plot level in 2014 was 57.1%, a decline from 66% persistence in 2013. As plots that have survived through two growing seasons are more likely to continue to persist, plot-level data is more likely to be representative of overall site survivorship.

Staff also observed rapid lateral expansion of *S. foliosa* plots during fall 2014 monitoring. For the subset of plots monitored, the total stem number was roughly 27,000 stems at installation. In 2014, there was a nearly threefold increase in total stem number with 74,000 stems counted. Note that this stem total underestimates the total number of stems present as only a subset of plots were monitored at these sites due to time constraints, **Table 4** shows site results and **Figure 7** shows changes in stem number by site. The Year 2 results showed that a substantial amount of native cordgrass has been established at sites and that those plots continue to expand laterally each year.

To help inform future planting decisions, regression analysis was conducted to determine what factors that were manipulated or recorded had a significant effect on *S. foliosa* plot survival (binary logit regression). The resulting best fit model included site, habitat type, caging, and donor source population (Alviso Slough, Starkweather). Factors that were not found to be informative for *S. foliosa* survivorship included substrate, initial stem number, and initial stem height. As some treatments were applied at only a few sites, these were not included in the analysis (i.e., caging type, wave action treatment, and absolute elevation).

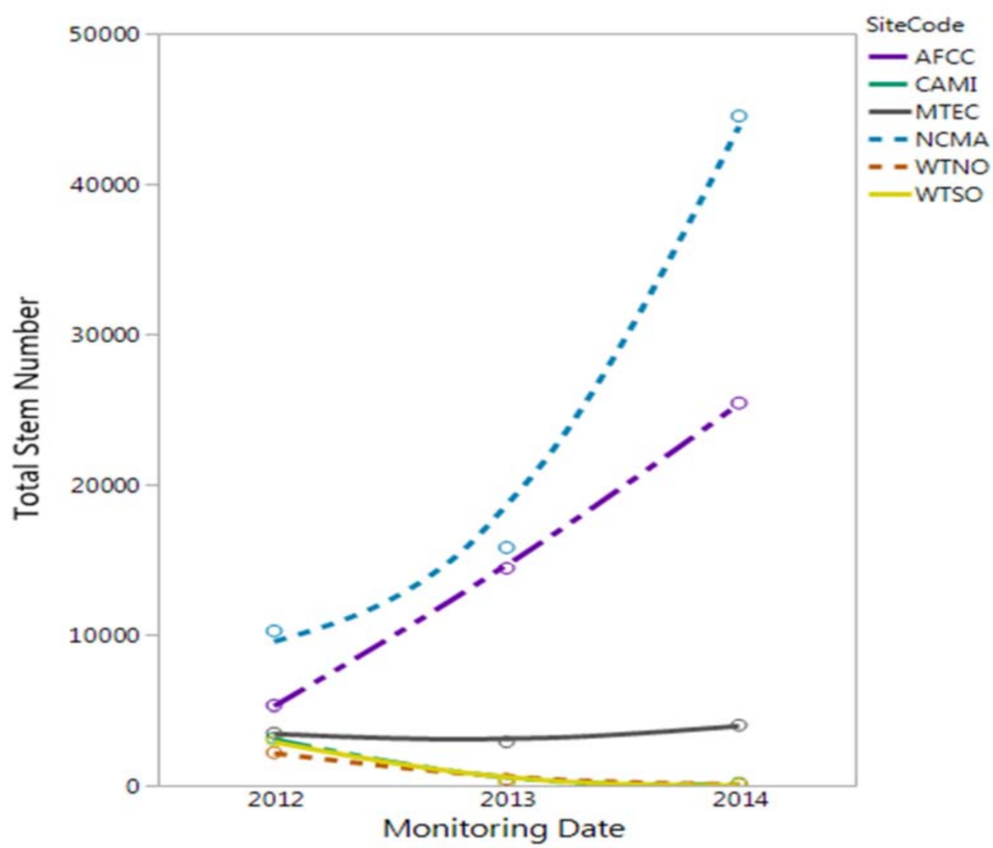

Figure 7. Change in Year 2 (2012-2013) S. foliosa survivorship at all sites from 2012 to 2014. North Creek Marsh (NCMA) showed the steepest growth curve for plants, more than doubling every year. See Appendix 1 for a list of site names and corresponding abbreviations.

2.3.5 Donor Source Population

In Year 2, *S. foliosa* plugs from eight donor source populations were outplanted at sites. These donor source populations were from geographically distinct areas of the estuary with three of the donor sources from the far South Bay (Alviso Slough, Coyote Creek, and Permanente Creek), three from isolated pocket marshes in the Central Bay (Seminary Marsh, Starkweather Marsh, and Golden Gate Fields), and two from the far North Bay (Port Sonoma Marina and Napa River). All eight source populations were outplanted at two marshes (Alameda Flood Control Channel or AFCC and North Creek Marsh). All eight sources were planted into blocks, with planting position within the block randomized. Blocks were then protected using rope cages. During monitoring after one growing season, marked differences were noted in source population growth rate, flowering time, and survivorship. Monitoring in 2014 indicated these differences persisted less than in previous monitoring years as height and growth rates appeared to stabilize. Site was still the biggest predictor of planting success. **Figure 8** shows that source population plant heights were greater at AFCC than at North Creek Marsh. **Figure 9** shows how source population influenced stem number.

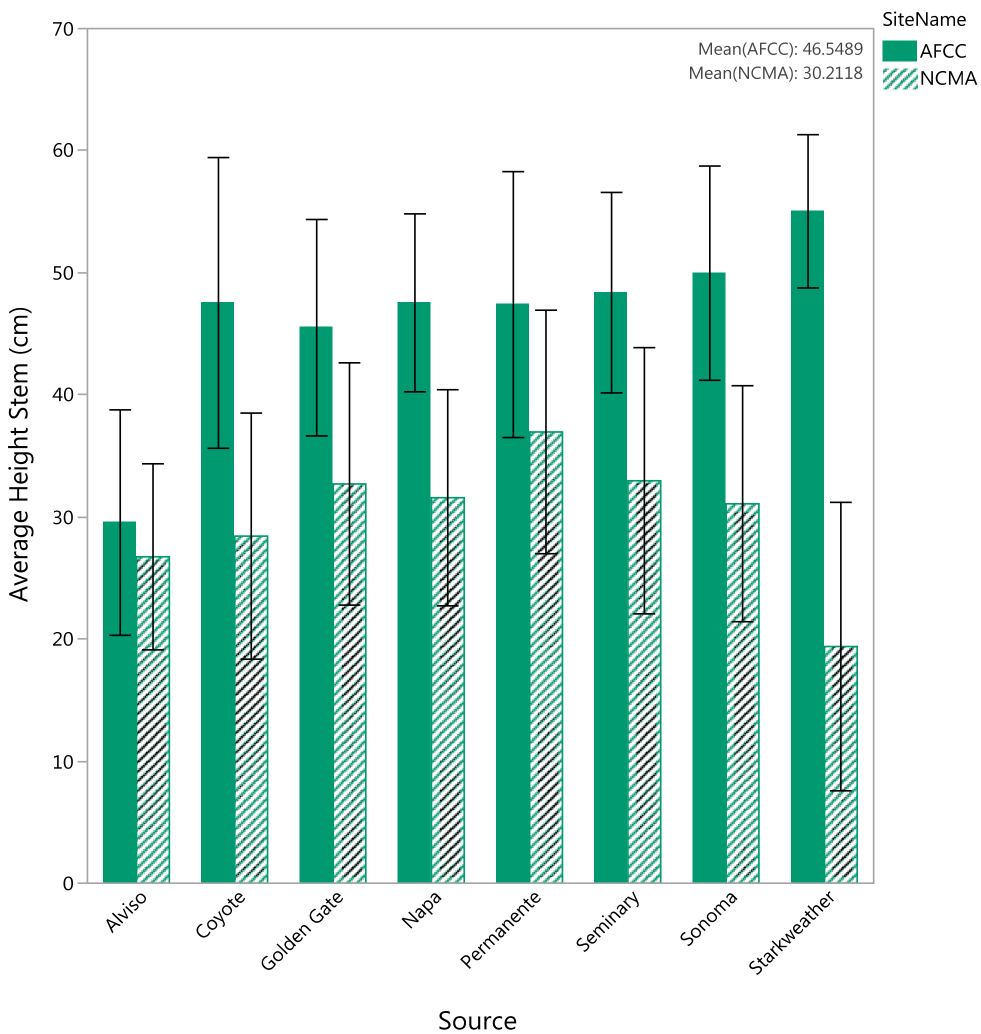

Figure 8. Year 2 (2012-2013) S. foliosa stem heights comparison at two sites: Alameda Flood Control Channel and North Creek Marsh in 2014.

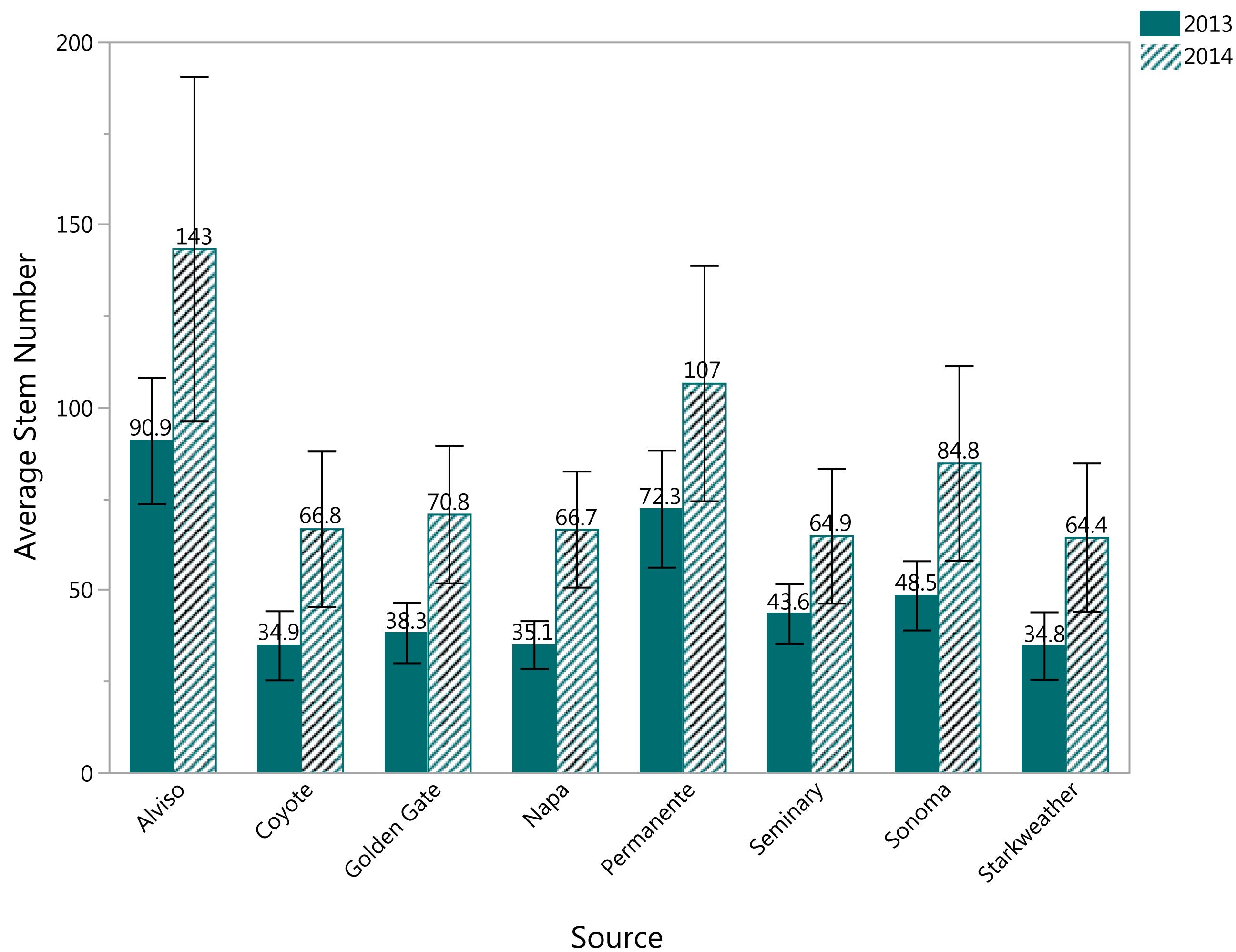

Figure 9. Average stem numbers for Year 2 S. foliosa plantings by source population. There were fewer statistically significant differences between source populations from 2014 monitoring. This could be a result of monitoring a subset of blocks.

2.3.6 Caging

In Year 2, the effectiveness of both rope caging and plastic mesh caging on planting success was tested at several sites. Monitoring after the first growing season indicated that plastic caging had an effect on survivorship across sites. However, monitoring after the second growing season indicated that the effect of plastic mesh caging had declined. Plants protected by plastic mesh had the highest Year 2 mortality with an over 10% decline. While plastic mesh caging still had a positive effect on continued plant survivorship (as compared to uncaged control blocks), caging may have less positive effect into the second growing season as it may act as a shade block or may promote algal growth.

During Year 2, the effect of rope caging on plant survivorship was tested at three sites. For each site, blocks of caged *S. foliosa* were paired with blocks of uncaged *S. foliosa.* **Figure 10** shows stem number differences at these three sites after two growing seasons: North Creek, Cargill, and Whales Tail South. Non-parametric Kruskal-Wallis tests indicated there was a continued positive effect of caging on survivorship after two growing seasons with all sites combined (p value = .034). No site by itself showed a statistically significant effect of caging on continued survivorship.

