Restoration of Carex marsh habitat in the K'omoks Estuary

2019 Final Report

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Fish and Wildlife Compensation Program

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Guardians of Mid Island Estuaries Society gratefully acknowledges the financial support of the Fish and Wildlife Compensation Program for its contribution to the Restoration of Carex marsh habitat in the K'omoks Estuary. www.fwcp.ca

Executive Summary

Restoration of *Carex* marsh habitat in the K'omoks Estuary is a project developed by the Guardians of Mid Island Estuaries Society (GoMIES) in partnership with the K'omoks First Nations (KFN) Guardian Watchmen. The goal of this project is to protect and restore *Carex* sedge habitat within the brackish high marsh zones of the K'omoks estuary at risk due to overgrazing by locally overabundant Canada Goose populations. The Eco-Cultural restoration prescriptions implemented by this project address priority one actions identified in the 2017 FWCP Puntledge River Watershed Action Plan (PUN.RLR.HB.14.01 Implement habitat restoration of the K'omoks estuaryP1) and the 2011 Comox Valley Project Watershed Society K'omoks estuary restoration plan.

Eco-Cultural estuary restoration involves the modification of traditional fish weir techniques to a more modern purpose to restore and protect productive *Carex* marsh habitat to increase salmon survival at the K'omoks estuary. *Carex* sedge habitats and other marsh vegetation will be protected from further Canada Goose herbivory by the construction of a series of wooden fences made from alder poles and willow branches to construct natural restoration exclosures.

In 2018, the project focus was to exclude critical sedge marsh habitats in Comox/Dyke slough locally known as the Hollyhock flats where extensive Canada Goose herbivory had severely degraded *Carex* channel edge habitats in this part of the K'omoks estuary. Alder poles were used to support green snow fenced sites to exclude Canada Geese. A large exclosure was erected within a portion of the estuary that was totally denuded of all marsh vegetation and *Carex* plugs were transplanted within this exclosure. Approximately 4,160 m^2 of prime high marsh channel edge habitat was protected in 2018.

In 2019, exclosure techniques evolved to what we refer to as Eco-Cultural Estuary Restoration (100% all-natural wood and hemp rope with no plastics) as we created several more restoration sites and expanded the original exclosures. Most of the green fencing was removed and replaced with willow. Considerable effort was made to transplant *Carex* plugs to suitable habitat sites devoid of any marsh vegetation. Protected and restored estuarine habitat exceeded 7,100 m^2 in 2019.

GoMIES also worked with community stewardship leader Project Watershed to ensure the public was aware of this project. Three local media stories provided the Courtenay/Cumberland/Comox communities information on this project and Project Watershed included a news bulletin on their website. Three interpretive signs were also installed off public walkways and estuary viewpoints in partnership with Project Watershed, KFN, and the Comox Valley Regional District. The public and members of KFN and Project Watershed have become very supportive of this restoration work especially for the all-natural Eco-Cultural Estuary Restoration structures.

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Introduction

Year-round resident CAGO and a variety of "visiting" sub-populations (Clermont, H. 2015), have been directly linked to over-grazing and grubbing of channel edge vegetation dominated by species such as the highly productive Lyngbye's Sedge (*Carex lyngbyei*), leading to the erosion of productive sediment/soils and the collapse of marsh benches on most estuaries found along the east coast of Vancouver Island. Since 2015, the Guardians of Mid Island Estuaries Society (GoMIES) have worked closely with the K'omoks First Nation (KFN) Guardians to address a new emerging issue that is severely impacting estuaries within the KFN traditional territories. Overabundant resident Canada Geese (CAGO) have over-grazed estuarine marshes in the K'omoks estuary which has caused erosion of significant marsh and beach structure in the estuary. The greatest loss of *Carex* channel edge communities in the K'omoks Estuary occurs in the Dyke/Comox Slough off Comox Road. Several other locations are at risk with over 1200 resident Canada Geese observed feeding on the K'omoks estuary in August, September, and October 2017 and 2018. The photos below are Canada Geese feeding in the K'omoks estuary in January 2018.

Figures 1 and 2. Canada Geese grubbing Carex rhyzomes which led to marsh platform erosion at the K'omoks Estuary, January 2018.

