22, 2017:

- Sampling took place Monday December 18th through Friday December 22nd. Data collected on the 22nd will be included in the next report.

Report date December 29, 2017:

- Sampling took place Tuesday December 26th through Friday December 29th. Data collected on the 29th will be included in the next report.
- Data collected on December 22nd have been included in this report.

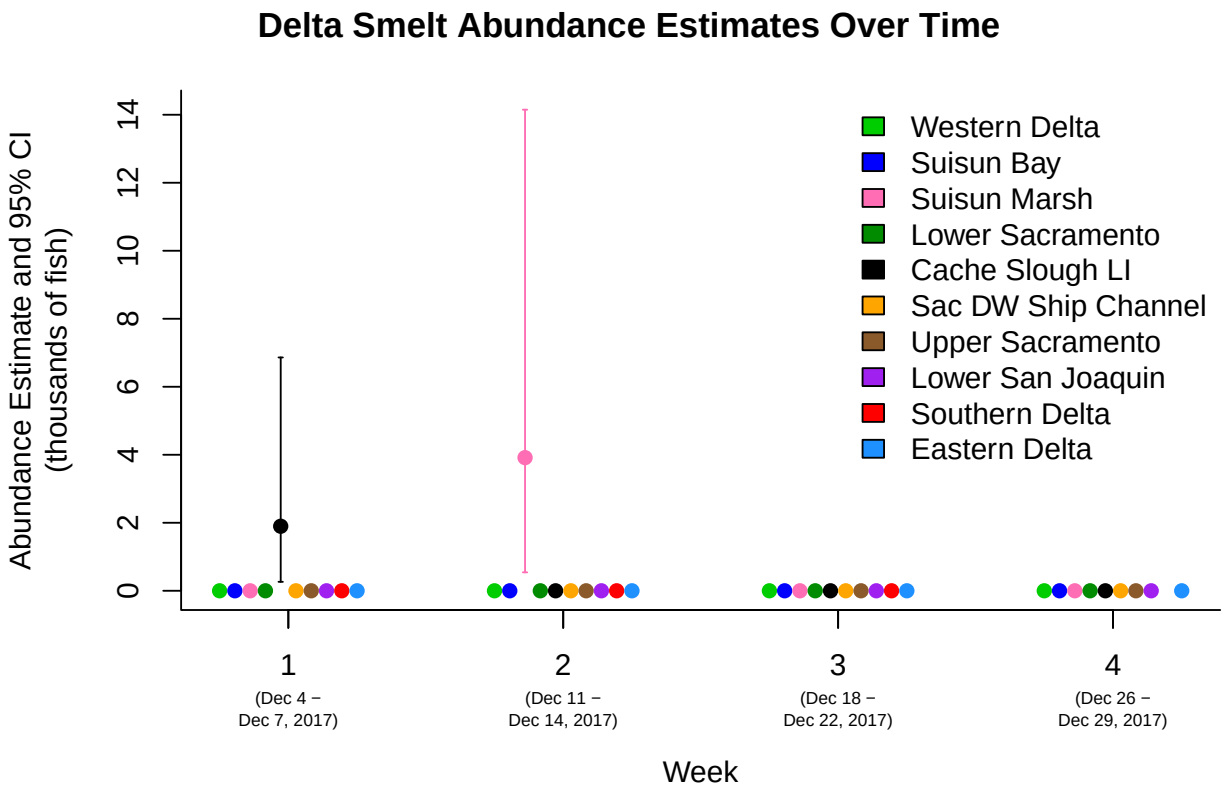
Results

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.