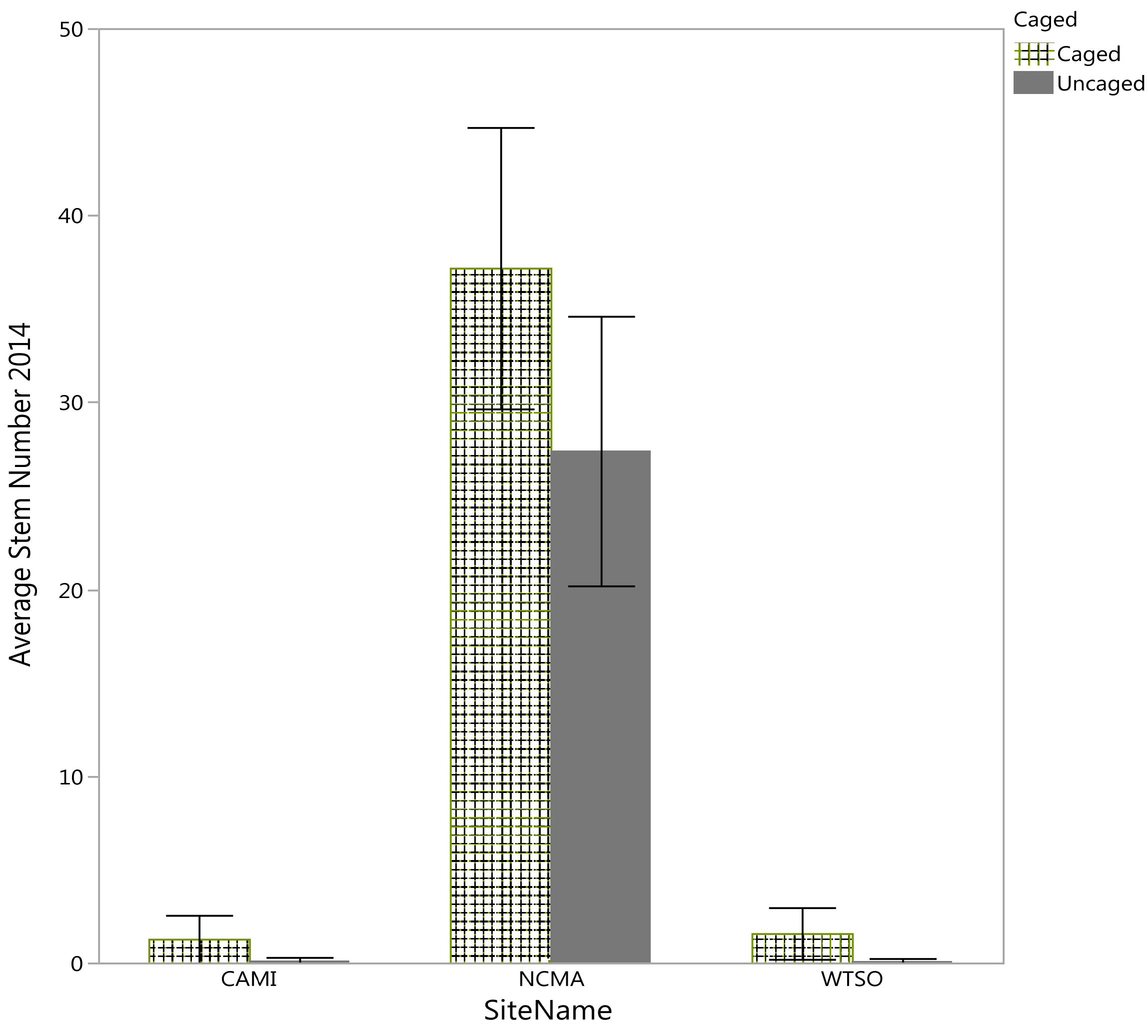

Figure 10. Differences in Year 2(2012-2013) S. foliosa stem number for planting blocks protected by rope caging and uncaged planting blocks in 2014. See Appendix 1 for a list of site names and corresponding abbreviations.

2.3.7 Other Treatments

Several weak trends were observed previously for Year 2 plantings after the first growing season including: 1) a trend that initial stem number influenced growth rate, and 2) an observed slight increase in plug number due to burlap protection. For more details on these planting designs, refer to Appendix 1 of the 2012-2013 Installation Report and 2013-2014 Revegetation Plan (Olofson Environmental, Inc. 2013). After two growing seasons, there was no discernible differences in growth rates based on initial stem number, nor was there a difference in survivorship for burlap protected versus non-burlap protected plots.

2.4 MONITORING RESULTS FOR YEAR 3 (2013-2014) PLANTINGS

The primary objectives of the initial monitoring in 2014 of Year 3 plantings were to assess survivorship of plantings, and assess the performance of new planting designs.

2.4.1 Planting Design

All Year 3 planting designs continued to use the plot-based approach outlined in Section 2.1.2. Key objectives of Year 3 plantings were: 1) continue to observe the influence of donor source population on plant growth and survivorship, 2) determine the extent that plant protection (caging) was necessary, 3) determine if trimming plantings promoted growth and survivorship of plugs, and 4) simplify planting designs in order to reduce planning and planting effort. In 2014, a minimum of four sources were planted at every site. Sites were planted using three different planting strategies. At sites with high survivorship, planting designs were simplified to reduce overall planning and implementation effort. At these sites, only half of all plantings were caged. To increase efficiency in planting and monitoring effort, single source population planting blocks were also tested. As stated above, after two growing seasons, plots grew together and it was impossible to track donor source populations in planting designs that contained multiple source populations. The single source population planting design will allow for the continued monitoring of source population differences over longer time periods. A second strategy was used at four new planting sites. At these sites, plantings were distributed in all observed suitable habitat types to increase the chance of survivorship. A higher proportion of plantings at these sites were caged due to unknown risk of herbivory. A third planting strategy was used at sites planted previously with low survivorship. At these sites, all suitable habitat types were also planted and included low marsh plain partly vegetated with perennial pickleweed, shorelines, and salt pannes. In addition, more labor intensive caging techniques (i.e., plastic mesh) were used at these sites. As in previous years, each planting design was planted at a minimum of two sites with all plots in all blocks randomized and planted in close proximity to each other (i.e., randomized block design).

2.4.2 Monitoring Method

A subset of Year 3 plantings at sites were monitored in the summer of 2014 with roughly 85 percent of plots monitored. **Table 5** shows the percentage of plots monitored at each site. For each monitored plot the following data was collected: the plot status (alive or dead), number of surviving plugs (out of 5), total number of live stems (culms), height (in centimeters) of the tallest stem in each plug, and the number of inflorescences produced.

2.4.3 Statistical Approach

Unless otherwise noted, data on the number of plugs surviving, flowers produced, and tillers counted were modeled with a zero-inflated Poisson distribution. Data on maximum and average culm heights as well as culm width were modeled assuming normal distribution of data. A generalized linear modeling approach was used for stem and plug survivorship and the model with the lowest AIC value was accepted. A binary logit regression modeling approach was used for plot survivorship and the model with the lowest AIC value was accepted. When significant differences were found in models, post-hoc comparisons were used to identify differences. All statistical analyses were conducted using JMP analytical software. An alpha level of 0.05 was considered significant. All graphs, unless otherwise noted, were constructed using 95% confidence intervals.

2.4.4 Overall Survivorship and Growth Rate

Aggregating all sites, the mean survivorship of plugs was 31.4%, which was lower than the first year survivorship for either Year 1 or Year 2 plantings. Two of our new sites, Triangle Marsh and Mt Eden Creek Marsh had the highest rates of survivorship with 56.7% and 59% respectively. North Creek Marsh was once again a strong performer with 51.7% of planted plugs surviving. Aggregating all sites, plot-level survivorship was 63.2%.

Table 5 Summarized results of monitoring Year 3 S. foliosa by site

Site Name	ISP Subarea Code	Date Monitored	Percent Monitored	Alive Plots (%)	Alive Plugs (%)	Mean Number of Stems per Plug
Alameda Flood Control Channel (AFCC)	01a, b & c	9/23/2014 and 12/8/2014	91	67.4	30.1	8.6
Cargill Mitigation (CARG)	13f	10/27/2014 and 11/5/2014	100	29.5	10.0	2.8
Cogswell A (COGA)	20m	11/5/2014	74	70	32.8	6.0
Mt Eden Creek "Demonstration" Marsh (DEMO)	13l & m	8/26/2014	99	93.2	59.0	21.6
Elsie Roemer (ELRO)	17a	11/4/2014	83	85.6	44.9	18.9
HARD Marsh (HARD)	20s	9/8/2014 and 9/19/2014	95	78.7	44.4	17.6
Mt Eden Creek (MTEC)	13j	7/22/2014	67	79.5	31.2	3.4
North Creek Marsh (NCMA)	13k	9/10/2014 and 9/24/2014	90	92.4	51.7	32.6
AFCC Pond 3 (PND3)	01f	9/23/2014	70	3.0	1.2	0.2
Triangle Marsh (TRMA)	20w	8/14/2014	91	92.8	56.6	24.1
Whale's Tail North (WTNO)	13d	10/30/2014	95	14.1	5.1	1.1
Whale's Tail South (WTSO)	13e	8/1/2014	94	32	11.2	1.3
Totals				63.2% (weighted)	31.4 (weighted)	11.9

Due to the fact that plots were monitored less optimally at several sites as described above in Section 2.1.4, plot-level survivorship may be a better predictor of overall survivorship. **Table 5** and **Figure 11** show overall plug survivorship for Year 3 plantings. Previous monitoring has showed that comparing the number of stems at installation with the number present after a growing season has been a good predictor of plot persistence. Figure 12 shows that HARD Marsh, Elsie Roemer, North Creek Marsh, and Triangle Marsh all increased in number of stems **(Figure 12).**

Two sites had unexpected survivorship results for 2014, Alameda Flood Control Channel and Elsie Roemer. Alameda Flood Channel, previously the highest performing site, had the lower survivorship this year. This may be because only half of the blocks at the site were caged or because the blocks were installed at slightly lower elevations than in previous years. In addition, this site was the first site where data was collected during monitoring and may not have yet reached peak growth. Data from a revisit to part of the site later during monitoring, indicated an increase in plug number and stem number. These data indicate that July may be too early to monitor for survivorship. Elsie Roemer, a previously poor performer had higher survivorship this year. However, during monitoring in November 2014, a large algal bloom was observed at this site and field observation noted plant mortality. A decline in Elsie Roemer survivorship may be observed due to algal blooms at this site during future monitoring.

To help inform future planting decisions, regression analysis was conducted to determine which factors that were manipulated or recorded had a significant effect on *S. foliosa* stem number (generalized linear regression). The resulting best fit model included site, habitat type, caging, presence of vegetation, and donor source population (Alviso Slough, Starkweather Marsh, and Coyote Creek). Factors that were not found to be informative for *S. foliosa* survivorship included substrate and initial stem height. As some treatments were only applied at a few sites, these were not included in the analysis (i.e., caging type, trimming, and the effect of absolute elevation).

2.4.5 Habitat Type

Planting blocks were installed in six different habitat types at twelve different sites in Year 3. Habitat type was highly correlated with site, with each site only having two to four of the habitat types. Habitat type was found to be a significant predictor of survivorship (Kruskal-Wallis $p<0.001$). Two habitat types (channels over six meters and shoreline habitats) had significantly lower survivorship than the other three defined habitat types. **Figure 13** shows plug survivorship by habitat type. Percent cover of other vegetation present in planting blocks and species type was also monitored. **Figure 14** shows the effect on plug stem number of other vegetation present in plots of different vegetation cover classes. As the amount of other vegetation increased in plots, the number of stems decreased. The type of vegetation did not have an influence, however, this may be due to the low sample size for plots that were planted with species other than perennial pickleweed.

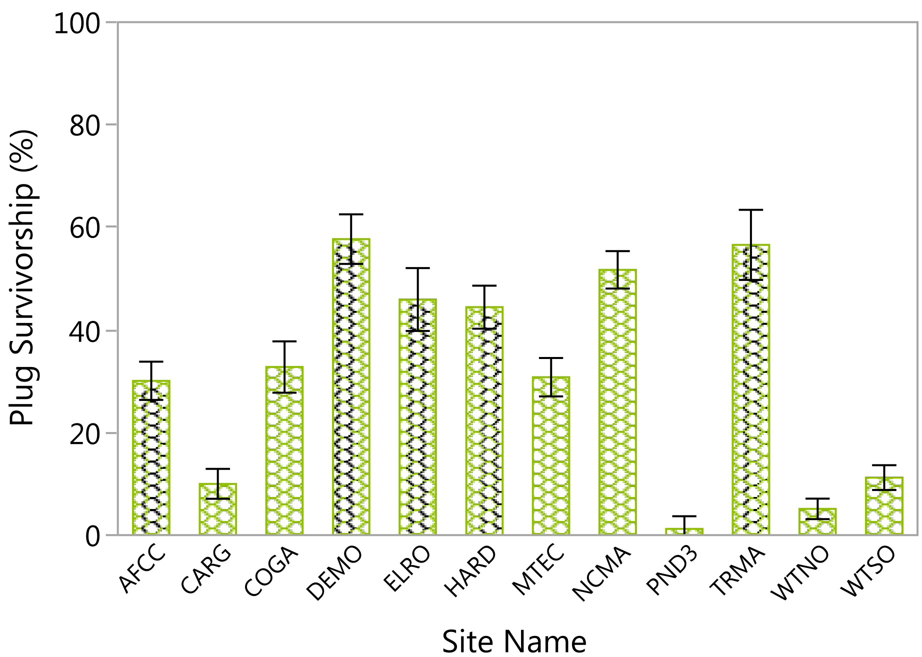

Figure 11. Plug survivorship of Year 3 (2013-2014) S. foliosa by site in 2014. Site was a predictor of plug survivorship (Kruskal Wallace p<.001). See Appendix 1 for a list of site names and corresponding abbreviations.

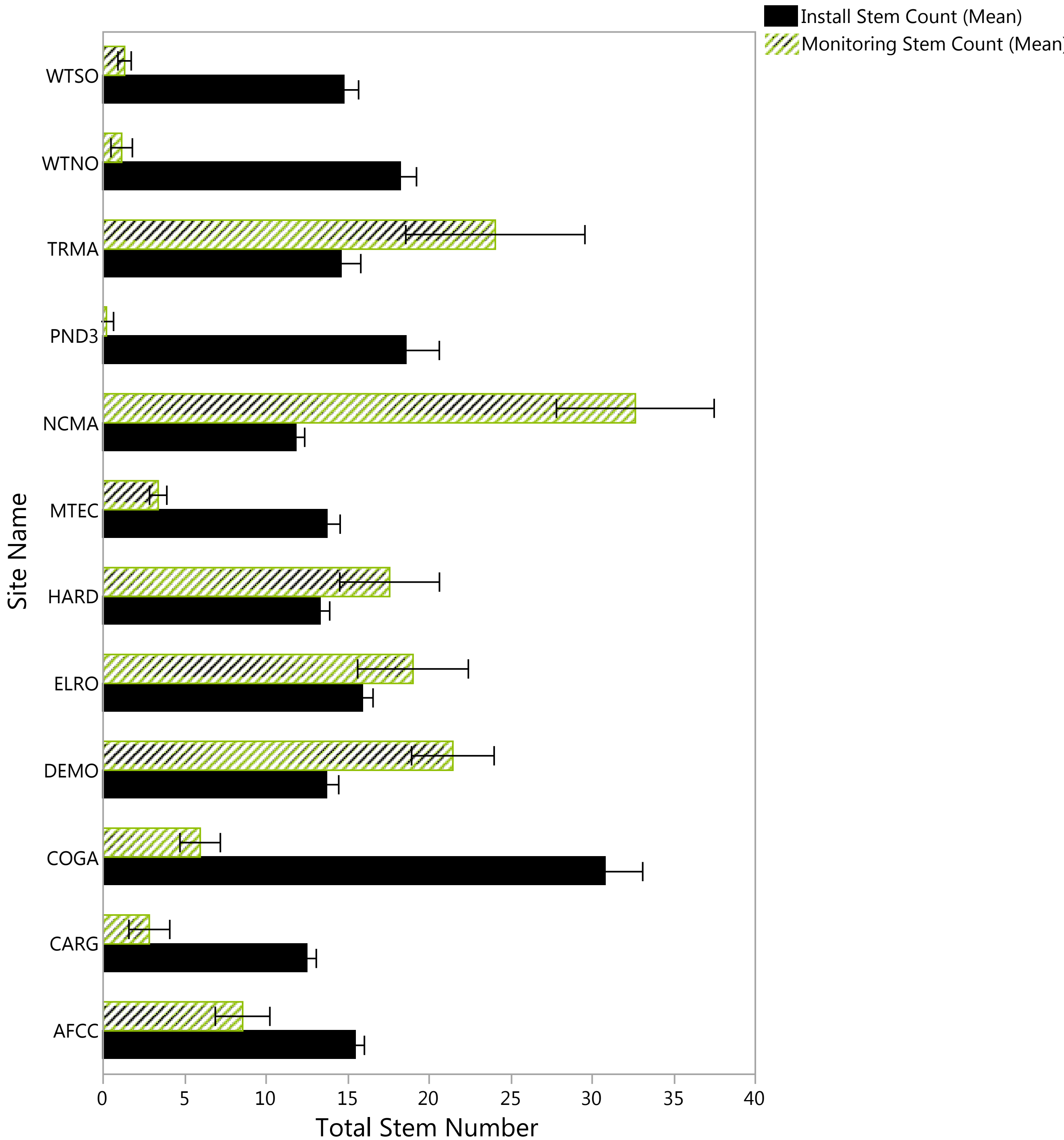

Figure 12. Year 3 (2013-2014) S. foliosa growth of stems by site in 2014. This growth rate was measured at plots with living plant material. North Creek Marsh, HARD, Triangle, and Mt Eden Creek Marsh all showed statistically significant increases in stem number. (Mann-Whitney U, p<.001). See Appendix 1 for a list of site names and corresponding abbreviations.

