

# 2017

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## British Columbia Spartina Eradication Program Progress Report

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Ducks Unlimited Canada (DUC)  
Environment Canada – Canadian Wildlife Service (CWS)  
Ecofocus Environmental Consulting  
Friends of Semiahmoo Bay Society (FOSBS)  
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Invasive Species Council of Metro Vancouver (ISCMV)  
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Port Metro Vancouver (PMV)  
Project Watershed  
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Tsleil-Waututh Nation  
West Coast Conservation Lands Management Program (WCCLMP)

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The representatives to the BCSWG include Kathleen Moore (Environment Canada – Canadian Wildlife Service - CWS), Robyn Worcester (Metro Vancouver), Kevin Li (Corporation of Delta), Liana Ayach (City of Surrey), 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 (West Coast Conservation Land Management Program, WCCLMP).

In addition, special thanks are extended to the field coordinators (Shawn Lukas, Mark Andres and Jenny Balke) for their dedication and hard work as well as BC Conservation Foundation (BCCF) coordinator Katie Calon. Several work crews (BCCF, DUC, Denman and Hornby Islands, WCCLMP, Corporation of Delta, and the City of Surrey summer technicians) were a cornerstone to the implementation of the Spartina mapping and control work.

Between April 2017 and March 2018, 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. Table 1 below acknowledges, hopefully, all those contributions to the BCSWG Program.

**Table 1. List of 2017 participants by organization who helped map and control Spartina in BC**

Organization	Participants
City of Surrey; SHaRP Program	Nida Kazmi, Amy Shears, Clayton Patrick, Cole Halket, Dawn Lo, Emmanuel Baig, Gurjot Singh, Jaden Gill, Jaskiran Kaur, Jochen Hsia, Justine Dumandan, Kaelyn Chaulk, Leon Fei, Lily Nguye, Markus Noel, Nick Houchmand, Ravleen Brar, Samuel Plourde, Sindi Li, Steffi Japitana, Van Albert Dela Torre, Cyndy Nguyen, Emily Fuchs, Jacob Rovere, Jennifer Hong, Josh Friedman
Corporation of Delta	Lauren Crosbie, Perry Brown, Adrian Avendano
Ducks Unlimited Canada	Matt Christensen, Lauryn Williams, Emma Cunningham, Lisa Horton, Vinson Yau, Lauren Crosbie, Megan Winand, Hilary Worm
Port Metro Vancouver	Kim Keskinen
Raincoast Education Society	Dan Harrison
West Coast Conservation Lands Management Program	Hilary Blackman, Shawn Lukas, Tom Reid and Peter deKoning
K'omoks First Nation	Cory Frank
Volunteers in the Fraser Delta	Alyssa Togado
Volunteers on Vancouver Island	Jennifer Sutherst, Steve Williams

## EXECUTIVE SUMMARY

In 2017, 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.

The BC Spartina Eradication Program applied \$439,475 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 200 km of BC's coastline in search of *Spartina* spp. throughout the summer, fall and winter months.

Since 2016 have seen a 46% decrease in *S. anglica*, which is only found in the Lower Mainland. *S. anglica* continues to be contained to its known locations in Roberts Bank and Boundary Bay. *S. densiflora* has continuously decreased since monitoring and removal started in 2015. However, *S. patens* has increased in abundance, density and geographic extent with three new locations throughout Vancouver Island and the Lower Mainland.

BC SWG monitors the program's success and means for improvement through our science and evaluation of each species. We annually monitor the efficacy of herbicide on *S. anglica* and as *S. patens* continues to increase, we have implemented operational-scale herbicide treatment in Burrard Inlet as a result of the success found in small-scale herbicide treatments conducted in 2015. So far digging of *S. densiflora* has proven fairly effective at reducing the population of this species. Manual means of control for *S. patens* have had limited success at best and have proven resource intensive and disruptive to the natural environment.

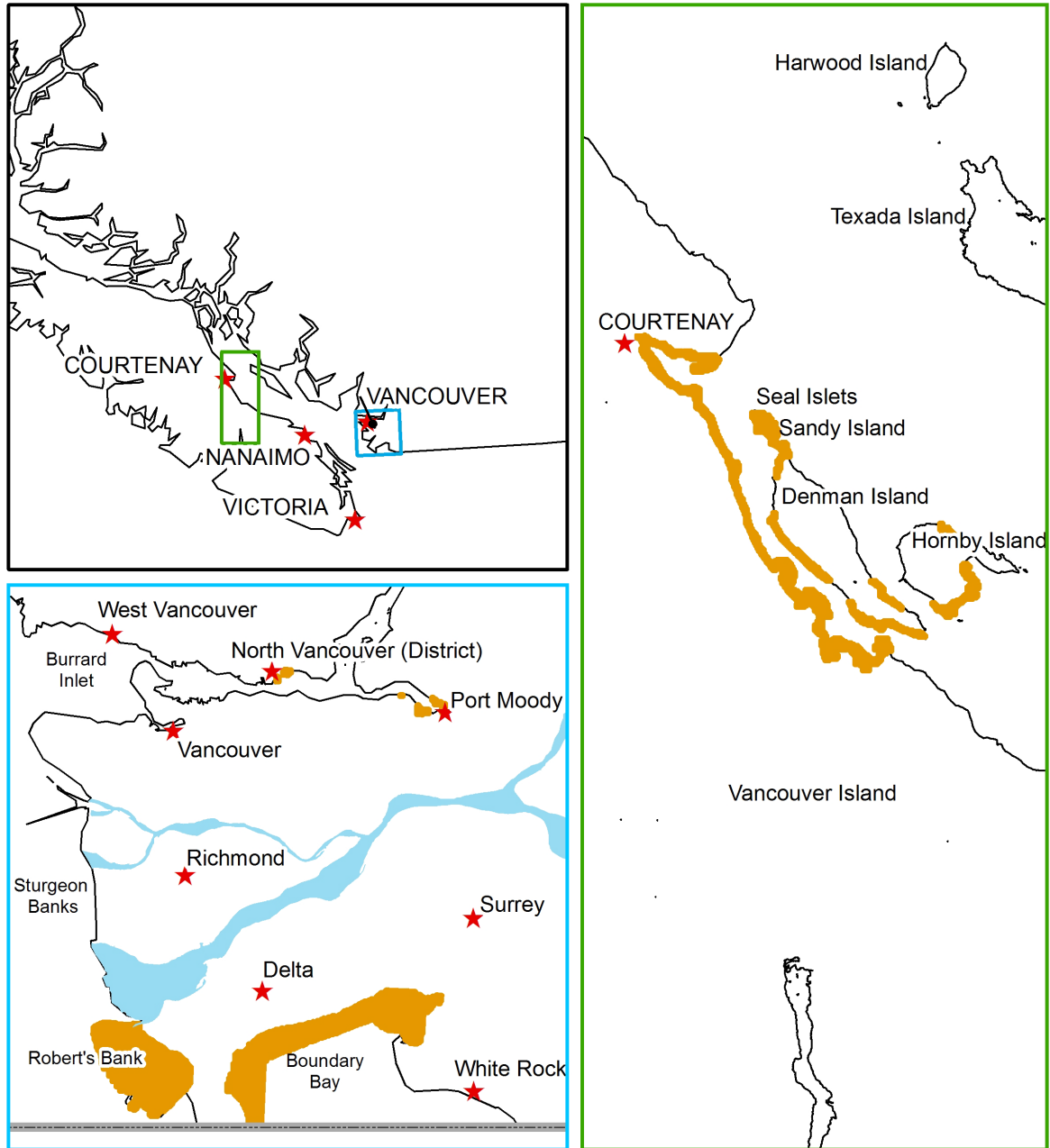
## BACKGROUND

In 2003, Gary Williams, a consultant for the Port Metro Vancouver, while conducting habitat surveys of the intertidal areas, found *S. anglica* in the Fraser River Delta. 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.

