

2016

British Columbia Spartina Eradication Program Progress Report

Prepared By
Ducks Unlimited Canada
#511 – 13370 78th Ave
Surrey, BC, V3W 0H6
604-592-0987

On Behalf of the BC Spartina Working Group



British Columbia Working Group Members Include:

City of Surrey

Coastal Invasive Species Committee (CISC)

Community Mapping Network (CMN)

Corporation of Delta

Invasive Species Council of Metro Vancouver (ISCMV)

Ducks Unlimited Canada (DUC)

Environment Canada – Canadian Wildlife Service (CWS)

Fisheries and Oceans Canada (DFO)

Friends of Semiahmoo Bay Society (FOSBS)

Metro Vancouver

Ministry of Environment (MoE)

Ministry of Forests, Lands & Natural Resource Operations (FLNRO)

Port Metro Vancouver (PMV)

City of Port Moody

Vancouver Island Conservation Lands Management Program (VICLMP)

We gratefully acknowledge the financial support of the following agency and organizations:



TABLE OF CONTENTS

ACKNOWLEDGEMENTS	4
EXECUTIVE SUMMARY	6
BACKGROUND	7
DETECTION	9
FRASER DELTA AND BOUNDARY BAY	9
BURREARD INLET	12
VANCOUVER ISLAND	13
DENMAN ISLAND, HORNBY ISLAND AND SANDY ISLAND	17
CENTRAL COAST.....	18
CONTROL & REMOVAL	19
FRASER DELTA AND BOUNDARY BAY	19
<i>Manual Control</i>	19
<i>Herbicide Control</i>	20
BURREARD INLET	23
<i>Manual Control</i>	23
VANCOUVER ISLAND MANUAL CONTROL	26
<i>Manual and Mechanical Removals</i>	26
<i>Shading</i>	26
DENMAN ISLAND, HORNBY ISLAND AND SANDY ISLAND – MANUAL CONTROL	27
<i>Mechanical Excavation</i>	27
<i>Mowing</i>	27
SCIENCE – EVALUATION - MONITORING	27

BURRARD INLET – HERBICIDE VS SHADING COMPARISON TRIAL.....	27
SPARTINA PATENS MONITORING – MAPLEWOOD CONSERVATION AREA.....	28
OUTREACH	28
INFORMATION AND INTERNET RESOURCES	28
SPARTINA IN THE MEDIA	28
SPARTINA PRESENTATIONS AND WORKSHOPS	29
FINANCES	30
PARTNERSHIPS	32
RECOMMENDATIONS FOR 2017	33
APPENDIX 1 - DETECTION	36
1.1 SPARTINA INVASION SUMMARY	36
1.2 FRASER DELTA AND BOUNDARY BAY	37

ACKNOWLEDGEMENTS

The work of the 2016 *Spartina* Eradication Program could not have been undertaken without funding from the Government of Canada (National Wetlands Conservation Plan, SummerWork Experience Programs), Province of British Columbia (Ministry of Forests, Lands and Natural Resource Operations, Ministry of Environment), Port of Vancouver, TD Friends of the Environment Foundation and Ducks Unlimited Canada. The BCSWG partners, plus other groups and several independent volunteers all helped to make this year's early detection rapid response (EDRR) efforts possible.

The representatives to the BCSWG included Kathleen Moore (Environment Canada – Canadian Wildlife Service - CWS), Robyn Worcester (Metro Vancouver), Kevin Li (Corporation of Delta), Liana Ayach (City of Surrey), Dan Buffett & Matt Christensen (Ducks Unlimited Canada), Rob Knight (Community Mapping Network), Margaret Cuthbert (Friends of Semiahmoo Bay), Becky Brown (Ministry of Forests, Lands & Natural Resource Operations), Kim Keskinen (Port Metro Vancouver), Graham Watson, Tasha Murray (Invasive Species Council of Metro Vancouver), Matthias Herborg (Ministry of Environment), Rachelle McElroy (Coastal Invasive Species Committee-CISC), Steve Godfrey, Karen Barry, and Tom Reid (Vancouver Island Conservation Land Management Program, VICLMP).

In addition, special thanks are extended to the field coordinators (Shawn Lukas, Mike Reid, Jennifer Sutherst, Ryan May and Jenny Balke) for their dedication and hard work amidst the uncertainty of funding as well as BC Conservation Foundation (BCCF) coordinator Katie Calon. Several work crews were a cornerstone to the implementation of the *Spartina* mapping and control work and they include BCCF, DUC, CWS, Denman and Hornby Islands, VICLMP, Corporation of Delta, and the City of Surrey summer technicians.

Between April 2016 and March 2017, many other individuals and groups contributed to finding and removing *Spartina spp.* in BC. Many landowners provided access through their property to map and control *Spartina* and we thank them for their support. The BCSWG is grateful for the hard work by numerous volunteers and partner organizations that mapped and removed *Spartina* on the Fraser Delta and in the Baynes Sound area. Those contributions to the BCSWG program are acknowledged in Table 1.

Table 1. List of 2015 participants by organization who helped map and control Spartina in BC

Organization	Participants
City of Surrey; SHaRP Program	Stephen Cara, Sarah Wong, William (Bill) Woods, Steve Zakrzewski, Nida Asad, Kierny Matthews, Crystal Tseng, Thumn Al-Rawe, Miriam Ayach, Emmanuel Baig, Maria Balisi, Tyler Blackwell, Yashashwini Hamal, Todd Higo, Anna Janzen, Jaskiran Karwal, Jasmine Padam, Jun Ryu, Jackson Simmons, Anoop Sarang, Tendayi Tsikayi, Miggy Ferrera, Roya Hussiny, Robin Jhatu, Nicholas Mann
Corporation of Delta	Kevin Li
Ducks Unlimited Canada	Matt Christensen
Environment Canada – Canadian Wildlife Service	Kathleen Moore
Ministry of Forests, Lands & Natural Resource Operations	Becky Brown
Port Metro Vancouver	Kim Keskinen
Raincoast Education Society	Dan Harrison
Parks Canada	JenniferYakimishyn
Tsawwassen First Nation TFN Construction / Matcon Joint Venture	Nicci Burgunder
Vancouver Island Conservation Lands Management Program	Steve Godfrey, Karen Barry, Hilary Blackman, Blair Dudeck, Jaylene Harper, Kim Wetten and Tom Reid
K'omoks First Nation	Cory Frank
Volunteers in the Fraser Delta	Megan Guo, Theo Harwood
Volunteers on Vancouver Island	Ryan May, P. Scott, T. Ingram, Lichen, M. McNulty and Susan Fussell

EXECUTIVE SUMMARY

In 2016, the British Columbia Spartina Working Group (BCSWG) continued to work toward the eradication of non-native, invasive *Spartina* species along the BC Coast. BCSWG recognizes the potential impacts of *Spartina* on local shorelines and wildlife habitat and is striving to support the Pacific Coast Collaborative goal of eradication of all non-native *Spartina* species (*Spartina anglica*, *Spartina densiflora*, and *Spartina patens*) by 2018 along the coasts of BC, Washington, Oregon and California.

In 2016, the BC Spartina Eradication Program applied approximately \$474,000 of in-kind and direct value to deliver program components focused on Monitoring, Removal, Herbicide, Coordination, Outreach and Science/Evaluation. The monitoring program included mapping over 600 km of BC's coastline and removing approximately 30 000 plants from the Lower Mainland, East Coast of Vancouver Island, Denman Island, Hornby Island, Sandy Island and Seal islets.

The 2016 inventory shows the density and abundance of *Spartina anglica* in Boundary Bay and Robert's Bank has continued to increase since 2007. However, the total number of large plants (> 0.3 m in diameter) is declining and the geographic extent of this species has reduced. Herbicide has played a critical role in maintaining containment of *Spartina anglica* as the geographic extent has continued to decline.

Manual/mechanical control has been effective for controlling and reducing *Spartina densiflora* on Denman Island, Hornby Island, Sandy Island and the east coast of Vancouver Island. While seedlings are still present, density has decreased since 2015. *Spartina patens* however has continued to increase in abundance, extent and density on Vancouver Island. New methods of removal for *Spartina patens* (i.e., manual, mechanical, cover plots, mowing and the use of herbicide) are being tested in the Lower Mainland and east coast of Vancouver Island.

BACKGROUND

In 2003, *S. anglica* was found in the Fraser River Delta by Gary Williams, a consultant for the Port Metro Vancouver, while conducting habitat surveys of the intertidal areas. This was the first record of *S. anglica* in BC and raised concerns about the spread of this invasive cordgrass. The Fraser Delta has approximately 25,000 ha of tidal mud flat that is internationally recognized as important habitat for fish and migratory birds. In all of Canada, the Fraser Delta has the highest density of wintering waterfowl, shorebirds and raptors. Prior to 2003, *S. patens* was identified in both Burrard Inlet and Courtenay estuary (1979). In 2005, *S. densiflora* was confirmed in the Baynes' Sound area of Vancouver Island. However, based on anecdotal conversations, it is believed to have been present there for some time.

The impacts of *Spartina* species include: conversion of mudflats to monoculture stands, loss of habitat for waterfowl and fish, accretion of sediments, and modification of drainage patterns. Intertidal areas in Washington State dominated by *Spartina* have exhibited large declines in the abundance of shorebirds and waterfowl. Significant expenditures have been required to control *Spartina* in Washington State costing approximately one million dollars per year. Oregon and Washington states spent approximately \$50,000,000 over a ten-year period in a concerted effort to eradicate *Spartina sp.* in their coastal habitats. It is only recently with sustained funding and use of herbicide that the States have significantly reduced the *Spartina* infestations. Controlling the spread at the early stages of species expansion is the most cost-effective approach and it is critical to control *Spartina* in BC as early as possible. The loss of important intertidal habitats in BC will be detrimental to a multitude of species and will require considerably greater resources to control in the future.

The BCSWG formed in 2004 and includes members from both government and non-government organizations. The team represents a diversity of responsibilities including: environment, migratory birds, habitat restoration, and public use. In addition, the team liaisons with San Francisco Estuary *Spartina* Project and the Washington State Department of Agriculture, which are two U.S. agencies involved in *Spartina* eradication along the Pacific Coast. The focus of this group is to employ early detection and rapid response methods to eradicate *Spartina*. Currently, there are mapping and removal efforts taking place around the Fraser Delta, Burrard Inlet, and east coast of Vancouver Island and around selected Gulf Islands. However; more work is needed to monitor other parts of the BC Coastline and expand the eradication efforts.