The scientists, fisheries, and wildlife biologists involved with GoMIES believe there is a direct link towards declining Chinook salmon stocks (and other salmonids) and loss of estuarine cover and productivity due to Canada Goose herbivory at several estuaries along the East coast of Vancouver Island including the K'omoks estuary. In 2010, GoMIES implemented a pilot project which included the installation of 16 exclosures on the Little Qualicum and Englishman River estuaries. Over the next three years during peak growing seasons, vegetation surveys were conducted along transects within each exclosure which were 50-100m^2 in size and compared to equivalent adjacent non exclosed plots. Since 2014, the Guardians have begun to restore *Carex* sedge channel edge communities at the Little Qualicum and Englishman River estuaries by both transplanting healthy *Carex* plugs and installing temporary fencing to prevent CAGO herbivory. This project builds on techniques that have been tested and proven effective in other estuaries.

Goals and Objectives, Measurables, and Linkage to FWCP Action Plans

The primary goal of Eco-Cultural estuary restoration is to generate high quality forage and rearing habitat for juvenile salmon and significantly increase the primary productivity of the K'omoks estuary by protecting vulnerable sites and by re-vegetating denuded and degraded areas with *Carex* dominated estuarine marshes.

The Dyke/Comox Slough (also locally known as Hollyhoch flats) were found to have the most fish use during the formulation of the Comox Valley Project Watershed Societies' 2011 estuary restoration plan. This zone has recently suffered the greatest degradation by Canada Goose herbivory and has the most potential for immediate protection and enhancement through our proposed habitat-based actions. Creating expanded intact sedge marshes will be critical for the successful restoration of the adjacent former Fields sawmill site (once acquired) as potential *Carex* donor sites and for natural *Carex* colonization.

Our project helps to implement priority one habitat-based actions identified in the 2017 FWCP Puntledge River Watershed Action Plan and specifically PUN.RLR.HB.14, 15, and 16.01 to Implement habitat restoration or habitat-based actions in the Comox Slough/Dyke Slough...K'ómoks estuary-P1.

The following objectives will be achieved through a series of activities and measurables as follows:

1. Develop a comprehensive habitat map that clearly illustrates healthy *Carex* channel edge communities, degraded or at risk Carex marsh habitat, and denuded mud flats suitable for restoration.

   Measurable: Restoration map completed and updated annually.

2. Construct Eco-Cultural estuary exclosures to protect vulnerable *Carex* channel edge habitat and to facilitate *Carex* restoration success.

   Measurables: *Carex* habitat protected and restored in m^2/hectares, numbers of Carex plugs transplanted leading to improved fish use from enhanced habitat structure and resiliency of the estuary.

3. Train First Nation Guardians to become skilled at Eco-Cultural restoration and monitoring.

   Measurables: Numbers of Coastal Guardians skilled to carry out all aspects of project monitoring, data collection, and to sustain restoration sites over the long-term.

4. Promote research and awareness of Eco-Cultural restoration techniques to improve fish and wildlife habitats in the K'omoks estuary.

   Measurables: Quality of interpretive outreach information and signage which highlights the role and contributions of KFN Guardians and community stewards. Three media

articles were published describing this project, 3 interpretive signs have been installed off public trails and viewpoints to the estuary, and GoMIES provided a thorough presentation to the audience at the Comox Valley Project Watershed Society's 2019 AGM.

Study Area and Restoration Map

The priority habitat representing the project study area involves high marsh, brackish channel edge vegetative communities found along the lower Courtenay River, Comox Slough, Courtenay Airpark lagoon, and all stream confluence areas containing high value fish and wildlife habitat that is vulnerable to CAGO over-grazing within the K'omoks Estuary. Please refer to K'omoks Estuary Restoration Map (Figure 3).

Methods

In the spring of 2018, GoMIES used GIS software to create georeferenced polygons and photos that identified healthy *Carex* donor sites, priority sites requiring immediate protection from Canada Goose herbivory, and fully denuded sites requiring long-term restoration. The kmz files were sent to our GIS specialist for mapping to help guide our phased restoration work.

In 2018, approximately 3,200 m^2 of heavily degraded sedge marsh within the Dyke slough portion of the estuary was fenced off using alder poles and green fencing. This technique was effective to keep Canada Geese out while existing *Carex s*edges recovered through rhyzomal growth. *Carex* plugs were also transplanted into fully denuded substrates within the main exclosure system and into a large exclosure completely devoid of any vegetation. Three exclosures were built in 2018 protecting 4,160 m^2 of key marsh habitat. A large custom-made all metal extractor tool designed by GoMIES collected cone shaped plugs from healthy sedge marsh donor sites. Each *Carex* plug typically contains the roots and rhizomes of 3-5 *Carex* plants. *Carex* plugs were then carried to restoration sites using blue fish totes and our tool was used to remove a similar sediment plug where we then inserted the transplanted plug. We have learned that *Carex* can be successfully transplanted in late February to mid-May using this technique. We made new *Carex* plug extractor tools that were stronger than our original design in 2019 which proved very effective in collecting and transplanting plugs to the restoration sites.

