



CEDAR COAST FIELD STATION

ANNUAL
REPORT 2021

 Mack Bartlett

“To preserve ecological health through place-based research and education that celebrates the cultural and biological diversity of Clayoquot Sound.”

www.cedarcoastfieldstation.org

ANNUAL REPORT **2021**

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Acknowledgements

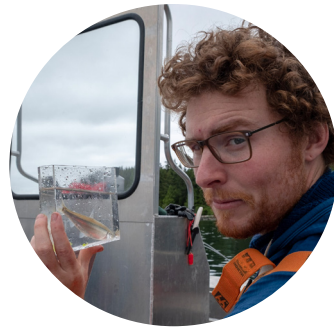
We acknowledge and honour the traditional territories of the Ahousaht, Hesquiaht, and λaʔuuk^wiʔaθ (Tla-o-qui-aht) First Nations. In the spirit of truth, healing and reconciliation, Cedar Coast Field Station invites all visitors to join us as respectful guests in this unceded Nuu-chah-nulth Ha'huulthii.

A Letter from Mack Bartlett: Research Director, Executive Director 2020-2021

2021 was a transitional year. As a community we adjusted to living within a pandemic world, feeling the pressure of social responsibility and the search for a semblance of normalcy. For Cedar Coast we adjusted to operating as a mostly research and monitoring focused organization without the use of our home base on Vargas Island. Despite the continued challenges we had an incredibly successful and busy year. We now have research programs running year-round, have expanded our existing monitoring programs, developed new educational programming, and deepened relationships with our collaborators.

Personally, the major transition for me was focusing my effort to ensure the society stays on its feet, and away from strictly managing our ecological monitoring efforts. At times I was stretched to my limits and struggled to find a balance between my new responsibilities and my natural state: chest waders on, dip net in hand, a seine net at my feet, chasing fish.

Luckily, I am fortunate enough to be working with some incredible young staff, who bring their own passion, skill sets and new ideas to the organization. They were more than happy to take my place, spending rainy days with their heads in buckets counting salmon or flying drones over kelp forests and salmon



streams. With our dedicated team and with our collaborators our continuing research programs grew even stronger. We managed to find the time to add new programs and finish some major assessments including kelp monitoring, oceanographic surveys, online educational programming and salmon population assessments. Keep an eye out for some new research reports that will be available soon.

The transition is not yet over. Pandemic restrictions continue to ease and with this we have opened our doors to the public once again. We managed to have a few groups late this season and it was wonderful to see the field station utilised again. We are clearing out the cobwebs, and cleaning off the solar panels in anticipation of a busy next year that is fast approaching. With the potential of a fully operating field station next year we are again filling out our team. I am excited to welcome our new Executive Director, Darryl McKenzie, who brings a wealth of knowledge and experience to the society. Hopefully this also means I can spend a little more time with my head in a bucket staring at fish!

I would like to thank all of our staff, partner organizations, volunteers and community members who made this year a success. We are excited for a busy 2022 and are looking forward to welcoming new and returning groups back to the field station.

Introducing Darryl McKenzie, Cedar Coast Field Station's New Executive Director

Throughout my life I've been fascinated with the natural world.

As a child, I spent my summers barefoot and carefree on the shores of Georgian Bay, the world's largest freshwater archipelago, where I sailed, kayaked, camped, hiked, and took every opportunity to explore the area's sparkling waters and rugged landscape. It was here, among the windswept white pines and granite shores of the Canadian Shield, that I began my career in outdoor education, and not-for-profit management. My first job was as a camp counsellor/sailing instructor, and eventually I progressed to a full-time Director at YMCA Camp Kitchikewana, a 3-season, water-access only, camp and outdoor education centre located in Georgian Bay Islands National Park.

Early in my career, I had the opportunity to work at numerous leadership and outdoor education facilities in Canada and internationally such as the Costa Rica Rainforest Outwardbound Bound School, Outward Bound Zimbabwe, and Youth Challenge International (Guyana and Costa Rica). I was fascinated by the ecological diversity and cultural landscape of these regions and yearned to experience and learn more.

Later, I trained as a Mountain Instructor and Ocean Sailing Instructor with the National Outdoor Leadership School (NOLS) in Lander, Wyoming and Baja, Mexico respectively and was able to fine tune my marine and emergency medical skills through my Search and Rescue work with the Canadian Coast Guard.

As my career progressed, my attention shifted to providing strategic leadership to not-for-profits where I led major growth and change initiatives, designed fundraising

programs, and developed strategies focused on mission impact and financial sustainability.

While I was passionate about my work, I inadvertently began spending more time "behind a desk" and less time outdoors. I was becoming disconnected from the natural world.

The upside of the COVID-19 pandemic was that it provided me with an opportunity to take a breath, slow down, and reflect. It was this reflection that led me to pursue employment with the Cedar Coast Field Station (CCFS). I'm both honoured and humbled to be joining CCFS as the organization's new Executive Director effective December 1st.

As we emerge from the COVID-19 pandemic, CCFS has a unique opportunity to connect and engage with more people in new and different ways. I look forward to building on the strong foundation laid by Founder Simon Nessman, the Board of Directors, Interim Executive Director Mack Bartlett and the entire CCFS staff and volunteer team.

I also look forward to working with our community partners and the Clayoquot Sound First Nations to further develop our research and program capabilities and to build a financially sustainable and impactful operation on Vargas Island.

