

Salish Sea Nearshore Habitat Recovery Project 2019-2020 Final Report

Submitted by SeaChange Marine Conservation Society Nikki Wright, Executive Director For the Coastal Restoration Fund - Fisheries and Oceans Canada <u>seachange@shaw.ca</u>

Table of Contents

Execu	tive Su	mmary	3
1.0	Miles	tone 1: Project Planning & Implementation	4
	1.1	Summary of the Technical Working Group Meetings	4
	1.2	Habitat Prescriptions for Yr. 3 Projects	4
		1.2.1 Northern Gulf Islands	0
		1.2.2 Southern Gulf Islands	8
		1.2.3 Howe Sound/Atl ka/tsem	13
		1.2.4 Sechell Intel 1.2.5 Burrard Inlet	15
2.0	Miles	tone 2: Habitat Restoration	10
2.0	2.1	Restoration Methods	17
	2.1	Hebitat Destantion	17
	2.2		17
		2.2.1 Southern Gulf Islands	17
		2.2.2 Howe Sound/Atl'ka7sem	21
		2.2.3 Sechelt Inlet	24
		2.2.4 Burrard Inlet	24
	2.3	Signage	24
3.0	Milestone 3: Monitoring and Reporting		24
	3.1	Monitoring Methods and Criteria	24
	3.2	Prescription for Future Eelgrass Restoration	26
	3.3	Schedule for Restoration Activities	28
Figure	1	Map of Denman Island survey Figure 12 GPS of Beach Beach	coordinate of Saturna h
D .	0		

-	area	-	Beach
Figure 2	Aerial view of Tribune Bay	Figure 13	GPS coordinates of Cotton Bay
Figure 3	GPS location of Scottie Bay	Figure 14	Location of eelgrass in
Figure 4	Some of debris in Scottie Bay		Tunstall Bay
Figure 5	GPS location of False Bay	Figure 15	GPS coordinates of Tunstall
Figure 6	GPS location of Hyashi Cove		
Figure 7	Aerial view of Hyashi Cove	Figure 16	Bay
Figure 8	GPS location of Hope Bay	Figure 17	Half sunken derelict boat in
Figure 9	GPS location of Medicine	0	Porpoise Bay
	Beach	Figure 18	Saturna Island volunteers
Figure 10	Substrate within eelgrass transplant Medicine Beach	Figure 19	Design drawing of Saturna Island transplant
Figure 11	Chart location of Saturna Beach	Figure 20	Location of Hyashi Cove transplant

Figure 21	Design drawing of Hyashi Cove	Figure 27	Transplant site in Tunstall Bay
	transplant	Figure 28	Design drawing of Tunstall Bay
Figure 22	Location of Hope Bay transplant		transplant
Figure 23	Design drawing of Hope Bay		
	transplant	Table 1	Rating of Transplants Based on
Figure 24	Location of Medicine Beach		Densities: 2017-2020
	transplant	Table 2	Sites for Future Restoration
Figure 25	Design drawing of Medicine Beach transplant	Table 3	Sites not deemed suitable for further restoration
Figure 26	Design drawing of Cotton Bay transplant		

Executive Summary

This report is a summary of the third year of work of the Salish Sea Nearshore Habitat Recovery Project (CL-PAC-22). Regional Community Coordinators in each of four regions within the Salish Sea have completed outstanding habitat recovery efforts by forging new community partnerships or building upon already established relationships to make a net gain in critical salmon habitats. The four Regional Coordinator's Reports can be found in <u>https://drive.google.com/drive/folders/1C1gJHTb62KZGgth0invy4roPFrQDm21Q</u> within the Regional Narrative Reports file.

Google drive contains all the pertinent information describing the extent of this year's work. This includes all reports, communications, in-kind contribution records, data, photos and maps completed for each project Milestone. Raw video footage of "before" and "after" videos of eelgrass transplants, as well as photos and videos off riparian restoration, debris removals and eelgrass monitoring can be found at this site. A video, "Salish Sea Nearshore Habitat Recovery Project – 2019-2020 Field Work" was created to summarize this past year's accomplishments: (https://drive.google.com/file/d/19oYCpGsKR8Ybv-pS_AVz9-N3LnkGQrav/view?usp=drivesdk An interactive map link (https://arcg.is/1n905j) indicates the locations of restoration efforts thus far in the Salish Sea.

