British Columbia *Spartina* Eradication Program
2011 Progress Report

Prepared for: Ducks Unlimited Canada (April 2012)
by Rob Knight (rknight@telus.net)
DUC Contact: Dan Buffett
Address: 511 – 13370 78th Ave Surrey BC V3W 0H6
Phone: (604) 592-0987 Fax: (604) 592-0930
Email: d_buffett@ducks.ca

On Behalf of: The BC Spartina Working Group (BCSWG)
City of Surrey
Coastal Invasive Plant Council
Community Mapping Network
Corporation of Delta
Invasive Plant Council of Metro Vancouver
Ducks Unlimited Canada
Environment Canada – Canadian Wildlife Service
Fisheries and Oceans Canada
Friends of Semiahmoo Bay
Metro Vancouver
Ministry of Forests, Lands & Natural Resource Operations
Port Metro Vancouver
Seagrass Conservation Working Group

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Acknowledgements

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Over the course of summer and fall of 2011, many other individuals and groups contributed to finding and removing *Spartina sp.* in BC. The BCSWG is grateful for the hard work by numerous volunteers and partner organizations that mapped and removed *Spartina* on the Fraser Delta and on Vancouver Is. (Baynes Sound and Tofino). The table below acknowledges most of those contributions beyond direct participation in the BCSWG activities.

Organization	Participants
City of Surrey; SHaRP/SNAP Programs	Liana Ayach/Celina Starnes: coordinating summer students & community volunteers
Friends of Semiahmoo Bay Society	Alison Prentice and Leeann Graham supervised and participated in removals along with Ben Olsen, Beach Heros - summer students: Amanda Sigouin & Christina Jaworski
Other Volunteers on Fraser Delta	Brad Mason, Peter Harris, Jesica Vanditmars, Roxanne Koczworski, Greta Borick, Chris Helmer, Olivia Gall
People for Puget Sound	Rachel Benbrook: out reach at Salish Sea Conf., Vancouver
Rotary Club of Ladner	Don Burkett with 19 volunteers, Rotary & in community
Tofino Mudflats & Area Mapping Volunteers: Tofino Botanical Gardens (TBG), Raincoast Education Society (RES), Paddlewest Kayaking (PK)	Josie Osborne (TBG), Kimberly Johnston, Laura Timmermans, Ava Hansen (RES) Dave Bailey, Caron Olive (community volunteer) Emre Bosut, Kellsie Maas and Josiane Briggs (PK)
Vancouver Island Land Conservation Management Program (VILCMP): Baynes Sound mapping, *S. densiflora* removals	Thomas Reid, Steven Godfrey & Clayton Billett
Comox Valley Regional District	Financial contribution to VILCMP work in Baynes Sound
Vancouver Island University & Baynes Sound Mapping Volunteers	Brian Kingzett (VIU - research vessel "Chetlo") & Ernie Sellentin, Jenny Balke, Brian Hay

Executive Summary

In 2011, 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 (*S. anglica*, *S. densiflora*, and *S. patens*) by 2018 along the coasts of BC, Washington, Oregon and California.

In 2011, the BC *Spartina* Eradication Program provided $178,434 of in-kind and direct value to deliver program components focused on Monitoring, Removal, Coordination, Outreach and Science/Evaluation. The monitoring program included mapping approximately 35km in the Fraser Delta, 18km of shoreline on the East Coast of Vancouver Island in Baynes Sound and 30km of shoreline near Tofino (by kayak - English Cove, Bedwell Sound). The 2011 inventory shows that the abundance and density of *Spartina anglica* in Boundary Bay and Roberts Bank has continued to increase from 2007 and even more rapidly on Roberts Bank since 2010. *Spartina sp*. were not found on the Tofino mudflats and *S. densiflora* is expanding its range in Baynes Sound.

Overall, the number of S. anglica plants in the Fraser Delta remained constant between 2010 and 2011 (decrease by 3%) based on annual June mapping, but since 2009 the number of plants has increased 107% (683 to 1441 plants). Over both time periods (2009 to 2010, 2010 to 2011), the number of 1meter and larger size clones continued to increase (i.e. increase of **61% between 2010 and 2011).**. The survey effort for mapping in 2011 was essentially the same or slightly less than in 2010 for the Fraser Delta area. If *S. anglica* infestations in BC are left unchecked they will grow rapidly into thousands of acres of salt grass meadows, exponentially increasing the future costs of eradication as previously experienced in Washington, Oregon and California.

Spartina removals in 2011 continued to use hand digging, and mechanical excavating in locations at high risk infestations sites. In the Fraser Delta, s *S. anglica removals* occurred on Roberts Bank (north of and beside the Delta Port causeway) and in Boundary Bay (112th St.). On Vancouver Island, some of the *S. densiflora* was manually removed from Baynes Sound .

S. patens infestations in Burrard Inlet and Baynes Sound have not been controlled in any manner to date as the limited financial resources have been targeted to S. anglica and S. densiflora species.

Outreach in 2011 was limited to some community based training on Vancouver Island delivered by GL Williams in cooperation with the Coast Invasive Plan Council (CIPC). The training in Tofino in 2010 resulted in a volunteer based monitoring in 2011, demonstrating the value of outreach activities.

Outcomes of the 2011 program continue to confirm the conclusion of the *BC Spartina Response*

Plan 2010 (Dresen et al, 2009) which indicated that mechanical control efforts have met with limited success.

Background

In 2003, *Spartina 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. Two other *Spartina* species have since been discovered in BC: *S. densiflora* (Vancouver Island) and *S. patens* (Burrard Inlet). These other two species tend to establish on shorelines with coarser materials in higher inter-tidal zone.

The impacts of *Spartina* species include: conversion of mudflats to monoculture stands, loss of habitat for waterbirds and fish, accretion of sediments, and modification of drainage patterns. Intertidal areas in Washington 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 both the Puget Sound Partnership and the Washington State Department of Agriculture which are two U.S. agencies that are involved in *Spartina* eradication in Washington State. All agencies involved bring valuable expertise to the group. 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, in Baynes Sound and Tofino (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.