This process is labour intensive and KFN and GoMIES crews of 4-6 people would work together to install exclosures and transplant *Carex* within the priority habitat sites as identified in the FWCP Action Plan and 2011 Estuary Restoration Plan. We harvested young alder up to 12 cm diameter and willow stakes from KFN lands and MOTI highway right of ways and cut alder poles 2.2 – 2.4 m in length with one end sharpened using chain saws and hand saws. Alder poles were installed by using a 6" diameter post pounder to insert each pole approximately 30% of its length into the sediment. Initially poles were place every two meters to attach green fencing using green twine fasteners. This required regular maintenance and we later modified our habitat exclosures by doubling the poles to every meter and we replaced most of the green fencing with a weave of 2-3 m long willow and alder branches fastened by hemp rope.

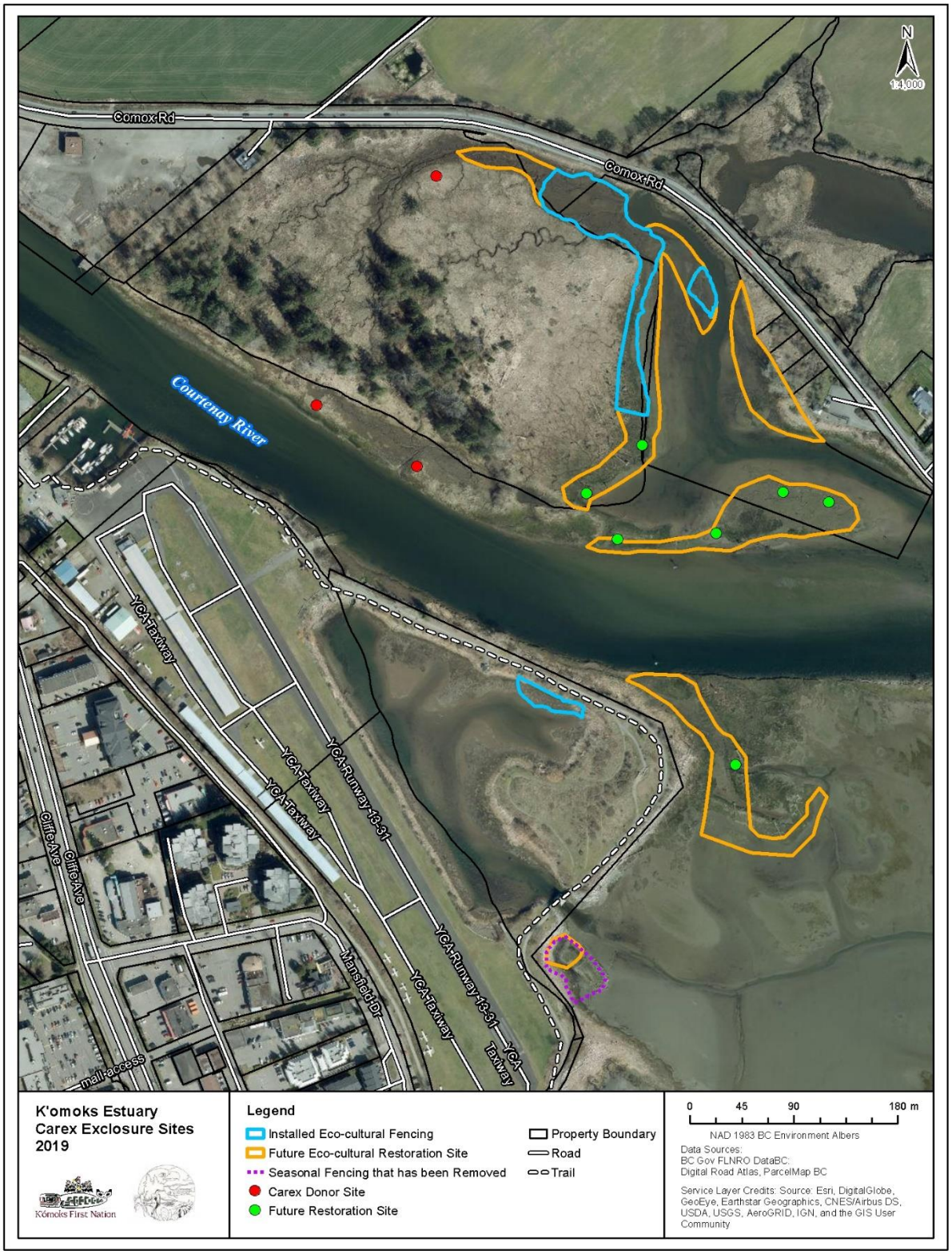


Figure 3. K'omoks Estuary Restoration Map - showing existing Eco-Cultural restoration sites, proposed restoration sites for 2020/21 and locations of healthy *Carex* donor sites.

