Queen's University Biological Station

Annual Report 2020

Director: Dr. Stephen C. Lougheed

Associate Director: Dr. Shelley A. Arnott

Senior Manager: Sonia Nobrega

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Cover image: Black-billed cuckoo, Elbow Lake. **Photo:** S.C. Lougheed

About QUBS

QUBS Mandate

To provide opportunities for teaching and research in biology and related sciences; and to use active stewardship and best management practices to conserve local terrestrial and aquatic environments, and biodiversity.

Specific Mission Statements & Goals

- Providing a dynamic and supportive environment for leading-edge research spanning, but not limited to, conservation, ecology, evolution and environmental studies.
- Supporting and developing undergraduate and graduate courses in field biology, environmental biology and related sciences.
- Acquiring, and protecting in perpetuity representative and/or significant properties, habitats and ecosystems near the field station.
- Providing locally obtained data and electronic resources on climate, the physical environment and biodiversity and making these available through a Geographical Information System and data/information archives.
- Acting as a liaison between university researchers and the local community, and a conduit for dissemination of natural history and scientific knowledge.
- Engaging in outreach to foster public awareness of environmental and conservation issues.

Meet the Team

Director: Dr. Stephen C. Lougheed
Associate Director: Dr. Shelley Arnott
Senior Manager: Sonia Nobrega
Opinicon, Operations and Stewardship Manager: Aaron Zolderdo
Elbow Lake, Operations and Maintenance Coordinator: Adam Morcom
Outreach and Teaching Coordinator: Emily Verhoek (on maternity leave, returned December 2020)
Interim Outreach and Teaching Coordinator: Sarah Oldenburger (January-November 2020)
Indigenous Knowledge-STEM Program Coordinator: Alice Johnston
Research Coordinator: Dr. Ivana Schoepf (position ended August 21, 2020)
Collections and Data Manager: Dr. Adriana Lopez Villalobos (position ended August 21, 2020)
Head Cook/Kitchen Manager: Veronika Jaspers-Fayer (on leave, QUBS kitchen closed in 2020)
Maintenance Assistant: Roger Green
Eco-Adventure Camp Director: Ruth Janet Bryce
Opinicon Housekeeping: Diane Bouliane
Elbow Housekeeping: Tina Deyo
Opinicon Kitchen Cooks: Due to the COVID-19 pandemic, the kitchen was closed in 2020. No kitchen casual staff employed.

2020 Summer Work Experience Program (SWEP) Interns at QUBS

The Summer Work Experience Program (SWEP) provides Queen's undergraduate students with an engaging, challenging and rewarding summer work experience, and helps support our spring and summer programming. QUBS is grateful to Queen's Career Services for facilitating the SWEP program, and for the partial funding provided through the undergraduate portion of the Student Assistance Levy.

Youth Environmental Educators (Eco-Adventure Camp Counsellors): Malcolm Douglas McCart Stewart (Assistant Director), Amanda Marie Miller, Joanne Irene Rae, and Skye MacDonald Jamieson
Outreach & Stewardship Interns: Lindsay Ann Wray and Meghan White
Conservation Research Intern: Laura Jane Yantha
Field & Data Management Intern: Keith David Holmes
Data Management and Herbarium Assistant: Amelie Gabriele Mahrt-Smith

Introduction and Overview

As for all organizations, the past year has been odd for the Queen's University Biological Station because of the COVID-19 pandemic. We celebrated the 75th year since our founding, but of course none of our planned events at either Opinicon or Elbow could be offered in-person. In addition, we were unable to host our full slate of researchers or field courses, which made for an unusually quiet QUBS in the spring and summer. We were also very sad to see the departure of our Research Coordinator, Dr. Ivy Schoepf, and our Collections and Data Manager, Dr. Adriana Lopez, because our NSERC grant had ended and because of diminution of other sources of income.

Despite the pandemic and the cancellation of most in-person activities at QUBS, we did have undergraduate summer interns (supported by the Queen's Summer Work Experience Program) and moved as much of our outreach program as possible on-line. Although we knew that our inability to host users would affect our 'bottom line', we felt strongly that we should continue to support Queen's students as best we could. They did a remarkable job, guided by QUBS' dedicated full-time staff. Our Eco-Adventure Camp went virtual with 65 campers, including 11 Leaders-in-Training. We had many successful outreach events and public lectures (both live and pre-recorded) that were well-attended or viewed, and which increased our 'geographic catchment' with attendees from the US and Western Canada. The students thus greatly enriched our on-line resources and social media presence, and these assets will endure long after this year draws to a close (https://youtube.com/user/QUBScam).