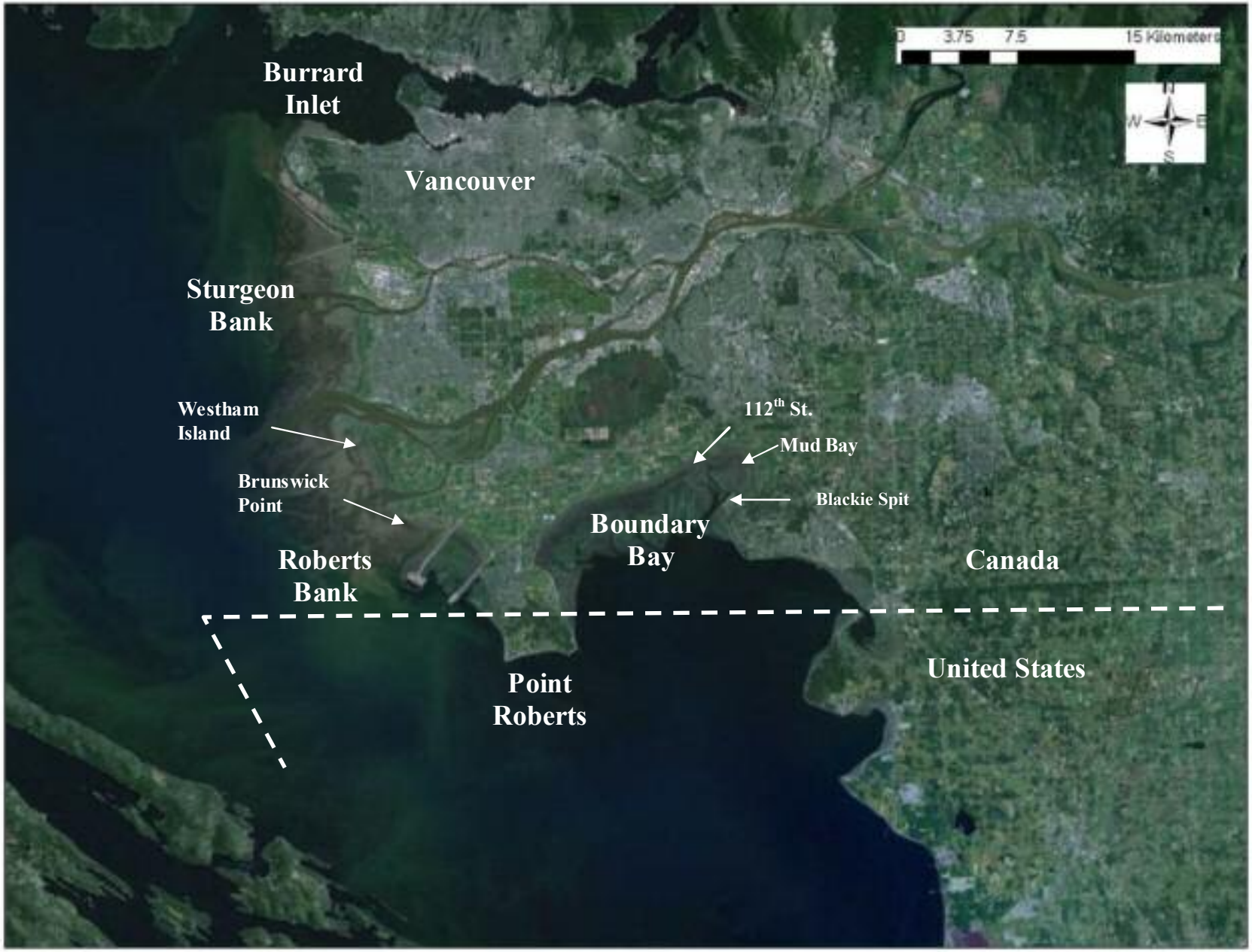

Figure 1. Areas in the Fraser River Delta

Fraser Delta Program - Detection

South Fraser

In 2011, it took approximately 64 person days (14 calendar days) to monitor about 35km of shoreline in the Fraser Delta. Mapping efforts continued to follow the same methods from 2008/09. The method of walking the intertidal habitat with hand held Global Positioning System (GPS) units (Garmin Etrex, Garmin GPSmap76S, Garmin GPSmap60Cx, Garmin 12XL, Garmin Dakota20, Marine Navigator Map 76) was used to identify the location of plants along Boundary Bay, Roberts Bank and Sturgeon Bank. Locations were denoted as one of: single seedling, clone <0.3m, clone 0.3m - 1.0m, clone > 1.0m in diameter, and 5m area of single plants. Surveying flags were used to mark the location of the plants. The flags reduced searching time during removals and led to more effective removals by volunteers.

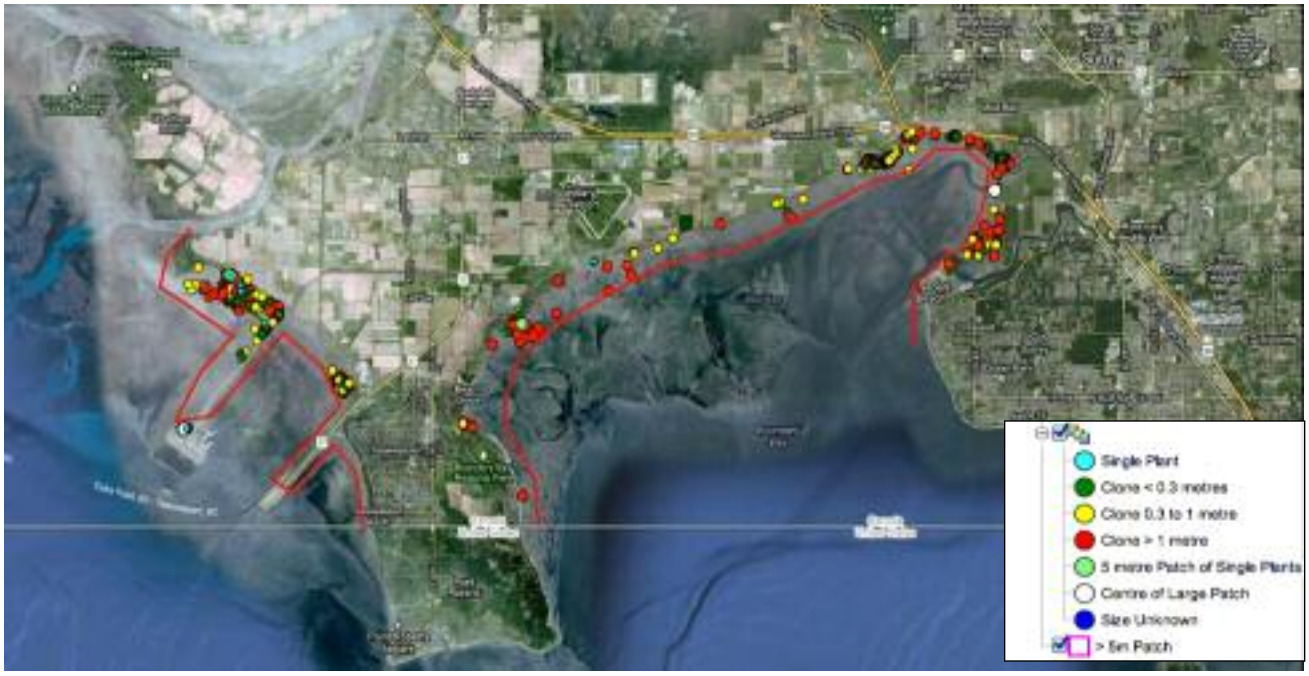

Figure 2. Spartina anglica Extent of Search Area (red line) and Distribution in the Fraser Delta Area – 2011

The extent of shoreline searched in 2011 was a bit less than in 2010 (similar to areas of 2005 to 2009) covering shores and mudflats of Mud Bay, Boundary Bay and Roberts Bank rounding Brunswick Point to the south arm of the Fraser River. The intertidal areas west of Westham Island and south of Crescent Beach to the Canada/US boarder were not surveyed in 2011 because of limited manpower and *S. anglica* was not found beyond the 2011 search extent in 2010. *Spartina anglica* was found growing in all intertidal zones and on a variety of substrates ranging from fine silt/mud, sand to cobble. It was found as seedlings, as larger isolated clones and integrated with other native marsh vegetation.