*Spartina* species affect tidal areas by converting mudflats to monoculture stands, reducing habitat for waterfowl and fish, increasing the accretion of sediments, and modifying 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 spp.* 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.

Forming in 2004, the BCSWG includes members of 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* spp. data (2004 to 2017) are provided in part by the Community Mapping Network (CMN). An overview of the coastline searched in British Columbia for *Spartina* spp. in 2017 is found in Appendix 1, Figure 15. Mapping methodology along with a summary of the *Spartina* invasion up to 2017 are in Appendix 1; Table 2. Species, plant size, GPS location and the extent of the area searched can be viewed at [www.spartina.ca](http://www.spartina.ca). Additionally, data is entered on the Invasive Alien Plant Program (IAPP) (<http://www.for.gov.bc.ca/hra/Plants/application.htm>).

All data collected evaluates eradication progress, assists in future monitoring, and control activities. Ducks Unlimited Canada (DUC) also maintains ESRI shapefile copies of these data for GIS analysis. Ducks Unlimited Canada is in the process of developing and hosting a central data repository in addition to the CMN.

### FRASER DELTA AND BOUNDARY BAY

*S. anglica*, found primarily in the Lower Mainland of British Columbia, grows within the intertidal zones and on a variety of substrates ranging from fine silt/mud, sand and cobble. In 2017, approximately 304 person-days of search efforts went into mapping and control/removal in the Lower Mainland. Mapping took place from Sturgeon Banks, BC to White Rock, BC covering approximately 46 km of shoreline (Figure 2). Mapping results, show *S. anglica* is not expanding out of its known areas of Boundary Bay between Blackie Spit and Beach Grove, and Roberts Bank between Brunswick Point and the north side of the Tsawwassen Ferry Terminal (Figure 3, Figure 4).

The total number of mapped *S. anglica* clones in each standardized size class reduced by 46% since 2016 as shown in Table 3. *S. anglica* recorded as 'single plants' had the greatest reduction in abundance while the number of clone sizes between 0.3 m to 1.0 m, remain about the same at approximately 5600 clones. This may be due to treatments missing smaller plants under larger clones thereby repopulating the patch.



Figure 2. All searched shoreline in the Lower Mainland for 2017.

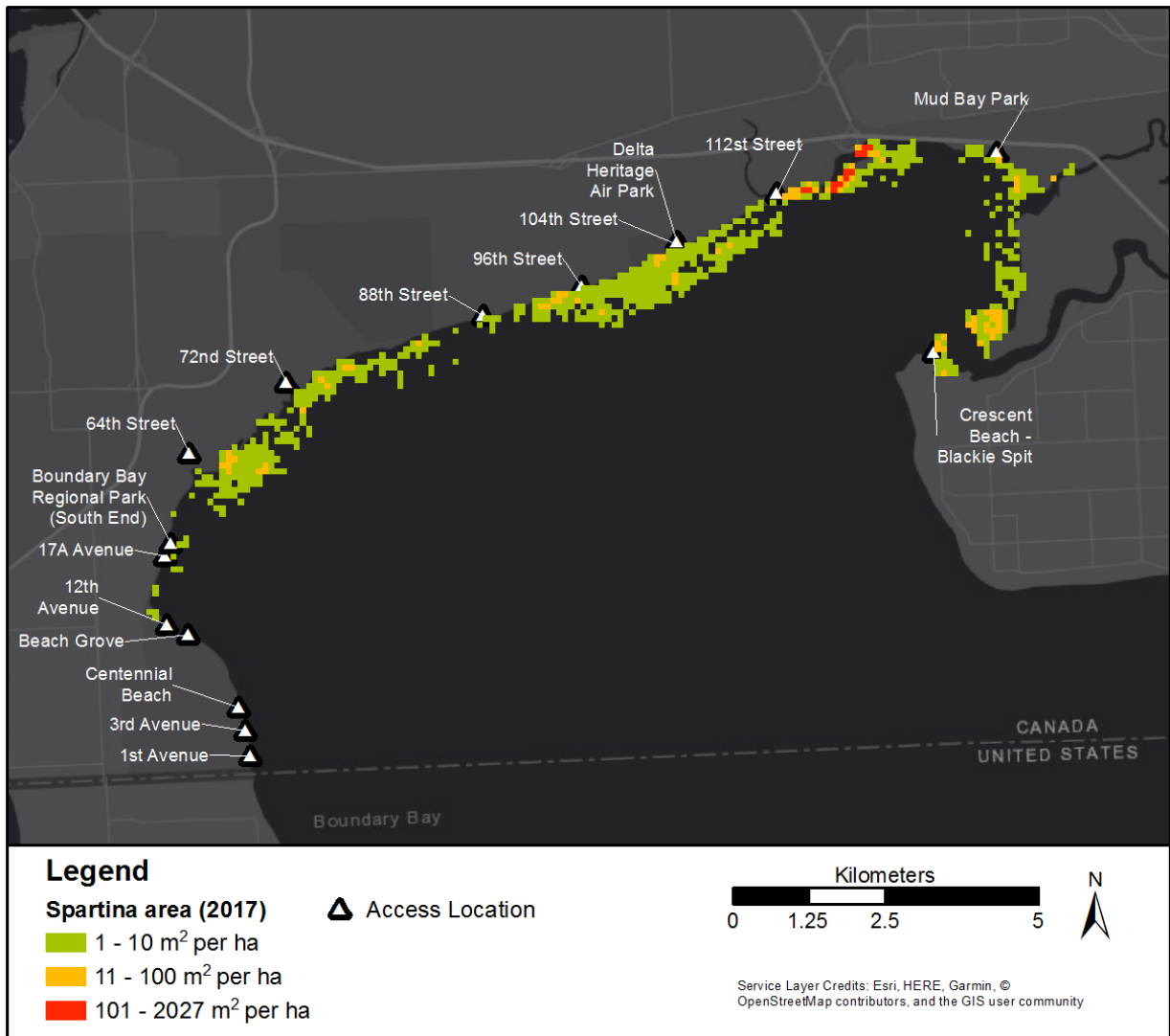
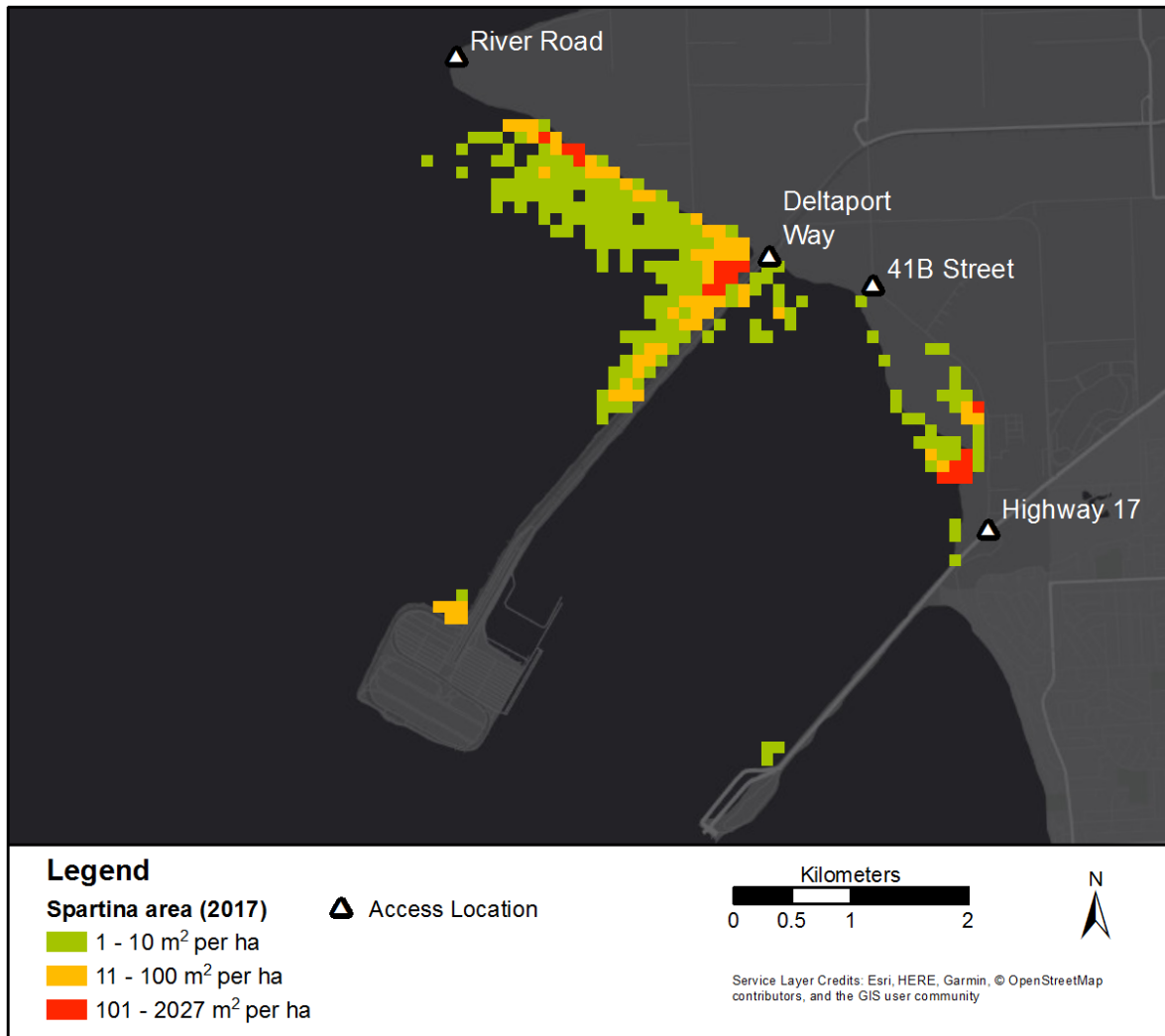