The cost to make the Eco-Cultural restoration wooden structures is lower than purchasing fence posts, rebar, and plastic snow fencing from big box hardware stores. The wood source is donated by MOTI and the cost to manufacture the alder poles and willow stakes is mostly First Nations and Guardians labour, tools, and transportation costs. Harvesting the wood products can be done year-round but building exclosures and transplanting *Carex* is best achieved during low day tides in late winter to spring which is typically a slower period for First Nations Guardian Watchmen programs.

Results and Discussion

In 2018, we installed a series of exclosures protecting 4,160 m^2 of sedge marsh habitat at three sites within the K'omoks estuary with 3200 m^2 in the Comox/Dyke Slough. We manufactured 940 alder poles from trees harvested on KFN lands and off nearby Ministry of Highways and Infrastructure (MOTI) highway right of ways (where alder is cut regularly for highways maintenance). One exclosure closest to the Comox road flag gates was over completely denuded mudflats and we transplanted over 300 *Carex* plugs in June of 2018.

In 2019, we expanded our exclosures protecting the Comox/Dyke slough marshes and converted these structures to all-natural wood with hemp fasteners now called – Eco-Cultural restoration exclosures. Most of the green "higher maintenance" fencing was removed, and more alder poles were installed with willow and alder branches used to create wooden fence barriers to CAGO. These structures are now stronger and more aesthetic to the natural environment and have been highly praised by KFN and the Comox Valley stewardship community as they resemble traditional fish weirs and provide immediate habitat cover to fish. We also built a new exclosure in the Courtenay Air Park Lagoon to help protect marsh habitat in this highly visible location of the estuary. Three interpretive signs were developed and installed adjacent to these restoration sites along the Air Park public walkways and at the Comox Road Rotary Park managed by the Comox Valley Regional District in cooperation with Project Watershed (PW). PW fielded many enquiries from the public, so we worked with them to issue press releases to media, for project information on their web site, and we presented our project at their June 2019 AGM.

The total 2019 restoration exclosures completed by August now protect over 7,000 m^2 of Carex sedge marsh habitat and we have transplanted over 1000 *Carex* plugs to date. An additional 1000+ alder poles were made and installed into our Eco-Cultural restoration sites along with 1000+ 2-3 m willow and alder branches weaved through these structures.

We have trained all the 4 full-time KFN Guardians including 4 summer student/junior Guardians. Students from the BCIT Masters Restoration program participated in our 2019 efforts and will help implement future monitoring and evaluation components of this project.

Project Milestones

2018/2019: Obtained BC Permit from Ministry of Forests, Lands and Natural Resorce Operations & Rural Development (FLNRORD) in June 2018 and reviewed with West Coast Conservation Land Management Program and Regional FLNRORD staff in April 2019. A 3-year permit will be obtained in October 2019 for expanded restoration activities at all the estuaries the GoMIES are now implementing Eco-Cultural Estuary Restoration techniques.

March 2018 and March 2019 - Purchased bulk orders of green fencing and other materials needed to implement this project. DFO and Project Watershed contributed some funding support before the end of their 2018 fiscal year. PSF is supporting material and supply costs to support this project and GoMIES work at 4 other estuaries.

April/May 2018 Mapped Carex donor sites and identified priority habitat areas requiring exclosure protection.

April 2018 – Met with KFN Guardian Program Manager to develop initial work plan.

April to June 2018: Harvested alder on KFN reserve lands to be used as poles supporting exclosure fencing.

April to July 2018: Collected photos of habitat areas prior to restoration and of key activities to document exclosure construction and Carex plug transplants.

May to July 2018: Transplanted Carex plugs from healthy donor sites to a completely denuded exclosure habitat area off dyke road.

June 2018: Obtained a Ministry of Transportation and Infrastructure (MOTI) permit to harvest alder and willow along their highway right of ways to provide natural and cost-effective materials for exclosures.

May/June 2018: installed a series of exclosures protecting priority one sedge marsh habitat off Comox Road – Dyke slough/Hollyhock marsh. Used over 500 manufactured alder poles from KFN lands and an additional 500 alder poles harvested from nearby highway right of way.

