

Crescent Harbor Salt Marsh Restoration 2013-2015 Vegetation Monitoring Report



Crescent Harbor Salt Marsh Restoration Site 08/13/15

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Introduction

Botanical inventories are being conducted as part of the Crescent Harbor Salt Marsh Restoration monitoring documentation. Vegetation surveys of the marsh surface were conducted in July of 2009 (pre-project), June of 2011, September of 2013, June of 2014 and August of 2015. Descriptions of the 2009 and 2011 surveys can be found in The Crescent Harbor Salt Marsh Restoration As-Built Report (SRSC, 2009) and in the Crescent Harbor Salt Marsh Restoration 2010-2011 Monitoring Report (SRSC, 2011). This document outlines results from the 2013 to 2015 surveys.

The 300-acre marsh is owned by the Naval Air Station Whidbey Island and located near the town of Oak Harbor on the northeastern shore of Whidbey Island. It was historically the largest open barrier island salt marsh on Whidbey Island. In the early 1900s, the marsh was diked and drained for agriculture and grazing, and cut off from fish access and tidal exchange, except through ground water. However, in 2009, several actions were taken to restore fish access and tidal flow to the site.

Methods

2014 vegetation cover was mapped using Island County aerial imagery flown April 13th and May 1st, 2014, taken in 3-inch scale. Ground surveys were performed in 2013, 2014 and 2014 to determine species composition. Eleven permanent transects of various lengths that perpendicularly cross defining channels within each cell were used to monitor the same locations in all years (Figure 1). Transects were defined utilizing t-posts and recorded using a Trimble Global Positioning System. A measuring tape reel was used to form straight lines between the t-posts for each transect. A point-intercept survey was performed using points five or fifteen feet apart, depending on the length of the transect. The initial point was randomly chosen using a random number generator. Transects 1, 2, 3, 5, 7, 8, 9, 10 and 11 used 5-foot spaced points and transects 4 and 6 used 15-foot spaced points. The purpose of these transects was to monitor changes in the vegetation specifically associated with the channels. In addition, 100-foot transects were placed perpendicularly to the channel transects to further identify vegetative communities and accurately identify the site's vegetative tendencies. These transects were placed every thirty, sixty or ninety feet, depending on the length of the channel transect. Cross transects were placed every thirty feet on transects 1, 3, 5, 7, 8, 9, 10 and 11, every sixty feet on transect 2, and every ninety feet on transects 4 and 6. Point-intercept surveys were performed using 5-foot spaced points. Plant species along transects were identified by SRSC botanist, Brenda Clifton. Distinct plant communities within each unit were noted and species lists were compiled separately for individual plant communities.



Figure 1. Location of permanent transects used for vegetation survey.

Results

In 2013 ground transects, seven species and two distinct plant communities were encountered (Table 1). The reintroduction of tidal influence to the site resulted in a large dieback of the existing vegetation. The majority of the site was in mudflats that supported various types of seaweed and large shellfish populations (Table 1). The site was dominated by bareground (61.5% relative abundance; Table 2). Seaweeds encountered at the site included: green tuft (10.0% relative abundance), witch’s hair (7.2% relative abundance), sea lettuce (1.6% relative abundance), green string lettuce (0.3% relative abundance) and nori (0.1% relative abundance). A few elevated areas supported salt marsh vegetation, in the form of pickleweed (4.4% relative abundance).

Table 1. Species encountered in the Crescent Harbor Salt Marsh Restoration in 2013 by transect location.

Transect		1	2	3	4	5	6	7	8	9	10	11
<i>Herbs</i>												
Pickleweed	<i>Salicornia depressa</i>							X	X	X	X	
<i>Seaweed</i>												
Witch’s Hair	<i>Desmarestia aculeata</i>		X	X	X				X	X		
Sea Lettuce	<i>Ulva sp.</i>											X
Nori	<i>Porphyra sp.</i>			X								
Green Tuft	<i>Cladophora columbiana</i>	X	X		X				X	X		
Green String Lettuce	<i>Enteromorpha linza</i>											X
<i>Shellfish</i>												
Mussel	<i>Mytilus sp.</i>	X	X	X							X	X
<i>No Vegetation</i>												
Bareground		X		X	X	X	X	X	X	X	X	X

Table 2. 2013 plant species composition within the Crescent Harbor Salt Marsh Restoration.