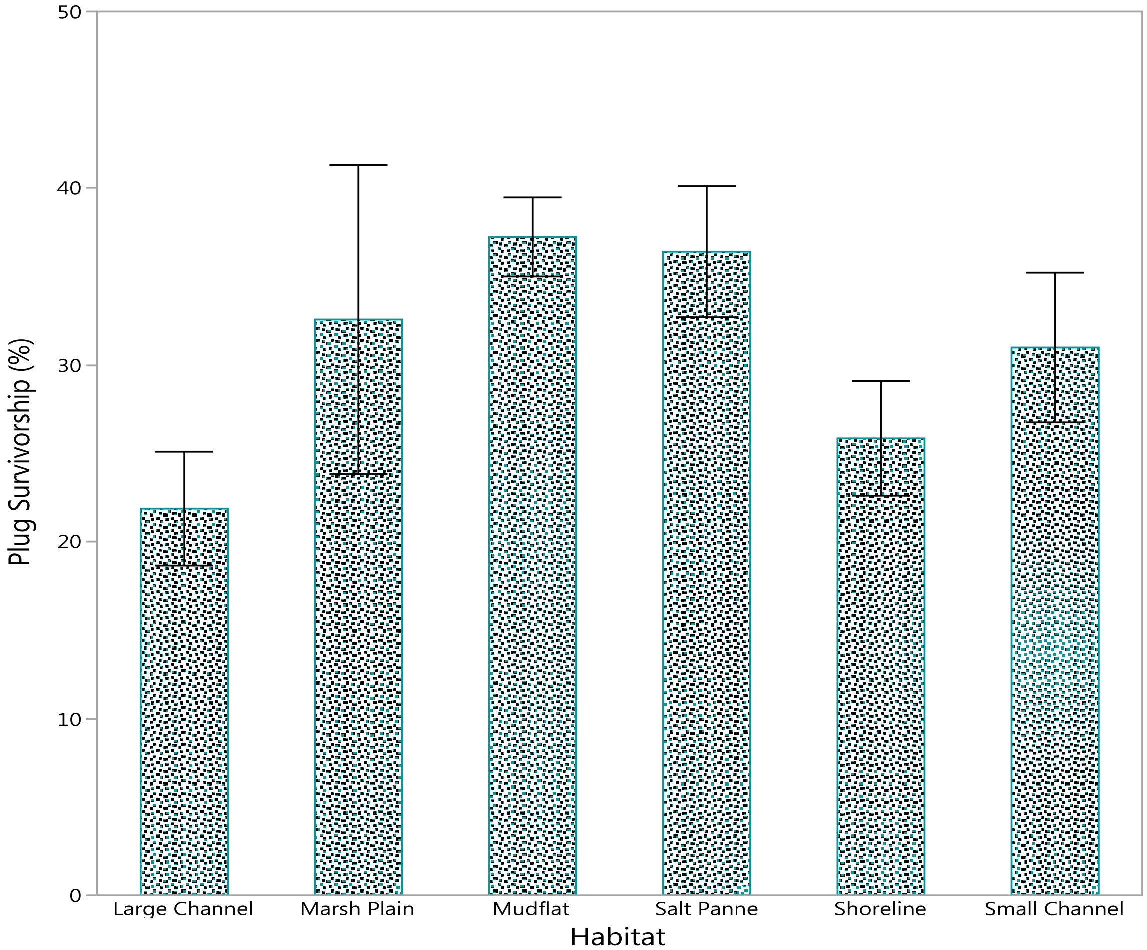

Figure 13. Year 3 (2013-2014) S. foliosa survivorship by habitat type in 2014. Lower survivorship on large channels occurred primarily at AFCC. This site previously had the highest survivorship. Marsh plain plantings had the highest variability in survivorship of all habitat types.

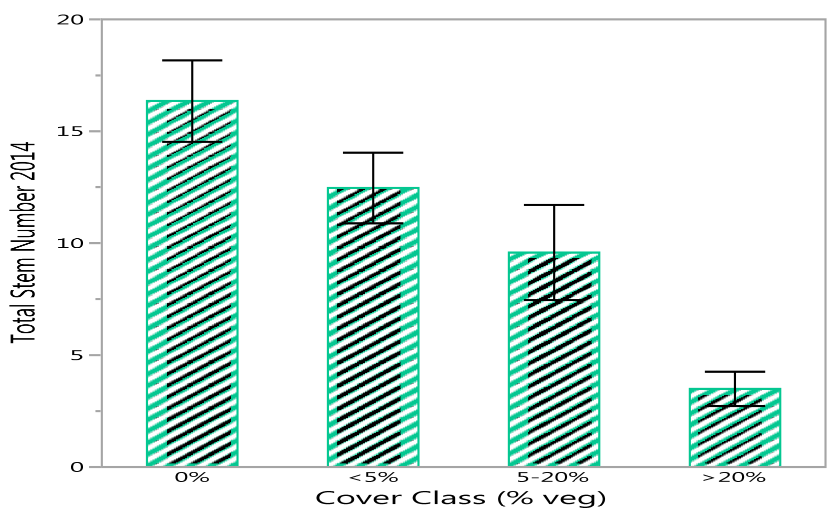

Figure 14. Effect of cover classes of vegetation on stem number of Year 3 (2013-2014) S. foliosa in 2014. Plots with over 20% vegetation are significantly different from plots with 0% vegetation.

2.4.6 Donor Source Population

For Year 3 plantings, *S. foliosa* source population material from eight donor populations was outplanted, and a maximum number of four sources were outplanted at a given site. Source population material was collected from geographically distinct areas within the estuary with three of the donor source populations from the far South Bay (Alviso Slough, Coyote Creek, and Permanente Creek), three from isolated pocket marshes in the Central Bay (Seminary Marsh, Starkweather Marsh, and Golden Gate Fields), and two from the far North Bay (Port Sonoma Marina and Napa River). Differences in survivorship for source populations were compared separately for high performing sites (those with survivorship greater than 40%) and lower performing sites (less than 40% separately). **Figure 15** shows plug survivorship by source population at high performing sites.

2.4.7 Caging

Rope caging to protect *S. foliosa* plugs was found previously to have a significant positive effect on survivorship. For Year 2 plantings, as caging had been found to have a positive effect on survivorship, several sites where herbivory was expected to occur were completely caged. As a result, the effect of caging could only be tested at a subset of sites during Year 2 (i.e., where both caged and uncaged plots could be compared). For Year 3 plantings, almost all sites had caged and uncaged plots and the effect

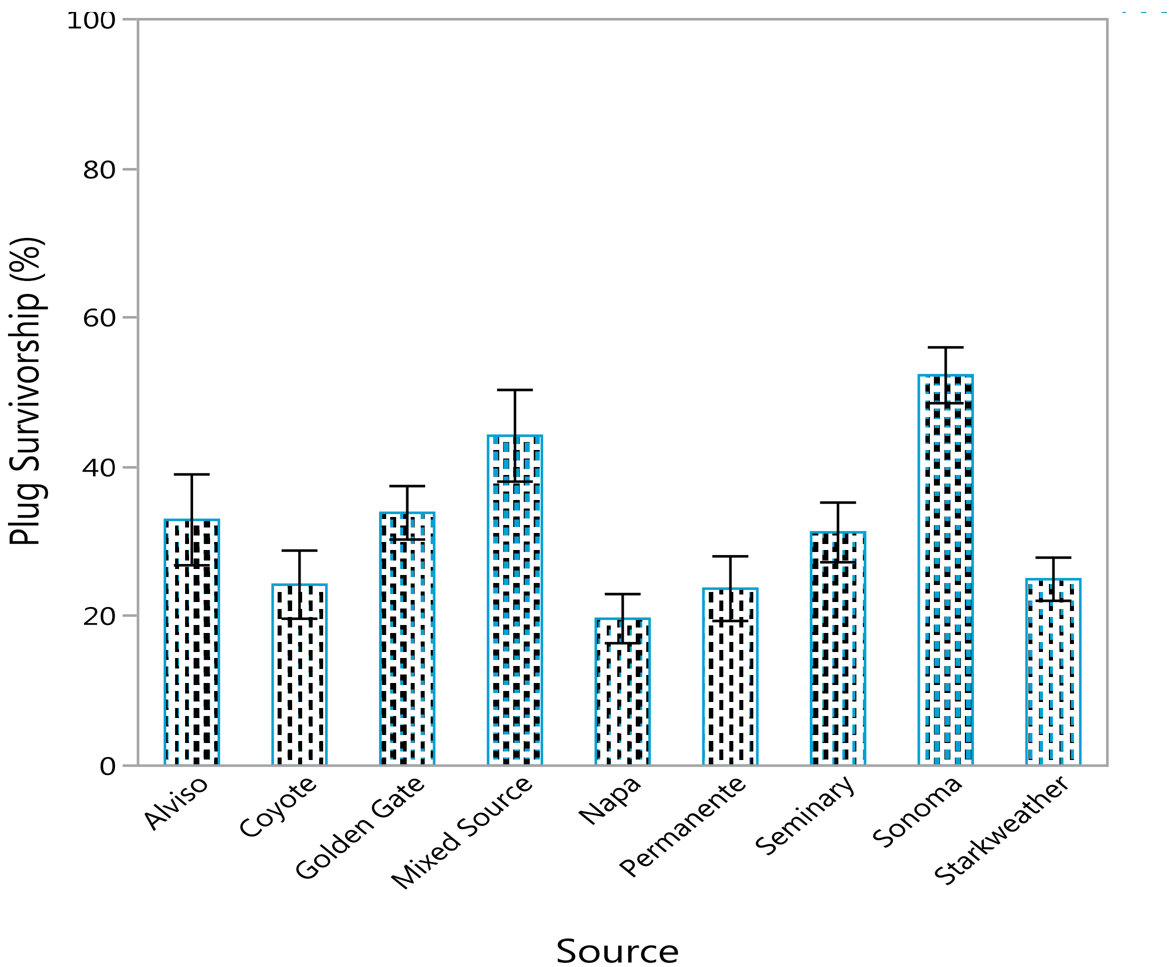

Figure 15. Year 3 (2013-2014) S. foliosa survivorship by donor source at high performing sites in 2014. Sonoma had the highest survivorship in Year 3 plantings. However, this may have been driven by performance at Mt Eden Creek Marsh. Each error bar was constructed using a 95% confidence interval of the mean.

of rope caging or plastic mesh caging on planting success was compared. Site-specific effects of caging as well as an interaction between caging and the relative ground cover that plots were installed into were detected. Blocks installed on open, non-vegetated mudflats had significantly higher survivorship when caged. Conversely, plots that were caged in vegetated areas had less of an effect on survivorship, and planting in highly vegetated areas resulted in lower overall survivorship. **Figure 16** shows the effect of caging on survivorship by percent cover of vegetation present in plots and **Figure 17** shows the effect of caging on survivorship by site. The two sites (Mt Eden Creek Marsh and Triangle Marsh) where all blocks were caged had the highest survivorship and were not included in this analysis. Nonparametric Mann-Whitney U tests found caging had a strong influence on survivorship at Elsie Roemer and HARD Marsh ($p < .001$). The non-parametric Kruskal-Wallace test was run to look at the interaction between caging and habitat type. A post-hoc Mann-Whitney U test detected a significant relationship between caging and presence of other vegetation in planting blocks (no vegetation present) ($p < .001$).

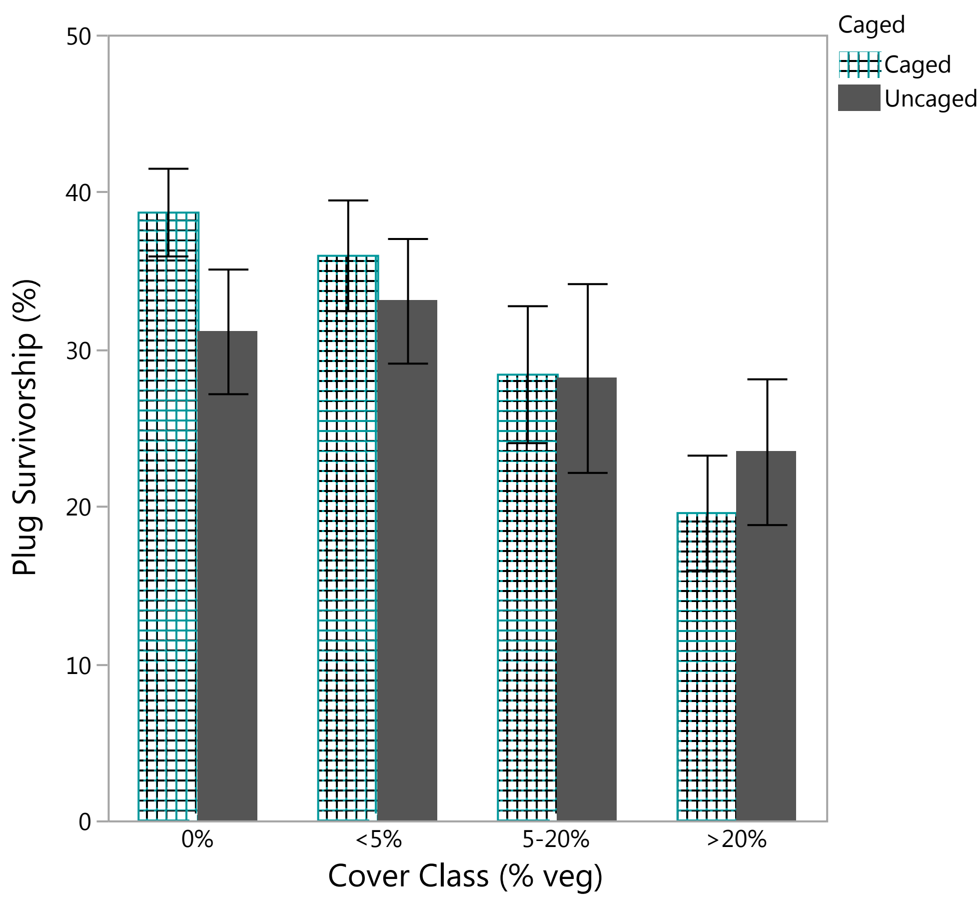

Figure 16. Effect of caging on Year 3 (2013-2014) S. foliosa survivorship by percent cover of vegetation within the planting plot in 2014. The interaction between caging and the amount of existing vegetation was found to be a significant predictor of plug survivorship.