A total of 6,684 eelgrass shoots (684m²) of eelgrass was transplanted with community support; over 15,000 kg of underwater debris was removed from two regions, and two marine riparian projects were completed. Eelgrass surveys were undertaken in Sechelt Inlet, Howe Sound, Burrard Inlet and Vancouver's Stanley Park with the support of leveraged funding from the Pacific Salmon Foundation (PSF). Monitoring of all eelgrass transplant sites on a six month schedule was completed with PSF support. Thirty-one eelgrass signs will be installed in the coming months after many consultations with community members.

A total of 217 community volunteers gave their time during meetings and restoration events. Over \$62,994 in labour and services are included as in-kind contributions in the form of accommodations, supplies, equipment and time, including: debris bins, tote bags, waivers for tipping fees, excavators, local government staff time for debris removals, work space for transplants, time for logistical planning, and boat moorage space.

Thirty-four partnerships were sustained or newly developed in four regions, including those with industries, local and First Nations governments and agencies.

During the CRF national conference in March 2020, there was a request to include stories in our final reports. Thus the Regional Coordinators were requested to summarize their community achievements through story as well as systematically. These unique narratives are included in Google drive, instead of being incorporated as separate sub-categories in this final report. More detailed accounts of habitat restoration and monitoring are included in the main body of this report.

Please Note: Because of the outbreak of Covid-10 in early March, 2020, no Community meetings were scheduled in the spring of 2020. Four Technical Working Group meetings were conducted digitally. Some had to be scheduled in early April, 2020.

1.0 Milestone 1: Project Planning and Implementation

1.1 Summary of the Regional Technical Working Group Meetings

Google drive (Community Participation file) includes the proceedings from each Region's Technical Working Group meeting held in 2019-20, and an updated list of each Region's TWG participants. Restoration Plans were forecasted for the coming months in each Region dependent upon the decrease of COVID-19 outbreaks and subsequent revisions of the B.C. Provincial Health Officer's Guidelines. A safety protocol for the SeaChange Dive Team is in progress based on these most recent updates.

1.2 Habitat Prescriptions for Year 3 Projects

The following is a synopsis of each of four Region's Restoration and Debris Removal Plans as identified by the Technical Working Groups and Habitat Surveys, including maps of the sites, criteria for site selections, survey results and a link to all underwater videos.

1.2.1 Northern Gulf Islands

Denman Island

Habitat surveys for the northern Gulf Islands (Denman, Hornby and Lasqueti Islands) were completed in July 2019. Underwater videos were recorded of the mid-western shoreline of Denman Island at the request of members of the Northern Gulf Islands Technical Working Group. The videos and photos can be viewed in the Google drive folder under the Habitat Survey file.



Figure 1. Eastern shore of Denman Island surveyed with underwater video July 23, 2019

Members of the Northern Gulf Islands Technical Working Group expressed concern that shellfish aquacultural operations were disturbing eelgrass habitats. The dive survey boat visited the shoreline twice near the nearshore oyster operations. From observations above and below water, the conclusion reached is the operations are not disrupting eelgrass productivity. The oyster rafts are located further out in deeper waters than the eelgrass bed locations. However, eelgrass habitats are patchier (less dense and continuous) than when they were surveyed for Islands Trust in 2013. There were very disturbed areas in the seabed to the degree that the sediment changed from mud to pebble/cobble, appearing to be caused by forceful water injection used for geoduck harvesting. A community member had mentioned during a TWG meeting that illegal geoduck harvesting in the area had been observed. Regeneration of eelgrass either naturally or by restoration is not easily achieved until this practice is terminated and the sediment is remediated.

The third Baynes Sound/Lambert Channel Ecosystem Forum was attended by members of the Northern Gulf Islands Technical Working Group in November 2019. This forum serves as an avenue for community concerns and actions to improve the marine ecosystem of Baynes Sound and Lambert Channel. A summary of this forum can be found in **Google drive (**Community Participation file).

Hornby Island

The two priority restoration sites as identified by the Northern Gulf Island's Technical Working Group members in 2020 were Tribune Bay (due to potential damage of eelgrass habitat from summer anchoring by recreational boaters) and Ford Cove, where a boating community is anchored near a marina.



Figure 2. Aerial view of Tribune Bay, July 24, 2019.

There was no noticeable disruption of eelgrass habitats by boat anchoring observed by video camera or aerial unmanned vehicle (UAV) during the survey. Signage at the dock in the bay was recommended and will be installed in the summer of 2020. This site will be included in a pilot

program for improved boat anchoring by mid-line anchoring systems, to begin in the summer of 2020. Because of the relationship with a local resident and member of the TWG, owners of permanently anchored boats in eelgrass have expressed an interest in having this "eelgrass friendly" mooring system installed. Please see Google drive (Regional Communications Resources Mooring video) for a description of this mooring buoy design.