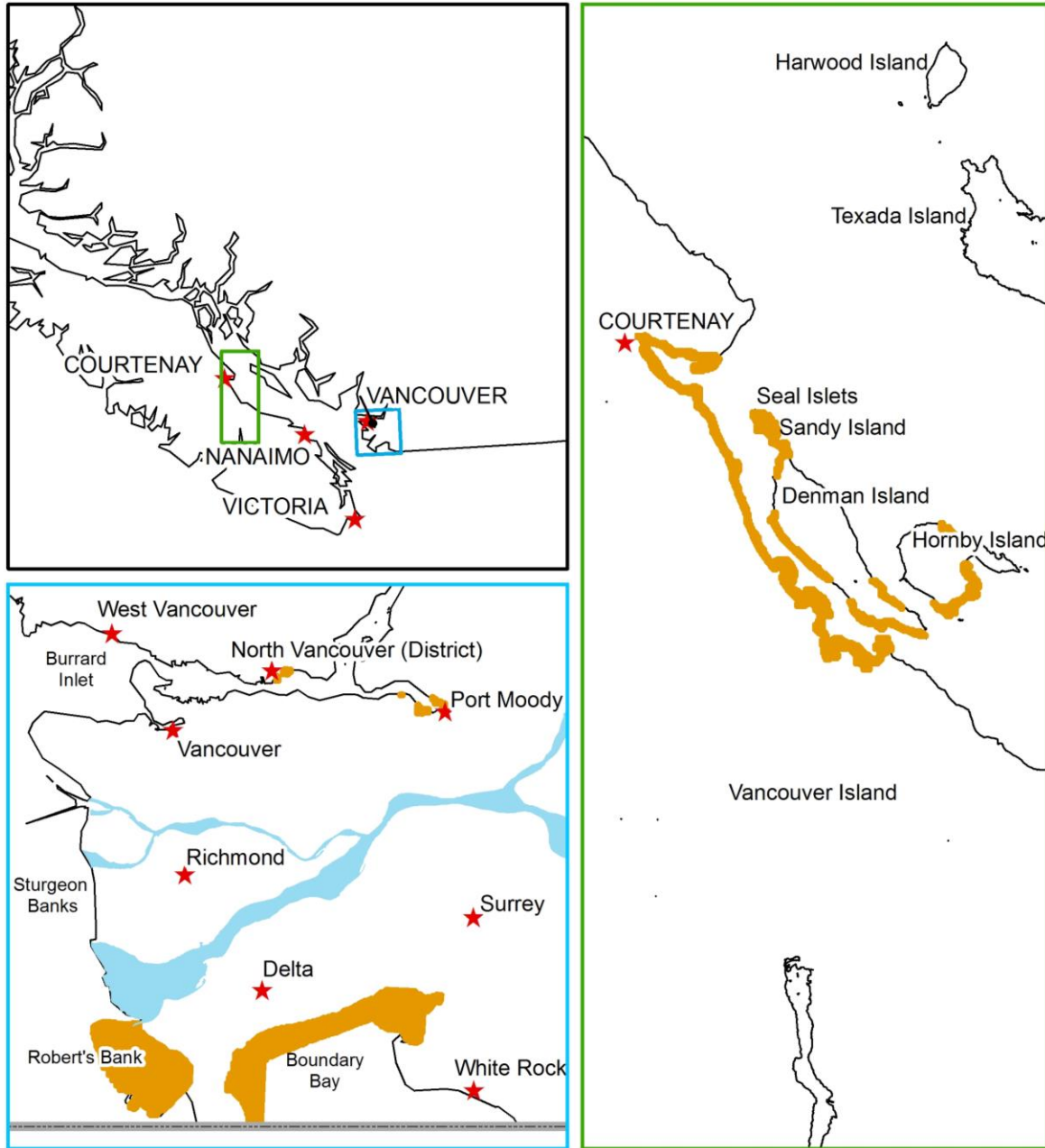


Figure 1. General Locations where *Spartina* is found in BC. Blue (Lower Mainland) & Green (Baynes' Sound). Approximate distribution of *Spartina sp.* shown in orange.

DETECTION

Data compilation and storage for *Spartina* sp. data (2004 to 2016) is provided in part by the Community Mapping Network (CMN). Mapping methodology along with a summary of the *Spartina* invasion up to 2016 are found in Appendix 1; Table 4. Species, plant size, GPS location and the extent of the area searched can be viewed at www.spartina.ca. This data is used for evaluating eradication progress and planning future monitoring and control activities. Ducks Unlimited Canada (DUC) also maintains ESRI shapefile copies of these data for GIS analysis.

Spartina data is also entered into the Invasive Alien Plant Program (IAPP) database (<http://www.for.gov.bc.ca/hra/Plants/application.htm>).

FRASER DELTA AND BOUNDARY BAY

In 2016, approximately 273-person days were devoted to map and remove *Spartina* along approximately 43 km of shoreline in the Fraser Delta (Figure 2). One *S. anglica* seedling was found at Sturgeon Banks in Richmond, outside of containment boundaries for Boundary Bay and Roberts Bank. The known extent of *S. anglica* is in the Lower Mainland in Boundary Bay between Blackie Spit and Beach Grove and at Robert's Bank between Brunswick Point and the north side of the Tsawwassen Ferry Terminal (Figure 3, Figure 4). *S. anglica* has been found growing in all intertidal zones and on a variety of substrates ranging from fine silt/mud, sand to cobble. A summary of *Spartina anglica* based on clone sizes is found in Appendix 1; Table 5 and Figure 15.