It's an exciting time for CCFS and I look forward to our journey together,

Darryl McKenzie
Executive Director



Our Vision & Mission

Our vision at the Cedar Coast Field Station is to preserve ecological health through place-based research and education that celebrates the cultural and biological diversity of Clayoquot Sound.

We continually strive towards this vision by ensuring we fulfill our Mission:

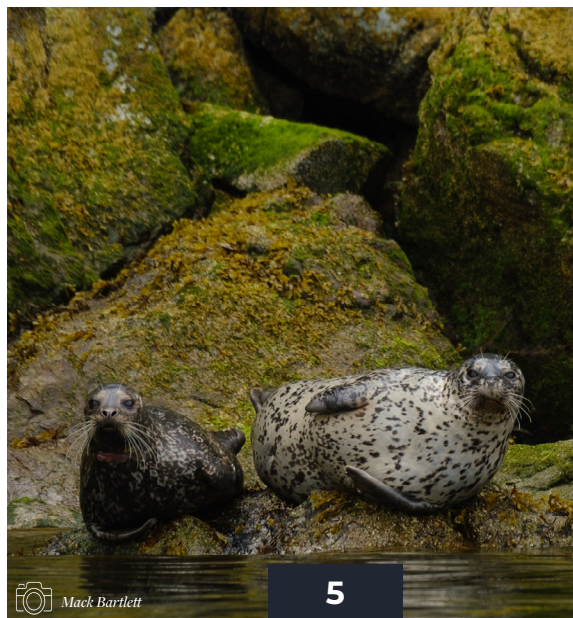
- ◊ to provide a place for exploration, observation, and contemplation of the local ecosystem;
- ◊ to be inclusive and accessible for a diverse and collaborative community of researchers, naturalists, artists, educators, and students;
- ◊ to provide scientific resources within Clayoquot Sound by conducting objective research and producing publicly available data;
- ◊ to inspire individuals to recognize and understand our human dependence on the natural world.



Education

Four years ago during our inaugural year of operation, we welcomed the very first school group out to the Cedar Coast Field Station. Coast Mountain Academy (CMA), based in Squamish BC, has continued to return each October with intrepid staff and students weighted in gumboots, Gore-Tex, and aspiring research questions. After 18 months of keeping our doors closed to the public, we swept out the wall tents and spruced up the station to once again welcome CMA students from October 19th-22nd, on the verge of storm season no less!

The majority of the students this year were a part of the Grade 10 Sustainability class where the project at hand was to investigate the sustainability of one of three human activities: Tofino's growth and related infrastructure; logging or commercial fishing in the area; or Indigenous presence on, connection to, and stewardship of the land. These proposed topics not only provided context to this Place, Clayoquot Sound, but also offered a lens for students to explore the challenges and successes of "growth" in regards to population, economic and social forms. Highlights of the trip included interviews with Cedar Coast staff, a tour of the field station's off-grid systems, and a rainy walk to Lennie & Marcie's homestead on Keltsmaht Beach where students bore witness to the quaint restored cabin which offers numerous difficulties and rewards to off-grid living on a coastal island.



 Mack Bartlett

The handful of Grade 11 Environmental Science students focused their studies on individual inquiry based science questions. Cedar Coast staff introduced students to our Lab, guidebooks and equipment available in order to facilitate each student's desired methodology and data collection. During their stay a large storm system swept through Clayoquot Sound, not surprisingly extending their field trip an extra day. Rain on the tin roof, a glowing wood stove, and zooplankton under the microscope made it all the better until their departure back to Squamish. Until next time CMA!

In addition to hosting one school group this past year, we took this second season of COVID as an opportunity to create some virtual educational content: another ArcGIS StoryMap. A StoryMap is an online tool which can include a variety of narratives, maps, and other interactive multimedia content. These stories act as educational resources not only for classrooms but for all audiences, and can be shared easily across social media channels. **"Salmon Population Assessment"** is our most recently published StoryMap and highlights the challenges of Pacific salmon enumeration on the west coast of Vancouver Island.

If you're interested in learning more about our StoryMaps, check out **"Assessing Juvenile Salmon in Clayoquot Sound"** or visit our **Archives page** on our website. A big thank you to the West Coast Nest for their support and facilitation of this project.

Earlier this spring, local Grade 11 student Toby Theriault interviewed one of our field technicians, Kayley Hollyer, to learn about her research interests, path to becoming a technician with us, and about monitoring juvenile salmon in Clayoquot Sound. This Science & Conservation Researcher Interview Series was funded and produced by the West Coast Nest in effort to highlight local scientists and their ongoing research projects here in Clayoquot Sound. To watch the interview, click **HERE!**



 Mark McKeough

A Successful Micro-trolling & eDNA Workshop, November 4-7th, 2021



This past November, we hosted a micro-trolling and environmental DNA (eDNA) workshop to connect students, DFO representatives, local organizations and indigenous governments along the west coast of Vancouver Island (WCVI). The workshop had two aims: to share information and help standardize juvenile chinook over wintering survey methods on the west coast, and to introduce coastal youth to the emerging technology of eDNA.

What is Micro-trolling?

Micro-trolling is a fishing technique designed to target juvenile chinook salmon. This project aims to determine the seasonal distribution of chinook salmon in WCVI nearshore areas, and assess the health and condition of juvenile fish through physical examination and the collection of small tissue samples.

What is eDNA (environmental DNA)?

eDNA refers to the DNA that can be found in the environment as a result of animals or plants naturally shedding cells. Since species have their own distinct DNA sequences, it is possible to detect species of interest through specific data analysis. This can help us answer questions about what was recently

present in the water.