We hope to begin construction of a new all-season teaching and research building at Opinicon Lake in spring 2021, and this year saw much planning and fund-raising, with very generous donations from Chancellor Emeritus Charles Baillie and family, and Reg Bronskill, Artsci'81 and Helen Findlay, Artsci' 77/MA'82 helping to bring this to reality. The new facility will house three labs on the lower level: two aquatics labs and one molecular lab. It will include two visiting researcher offices, a broadcast quality learning/ communications space, and a geomatics laboratory. We will use some form of bird proof glass to minimize bird mortality and hope to have a green roof and a geothermal system for heating and cooling. We aspire to make this our first truly accessible facility with elevator, ramps, and accessible washrooms.

In autumn 2020 we created the 'Jessie V. Deslauriers QUBS Diversity Award' to support students from diverse backgrounds so that they may participate in field courses

at QUBS. It should be in place to fund students in 2021 (assuming we can host field courses). Here is the preamble for the Terms of Reference:

> *Field courses provide among the richest academic experiences in any student's career, affording opportunities to gain practical skills and learn about biodiversity and the environment in natural settings. Yet not all students can attend such field courses, nor historically has diversity within these courses reflected Canadian society more broadly. The intention of this fund is to help redress this. The Queen's University Biological Station (QUBS) hosts multiple field courses each year and financial support from the QUBS Diversity Award is intended to help offset the costs of taking any of the field courses offered at the station.*

We received one year of NSERC PromoScience funding with the goal of contributing to grade 9 and 10 STEM curriculum using research done by QUBS (from multiple institutions) and Queen's University researchers. A motivation for this is to incorporate Indigenous perspectives into science lesson plans, while enhancing prospects for Indigenous youth, young people from diverse backgrounds, and young women to pursue careers in STEM. This allowed us to hire a part-time coordinator for the project, Alice Johnston. We hope to extend this program for three more years and applied again to the NSERC PromoScience program. Also enhancing our partnership with local Indigenous organizations are activities funded by the TD Friends of the Environment Foundation that will provide signage and new stations for our trail app in both local Indigenous languages showcasing traditional ecological knowledge. Support from South Frontenac Township will help us create an accessible nature trail at the Elbow Lake Environmental Education Centre. Finally, we have been busy with myriad stewardship and maintenance tasks including painting our iconic boathouse, and building a series of small bridges and boardwalks on our trail system to lessen impacts on wetlands and streams.

In 2020, total user-days were reduced by approximately 70% relative to 2019, with only 3,426 user-days (user-day data are displayed in tabular form on pp 18 below). Because of COVID-19 related health and safety measures, we were largely unable to open our facilities during the 2020 operating year. As a result, we did not host field courses, workshops, conferences, or teaching activities, with the exception of a field trip from Biology 212 (Scientific Methods in Biology) from Queen's University at our Opinicon Campus in February. However, despite the many challenges and restrictions imposed from COVID-19 health and safety measures, we still managed to host researchers in a limited capacity. Approximately 40 researchers (professors, graduate

students, undergraduate honour thesis students, and assistants) carried out essential research at QUBS during the 2020 operating year. Researchers were only permitted to conduct research deemed to be essential and that could be undertaken safely (e.g., long-term studies where annual monitoring is vital), which was determined through a vetting process established by Queen's University. Research projects and the personnel involved can be found below in the Research Summaries section.