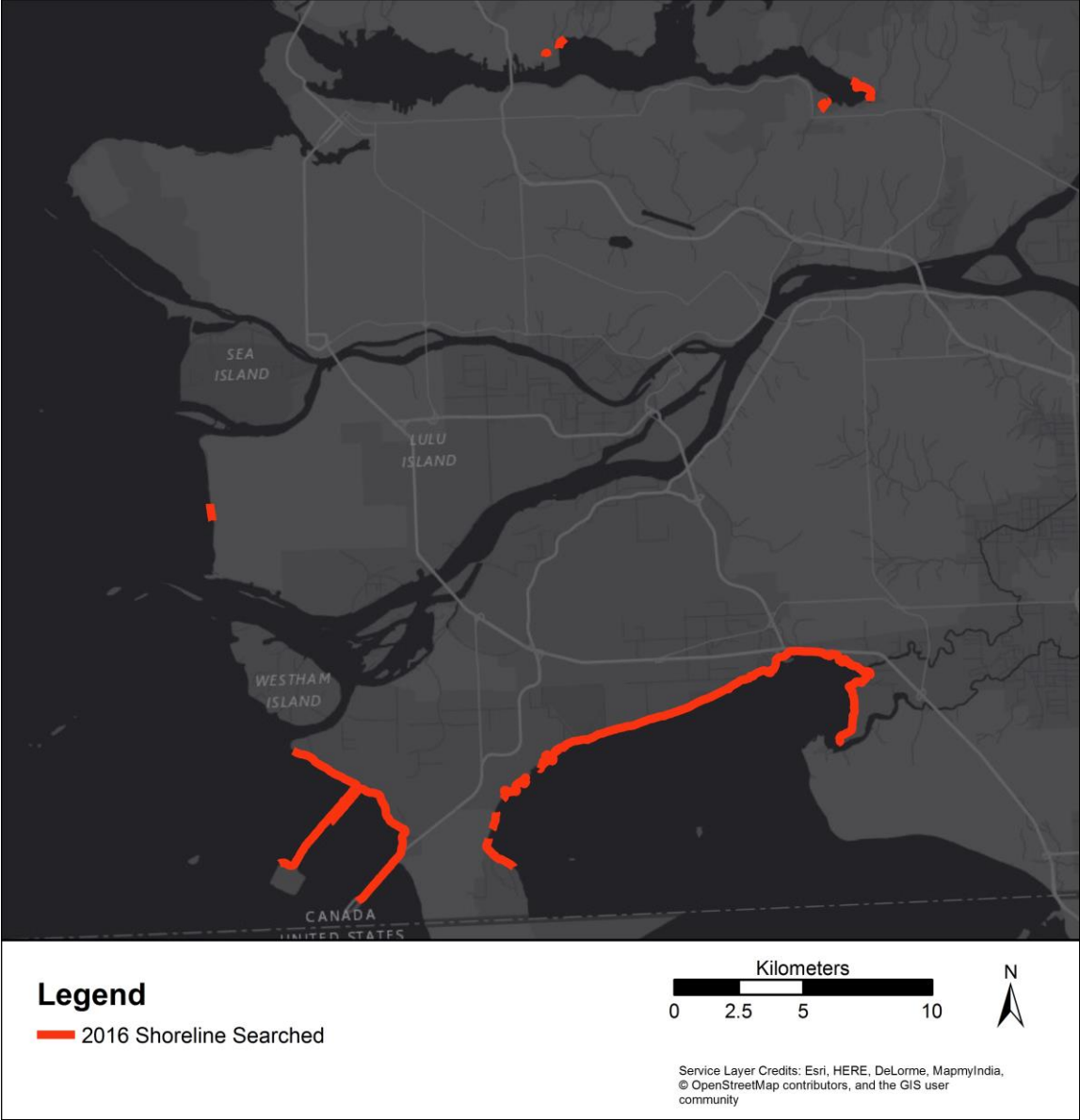


Figure 2. Coastline searched for *Spartina* sp. in the Lower Mainland in 2015

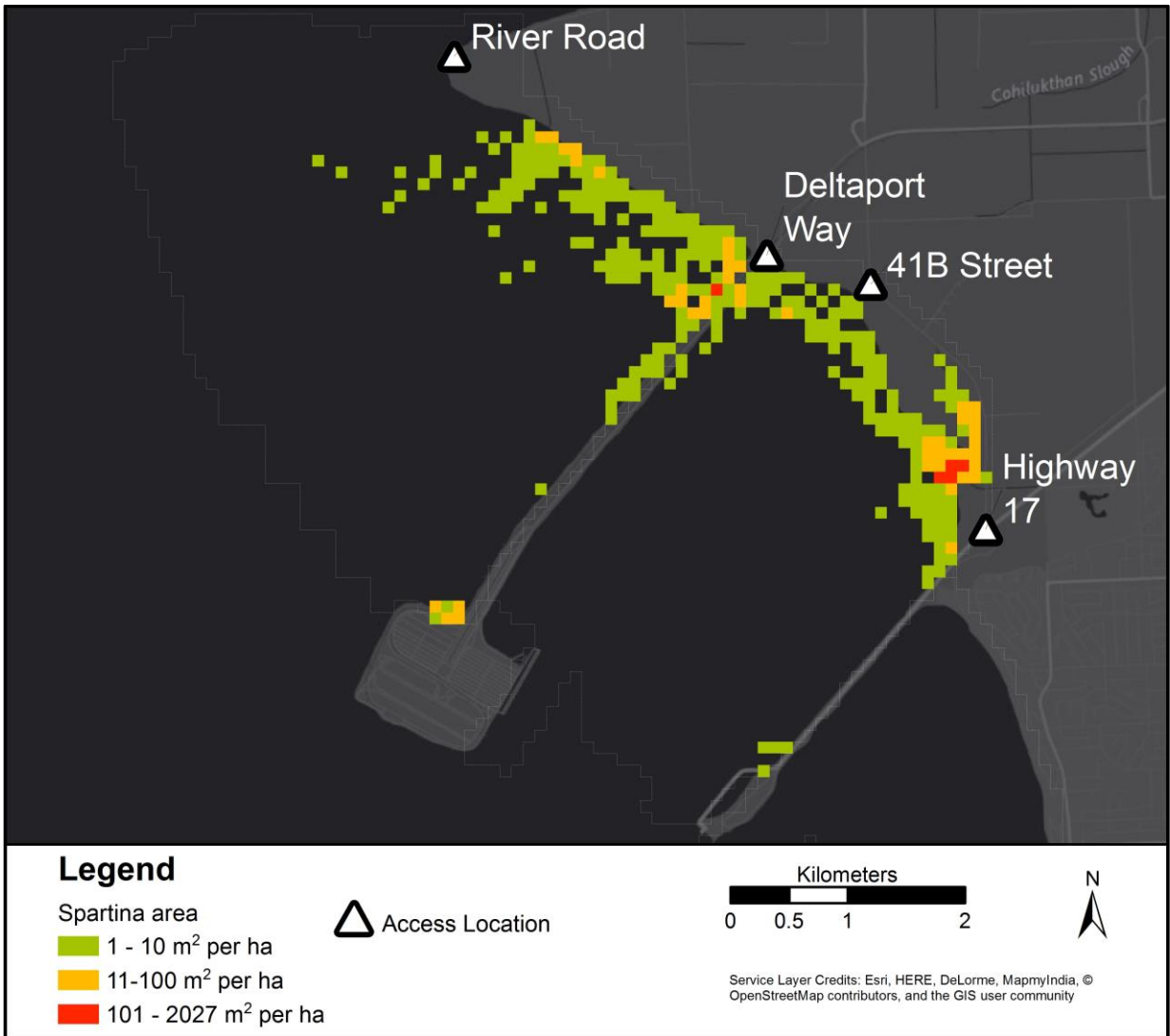


Figure 3. 2016 Spartina Infestation in Roberts Bank

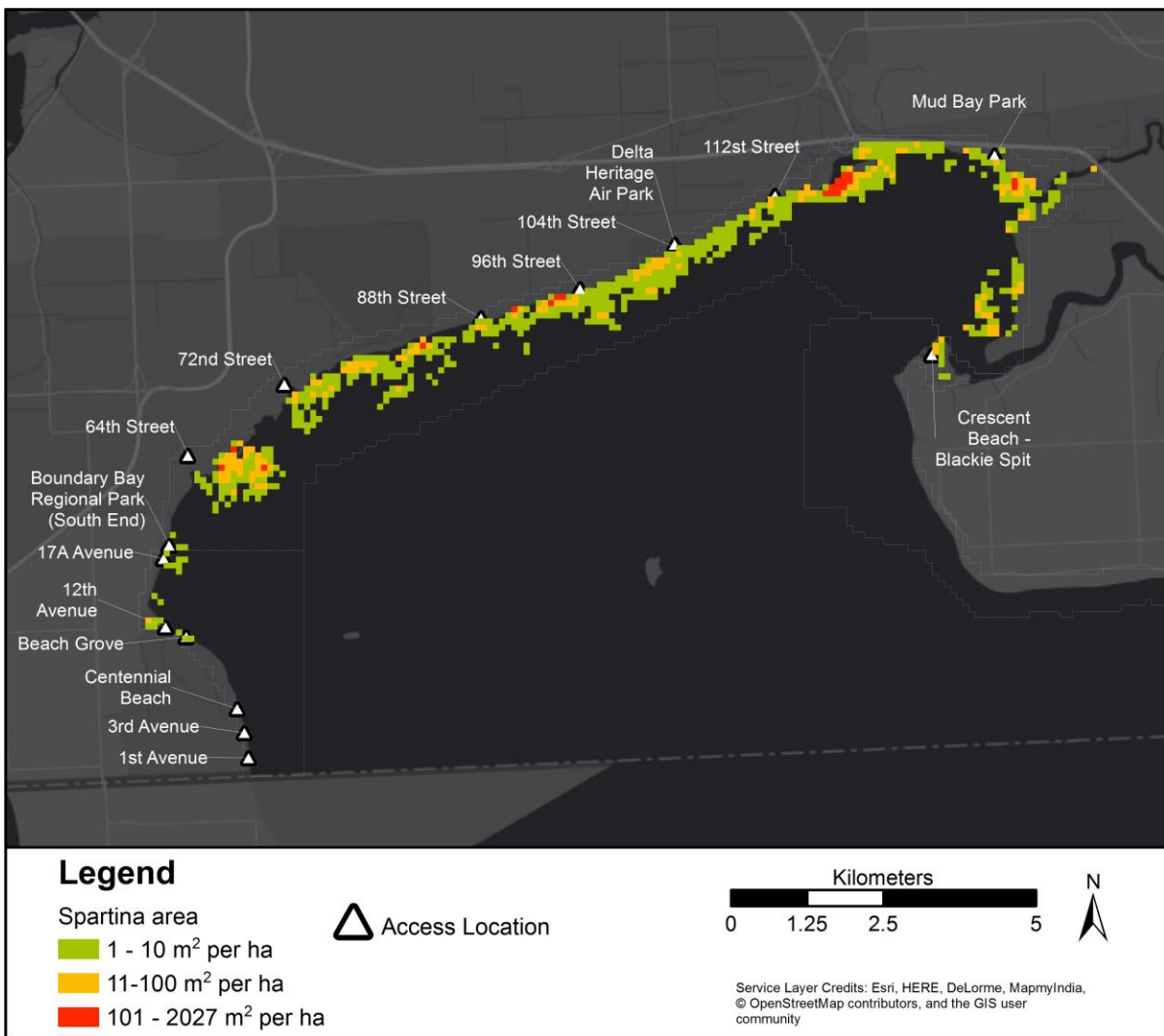


Figure 4. 2016 Spartina Infestation in Boundary Bay

BURRARD INLET

In 2016, the shoreline was checked at three known locations in Burrard Inlet: Maplewood Conservation Area in the District of North Vancouver, Old Orchard/Shoreline Park and Flavelle Cedar Mill/ Pacific Coast Terminals foreshore in Port Moody. *S.patens* is found in two main geographic areas of Burrard Inlet, Maplewood Flats Conservation Area and Port Moody Arm as shown in Figure 5. *S.patens* appears to have a relatively stable population and clone expansion is slower compared to *S. anglica*.

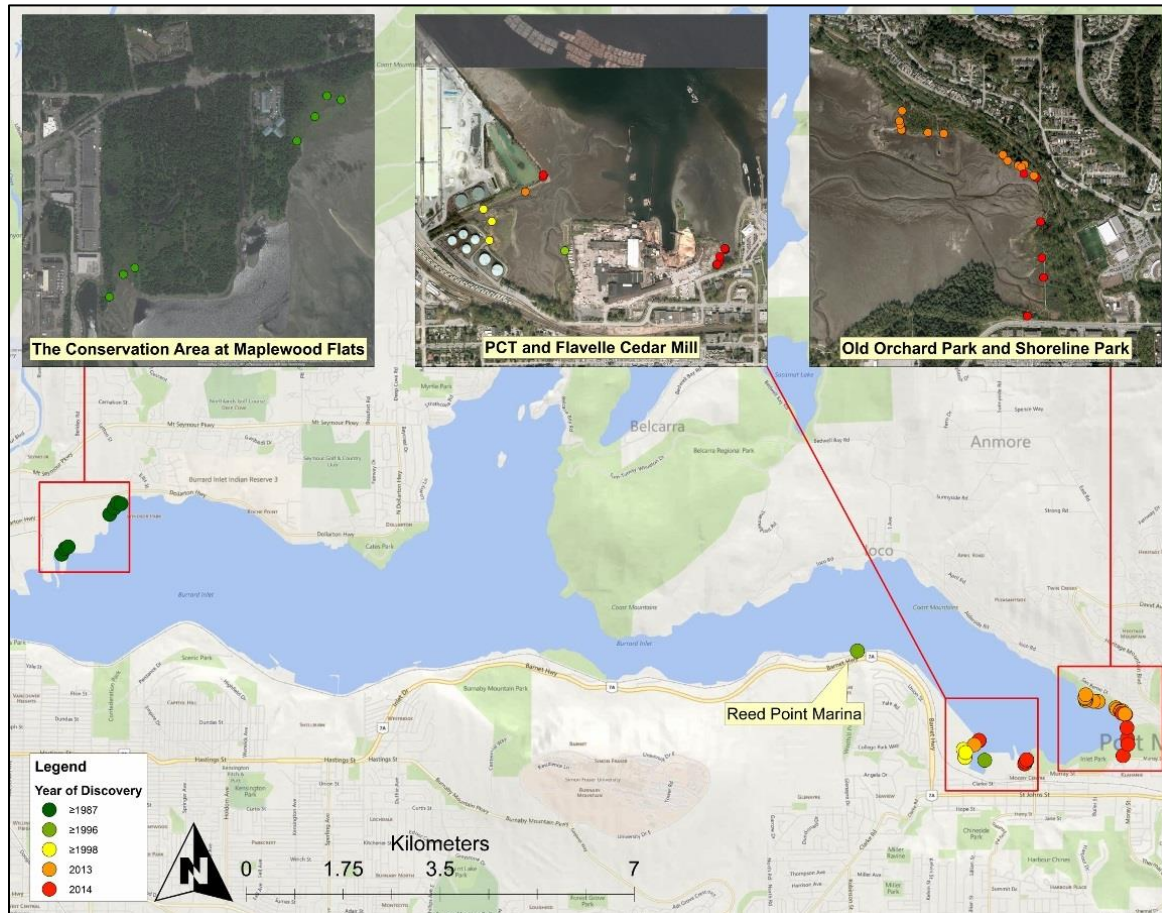


Figure 5. Current Mapped Distribution of *S.patens* in Burrard Inlet – 2016

VANCOUVER ISLAND

Approximately 289 kilometers on the east coast on Vancouver Island were surveyed for *Spartina*, including 121 kilometers of foot-based surveys and 138 kilometers of boat-based as shown in Figure 7. Most *S. densiflora* found on the east coast of Vancouver Island was new germination from seed and/or rhizomes as shown in Table 2.