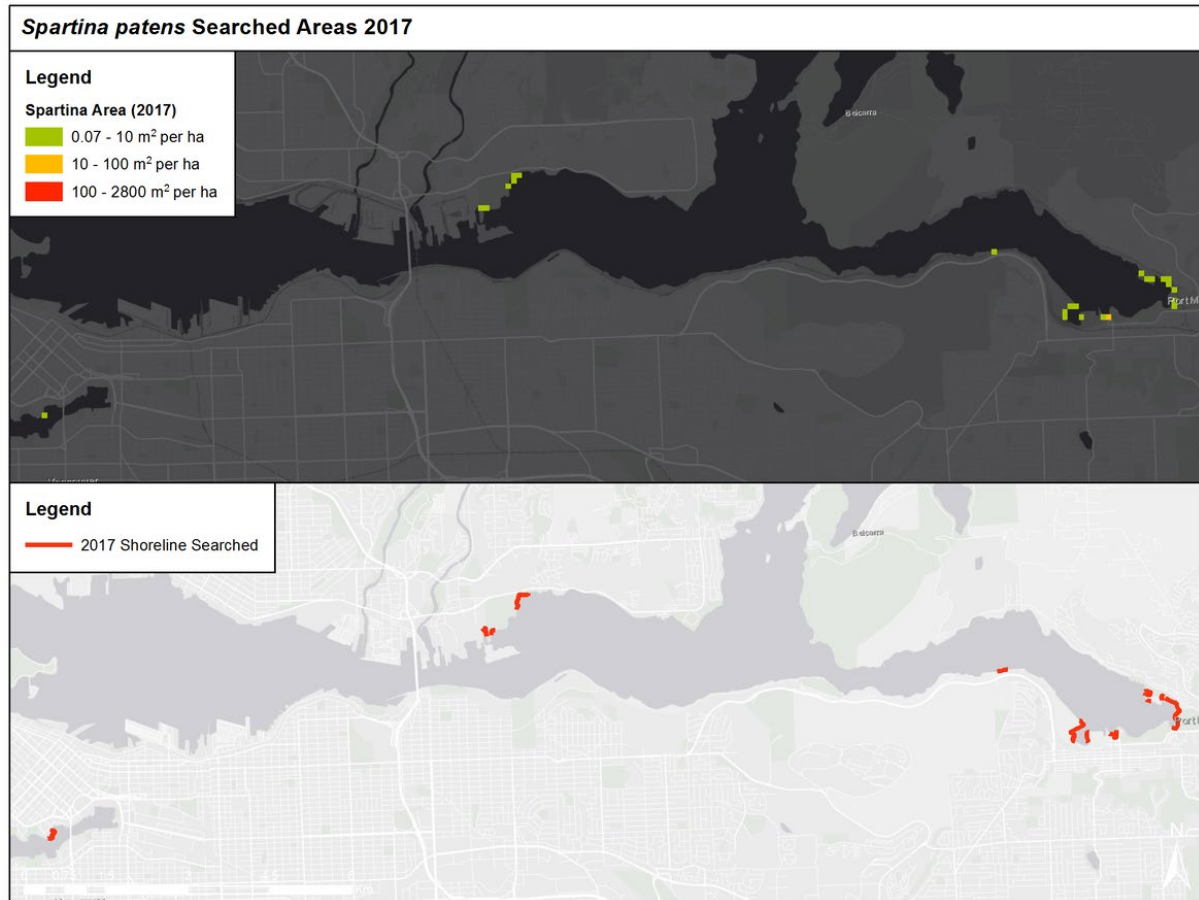
Figure 3. 2017 *S. anglica* infestation in Boundary Bay.



**Figure 4. 2017 *S. anglica* infestation in Roberts Bank.**

## BURRARD INLET

*S. patens* is found on the shoreline of the City of Vancouver, District of North Vancouver, and City of Port Moody in Burrard Inlet. Mapping along the shorelines of Burrard Inlet, Maplewood Conservation Area in the District of North Vancouver, Shoreline Park and, Pacific Coast Terminals in Port Moody continued into 2017. Clone expansion appears to be slower in comparison to *S. anglica* however, *S. patens* has spread to a new location in False Creek as shown in Figure 5. The density of *S. patens* despite the expansion in distribution has remained consistent from data collected in 2016.



**Figure 5. All known locations and areas searched for *S. patens* in Burrard Inlet for the 2017-2018 season.**

## VANCOUVER ISLAND

### EAST COAST OF VANCOUVER ISLAND

*S. patens* and *densiflora* surveys took place over approximately 120 kilometers on the east coast of Vancouver Island (Figure 5, Figure 6). Two large patches of *S. patens* were discovered along the coastline of Baynes Sound; one patch around 100m<sup>2</sup> in Trent River Estuary and another approximately 500m<sup>2</sup> in Deep Bay. Although *S. patens* distribution is expanding, *S. densiflora* remains contained to known locations with the majority categorized as seedlings assumed to be from the adjacent salt marsh.