Participants learned the theory behind micro trolling and eDNA collection through presentations, then had the chance to try these data-collection methods out in the field. In order to keep micro-trolling methods standardized across the coast, participants practiced setting up the necessary gear, recording accurate data and sampling the juvenile chinook they caught. The data and tissue samples from these days will be processed and included in the WCVI microtrolling database managed by DFO.

Each eDNA student had the opportunity to collect water samples throughout the Sound all while keeping their proposed research question in mind. Participants were also introduced to the complexities of sea lice ID, zooplankton ID, and the role eDNA research plays in regards to pathogen monitoring in and around salmon farms.

We were thrilled with the outcome of this workshop, which included forty-two participants representing: DFO's Molecular Genetics Lab (MGL) including Dr. Kristi Miller, UBC, the Pacific Salmon Foundation (PSF), DFO Stock Assessment, Salmon Coast

Field Station, students from University of Victoria, local organizations including Uu-a-thluk Fisheries, Maaqutusiis Hahoulthee Stewardship Society, Ha'oom Fisheries Society, and members from Kyuquot & Checkleset First Nations, Ahousaht (MHSS), Mowachaht/ Mucthalaht, Hesquiaht First Nation, Tseshaht Hupacasath First Nations, Fort Nelson First Nation, Kitsoo Xai'xais Stewardship Authority, and Huu-ay-aht.

This workshop was made possible through the grants, discounts and in-kind donations from a number of organizations and local businesses: Clayoquot Biosphere Trust, Students on Ice Foundation, Tofino Resort & Marina, Tofino Co-op Grocery, Gaia Grocery, Rhino Coffee, Basic Goodness Pizza, and Tofino Ucluelet Culinary Guild. Thank you all for your contributions! And a special thank you to all the participants, presenters, collaborators and boat captains!

This program was designed and led in collaboration with the Maaqutusiis Hahoulthee Stewardship Society, Ha'oom Fisheries Society, Uu-a-thluk Fisheries, Department of Fisheries, and the Cedar Coast Field Station Society.




"Participating in the eDNA and microtrolling workshop not only gave me hands-on experience with novel fisheries monitoring techniques but also allowed me to meet many scientists applying these techniques in their fields. The workshop brought together a diverse group of biologists, guardians and other researchers, and helped give me a better picture of the many interconnected projects currently monitoring salmon on the west coast of Vancouver Island. I am excited to apply skills from this workshop to my workplace."

- Carilia


Facility Buyouts

Upon request, the Cedar Coast Field Station is often able to accommodate local groups and businesses wishing to utilize the facility for private events, retreats or workshops. Our wall-tents accommodate up to 33 people, equipped with woodstoves to keep you cozy during the shoulder seasons, and the 5,000+ sq. foot lodge offers comfort & amenities all with an ocean view. We look forward to welcoming you in 2022 so that we can once again share the space and beauty of Vargas Island with community members.



 Ian Harland



 Julia Simmerling

Research: 2021 Season in Review

Public health orders and provincial restrictions kept our station doors closed for another season, but our fieldwork throughout the Sound stayed its course. Turns out that doing good science doesn't require much, just a boat, write-in-the-rain paper, and some basic field equipment. So our projects carried on with our dedicated team all year long. Each year, our projects continue to strengthen with growing data sets and evolving partnerships. We'd like to say a special 'Thank You' to Jared Dick, Central Region Biologist for Nuu-chah-nulth Tribal Council Fisheries (Uu-a-thluk), Danny O'Farrell, Stewardship Biologist for Maaqtusiis Hahoulthee Stewardship Society (MHSS), Jess Edwards, Associate Biologist and Candace Picco, Fisheries Biologist for Ha'oom Fisheries Society. It's been a pleasure working with you all. Thank you for another memorable season!

To access all of our research reports, visit the **Archives** section of our website.



 Jeremy Mathieu



 Jeremy Mathieu



Craig Lugsden



Craig Lugsden



Craig Lugsden



Craig Lugsden

01.

Kelp Monitoring: Clayoquot Sound 2021

Days in the Field: 9 (July - October)

Kelp are foundation species of algae, meaning they create rich environments to build communities and habitats for other species to dwell and feed. The nutrients and energy harnessed by canopy-forming kelps such as giant kelp (*Macrocystis pyrifera*) and bull kelp (*Nereocystis luetkeana*) are passed throughout coastal communities from herring to salmon to orca and beyond. Kelps keep our coasts productive and our plates full. In addition, these protists buffer habitat from the effects of marine heat waves, hypoxia, and acidification all while sequestering carbon from the atmosphere.

Potential Risks to Kelp Forests

To protect these important players in coastal ecosystems, we start by addressing the risks kelp forests face and what we can do to help mitigate those risks. Climate change can directly affect kelp which amplifies into serious threats to kelp forest communities. For example, kelps do not respond well to the rising temperature, marine heatwaves and acidification that comes with climate change. We conducted kelp mapping surveys to understand the current state of kelp forest distribution and - with subsequent, annual monitoring - to track how kelp forests will change over time.

Although kelp aquaculture has been found to have a neutral to positive effect on the surrounding environment, large scale operations growing at a fast pace can often lead to environmental disturbances and degradation. As interest in kelp aquaculture grows for Clayoquot Sound, it is important to solidify a sturdy foundation of knowledge on the natural or semi-natural state of kelp before large-scale operations potentially cause irreversible effects. A long term monitoring project provides that opportunity.