June 2018: Worked with Project Watershed and KFN to develop a press release explaining the restoration process and the urgency to protect key sedge marshes from Canada Goose herbivory/damage.

June 2018 to April 2019: Maintained exclosures and regularly cleared debris from the green fencing. Repaired exclosures as necessary.

October 2018: Installed an exclosure off the Courtenay Air park to protect a salt marsh enhancement site developed by Project Watershed. In March 2019 some fencing was removed at this location due to exposure to wave action during winter storm events.

December 2018: Met with Project Watershed to address public questions regarding the restoration project. With their input we developed interpretive signs that were installed in the

spring of 2019 along the Air Park Lagoon public walkway at two locations and one at the Rotary Park nature park viewpoint off Comox Road all adjacent to our restoration work.

March to May 2019: Removed most of the green fencing and incorporated Eco-Cultural restoration techniques to build all wooden exclosures with shorter gaps between alder poles to support interwoven willow branches to exclude geese. The new structures were viewed as being more aesthetically pleasing and resemble ancient First Nation fish weirs with strong community support.

March to June 2019: Transplanted over 800 *Carex* plugs into denuded sites within existing exclosures.

June 2019: Developed a Power Point presentation that was unveiled at the 2019 Project Watershed AGM where our work was strongly endorsed.

August 2019: Installed a new exclosure to protect estuarine marsh habitat within the Air park lagoon. Junior KFN Guardians (summer students) were trained how to construct Eco-Cultural exclosures.

September/October 2019: Final draft report completed and updated restoration polygon kmz files sent to GIS specialist for mapping updates.

October 2019: Updated habitat restoration map illustrating 2018, 2019 restoration sites, and proposed future restoration sites (Figure 3 – attached to this document).

Ongoing: Photo monitoring and photo library documented all phases of our restoration project (Table 1.)

Lesson's Learned and Recommendations

With the estuary restoration sites adjacent to public trails in the City of Courtenay and the main access road to Comox, the public was very inquisitive of our project. Once the grant was awarded there was urgency to get started to protect as much vulnerable habitat as we could and to transplant *Carex* during the optimal window. Unfortunately, we did not have the resources to develop a communications plan and we should have developed a press release describing our restoration work upon starting our project. We want to thank staff from Project Watershed who fielded many of the initial enquiries and passed on our contact information. We did address this issue through several media releases in mid to late 2018 and attended Project Watershed meetings to keep them apprised of our progress and rationale for the techniques used to protect and restore the sedge marshes of the K'omoks estuary. The interpretive signs installed in early 2019 and community presentations helped to garner support from the community, stewardship leaders, and local governments. Provincial and Federal Fisheries biologists have also been complimentary of our Eco-Cultural estuary restoration approach.

The KFN and GoMIES work very well together and over the past 4 years have built a solid partnership to tackle the overabundant goose populations and to develop effective estuary

restoration techniques. The transition to all wood exclosures and evolution to Eco-Cultural restoration techniques was a testament of our collaboration with the KFN Guardian Watchmen program. The larger openings created by the alder and willow fencing allows easy access for fish of all sizes to utilize the immediate habitat structure of Eco-Cultural restoration. Maintenance has been reduced by using these methods which allows our resources to focus on quickly restoring key salmon and wildlife habitat in the K'omoks Estuary.

More sites still require exclosures and the next phase should ramp up *Carex* transplants to help speed up recovery. This project will take 3-5 years to reach recovery of a targeted 24,000 m^2 of prime *Carex* sedge marsh habitat in the K'omoks Estuary.

Acknowledgements

Guardians of Mid Island Estuaries Society gratefully acknowledges the financial support of the Fish and Wildlife Compensation Program for its contribution to the Restoration of *Carex* marsh habitat in the K'omoks Estuary. www.fwcp.ca

We want to thank the KFN Guardian's, especially Cory and Randy Frank, Krissy Brown, Kaylan Mclean, and Cedar Frank who contributed so much hard work and expertise to make this work enjoyable and rewarding. Special thanks to Danielle Morrison for her great work preparing our Estuary Restoration maps and to GoMIES field biologist, Garreth Ashley for contributing photos and photo descriptions to this report. Garreth also led several field days involving the KFN and our BCIT restoration biologists Emma Cummings and Jay Miles Baker-French and participated in several community meetings.

