Dense-flowered Cordgrass *Spartina densiflora* & Salt Meadow Cordgrass *Spartina patens*

Denman Island & Sandy Islands Marine Park, BC

Fall 2016

Submitted to M. Christensen & D. Buffett Ducks Unlimited Canada

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Abstract

From September to November 2016 the foreshores of Denman Island and Sandy Islands Marine Park were checked as part of the ongoing BC Spartina Working Group's program for the monitoring and removal of invasive cordgrass. Regenerating plants of dense-flowered cordgrass *Spartina densiflora* were removed from both areas and initial steps were taken for the removal of salt meadow cordgrass *S. patens* from the Sandy Islands' shoreline.

On Denman, 1141 plant-bunches of *S. densiflora* were removed from the foreshore. Tiny to medium-sized plant-bunches were found, and 30 or 2.6% had at least one seed-head. On the Sandy Islands 375 plant-bunches were removed with 139 or 37% of them having at least one seed head. Overall less than 10-15% of these seed heads had shed seeds at the time of removal. Rechecking sites on Denman that were initially monitored in early October when the salt marshes were still green and growing showed that many tiny plants were missed. The tiny *S. densiflora* are more visible when the rest of the salt marsh is brown. Thus monitoring early after the summer growing season is important to remove plants prior to going to seed, but a second later monitoring is necessary to ensure removal of most of the seedlings. All of the *S. densiflora* plant material was composted on the respective islands.

New experimental treatments for the removal of *S. patens* on the Sandy Islands' foreshores were begun. As trying to use cover treatments at these *S. patens* sites proved ineffective due to the tidal and wind exposure in this area, manual digging and surface root-burning will be investigated over future growing seasons. Three sites were prepared for 2017-burning, by clipping and removing the vegetative material. Three additional sites were selected for manual removal of *S patens* and the digging of *S. patens* was begun at one of these sites. The digging of the small rhizomatous roots was impaired by poor visibility in wind and pouring rain, but further removal will be conducted in 2017. *S. patens* plant material was also composted in a separate covered compost pile on Tree Island.

***Spartina densiflora* growing on a log on Denman Island**

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Acknowledgements

The Spartina mapping and removal along the shores of Denman and Sandy Island Marine Park is funded through the efforts of Ducks Unlimited Canada (DUC), which leads the BC Spartina Working Group (SWG) and coordinates the BC Spartina Control and Eradication Program. Thanks to Matt Christensen, Conservation Programs Specialist – BC Coast for DUC, who continues to supervise this program under the direction of Dan Buffett, Head of Conservation Programs for DUC. Appreciation as always to Mark van Bakel, GIS specialist with the Islands Trust, for mapping background. Also many thanks to the residents of Denman Island who continue to support the program and allow access through their lands, with special appreciation to the owners of Komas Ranch for their support with the extended program on Sandy Islands Marine Park shores. In addition, thanks to Susan Fussell who volunteered to dig *S. patens* in the pouring rain and wind on Tree Island shores and to the sub-contract assistants, P. Scott, T. Ingram and Lichen who assisted with the initial *S. patens* work.

Abbreviations

DUC	Ducks Unlimited Canada
SWG	Spartina Working Group

***Spartina patens* in seed on Tree Island**

Introduction

The goal of the Denman Fall 2016 Spartina Project was to remove as many regenerating *S. densiflora* plants as could be located on Denman and the Sandy Islands' shores and to begin new experimental treatments for the removal of *S. patens* on the shores of the Sandy Islands.

Methods

The Spartina control activities took place from September 27 to November 3 2016. Erica McClaren and Derek Moore of BC Parks were contacted regarding access across Sandy Islands Provincial Park. Komoks First Nation Guardian Watchmen Supervisor, Cory Frank was also contacted due to the proposed activities on the Sandy Islands' foreshores in their First Nations' territory and adjacent to their oyster lease.

The project activities for *S. densiflora* included walking all the Denman Island and Sandy Islands Marine Park shorelines that have any high to mid intertidal foreshore. All *S. densiflora* plants were manually dug with a pick-mattock and removed. All plant removals were mapped and recorded, and the plant material was composted. As these removals began early in the fall when the salt marshes were still tall and green, rechecks of six sites were made in November to see if tiny plants had been missed.