Lasqueti Island

A Habitat Survey was completed of potential restoration sites recommended by the Technical Working Group in July of 2019. The Survey Report can be found in Google drive (Habitat Survey Reports). As a result of follow-up landowner contacts by Lasqueti Island TWG members, it was recommended that the first project to complete is debris removal from the seabeds in Scottie and False Bays, and a follow-up eelgrass transplant in Scottie Bay. Plans are moving forward to undertake this work in late May, 2020, with health safety protocols in place for all members of the SeaChange Team. Islanders will not be directly participating in this restoration.

Scottie Bay



Figure 3. Scottie Bay potential eelgrass restoration site near debris removal site 49°30'48.4" N 124°20'35.9" W



Figure 4. Some of the debris to be removed from Scottie Bay.

Notes from the Habitat Survey for Scottie Bay:

This bay is very protected from wave energy. Since the site is a working shipyard there is much intertidal and underwater debris to be removed. Fetch is 6 km with a northeasterly aspect. No eelgrass is observed on the southwest end of the bay, possibly due to sewage outfalls affecting water quality. Larger derelict boats and barge will need to be removed with a larger barge and crane operation.

Side-scan sonar indicated scattered underwater debris. However the area on the north end of the bay might be suitable for eelgrass transplants. There are two gaps in an otherwise continuous eelgrass bed that could be filled in (49°30'48.4" 124°20'35.9"). Total area for a transplant would be ~ 80m x 5m or ~ 400 shoots. No boat moorages or anchoring were observed in this area of the bay at the time of the survey. The eelgrass habitat here is very healthy and extends about 100m wide at a depth from approximately -2' chart datum to -6'. Donor eelgrass bed is outside the entrance to the bay. Muddy substrate is suitable for eelgrass expansion.

<u>Site considered high priority because of the following criteria:</u> Fetch, substrate type and quality, depth, proximity of donor site, completion of underwater debris removal, local community support, and absence of boat anchoring in site.



False Bay

Figure 5. Location of False Bay, near the False Bay ferry dock: 49°494345 N 124°348026 W

Notes from the Habitat Survey of False Bay:

Area near the Government ferry dock needs debris removal, especially within the depth of the existing eelgrass habitats. Bottles, batteries, tires and other types of debris were observed near the barge on the south side of the dock.

<u>Site considered high priority because of the following criteria:</u> Proximity to existing eelgrass habitat, positive community response and collaboration -(Barge and crane will be provided to remove debris from the dock once *Collective Effort* removes it from the seabed, proximity to eelgrass signage to be installed on the wharf.

1.2.2 Southern Gulf Islands

The following is a summary of the habitat prescriptions for the southern Gulf Island for Year 3.

Pender Island

From the Habitat Surveys completed of sites recommended by community members of Pender Island in the summer of 2019, three were selected for eelgrass restoration for Year 3. The Habitat Survey for the southern Gulf Islands can be found in Google drive (Habitat Surveys).

Hyashi Cove



Figure 6. Hyashi Cove: 48°47′46 N 123°18′16″ W

Notes from the Habitat Survey:

A survey of the presence/absence of eelgrass habitats in this bay was completed for the Islands Trust in 2012, which indicated that most of this bed contained a continuous flat eelgrass habitat, with the exception of most of the northeastern end of the bay. Free divers (divers without the use of SCUBA tanks, who dive holding their breaths) surveyed the bay in July of 2019 and observed there was a larger eelgrass bed in deeper Hyashi Bay

Figure 7. Aerial view of Hyashi Cove, Pender Island

water in the centre and northeastern sections of the bay that was not identified in 2012. There is a gap between the habitat mapped in 2012 and 2019 parallel to shore of about 70m wide.

Google Earth

The sediment is clean mud (devoid of woody debris) and consolidated. The bay has a fetch of 8 km and a westerly exposure. Backshore is residential, cleared and forested land. Beach is possibly a forage fish spawning site. Two boat moorings were observed as well as Canada geese and two river otters.

Eelgrass within the deeper part of the bay is dense and appears healthy with many seeding eelgrass shoots. The blades have a high epiphytic load (microalgae). Depth range for this deeper bed is between -9' to -15'. There were two small patches deeper than 15'.