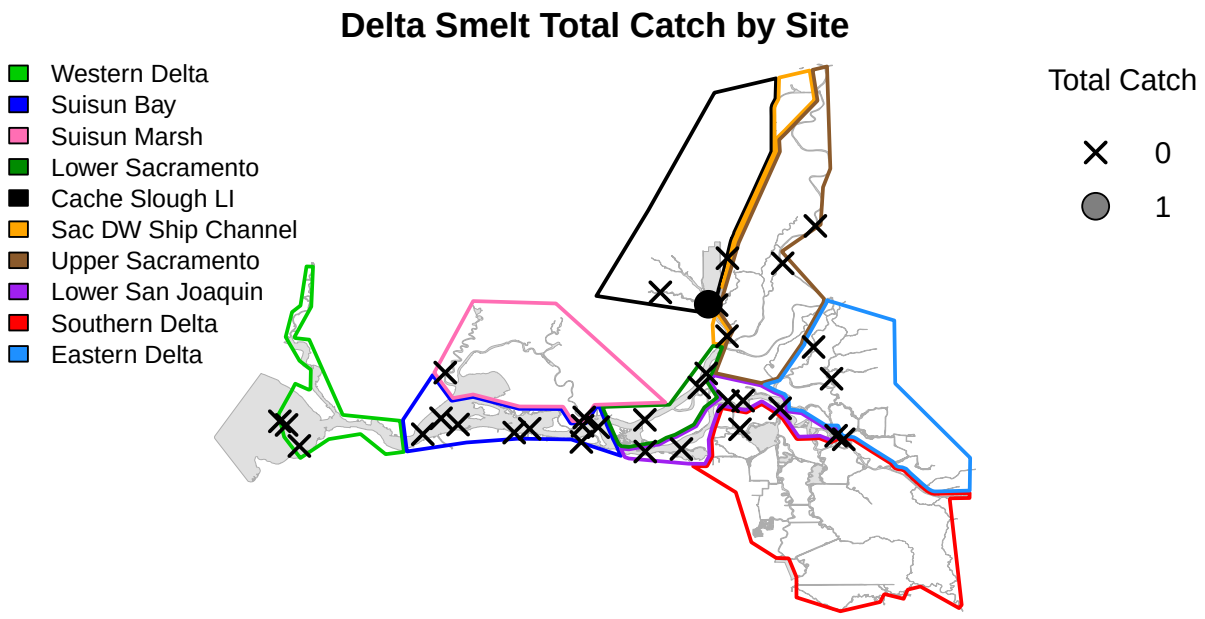
					Estimate and 95% CI		
Stratum	**Number of Sites**	**Number of Tows**	**Number Caught**	**Total Sample Volume**	**Abundance**	**Lower Bound**	**Upper Bound**
Week 1: December 4 - 7, 2017							
Western Delta	3	15	0	66,033	0*	-	-
Suisun Bay	8	40	0	87,849	0*	-	-
Suisun Marsh	2	10	0	17,629	0*	-	-
Lower Sacramento	3	15	0	32,026	0*	-	-
Cache Slough LI	3	12	1	24,384	1,898	263	6,862
Sac DW Ship Channel	2	10	0	24,885	0*	-	-
Upper Sacramento	2	12	0	53,115	0*	-	-
Lower San Joaquin	6	26	0	44,002	0*	-	-
Southern Delta	2	12	0	48,445	0*	-	-
Eastern Delta	2	12	0	31,466	0*	-	-
Total	33	164	1	429,834	-	-	-
Week 2: December 11 - 14, 2017							
Western Delta	2	12	0	57,590	0*	-	-
Suisun Bay	5	25	0	52,566	0*	-	-
Suisun Marsh	3	13	1	26,983	3,916	542	14,148
Lower Sacramento	3	15	0	27,428	0*	-	-
Cache Slough LI	3	15	0	22,179	0*	-	-
Sac DW Ship Channel	3	16	0	23,955	0*	-	-
Upper Sacramento	2	12	0	37,196	0*	-	-
Lower San Joaquin	6	30	0	61,852	0*	-	-
Southern Delta	2	12	0	39,691	0*	-	-
Eastern Delta	2	11	0	47,028	0*	-	-
Total	31	161	1	396,467	-	-	-
Week 3: December 18 - 22, 2017							
Western Delta	4	15	0	53,007	0*	-	-
Suisun Bay	4	20	0	41,189	0*	-	-
Suisun Marsh	3	15	0	32,206	0*	-	-
Lower Sacramento	3	15	0	31,904	0*	-	-
Cache Slough LI	3	15	0	24,123	0*	-	-
Sac DW Ship Channel	2	10	0	17,847	0*	-	-
Upper Sacramento	2	12	0	41,123	0*	-	-
Lower San Joaquin	6	30	0	53,916	0*	-	-
Southern Delta	2	12	0	40,071	0*	-	-
Eastern Delta	2	12	0	40,630	0*	-	-
Total	31	156	0	376,017	-	-	-
Week 4: December 26 - 29, 2017							
Western Delta	2	12	0	56,594	0*	-	-
Suisun Bay	4	20	0	39,904	0*	-	-

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.