And we thank the many staff, Directors, and volunteers of Project Watershed. They have our deep respect and admiration as the community stewardship leaders of the Comox Valley and we greatly value their feedback and participation in all projects related to protecting and restoring key habitats within the K'omoks estuary and its watershed.

We want to acknowledge the Pacific Salmon Foundation for their support of cost-effective manufacturing and transport of KFN and MOTI wood materials used for restoration and their funding greatly supported overall project material, supplies, and signage costs.

We also want to acknowledge the support of the Ministry of Highways and Transportation Infrastructure for allowing us a steady nearby wood source for all our Vancouver Island Eco-Cultural Estuary Restoration projects, especially Brendan Kelley and Sean Wong.

We hope to continue to work closely with all partners associated with helping to conserve and restore the K'omoks estuary.

References

Clermont, H. 2015. Canada Goose (*Branta Canadensis*) Management Strategy for Mount Arrowsmith Biosphere Region: Towards the Restoration of Goose-Damaged Estuaries. Prepared for the Guardians of Mid-Island Estuaries Society. 272 pp. Available from guardiansmie.org

Dawe, N.K., W.S. Boyd, T. Martin, S. Anderson and M. Wright. 2015. Significant marsh primary production is being lost from the Campbell River estuary: another case of too many resident Canada Geese (*Branta canadensis*)? British Columbia Birds, Journal of the BC Field Ornithologists, 25:1-12.

Dawe, N.K., W.S. Boyd, R. Buechert. A.C. Stewart. 2011. Recent, significant changes to the native marsh vegetation of the Little Qualicum River estuary, British Columbia; a case of too many Canada Geese (Branta Canadensis)? British Columbia Birds, Journal of the BC Field Ornithologists, 20: 11-31.

Dawe, N.K., and R. Buechert. 1995. Bird use of the Little Qualicum River estuary, Vancouver Island, British Columbia, 1975-1979. Technical Report Series Number 240. Canadian Wildlife Service, Pacific and Yukon Region, Delta BC.

Fisheries and Oceans Canada. 2017. Action Plan for the Northern and Southern Resident Killer (*Orcinus orca*) in Canada. *Species at Risk Act* Action Plan Series. Fisheries and Oceans Canada, Ottawa. v +33 pp.

Fish and Wildlife Compensation Program. 2017. Puntledge River Watershed Action Plan. 35 pp.

Ford, J.K.B, B.M. Wright, G.M. Ellis, and J.R. Candy. 2010b. Chinook salmon predation by resident killer whales: seasonal and regional selectivity, stock identity of prey, and consumption rates. DFO Can. Sci. Advis. Sec. Res. Doc. 2009/101. iv + 43 p.

Gaboury, M., D. Robichaud, and J.D.C. Craig. 2012. Habitat Utilization and Improvement Opportunities In the Englishman River Estuary. Prepared for the BC Conservation Foundation, Nanaimo, British Columbia. 45 pp.

Levings, C.D.,C.D. McAllister, AND B.D. Cheng. 1986. Differential use of the Campbell River estuary, British Columbia, by wild and hatchery-reared juvenile chinook salmon (*Onchorynchus tshawytscha*). Canadian Journal of Fisheries and Aquatic Science 43:1386-1397.

Project Web Links

https://projectwatershed.ca/guardians-building-resiliency-in-the-komoks-estuary/

https://tidechange.ca/2018/08/08/guardians-building-resiliency-in-the-komoks-estuary/

https://www.estuaryguardians.org/

Table 1: Guardians of Mid Island Estuaries Society - *Carex* restoration in K'omoks estuary 2018-2019.

Restoration Photos and Descriptions

Our two leaders, making the original K'omoks estuary restoration work plan. Cory Frank (K'omoks Guardians) and Tim Clermont (GoMIES),April 2018.