Each year since 2007 the number of larger 1m+ clones has steadily increase in spite of considerable control efforts using mechanical removal by hand and machine. Between 2010 and 2011 there was a **61% increase** in the number of 1m+ size clones and a **55% increase** in larger patches of mixed size plants (patches greater than 5m diameter). Overall, the number of *Spartina anglica* plants stayed the same since 2010 after a dramatic increase in 2009. The mapping effort in 2011 was essentially the same as 2010. (Table 1, Figure 3Spartina anglica Size Classes Mapped from 2005-2011)

Table 1. Spartina anglica Size Classes Mapped from 2005-2011 in Boundary Bay and Roberts Bank.

Size	2005	2006	2007	2008	2009	2010	2011
Single plants	167	107	41	56	67	197	185
Clone < 0.3m	329	229	111	110	221	532	433
Clone 0.3m-1.0m	204	210	108	60	234	475	441
Clone > 1.0m	90	42	33	61	149	184	296
Patch 5m dia.	0	97	49	47	12	78	55
Large Patch >5m	0	0	0	0	0	20	31
Total	790	685	342	334	683	1486	1441

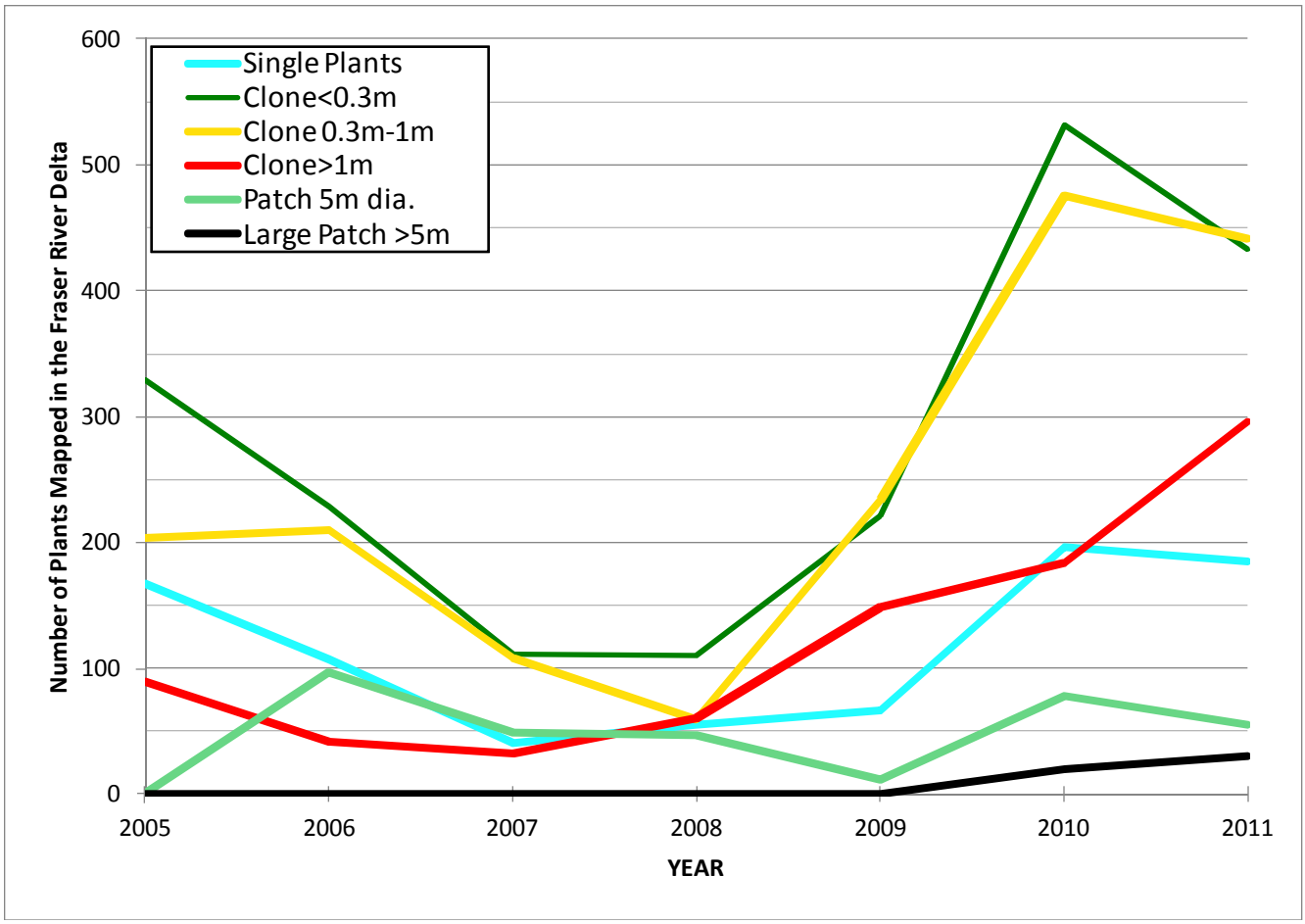

Figure 3. Spartina anglica Size Classes Mapped from 2005-2011

Focus Areas of Greatest Concern:

The following three areas are of greatest concern because of the relatively high infestation and ecological values.:

Brunswick Point:

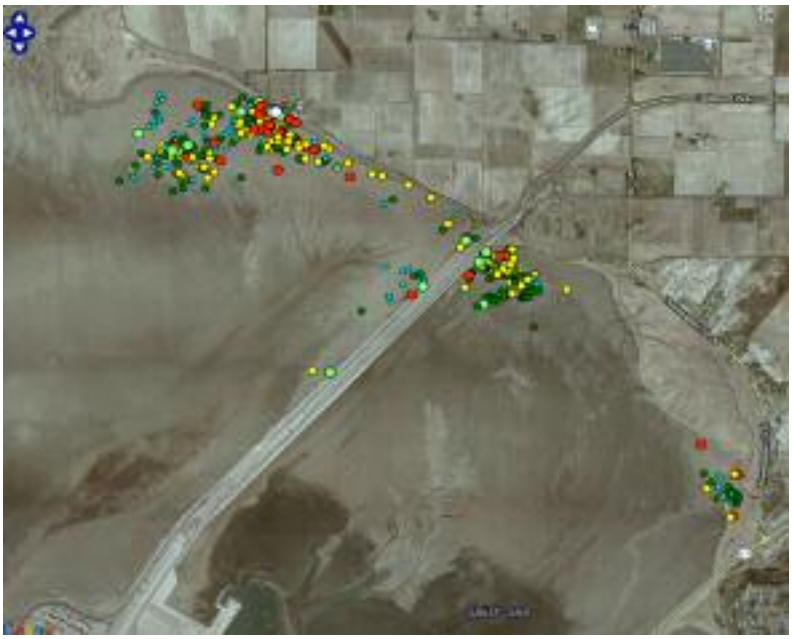

Figure 4. Distribution of S. anglica at Brunswick Point – 2010

This area has very high ecological values for avian and fish species, specifically as the only confirmed, significant source of bio-film that Western Sandpiper utilize as an essential food source in the spring migration north. The *S. anglica* infestation in this area has spread considerably over the past several years. A large infestation of all clone sizes has expanded on the mudflats between Brunswick Point and the Delta Port causeway in spite of considerable effort to remove all sizes by hand and with excavators. Many 1m and larger clones were removed in the intertidal marsh area between Brunswick Point and the Delta Port Causeway in 2010 but the rapid expansion has continued beyond the resources currently available to control this infestation. In addition a new infestation was mapped in 2011, at the southern end of the causeway (Figure 5)

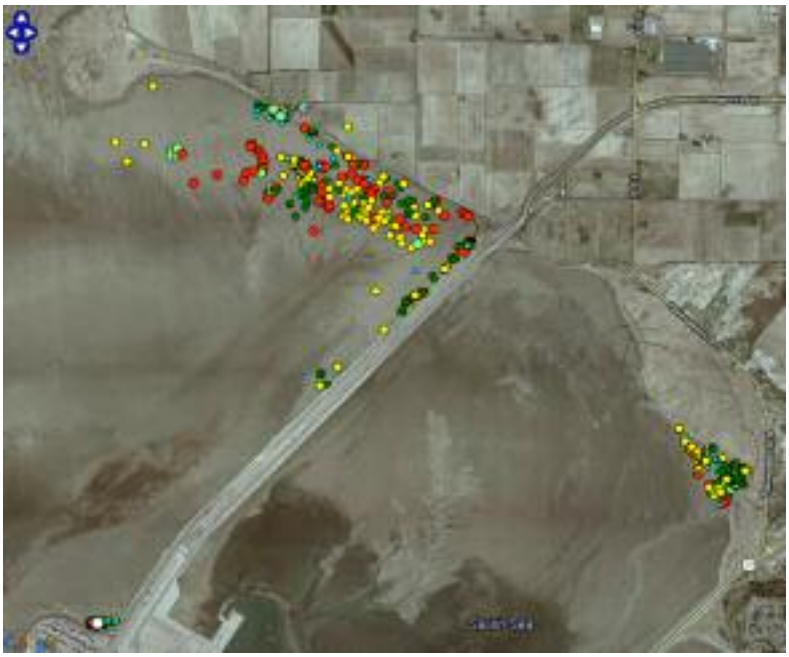

Figure 5. Distribution of S. anglica at Brunswick Point – 2011

112th Street:

In 2010 this area was the largest and densest infestation in Boundary Bay and despite removal efforts in 2007, 2008, 2009 and 2010 there is still a large infestation in this area. The majority of data points in the 2011 data are now 1m+ clones in contrast to 2010 when the smaller clones sizes were more numerous. This trend is indicative of the limited resources available for mechanical removal that cannot cope with the numerous larger clones, compounded by limited volunteer labour in previous years to control the very numerous smaller clones.

Figure 6. Distribution of S. anglica at 112th Street – 2010

Figure 7. Distribution of S. anglica at 112th Street – 2011

Mud Bay:

Figure 8. Distribution of S. anglica at Mud Bay – 2011

The Mud Bay area continues to be of concern because river outflows from the Serpentine and Nicomekl Rivers could spread *S. anglica* seeds to new locations west and south towards mudflats in Washington State. But the 2011 mapping shows expansion west and south is minimal to date.

The mud flats between the two rivers is very difficult to access and there have not been removals there but hand removals on the north and south of the rivers, are ongoing. The 2011 mapping shows clones through out this area have grown larger while the smaller sizes are less numerous compared to 2010 inventory (Figure 8) because some of them have been removed by hand.

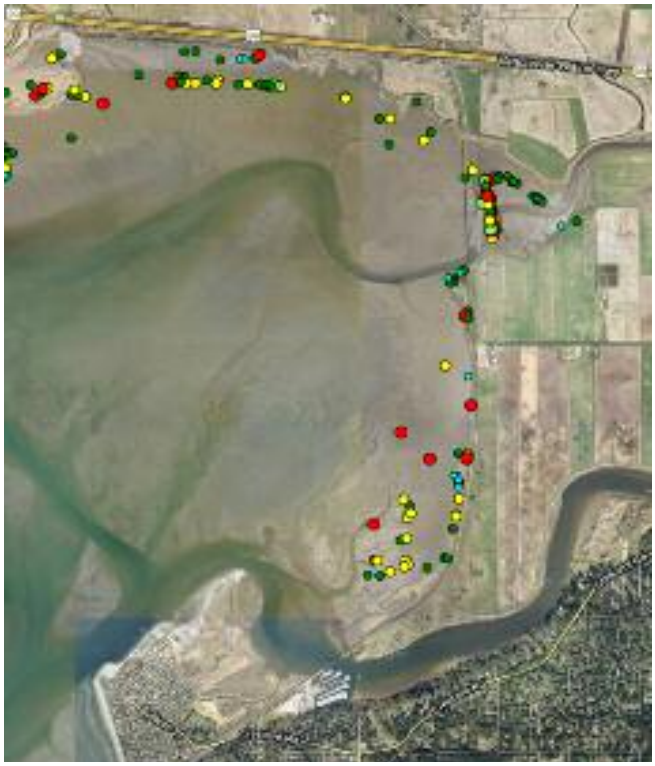

Figure 9. Distribution of S. anglica at Mud Bay – 2010

*Three clones >1m+ near the train trestle (2011) were not mapped in 2010

Kayak Monitoring:

The BCSWG undertook a pilot kayak monitoring program in 2010 modeled on the methods employed by People for Puget Sound (PFPS) to locate and map *Spartina sp.* Based on what was learned from that pilot the BCSWG decided not to continue it in 2011. Given the minimum cost to run the program would exceed what was available in 2011, the large extent of mudflats in the Fraser Delta reduced the effectiveness in 2010, it was decided to not to continue the kayak monitoring program in the Fraser Delta Program.