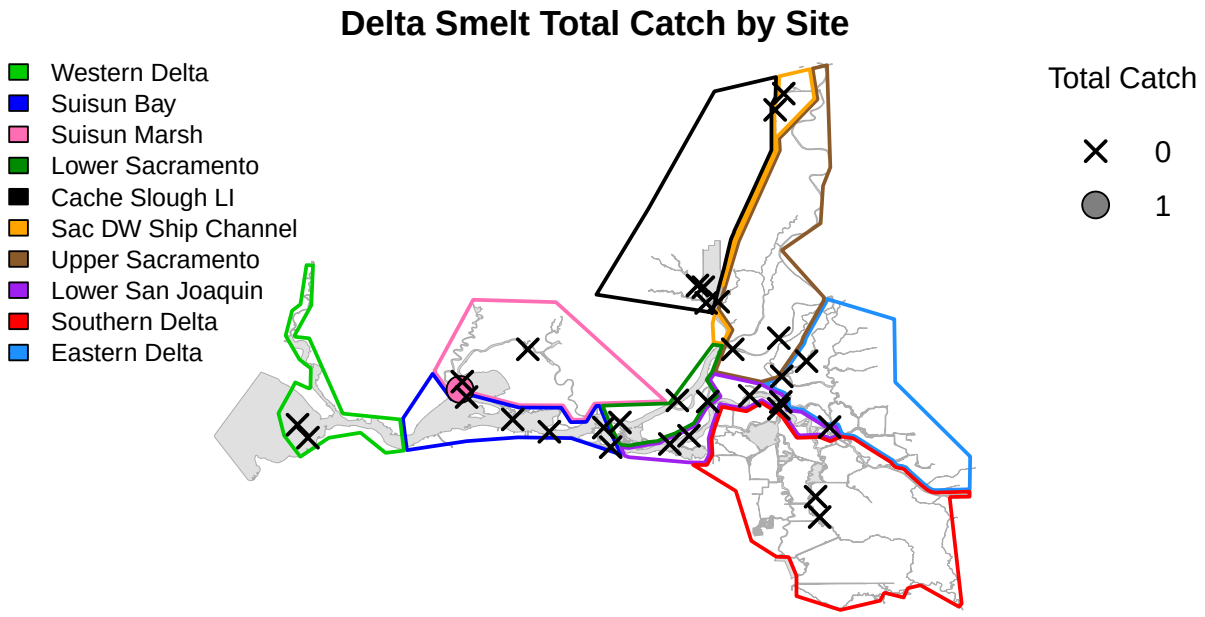
					Estimate and 95% CI		
Stratum	**Number of Sites**	**Number of Tows**	**Number Caught**	**Total Sample Volume**	**Abundance**	**Lower Bound**	**Upper Bound**
Suisun Marsh	3	15	0	25,459	0*	-	-
Lower Sacramento	1	5	0	9,499	0*	-	-
Cache Slough LI	3	15	0	25,615	0*	-	-
Sac DW Ship Channel	3	15	0	26,325	0*	-	-
Upper Sacramento	2	12	0	43,632	0*	-	-
Lower San Joaquin	6	30	0	58,115	0*	-	-
Southern Delta	0	-	-	-	-	-	-
Eastern Delta	2	12	0	37,573	0*	-	-
Total	26	136	0	322,716	-	-	-


Delta Smelt Abundance Estimates Over Time
Abundance Estimate and 95% CI
(thousands of fish)
0
2
4
6
8
10
12
14
Western Delta
Suisun Bay
Suisun Marsh
Lower Sacramento
Cache Slough LI
Sac DW Ship Channel
Upper Sacramento
Lower San Joaquin
Southern Delta
Eastern Delta
1
(Dec 4 –
Dec 7, 2017)
2
(Dec 11 –
Dec 14, 2017)
3
(Dec 18 –
Dec 22, 2017)
4
(Dec 26 –
Dec 29, 2017)
Week