Experimental treatments for *S. patens* sites on Sandy Islands' foreshores were designed. A summer visit by Matt Christensen, of Ducks Unlimited, confirmed the identity of the numerous small patches of *S. patens* on the Tree Island and second islet shorelines. Three sites for each of the experimental trials of manual removal and root burning were selected. The vegetation from the three future burn-plots was removed with a gas-powered brush-cutter and the material was composted on Tree Island. One of the small dig-plot was manually dug with a garden fork and hand tools, and all the vegetative material, including all roots, was also composted on Tree Island.

Results and Discussion

S. densiflora

The high and mid foreshore areas surrounding most of Denman Island were examined, so that all areas that previously had *Spartina densiflora* plants were checked. The rugged rocky cliff shoreline at the extreme southeast was not checked in this fall monitoring session, but all tiny, exposed foreshore sites in this cliff area will be examined in the spring. Also, all but the most northern tip of the second islet and the third islet of the Sandy Islands were monitored for *Spartina densiflora* in this session. Maps of all active and formerly active sites and summary area charts with site effort will be included in the final report in March 2017, when the monitoring of Spartina growth during the past growing season is completed.

S. densiflora regenerating seedlings were removed from 60 sites on Denman during this initial fall monitoring, completed by mid October. A total of 1141 tiny to medium-sized plant clumps were removed and composted. The numbers and sizes of plants removed from each site are included in the Appendix Table 1. At least one seed head was present on 30 or 2.6 % of these plant clumps, but less than approximately 10% of these seed heads had shed any seeds prior to removal.

Six Denman sites were rechecked in order to determine whether plants were missed when checking early in the fall, prior to the winter die back of the salt marshes. As the fall progresses, the surface vegetation of the major salt marsh species on Denman, sea asparagus *Salicornia virginica* and

seashore saltgrass *Distichlis spicata*, dies and turns brown, leaving the erect green leaves of tiny *S. densiflora* exposed. The second monitoring pass revealed an additional 159 plant clumps or 40% of the overall total, as shown in Figure 1. These missed plants were nearly all tiny ones that had been hidden in the tall, green and thriving the salt marshes. Of note, other factors affecting the visibility of *S. densiflora* are the amount of seaweed or log debris. At the time of the second pass there was little of either of seaweed or logs at these sites and this also aided the removal.