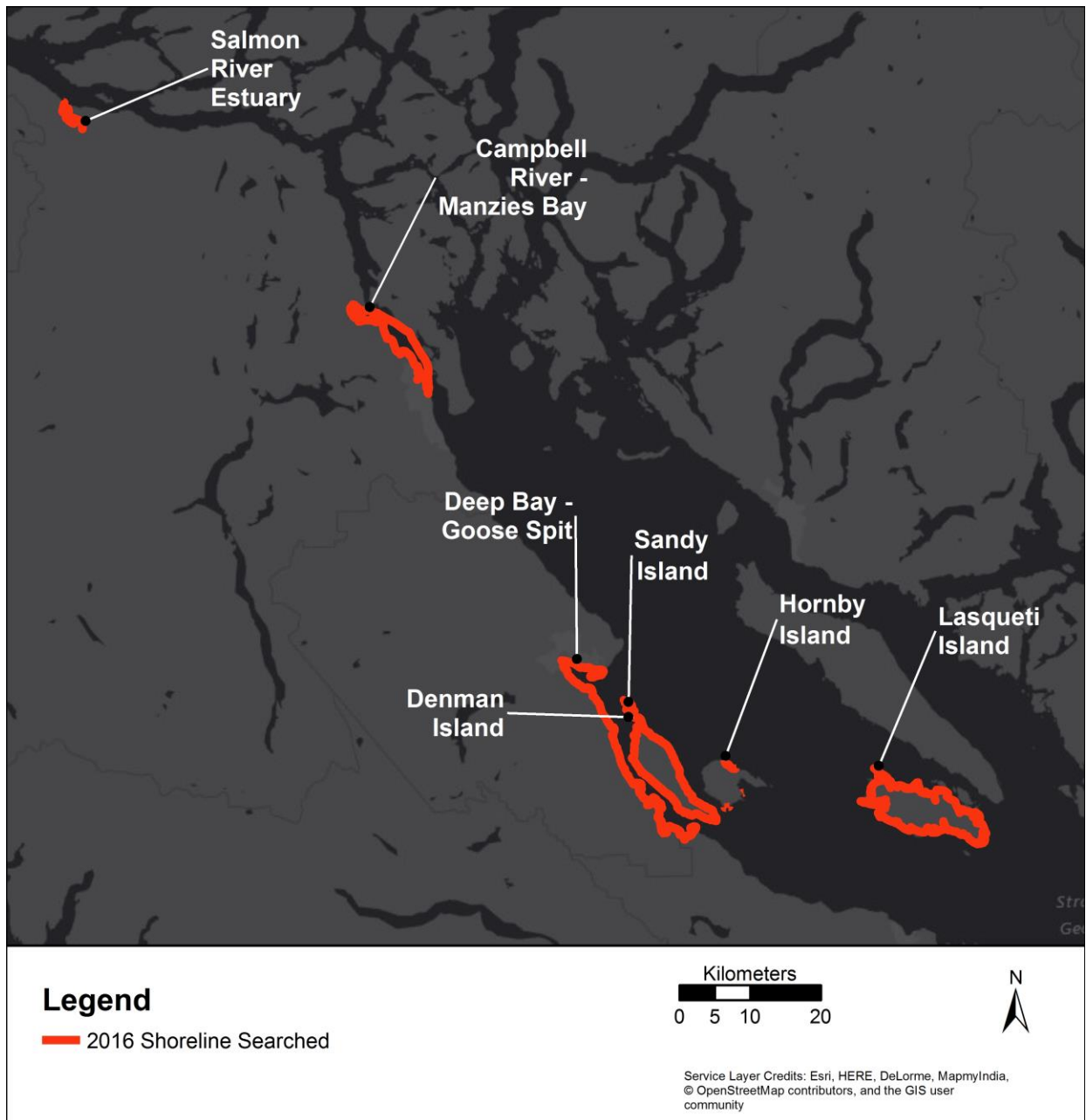


Figure 6. Vancouver Island and Gulf Island *Spartina* search areas

There has been a reduction in the average size of *S. densiflora* plants throughout Baynes Sound however the number of plants recorded have increased with most being seedlings. Ongoing mapping and manual removal will be required for *S. densiflora* to continue reducing the overall population in BC. Those sites which received manual digging treatments in previous years have shown very little vegetative re-growth from previously dug clones, although there are often new clones beginning to establish themselves from seed.

Table 2. Change in abundance of *S. densiflora* plants before and after manual treatments in the spring on the East Coast of Vancouver Island

	2015 Program Year		2016 Program Year	
	First Pass Summer 2015	Second Pass February 2016*	First Pass Summer 2016	Second Pass Jan-Feb 2017*
Size Class	Frequency of size class observed			
<i>S (Seedling)</i>	107	0	370	51
<i>A (<30cm)</i>	55	0	488	0
<i>B (30cm – 100cm)</i>	2	0	425	1
<i>C (>100cm)</i>	0	0	4	0
<i>D (Site of several seedlings)</i>	72	20	32	5
<i>M</i>	0	0	52	10
TOTAL	236	20	1371	67
*Indicates 2 nd pass				

Approximately 144 kilometers on the west coast of Vancouver Island (including Tofino WMA) was surveyed for *Spartina* by the Raincoast Education Society (RES) and Pacific Rim National Park staff during the 2016 BC SWG program year. Survey locations included: Arakun and Ducking flats, Maltby Slough, South Bay, Laddie, Mike's Islands, Grice Bay to Cannery Bay & Indian Island, Tonquin Beach & Duffin Cove to Tofino Botanical Gardens, Raccoon Island, east side of Vargas Island & South portion of Meares Island (including Opitsaht IR), Long Beach, Comber's Beach, Wickaninnish Beach, and Florencia Bay, Radar Beach, and Schooner Cove (Figure 7). No *Spartina* was observed.

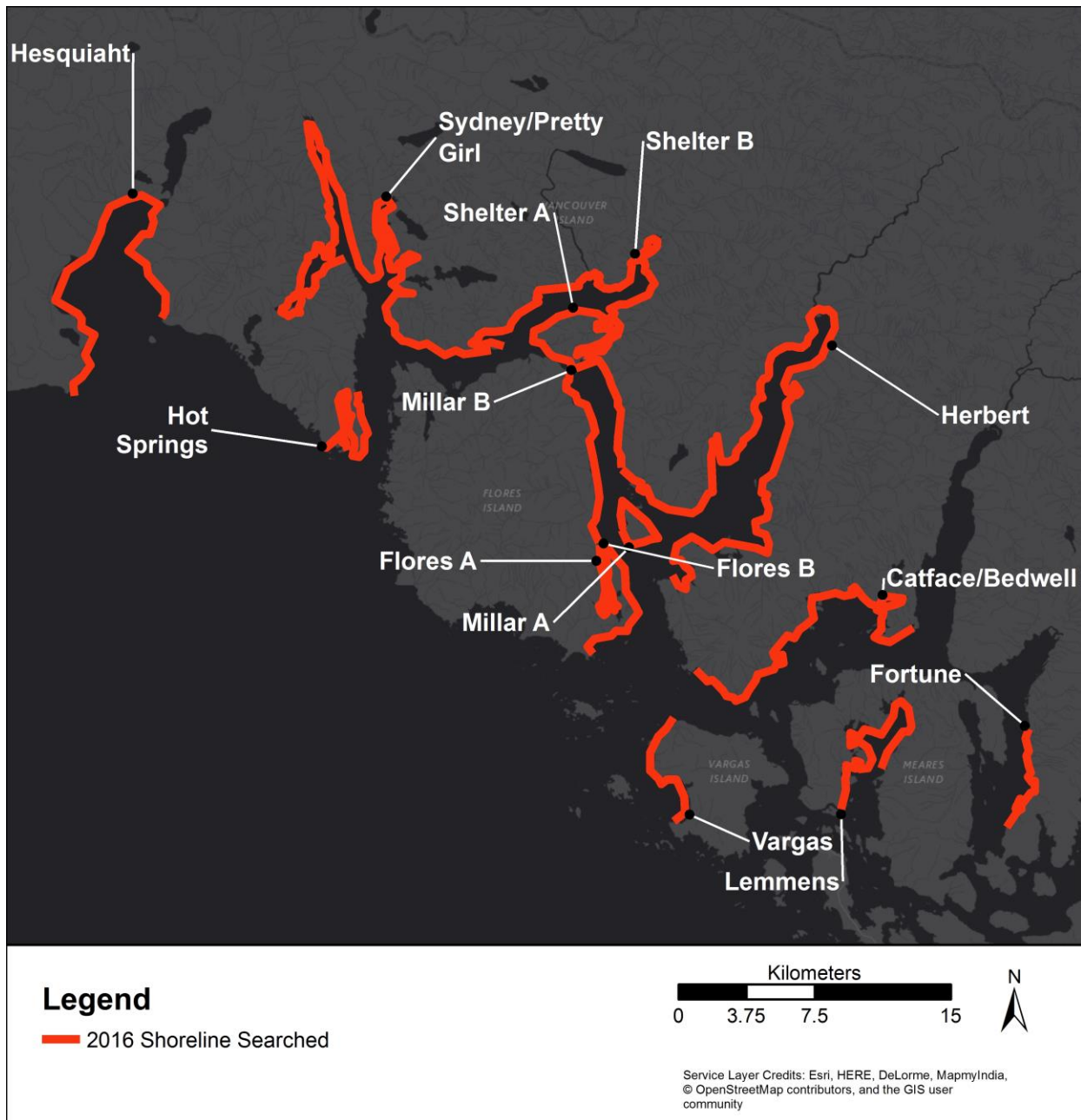


Figure 7. West Coast Vancouver Island 2016 *Spartina* search areas

S. patens remains primarily contained in the Courtenay Estuary, with isolated patches found along Sandy Island, Royston, Union Bay and Buckley Bay. Approximately 8 hectares of *S. patens* was mapped in Baynes Sound from Goose Spit to Royston This approximate area was calculated

by drawing polygons around infested areas using the smart device app, GIS Kit by Garafa¹, and while this method may clearly indicate different levels of infestation across the region, it does not accurately measure the total area or patch size of *S. patens* plants. The BC SWG will continue to develop and evaluate the inventory strategy to better track *S. patens*.

DENMAN ISLAND, HORNBY ISLAND AND SANDY ISLAND



Figure 8. *S. densiflora* seedlings on Denman Island

In 2016, approximately 57 kms of shoreline was searched for *Spartina* on Denman Island and Hornby Island, respectively. Jenny Balke coordinated mapping and removals on the shorelines of Denman and Hornby Islands with support from Ryan May, P. Scott, T. Ingram, Lichen, M. McNulty and Susan Fussell. The shorelines of all three islands were checked twice for *Spartina* spp as identification of *Spartina densiflora* is easier when native vegetation senesces.