Fraser Delta Program - Removals

Manual Removals

A total of 1140 clones were removed by hand in the infested areas of the Fraser Delta. The high priority areas continue to be 112th Street, Mud Bay, and Brunswick Point to stop dispersal to uninfected areas. Two other volunteer organizations undertook hand removals of smaller infestations at Blackie Spit (Friends of Semiahmoo Bay Society and City of Surrey's SHARP and SNAP summer crews) and at Beach Grove (Ladner Rotary Club) that are at the edge of the infected area in Boundary Bay (Figure 13). The tally on 2011 hand removals is: **563** Single plants, **405** <0.3m (A) clones, **166** 0.3m-1m (B) clones, **6** >1m (C) clones. Note that hand excavation of a 1m+ clone by hand is very hard work and the volunteer groups mentioned above are to be commended for doing that in locations not suitable for an excavator.

As in previous years, participants dug up individual plants and smaller clones using hand shovels, loading them into large garbage bags. The garbage bags were pulled using snow sleds to an area accessible to the ATV or pick up truck. At 112th Street, Brunswick Point and Mud Bay Park one or two small all-terrain vehicles gathered up the filled bags filled and transported them to the dyke or to a near by disposal bin stationed for the removal work. Using inexpensive moulded snow sleds (a new technique in 2010) enabled participants to bring removed plants from further out on the mud flats while keeping the lift weight in each bag smaller and reducing the chance of bags ripping. In August, after the removal season, the bins were taken to Metro Vancouver's sanitary landfill.

2011 program funding was available to hire a three person Spartina crew for July and August. The crew focused on hand removals, seed head clipping, additional mapping, stem plot surveys to measure clone growth rates and supervised volunteer removal activities in August.

No actions were taken with the *S. patens* infestations in Burrard Inlet and a long term solution for these areas is not yet determined.

Excavator Removals

Concord Excavating and Contracting Ltd. was hired to conduct mechanical removals of *S. anglica* at Brunswick Point, along the Delta Port Causeway and at 112th St. east toward Mud

Bay. Approvals were granted by Fraser River Estuary Management Program (FREMP), Corporation of Delta, Canadian Wildlife Service, Tsawwassen First Nations, and the Ministry of Forests, Lands & Natural Resource Operations .

This year a smaller amphibious excavator (Figure 12) with very low ground pressure was used to remove and bury larger clones (>0.3m dia.) in 262 locations (GPS recorded) on the intertidal marsh areas of 112th St., Brunswick Point and at the south end of the Delta Port causeway (Figure 10). The excavator dug 3m deep holes and buried clones with a minimum cap of 1.5m to 2m of mud/sand. Based on an estimate of 4 clones of varying size buried per recorded location an estimated 1048 clones were buried. Total machine time for the 3 locations was 21.5 days costing $33,600 including mobilization.

Figure 10. Amphibious Excavator Removing S. anglica 112 St. Boundary Bay, 2011

The smaller excavator used this year has many advantages over the larger machine used in 2010 and previous years. Smaller means much lower mobilizations costs, lower hourly rate, rapid travelling over intertidal areas and considerable less track damage to native vegetation. These savings allowed for more days of excavation but the smaller machine was somewhat underpowered on some ground conditions. Overall the smaller excavator is more cost effective and less disruptive to the intertidal habitat but considerable more funding for machine time is need to eradicate *Spartina anglica* in Boundary Bay.

Figure 13. 2011 Burial sites and Beach Grove - Blackie Spit hand removal locations

Science/Evaluation

The province of British Columbia has committed to eradicate *Spartina* from BC marine environments by 2018, under the *West Coast Governors' Agreement on Ocean Health*, the *Pacific Coast Collaborative Agreement* and in action plans of B.C.'s *Oceans and Coastal Strategy.*

But the outcomes of this years program continue to confirm the conclusions of the *BC Spartina Response Plan* 2010 (Dresen et al, 2009) which indicated that mechanical control efforts have met with limited success and suggests that herbicide is necessary for eradication of *Spartina* in BC. Herbicide treatment has been extremely efficient in achieving control of infestations in Washington, Oregon and California, but herbicide application is not currently permitted in estuarine environments in B.C.

Herbicide Evaluation

In June 2010, a technical working group formed to investigate the options for herbicide application and research for future *Spartina* control in BC. The working group has undertaken extensive consultation with provincial, federal and US partners, as well as industry, to determine regulatory requirements, optimal treatment efficacy and methodology, and benefits and drawbacks. Use of herbicide would reduce mudflat compaction and disturbance by reducing the number of people and equipment entering the estuarine environment and would be more cost effective. The following principles guide the technical working group:

- Utilize the most effective products with the least impacts to non-target species;
- Review the impacts of herbicide on fish and other aquatic organisms
- Develop techniques to minimize amount of require herbicide and maximize application efficacy;
- Ensure consistent treatments to achieve optimal results, and;
- Maintain public education and awareness about invasive species and associated risks.

The working group is assessing the options and risks and continues to practice due diligence as it determines the viability of herbicides as a control option for *Spartina* in BC. If support is received from partners to proceed with integrating herbicide as a control for *Spartina*, the working group will work with federal and provincial agencies to ensure all applications and procedures are in accordance with regulations and guidelines.

Cover Plots

The experimental cover plots (previously established) were examined at 64th St, Mud Bay Park and Brunswick Point. The geo-textile fabric was removed from the Brunswick Point cover plots as they had been in place for two years, the remaining cover plots were re-fastened as needed using 16 inch plastic stakes. The uncovered plots at Brunswick Point were marked using the orange plastic stakes, one at each corner and one in the centre. No living vegetation was observed within the cover plots.

In 2010, 15 clones were selected and measured as a baseline to determine growth rates. In 2011, 10 clones remained and were re-measured. There was an average increase of 0.4m diameter for the clones, which was an increase of 101.8% meaning that on average the clones doubled in size between 2010 and 2011 (Table 2).

Table 2. Spartina anglica Clone Diameter and Area Change 2010-2011 in the Fraser River Delta

Summary	Average Diameter		Change in Diameter		Change in Area	
Plot	2010	2011	m	%	m2	%
1	0.6	2.2	1.6	27.3%	3.4	1240.3%
7	1.7	1.5	-0.2	111.4%	-0.4	-19.4%
8	0.6	1.6	1.0	38.1%	1.7	589.9%
9	1.7	2.3	0.6	72.5%	2.1	90.4%
10	1.5	1.9	0.4	77.7%	1.2	65.6%
11	0.8	0.7	0.0	104.2%	0.0	-7.8%
12	1.1	0.3	-0.8	339.7%	-0.8	-91.3%
13	2.8	3.2	0.4	88.8%	1.7	26.9%
14	4.2	4.7	0.4	90.5%	3.1	22.1%
15	0.4	0.6	0.2	67.6%	0.1	119.0%
Average	**1.5**	**1.9**	**0.4**	**101.8%**	**1.2**	**203.6%**

Vancouver Island Program

In 2005, *Spartina patens* was confirmed in the Comox estuary and is believed to have been present there for sometime. *Spartina densiflora* was also reported in and around Baynes Sound at that time . Although much of East Vancouver Island and the Gulf Islands shorelines are at risk for invasion, most of those shores have not been surveyed for *Spartina sp*.