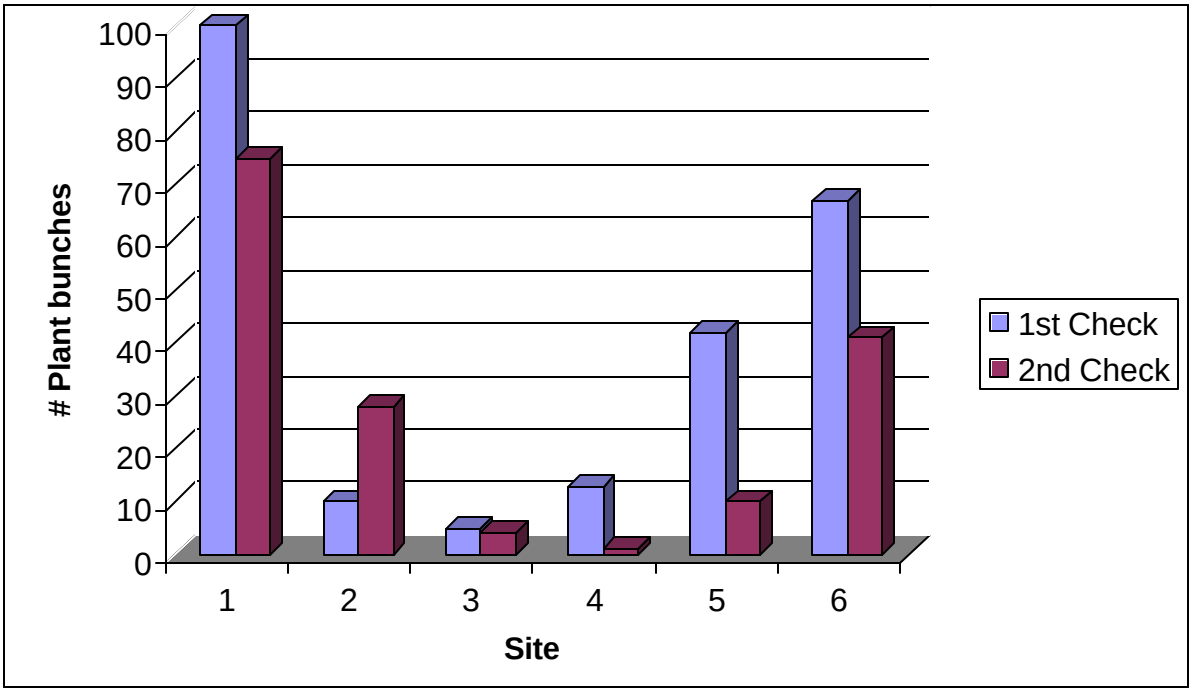

Figure 1. The number of *Spartina densiflora* plant bunches removed during the second check indicates those missed during early fall monitoring in green salt marshes.

On Denman, *Spartina densiflora* seedlings continued to demonstrate their habitat flexibility as seedlings were found growing in a variety of substrates, as well as in unusual places. Two were growing on a log above the beach surface, as shown in the photograph on page 1. Other plants were situated on the very high foreshore, under shoreline shrubs or above all other inter-tidal plants.

On the Sandy Islands' foreshores, there were 42 *S. densiflora* sites, with 375 tiny to medium plant bunches. These are recorded in the Appendix Table 2. In mid-October, at least one seed head was seen on 139 or 37% of these plant-bunches, although only about 15% of the seed heads had shed any seeds. Also, to illustrate how plants can be missed, shifting seaweed and logs exposed 13 of these Sandy Islands' *S. densiflora* seedlings during the *S. patens* work, 2 weeks after the *S. densiflora* monitoring.

S. patens

On the Tree Island foreshore, experimental sites for the *S. patens* treatments were selected and these are shown in Figure 2. Figure 3 (a&b) shows the three small *S. patens* sites that were selected for the trial root-burning. The vegetation was clipped with a brush-cutter and all the cut plant material was raked, removed and composted on Tree Island. The cut surface of these burn-sites was left with tiny <2cm *S. patens* stems. Burning is planned for 2017.

Figure 2. Map of the experimental *Spartina patens* treatment sites and Spartina compost site around Tree Island.

Figure 3a. Three *Spartina patens* experimental burn-sites on Tree Island foreshore with surface vegetation clipped and removed, prepared for burning.

Surface close up:

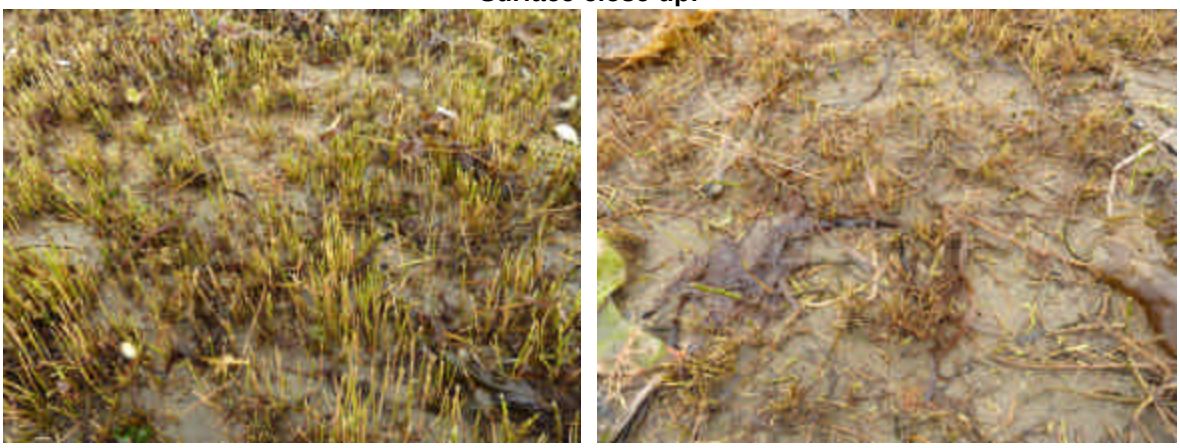

Figure 3b. Clipped surface of future burn-sites for *Spartina patens* on Tree Island foreshore.