Regenerated *Spartina densiflora* seedlings were present in areas previously known to have *Spartina*; suspected to be left over larger

patches of *Spartina densiflora* from the 2015-16 season (Figure 9). Between October 2016 and March 2017, approximately 1400 plants from Denman and 1200 plants from Sandy and Hornby Island were manually dug, bagged and composted. *Spartina* was not observed in any new areas.

¹ <http://garafa.com/wordpress/all-apps/gis-pro>

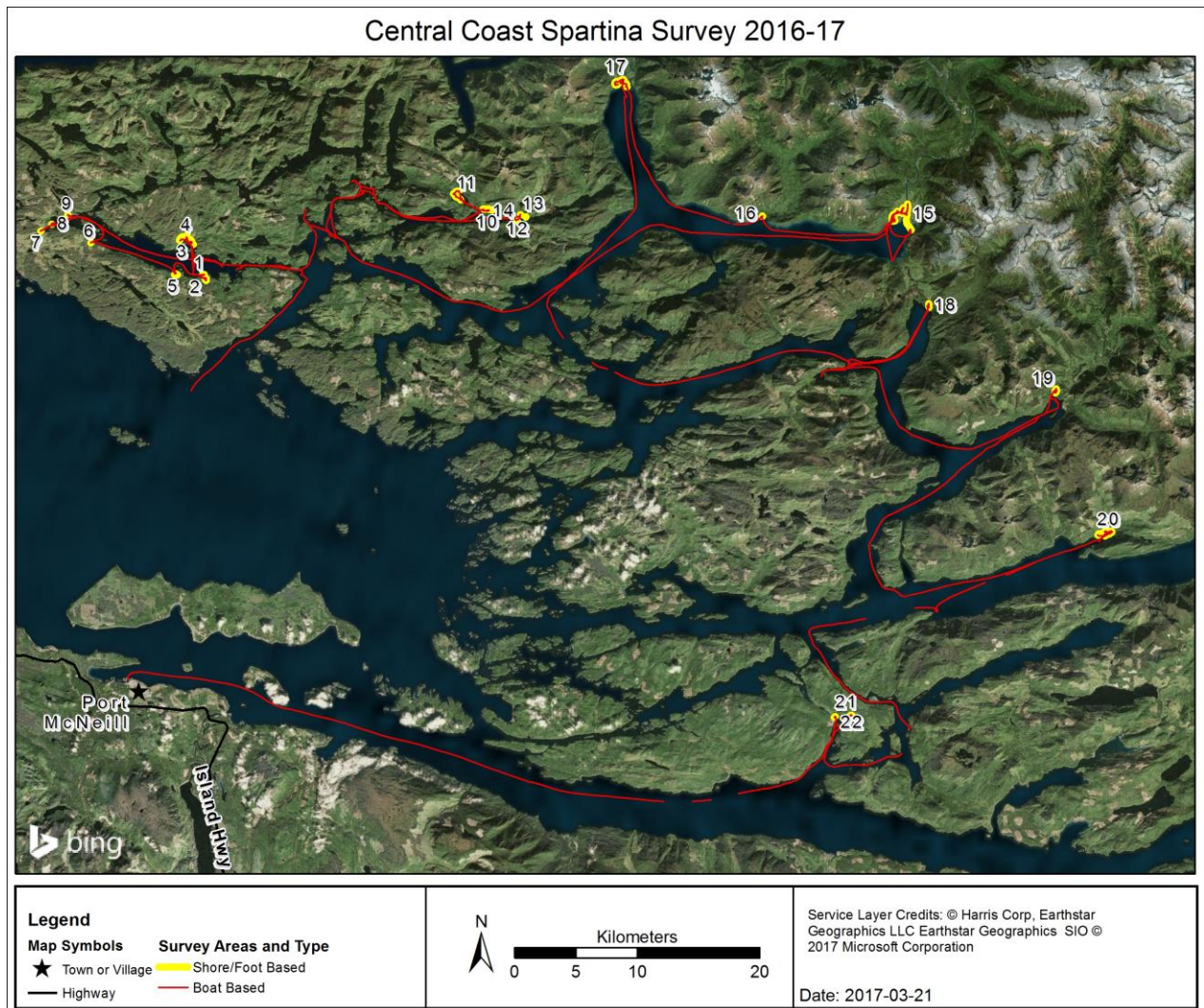


Figure 9. Central Coast Shoreline Searched for *Spartina sp.*

A survey on the Central Coast was completed in 2016 to inventory susceptible, remote coastal habitat outside of Vancouver Island.. No *Spartina* was detected during the surveys. Becky Brown (Invasive Plant Specialist, FLNR), Matthias Herborg (Aquatic Invasive Species Specialist, MoE), Ken Marr (Curator of Botany, RBCM) and Erica Wheeler (Botany Collections Manager, RBCM) conducted *Spartina* surveys on the Central Coast. An additional crew member, Henry Choong (Curator of Invertebrate Zoology, RBCM), made invertebrate collections. The FLNR Compliance and Enforcement Department and the Forest Patrol crew (Rick Rottluff and Fred Said) provided information for survey planning to include historical and current industrial activity areas, locations of habitat that could potentially support *Spartina*, and navigational

expertise. The large open channels were mostly comprised of solid rock ridges occasionally capped with narrow vegetated benches, thereby limiting the potential for *Spartina* establishment. Inlets frequently had cobble/gravel beaches terminating in large estuaries with shallow sloped beaches of mud substrate. The targeted surveys focused on large estuaries during low tide, remote communities and industrial operations associated with disturbance. The searched areas are shown in Figure 9 where a passive survey used the main vessel looking from a distance between 200 to 500 m with binoculars and an active survey occurred on foot. Active survey sites were accessed using a small skiff launched from the main vessel, allowing selection of ideal habitat for closer investigation. Seed head morphology, vertical structure and growth pattern were the main components for search image recognition and confirming presence/non-presence of *Spartina*. It was determined that if *Spartina* was positively identified at a site then adjacent sites would also be surveyed for presence/absence.

CONTROL & REMOVAL

FRASER DELTA AND BOUNDARY BAY

MANUAL CONTROL

With integrated control plan continued in 2016 with the herbicide use on *S. anglica* and manual removals (i.e. pulling and digging) of single plants and small clones and the use of herbicide for clones greater than 0.3m in diameter.

A few organizations undertook hand removals of infestations:

- City of Surrey's SHARP and SNAP summer crews: Boundary Bay in the Serpentine River Estuary and Mud Bay and;
- Corporation of Delta's Noxious Weed Control Crew: Robert's Bank and Boundary Bay from Pt Robert's to west of 112 St.
- Environment Canada - Canadian Wildlife Service Summer Students: Robert's Bank and Boundary Bay

The high priority areas for control continue to be Roberts Bank (from Brunswick Point to the Deltaport Causeway), Boundary Bay at 112th Street, & Boundary Bay at Mud Bay, to reduce dispersal to uninfected areas.

As in previous years, participants dug up individual plants and smaller clones using hand shovels, loading them into re-usable shopping bags. The shopping bags were dumped into large

garbage cans and transported to a dumpster for disposal. Using inexpensive molded snow sleds, participants were able to bring removed plants from further out on the mud flats to the shore.

A four-person Spartina crew was hired through BCCF for June, July, August and part of September. The crew focused on hand removals, mapping, supervising volunteer removal activities, and providing mapping support for the herbicide use. In 2016, 587 'S' size (single plants or seedlings) and 1029 'A' size (< 30 cm in diameter) clones were manually removed.

HERBICIDE CONTROL

PERMITTING BACKGROUND

For more than a decade Spartina control work in BC on *S. anglica* using only mechanical/manual was not able to achieve containment. Therefore, since 2010, a small sub-group of the BC Spartina Working Group has worked with staff from provincial and federal Canadian agencies to determine the requirements and process to use herbicide as a control activity on Spartina. The sub-group evaluated the ecological impacts and best management information based on the success of using two herbicides to control Spartina in the United States (Washington, Oregon and California). It was determined that herbicide use in BC would require registration of the herbicides with the federal Pest Management Regulatory Authority (PMRA) as well as a Pesticide Use Permit (PUP) from the BC provincial Ministry of Environment.

The BC Ministry of Environment, as a member of the BC SWG, submitted an emergency use registration to the PMRA in February 2012 for the use of 2 herbicides to control Spartina: Rodeo (active ingredient glyphosate) and Habitat (active ingredient imazapyr) along with supplementary documentation including the proposed methods, evaluation and monitoring process. On February 13, 2013, the PMRA granted the emergency registration of the herbicides Habitat (imazapyr) and Rodeo (glyphosate) for control of Spartina in intertidal areas of BC until December 31, 2013. The application for emergency use registration with PMRA requires that a new application be submitted annually. In 2013, and since that time, the decision was made to only use Habitat (imazapyr) along with the surfactant (Ag Surf II) to control Spartina following consultation with Washington State staff and to minimize overall herbicide use. As part of the approval, PMRA identified that the surfactant Ag-Surf II is to be used with the herbicides that would bind the herbicide with the plant and reduce the amount of herbicide needed. The PMRA reviewed all the potential surfactants and recommended the surfactant based on its low toxicity in the environment.

In 2013, the BC Ministry of Environment submitted a Pesticide Use Permit (PUP) for both herbicides (Rodeo (active ingredient glyphosate) and Habitat (active ingredient imazapyr) to BC Ministry of Environment. Consultation was conducted prior to and after the submission of the PUP. The (PUP) No. 804-0004-2013/2015 was issued in June 2013 for a 3-year period ending December 30, 2015. The (PUP) No.138-0211-2016/2019 was re-issued in June 2016 ending May 2019. Follow-up reports are provided to the Section Head – Integrated Pest Management Coastal Region on or before December 31, of each calendar year as a requirement of the PUP. Approval to use the approved herbicides for the 2017 and 2018 season in the Boundary Bay and Roberts Bank Wildlife Management Area was provided by BC Ministry of Forest, Lands and Natural Resource Operation.

HERBICIDE CONTROL ACTIVITIES

Approximately 185 people days were spent on herbicide application in 2016. Herbicide treatment of *S. anglica* (22 196 clones) was completed in Roberts Bank and Boundary Bay. The 2016 treatment is estimated to be 6.26 ha of solid *Spartina* spread over more than 5700 ha of intertidal habitat (based on 4.67 L/ha of herbicide and 29.70 litres of Habitat (24% imazapyr) used. Approximately 19.80 L of surfactant, Ag-Surf II (92% alcohol ethoxylate) and over 1900 L of fresh water were mixed with the herbicide. The treatments were conducted: at low tide during the day to allow a 4-hour drying time after application. Weather was clear to partially cloudy with temperatures between 17 C & 23 C. Herbicide was applied to *S. anglica* plants on Jul 11-14, 19-22, 25-28, Aug 3-5, 10-11, 25-26, 30, Sept 13-16, 28-30, and Oct 30. Below are maps of the herbicide treated areas (Figure 10, Figure 11).