Figure 11. Baynes Sound shoreline Search Area – 2010, 2011

The Coastal Invasive Plant Committee (CIPC) developed an Island Spartina Working Group in 2008, to coordinate inventory and management beginning in 2009. In 2010 mapping surveys were carried out around Main and Prevost Islands in the Gulf Island archipelago and in parts of Baynes Sound using both land and boat monitoring techniques. The 2010 Gulf Islands surveys were negative but Baynes Sound surveys prompted more work in 2011 (Figure 11) to complete shoreline surveys. 2010 and 2011 mapping followed the same on–shore method as the established Fraser Program, investigating suspected plants on shore when seen from a boat travelling along the shore.

2010/2011 mapping in Baynes Sound located 241 clones and 44 of those locations are clusters of clones in an area 5 meters in diameter or larger. The 2011 summer mapping (Figure 12) and removals (Figure 13) were carried out by the Vancouver Island Conservation Land Management Program (VICLMP) and the 2011 mapping was completed by DUC assisted by local volunteers in November.

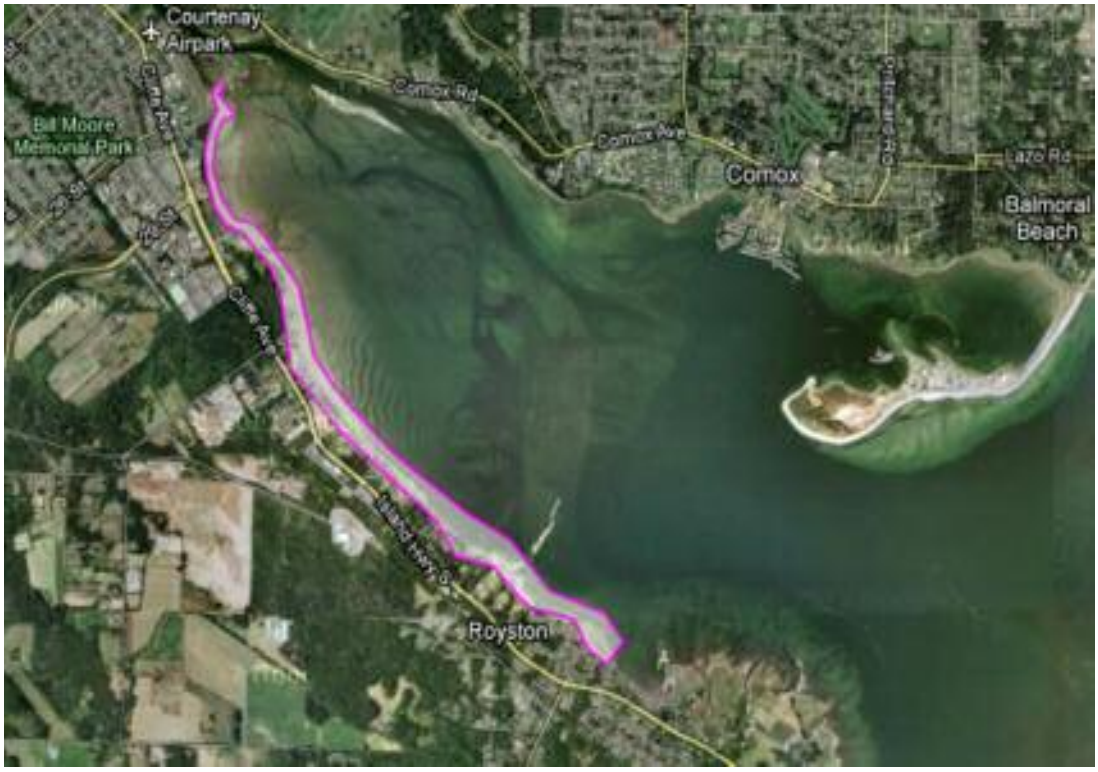

Figure 12. Estimated Distribution of S. patens, Courtenay R. Estuary – 2007

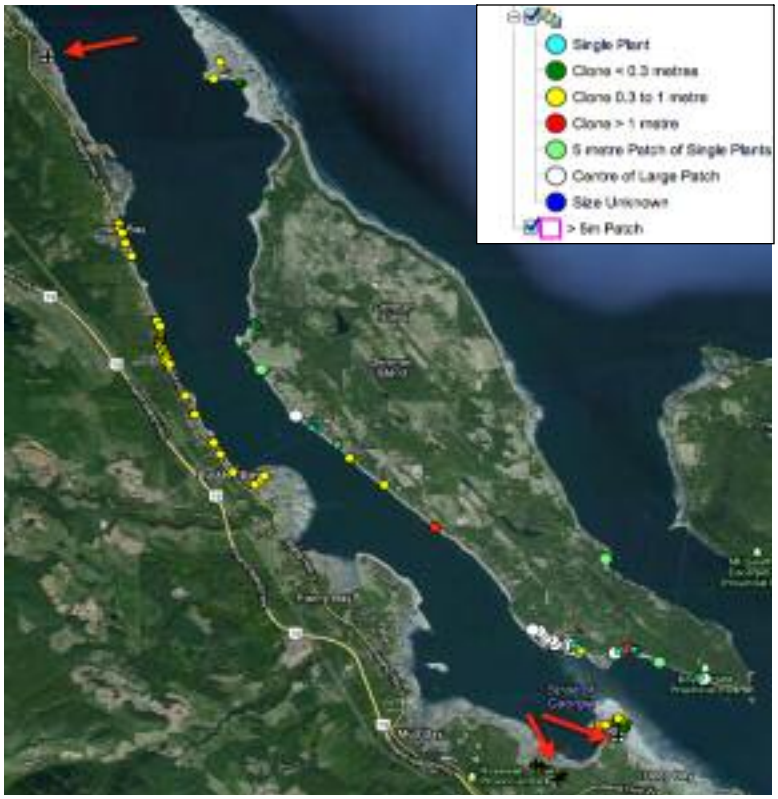

Figure 13. Cumulative Distribution of S. densiflora in Baynes Sound (2010 & 2011) and sites of removals (red arrows)

The VICLMP crew carried out some removals of *S. densiflora* in three locations in Baynes Sound in 2011 where large patches were accessible. The most southern location in Deep Bay produced 1500 kg. of bags for landfill disposal. But almost all of the *S. densiflora* and *S. patens* are only accessible by water and the large number of clones throughout the sound will require a concerted effort to remove.

S. densiflora is primarily located on gravel beaches at high tide levels that can support a compact, tracked excavator (e.g. Kubota KX) transportable by barge. This option should be considered for a summer program to remove and dispose of *S. densiflora* throughout the sound. However; the large clones/meadows of *S. patens* are located on high marsh tidal (soft) areas and it could not be removed using the Kubota. During Nov. 2011 mapping, boat access to Denman shores was provided by the RV Chetlo, a research vessel of the Vancouver Island University. The "Kubota" solution was discussed as a practical approach that could be landed from the Chelto. A small crew working with the Kubota could efficiently remove *S. densiflora* and transport it using the Chelto for disposal.