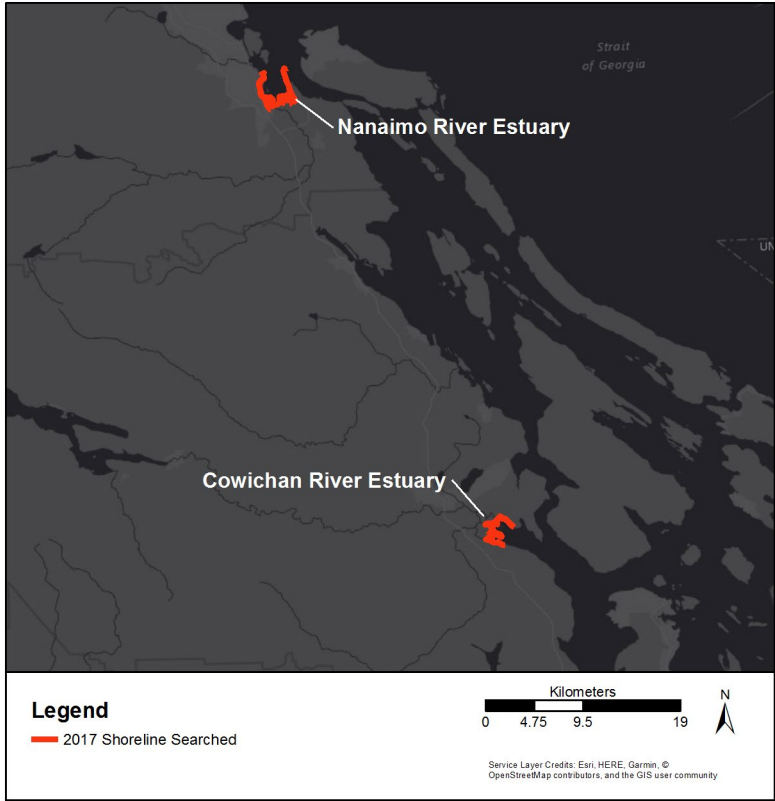


Figure 6. Coastline searched in 2017 along the east coast of Vancouver Island.

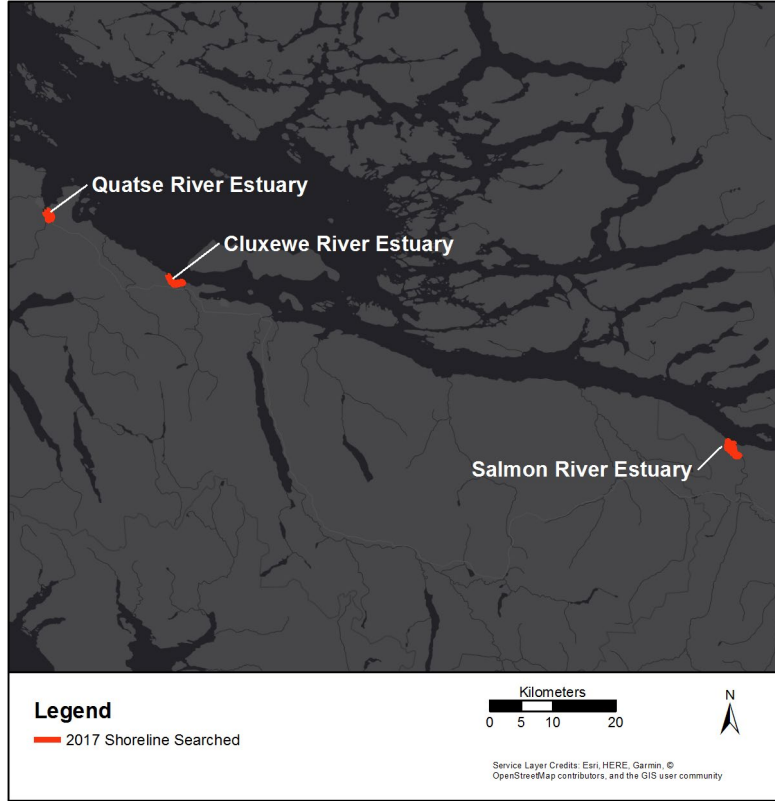


Figure 7. Coastline searched in 2017 along the east coast of Vancouver Island.

## DENMAN ISLAND, HORNBY ISLAND AND SANDY ISLAND

In 2017, approximately 79.5 km of shoreline was surveyed between Denman, Hornby and Sandy Island (Figure 7). Only *S. densiflora* was recorded on Denman, Hornby and Sandy Island as of 2016 however, the 2017 survey confirmed the presence of *S. patens* on Hornby Island.

Removal efforts coordinated by Jenny Balke for *S. densiflora* is continuing to show a reduction in density. Only seedlings appear to be either regenerating from surrounding waters with seed sources or seeds that remained in the seed bank.



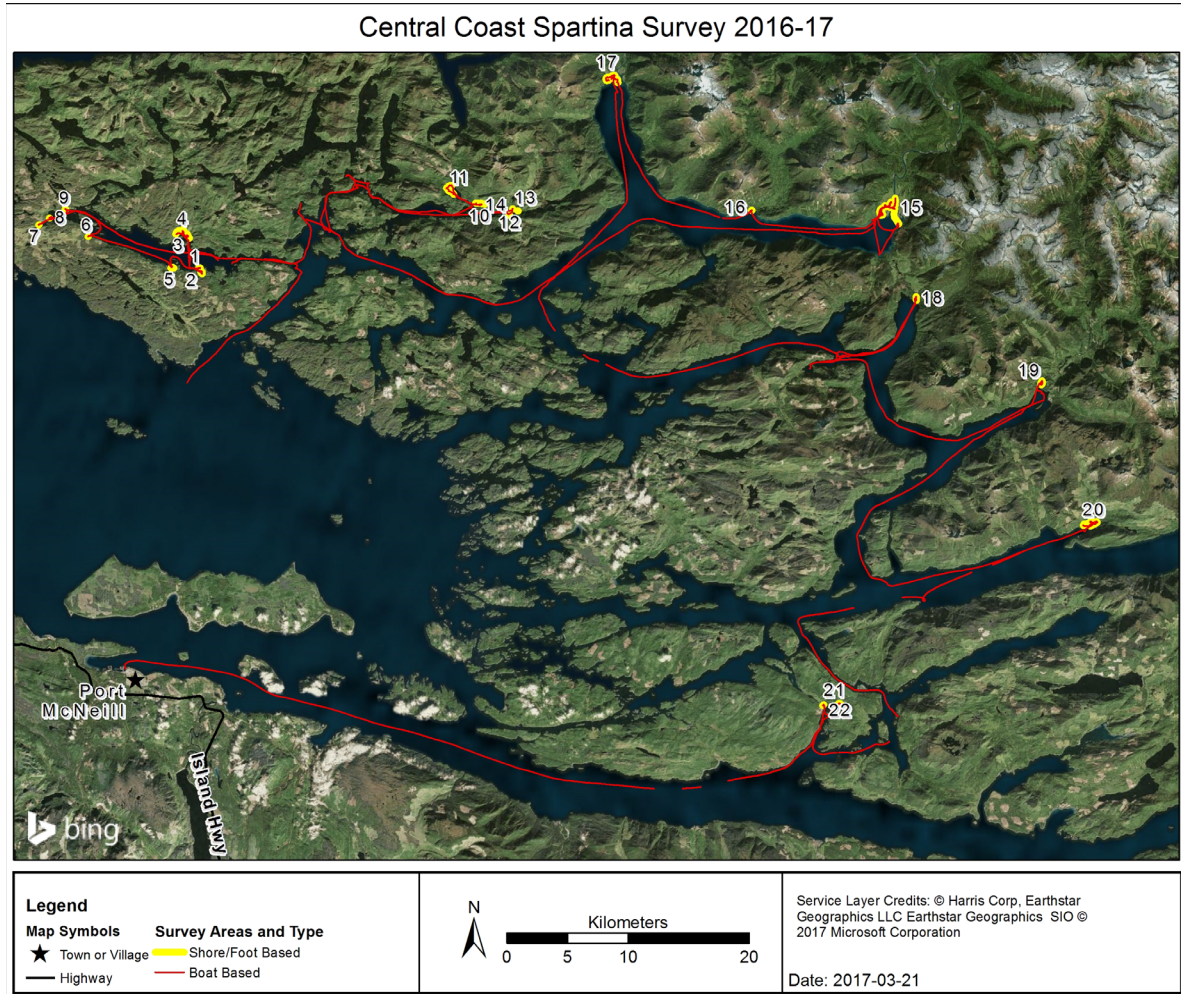
**Figure 8. Coastline searched in 2017 on Denman, Hornby and Sandy Island.**

## CENTRAL COAST



In 2016, the central coast of Vancouver Island (Figure 8) was surveyed for *Spartina* spp. Surveys focused on large estuaries, remote locations and industrial operations associated with disturbance. No *Spartina* was observed. Due to accessibility limitations and the absence of *Spartina* present, these areas were not surveyed in 2017-2018.