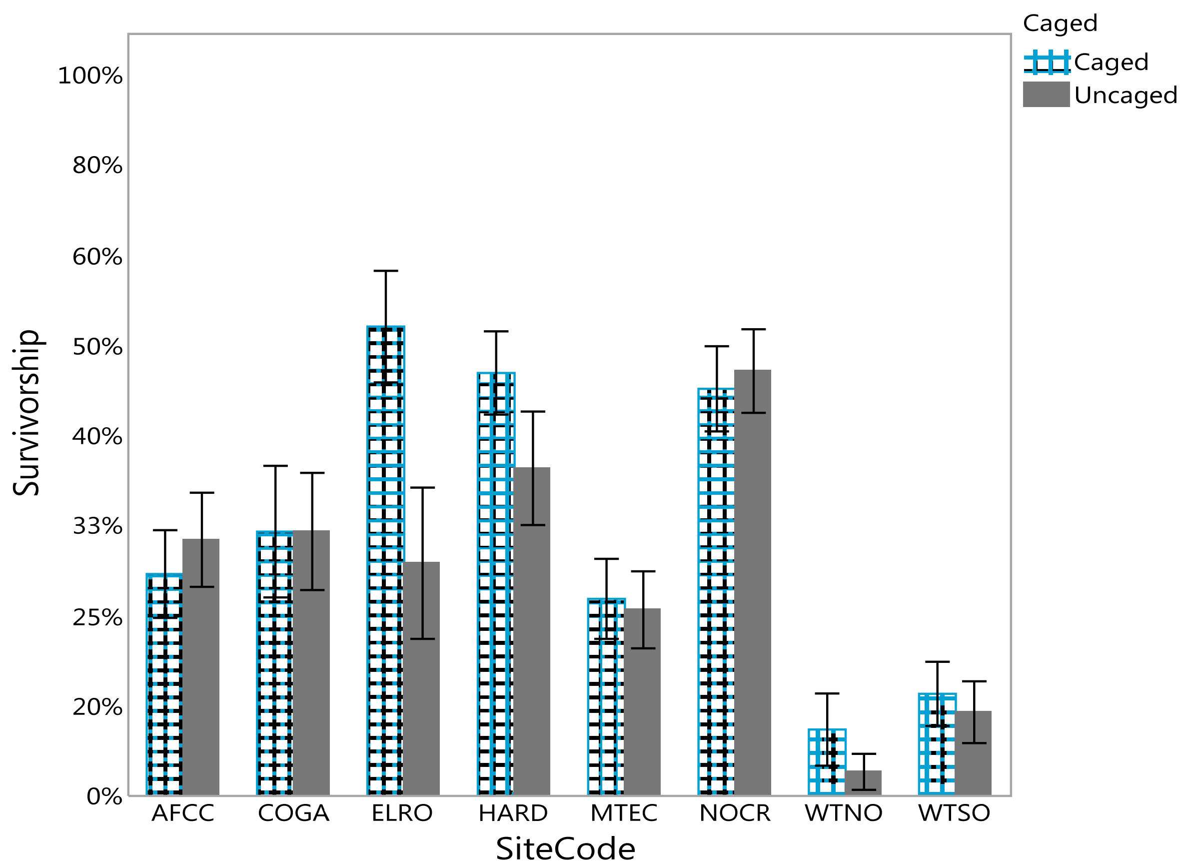

Figure 17. Effect of caging on Year 3 (2013-2014) S. foliosa survivorship by site. Caging was found to be a significant predictor of survivorship at HARD, Whale's Tail North, and Elsie Roemer. Each error bar was constructed using a 95% confidence interval of the mean. See Appendix 1 for a list of site names and corresponding abbreviations.

2.4.8 Trimming

In Year 3, plant leaves were trimmed at the time of plug installation in several habitat types at four sites as an additional method to minimize herbivory and reduce transplant shock (i.e., half of the plots were trimmed). Trimming was tested based on two ideas: 1) herbivory could be minimized by reducing the amount of visible green on newly planted plugs, and 2) transplant shock could be reduced by redirecting resources to the roots from the leaves. Trimming was not found to have an effect on survivorship, even when interactions of site, source, and caging were modeled. **Figure 18** shows this result demonstrated by site.

2.4.9 Direct Transplants

Previously for Year 1 plantings, cordgrass plugs were collected from two donor source populations (Golden Gate Fields and Port Sonoma Marina) and directly planted at revegetation sites and caged. Survivorship for these direct transplants was compared with plugs from the same source populations that were planted into nursery beds and cultivated for five to seven months before outplanting. After one growing season, monitoring results showed that the nursery-propagated plants had higher overall survivorship than the directly transplanted plugs from either source population. In Year 3, a small number of direct transplants along with nursery-propagated plugs were installed at one site and during 2014 monitoring, after one growing season, the opposite trend was found with the direct transplants

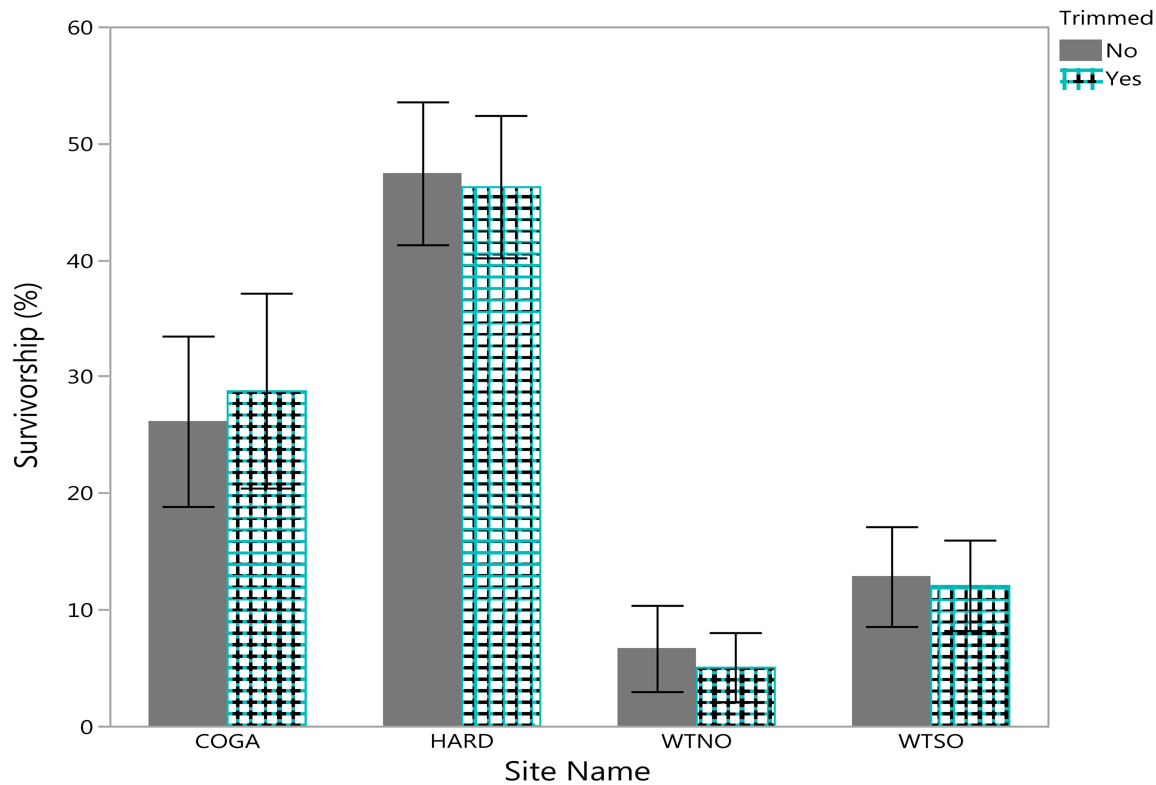

Figure 18. Effect of trimming on Year 3 (2013-2014) S. foliosa survivorship by site in 2014. See Appendix 1 for a list of sites names and corresponding abbreviations.

surviving better than the nursery-propagated plugs (n=5 replicates, **Figure 19**). As there were different results for different planting years for direct transplant as compared to nursery-propagated plug survivorship, this will continue to be tested if possible.

2.5 SUMMARY

A summary of results from 2014 monitoring is listed below by planting year:

1) All Years:

   a) Site and planting location or habitat type within a site continue to be the most important predictors of cordgrass planting success. Cordgrass planted on uniform, wide mudflats continues to have the highest survivorship for all years. For Year 3 plantings, salt pan habitat, a new habitat type, also had better survivorship than other habitat types, and marsh plain habitat had the highest variability in survivorship. Bayfront or shoreline habitat had higher survivorship than other habitat types at two low performing sites: Whales Tail North and Whale’s Tail South.

   b) Growth and expansion of plantings, both laterally and in elevation, has been observed during all three years of monitoring. For Year 1 plantings, after three growing seasons, not only have individual plugs grown together but the plots in planting blocks have grown together making the basic planting unit of the plot (i.e., five plugs from the same source population) no longer distinguishable. To account for the expansion of plantings, a new method of monitoring at the planting block level was developed for 2014. For Year 2 plantings, after two growing seasons, individual plugs have grown together and monitoring of survivorship was conducted at both the

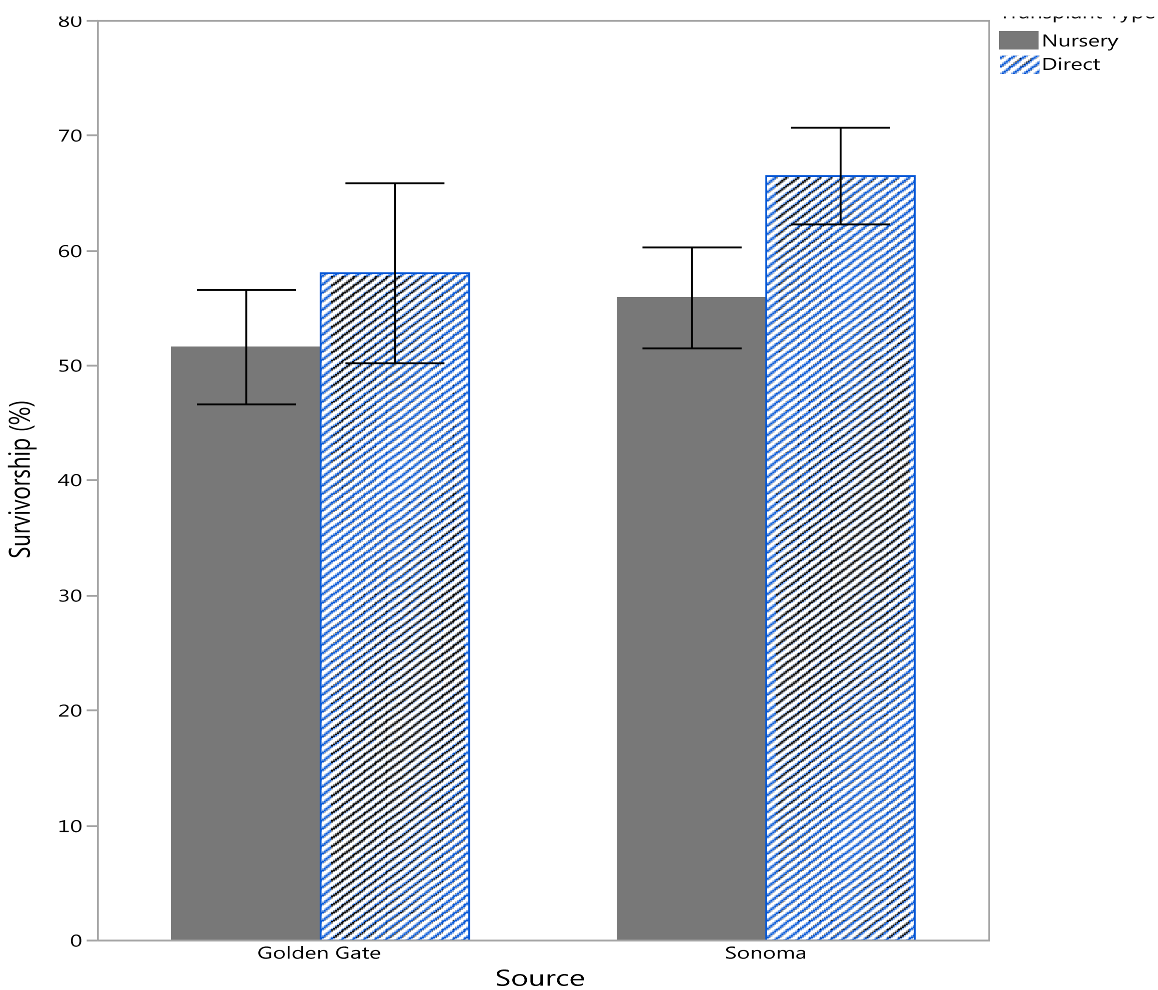

Figure 19. Difference in survivorship by source type (nursery or direct transplant) at Mt Eden Creek Marsh. Each error bar is constructed using a 95% confidence interval of the mean. Direct transplants from Port Sonoma Marina were found to be significantly different from Golden Gate.

individual plug level and at the plot-level. Monitoring results show that a substantial amount of native cordgrass has been established at sites and that those plots continue to expand laterally each year.

c) Caging continues to improve survivorship at most marshes. Year 1 planting blocks that were protected using rope cages at North Creek Marsh contained more *S. foliosa* (measured as net area) during 2014 monitoring, after three growing seasons, than uncaged blocks. In addition, Year 2 caged plots (rope caging) also survived better than uncaged plots after two growing seasons. For Year 3 plantings, caging was found to be less important when plantings were installed in blocks that contained other marsh vegetation. Plastic mesh caging was beneficial at sites with high potential for erosion or wave action, but appears to have decreased benefit after one growing season possibly due to shading of the plants.

d) Donor source population was found to be a strong driver of both survivorship and growth rate (based on stem counts). As donor sources were found to perform differently, multiple donor sources will continue to be used at each site and a minimum of three donor sources will be used when evaluating treatments. Source population makes a difference in survivorship.

e) Newly colonizing native Spartina was observed in areas not planted by ISP at two sites, Alameda Flood Control Channel and North Creek Marsh in 2014. These sites do not have local sources for *S. foliosa* indicating that, as planned, ISP plantings are producing viable propagules that will help to populate other areas of these marshes.

2) Year 1 (2011-2012) Plantings: After three growing seasons, the total area of surviving planted *S. foliosa* was over 1,300 meters squared. Net cover of *S. foliosa* (calculated as area of cordgrass multiplied by ocular cover) was roughly 350 meters squared.