Data Management

Data compilation and storage for *Spartina sp.* data (2004 to 2011) is provided by the Community Mapping Network (CMN). Species, clone size, GPS location and the extent of the area searched can be viewed at www.spartina.ca. These data are used for measuring eradication progress, and planning future monitoring and control activities. Data for the 2006/07 Drift Card Study and Washington State Partners are also viewable at this web site. Ducks Unlimited Canada (DUC) also maintains ESRI shp file copies of these data for GIS analysis.

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/
- The BCSWG reprinted 250 additional "2009 Spartina ID Card" sets which include info on the GPS mapping method and native marsh plants – distributed to volunteers and partners.
- The BCSWG published a 2 page "Prohibited Weed Bulletin" on Spartina in 2011 for distribution http://spartina.ca/ (attached file section)
- Three BC News papers carried articles about community efforts to find and control local *Spartina sp.* infestations:
    1. *The Province*, July 12, 2011 by Mike Raptis, "Surrey's Natural Areas Partnership (SNAP), the Salmon Habitat and Restoration Program (SHaRP)….. and community volunteers are working to take Blackie Spit Park back from …. invasive plant species (*S. anglica*) …. near

Crescent Beach."

2. *Westerly News*, August 4, 2011, by Yasmin Aboelsaud, "The search for Spartina is focused on Tofino's mudflats. Josie Osborne, of the Tofino Botanical Gardens is partnering with the Central Westcoast Forest Society (CWFS), the Raincoast Education Society (RES), Pacific Rim National Park Reserve and the Ucluelet parks department. Osborne will be using kayaks and binoculars to cover ground and search for the plant."

3. *Vancouver Sun*, Oct. 21, 2011, by Jessica Kerr, "Ladner Rotary Club has been working hard this fall to help rid the area (Beach Grove salt marsh) of a noxious weed. Don Burkett and several other members …. armed with shovels …. to eradicate spartina anglica from the area."

Finances

In addition to external funding from grants and partners the BCSWG partners and individual volunteers contributed over $90,000 of in-kind time and resources to the project. These in-kind and direct contributions were essential to the success of the project. Table 3 summarizes the income and expenditures for 2011, Figure 14shows the percentage of contributions by component and the ration of in-kind to direct (cash) contributions and Table 4 details the contribution by all partners for each Component of the Program.

Table 3. Expenditures by Component and Income Sources – BCSWG 2011

Cash Expenses to Spartina Working Group	Inventory	Removals	Coordination	Outreach	Science/ Evaluation	Total
Excavator		$33,600				$33,600
Corrdinator contract			$8,000			$8,000
BCCF Crew	$4,000	$12,119				$16,119
BCCF Crew Vehicle	$1,000	$2,357				$3,357
BCCF Crew Gear		$347				$347
Herbicide Permitting			$19,042			$19,042
Bin Renta & Dump - Tidy Bin		$3,371				$3,371
CMN website	$1,000					$1,000
Pesticide Management Regulatory Authority (PMRA)					$524	$524
Vancouver Island Training				$560		$560
GVIPC Crew contract		$4,480				$4480
Outreach-Traiing Contractor		$1,800				$1,800
Bayside Backhoe Contractor		$636				$636
Materials, Supplies, misc.	$982	$731				$1,713
Total	$6,982	$59,441	$27,042	$560	$524	$94,549