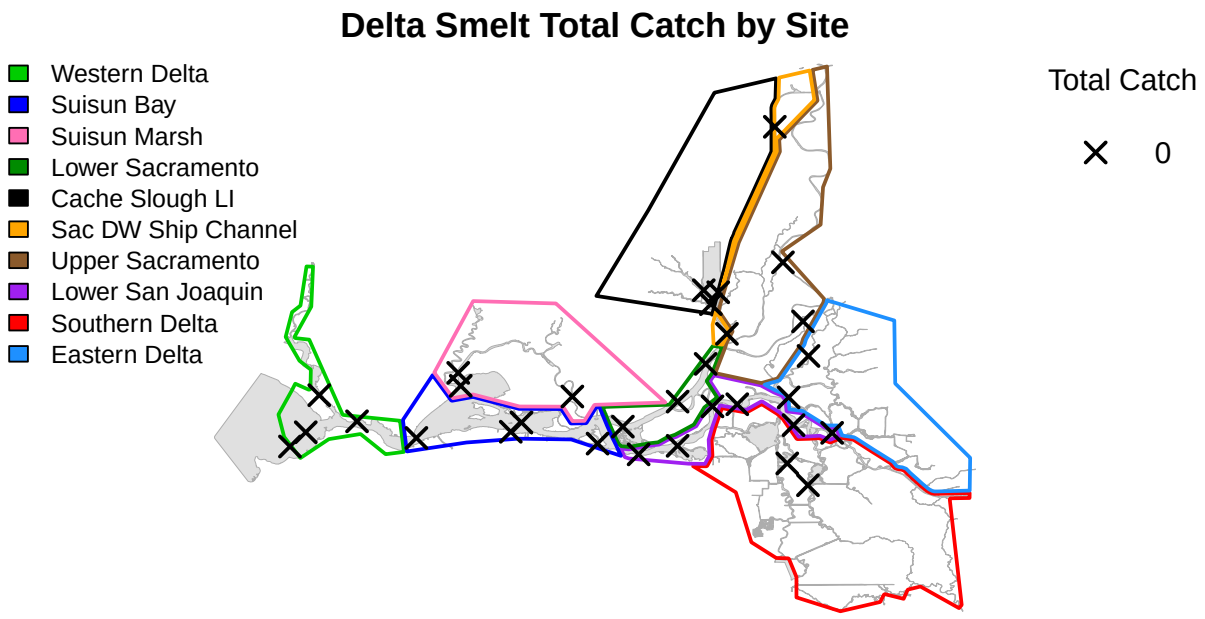
Week 1 (Dec 4 − Dec 7, 2017)



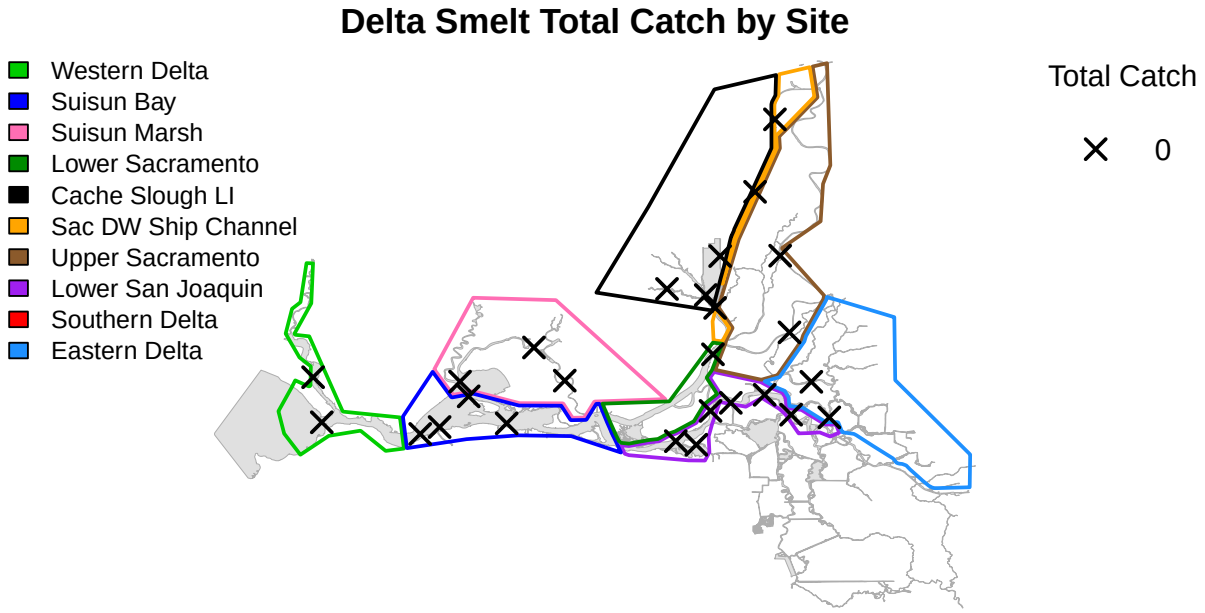
Week 2 (Dec 11 − Dec 14, 2017)



Week 3 (Dec 18 − Dec 22, 2017)