Bareground	61.5%
Mussel	14.8%
Green Tuft	10.0%
Witch’s Hair	7.2%
Pickleweed	4.4%
Sea Lettuce	1.6%
Green String Lettuce	0.3%
Nori	0.1%

In 2014 transects, nine species were recorded at the project site (Table 3). Bareground continued to cover the majority of the site (61.1% relative abundance). Seaweed species present at the site included: green tuft (7.3% relative abundance), sea lettuce (5.7% relative abundance), witch’s hair (2.5% relative abundance), nori (1.4% relative abundance) and green string lettuce (0.2% relative abundance). Salt marsh species richness increased in 2014; pickleweed was still present (4.9% relative abundance), and seashore saltgrass and brass buttons were also recorded (0.8 and 0.2% relative abundance).

Table 3. Species encountered in 2014 at Crescent Harbor Salt Marsh by transect location.

Transect		1	2	3	4	5	6	7	8	9	10	11
<i>Herbs</i>												
Pickleweed	<i>Salicornia depressa</i>						X	X	X	X	X	X
Brass buttons	<i>Cotula coronopifolia</i>											X
<i>Grass</i>												
Seashore saltgrass	<i>Distichlis spicata</i>											X
<i>Seaweed</i>												
Witch's Hair	<i>Desmarestia aculeata</i>	X		X	X				X	X		
Sea Lettuce	<i>Ulva sp.</i>	X	X	X	X						X	X
Nori	<i>Porphyra sp.</i>		X							X		X
Green Tuft	<i>Cladophora columbiana</i>		X						X			
Green String Lettuce	<i>Enteromorpha linza</i>											X
<i>Shellfish</i>												
Mussel	<i>Mytilus sp.</i>	X	X	X	X						X	X
<i>No Vegetation</i>												
Bareground		X		X	X	X	X	X	X	X	X	X

Table 4. 2014 plant species composition within the Crescent Harbor Salt Marsh Restoration.

Bareground	61.1%
Mussel	15.9%
Green Tuft	7.3%
Sea Lettuce	5.7%
Pickleweed	4.9%
Witch's Hair	2.5%
Nori	1.4%
Seashore saltgrass	0.8%
Brass buttons	0.2%
Green String Lettuce	0.2%

In 2015, the number of species recorded at the site decreased to seven, with the loss of brass buttons and green tuft algae (Table 3). Bareground continued to cover the majority of the site (62.0% relative abundance). Seaweed species present at the site included: sea lettuce (5.9% relative abundance), witch's hair (3.2% relative abundance), green string lettuce (1.1% relative abundance) and nori (0.4% relative abundance). Salt marsh species included pickleweed (2.7% relative abundance) and seashore saltgrass (0.2% relative abundance). The combined abundance of salt marsh species in 2015 decreased by 3.0% since 2014. This likely reflects the enlargement of the channel in transects 10 and 11 resulting in the loss of salt marsh area.

Table 5. Species encountered in 2015 at Crescent Harbor Salt Marsh by transect location.

Transect		1	2	3	4	5	6	7	8	9	10	11
<i>Herbs</i>												
Pickleweed	<i>Salicornia depressa</i>						X	X		X	X	
<i>Grass</i>												
Seashore saltgrass	<i>Distichlis spicata</i>							X				
<i>Seaweed</i>												
Witch's Hair	<i>Desmarestia aculeata</i>		X	X	X							
Sea Lettuce	<i>Ulva sp.</i>	X		X					X	X	X	X
Nori	<i>Porphyra sp.</i>				X							

Green String Lettuce	<i>Enteromorpha linza</i>												X	
<i>Shellfish</i>														
Mussels	<i>Mytilus sp.</i>	X	X	X	X									X X
<i>No Vegetation</i>														
Bareground		X	X	X	X	X	X			X	X	X	X	

Table 4. 2014 plant species composition within the Crescent Harbor Salt Marsh Restoration.

Bareground	62.0%
Mussel	24.6%
Sea Lettuce	5.9%
Witch’s Hair	3.2%
Pickleweed	2.7%
Green String Lettuce	1.1%
Nori	0.4%
Seashore saltgrass	0.2%

Vegetation communities delineated from 2014 aerial photographs indicate that the majority of the area is in mudflats (176.5 acres; 79.1% relative cover; Table 5). Salt marshes have colonized some slightly higher areas on the marsh surface and are encroaching around the edge (34.6 acres; 15.5% relative cover). Some mixed grasses are present on the southern levee (2.2 acres; 1.0%), shrubs persist on an upland bench in the far west of the project area (3.5 acres; 1.6% relative cover) and cattail stands exist where Crescent Creek inputs freshwater into the system (2.3 acres; 1.0% relative cover).