**Figure 9. Coastline along the central coast searched in 2016.**



## WEST COAST OF VANCOUVER ISLAND

The Raincoast Education Society (RES) surveyed approximately 144.7 kilometers on the west coast of Vancouver Island (including Tofino WMA) for *Spartina* spp. Surveys took place by boat, helicopter and on foot throughout Nootka Sound and Barkley Sound (Figure 9, Figure 10). No *Spartina* was observed. Monitoring of these areas will continue into the 2018/2019 season to ensure invasion does not spread to other areas such as Clayoquot Sound UNESCO Biosphere Reserve and Tofino Mudflats Wildlife Management Area.

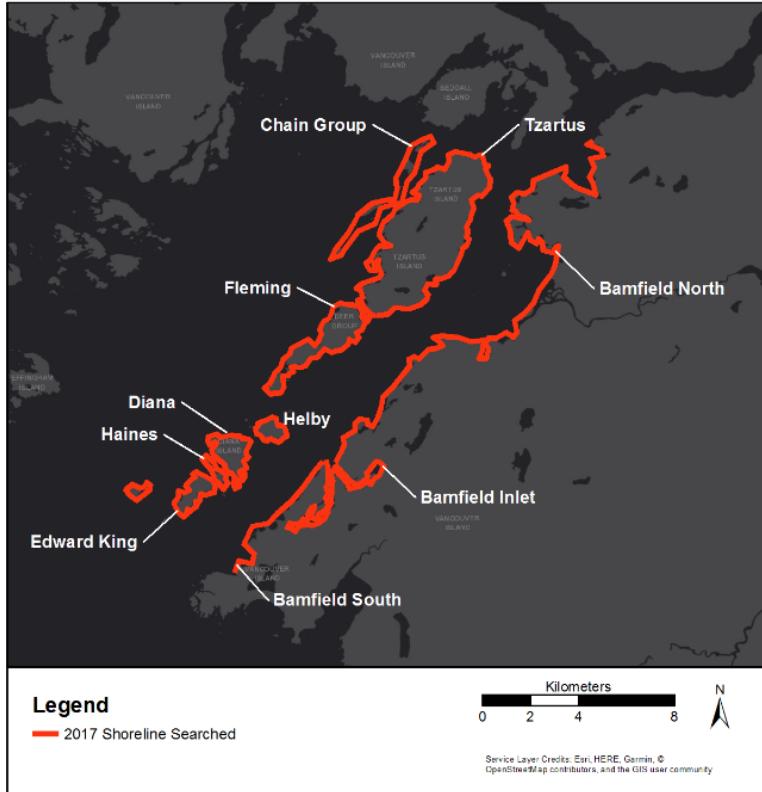


Figure 10. Coastline along the west coast of Vancouver Island searched in 2017.

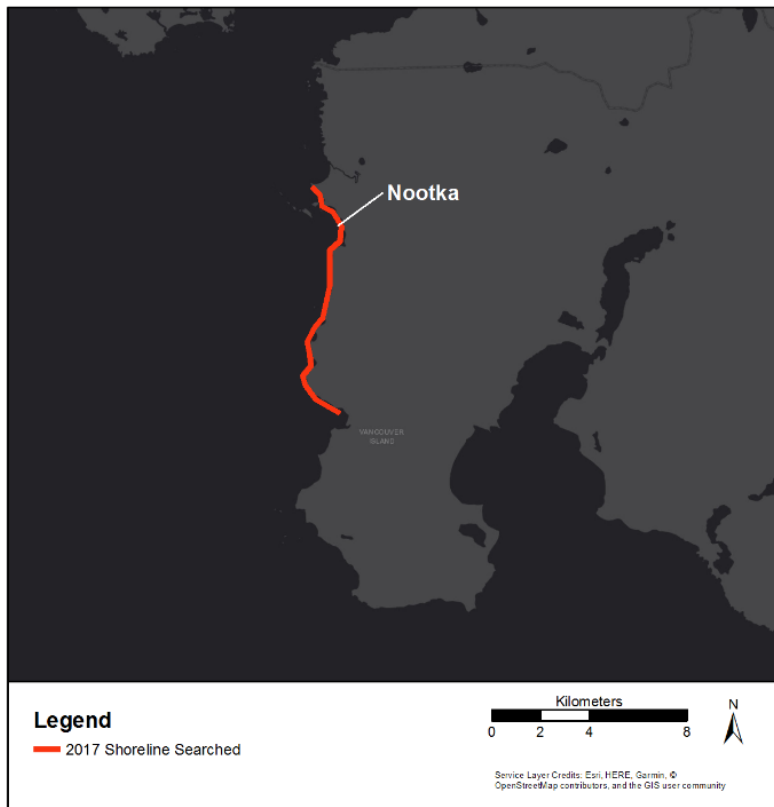


Figure 11. Coastline along the west coast of Vancouver Island searched in 2017.

## CONTROL & REMOVAL

### FRASER DELTA AND BOUNDARY BAY

#### MANUAL CONTROL

As in previous years, participants dug up individual plants and smaller clones using hand shovels before loading them into re-usable shopping bags or sleds for transport.

Manual control follows the integrated control plan by using manual removal (i.e. pulling and digging) for single plants and small clones with a focus on herbicide for clones < 30 cm. In 2017, 21 size 'S' (single plants or seedlings) and 4 size 'A' (< 30 cm in diameter) clones were manually removed. There has been a significant reduction in the total number of spartina plants removed by hand as a result of less small plants that are easily and effectively able to be removed as a result of years of hand removals and herbicide treatments.

Alongside a four-person Spartina crew hired through BCCF, the City of Surrey's SHARP and SNAP summer crews and Corporation of Delta's Noxious Weed Control Crew played a role in the mapping and hand removals of *Spartina* clones.

#### 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. Annual 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.

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#### HERBICIDE CONTROL ACTIVITIES

Approximately 136 people-days were spent on herbicide application in 2017. Herbicide treatment for 12 515 clones *S. anglica* was completed in the Roberts Bank and Boundary Bay (Figure 11, Figure 12). The 2017 treatment is estimated to be 4.82 ha of *Spartina* spread over more than 5700 ha of intertidal habitat (based on 2412 L/ha of herbicide mix used).

Approximately, 18.09 litres of Habitat (24% imazapyr) and 12.06 L of surfactant, Ag-Surf II (92% alcohol ethoxylate) were used throughout the 2017 season. 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. When conditions permitted, herbicide was applied to *S. anglica* on June 20, 21, 23, July 4 -7, 18 - 21, 24 - 26, August 8 – 10, 16 – 18, 21 – 23, September 5 – 7, 20 – 22 and October 5 – 6, 29 – 31<sup>st</sup>.

Herbicide application in Boundary Bay shows spots with no herbicide treatment. While all *Spartina* plants were sprayed over two passes; due to a change in technology used to record treatments (i.e. switched from GPS units to Collector and Survey 123 applications), some treatment data was entered improperly and is therefore not shown in Figure 12.