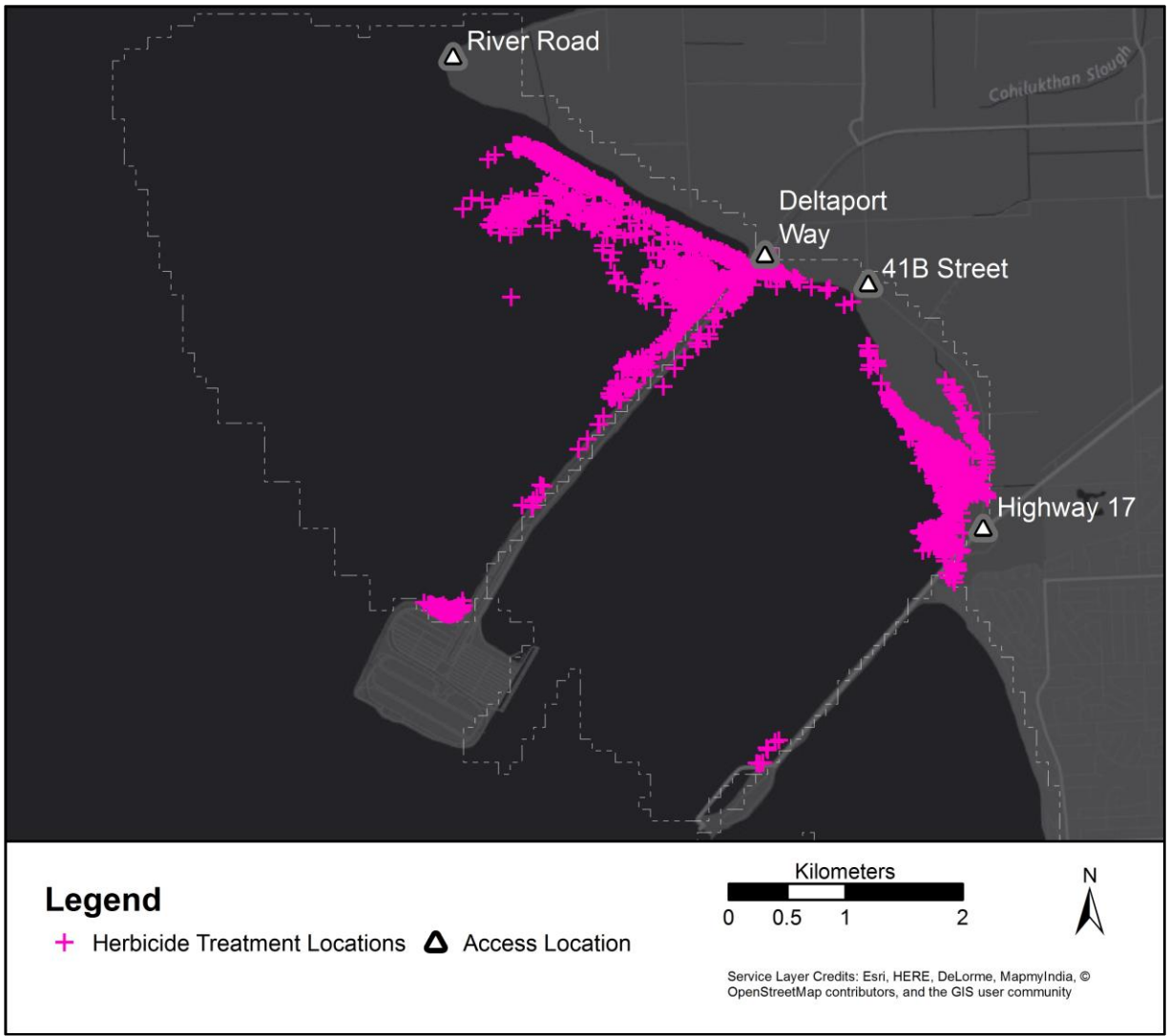


Figure 10. Spartina Infestation Treated with Imazapyr (purple cross) in Roberts Bank in 2016.

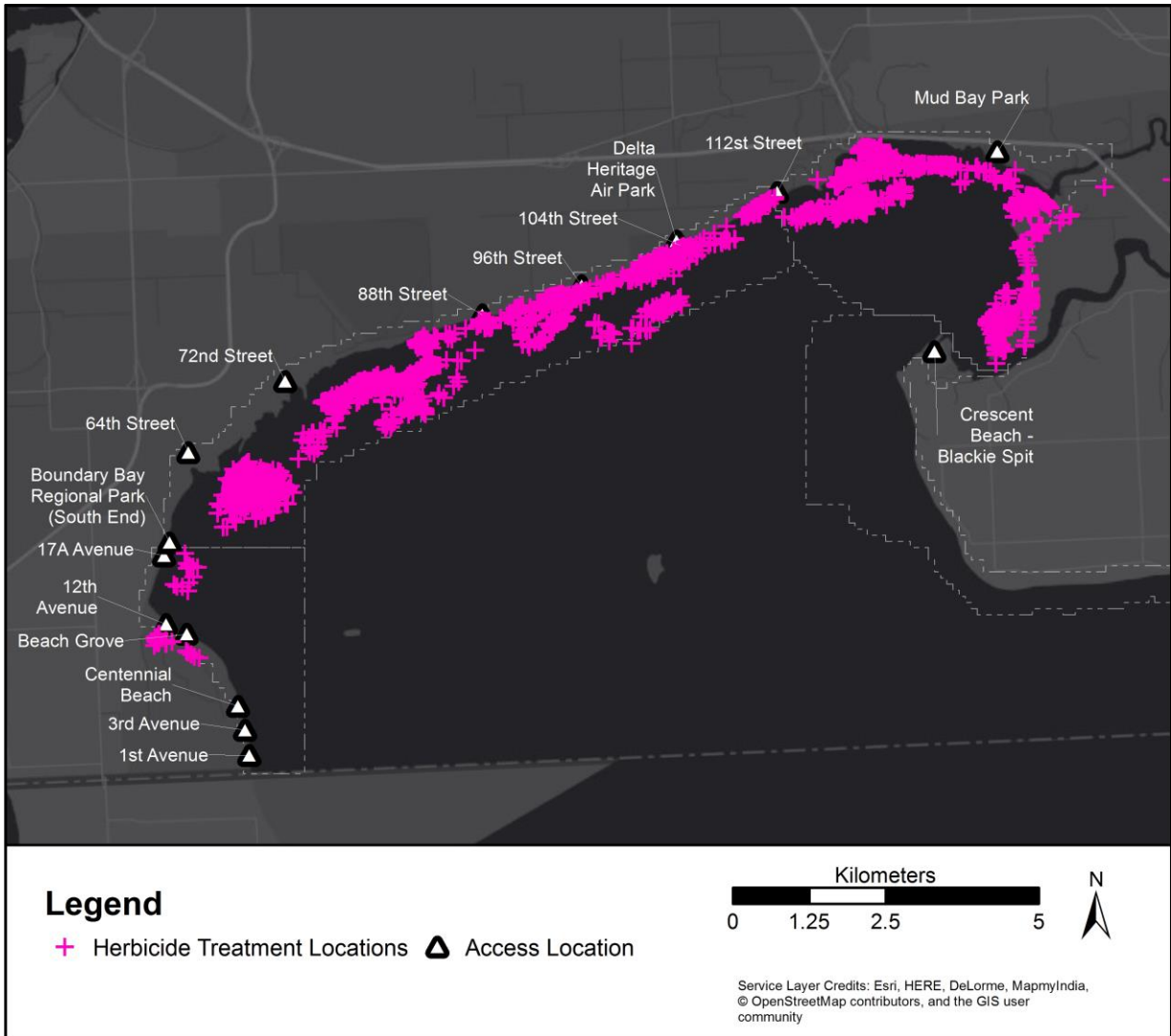


Figure 11. Spartina Infestation Treated with Imazapyr (purple cross) in Boundary Bay in 2016.

BURRARD INLET

MANUAL CONTROL

The *S.patens* infestations pose a challenge to the traditional BC Spartina control techniques of manual digging, as *S.patens* does not grow in tufts or clones but grows in a dense mat that eventually forms a meadow. This species also grows in the high salt marsh where a greater diversity of native plants is found compared to *S. anglica* which is generally found in bare mud. Therefore, digging the established plant populations would significantly modify the topography and likely create collateral damage by eliminating all native plant populations. A shading

technique (i.e. cover plots) was identified as a pilot experiment in 2012. This technique utilizes the approach used in Oregon to control *S.patens*.

Cover plots consisted of a layer of Nilex 2002 woven geotextile fabric, providing more protection for the bottom layer of polyethylene sheeting which limits sun penetration. Cover plots installed in 2012 at Reed Point Marina, Burrard Inlet had a substantial regrowth of *S. patens* after removing the geotextile in 2015. It was suspected that the re-establishment of *Spartina* is due to a large energy reserve in the roots limiting the effectiveness of the cover material and possibly the existence of a seedbank. No additional activities are planned for the Reed Point Marina site, as it will be altered as part of the PCT potash handling expansion facility development.

In total, 175 m² of cover plots have been installed on the foreshore in Port Moody since 2015 to eradicate *S. patens* and manage existing infestations. Cover plots that were installed in 2015, were assessed to find a significantly reduced above ground biomass shown in Figure 13, however evidence of growth was observed in each of the three locations in the months following. Additional cover plots were installed in 2016 with one small patch of *S. patens* manually removed. Cover plots will be removed in 2018 and results will be assessed in 2019.



Figure 12. Photos on the left show *Spartina patens* in 2015 before cover plots were installed. Photos on the right show the same plots after removing the geotextile layer in 2016.

The Vancouver Island Conservation Lands Management, Project Watershed and Raincoast Education Society coordinated the control of *S. densiflora* and *S. patens* on the east coast of Vancouver Island except for Denman, Hornby and Sandy Islands.

MANUAL AND MECHANICAL REMOVALS

In Baynes Sound, a total of 568-person hours was dedicated to the removal of approximately 4000 *S. densiflora* plants from over 100 km of shoreline recorded during the 2016 surveys. It has been noted that *S. densiflora* seedlings break off when manually pulled therefore, each plant is manually dug or left until large enough to pull manually without breaking at the stem using hand tools (mattocks and shovels). Approximately 7000 kg of waste material was bagged using heavy-duty bags and taken to the Church Rd Transfer Station in Parksville for disposal.

As of February 26, 2016, no regeneration of *S. patens* or native vegetation was observed at any of the eight excavated sites from 2014-15. Results show an absence of both *S. patens* regrowth and the establishment of a handful of native plants and plants too small to identify approximately one year after excavation. An additional eight mechanical excavation trial plots, plots are > 5.0 m², were added in 2016 and will be assessed in 2017.