3) Year 2 (2012-2013) Plantings:

   a) Mean survivorship of plugs from Year 2 plantings monitored in 2014 was 30.4% which was a slight decline from the previous year's survivorship of 35.7%. Aggregating all sites, mean survivorship of Year 2 plantings at the plot level in 2014 was 57.1%, a decline from 66% persistence in 2013.

   b) Rapid lateral expansion of Year 2 plantings was observed during fall 2014 monitoring. For the subset of plots monitored in 2014, the total stem number increased from approximately 27,000 stems counted during installation to 74,000 stems, a nearly threefold increase. Note that this stem total underestimates the total number of stems present as only a subset of plots were monitored in 2014 due to time constraints.

4) Year 3 (2013-14) Plantings:

   a) Mean survivorship of plugs from Year 3 plantings monitored in 2014 was 31.4%, which was lower than the first year survivorship for either Year 1 or Year 2 plantings. Aggregating all sites, plot-level survivorship was 63.2%.

   b) Survivorship of donor source populations continued to be variable. At high performing sites (sites with greater than 40% overall survivorship), all source populations had at least 20% survivorship with Port Sonoma surviving the best.

   c) The planting method of trimming did not have an effect on outplanting success and this method is not recommended for use in the future.

3.0 *GRINDELIA STRICTA*

3.1 OVERVIEW

In the fall of 2014, monitoring was conducted on *Grindelia stricta* plantings from Year 1 (those installed in the winter of 2011-2012), Year 2 (installed 2012-2013) and Year 3 (installed 2013-2014). For each installation year, overall *G. stricta* survivorship or number of plants per plot was monitored. Overall survivorship is presented both by year and by site. Additionally, we had several treatments designed to improve *G. stricta* survivorship and maximize the growth of plantings to rapidly enhance habitat that can be used by Ridgway's rail. The results of monitoring these treatments will be used to inform adaptive management strategies going forward.

3.1.1 Data Collection and Analysis

ISP staff members mapped and monitored planting patches using handheld mapping grade GPS units (Trimble Yuma 2). Data were collected in customized forms in ArcPad. Quality control was performed in ArcGIS 9.3. All analyses were conducted using R and graphs were made using R with the ggplot2 package (R Core Team 2013). All error bars in graphs represent 95% confidence intervals.

3.2 MONITORING RESULTS FOR YEAR 1 (2011-2012) PLANTINGS

3.2.1 Planting Design

The Year 1 planting design for *G. stricta* patches included ten plants in two rows, each row containing five plants. Along each row plants were planted 1.0 meter apart from one another and the two rows were 0.25 meters apart from one another. Plants were planted into two zones: the marsh plain, where plantings were along the edges of channels to provide roosting, nesting and high tide refuge habitat for Ridgway's rail, and on mounds or berms that are areas of higher ground that are less frequently inundated that could provide refuge for Ridgway's rail during both normal high tide and extreme high tide events. For marsh plain planting patches, the row of plants that was closer to the channel was referred to as the inner row and for patches installed on higher elevation mounds and berms the row of plants that was lower in elevation was referred to as the inner row. During Year 1, the inner row of all marsh plain patches was 0.25 – 0.5 meters from the channel edge and the outer row was planted 0.25 meters further from the inner row. For patches installed on mounds and berms, the inner row was at a lower elevation and the outer row was the row at a higher elevation. ISP staff selected the patch location by choosing an appropriate elevation for the lower, inner row that was planted with *G. stricta*, based on their knowledge of *G. stricta* planting requirements. The outer, higher row was placed 0.5 meters from the inner row. Three pot sizes were planted in Year 1: "stubby" pots that contain 7 cubic inches of soil, Deepot 16 (D16) pots that contain 16 cubic inches, and gallon pots that contain 180 cubic inches.

3.2.2 Monitoring Method

In the fall of 2014 during monitoring, ISP staff observed that Year 1 patches, with three growing seasons and associated seed production, were now difficult to assess for survivorship. Staff found it difficult to determine whether an individual *G. stricta* plant was installed during Year 1 or if it was a new recruit that had established from seed. As a result, the monitoring method for 2014 changed from counting survivorship of the installed plants to counting the total number of *G. stricta* plants within each plot. This also allowed the program to take credit for some of the plants that have recruited from seed produced by previously installed plants. In addition, at each plot, the height and width of every *G. stricta* plant was measured at the highest or widest point of each plant using a meter stick. Height and width were both recorded in binned increments. Bins were in increments of 5 centimeters when height or width was under 10 cm and in increments of 10 centimeters when heights were over 10 cm (e.g., <5 cm, 5-10 cm, 11-20 cm, 21-30 cm). From these measurements, volume of each plant was calculated based on each plant having a roughly cylindrical shape. Volumes were examined as both total volume per plot and volume per plant per plot. For the volume comparisons, all plots that had zero survivorship were eliminated from analysis. When making pot size comparisons, data was simplified by classifying plots into either plots that contained gallons or plots that did not contain gallons. Data from four sites where substantial numbers of gallons were planted during the first year were examined for pot size comparisons.

3.2.3 Monitoring Results: Number of Plants, Total Volume Per Plot, and Volume Per Plant

Overall, the mean number of *G. stricta* plants per plot was 2.4, the mean total volume of plots was 0.45 m^3, and the mean volume per plant was 0.09 m^3. Non-parametric Kruskal-Wallis tests were used to examine differences among treatments. The mean number of plants per plot varied significantly by site ($p<0.0001$) (**Figure 20** and **Table 6**), between a high of 5.1 at Oro Loma East and Oro Loma West to a low of 0.4 at Bair B2 North West. Per plant volume varied significantly among sites ($p<0.0001$) (**Figure 21** and **Table 6**) and total volume varied significantly among sites ($p<0.0001$) (**Figure 22** and **Table 6**).

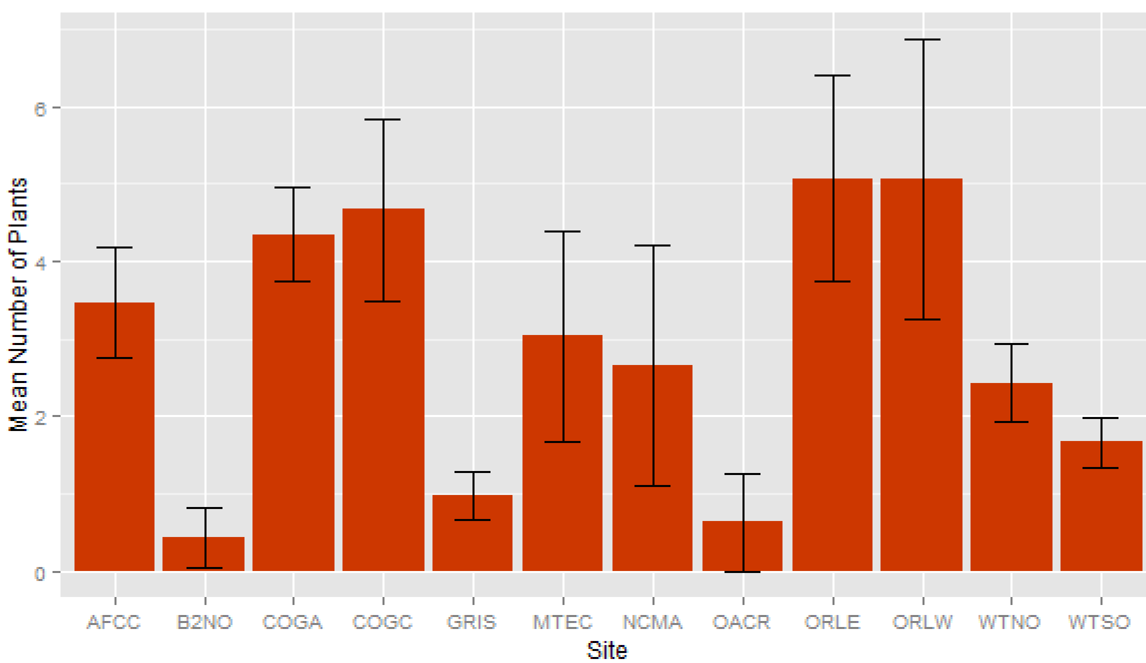

Figure 20. Year 1 mean number of G. stricta plants per plot by site. See Appendix 1 for a list of sites names and corresponding abbreviations.

Table 6 Mean number of plants per plot, mean volume per plot, and mean volume per plant of Year 1 G. stricta monitored

Site	ISP Subarea Code	Number of Plants Per Plot	Volume Per Plot (m^3)	Volume Per Plant (m^3)	N
AFCC	01a, b & c	3.5	0.37	0.08	34
Bair B2 North West (B2NO)	02c.1	0.4	0.14	0.05	46
Cogswell A (COGA)	20m	4.3	0.72	0.12	119
Cogswell C (COGC)	20o	4.7	0.75	0.12	45
Greco Island (GRIS)	02f	1.0	0.18	0.04	155
Mt. Eden Creek (MTEC)	13j	3.0	0.42	0.06	28
North Creek Marsh (NCMA)	13k	2.7	0.69	0.08	32
Old Alameda Creek (OACR)	13b	0.6	0.12	0.03	30
Oro Loma East (ORLE)	07a	5.1	1.35	0.26	14
Oro Loma West (ORLW)	07b	5.1	0.89	0.12	19
Whale's Tail North (WTNO)	13d	2.5	0.19	0.05	85
Whale's Tail South (WTSO)	13e	1.6	0.19	0.06	149
Overall		2.4	0.45	0.09	427

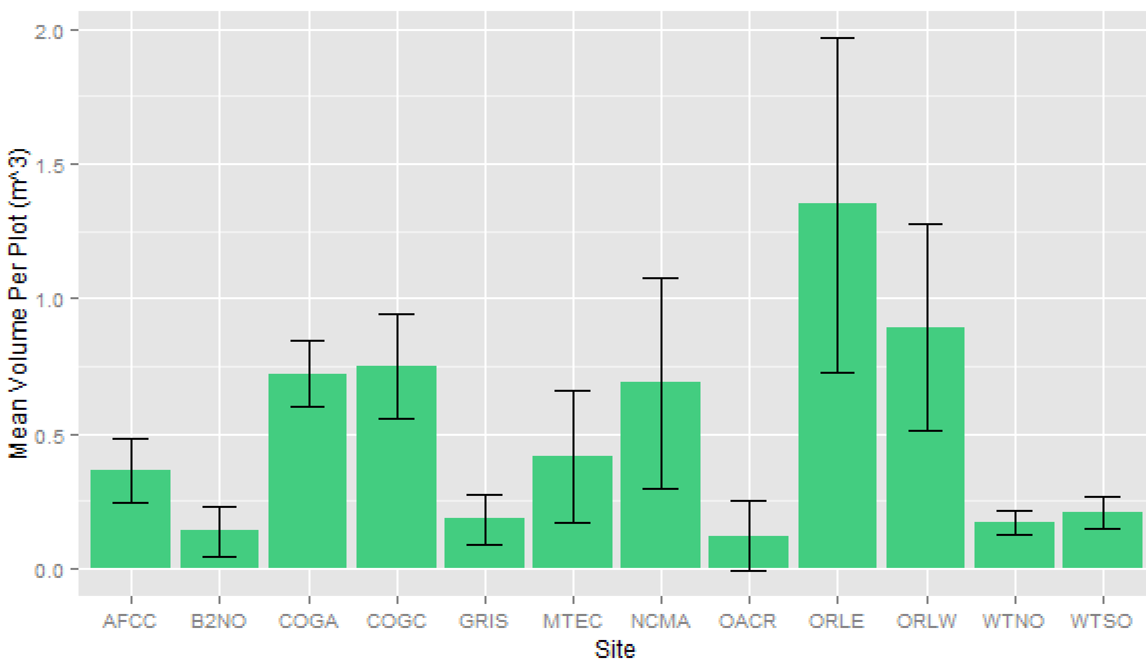

Figure 21. Year 1 G. stricta mean volume per plot by site.

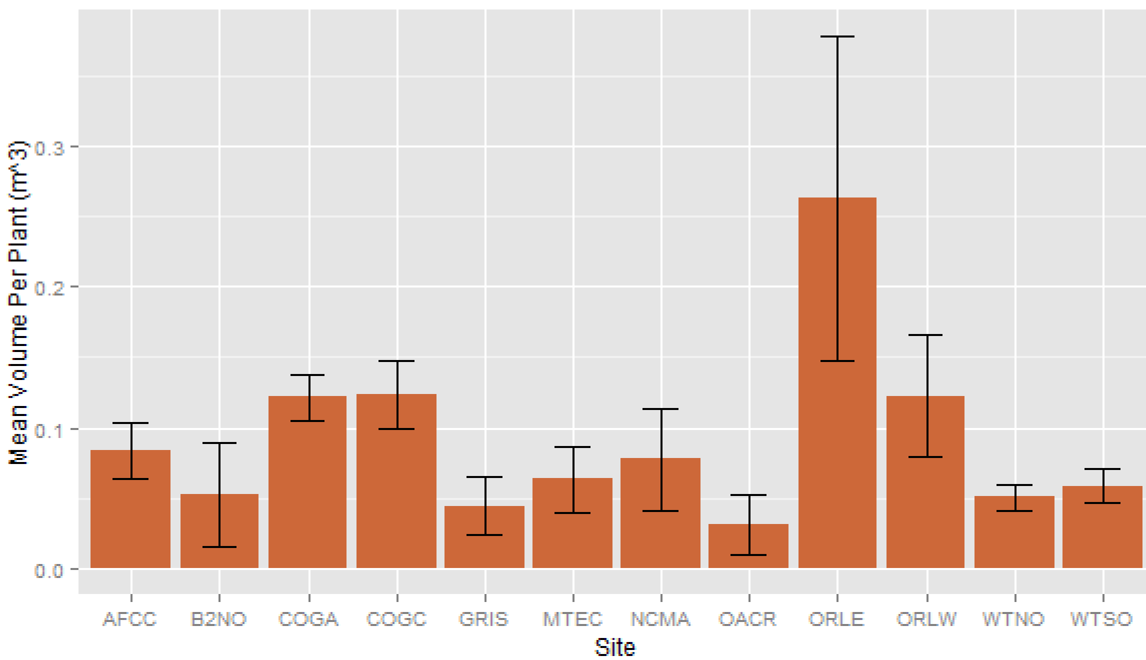

Figure 22. Year 1 mean volume per G. stricta plant per plot by site.

3.2.4 Effect of Pot Size

Pot size had a significant effect on survivorship of Year 1 *G. stricta* during the first year of monitoring. However, looking at the patches that have survived three growing seasons, pot size does not appear to have an effect. When conducting a two way ANOVA with site and pot size as factors, there was no statistically significant effect of pot size on number of plants per plot (p=0.297) (**Figure 23**), per plant volume per plot (p=0.66) (**Figure 24**), or total plant volume per plot (p=0.956). When comparing the effect of pot size for each site individually, there was no significant effect of pot size on number of plants or volume found in any site.