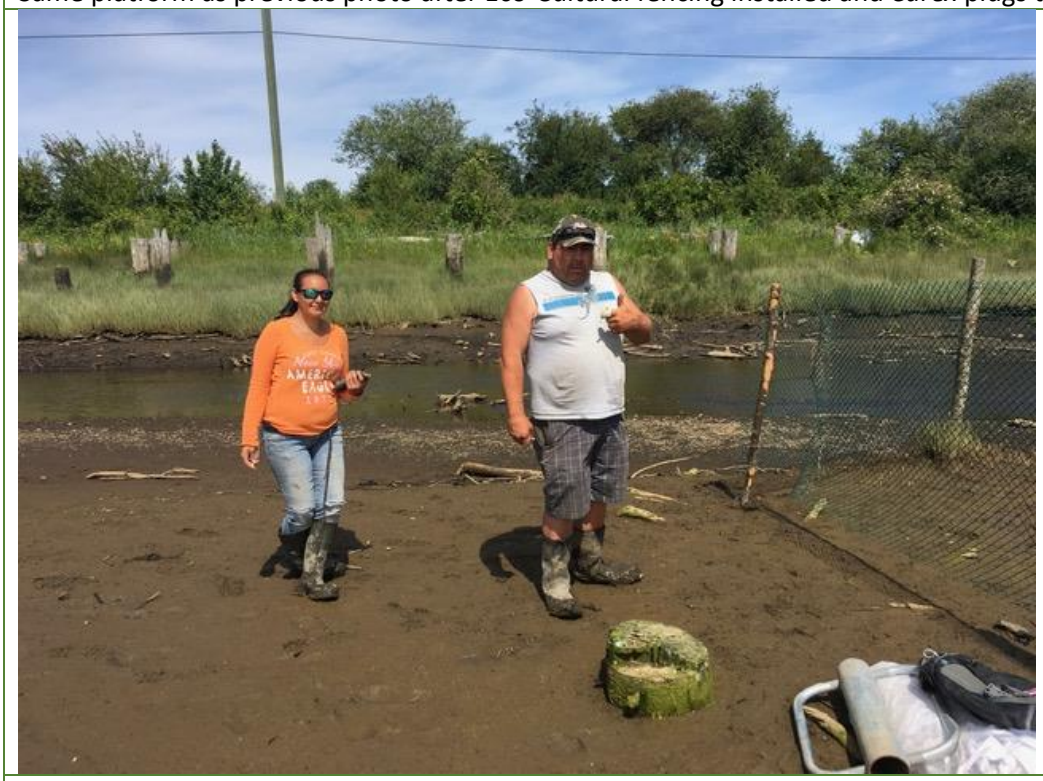
K’omoks Estuary marsh platform degradation adjacent to the Courtney River, July 2018.

Example of pristine dendritic channels and Carex meadows at Hollyhock marsh, April 2018.

Meeting with local stakeholders, Project Watershed, at the Courtenay Airpark Lagoon to inform them on GoMIES plans and goals for the K'omoks estuary, 2018.

Early stages of restoration fencing being installed to protect remaining platform, transplants were later introduced to this site, May 2018.

Same platform as previous photo after Eco-Cultural fencing installed and *Carex* plugs transplanted, May 2019.

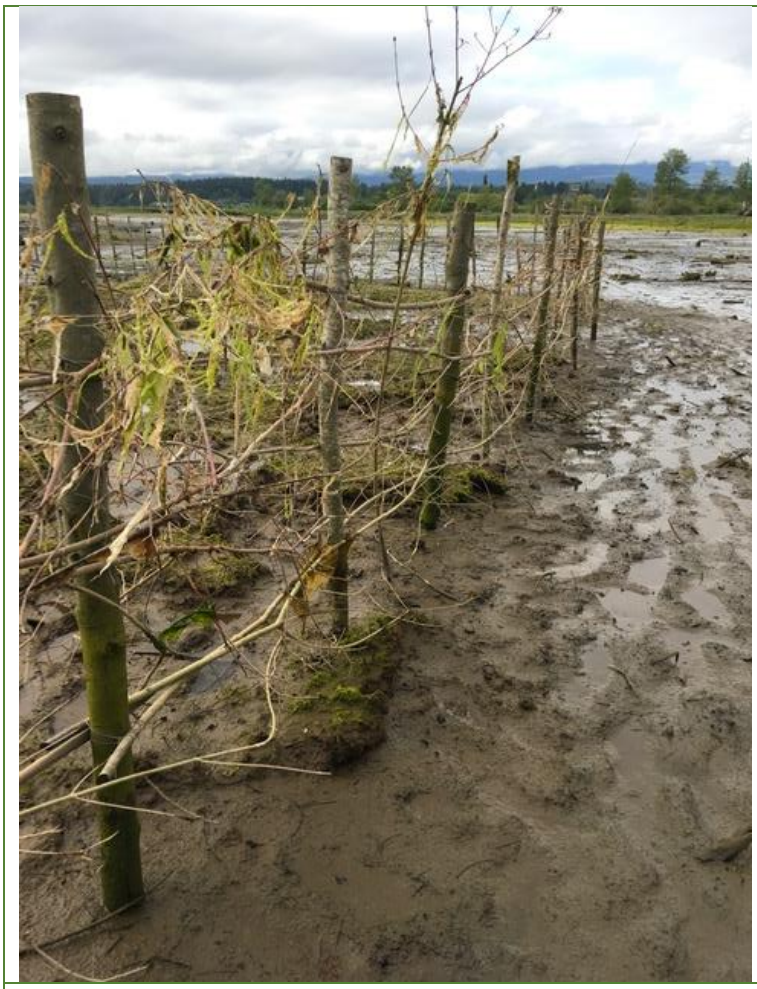


Krissy Brown and Randy Frank, installing fencing in June, 2018.