Week 4 (Dec 26 − Dec 29, 2017)



All Sampling Locations To Date

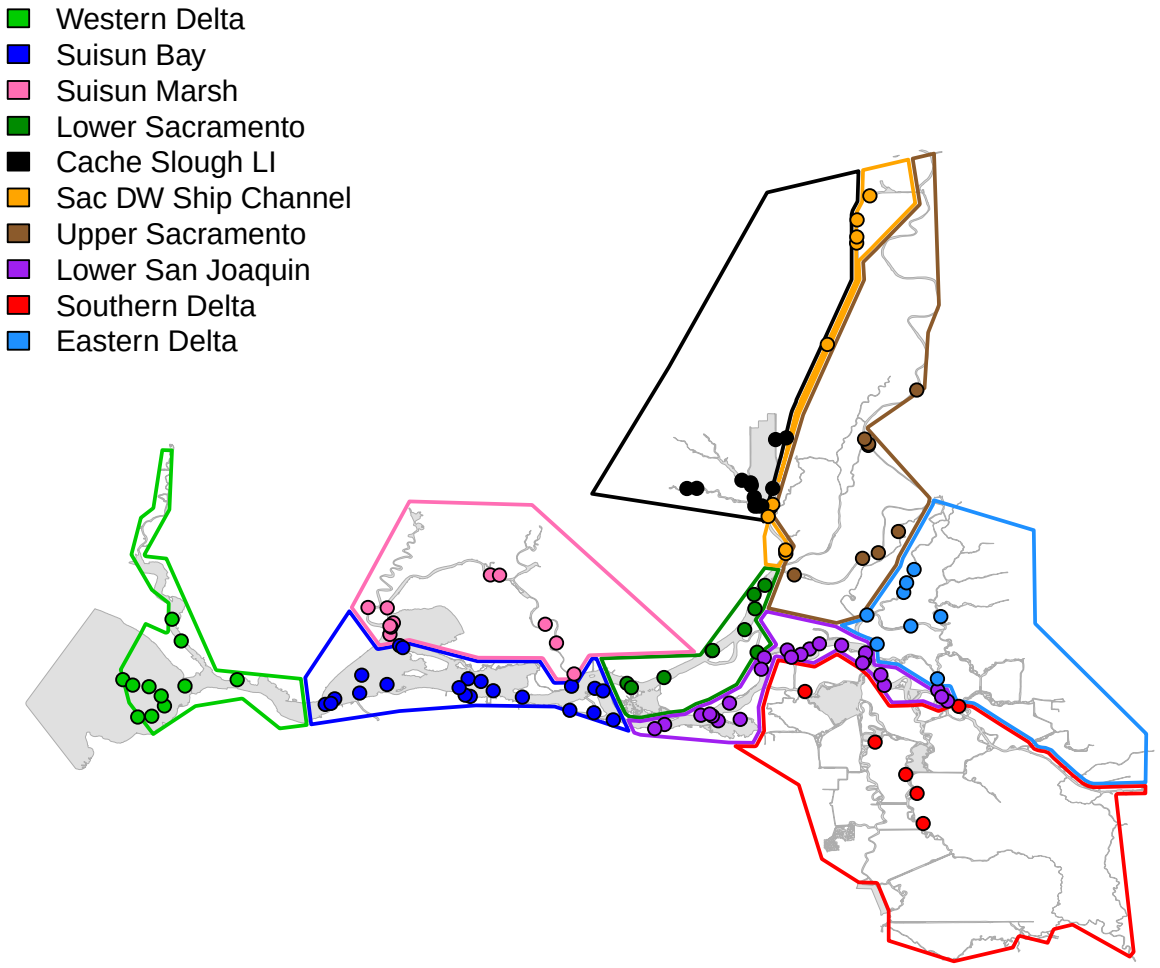


Table 2: Estimates of water volume (cubic meters) between 0.5-m and 4.5-m depth, by stratum.

Stratum	**Volume**
Western Delta	190,166,275
Suisun Bay	285,840,678
Suisun Marsh	76,278,718
Lower Sacramento	88,162,170
Cache Slough LI	33,420,492
Sac DW Ship Channel	30,411,491
Upper Sacramento	53,100,572
Lower San Joaquin	122,096,565
Southern Delta	169,844,010
Eastern Delta	48,788,659

References

[1] Stevens, Don L., Olsen, Anthony R. 2004. Spatially balanced sampling of natural resources, *Journal of the American Statistical Association*, 99(465): 262 – 278.