Harvest may not be a risk unless improperly managed. It is important to know how much of the population can be safely harvested. Although an exact safe proportion is unknown, quotas are developed based on the best available knowledge. Having area and density data can better inform quotas, improving harvest for harvesters and kelp forest communities.

Restoration of kelp has been put forth as a resolution for potential losses due to climate change. Knowing the distribution of the different species of kelp would give

restoration initiatives a template to work towards as well as track which areas merit restoration.

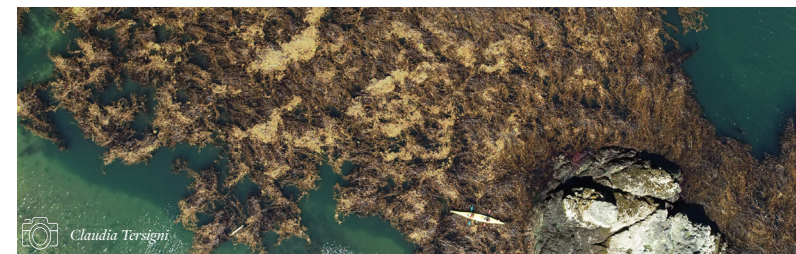
What We Can Do To Mitigate Risks

To contribute to the effort in mitigating these risks, we began our kelp surveying initiative with the pilot year of a long term monitoring project on giant and bull kelp. Rebecca Martone and Meredith Fraser provided Marine Plan Partnership (MaPP) training to CCFS and a group of core volunteers to ensure our efforts were consistent with other groups across Vancouver Island. We conducted 10 kelp surveys where 5 sites were mapped via drone and density samples were taken by kayak. The results from these surveys will be processed and analyzed to give the current distribution of giant and bull kelp, help inform MHSS resource management plans, and will be available for ground truthing the satellite imagery surveys by the Spectral Lab at UVic. In the process of analyzing our data we have connected with Luba Reshitnyk from Hakai Institute who is improving efficiency in the kelp mapping process using artificial intelligence (AI).

What We Envision For The Future Of This Project

We hope to continue organizing community surveys and reporting the state of kelp distributions of Clayoquot Sound in 2022. Potential future paths include further documentation of genetic and biodiversity baselines for kelp forests around Clayoquot Sound. We are excited to have completed our first year of engaging community members in marine stewardship with this long term kelp monitoring program.

Thank you to the volunteers that came out, Naas Seafoods for their guidance, MHSS for their help and stewardship of the kelp forests around Clayoquot Sound. And a big 'Thank You' to the Clayoquot Biosphere Trust for the funding that made this project possible.



Claudia Tersigni

02.

Juvenile Salmon & Sea Lice Monitoring

Days in the Field: 20 (March -June)

Every spring, juvenile salmon migrate through Clayoquot Sound from their natal rivers out to the Pacific Ocean. Since there is a distinct relationship documented between farm fish, sea lice, and wild juvenile salmon, it is critical that we monitor the health of, and parasite load on juvenile salmon using the nearshore waters and protected bays. Each week, our monitoring consists of recording the number of sea lice per salmon and the lice life-stage. Along with our sea lice data, we record the school size of salmon caught, their external health, and their body metrics. We also record environmental conditions such as temperature and salinity, as well as the GPS coordinates of all our sites. All of our data for this monitoring is publicly accessible [HERE](#).

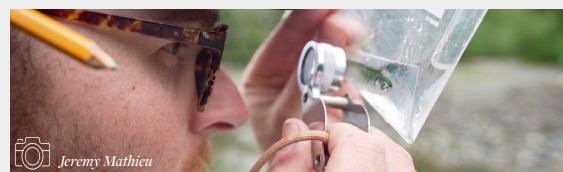
Fisheries and Oceans Canada (DFO) requires industry (fish farms) to manage lice populations in BC to an average of 3 lice per fish. This margin was exceeded 7 times by Cermaq operating in Ahousaht Territory this past year. In an attempt for a more localized approach to management, Maaqtusiis Hahoulthee Stewardship Society (MHSS) mandated a threshold of 1.5 lice per fish on farms within Ahousaht Territory. But despite this new requirement, Cermaq exceeded this threshold 34 times. The instances of high lice levels on farms likely contributed to the high lice levels observed on wild juvenile salmon in 2021.

Throughout the monitoring season (March -June), we observed many instances of high lice levels. The abundance (mean number of lice per fish) and prevalence (percentage of fish infected with one or more lice) were highest in May, where the observed peak abundance was 5.68 lice per juvenile fish and our prevalence was 82%.

Although we yet again observed high levels of sea lice on migrating juvenile chum and chinook salmon, the overall sea lice abundance on wild fish was generally lower than in years prior. This is likely due to a combination of environmental and sea lice control factors. This year we observed an average 1 degree decrease in temperature, which could have had an influence on sea lice development and transmission; MHSS mandated a 1.5 lice threshold for fish farms in their traditional territory; and there were 1.5 times as many sea lice treatments used during the outmigration season and nearly 3 times as many treatments in 2021 overall compared to 2020, a result of the new lice threshold.

If you're interested in learning more about our methodology and findings of this project, keep an eye out for our annual Juvenile Salmon & Sea Lice Monitoring report that will be publicly available in the coming weeks! In the meantime, take a look at our past reports by clicking [HERE](#) or explore our story map funded by the Clayoquot Biosphere Trust. **"Assessing Juvenile Salmon in Clayoquot Sound"** is an interactive outreach tool that speaks to the importance of wild salmon and offers a glimpse into why they are disappearing.

