Thank you for submitting

ARC Engage Final Report

Our team may reach out to you with follow-up requests for clarification regarding your submission.

Review your submission responses below:

Researcher First Name: Kevin

Researcher Last Name: Rey

Department: Science Literacy

Other Department:

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Project Title: eDNA monitoring of False Creek and recognition as a National Urban Park

Start semester: 9/1/2024

End Semester: 5/31/2025

Introduction - Please introduce yourself and include pertinent background information as it relates to your project's research area. I teach Science Literacy at Langara College and have an interest in making science accessible to the public. That's why I reached out to a community group to support their environmental

conservation goals by giving them access to the techniques I am familiar with as a wet-lab scientist. In particular, the use of DNA sequencing can provide relatively low-cost insight into the ecological health of bodies of water. This is done by analyzing the DNA in the water, which is constantly shed by fish and other organisms, and comparing what is found to databases of known organisms. False Creek is a marine environment significantly altered by human activity, and understanding its current ecological health is important for tracking any changes over time.

Please discuss your educational background and your work experience as it relates to this project. If possible, include a quote that helps define your interest in the project. My research background is in the life sciences, specifically in transplant rejection and the regulation of the immune system. I completed my PhD at Simon Fraser University. At Langara, the model of research done in partnerships with businesses or NGOs encouraged me to think of ways that my skills could be applied outside of my original field. When I met the False Creek Friends Society, I knew that I could help them achieve their conservation and policy goals by giving them access to the data that could be produced using the ARC lab space. Since I have experience developing novel research projects, managing supplies, and coordinating staff, I was able to develop this ARC Engage project. My experience in molecular biology and bioinformatics was also useful, since those were major processes in this project (and this partly influenced my search for a partner org).

Please summarize your project in plain language that others not in your field could understand. This ARC Engage grant supported exploratory studies in environmental monitoring in close partnership with the False Creek Friends Society (FCFS). Their vision for False Creek is to restore it and steward it in line with First Nations principles such that False Creek becomes a healthy environment for all, human and non-human, to experience and enjoy. This ARC Engage period largely covered some proof-of-concept work ahead of a larger grant application that would essentially use the same methods. My role was to design an environmental study based on some initial work done in 2022. We decided on the technique of environmental DNA monitoring. Environmental DNA (eDNA) comes from a combination of micro-organisms and cells floating in the water, as well as free-floating DNA. Every organism will leave behind a trace amount of DNA when they pass through water, and by analyzing that DNA, their presence or absence can be tracked. Due to my previous research experience and the context of False Creek, FCFS and I agreed to examine bacterial eDNA, since that can act as a proxy measurement for contamination or ecological conditions. I worked with FCFS to determine a set of sampling sites, and hired a student research assistant to help collect these water samples using specialized equipment. A second student research assistant used eDNA samples generously donated by another faculty member to check that our DNA preparation process was reliable and compatible with our DNA sequencing equipment. Lastly, a

senior bioinformatics student was hired to develop the software process of interpreting the resulting DNA sequences into useable information. He navigated the many nuanced and often challenging process of using different pieces of software to build a “pipeline” and showed that this worked by using freely available eDNA datasets. At the conclusion of this project, we were able to show that our sample collection, processing, and analysis processes were up and running. Unfortunately, due to time constraints and a significant delay in receiving purchased materials, we weren’t able to process samples through this pipeline. However, this work directly contributed to the success of a major grant application that will fund a similar study for three years.

Identify the project goals and objectives. Explain how the results may be used to solve a problem or inform further research in the field. Goal #1: Establish an eDNA sampling process and pipeline. Based on the work described above, we were able to, in principle with simulated inputs or data, accomplish all three steps in an eDNA monitoring project. This will dramatically reduce the start-up time for future eDNA studies at Langara since some initial challenges have been addressed already. Goal #2 Establish a research plan for False Creek with FCFS During this ARC Engage period, further conversations with FCFS helped inform a growing collaboration with The Hakai Institute, a marine science non-profit that routinely assists volunteer groups and First Nations with eDNA monitoring of water ways in the Salish Sea. This ARC Engage grant helped provide FCFS with the scientific perspective in order to see the value in beginning such a partnership, and a confidence that they would receive technical support. The partnership between Hakai, FCFS, and Langara led to a three-year research plan for False Creek that received federal funding.