The three tiny dig-sites on the Tree Island foreshore that were chosen as *S. patens* manual removal sites are shown in Figure 4. In 2 1/2 hours in the pouring rain and wind, a four-person team manually dug, bagged and removed to the compost site nearly all of the vegetative material. Digging proved easier than for *S. densiflora* as the *S. patens* roots are shallow. But the inclement weather made it difficult to see all the root fragments. Good weather is recommended for this fairly detailed work and the plan is to revisit and complete the manual removal of these dig-sites in the spring. The first site where *S. patens* was removed manually is shown in Figure 4.

As noted, all removed plant material for *S. densiflora* and *S. patens* was composted. On Denman plants were mixed with other invasive species and piled on the contractor's property on Denman Island. Plants from the Sandy Islands' were composted on Tree Island in separate piles for *S. densiflora* and *S. patens*, at a site shown in Figure 2. The piles were covered with tarps and woody debris as shown in Figure 5.

Conclusions & Recommendations

S. densiflora: Manual removal of *S. densiflora* continues to be very successful. Complete data will be available after the final February – March 2017 monitoring session, but it appears from the initial monitoring that the number of regenerating plants has dropped considerably on Denman. After the previous growing season in 2015 almost 13,000 plant bunches were removed, and after the 2016 seaso, so far only 1141 plant bunches were found. The numbers for *S. densiflora* from the Sandy Islands are less dramatic. In the spring of 2016, 491 plant bunches were removed and this fall there were 375. Some of the plants removed in the spring may have been present for more than one season, especially any that were tiny in the fall of 2014. Some of these may have continued to seed the area.

The recheck results confirmed that many tiny *S. densiflora* seedlings can be missed in the actively growing salt marshes, prior to November. But the early removal of potentially reproducing plants is indicated as 3 to 37% of regenerating seedlings reached the seed-bearing stage by mid-October. Thus, at least in the early removal stages, *S. densiflora* is best monitored in the late summer to fall, Aug-Sept and then in the winter, Feb-March. In the future, as plant numbers decline one session will likely be sufficient.

S. patens: Conclusions, from the initial experimental efforts with *S. patens* on the Tree Island foreshore, are that the manual removal of *S patens* in this substrate will require detailed and time-consuming effort in order to extract as many small rhizomatous roots as possible, but it will not be a physically difficult task. As labour-time is costly, removal from large sites will be expensive. The actual effectiveness of manual removal at eliminating *S. patens* re-growth will only be known when these sites are monitored through future growing seasons. Thus, it will take several years to know if spending considerable funds on manual removal of *S. patens* is of value. The root-burning sites remain to be treated in 2017 and they will also be monitored through several seasons. Lastly, the success of *S. patens* composting will be evident after the next growing season.

Surface close up:

Figure 4. ***Spartina patens* experimental manual removal 'dig-site' on Tree Island foreshore, before, and several tides after initial digging and plant removal.**

Figure 5. Tree Island compost site for *S. densiflora* and *S. patens*.