SHADING

To date 20 shade trials have been installed on the East Coast of Vancouver Island from the Comox foreshore at Beach Drive to Royston. Two shade trials were installed in 2012 and were found to be damaged by wind and wave action or vandalism in 2013. They were removed in January 2015 and have not been checked for re-establishment of vegetation (*Spartina* or native) to date. Five cover plots were installed in 2014 and remained intact until removal in December 2016. In 2016, an additional eight trial covers on *S. patens* patches ranging from 0.75 m² – 1.5 m² and > 5.0 m² were installed along K'omoks Estuary. Each cover was constructed of an ArmTec 855 woven geotextile fabric with a wooden frame of 2"x4" braced along each corner as used in previous cover plot trials. Each cover was anchored in place by ¾" rebar hammered into the substrate and nailed to the frame and extra weights were placed on top of each cover consisted of either 40L sandbags and/or rocks. Assessment of cover plots will take place in 2018.

MECHANICAL EXCAVATION

Approximately 2600 plants were found on Denman, Hornby and Sandy Islands. All plants were removed and composted on Denman Island. Mapping and removal efforts since 2013 has provided insight into the success of manual and mechanical removal for *Spartina densiflora*. Removal treatments have decreased density by 62% since 2015. Manual removal continues to be the only control method used at this time, however other regions, such as Washington State, use herbicide as to control *S. densiflora*. The BCSWG should continue to monitor *S. densiflora* populations and use herbicide treatments for control of this species if and when it is needed and utilizing the best available science and information

MOWING

To depress the growth and exhaust *S. patens* found on Denman Island, seed heads were cut in the fall of 2016 with brush cutters and composted. Observations in March 2017 showed signs of early regrowth however, continuous monitoring and cutting sessions would provide a better oversight into the success of this treatment. Since *Spartina* is a grass species, it is expected that it will continue to re-grow and mowing is only potentially a means of limiting seedhead production and patch expansion.

SCIENCE – EVALUATION - MONITORING

BURRARD INLET – HERBICIDE VS SHADING COMPARISON TRIAL

In 2015, the use of herbicide to a small area of *Spartina patens* at PCT (12 m² in total) was applied with the rationale that:

- Cover plots have had a relative low efficacy to-date;
- Rocky and steep terrain at some areas of PCT site makes cover plot application challenging;
- The site is extensive and long-established indicating it likely has extensive roots and seed bank;
- Herbicide treatment may have lower impact to native vegetation compared to other methods; and,
- Better understand logistics, challenges for use of herbicide with *S.patens*

- The herbicide used for these treatments was Imazapyr in the same formulation as used for *S. anglica*.

SPARTINA PATENS MONITORING – MAPLEWOOD CONSERVATION AREA

Determining the elevation preference of *Spartina patens* in relation to other salt marsh plants improves our understanding on:

- *S. patens* habitat characteristics
- Restoration methods after *S. patens* has been removed

Plots located on the east and west side of Maplewood Conservation Area marsh were surveyed for *S. patens* and other marsh plants. Each plot, alongside vegetation surveys were measured for elevation using a Navcom LandPak SF-3040 GNSS Survey System. The elevation data collected will inform the post treatment restoration planting plan.

OUTREACH

INFORMATION AND INTERNET RESOURCES

- Community Mapping Network provides web mapping and other information on the distribution of *Spartina sp.* in BC. www.spartina.ca
- The BCSWG uses an email “List Serve” to communicate & coordinate with identified volunteers and partner organizations in BC. spartina-ca@vancouvercommunity.net
- Friends of Semiahmoo Bay Society uses their web site for volunteer call out, information & partner links <http://www.birdsonthebay.ca/>
- Corporation of Delta website: <http://www.delta.ca/environment-sustainability/plants-wildlife/invasive-plants>
- City of Port Moody website: <http://www.portmoody.ca/index.aspx?page=1260#Saltmeadow> Cordgrass (*Spartina patens*)
- Coastal Invasive Species Committee: <http://www.coastalisc.com/priority-invasive-plants>

SPARTINA IN THE MEDIA

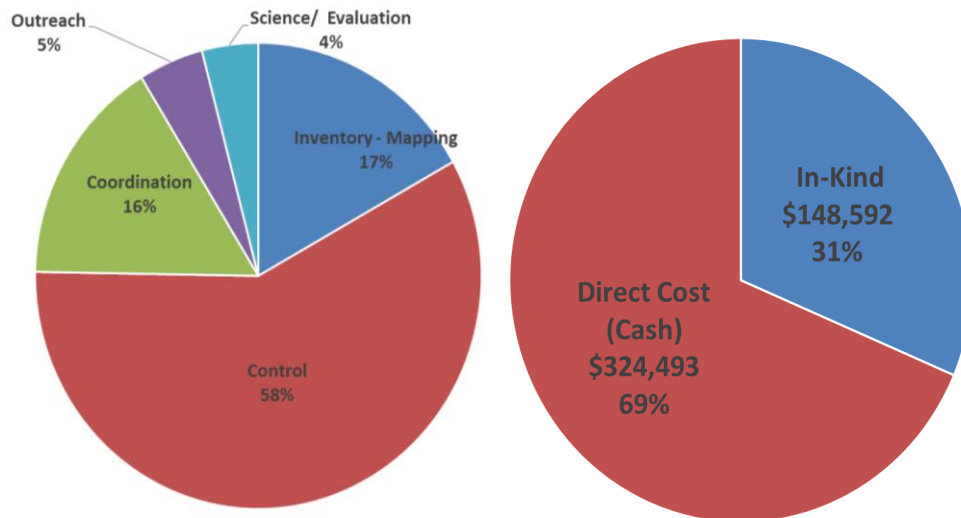
- a. Partnership Walking Tour – October 2016

SPARTINA PRESENTATIONS AND WORKSHOPS

- a. Fanny Bay Community Meeting – presentation (January 2016)
- b. Pacific Estuarine Research Society – poster (March 2016)
- c. Vancouver Aquarium – presentation (April 2016)
- d. 7th Invasive Species Workshop – workshop (August 2016)
- e. Pacific Coast Terminals Demonstration – presentation (August 2016)
- f. Aquatic Herbicides Workshop – workshop (Feb 2017)

FINANCES

The BCSWG partners and individual volunteers contributed over \$148 000 of in-kind time and resources to the project, in addition to external funding from grants and partners. These in-kind contributions were essential to the success of the project. shows the percentage of contributions by component and the ratio of in-kind to direct (cash) contributions. The recent history of financial contributions (cash and in-kind) of the BC Spartina Working Group is found in Figure 14. **Error! Reference source not found.** summarizes the income and expenditures for



2016.

Figure 13. 2016 Spartina Program Expenditures by Component & Type/Amount

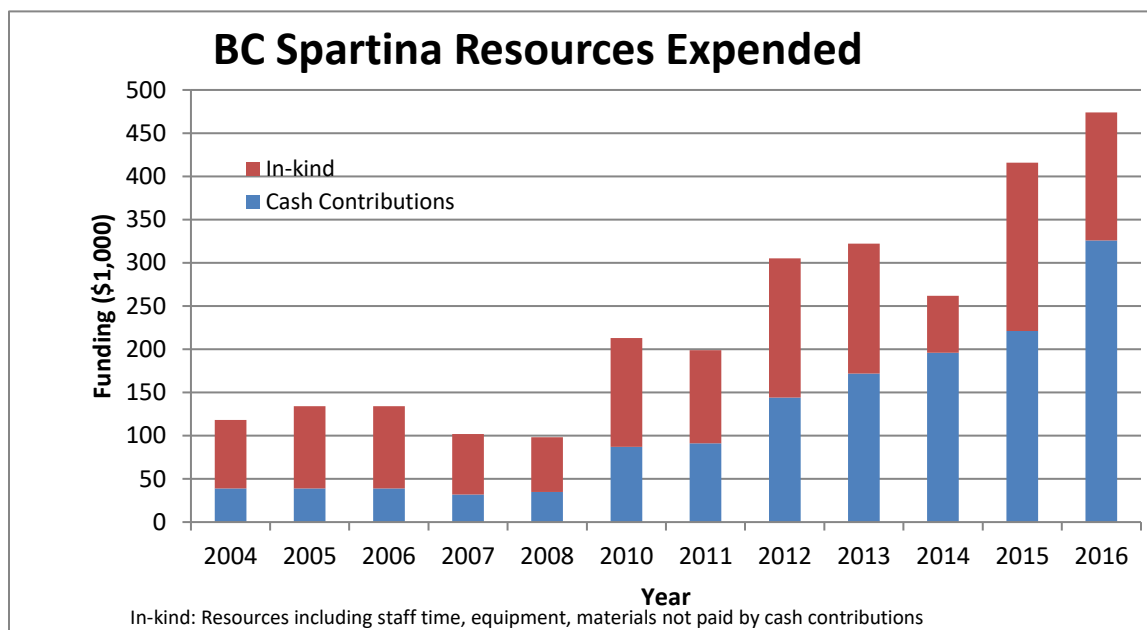


Figure 14. BC Spartina Resources Contributed Over Time

Table 3. BC Spartina Eradication Program Direct Cost (Cash) Contributions - BCSWG 2016

Direct Costs (Cash)	Committed & Expenditures by Program Components					Total
	Inventory	Control	Coordination	Outreach	Science/Evaluation	
Contractors						
Lower Mainland	\$33,073	\$149,430	\$56,812	\$5,000	\$2,533	\$246,848
East Coast Vancouver Island	\$17,000	\$38,000	\$5,000	\$7,300	\$4,000	\$71,300
Materials & Supplies	\$2,417	\$3,200		\$728		\$6,435
Total	\$52,490	\$190,630	\$61,812	\$13,028	\$6,533	\$324,493

Table 4. BC Spartina Eradication Program In-Kind Contributions - BCSWG 2016

2016 Program Partners	In-Kind by Program Components					In-Kind
	Inventory	Removals -Clipping	Coordination	Outreach	Science/Evaluation	
BC Conservation Foundation		\$300				\$300
BC Ministry of Environment	\$2,400		\$1,200		\$400	\$4,000
BC Ministry of Forests, Lands, and Natural Resource Operations,	\$2,400	\$50,000	\$1,200		\$400	\$54,000

2016 Program Partners	In-Kind by Program Components					
	Inventory	Removals -Clipping	Coordination	Outreach	Science/Evaluation	In-Kind
City of Surrey - SHaRP, SNAP & COHO Programs	\$6,800	\$6,800	\$200			\$13,800
Vancouver Island Conservation Land Management Program (VICLMP)	\$4,000	\$10,000	\$3,500			\$17,500
Community Mapping Network			\$400	\$5,000		\$5,400
Corporation of Delta	\$4,000	\$4,000	\$400			\$8,400
Ducks Unlimited Canada	\$0	\$0	\$0	\$0	\$8,500	\$8,500
Environment Canada- Canadian Wildlife Service	\$3,600	\$4,000	\$800		\$800	\$9,200
Service Canada - Canada Summer Jobs						\$17,892
Friends of Semiahmoo Bay Society	\$200	\$200	\$200	\$400		\$1,000
GL Williams & Associates			\$200			\$200
Various Denman Island volunteers	\$800	\$800				\$1,600
K'omoks First Nation		\$2,000				
Invasive Species Council of Metro Vancouver			\$200			\$200
Port of Vancouver	\$400	\$600	\$1,200		\$2,000	\$4,200
City of Port Moody		\$400	\$1,600	\$400		\$2,400
Total	\$24,600	\$79,100	\$11,100	\$5,800	\$12,100	\$148,592

PARTNERSHIPS

Developing partnerships are a key principle of the BC Spartina Working Group to achieve control and eradication of Spartina plants. This principle is demonstrated in the diversity of partnerships (government, non-government, community, industry) that are part of the steering committee.