Table 5. Comparison of acreages and relative cover of vegetation community types found at the Crescent Harbor Salt Marsh Restoration site.

Vegetation Community	Acreage	Relative Cover
Mudflat	176.5	79.1%
Salt marsh	34.6	15.5%
Channels	4.1	1.8%
Shrubs	3.5	1.6%
Cattail Stands	2.3	1.0%
Grasses	2.2	1.0%
Total	223.2	100.0%

Discussion

Six years have passed between the project implementation and the 2015 survey. Pre-project communities included a mixture of high and low estuarine salt marsh, and upland vegetation. In 2014, these had shifted to intertidal mudflats and low estuarine salt marshes. Estuaries, such as these, are highly productive systems containing a high diversity and density of fish and invertebrates (Beck et al. 2001). Furthermore, open mudflats support large numbers of shorebirds and waterfowl as they feed on a variety of invertebrates.

Several undesirable, noxious weed species are no longer present since the restoration of the site, including: Himalayan blackberry, field mustard, common St. Johnswort, oxeye daisy, and European bittersweet. However, salt marsh species richness has decreased. Several of the pre-project salt marsh species associated with fresh water inputs, such as soft-stemmed bulrush and American bulrush, are no longer present. However, over time, new species should continue to colonize this area. Several seaweed and shellfish species were also encountered in the mudflats. Sessile benthic invertebrates function as ecosystem engineers to form structure that provides valuable nursery habitat to estuarine fish (Hosack et al., 2006).

In 2011, the site was classified as dominated by low salt marsh (91.3% relative cover). This differs greatly from the 2014 description of the site as dominated by mudflats. The difference in classification could be the result of a number of factors: 1) 2011 cover was classified optimistically. Because the ground survey had several areas where salt marsh vegetation was colonizing, it was assumed the remaining bareground would revert to salt marsh, and it was classified as such on the aerial maps. 2) Water level has increased or ground level has decreased. In 2011, transect vegetation surveys recorded 16.9% relative abundance of salt marsh species, while in 2013, this was reduced to 4.4%. The structural monitoring data is still being analyzed, but the change in vegetation suggests a physical change to the site. Channel size has been increasing, which could be allowing more water to enter the site during tidal inundation. Furthermore, the increased energy could be scouring the surface of the marsh, removing sediment faster than it is being replaced.

Within estuaries, structure created by salt marsh vegetation provides trophic resources and predator refugia for rearing salmonid species. At Crescent Harbor, salt marsh formation has been limited by elevation. While pickleweed and saltgrass dominate the highest sites, brass buttons, an annual and pioneer species, has been encroaching further onto the mudflats. It remains to be seen if the site will continue to be dominated by bareground, or if the marsh surface will continue to expand as soil organic matter lost through scouring builds-up in the remaining substrate over time.



Figure 1. Vegetation communities at the Crescent Harbor Salt Marsh Restoration delineated from the 2014 Island County aerial photo.

Invasive Species Control

In 2014, a few *Spartina* individuals were spotted near the permanent transects. *Spartina* is a Washington State Class A Noxious Weed, with mandatory control in Island County. It is abundant in many of the nearby Whidbey and Camano Island salt marshes (Stein, 2014) and Crescent Harbor is at risk of domination by this undesirable species. As a result, the entire site is being surveyed annually. In 2014, eight *spartina* populations were encountered ((Figure 2). These were treated by removing the seed heads and spraying with a 3% glyphosate and 3% imazapyr solution. The site was resurveyed in August of 2015 and 33 new populations were encountered (Figure 3). These were different than the individuals mapped in 2014, which were successfully treated. The similar location to 2014 plants indicates the presence of a seed bank, or a consistency in where the tidal flow deposits propagules. The majority of plants encountered at the site were small enough to have established this year. A small number were several years old, but still small, and likely flowering for the first time. These were missed in 2014 because they not distinguishable from the surrounding marsh without seed heads. Unfortunately, *spartina* will likely continue to immigrate into the Crescent Harbor Salt Marsh Restoration site. It is able to colonize mudflats as well as salt marsh, and occupies a slightly lower niche than our native species. Fortunately, the last few years have shown progress in the control of this species state wide with the introduction of imazapyr herbicide as a control option. In fact, Island County has eradicated the species from several sites. As reproductive propagules decrease in the tidal prism, so will the occurrence of this species at the site. In the mean time, persistence is needed to continually remove this species from the restoration project.



Figure 2. 2014 *Spartina* sp. treatment locations.



Figure 3. 2015 *Spartina* sp. treatment locations.

References

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