Appendix

Table 1. ***S. densiflora*** **Sites on Denman Island Shoreline Fall 2016**

UTM site	Removal	Total #
10 U 366999 5496719	Oct 11 R M-seed 1	1
10 U 367597 5496251	Oct 11 R M-seed 1	1
10 U 367701 5496145	Oct 11 R M-flower 1	1
10 U 367342 5494878	Oct 11 R M-flower 1 S 1 T 1	3
10 U 366788 5491479	Oct 11 R M-flower 3 S 3 T 2	8
10 U 366771 5491419	Oct 11 R S 1	1
10 U 366796 5491377	Oct 11 R M-flower 1 M 1 T 6	8
10 U 366821 5491336	Oct 11 R S 1	1
10 U 366698 5491012	Oct 11 M-seed 1 T 13	14
10 U 366816 5491352	Oct 10 R S 1	1
10 U 366820 5491337	Oct 10 R S 1	1
10 U 366830 5491317	Oct 10 R S 1	1
10 U 366836 5491298	Oct 10 R S 1 T 1	2
10 U 366700 5491007	Oct 10 R M-seed 1 T 1	2
10 U 366587 5490791	Oct 10 R M-seed 5 M-flower 1 M 1 S 6 T 9	22
10 U 366656 5490780 10 U 366656 5490780	Oct 10 R S 3 T 11	14
10 U 366658 5490759	Oct 10 R M-seed 6 M-flower 5 S 12 T 10	33
10 U 366784 5490456	Oct 10 R S 1	1
10 U 366808 5490407	Oct 10 R M-seed 3	3
10 U 366877 5490246	Oct 10 R T 1	1
10 U 366886 5490207	Oct 9 R T 11	11
10 U 366907 5490167	Oct 9 R M-seed 1 S 5	6
10 U 367618 5489080	Oct 9 R S 1	1
10 U 367709 5488938	Oct 5& 9 R M-seed 2 M-flower 2 M 1 S 71 T 191	267
10 U 367905 5488765	Oct 5 R M 1	1
10 U 367808 5488852	Oct 5 R T 1	1
10 U 367795 5488864	Oct 5 R T 1	1
10 U 368041 5488627 10 U 368004 5488669	Oct 3 R S1 T 6	7
10 U 368110 5488556	Oct 5 R M 1	1
10 U 368288 5488431	Oct 3 R S 1	1
10 U 368365 5488366	Oct 3 R S 1	1
10 U 368545 5488213	Oct 3 R S 1	1
10 U 368178 5488494	Sep 30 R S 12 T 10	22
10 U 373143 5483170	Sep 30 R S 2 T 1	3
10 U 373143 5483170	Sep 30 R M-seed 1 M-flower 12 S 28 T 45	86
10 U 373293 5483052	Sep 30 R M-flower 1 S 1 T 1	3
	Sep 30 R M-seed 2 M-flower 1 M 1 S 25 T 64	93
10 U 373364 5483002	Sep 30 R T 2	2
10 U 373436 5482891	Sep 30 R M-flower 1 S 4	5
10 U 373504 5482852	Sep 30 R M-flower 4 M 4 S 17 T 1	26
10 U 373638 5482797	Sep 29&30 R M-seed 2 S 22 T 76, Oct 31 & Nov 3 R S 1 T 74	175
10 U 373701 5482868	Sep 27 & 29 R M-seed 1M-flower 3 S 5 T 1, Oct 31 & Nov 3 R S 8 T 20	38
10 U 373765 5482891	Sep 27 R S 5, Sep 30 R T 2, Oct 31 R T 2	9
10 U 373796 5482889	Sep 27 R M-flower 1 S 5 T 3, Sep 30 R T 4, Oct 31 R T 1	14
10 U 373809 5482890	Sep 27 R S 35 T 5, Sep 30 R T 2, Oct 31 R S 1 T 9	52
10 U 373791 5482892	Sep 27 R S 4	4
10 U 373855 5482843	Sep 27 R S 2	2
10 U 373883 5482817	Sep 27 R M-flower 1 S 4, Nov 4 R S 1	6
10 U 374022 5482715	Sep 27 R S 3	3

Denman Island Fall 2016 continued.

UTM site	Removal	Total #
10 U 374832 5482614	Sep R S 44 T 7	51
10 U 374874 5482635	Sep R S 1	1
10 U 374906 5482658	Sep R S 2	2
10 U 373811 5482891	Sep 27 R M-seed 1 M-flower 2 S 2	5
10 U 375487 5482577	Sep 28 R S 1	1
10 U 375832 5482357 10 U 375884 5482329	Sep 28 R S 1 T 2	3
10 U 376799 5481935	Sep 28 R M 1	1
10 U 376810 5481935	Sep 28 R M-flower 1	1
10 U 376828 5481933	Sep 28 R M 15 M-seed 2 M- flower 20 S 26 T 4, Nov 1 R S 1 T 40	108
10 U 374753 5485273	Sep 29 0	0
10 U 374695 5485156	Sep 29 R S 1 T 1	2
10 U 374697 5485083 10 U 374696 5485031	Sep 29 R S 2 T 3	5
10 U 374688 5484957		
	TOTAL	**1141**