The bed closer to shore begins at -7' depth and is less dense. There is more U*lva* present (unattached green sea lettuce). Depth range of the shoreward eelgrass bed is between -7' to - 4.5'.

A video was taken of the gap between the two beds. There seemed to be no difference in the sediment between the areas with and without eelgrass. Juvenile Dungeness crabs, sole, tube snout, perch and hooded nudibranchs were observed. No algae were noted within the gap; motile algae and kelp were observed in the shallow bed, possible being washed shoreward from the ferry wake, causing a back eddy.

<u>Site considered high priority because of the following criteria:</u> Low fetch, aspect, sediment quality, relatively undeveloped backshore, proximity of healthy eelgrass beds, habitat connectivity (possible forage fish spawning shore), depth range, presence of diverse marine life, lack of high recreational boat use.

Hope Bay



Figure 8. Hope Bay: 48°48'10"N 123°16'31"W

Habitat Survey notes:

Eelgrass is healthy in Hope Bay. The site has a 6 km fetch with an easterly exposure. There are five residential houses in the backshore. No riparian re-vegetation is needed in front of the bay. There are no mooring buoys at the site. The dock had 6 vessels berthed at the time of the survey. The sediment is unconsolidated mix of sand and shell. A video recording was taken of the area -4 - 5', the depth at which it was observed in Hope Bay. Sand with shell with tufted algae was observed with some rocky areas. Kelp coverage could be attached on rocks or drifting. The area further up the cove is too shallow for eelgrass growth.

Farmland is on the Pt. to the east and a pub to the west, with a road along the head of the embayment. An underwater survey was taken of the three small pocket beaches NW of this site – all three contained healthy eelgrass beds observed lying down because of the strong current.

<u>Site considered high priority because of the following criteria</u>: Proximity to healthy eelgrass habitat, low fetch, aspect, low backshore development, undisturbed riparian area, low recreational boat anchoring/mooring, sediment quality, habitat connectivity (presence of kelp), high flushing.

Recommendation at the time of the survey was to transplant eelgrass within the northwest portion of Hope Bay near the Government dock in an area \sim 5m x 25m (125m²).



Medicine Beach

Figure 9. Medicine Beach: 48°45.632 N 123°15.967 W

Notes from the Habitat Survey (2018):

Clean sandy semi-consolidated substrate with shell fragments (shell hash) in potential restoration site, diatomaceous cover observed on surface of the sandy substrate. Fetch is ~5km. Area does contain underwater woody debris showing evidence of log transfer. Possibly site was

used for temporary log storage. Shore receives wave energy from SE. An area of approximately 130m² could be planted from 3m to 3.4m depth. Restoration site will be situated in lee of bluff southwest of shore for some protection from winter storms. Underwater video taken along 26m transect (3.0m to 3.4m @ 16:00 (4 pm on March 17th) which can be viewed on SLACK site (<u>https://salishsearecovery.slack.com</u>).

A derelict sailboat (approximately 20' in length) observed on shore, present since winter of 2018. An abundance of large woody debris lies on the beach, which may be blocking the stream leading from the wetland to the shore. The Islands Trust Fund manages this designated Nature Sanctuary from the high water mark to the access road. The Pender Island Conservancy Association (PICA) has undertaken long- term monitoring of the nearshore. Small shed has been built over the First Nations (Coast Salish) shell midden on the southern end of the shore. There is high potential for forage fish spawning on this beach. The backshore is forested coniferous with few houses (five residences on south end of shore). Substrate on shore: sand/pebble to cobble from south to north.

One thousand four hundred and eleven eelgrass shoots were transplanted at this site in 2017. An additional 1571 shoots were added in September, 2019.

<u>Site considered high priority because of the following criteria:</u> Results from previous monitoring of first transplant (8.5 shoots/0.25m² transplant/ 14.6 shoots/0.25m² reference site at Hamilton Beach), habitat connectivity (presence of wetland, forage fish spawning shore, forested backshore, stream), protected and undeveloped backshore, removal of derelict boat on shore in 2018, sediment quality, importance to First Nations cultural site, protected backshore, high level of engagement of local Conservancy and community volunteers.



Figure 10 Substrate in Medicine Beach.