3.3 MONITORING RESULTS FOR YEAR 2 (2012-2013) PLANTINGS

3.3.1 Planting Design

The planting design for Year 2 was very similar to the Year 1 design described above with *G. stricta* planted in patches of ten plants. The main difference for marsh plain patches was to allow the distance from the channel edge where the inner row plants were installed to increase from 0.25 meters to 0.5 meters or more based on local site conditions. Observations from monitoring had noted that the inner row of plants installed in the previous year were eroding at some sites. The majority of *G. stricta* planted during Year 2 were salt hardened. However, to test the efficacy of salt hardening in improving survivorship, at sections of Bunker Marsh, North Marsh, Greco Marsh, and Cogswell B, non-salt hardened plants were planted in the marsh plain. In these sections, pairs of salt-hardened and non-salt hardened plots were planted in an alternating pattern to make certain that they were evenly distributed spatially. Caging was tested as a means of deterring herbivory for some of the berm plantings which were installed during Year 2. Caging was found to have little effect on survivorship during the 2013 monitoring season and cages were all removed during 2013.Two pot sizes were planted in Year 2: Deepot 40 (D40) pots that contain 40 cubic inches of soil and gallon pots that contain 180 cubic inches. Most patches included 10 D40 pots. Patches that included gallon pots had five D40 pots in one

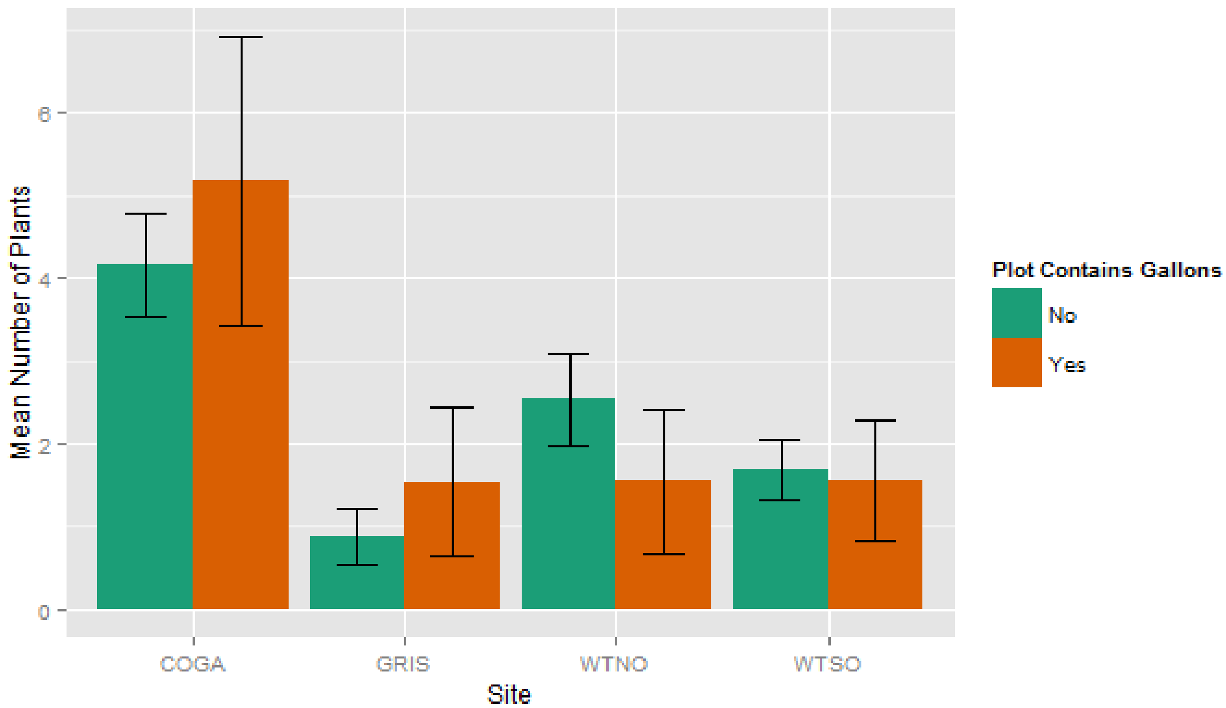

Figure 23. Year 1 mean number of G. stricta plants per plot by pot size and by site. Error bars represent 95% confidence intervals. See Appendix 1 for a list of site names and corresponding abbreviations.

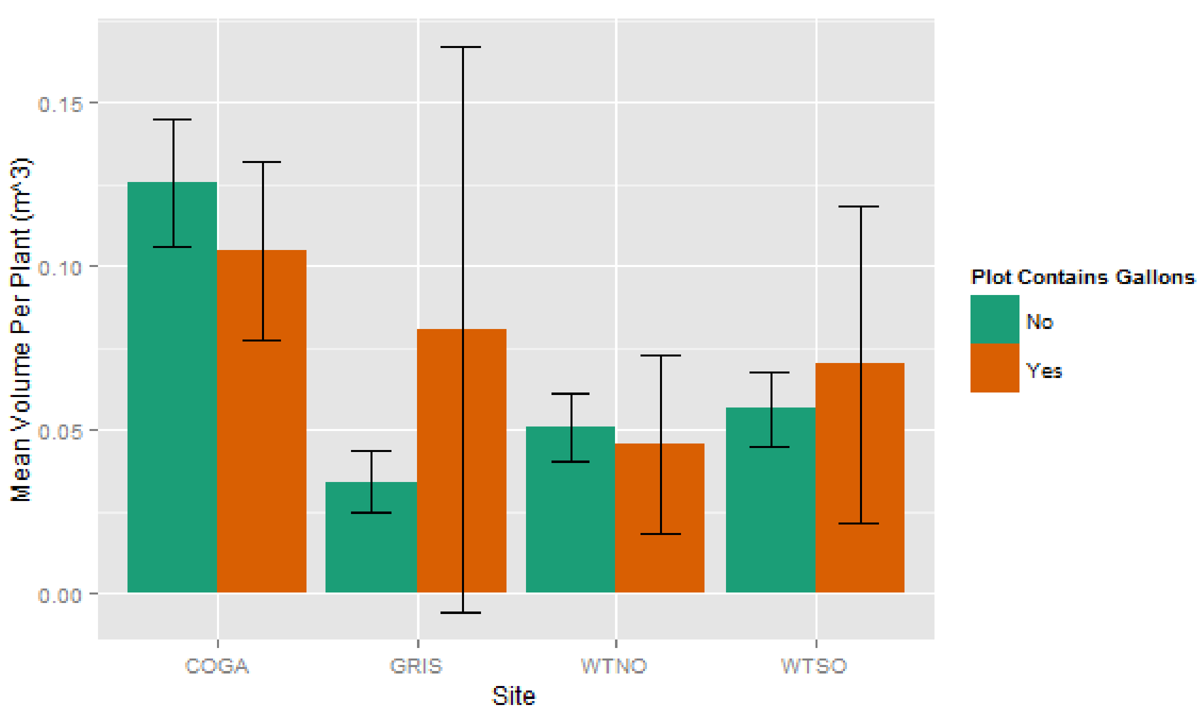

Figure 24. Year 1 mean volume per G. stricta plant per plot by pot size and by site. Error bars represent 95% confidence intervals. See Appendix 1 for a list of site names and corresponding abbreviations.

row and five gallon pots in the other row. In order to control for any effect of row placement on survivorship, the gallon row and the D40 row switched from inner to outer in adjacent patches.

3.3.2 Monitoring Method

Year 2 patches were initially monitored by simply counting the number of plants surviving within each plot. During the second year of monitoring in 2014, it was no longer possible to tell which row any individual plant had been planted in, so plants from both the inner and outer rows were lumped together. The 2014 survivorship monitoring data was compared to the 2013 survivorship monitoring data (Olofson Environmental, Inc. 2013).

3.3.3 Monitoring Results

Overall mean survivorship of Year 2 plantings during the 2014 monitoring season was 45.1%. Although this represented a decline of 9.5% from the previous year's 54.6% survivorship, survivorship was still higher than the target survivorship of 40%. Based on the result of a Kruskal-Wallis test, site had a significant effect on change in survivorship ($p<0.0001$). Survivorship by site is presented in **Table 7** and **Figure 25**. At Damon Marsh, an apparent increase in survivorship from 2013 monitoring to 2014 monitoring was observed. This was likely due to the recruitment of seedlings between 2013 and 2014 that were counted during the 2014 monitoring. These seedlings may have recruited from seeds produced by the previous year's plantings or from existing *G. stricta* that was present in other areas of this site.

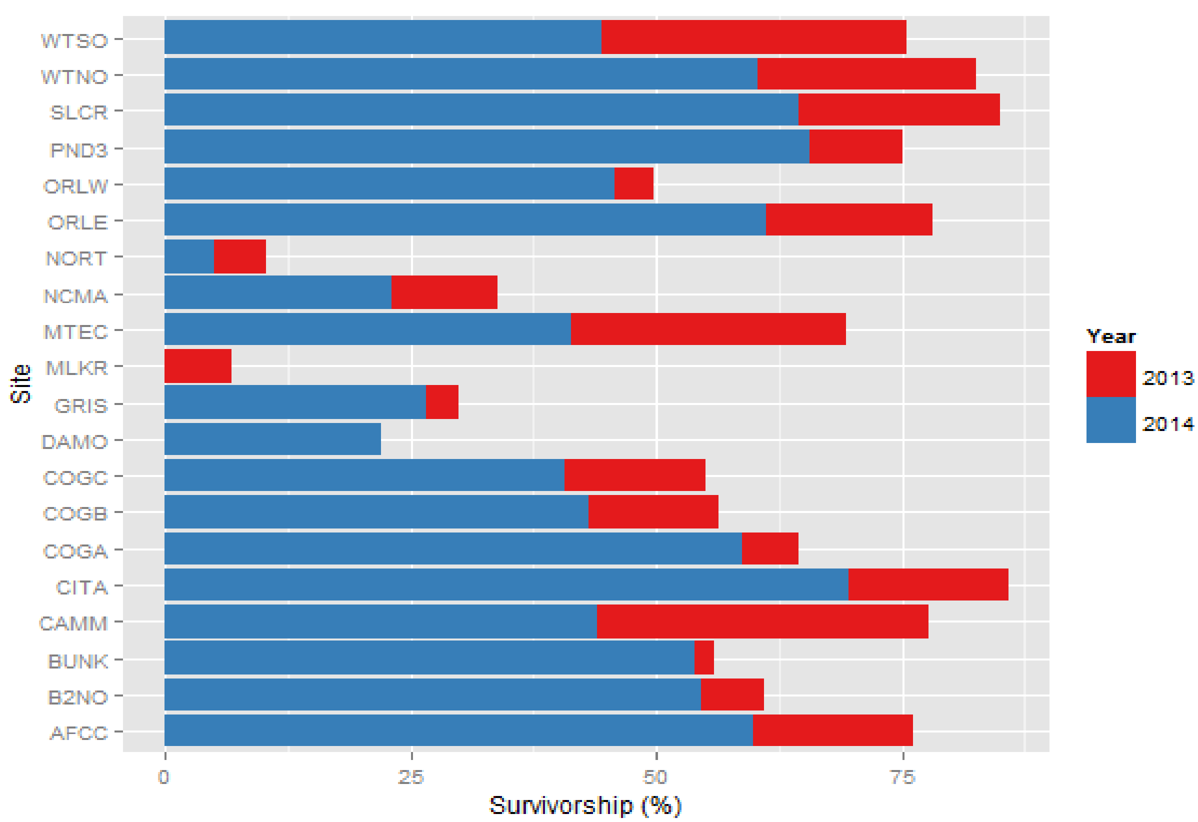

Figure 25. Year 2 G. stricta mean survivorship in 2013 and 2014 by site. Bars overlap one another, with the bar representing 2013 survivorship behind the bar representing 2014 survivorship. See Appendix 1 for a list of site names and corresponding abbreviations.

Table 7 Year 2 G. stricta mean Year 2 survivorship, mean Year 3 survivorship, and change in survivorship from Year 2 to 3 by site

Site	ISP Subarea Code	Year 2 Mean Survivorship (%)	Year 3 Mean Survivorship (%)	Change in Survivorship (%) 2013-2014
AFCC	01a, b & c	76.3	59.8	-16.5
AFCC Pond 3 (PND3)	01f	75.0	65.6	-9.4
Bair B2 North West (B2NO)	02c.1	61.0	54.7	-6.3
Bunker (BUNK)	20g	55.9	54.0	-1.9
Cargill (CAMM)	13f	77.7	44.0	-33.7
Citation (CITA)	20d	85.8	69.6	-16.2
Cogswell A (COGA)	20m	64.5	58.9	-5.6
Cogswell B (COGB)	20n	56.4	43.2	-13.2
Cogswell C (COGC)	20o	55.1	40.7	-14.4
Damon Marsh (DAMO)	17d.4	10.2	21.9	+11.7
Greco Island (GRIS)	02f	30.0	26.7	-3.3
MLK Restoration (MLKR)	17h	6.8	0	-6.8
Mt. Eden Creek (MTEC)	13j	69.3	41.4	-27.9
North Creek Marsh (NCMA)	13k	33.8	23.0	-10.8
North Marsh (NOMA)	20f	10.2	5.0	-5.2
Oro Loma East (ORLE)	07a	78.1	61.2	-16.9
Oro Loma West (ORLW)	07b	49.8	45.8	-4.0
San Lorenzo Creek Mouth (SLCR)	20h.1	85.0	64.5	-20.5
Whale's Tail North (WTNO)	13d	82.7	60.4	-22.3
Whale's Tail South (WTSO)	13e	75.6	44.5	-31.1
Overall		54.6	45.1	-9.5

3.4 MONITORING RESULTS FOR YEAR 3 (2013-2014) PLANTINGS

3.4.1 Planting Design

The Year 3 *G. stricta* planting design increased the density of plantings from 10 to 20 plants per patch. In each patch, twenty *G. stricta* plants were installed in two rows of ten. The distance between rows remained at 0.5 meters but the distance between plants within each row decreased from 1.0 to 0.5 meters. Similar to previous year’s designs, the position of the inner row of each patch was selected by ISP biologists based on co-occurring vegetation, channel morphology, and approximate elevation. Three pot sizes were planted during Year 3: D40s, gallons, and TB4s (Treeband 4 pot with 160 cubic inches of soil). TB4s were tested as an alternative to gallon pots in Year 3 and replaced gallons in patches at selected sites. As in Year 2, most patches included only D40 pots. In patches that included gallons (or TB4s), 10 gallons/TB4s were planted in one row and 10 D40s in the other row. A portion of D40s were salt hardened and these salt hardened plants were distributed to ten different marshes. In these marshes, salt hardened D40s and non-salt hardened D40s were planted in as spatially mixed a plan as possible in order to test the effect of salt hardening on survivorship. *Distichlis spicata,* delivered in gallon pots, was installed along with the *G. stricta* in patches at some sites. During installation, two *D. spicata* gallon pots were installed per patch. Each of these pots was divided in half, with each half installed on opposite sides of one of the outer row *G. stricta* plants. Additionally, a small number of gallon-sized *G. stricta* pots were cultivated as "combo" pots, with two ramets of *D. spicata* grown in the same pot as the *G. stricta*.