Briefly explain the steps taken (methods used) to conduct the research, and describe the key findings. The next steps for this project were to complete an application to major natural grant (name currently under embargo), and this was completed in February 2025. In late May, we received the exciting news that our proposed three year study of False Creek was funded. In Fall 2025, we will begin establishing a research committee, hiring students, and dialoguing with First Nations such as Musqueam, in earnest. In this new project, I am acting as co-principal investigator alongside Dr. Janot.

Who was involved in this project (eg. faculty, students, community partners)? How did their involvement contribute to the project’s success? Were there any challenges to overcome? Langara faculty contributed to the success of this project by providing technical support, and perspective. Dr. Kyra Janot provided essential research inputs by providing start-up eDNA samples for analysis and advice on setting up a lab at ARC. This project also benefitted from the support from Drs. Jang and Hatam related to lab operations and bioinformatics, respectively. ARC Staff similarly contributed by providing guidance on how to receive shipping, organize lab space

etc. This project hired three student research assistants in the roles listed above and were essential to the success of this project. In particular, access to capable students in the bioinformatics degree program inspired myself to apply, since I would be able to enlist their help at a high level of independence. Other student research assistants at ARC also made important contributions. Our community partner FCFS contributed to this project by providing vision and specific overall study goals. Importantly, this guidance was in parallel with helping myself establish connections with other False Creek or local environmental and community groups, and they provided opportunities to share about this ARC Engage process at local events.

Please share any personal stories that made this research experience memorable/valuable.

FCFS had invited Langara to an event that was a gathering of like-minded non-profits and other organizations. All in all, there were something like a dozen groups present, all invested in the environmental and cultural future of False Creek. I was inspired by this event because after the presentations had been done, it was clear that a consensus was starting to form. I was amazed that FCFS had done so much leg-work to establish connections in such a broad group of people (including City of Vancouver, the Vancouver Police Department, Simon Fraser University). Also, this grant provided invaluable time for me to complete a literature review on research conducted on Indigenous territory or with Indigenous peoples. The perspective I gained from having the protected time to read widely has been invaluable, and led to important changes in the way I conceptualize and discuss work being done on unceded territory. This was reflected in the proposed budget and governance structure I prepared for a major grant, and I believe was a major factor in its successful funding.

What are the next steps for this project and for you as a researcher?

To sample water and prepare it for DNA isolation, we used a protocol already developed by Hakai and Dr. Kyra Janot at ARC for a different project. This involved identifying ecologically significant and accessible sites in False Creek and using a sampling armature to retrieve water. The samples were brought back to Langara for filtration and preservation so the DNA could be isolated at a later time. In the molecular biology lab, previously collected DNA samples, also provided by Dr. Janot, were used as inputs for the DNA amplification step (PCR) necessary before sequencing. We used custom DNA primers to target a region present in bacterial DNA and tested various experimental conditions until we had reliable, contamination-free results. Lastly, we worked on a software pipeline to analyze the data that would result from DNA sequencing. This was done by first identifying that different software available for different steps in the pipeline, and choosing options that maximized compatibility and fit for the specific outputs we would produce eg. Databases that had the best reliability RE: bacterial eDNA. These software were then hosted on the Digital Research Alliance of Canada server. Freely

available sets of input data were used to benchmark different parameters in the various steps of the analysis. Unfortunately due to time constraints exacerbated by extreme delays in the arrival of supplies, no sequencing has been done with the collected False Creek samples.

Please upload any images that will help to showcase your project.

By submitting, I consent to uploading my ARC Fund final report to the Langara Institutional Repository (The LaIR).
True

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