This project was financially supported by Ocean Outfitters, and the Sitka Foundation. Thank you for valuing our work and believing in this project. We are so grateful for your unwavering support.



Links to our work:

"Sea Lice Push Wild Salmon to the Brink" a short film
 "Assessing Juvenile Salmon in Clayoquot Sound" StoryMap
 "Juvenile Salmon and Sea Lice Monitoring in Clayoquot Sound 2020" Report
 Our recent reports

03.

Hydrolicer Project

In 2020, the aquaculture industry in Clayoquot Sound relied heavily on new mechanical techniques to control sea lice infestations on farms. This was a result of sea lice becoming resistant to the previous use of the medical treatment SLICE® - Emamectin benzoate administered in pelleted food. The aquaculture industry in BC purchased multiple "Hydrolicer" barges equipped with water jets to dislodge lice from farmed fish. As stated by Cermaq Canada on their website,

"The Salar uses nothing more than ocean water and fluctuating water pressure to first loosen and then remove sea lice and eggs from our fish. The removed lice and eggs are then filtered out of the water used for treatment and stored for disposal on land."

As mentioned, these systems require filtration to prevent returning the lice to the water and reinfesting their fish or infecting wild salmon. Interestingly, in close proximity to these mechanical treatments at farm sites, we found a spike in juvenile sea lice abundance on the wild juvenile salmon we were monitoring throughout the spring. Similar results were found by Raincoast Research near farm sites located on the eastside of Vancouver Island where industry is also relying on this new technology.

Furthermore, during a DFO led [Marine Finfish Technical Working Group](#), there was a disagreement on whether or not technology currently exists to capture 100% of all viable sea lice dislodged following mechanical baths. In 2021, working with partner organizations we collected samples of the effluent coming out of these barges to test for the inclusion of viable sea lice. A report from this first year of sampling will follow soon.

Thank you to Ocean Outfitters for funding this monitoring, Maaqtusiis Hahoulthee Stewardship Society (MHSS) and Clayoquot Action for providing samples, and Salmon Coast Field Station, and Raincoast Research for technical support.





04.

Stream Level Population Assessment

Historically, Fisheries and Oceans Canada (DFO) has assessed salmon stocks by large geographic regions as opposed to individual salmon-bearing rivers. And over the years, counting efforts have declined in conjunction with declining salmon populations here in Clayoquot Sound.

As a result, salmon population assessments don't actually address how individual rivers and their respective salmon populations are doing. Because the current available data is relying on only a few major salmon populations of interest (known as "indicator populations" which typically host hatchery populations, in turn artificially inflating the abundance), smaller populations that offer important genetic diversity and resilience to their species are often overlooked.

Over the past 2 years we have collaborated with the Salmon Coast Field Station and used their assessment framework to develop stream-level population assessments for all salmon species in Clayoquot Sound and the entire West Coast of Vancouver Island (WCVI). This approach allows us to assign distinct salmon populations a status based on each salmon population's current health and its productivity, or ability to rebound, even if abundance is low. Statuses were given according to the Wild Salmon Policy (WSP) and DFO status assessment criteria. For these assessments, all data came from DFO.

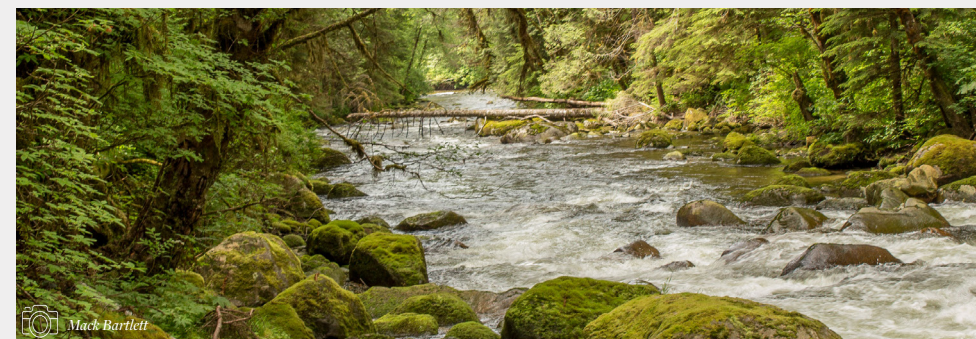
According to the WSP, salmon populations with a Red status have a higher risk of extinction and require immediate management; Amber status indicates the population may become at risk of extinction and unlikely to produce maximum sustainable yield; Green status indicates a population is unlikely to be at risk of extinction. The majority of documented populations across WCVI had an Unknown status due to a lack of enumeration data. For the populations with sufficient data, the majority had an Amber status – indicating they may become at risk of extinction – followed by Red and then Green. Within Clayoquot Sound specifically, the majority of populations with sufficient data for a stock assessment were at higher risk of extinction, requiring immediate conservation and or restoration measures (Red status). Recent enumeration of some populations in Clayoquot Sound showed a decline to zero recorded returning adults.

The assessments for each documented stream are given in our final report, which will become available to the public in the coming months.