3.4.2 Pot Size Effect

Pot sizes used for Year 3 plantings included D40s, gallons, and TB4s. Gallon-sized "combo" pots contained both a *G. stricta* seedling and two ramets of *D. spicata*, however, due to the small sample size combo pots were excluded from this analysis. Pot size was tested at nine sites where *G. stricta* was planted. In patches where gallons or TB4s were planted, one row (either inner or outer) was planted with gallons or TB4s and the other row was planted with D40s. Therefore, patches were separated into rows for comparison. Pooling rows from all sites, we found that, as in earlier years, larger pot sizes were correlated with increased survivorship. Based on a two way ANOVA using site and pot size as factors, there was a significant difference in survivorship among pot sizes (p=0.00012). The difference was not as great as we have seen in earlier years. In the sites where pot size was tested, mean survivorship in gallon rows was 33.2%, mean survivorship in TB4 rows was 32.4% and mean survivorship in D40 rows was 28.7%. Within individual sites, statistically significant differences by pot size were observed at many sites (**Figure 26**). At most sites, the larger TB4 and gallon pot sizes had higher survivorship. However, at HARD Marsh and North Creek Marsh, gallons were correlated with lower survivorship than D40s. This may be due to the relatively small number of gallons which were installed at these sites, resulting in very low sample size. In addition, gallon-size pots were only

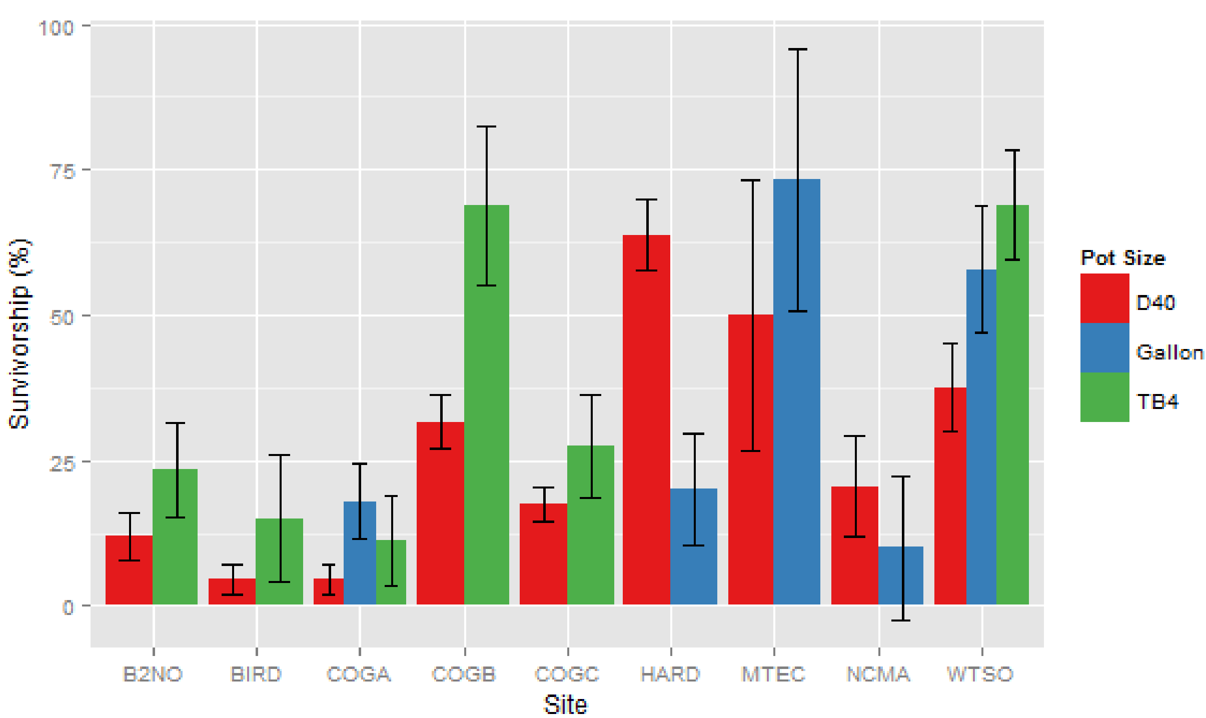

Figure 26. Year 3 G. stricta mean survivorship by site and by pot size. Error bars represent 95% confidence intervals. See Appendix 1 for a list of site names and corresponding abbreviations.

installed on the marsh plain in Year 3 at these two sites, while D40s were planted on berms as well, and it is possible that survivorship varied by planting location at these two sites.

3.4.3 Monitoring Method

Patches were monitored by counting the total number of surviving *G. stricta* plants in each row. The total number of surviving *D. spicata* were also counted. During 2014 monitoring, ISP staff monitored all Year 3 *G. stricta* patches.

3.4.4 Overall Survivorship

Aggregating all sites, overall survivorship was 33.6%. While this is slightly higher than first year survivorship of the Year One plantings (31.6%), it is considerably lower than first year survivorship of the Year 2 plantings (54.6%). While overall survivorship was under 40%, survivorship at 12 of the 22 sites where *G. stricta* was planted in 2013-14 exceeded the target of 40%. Survivorship by site is shown in **Table 8** and **Figure 27.**

Table 8 Year 3 G. stricta mean survivorship and sample size by site.

Site	ISP Subarea Code	Mean Survivorship (%)	N (plots monitored)
AFCC	01a, b & c	13.9	20
AFCC Pond 3 (POND3)	01f	68.8	12
Arrowhead Marsh (ARMA)	17c	1.9	29
Bair B2 North West (B2NO)	02c.1	15.6	49
Bair B2 North - South of Boardwalk (BAIR)	02c.2	42.5	83
Bair B2 South (B2SO)	02d.3	29.6	38
Bird Island (BIRD)	02a.3	6.9	26
Bunker (BUNK)	20g	80.7	14
Cargill (CAMM)	13f	16.0	25
Citation (CITA)	20d	56.5	31
Cogswell A (COGA)	20m	11.5	48
Cogswell B (COGB)	20n	34.1	61
Cogswell C (COGC)	20o	18.3	93
Greco Island (GRIS)	02f	46.7	99
HARD Marsh (HARD)	20s	57.0	42
Mt. Eden Creek (MTEC)	13j	60.0	7
North Creek Marsh (NCMA)	13k	18.7	33
Oro Loma East (ORLE)	07a	51.7	26
Oro Loma West (ORLW)	07b	72.7	11
Triangle Marsh (TRMA)	20w	27.7	15
Whale's Tail North (WTNO)	13d	46.7	9
Whale's Tail South (WTSO)	13e	46.4	42
Overall		33.6	815

Continued drought conditions likely lowered survivorship of Year 3 plantings. Low survivorship seen at sites with previously high survivorship like Cogswell A, B and C was likely due to planting date as this marsh complex was planted in early December prior to any rainfall. Extremely low survivorship at Arrowhead Marsh was not unexpected as previous planting efforts at that site by partner Save The Bay also documented very low survivorship. Lower marsh elevations likely contributed to lower survivorship at this site and at Bird Island.

3.4.5 Salt Hardening Effect

The effect of salt hardening on plant survivorship was tested at ten sites during Year 3. At each of these sites, salt hardened and non-salt hardened patches were installed in a manner that maximized spatial mixing of these two treatments. Pooling patches from all sites where salt hardening was tested, survivorship was found to be significantly higher in salt hardened patches than in non-salt hardened patches (p=0.02387). Overall, mean survivorship among salt hardened patches at these sites was 41.8%, as compared to 35.6% for non-salt hardened patches. Nonparametric Mann-Whitney U tests were used to compare survivorship between salt hardened and non-salt hardened patches at individual sites. When comparing survivorship for individual sites, only three of the ten sites had significantly higher survivorship in salt hardened versus non-salt hardened patches. These sites were Bair B2 South

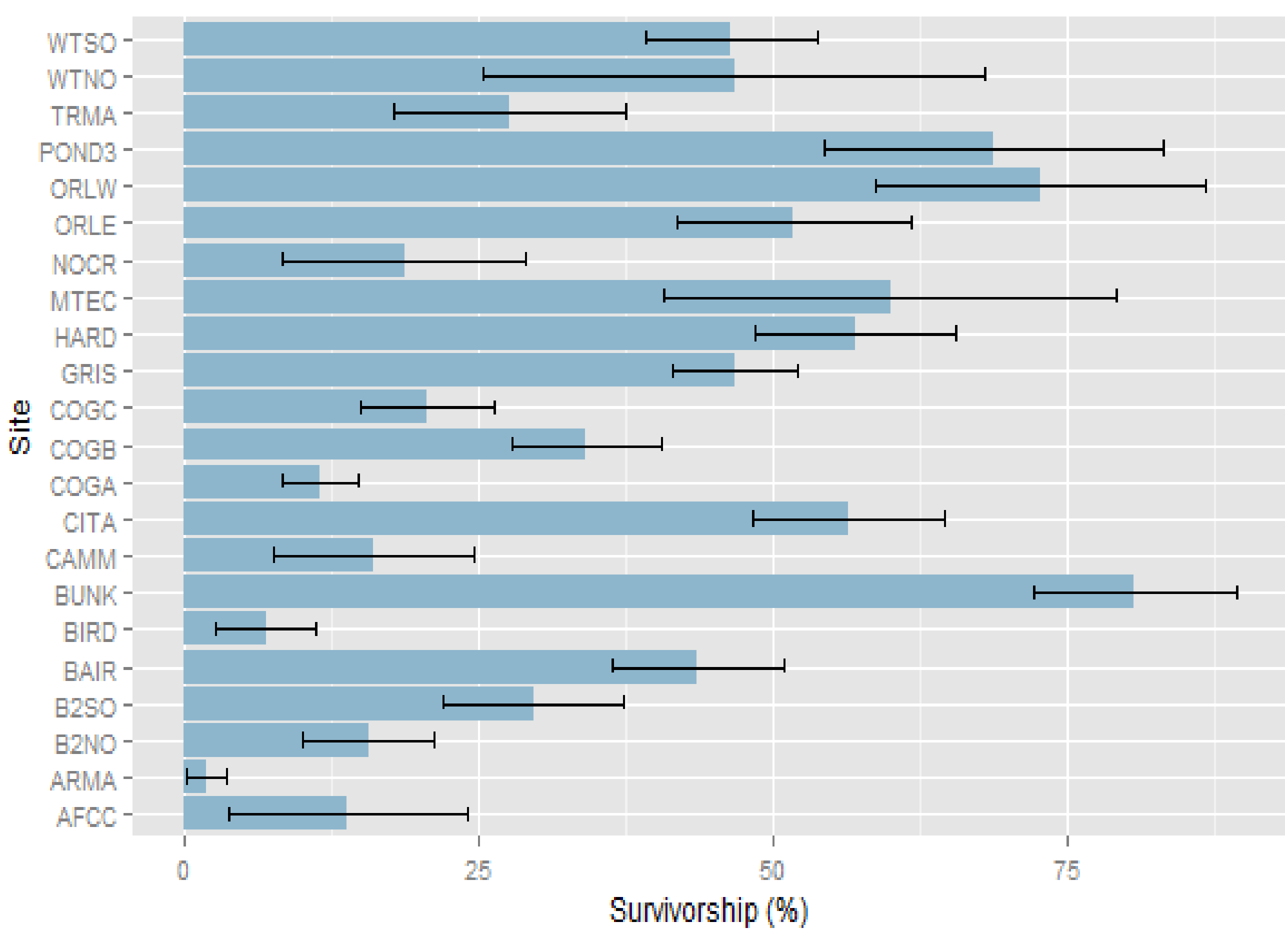

Figure 27. Year 3 G. stricta mean survivorship by site. Error bars represent 95% confidence intervals. See Appendix 1 for a list of site names and corresponding abbreviations.

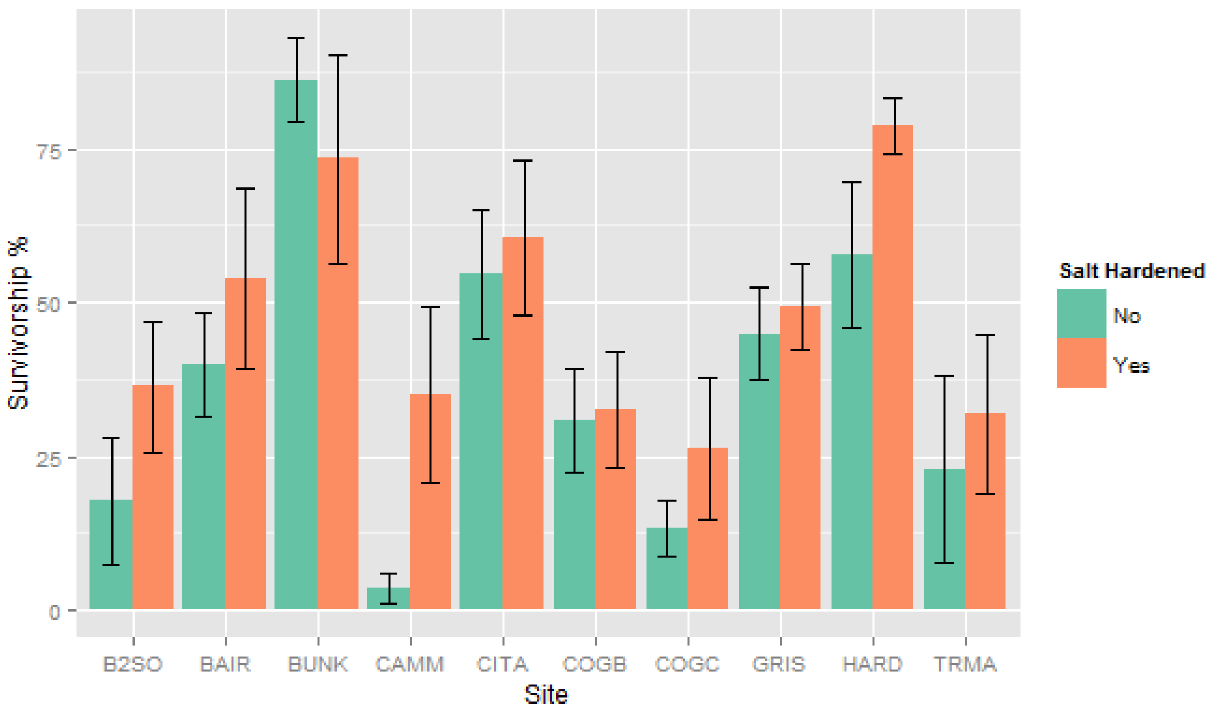

Figure 28. Year 3 G. stricta mean survivorship by site and by salt hardening treatment. Error bars represent 95% confidence intervals. See Appendix 1 for a list of site names and corresponding abbreviations.

(p=0.02217), Cargill Mitigation Marsh (p=0.0006), and Cogswell C (p=0.0275) (**Figure 28**). Additionally, Bair B2 North - South of Boardwalk had non-significant but slightly higher survivorship for salt hardened plots (p=0.0601). All other sites showed no statistically significant difference in survivorship between salt hardened and not salt hardened patches. However, most of these sites had a non-significant trend toward higher survivorship in the salt hardened plots. Only one site, Bunker Marsh, had higher mean survivorship for non-salt hardened plots and this was not statistically significant.