Saturna Island

Saturna Beach



Figure 11. Saturna Beach site: 49° 46'36"N 123°12'05"W

Notes from Habitat Survey:

This bay has a 5 km fetch, a westerly exposure and consolidated sand/mud sediment. Depth range for eelgrass is ~0 to -.5'. Flat continuous eelgrass was surveyed for Islands Trust in 2014. The backshore is a mix of cleared and forested areas with a Community Park recreational area facing the beach. There is a private dock on the north end of the shore with a rip rap retaining wall, and a seemingly derelict dock in the centre of the shore. Three mooring buoys are located near the beach, one in eelgrass habitat. One mooring block with a chain attached was located north of the derelict dock and should be removed. In addition, there was a rope from shore to a

mooring block in the eelgrass bed in front of the dilapidated dock. Two wheelbarrows of concrete south of this dock were submerged and also should be removed.

This is a very quiescent site. Seals and seal pups were in the water at the time of the survey. An abundance of juvenile Dungeness crab was present. There is also an abundance of brown kelps and green algae. Depth of eelgrass, a mix of patchy and continuous habitat, grows between ~-3.7' to -4.7' (chart datum). One clear area with clean sediment was observed north of the dilapidated dock (48°46.634'N 123°12.069'W).



Figure 12. GPS coordinates for Saturna Beach.

SCUBA divers measured an area approximately 6m x 25m at a depth of -5- -7' suitable for an eelgrass transplant which could continue the existing eelgrass towards the SE.

Boulders delineated a possible forage fish spawning shore from the backshore. Re-vegetation of native plants would benefit recreational users and potential forage fish (sand lance and surfsmelt), as it would provide shade during the summer months.

<u>Site considered high priority because of the following criteria</u>: Aspect, low fetch, sediment quality, low developed backshore, habitat connectivity (forest, possibly forage fish spawning shore), presence of eelgrass, marine life diversity, depth, and high level of community engagement.

1.2.3 Howe Sound/Atl'ka7tsem

The Habitat Surveys for Year 3 Howe Sound/Atl'ka7tsem are located in Google drive (Habitat Surveys).



Cotton Bay, Gambier Island

Figure 13. Cotton Bay: 49°46.098 N 123°44.899 W

Notes from habitat survey 2018

A salt marsh is located just upland from the mouth of Mannion Creek, where there is a large population of intertidal mussels. No boat moorages or recreational boats anchored in the bay. Fetch is 8.9 km with a south-southwesterly aspect. There is construction on land taking place and a barge transfer site on shore. Some construction of housing is completed on the south end of the barge transfer site. Marine riparian vegetation removal noted.

Eelgrass range is 0 to -9.65' (chart datum). Eelgrass was mapped in 2012 for the Islands Trust. Most of the habitat was characterized as fringing and patchy on the south end of the bay as was observed during this survey. Between the pilings o the south end of the bay there is a large area (7m x 95m) that could be restored. The sediment in this site is clean and consolidated. Juvenile pile perch, juvenile crabs were buried in the sandy sediment, and many cockle and other shellfish siphons were noted. The depth for the restoration is ~-2.7' (chart datum). Coordinates for the transplant site are 49°46.080 N 123°44.845 to 49°46.028 N 123°44.751. There is little evidence on the shore of high wave energy (intact salt marsh with few drift logs on the shore). One underwater and two aerial videos were taken at the site. Potential eelgrass restoration of ~665m².

Notes from 2019 Habitat Survey:

This site received 600 total eelgrass shoots in the spring of 2019. Three hundred plants were installed on each side of an existing bed. Density results from monitoring the site in August 2019 showed 20.8 shoots/.25m² compared to 14.6 shoots/.25m² in the pre-existing bed. Flowering shoots were evident. Test plots are in good health and could benefit from additional transplants. Fiona to contact Jim Green to discuss ensuring that development continues in an environmentally friendly manner.

<u>Site considered high priority because of the following criteria:</u> Monitoring results in August, 2019 following the first transplant in April of the same year showed a 142% shoot density coverage as compared to the reference site (0.25m² quadrat used), sediment quality, fetch aspect, habitat connectivity (partially forested backshore, creek, wetland), presence of intertidal mussels (possible indicator of water quality), marine species diversity, presence of eelgrass and suitable depth range.



Tunstall Bay, Bowen Island:

Figure 14. Tunstall Bay: (N 9°21.167' W123°25.38'

Legend: Pink lines = eelgrass distribution, Red and orange lines = forage fish potential spawning beach, blue dot = recreational docks, orange dots = recreational mooring/anchorages, dark blue lines = salmon bearing streams (based on DFO dataset, but sometimes incomplete)

Notes from Habitat Survey (August 2019)

Continuous eelgrass habitat was mapped in 2013 for the Islands Trust. There were eelgrass beds on the N and S end of the shore, less in the centre. (Video film was taken of the eelgrass beds during this field visit). Moorings may be inhibiting eelgrass growth on the S end. There was an increase of drift kelp closer to shore due to change from unconsolidated sand to rock. Visibility was low. Small eelgrass patches are growing on the north side of the wharf at -3' depth. The plants appear tall and thin bladed. In the centre of the bay there are eelgrass patches between two moored boats (N 49° 21.199 W 123° 25.209'). There could be a 10' x 10' area that could support eelgrass. Donor plants could be harvested from the N end or from Pasley Island.