Through our assessments of WCVI salmon populations, we found a need for immediate action to conserve and restore wild salmon populations across WCVI. Management that can respond quickly to imminent threats to salmon populations is limited by the large data gaps and an all-time low in monitoring. Due to the higher risk of extinction for many of the populations considered, it is critical to address the sources of declines outlined in previous stock assessment reports by DFO: overfishing, climate change, habitat degradation, and pathogen transmission. Our WCVI salmon population assessment will be available in the Spring of 2022.

We hope to release future reports that focus on the other seven fisheries management areas of WCVI, outside of Clayoquot Sound.

We would like to thank Emma Atkinson, Andrew Bateman, and Sean Godwin for their patient tutelage and inclination to share information and knowledge. This project was financially supported by Ocean Outfitters, and the Sitka Foundation. We cannot thank you enough for supporting us, year after year, in our efforts to resist the extinction of Pacific salmon.



05.

Counting Chum Salmon with Drones

Days in the Field: 15 (August - November)

The storms, wind, and rain did not prevent the CCFS team from completing our second season of flying remotely piloted aircraft systems (drones) to enumerate Chum salmon spawning in-river. Chum salmon are ecologically, commercially and socially important, but do not receive the same attention as other Pacific salmon species. This means that many Chum salmon runs go uncounted or are only counted during the peak spawn of a target species like Chinook or Sockeye salmon. Due to funding restrictions fewer salmon rivers are counted than ever before, leaving gaps in our understanding of salmon populations. Through this project, we hope to contribute to closing some of those gaps.

Similar to last field season, this year began with collecting imagery of spawning Chum salmon to help further develop our AI software. With a year of fieldwork experience under our belt, our team was able to get imagery of all the Chum spawning and holding sites on the river each time we went to Tranquil Creek, located approximately 20km from Tofino in traditional Tla-o-qui-aht territory and within the Tranquil Tribal Park. Our growing knowledge of the river helped us know where the salmon would be at certain times of the season, and what parts of the river we should pay special attention to.

Tranquil is an aptly named small creek where Chum spawn in shallow clear waters in the thousands making for an ideal test system. The Tranquil Creek is also counted through snorkel surveys and a mark-recapture

study so there is adequate counting data to compare to. From our experience working with the AI last season, we learned that a diversity of imagery is important when training software to recognize salmon. For this reason, we expanded our survey area to include the Bedwell River, located 30km from Tofino in the traditional territory of the Ahousaht First Nation, and the Big Qualicum River, located 180km from Tofino in the traditional territory of the Qualicum First Nation. Big Qualicum River offers the opportunity to get photos of Chum salmon returning in the tens of thousands, something that is not possible in Clayoquot Sound. While we were only able to make it to the Big Qualicum once this year and nearing the end of spawning season, we hope to incorporate this river into our sampling sites next year.

While there is still a long way to go before our technology is perfect, we made great progress in our first season of analysis, and in our second season of fieldwork. We were able to achieve the three goals we set for ourselves: 1) we determined that it is practical to photograph spawning salmon in-river, with counts approaching that of traditional snorkel surveys under optimal conditions 2) we developed an algorithm to detect salmon in the imagery captured by the drone, 3) we created methods from this process that can be passed on to other teams hoping to do drone based salmon enumeration. It was a big achievement for us to show that automated salmon detection in drone imagery is possible.

Throughout the next few months, we will be working to analyse the imagery from Tranquil, Bedwell, and Big Qualicum Rivers. With the knowledge we gained from fieldwork last year, we have a plethora of quality imagery to work with this year. The goal of the analysis this winter will be to improve the predictive abilities of our automated counting system. In other words, the model's ability to tell how many fish are present in an image, instead of just 'yes' there are fish or 'no' there are not fish. This development still requires our staff to first manually mark thousands of salmon from our images so they can then be fed into the system.

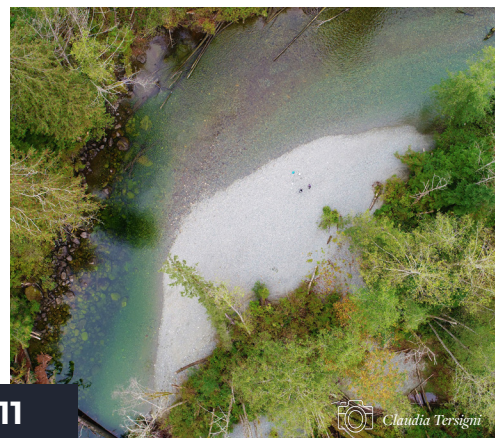
This project was completed in conjunction with, and supported by Aeria, Quest University Canada, the Pacific Salmon Commission (PSC), Uu-a-thluk Fisheries, Canadian Department of Fisheries and Oceans (CDFO), Tla-o-qui-aht Tribal Parks, Maaqtusiis Ha'oulthee Stewardship Society (MHSS), Clayoquot Wilderness Resort and Central Westcoast Forest Society (CWFS).



 Mack Bartlett



 Claudia Tersigni



 Claudia Tersigni



 Mack Bartlett

Collaborative Research

01.

Micro-trolling for Juvenile Chinook Salmon

Days in the Field: 12 (November 2020-March 2021, October 2021- December 2021)

Chinook salmon in Clayoquot Sound are on life support, with only around 700 adults returning to spawn in the area this year. We know very little about Chinook salmon once they leave the rivers and first enter the ocean. Early marine survival has recently been highlighted as a critical component for population growth in other salmon stocks. In 2020, we started a multilateral and community driven effort to understand how juvenile Chinook salmon are using Clayoquot Sound and how they are being impacted while they are here.