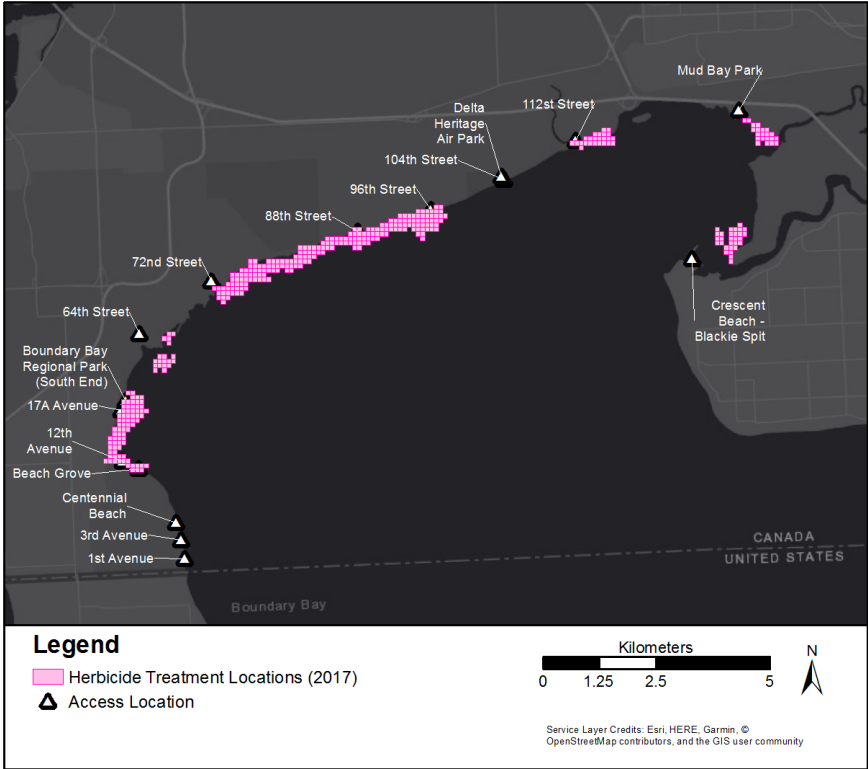


Figure 12. Spartina infestation treated with imazapyr in Boundary Bay in 2017.

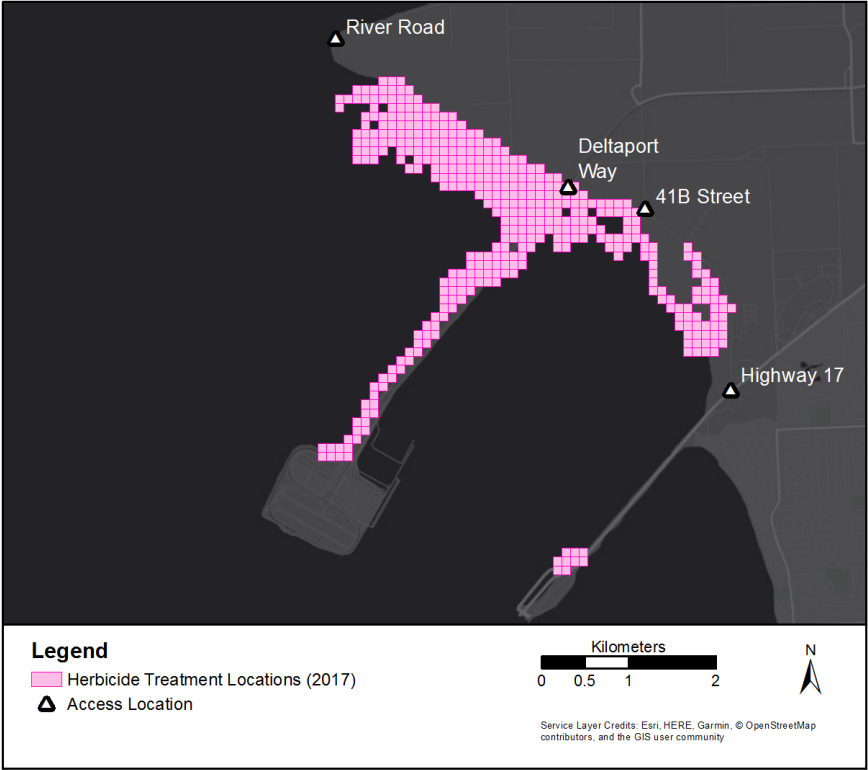


Figure 13. Spartina infestation treated with imazapyr in Roberts Bank in 2017.

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#### MANUAL CONTROL

The infestation of *S. patens* poses 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 with a greater diversity of native plants compared to *S. anglica*, which is generally found in bare mud. Removal trials using cover plots and mechanical excavation have taken place since 2012. The last cover plot trial was installed in 2015/2016 at Port Moody with the intention of leaving the woven geotextile covers for two years. Cover plots are to be removed in August of 2018 and assessed for regrowth of *S. patens*. To date, manual and mechanical removal has been met with little success as *S. patens* regrew in areas after the geotextile was removed. Post shading or digging control of *S. patens* has resulted in limited natural colonization by native marsh vegetation and *S. patens* has regenerated within 2 years.

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#### HERBICIDE CONTROL ACTIVITIES

Due to the limited success with eradicating *S. patens* using manual removal, herbicide trials at Pacific Coast Terminals were implemented in 2015 with success when compared to previous removal efforts (i.e. manual and mechanical removal) (Figure 13). Therefore, in 2017 larger scale treatments were conducted on *S. patens* using the same protocol as *S. anglica*; at low tide during the day to allow a 4-hour drying time after application with clear to partially cloudy weather and temperatures between 17<sup>o</sup> C & 23<sup>o</sup> C. When conditions permitted, herbicide was applied to *S. patens* on May 29 and 31, 2017.



**Figure 14. Herbicide applicators spraying imazapyr on *S. patens* at Pacific Coast Terminals in 2017.**

#### VANCOUVER ISLAND MANUAL CONTROL

The West Coast Conservation Lands Management (WCCLM), Project Watershed and Raincoast Education Society (RES) coordinated inventory and/or control measures for of *S. densiflora* and *S. patens* on the east coast of Vancouver Island except for Denman, Hornby and Sandy Islands.

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#### MANUAL AND MECHANICAL REMOVALS

In 2017, WCCLMP, Project Watershed and RES dedicated approximately 678-person hours to the mapping and removal of *Spartina spp.* Of which, 380-person hours were used to map and remove 865 kg of *S. densiflora* from Deep Bay to Goose Spit, Sandy Island, and the Seal Islets. The remaining 298-person hours were dedicated to the mapping and removal of over 30 000 kg of *S. patens*. Although most *S. patens* patches were too large to remove effectively, smaller patches along with *S. densiflora* were transported to the Comox Valley Waste Management Centre for disposal (Figure 14).



**Figure 15. *S. patens* removed and bagged for disposal.**

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## 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 m<sup>2</sup> – 1.5 m<sup>2</sup> and > 5.0 m<sup>2</sup> were installed along K'ómok 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.

Preliminary assessments of previously removed cover plots show signs of *S. patens* re-establishing (Figure 15). Cover plots are assumed unsuccessful due to the surrounding area remaining infested with *S. patens* thereby recolonizing bare areas after covers are removed.





**Figure 16. *S. patens* re-establishing an area previously treated with a cover plot.**

#### DENMAN ISLAND, HORNBY ISLAND AND SANDY ISLAND – MANUAL CONTROL

##### MECHANICAL EXCAVATION

In total, approximately 460 plant clusters were manually dug, bagged and removed from site to be composted on Denman Island between October 2017 and March 2018. Mapping and removal efforts since 2015 has provided insight into the success of manual and mechanical removal for *S. densiflora* as the number of regenerating seedlings removed each year has continued to decrease on Denman Island. Given the success in reducing plant size and population abundance of *S. densiflora* to date, hand removals will continue to be the primary means of control. Herbicide treatment is recommended as a secondary treatment option for *S. densiflora* should the need arise to effectively manage and eradicate this species.