Overall the habitat is less continuous than in 2013. It would be advisable for the two moored

boats in potential eelgrass habitat to be moved to a deeper area. Tunstall Bay Community Association is receptive to altering mooring buoy designs, and community members are keen to contribute to restoration.

Site considered high priority because of the following criteria: Habitat connectivity (partially forested backshore, eelgrass), proximity of eelgrass beds, sediment quality, high flushing zone, high level of local community interest and engagement, retired log lease area.





1.2.4 Sechelt Inlet

Figure 16. Porpoise Bay: 49°33'08″ 123°45'56″

Figure 15. Tunstall Bay GPS coordinates



Figure 17. Half sunken runabout will be removed in 2020 to allow space for eelgrass recovery

Debris site mapping was carried out using a side scan sonar within the southwestern portion of Porpoise Bay, at the southern tip of Sechelt Inlet, during August 27th to 31st, 2018, and the southeastern side of Porpoise Bay was mapped for the locations of sunken derelict boats from February 28 to March 2nd, 2019 for later removal by barge and crane.

Debris removal continued in January 2020 over seven days. A total of 2.01 metric tonnes was removed. Please see Regional Coordinator's Report about the

partnerships the removals required. Photos of the types of debris that were removed

from the seabed can be seen in the Google drive (Photos: Sechelt Inlet). Eelgrass transplanting will take place in 2020 in the debris-free areas. An eelgrass survey was completed of the Inlet with the support of PSF funding. Potential restoration sites were identified (Google drive (Eelgrass Mapping Sechelt).

1.2.5 Burrard Inlet

Google drive (Regional Narrative Reports) includes a report from the two Regional Coordinators



-123.0116203 49.3392579 Degrees

of Burrard Inlet on the restoration plans for Buntzen Bay (creosote log removals for eventual shellfish harvesting in Indian Arm by the Tsleil-Waututh Nation), Port Moody and Stanley Park (native plant re-vegetation) and North Vancouver, Cates Park (eelgrass restoration following debris removal completed in 2020). Underwater videos and photos of the North Vancouver site can be found in Google drive (Photos for 2019-20 Report: Burrard Inlet).

2.0 Milestone 2: Habitat Restoration

2.1 Restoration Methods

The Eelgrass Manual describing the methods used for eelgrass transplants, the "Before" and "After" videos of each of the six transplants and a video demonstrating the transplant method to community volunteers on Pender Island can be seen in Google drive (CRF Eelgrass Transplants 2019-20).

Debris removal photos and videos from work completed in North Vancouver and Sechelt Inlet, and photos of the riparian native plant restoration projects in Port Moody and on Mayne Island can be seen on Google drive (Photos).

The Mayne Island riparian project was completed with funding support from the Pacific Salmon Foundation. Although this work does not fall under the Coastal Restoration funded project, it showcases the additional recovery efforts that can occur because of this CRF project.

2.2 Habitat Restoration

2.2.1 Southern Gulf Islands

Saturna Island

Saturna Beach

On September 17, 2019, 1045 eelgrass shoots were transplanted by 17 members of the Saturna Ecological Education Centre (SEEC). A HOBO unit was installed. Follow up meetings with the students is planned to report on the success or failure of this transplant and to discuss the monitoring methods and results. Future work with the school is also planned, as it can provide experience and exposure to field biology and ecology that could lead to future career development.



Figure 18. Saturna Island volunteers learning about eelgrass transplanting.



Saturna Beach transplant design drawing. Area transplanted: 14m x 4m. HOBO data logger installed. Monitoring began 6 months after the transplant.

Figure 19. Design drawing of Saturna Beach transplant.

Pender Island

Hyashi Cove



Figure 20. Eelgrass transplant site location at Hyashi Cover

A total of 1041 eelgrass shoots was installed by 33 community volunteers on September 22, 2019. These volunteers traveled from Victoria and other Gulf Islands for two days to complete the three transplants on Pender Island. One of the volunteers was the DFO Project Manager, who assisted this work for the entire two days.