Mr. Frank extracting *Carex* pugs in 2018.

Previously degraded *Carex* stands recovering due to restoration fencing protecting from Canada Goose herbivory. March 2019.

Harvesting alder and willow with the K’omoks Guardians crew to be used in eco-cultural fencing.



Example of eco-cultural fencing, no plastics of metals involved in the construction process.

Site protected with eco-cultural fencing, 100s of *Carex* transplant plugs introduced, March 2019.

Denuded mudflats, exposed to erosion, prior to 2018 restoration fencing. School group seining fry with DFO and PW volunteers.

Carex rhyzomes spreading over previously denuded area, May 2019. Improved eco-cultural fencing in progress.

Rhizomal spread of *Carex* now possible after exclosure protection from Canada Goose herbivory. Comox Slough/Hollyhock flats, May 2019.

Temporary plastic “snow fencing” coming down to be replaced by 100% natural eco-cultural fencing, constructed of alder, willow, and hemp, May 2019.

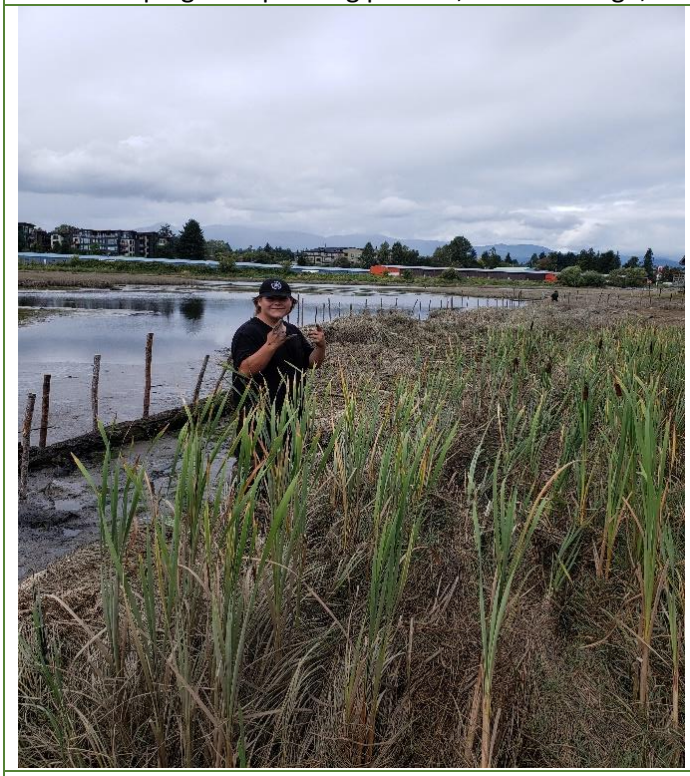
Emma Cummings, a BCIT/SFU graduate student working with the Guardians of Mid-Island Estuaries Society, is all smiles as she helps install eco-cultural fencing in the spring of 2019.

Eco-cultural fencing going up in the spring of 2019.

2019 *Carex* growth flourishing under the protection of eco-cultural fencing.

Carex flourishing behind the protective eco-cultural fencing and beginning to re-establish along the dendritic channel, Comox/Dyke Slough, May 2019.

The *Carex* plug transplanting process, Comox Slough, May 2019.



Construction of eco-cultural fencing begins in the “lagoon”. Cedar Frank, a summer student for the K’omoks Guardian program is excited to be protecting local salmonid habitat! August 2019.

Ian, another K’omoks Guardian summer student, checks on the sturdiness of his recent construction.

Eco-cultural fencing up in the “lagoon.” August 2019.

Krissy Brown in August 2019, tying in Willow to the new Air Park Lagoon eco-cultural fence.

The city of Courtenay in the background of the newly installed eco-cultural fencing, August 2019.

K’omoks First Nations Guardians: Cedar and Ian, ready for a break after a hard day’s work.
Courtenay Air Park Lagoon, August 2019.

Interpretive sign explaining the restoration project installed by the Comox Valley Regional District parks department at the Comox Road – Rotary Park Estuary Viewpoint, June 2019