## SCIENCE – EVALUATION - MONITORING

### HERBICIDE EFFICACY MONITORING – BOUNDARY BAY & ROBERT’S BANK

Herbicide efficacy assessments took place in October 2017. BCCF crewmembers visually assessed *S. anglica* herbicide treatment efficacy across two levels of infestation, low (1-10 m<sup>2</sup> spartina) and high (> 10 m<sup>2</sup> spartina). Crewmembers noted for the absence and/or presence of *S. anglica*, categorizing *S. anglica* present in the plots as alive, dead or showing signs of previous treatment. Alive plants are classified as having green leaves and no visual signs of stress, dead plants are classified as having no green leaves and obvious signs of decay, and previously treated plants are classified as having green to yellow leaves with signs of stress and no sign of regrowth.

Results indicated the majority of *S. anglica* was found in high-leaf areas with a mud substrate. Most of plants fell into Size A and Size B categories. A total of 438 plants were found in all the grid cells; 54.80% of those plants were treated, 40.18% of those plants were alive and 5.02% were dead. Reassessment of plots will take place in 2019.

## 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](http://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](mailto: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 (*S. patens*)
- Coastal Invasive Species Committee: <http://www.coastalisc.com/priority-invasive-plants>

### SPARTINA IN THE MEDIA

- a. An APP Solution! – <https://www.ducks.ca/stories/science/spartina-app/> (February 2018)

### SPARTINA PRESENTATIONS AND WORKSHOPS

- a. K’omoks First Nations Meeting – presentation (December 2017)
- b. North Puget Sound Annual Spartina Meeting – presentation (May 2017)

## FINANCES

The BCSWG partners and individual volunteers contributed over \$420,346 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 however these contributions were not tracked as effectively as in previous years. In 2017 approximately \$30,000 in in-kind contributions were made by the following agencies:

BC Conservation Foundation	Corporation of Delta
BC Ministry of Environment	Environment Canada- Canadian Wildlife Service
BC Ministry of Forests, Lands and Natural Resource Operations	Friends of Semiahmoo Bay Society
City of Surrey – ShaRP & SNAP Programs	K’omoks First Nation
Vancouver Island Conservation Land Management Program	Port of Vancouver
Community Mapping Network	City of Port Moody

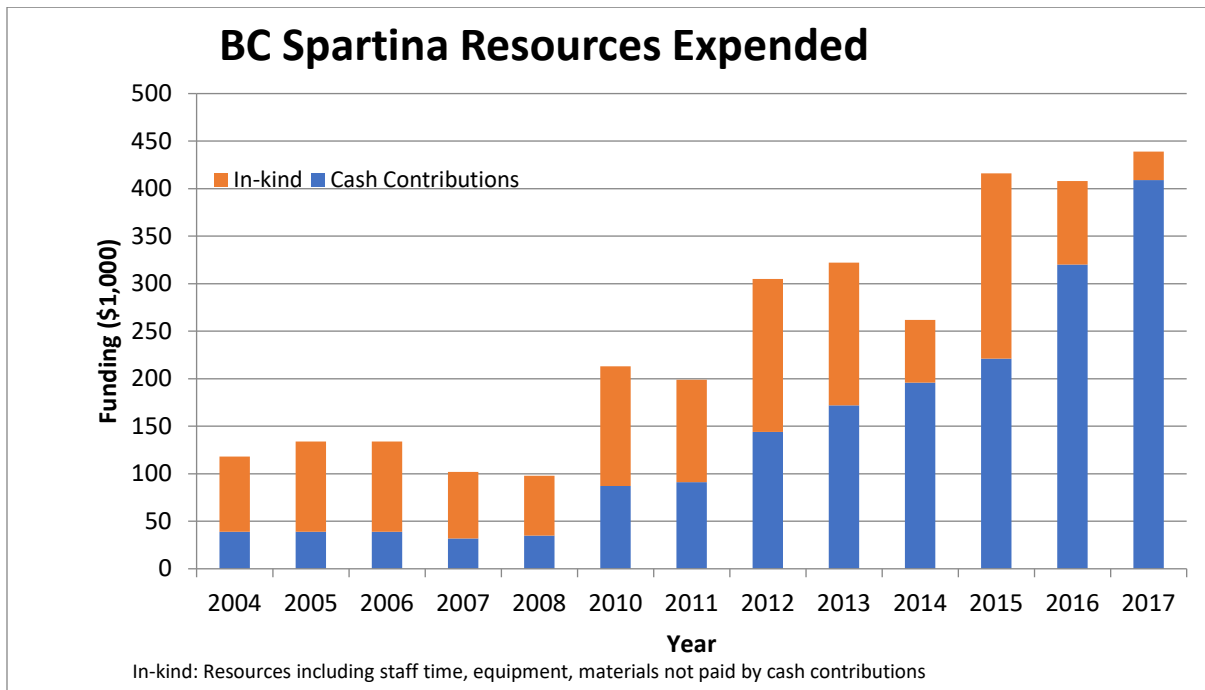
The recent history of financial contributions (cash and in-kind) of the BC Spartina Working Group is found in Figure 16. Table 2 and Table 3 summarize the income and expenditures for 2017, respectively.

**Table 2. BC Spartina Eradication Program 2017 Revenue**

Revenue		
Source	Through DUC	Through BC SWG Member
Province of BC	\$200,000	
Port Metro Vancouver	\$25,000	
Environment Canada-National Wetlands Conservation Fund	\$161,500	
Service Canada – Canada Summer Jobs		\$22,650
<b>Subtotal</b>	<b>\$386,500</b>	<b>\$22,650</b>
<b>Grand Total</b>	<b>\$409,150</b>	

**Table 3. BC Spartina Eradication Program Direct Cost (Cash) Contributions - BCSWG 2017**

Expenditures		
Category	Fraser Delta	Baynes' Sound
Travel	\$7,385	\$2,975
Gas, Mileage, Truck Rental	\$13,400	\$12,146
Personnel - Contractors	\$127,323	\$72,067
Personnel - Staff	\$86,566	\$66,723
Small tools, Supplies etc...	\$16,560	\$4,006
Subtotal	\$251,234	\$157,917
Total	<b>\$409,150</b>	



**Figure 17 BC Spartina Resources Contributed Over Time**

## 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 other states are important. The Washington State Department of Agriculture (WSDA) has been a long-term partner with the BCSWG and the BC SWG will continue to work with WSDA for eradication of *Spartina*.

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 2018

While the Spartina Project documented several successes and shortfalls in 2017, a continued collaborative commitment of resources is required to achieve eradication. The Pacific Coast goal of eradication of non-native Spartina by 2018 should be re-visited with those parties who signed on to this commitment. The following recommendations should be taken into consideration:

1. Mapping and Control (General)
  - a. Utilize an integrated pest management approach towards eradicating *S. patens*. Implement the use of herbicide to manage *S. patens* in the Lower Mainland.
  - b. Use chemical treatments on *S. patens* in Burrard Inlet with intentions of treatment use on Vancouver Island.
  - c. 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. Proceed with operational scale herbicide treatments of *S. patens*
5. Vancouver Island
  - a. Initiate mapping and control in early spring 2017 (before plants begin to flower) and continue removals into winter 2018. Control efforts should focus on previous priority sites continuing to deplete these *Spartina* infestations.
6. Partnerships and Outreach
  - a. Continue to expand partnerships with other groups in the Lower Mainland and Vancouver Island.
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

Data collection of *Spartina spp.* through Collector and Survey 123 applications has replaced the need of Global Positioning Systems (GPS) units used in previous years. Both applications are accessible on iPhones used by summer students, volunteers and herbicide applicators providing real-time track logs of mapped areas and location of clones. Survey 123 records the location and size class of *S. anglica* denoted as single seedling, clone <0.3m, clone 0.3m - 1.0m, clone > 1.0m in diameter, or 5m area of single plants. Due to *S. densiflora* and *S. patens* growing in patches, location and size are recorded in Survey 123 but are categorized by m<sup>2</sup>.