Sites Rechecked:	
Site Importance:	**20-49**
	50-99
	>100

2016 PLANT SIZE designations: All with flower or seed called at least M, S 5-10 stems, T <5 stems

Table 2. ***S. densiflora*** **Sites on the Sandy Islands Fall 2016**

UTM	Site	Removal	Total #
10 U 366954 5497452	Tree	Oct 13 R M-seed 1	1
10 U 367022 5497482	Tree	Oct 13 R M-seed 2	2
10 U 367046 5497488	Tree	Oct 13 R M-seed 2	2
10 U 367060 5497512	Tree	Oct 13 R M-seed 5	5
10 U 367070 5497535	Tree	Oct 13 R M-seed 1	1
10 U 367066 5497550	Tree	Oct 13 R M-seed 31 M-flower 7 S 26 T 14	78
10 U 365954 5497760	Tree	Oct 13 R M-seed 15 M-flower 4	19
10 U 366278 5497786	Tree	Oct 13 R M-seed 1	1
10 U 366304 5497785	Tree	Oct 13 R S 10	10
10 U 366328 5497784	Tree	Oct 13 R M-seed 12 T 1	13
10 U 366624 5497615	Tree	Oct 13 R M-seed 4 M-flower 2 S 1 T 1	8
10 U 366926 5497436	Tree	Oct 14 R S 2	2
10 U 366806 5497475 10 U 366770 5497488	Tree	Oct 14 R M-seed 3	3
10 U 366656 5497594	Tree	Oct 14 R M-seed 2 M-flower 1 S 5 T 2	10
10 U 366413 5497759	Tree	Oct 14 R M-flower 2 S 5 T 1	8
10 U 366275 5498337	Inter-islet SM	Oct 14 R M-seed 1 S 1	2
10 U 366220 5498209	Tree	Oct 14 R T 4	4
10 U 366208 5498173	Tree	Oct 14 R M-seed 6 M-flower 2 S 5 T 1	14
10 U 366991 5497585	Tree	Oct 15 R S 5	5
10 U 366940 5497624	Tree	Oct 15 R S 2	2
10 U 366912 5497635 10 U 366894 5497653 10 U 366897 5497664	Tree	Oct 15 R M-flower 2 S 10 T 9	21
10 U 366852 5497747		Oct 15 R M-seed 16 M-flower 4 S 28 T 28	76
10 U 366743 5497709	Tree	Oct 15 R M-seed 1	1
10 U 366293 5498105	Tree	Oct 15 R M-seed 2	2
10 U 366213 5498159	Tree	Oct 15 R T 1	1
10 U 366246 5498141	Tree	Oct 15 R S 1 T 5	6
10 U 366301 5498099	Tree	Oct 15 R T 1	1
10 U 366802 5497723	Tree	Oct 15 R S 1	1
10 U 366910 5497714	Tree	Oct 15 R T 2	2
10 U 366904 5497678	Tree	Oct 15 R T 1	1
10 U 366893 5497663	Tree	Oct 15 R S 1	1
10 U 367075 5497576	Tree	Oct 15 R M-flower 1 S 2	3
10 U 366921 5498006	2nd Islet	Oct 16 R M-seed 2	2
10 U 366938 5498007	2nd Islet	Oct 16 R M-seed 1	1
10 U 366881 5498098	2nd Islet	Oct 16 R M-seed 1	1
10 U 366790 5498150	2nd Islet	Oct 16 R M-seed 2 T 1	3
10 U 366588 5498238	2nd Islet	Oct 16 R M-seed 1	1
10 U 366548 5498268	2nd Islet	Oct 16 R T 5	5
10 U 366531 5498284	2nd Islet	Oct 16 R M-seed 1	1
10 U 366503 5498311	2nd Islet	Oct 16 R M-seed 2 M-flower 1 S 2	5
10 U 366490 5498324	2nd Islet	Oct 16 R M-flower 1	1
10 U 366461 5498356	2nd Islet	Oct 16 R M-seed 1 T 8	9
10 U 366448 5498370 10 U 366393 5498423	2nd Islet	Oct 16 R M-seed 5 S 1 T 21	27
Add to total from Tree during Spartina patens work : ~ S 5 T 8			13
		Total Plant clumps	**375**

2016 PLANT SIZE designations: All with flower or seed called at least M, S 5-10 stems, T <5 stems

Site Importance:	**20-49**
	50-99
	>100