3.4.6 *Distichlis spicata* survivorship

Overall mean survivorship for saltgrass (*D. spicata*) that was planted with *G. stricta* plantings was 26.0%. Survivorship varied across sites from zero survivorship at Citation Marsh and HARD Marsh to 51.5% at Cogswell A (**Figure 29**). For most patches, *D. spicata* plants were installed in the manner described above. However, at Cogswell A and Whale's Tail South, some patches were planted with "combo" pots. At these sites, both the regular patches and "combo" patches were monitored for *D. spicata* survivorship. Survivorship was expressed as a percentage of ramets surviving. Differences between planting methods were evaluated using nonparametric Mann-Whitney U tests. While there was a trend toward higher survivorship for *D. spicata* planted adjacent to *G. stricta* at both sites, this was not statistically significant at either Cogswell A (p=0.0902) or Whale's Tail South (p=0.5625) (**Figure 30**).

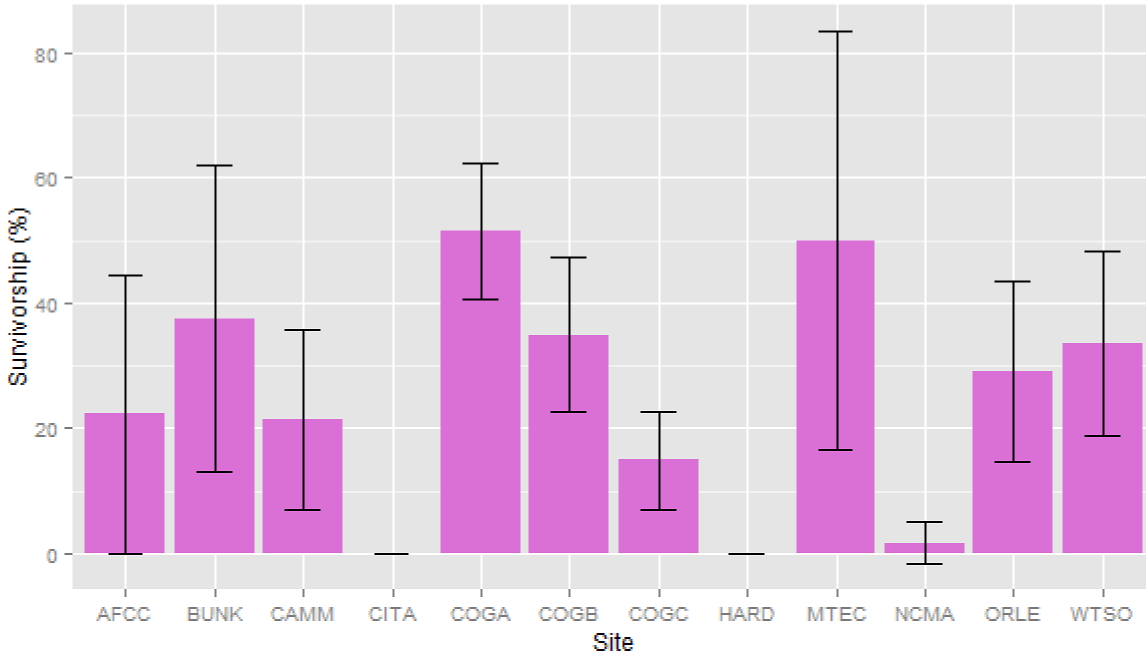

Figure 29. Year 3 D. spicata mean survivorship by site. Note that Citation Marsh and HARD Marsh had zero mean survivorship.

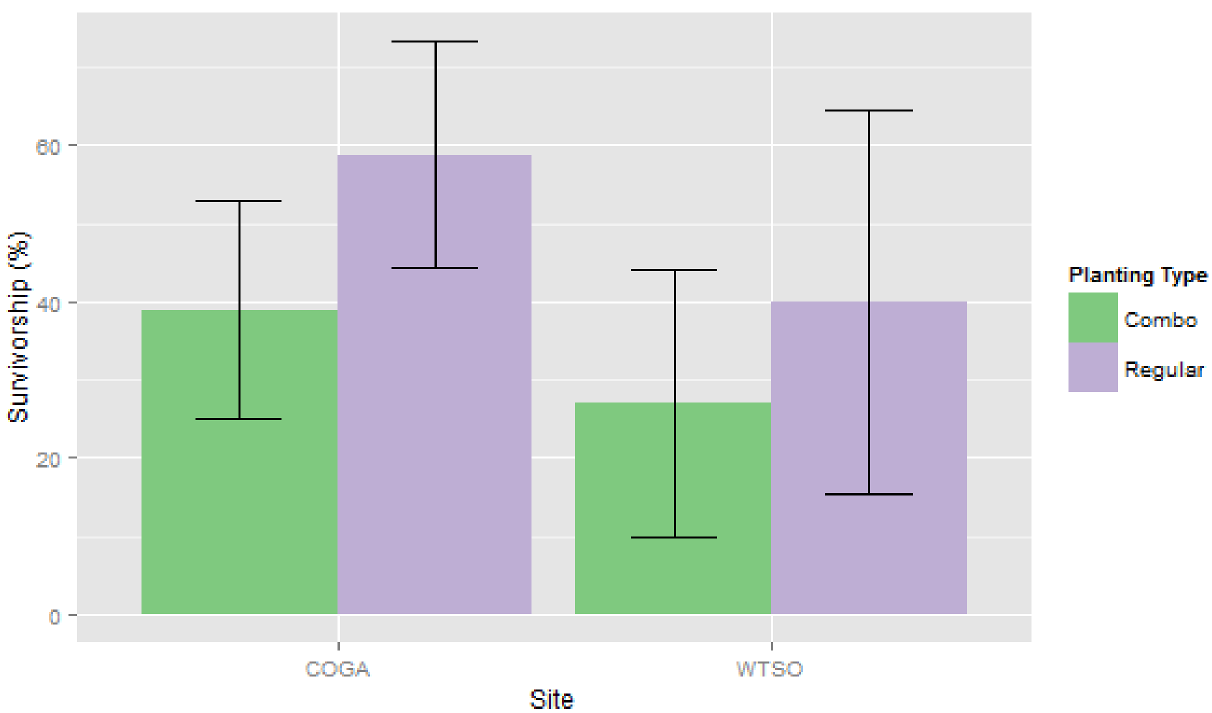

Figure 30. Year 3 D. spicata mean survivorship by site and by planting type. .

3.5 SUMMARY

A summary of results from 2014 monitoring is listed below:

1) Overall survivorship for Year 3 marsh gumplant was slightly higher than first year survivorship of the Year 1 plantings but was considerably lower than the Year 2 plantings. This is at least partially due to continued drought conditions in California. While overall first year survivorship for Year 3 was lower than the target of 40% success, survivorship at 12 of the 22 sites exceeded the target of 40%. Sites within the Cogswell complex had significantly lower survivorship for Year 3 plantings likely due to plant installation occurring in early December before any rainfall occurred.
2) In Year 3, the effect of salt hardening on plant survivorship was more apparent with salt hardened plants surviving better. Higher salinity levels likely occurred in marshes due to the lack of seasonal flushing by rain and that may have resulted in increased transplant shock for new plants. Year 3 results indicate that salt hardening is an important tool to increase survivorship during continued drought.
3) Several sites were planted in Year 3 that had extremely low survivorship (Arrowhead Marsh, Bird Island) likely due to unsuitable site conditions (e.g., elevation too low) and these sites should be carefully considered before planting is proposed in the future.
4) For Year 1 plantings, after three growing seasons, the mean number of *G. stricta* plants per plot was 2.4 (out of 10 total planted), the mean total plant volume of plots was 0.45 m^3, and the mean volume per plant was 0.09 m^3. All three of these measurements varied significantly by site (e.g., mean number of plants per plot varied from 0.4 to 5.1 (out of 10 total planted).
5) All years of monitoring have showed that, in general, larger pot sizes survive better likely due to larger pot sizes allowing for more developed roots as well as more soil material, both of which may help decrease initial transplant shock. While pot size has a significant initial effect on survivorship, looking at the patches that have survived three growing seasons, pot size does not appear to have a continued effect as measured by several metrics. These metrics include the number of plants per plot, per plant volume per plot, and total plant volume per plot.
6) A comparison of saltgrass planting methods (i.e., gallon pot for saltgrass planted around gumplant vs. combo pots with gumplant and salt grass propagated in the same gallon pot) at two sites found that combo pots had lower survivorship, however, this result was not significant.

4. PROGRAM MANAGEMENT RECOMMENDATIONS

4.1 GENERAL RECOMMENDATIONS

For all revegetation plantings to date, survivorship varied significantly by site. For cordgrass plantings, planting location within the site was also an important predictor of planting success. As survivorship does vary by site and planting location within site, planting designs should continue to consider site-specific conditions when choosing planting locations. Habitat type within the site, planting elevation, substrate, potential salinity levels, local inundation, and other factors that might affect plant survivorship should be considered as much as possible.

Observation of areas where there are existing established plants at sites can aid in selecting suitable planting locations. During ground-truthing to select plant locations, it is recommended that existing vegetation continue to be used as a guide. Monitoring data collected previously indicated that elevation plays a strong role in survivorship of both *S. foliosa* and *G. stricta*, and an understanding of proper planting elevation at each site has the potential to greatly improve survivorship. A continuing recommendation is to collect RTK elevation data whenever possible to achieve a better understanding of the influence of elevation on survivorship across many sites. It is recommended that the collection of elevation data be prioritized at sites where target survivorship goals have not been met.

Use of caging, primarily for cordgrass plantings, should be considered for any site where herbivory might have a strong negative effect on survivorship.

4.2 *SPARTINA FOLIOSA*

1. Plant establishment was highest at sites with uniform mudflats and wide channel banks. Plants established at much lower rates on second order channel banks and on bayfront edges. At revegetation sites that do not have mudflats or wide channel banks, more experimentation may be needed in order to increase survivorship.
2. The donor source population for cordgrass plugs is a strong predictor of survivorship and growth rate for the first year after planting, but may become less important in following years. Long-term monitoring of blocks that have one source population (still able to monitor even as the individual plots coalesce because they are the same source) will provide data on whether this effect persists.
3. At least three source populations will be planted in all experimental treatments and multiple source populations planted at each site. It is also recommended that donor source populations continue to be tracked in order to ensure that different sources, when outplanted, achieve heights that are suitable for providing habitat that supports California Ridgway's rail.
4. Caging remains important, but leaving plastic mesh caging in place for more than one growing season may be detrimental for plants. It is recommended that caging continue to be used at sites with high grazing pressure (typically by Canada goose).
5. Planting visibility may be important when considering caging. Caging may be most important on highly visible open mudflats and less important when planting into areas vegetated with pickleweed. Open mudflats should be prioritized for caging over other habitat types.
6. Trimming plugs during plant installation did not have an effect on outplanting success. It is recommended that this method not be employed in the future.
7. Block-level monitoring is recommended for plantings after two or more growing seasons as plots have grown together and are difficult to distinguish. For comparison, it is recommended that data should be collected at reference sites with Ridgway's rail populations to determine if the block-level metrics are useful for measuring habitat value.
8. Monitoring for cordgrass should occur as late in the growing season as possible to capture peak biomass and stem density.

4.3 *GRINDELIA STRICTA*

1. Salt hardening resulted in significant increases in first year survivorship for Year 3 plantings. It is recommended that salt hardening of *G. stricta* plants be implemented to as great an extent as budget allows. Allocation of salt hardened plants should be prioritized for sites such as Cargill Mitigation Marsh and Cogswell C where salt hardening has been demonstrated to have a particularly strong beneficial effect on survivorship.

2. Sites that exhibited extremely low first year survivorship for Year 3 plantings are likely not suitable for planting in future years. It is suggested that *G. stricta* planting at low-survivorship sites such as Arrowhead Marsh and Bird Island be discontinued.
3. Larger pot size (gallon) continues to have a significant positive effect on first year survivorship. However, data from monitoring of Year 1 plantings (after three growing seasons) suggests that this effect may not persist. It is therefore suggested that the decision to plant larger pot sizes be examined in a cost/benefit framework.
4. A limited comparison of saltgrass planting methods (i.e., gallon pot for saltgrass planted around gumplant vs. combo pots with gumplant and salt grass propagated in the same gallon pot) in Year 3 at two sites found that combo pots had lower survivorship, however, this result was not significant. As only a limited comparison was possible between the two methods, both methods of saltgrass propagation and plant delivery will be continued.

5. REFERENCES

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APPENDIX 1:

List of Site Abbreviations Used in Report

Site Abbreviation	Site Name	ISP Sub-Area	Marsh Complex
AFCC	**Alameda Flood Control Channel**	**01a, b & c**	**San Francisco Bay Don Edwards NWR**
ARMA	**Arrowhead Marsh**	**17c**	**San Leandro Bay – Martin Luther King Jr. Regional Shoreline**
B2NO	**Bair B2 North - West**	**02c.1**	**Bair Island NWR**
B2SO	**Bair B2 South**	**02d.3**	**Bair Island NWR**
BAIR	**Bair B2 North - South of Boardwalk**	**02c.2**	**Bair Island NWR**
BIRD	**Bird Island**	**02a.3**	**Bair Island NWR**
BUNK	**Bunker Marsh**	**20g**	**Robert's Landing**
CAMM	**Cargill Mitigation Marsh**	**13f**	**Eden Landing Ecological Reserve**
CITA	**Citation Marsh**	**20d**	**Robert's Landing**
COGA	**Cogswell A**	**20m**	**Hayward Regional Shoreline**
COGB	**Cogswell B**	**20n**	**Hayward Regional Shoreline**
COGC	**Cogswell C**	**20o**	**Hayward Regional Shoreline**
DAMO	**Damon Marsh**	**17d.4**	**San Leandro Bay – Martin Luther King Jr. Regional Shoreline**
DEMO	**Mt Eden Creek Marsh**	**13l & m**	**Eden Landing Ecological Reserve**
ELRO	**Elsie Roemer**	**17a**	**San Leandro Bay – Elsie Roemer Bird Sanctuary**
GRIS	**Greco Island North**	**02f**	**Bair Island NWR**
HARD	**HARD Marsh**	**20s**	**Hayward Regional Shoreline**
MLKR	**MLK Restoration Marsh**	**17h**	**San Leandro Bay - Martin Luther King Jr. Regional Shoreline**
MTEC	**Mt. Eden Creek**	**13j**	**Eden Landing Ecological Reserve**
NCMA	**North Creek Marsh**	**13k**	**Eden Landing Ecological Reserve**
NOMA	**North Marsh**	**20f**	**Robert's Landing**
OACR	**Old Alameda Creek**	**13b**	**Eden Landing Ecological Reserve**
ORLE	**Oro Loma East**	**07a**	**Hayward Regional Shoreline**
ORLW	**Oro Loma West**	**07b**	**Hayward Regional Shoreline**
PND3	**AFCC Pond 3**	**01f**	**San Francisco Bay Don Edwards NWR**
SLCR	**San Lorenzo Creek Mouth**	**20h.1**	**Robert's Landing**
TRMA	**Triangle Marsh**	**20w**	**Hayward Regional Shoreline**
WTNO	**Whale's Tail North**	**13d**	**Eden Landing Ecological Reserve**
WTSO	**Whale's Tail South**	**13e**	**Eden Landing Ecological Reserve**