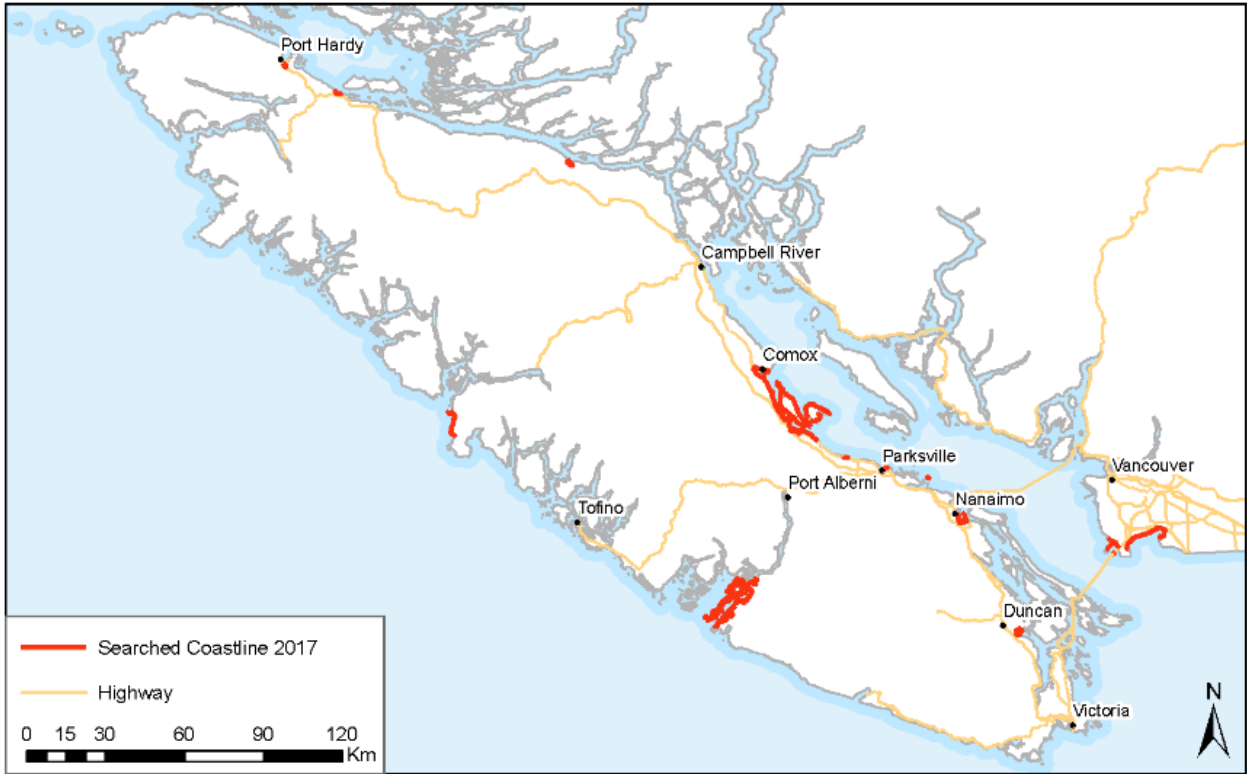


Figure 18. Overview of all searched coastline for *Spartina* spp. in British Columbia for 2017

SPARTINA INVASION SUMMARY

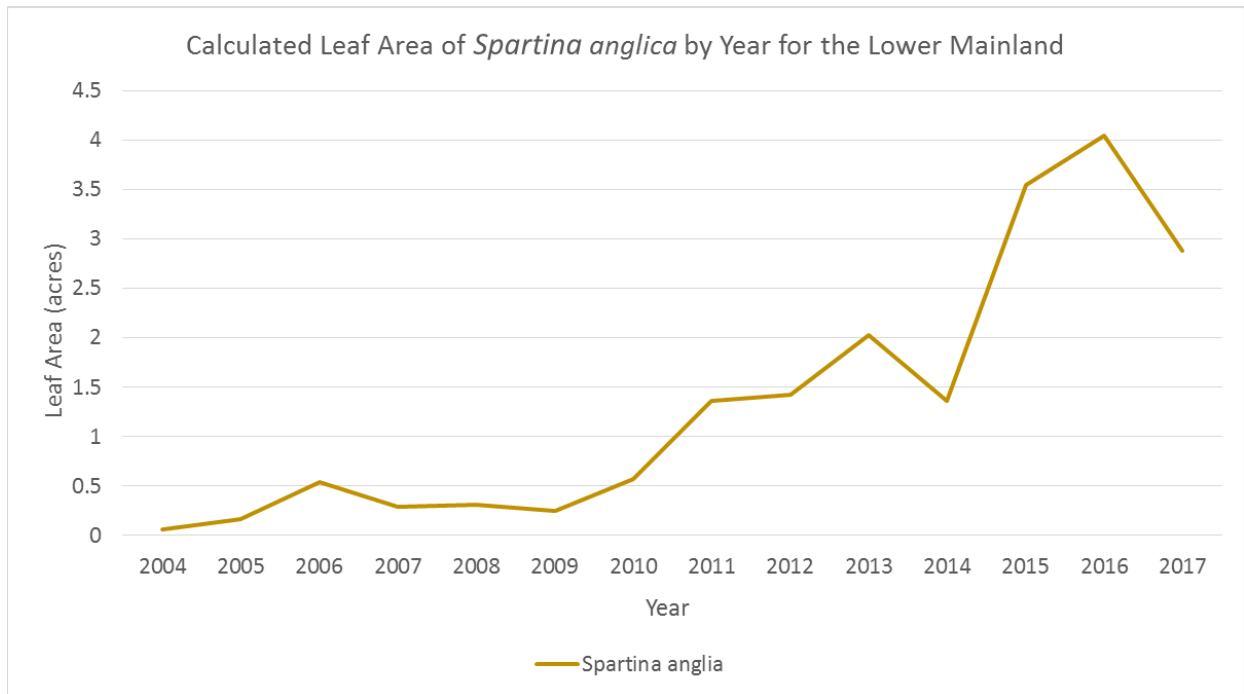
**Table 4. Invasion summary of all *Spartina* spp. in British Columbia from 2013 to 2017**

	<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
<b>2013</b>	0.8191	940	8511	-	-	-	-
<b>2014</b>	0.5499	937	13921	-	-	-	-
<b>2015</b>	1.435	898	18074	.3395 (0.005*)	92 (12*)	0.4021	194
<b>2016</b>	1.637	973	23260	.0997 (.0163*)	66 (25*)	0.3977	278
<b>2017</b>	1.167	900	12499	1.006 (.0163*)	157 (25*)	0.0147	147
*Lower Mainland Only							
**Area estimates are based on a grid of 1-hectare cells for BC's coastline.							



**Table 5. *S. anglica* detected by size class from 2005-2017 in Boundary Bay and Roberts Bank**

Size	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Single plants	167	107	41	56	67	197	185	4497	5210	4431	832	6036	337
Clone < 0.3m	329	229	111	110	221	532	433	685	3548	6771	6692	8610	4893
Clone 0.3m - 1.0m	204	210	108	60	234	475	441	538	1371	1252	8123	5733	5577
Clone > 1.0m	90	42	33	61	149	184	296	1065	1334	1102	1930	2770	1617
Patch 5m dia.	0	97	49	47	12	78	55	7	36	29	66	107	68
Large Patch >5m	0	0	0	0	0	20	31	12	7	0	2	16	14
<b>Total:</b>	<b>790</b>	<b>685</b>	<b>342</b>	<b>334</b>	<b>683</b>	<b>1486</b>	<b>1441</b>	<b>6804</b>	<b>11506</b>	<b>13585</b>	<b>17645</b>	<b>23272</b>	<b>12506</b>



**Figure 19 *S. anglica* Size Classes Mapped from 2005-2017**