CAVE NATIUE -09101-1 -A6 0919-4 RED ---Stole -.74637 0487 47.796'N COPPER PiPE HOBO 123 18,4326 Coffer PO -0119 \$ 14 N 111 SHAILOW END S. Hoot S JTA(104 --SEPT 27 -TEVP: 14.4CC -PH: CLIFI O. 5.5 hos -02-00: MG D0706 -MIDDLE Scale: 1 square = HOGO PLACED

A double density design (20 shoots/m²) was used for this shoot transplant within a 4m x 14m area in the shallow end of the bay to connect with the deeper and shallow existing native eelgrass habitats. A HOBO unit was installed. Monitoring began 6 months following the transplant.

Figure 21. Design drawing of Hyashi Cove transplant.

Hope Bay

On September 21, 2019,860 shoots were transplanted by the same number of volunteers (33) on Pender Island.



Figure 22. Location of Hope Bay transplant.



A double density design was used in a 19mx 2m area. Monitoring commenced 6 months after the transplant date. A HOBO unit was installed.

Figure 23. Design drawing for Hope Bay transplant.

Medicine Beach

Thirty three community volunteers helped to transplant a total of 1571 eelgrass shoots in a previously transplanted site in front of Medicine Beach.

The derelict sailboat on the shore has been subsequently removed by the Dead Boat Disposal Society.



Figure 24. Location of Medicine Beach transplant.



Medicine Beach design for a 22m x 3m transplant area to fill in an area previously planted (1411 shoots in March, 2017). Monitoring continued 6 months after the transplant.

Figure 25. Design drawing of Medicine Beach transplant.

2.2.2 Howe Sound/Atl'ka7tsem

Cotton Bay, Gambier Island

A total of 1086 shoots added to an already existing transplant (600 shoots planted in April 2019) on August 29, 2019 by 25 community volunteers.





Eelgrass transplant area is 14m x 4m. Monitoring continued 6 months following this installation. HOBO data was downloaded.

Figure 26. Design drawing of Cotton Bay transplant.

Tunstall Bay, Bowen Island

Community volunteers assisted the transplant of 1081 shoots in Tunstall Bay.



Figure 27. Transplant site Tunstall Bay.

Transplant area is 14m x 4 m. HOBO was installed at the time of the transplant. Monitoring occurred 6 months after installation.

Figure 28. Design drawing of Tunstall Bay transplant.



2.2.3 Sechelt Inlet

A total of 2.01 metric tonnes were removed from Porpoise Bay. A summary of that work is contained in the Sechelt Inlet Regional Report. Photos can be can be viewed in Google drive (Photo file).

2.2.4 Burrard Inlet

A total of 13 tonnes of sunken and derelict debris was removed over three days in 2020. Details of the debris removal are in the Burrard Inlet Report. Photos can be seen in Google drive (Photos file).

2.3 Signage

Voluntary Anchor–Out-of-Eelgrass signs were posted at 10 land-based sites in the southern Gulf Islands. Thirty-one more signs are scheduled to be installed at marinas, docks and wharves, with permits in place with BC Parks and permissions obtained from other land managers in the four regions. These signs were constructed with funding support from the Pacific Salmon Foundation. An example of this signage and a list of the locations for the installations can be found in Google drive (Regional Communications). A sign recognizing CRF funding is posted on the SeaChange web site: www.seachangesociety.com

Signage was also created and installed at the restored riparian site at St. Margaret's Cemetery on Thetis Island. The sign can be viewed in the above Google drive folder.

Milestone 3: Monitoring and Reporting

3.1 Monitoring Methods and Criteria

The Monitoring Plan outlining the methods used for mapping and monitoring eelgrass habitats in B.C. can be found in Google drive (Eelgrass Monitoring: Eelgrass Monitoring Documents). Graphs showing the transplant eelgrass density counts compared to those in each transplant's reference site can be viewed in the Monitoring Documents file.

The information below rates restoration success (Good, Fair, Poor) based on average shoot density counts since the time of the first monitoring date of the transplants compared to their respective reference sites as of February, 2020, which was the last monitoring event.

An example of a successful transplant is Hope Bay. It is considered a success at this point in time because monitoring results show the shoot density of the transplant is higher than 75% of the shoot density of the reference site. The shoot density in February, 2020 was 100%.