Given the nature that Spartina is a cross border issue, it follows that maintaining partnerships with organizations in Washington State and others states are important. The Washington State Department of Agriculture (WSDA) has been a long-term partner with the BCSWG and the BC SWG attended the North Puget Sound Spartina Planning meeting in the spring of 2016.

At a high level, the Pacific Coast Collaborative (PCC) leaders signed the “Action Plan for Ocean Conservation and Coastal Climate Change Adaptation” on February 12, 2010. One of the actions in this plan is to reduce or prevent the spread of invasive species, with Spartina being a top priority. The PCC issued a “Spartina Progress Report for the Pacific Coast Collaborative Leaders Forum November 16th, 2010” which states British Columbia, Washington, Oregon, and California have jointly committed to eradicate non-native Spartina by 2018.

This document and the Action Plan for Ocean Conservation can be viewed at <http://spartina.ca> in the “Atlas Documents” section.

RECOMMENDATIONS FOR 2017

While the Spartina Project documented several successes and shortfalls in 2016, further resources and progress is required to achieve the Pacific Coast goal of eradication of non-native Spartina by 2018. Therefore, the following recommendations should be taken into consideration:

1. Mapping and Control (General)
 - a. Continue the partnership approach to Spartina mapping and control
 - b. Continue to expand mapping areas beyond known distribution
 - c. Secure multi-year financial funding to enable longer planning intervals and a consistent core program that can be expanded upon with additional annual funding
 - d. Utilize an integrated pest management approach towards eradicating *S.patens*. Explore chemical treatments, excavator treatments and hand-digging and associated restoration requirements.
 - e. Use chemical treatments on *S. patens* in Burrard Inlet with intentions of treatment use on Vancouver Island

- f. Systematic expansion of search areas rather than annually checking the same areas and confirming non-presence. If an area has had non-presence consistently then check it every other year or every 3 years and check new areas annually.
2. Restoration
 - a. Control efforts on *S. anglica* and *S. densiflora* have not required any restoration assistance to date. Removal efforts of *S. patens* show a need for restoration. A review of methods for control & restoration and associated monitoring/evaluation criteria will be implemented for 2018.
3. Fraser Delta and Boundary Bay
 - a. Target herbicide application with two complete passes to ensure every plant is treated once.
 - b. Continue to map and spray at the same time when resources are available.
4. Burrard Inlet
 - a. Continue to develop and strengthen relationships with Burrard Inlet stakeholders to support Burrard Inlet eradication goal of *S.patens*
 - b. Move forward in addressing the *S.patens* infestation in Burrard Inlet with chemical control, associated restoration activities, and long term mapping/early detection goals.
5. Vancouver Island
 - a. Initiate mapping and control in early spring 2017 (before plants begin to flower) and continue removals into winter 2017. Control efforts should focus on previous priority sites continuing to deplete these *Spartina* infestations.
 - b. Continue to employ active, foot-based surveys where *Spartina* has been detected in previous years from Courtney to Deep Bay, and on Denman, Hornby and Sandy Islands.
 - c. Complete boat or foot-based surveys in previous unchecked areas near known existing or historic infestation sites
6. Partnerships and Outreach
 - a. Continue to support the community efforts of *Spartina* searching and mapping in the Tofino area and in other Vancouver Island estuaries by:
 - i. Providing stimulus funding for initiating a program and/or acquiring additional funding support
 - ii. Providing training and resources (such as staff time, boats, mapping equipment)
 - iii. Encouraging volunteer mapping and removal days to foster a greater understanding of the importance and challenges in eradicating *Spartina*

- b. Continue to host training session on native plant ID and *Spartina* ID for stakeholders and other agencies who work in potential *Spartina* infested areas on east coast of Vancouver Island
 - c. Increase awareness of *Spartina* activities using various methods such educational display at public events like World Oceans Day, Farmers Market or Earth Day. Continue to work with local stewardships groups such as Project Watershed and Comox Valley Naturalists directly
 - d. Publish several articles in local newspapers and post online to garner support for project.
7. Test aerial detection techniques with new technologies such as a remote controlled, electric, unmanned aerial vehicle (UAV). These activities would be most suitable to detecting large clones and large meadows of *Spartina*.

APPENDIX 1 - DETECTION

Mapping Methodology Mapping efforts continued to follow the same methods from 2008/09. The method of walking the intertidal habitat every June/July with hand held Global Positioning System (GPS) units (Garmin Etrex20, Garmin GPSmap76S, Garmin GPSmap60Cx/62Cs,) was used to identify the location of plants along Boundary Bay, Roberts Bank and Sturgeon Bank. *Spartina* size classes for each location were denoted as one of: single seedling, clone <0.3m, clone 0.3m - 1.0m, clone > 1.0m in diameter, or 5m area of single plants. Surveying flags were used to mark the location of the plants. The flags reduced searching time during removals and herbicide application.

1.1 SPARTINA INVASION SUMMARY

Table 5. *Spartina* invasion summary for the Lower Mainland and Vancouver Island up to 2016.

	<i>S. anglica</i>			<i>S. patens</i>		<i>S. densiflora</i>	
	Estimated Plant Area (ha)	Impacted Area	Number of Plants Detected	Estimated Plant Area (ha)	Impacted Area	Estimated Plant Area (ha)	Impacted Area
2013	0.8191	940	8511	-	-	-	-
2014	0.5499	937	13921	-	-	-	-
2015	1.435	898	18074	.3395 (0.005*)	92 (12*)	0.4021	194
2016	1.637	973	23260	.0997 (.0163*)	66 (25*)	0.3977	278

*Lower Mainland Only

**Area estimates are based on a grid of 1-hectare cells for BC's coastline.

1.2 FRASER DELTA AND BOUNDARY BAY

Table 5. *S. anglica* Detected by Size Class from 2005-2016 in Boundary Bay and Roberts Bank.

Size	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Single plants	167	107	41	56	67	197	185	4497	5210	4431	832	6036
< 0.3m	329	229	111	110	221	532	433	685	3548	6771	6692	8610
0.3m-1.0m	204	210	108	60	234	475	441	538	1371	1252	8123	5733
> 1.0m	90	42	33	61	149	184	296	1065	1334	1102	1930	2770
Patch 5m dia.	0	97	49	47	12	78	55	7	36	29	66	107
Large Patch >5m	0	0	0	0	0	20	31	12	6	0	2	16
Total	790	685	342	334	683	1486	1441	6804	11505	13585	17645	23272

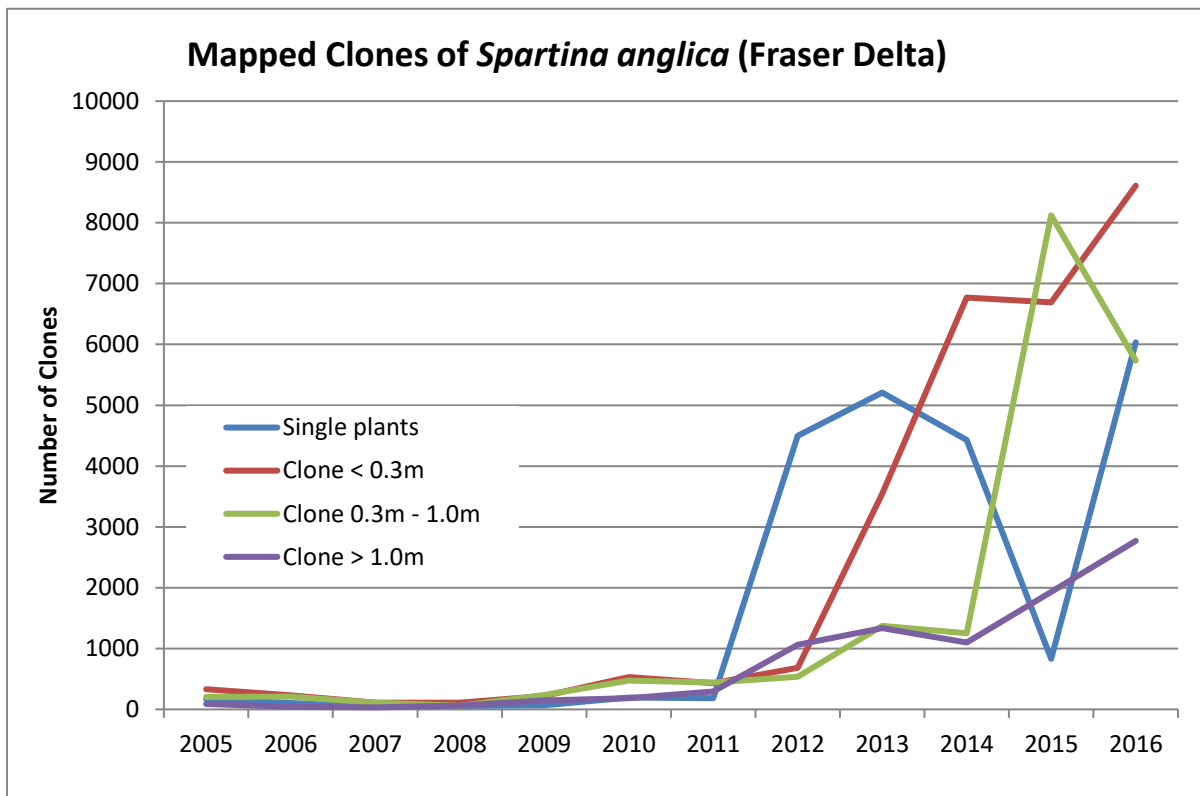


Figure 15. *S. anglica* Size Classes Mapped from 2005-2016