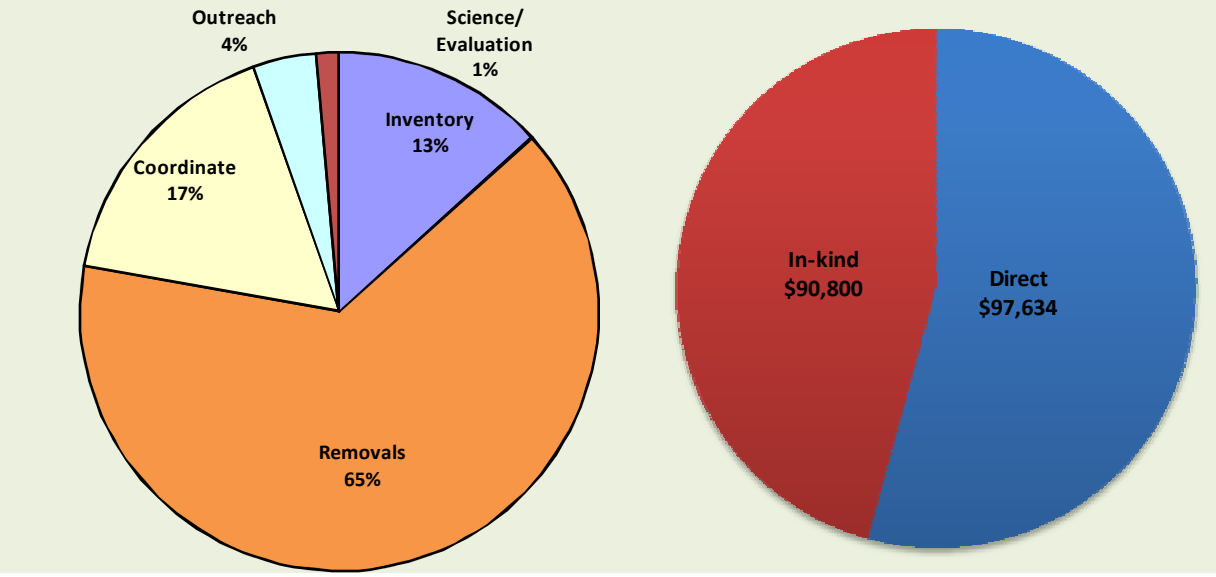

Figure 14. 2011 Spartina Program Expenditures by Component & Type/Amount

Table 4. BC Spartina Eradication Program Contributions - BCSWG 2011

Organization : (green highlight signifies BCSWG member)	Program Components					Summary		
	Inventory	Removals	Coordinate	Outreach	Science/ Evaluation	Direct Costs	In-Kind	Total
BC Conservation Foundation			$800				$800	$800
BC Ministry of Environment			$6,000				$6,000	$6,000
BC Ministry of Forests, Lands, and			$6,400		$1,600		$8,000	$8,000
BC Ministry of Forests, Lands, and		$400	$400				$800	$800
BC Public Conservation Assistance	$1,500					$1,500		$1,500
City of Surrey - SHaRP Program		$4,400		$2,400			$6,800	$6,800
City of Surrey - SNAP Program		$4,000					$4,000	$4,000
CN Rail		$10,000				$10,000	$0	$10,000
Coastal Invasive Plant Council and Baynes Sound MAPPING	$1,200			$337		$337	$1,200	$1,537
Community Mapping Network	$4,000			$800	$1,200		$6,000	$6,000
Comox Valley Regional District	$2,000					$2,000		$2,000
Corporation of Delta	$2,508	$7,780	$2,000			$1,888	$10,400	$12,288
DFO Fisheries & Oceans	$400		$400				$800	$800
Ducks Unlimited Canada			$12,400				$12,400	$12,400
Environment Canada- Canadian Wildlife Service	$1,600	$6,000	$1,200				$8,800	$8,800
Friends of Semiahmoo Bay Society	$1,600	$2,000	$2,000	$2,000		$2,000	$5,600	$7,600
GL Wiliams & Associates				$800			$800	$800
Government of Canada - Summer Jobs Program		$5,409				$5,409	$0	$5,409
Independent Volunteers	$3,600	$400					$4,000	$4,000
Invasive Plant Council of Metro	$400		$800				$1,200	$1,200
Invasive Alien Species Partnership Program (IASPP), Gov. of Canada		$33,000				$33,000	$0	$33,000
Ladner Rotary Club		$5,200					$5,200	$5,200
Metro Vancouver			$400				$400	$400
People for Puget Sound				$800			$800	$800
Port Metro Vancouver		$25,000	$400	$400		$25,000	$800	$25,800
Stewardship Centre for BC		$20,000				$20,000		$20,000
Tofino Botanical Gardens	$4,400						$4,400	$4,400
Vancouver Island Land	$2,000	$4,500				$6,500		$6,500
Vancouver Island University	$1,200			$400			$1,600	$1,600
Total Expenses	**$26,408**	**$128,089**	**$33,200**	**$7,937**	**$2,800**	**$107,634**	**$90,800**	**$198,434**

Cross Border Partnerships

As described in the previous "BC Spartina Eradication Program 2010 Progress Report", the Washington State Department of Agriculture (WSDA) was a key partner in the boat monitoring tour in the Gulf Islands and Denman Island. In 2011, the WSDA was not directly involved with BC inventory activities but we continue to have regular communications with their staff on Spartina EDRR and provided assistance to the working group assessing the role of herbicide. The WSDA and People for Puget Sound have added their Spartina mapping data (2009 & 2010) to the web mapping at http://spartina.ca and 2011 data is anticipated soon, to illustrate that Spartina is a common threat and needs cross border cooperation to eradicate.

At a higher 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 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 and the Action Plan for Ocean Conservation can be viewed at http://spartina.ca in the "Attached Files" section.

The Feb. 12, 2010 Action Plan for Ocean Conservation states regarding the spread of invasive species:

"Cooperate to prevent or reduce the spread of invasive species by:

a) refining and coordinating capacity to recognize, identify, report, and rapidly respond to both newly discovered and existing invasive infestations;

b) addressing pathways of introduction such as ballast water, vessel hulls of commercial ships and recreational boats, and boat trailers traveling across state and provincial boundaries; and

c) supporting the efforts of the Pacific Ballast Water Group and coordinating ballast water policies.

As priorities for initial coast-wide efforts, focus rapid detection, early response and eradication efforts on non-native cordgrasses (genus *Spartina),* tunicates, and green crab, which may expand their range along the west coast via ocean currents or human activities."

Concluding Remarks

The success of the 2011 *Spartina* Project could not have been completed without the commitment of the BCSWG partners and the financial contributions from CN Rail, the Federal Summer Student Program, the Invasive Alien Species Partnership Program, the Pacific Conservation Assistance Fund, Port Metro Vancouver and the Stewardship Centre for BC.

The value of the *Spartina* program in 2011 was $178,434 compared to 2010 at $213,742. The in-kind contributions in 2011 were valued at $90,800 vs. $126,246 in 2010 and direct costs in 2011 were $97,634 vs. $87,496 in 2010.

Since 2007 the number of larger 1m+ clones has steadily increase in spite of considerable control efforts using mechanical removal by hand and machine. From 2010 to 2011 there was a **61% increase** in the number of 1m+ size clones and a **55% increase** in larger patches of mixed size plants (patches greater than 5m diameter). This is a continuation of increasing numbers of larger clones as seen in 2009 vs. 2010 data where larger 1m+ size clones increased by **23%** .

Overall in 2010, manual removals kept smaller more manageable clones at relative constant numbers but not enough to limit the larger clones from moving into the 1m+ category. Manual and machine removal effort in 2011 was similar to 2010 and hopefully the 2012 mapping will show the size categories smaller than 1m+ continue to remain constant or decrease.

An exception to this trend is on Roberts Bank near Brunswick Point (Figure 1). There was a very large increase of smaller clones in this area since 2010 that are beyond the reach of manual and machine methods available in 2011. This area has very high ecological values for avian and fish species, specifically as the only confirmed, significant source of bio-film that Western Sandpiper utilize as an essential food source in the spring migration north. The *S. anglica* infestation in this area appears to be near a tipping point where the BCSWG does not have the resources to stop the expansion at present levels of funding .

Given the continued and alarming expansion of *S. anglica* at the Brunswick Point and the steady expansion in Mud Bay (eastern extent) it is difficult to see how BC will meet its 2010 commitments to the Pacific Coast Collaborative to eradicate *Spartina sp.* from BC's coastal habitats by 2018 with out a much larger influx of resources or a non-mechanical method of control that is more efficient

Year over year mapping of the same intertidal habitat seems to indicate that the deep burial method is an effective control technique. Monitoring of the 2010 and 2011 burial sites in 2012 would be useful now that the number of located burial sites represents a very large sample size for an evaluation study.

The Vancouver Island Program has made some key progress in 2011 by completing mapping in most of Baynes Sound and in Tofino mudflats and some strategic removals of *S. densiflora* in Deep Bay. The Courtenay R. Estuary and shores north still need mapping using the established BCSWG method to confirm earlier reports of *S. densiflora* and *S. patens*.

The comprehensive search of Tofino Mudflats and surrounding shores in 2011 for *S.anglica* and *S. densiflora* was negative and this is very reassuring information. The 2006/07 drift card project found a card on these mudflats that came from the Port Metro Vancouver release point and this is the first time the mudflats have been checked since that drift card was found.

The cross-border partnerships that have been developed over the years have been extremely valuable to the BCSWG. Through joint projects such as the drift card study (2006/07) we are now able to target our mapping approach focusing on areas with high risk of infestation. Continued collaborative work will facilitate information sharing and will improve and expand control techniques associated with *Spartina* in both BC and Washington.

Recommendations for 2012 include:

1. Complete the evaluation of the impacts and feasibility of using herbicide.
2. Step up efforts to remove S. anglica in the Fraser River Delta either through increase resources for manual removal or herbicide option otherwise the infestation will continue to expand
3. Implement and evaluate potential removal techniques for S. densiflora on East Coast Vancouver Island that include: use of compact, tracked excavator (e.g. Kubota KX) transportable by barge, and the use of brush saws as used in San Francisco
4. Determine a plan to address S. patens infestation in the Burrard Inlet area
5. Support the community efforts of Spartina mapping and removal (if needed) in the Tofino and Baynes Sound area.