	<u>Density (shoots/0.25m²)</u>	
Than 75%	51-75%	26-50%
Hope Bay, Pender Island	Clam Bay, Thetis Island	Hyashi Cove, Pender Island
Halkett Bay, Gambier Island	Medicine Beach, Pender Island	Brigade Bay, Gambier Island
Cotton Bay, Gambier Island	Port Graves, Gambier Island	
Tunstall Bay, Bowen Island	Saturna Beach, Saturna Island	
Plumper Cove, Keats Island		
% of total # of sites: 45%	36%	18%

Table 1. Rating of transplants based on density: 2017-2020.

The total number of sites with Good / Fair ratings is 81%. The overall success rate of 33 transplants in the Salish Sea completed by SeaChange since 2014 is 70%.

These monitoring results are not conclusive, as a restored site can only be considered a success after 5 years of monitoring.¹ At the end of five years, the total area coverage by eelgrass is compared with the area at the time of the first transplant. The Transplant Baseline Monitoring Data sheet for each site is in Google drive (Eelgrass Monitoring Documents).

If transplanted eelgrass is showing new growth and is increasing in density, and resources are available, more shoots are installed within the site to encourage continuous area coverage for the recovery of ecological structure and function. If a site is not showing an increase in density, monitoring is continued but no new transplants are undertaken.

In some sites, conditions improve over time, as for example, less predation occurs by juvenile crabs from one year to the next, increasing the likelihood of success over time. Wind and wave velocities, El Niño-Southern Oscillation events, and



Photo: Coastal Photography Studio

¹Thom, .R.M. 1995b. Year five eelgrass {Zostera marina L.) transplant monitoring in Grays Harbor, Washington. Letter Report to the U. S. Army Corps of Engineers, Seattle District by Battelle/Marine Sciences Laboratory, Sequim, Washington. Prepared for Seattle District. U.S. Army Corps of Engineers. Seattle, Washington.

temperature fluctuations during some years determine higher and lower densities. A five year monitoring schedule can average the results from some of these fluctuations.

The relatively high rate of success of the transplants may be due, in part, to the site selection criteria used, based on research of eelgrass restoration methods and field experience. Criteria for site selection can be seen in Google drive (Site Selection). Before this project is completed in 2022, it might be helpful to hold a workshop for all CRF project staff who are interested in discussing and comparing criteria used for site selection for eelgrass transplants.

3.2 Prescriptions for Future Eelgrass Restoration

Of the 11 sites monitored during the first three years of this project, six are considered for additional transplants, based on shoot density and available suitable subtidal area.

Site location	Reason for further restoration
Medicine Beach, Pender Island	Habitat connectivity, significance to FN culture/history.
Hope Bay, Pender Island	Favorable conditions (healthy eelgrass present, high flushing in bay, low recreational boat use, low backshore development).
Saturna Beach, Saturna Island	Habitat connectivity (possible forage fish spawning beach, forested backshore, existing eelgrass habitat), engaged local community.
Cotton Bay, Gambier Island	Habitat connectivity (creek, wetlands, existing eelgrass habitat), engaged community, restoration of former log storage site.
Tunstall Bay, Bowen Island	Opportunity to connect existing eelgrass beds, high level of community engagement.
Plumper Cove, Keats Island	BC Provincial Park (protected area); debris removal will add area for eelgrass recovery, high public profile. Additional eelgrass restoration will connect existing salmon habitats.

 Table 2. Sites for Future Restoration (based on 2019-2010 transplant monitoring results)

Site Location	Rationale for no further restoration
Halkett Bay, Gambier Island	No subtidal space available; recovery is considered successful. Area protected from recreational boating activities.
Brigade Bay, Gambier Island	Shoot densities are decreasing; poor substrate quality considered a limiting factor. More research is needed to determine cause of failure.
Port Graves, Gambier Island	Shoot density of transplant is not improving as compared to reference site. More research of sediment quality required.
Clam Bay, Thetis Island	Recovery from mooring chain disturbance slow. Continue monitoring to gauge success.
Hyashi Cove, Pender Island	Poor density counts indicate the transplant area may be impacted by waves or sediment transport. Further monitoring of site required.

Table 3. Sites not deemed suitable for further restoration

3.3 Schedule for Restoration Activity

More eelgrass sites have been recommended and are being considered for 2020-2021 as a result of Habitat Surveys and discussions within the Technical Working Groups. They include Lyall Harbour on Saturna Island, North Vancouver, Scottie Bay, Lasqueti Island and Porpoise Bay, Sechelt Inlet. The Proposed Work Plan for 2020-2021 is included in Google drive (Regional Narrative Reports).