The project focuses specifically on Chinook salmon in their first year at sea. By catching and taking a small tissue sample from these juvenile fish, we hope to learn about juvenile Chinook abundance, spatial and temporal distribution, stress and disease profiles, and genetic stock. The data can help us investigate how size, condition, pathogen or parasite load, and environmental conditions may relate to growth and survival.

From the 2020 preliminary sampling season we found that the majority of the 119 Chinook caught originated on the WCVI, with half from Robertson Creek Hatchery. From the tissue samples analyzed, 30 infectious agents were

detected in the 119 Chinook salmon that were sampled. Of these infectious agents, 13 were also found in the sea lice parasitizing on the sampled fish. It is still unclear whether or not infectious agents are passed between parasite (louse) and host (juvenile chinook).

This program started as part of a Clayoquot Sound community effort working with local guides in March, 2020. Due to the success of the first sampling effort, the project has been expanded to sample over winter through all major inlets on the West Coast of Vancouver Island. To strengthen collaboration and ensure consistency in sampling methodologies, this past November we hosted a micro-trolling workshop based out of Tofino for local organizations, government, First Nations, and coastal youth to take part.

This project is in collaboration with Nuu-chah-nulth Uu-a-thluk Fisheries, Ha'oom Fisheries Society, Maaqutusiis Hahoulthee Stewardship Society, Fisheries and Oceans Canada, Pacific Salmon Foundation, and the BC Conservation Foundation. Funding was provided by Fisheries and Oceans Canada, Sitka Foundation, Eco Canada, and the Clayoquot Biosphere Trust.



Mack Bartlett



Jenny O'Farrel

12

02.

Coastal Wolves Monitoring (Year Round)

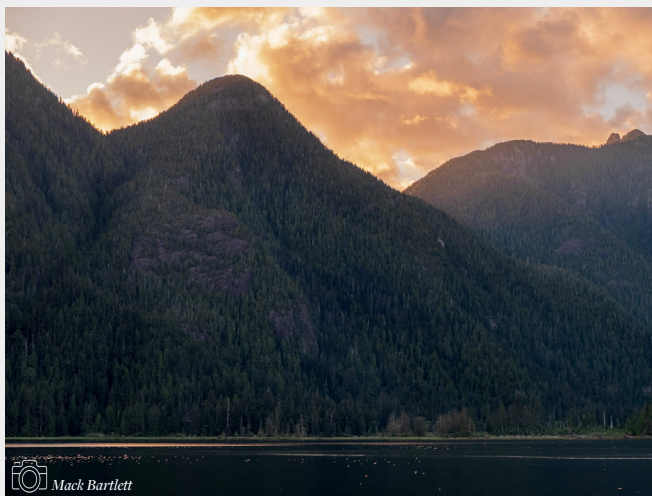
It is no secret that Vargas Island is home to a small population of coastal wolves. Though we do not flaunt their existence, people have been arriving on the island for years to photograph their unique and admired way of life. We are honoured to share this place with them and adapt the ways in which we live in order to peacefully coexist with one another.

In 2017, we set up the first wildlife camera on our property. Our intention was to learn more about the wolf population inhabiting the island without causing discomfort or confrontation. Since then, Cedar Coast has collaborated with Parks Canada, BC Parks, The Nature Conservancy of Canada, Maaqutusiis Hahoulthee Stewardship Society, and the Wildlife Restoration Ecology Lab (University of Northern British Columbia) to try and understand how the Vargas wolves connect with those throughout the rest of Clayoquot Sound.

Although our participation in this project over the past year has been minimal, we are keen to become re-acquainted with the camera array set up around Vargas Island. On-site staff & volunteers throughout our 2022 operating season will significantly increase our capacity to check camera batteries and footage as requested.

To learn more about the wolf monitoring taking place in Clayoquot Sound, visit Parks Canada's **"Wild About Wolves"** Research Project website.

Marcie Callegari



Community Building: Trail to Ahous Bay

Over the years, the meandering trail from the southeast side of Vargas Island leading to Ahous Bay, on the west side of the island, has undergone numerous storms and withstood the countless footsteps of hikers and wolves alike. With all this wear and tear, many parts of the Ahous Bay trail were in a disrepair and desperately required trail building attention and maintenance! In June, a crew of BC Parks Junior Park Rangers stayed at the Cedar Coast Field Station and repaired dilapidated parts of the boardwalk and performed trail clearing. Thanks to the hard work of these junior rangers, access to Ahous Bay via the hiking trail is far safer and more accessible than it has been in the past.



03.

Oceanographic Research

Oceanic oxygen content is decreasing worldwide, and climate changes combined with local watershed influences result in greater rates of decrease in coastal oceans. Despite the ecological and cultural significance of Clayoquot Sound, the oceanographic controls on important water properties such as oxygen are virtually unknown. Understanding these dynamics is vital, as inadequate oxygen levels may directly or indirectly threaten the survival of all marine species which reside in these waters.

This year, Cedar Coast added oceanographic assessment to the suite of in-house monitoring and environmental research projects. We are collaborating with researchers from the Hakai Institute, University of Washington-Tacoma, and the Institute of Ocean Sciences (DFO) to investigate a mid-depth oxygen minimum layer that appears in late summer in Herbert Inlet. Herbert Inlet is perplexing: despite being the only watershed untouched by industry (e.g., logging, mining) in Clayoquot Sound, wild salmon returns to the Moyeha River which feeds into Herbert are as low as other local inlets that have experienced anthropogenic disturbance. This observation, of course, begs the question: what other oceanographic features of Herbert Inlet may contribute to wild salmon declines?

So far, we have identified three key findings that suggest that low-oxygen conditions in Herbert Inlet may influence wild salmon declines:

1. The threshold oxygen concentration for salmon after which avoidance behaviours are exhibited is ~ 5mg/L.
2. Oxygen concentrations in Herbert Inlet are less than 5mg/L in all parts of the water column in late summer/fall.
3. Salmon in-migrations to Herbert Inlet and the Moyeha River overlap with this time window.

Though further research is needed to definitively pronounce low oxygen a contributor to wild salmon declines in Herbert Inlet, our observations of 'co-location' of salmon and the low-oxygen zone provide a compelling reason to investigate further. Our findings will be submitted as a Geophysical Research Letters paper at the end of 2021, which we hope will increase awareness of low-oxygen conditions in Clayoquot Sound and inform future conservation efforts.

We wish to acknowledge the support of our community partners who contributed in various capacities to the collection of data used in our analysis: Jared Dick, Nature's Trust, Danny O'Farrel, MHSS, NTC, and Uu-a-thluk Fisheries.

Directors & Board Members

Thank you to our entire Board for sharing the vision and guiding this organization through the many hurdles and successes over the past five years. We look forward to what the 2022 season will bring with our new Executive Director, Darryl Mackenzie.

Directors & Board Members

- ◆ Simon Nessman
- ◆ Lennie John
- ◆ Zephyr Polk
- ◆ Colin Bates
- ◆ Dave Ratcliffe
- ◆ Zoë Marler
- ◆ Tsimka Martin
- ◆ Kay Gray



Staff

- ◇ Mack Bartlett, *Research Director, Interim Executive Director*
- ◇ Claudia Tersigni, *Operations Coordinator*
- ◇ Julia Simmerling, *Education Program Coordinator*
- ◇ Christian Carson, *Research Technician*
- ◇ Kayley Hollyer, *Research Technician*
- ◇ Rowen Monks, *Research Technician*
- ◇ Satchel Robertson, *Research Technician*
- ◇ Sarah Rosen, *Research Technician*
- ◇ Marcie Callewaert, *Educator*
- ◇ Sierra Boudreau, *Educational Development*
- ◇ Aaron Lomax, *Facilities Maintenance*



📷 Mack Bartlett



📷 Crity Carson



📷 Teagan O'Shaughnessy



📷 Claudia Tersigni



📷 Marcie Callewaert



📷 Claudia Tersigni



📷 Rowen Monks

Volunteering

A huge thank you to all of the local community members who came out to volunteer with us this past season. The early mornings, positive spirits, laughs, and strength wrangling kayaks are so valued. Thank you for spending some days with us in the field!

- ◇ Craig Lugsden
- ◇ Hutton Noth
- ◇ Cam Dalinghaus
- ◇ Melanie Merchant
- ◇ Emily Fulton
- ◇ Marie-France Roy
- ◇ Caeleigh Marshall
- ◇ Sam Cutcliffe
- ◇ TJ Straver
- ◇ Janessa Dornstauder
- ◇ Michael Lee
- ◇ Tim Henderson
- ◇ Teagan O'Shaughnessy

Our 2022 operating season is just around the corner, so we'd like to extend an invitation to all interested volunteers to apply! We are looking for individuals over the age of 18 years to spend multiple weeks on-site at the field station. Volunteer tasks will most likely include gardening, station cleaning, firewood, one day of field work each week, and opportunity to deliver educational programming for the right candidate. For more information, visit our website or send us a letter at info@cedarcoastfieldstation.org



📷 Craig Lugsden

Donors & Supporters

Thank you to our supporters!

All of our work would not be possible if it weren't for the support of the grants, donations, and wage-subsidies we receive each year. We are surrounded by a wonderfully unique west coast community and connected to a greater global community, both who continue to value our monitoring programs and encourage our educational programming, year after year.

We thank you, and appreciate your generosity towards this project.

- ◇ Ocean Outfitters
- ◇ Clayoquot Biosphere Trust, Vital Grants
- ◇ Clayoquot Biosphere Trust, Research & Environment Grant
- ◇ Clayoquot Biosphere Trust, Giving Catalogue
- ◇ West Coast NEST
- ◇ Royal Roads University
- ◇ NSERC Promoscience program
- ◇ Saltwater Classic
- ◇ Pacific Salmon Commision
- ◇ Pacific Salmon Foundation
- ◇ Sitka Foundation
- ◇ Canadian Department of Fisheries & Oceans
- ◇ Eco Canada
- ◇ Canada Summer Jobs
- ◇ Clean Foundation
- ◇ Blue Pathways
- ◇ Tofino Resort & Marina
- ◇ Tofino Ucluelet Culinary Guild
- ◇ Gaia Grocery
- ◇ Tofino Co-op Grocery
- ◇ Simon Nessman

Donations

Interested in contributing?

If you are interested in supporting the Cedar Coast Field Station Society please make a donation at the following link: <https://www.cedarcoastfieldstation.org/donate/>



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| ◇ Kayley Hollyer | ◇ Danny O'Farrel |
| ◇ Marcie Callewaert | ◇ Jeremy Mathieu |
| ◇ Teagan O'Shaughnessy | ◇ Mark McKeough |
| ◇ Craig Lugsden | ◇ Valerie Law |

Thank you to our
photographers!