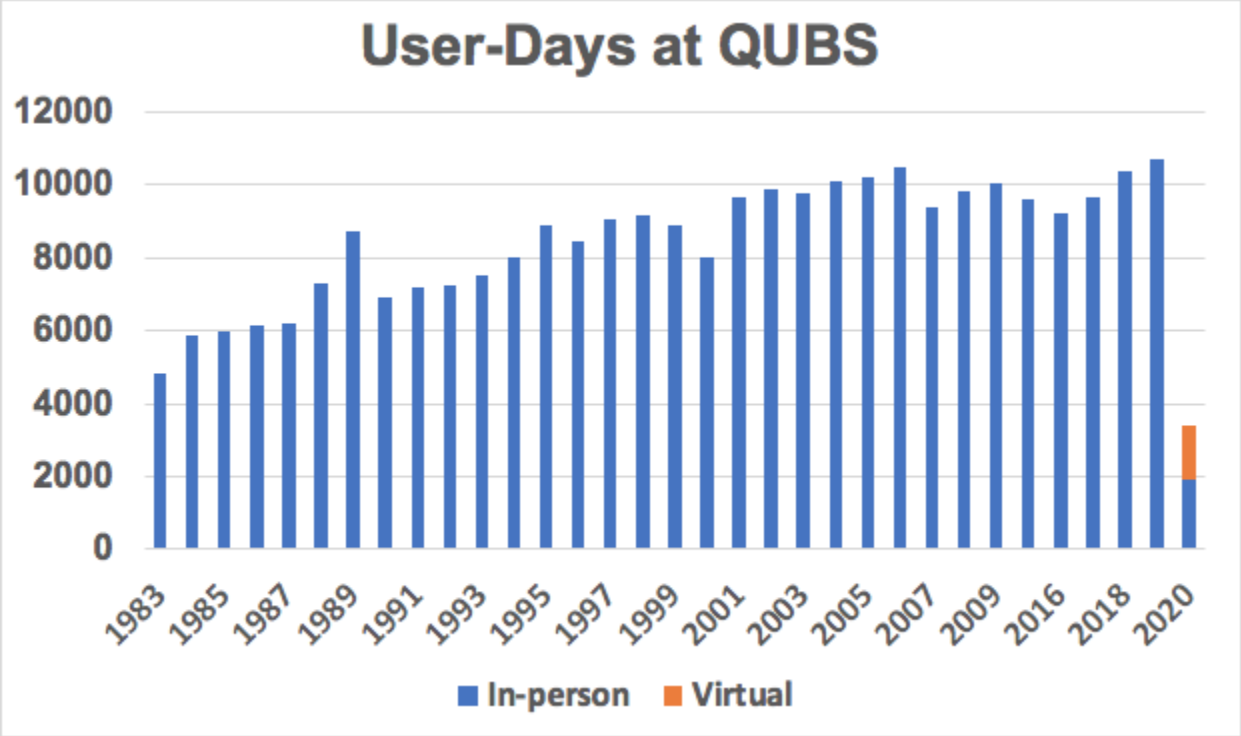


Figure 1. The data above represents the approximate number of user-days per calendar year. Although QUBS has been in operation since 1945, user-days were not accurately recorded prior to 1983, or between 2011-2015.

Donor Support

As of December 2020, our QUBS Endowment Fund contained $919,664 and our new Jessie V. Deslauriers QUBS Fund had $1,930,000. Contributions from the Lawson Foundation ($45K/year) continue to underwrite a significant portion of the salary of our *Teaching and Outreach Coordinator* and contribute to programming for young people. Our Land Trust and Community Outreach Fund at year's end totalled $38,756 and $28,445, respectively. In April 2020, we were awarded a *TD Friends of the Environment* grant ($8,266) in support of 'Multi-lingual interpretative signage and trail app stations recognizing Indigenous cultural heritage at the Elbow Lake Environmental Education Centre'. The *South Frontenac Township Community Grant* awarded funds ($5,000) towards the accessible trail at Elbow Lake. Generous support ($5,000) was also

received from the *Community Foundation for Kingston & Area* in November 2020 towards the 'Elbow Lake Trail Accessibility and Interpretive Signage Project' on the Elbow Lake property. We are grateful to South Frontenac Community Grant, QUBS donors, the Community Foundation of Kingston and Area and the TD Friends of the Environment grants for supporting an initiative that will provide an inclusive experience that allows people of all abilities to enjoy natural spaces in our community.

Queen's University Biological Station Scholarships 2020

Over the last decades the generosity of donors has endowed various scholarships for both Queen's University undergraduate and graduate students. As our capacity was limited in hosting student researchers, these awards were not given out in 2020. Interest from fund investments that support these scholarships were re-invested in the scholarship endowments.

Karen Huntley Memorial Award

Established by family and friends in memory of Karen Huntley, an undergraduate student in Biology who died in May 1990. Awarded to a student in an Honours Biology or an Environmental Science Subject of Specialization (SSP) Biology degree program who will be doing a field course or field research at Queen's University Biology Station or at another site in conservation, environmental biology or sustainable forestry. This award will support expenses incurred at the field site.

The Wes and Dorletta Curran Memorial Award

For Research in Aquatic Biology

This award was established to support undergraduate students who aspire to study at QUBS. Awards will be based on financial need (defined as eligibility for OSAP or other governmental student assistance programs), academic excellence, and full-time enrollment in the Biology undergraduate program at Queen's University. Preference will be given to students doing field or laboratory research in aquatic ecology, illuminating the ecology of the freshwater habitat.

J. Allen Keast Lake Opinicon Undergraduate Research Fellowship

For Independent Research at QUBS

This award was established to support undergraduate students to carry out a one-summer study at QUBS. Preference will be given to broader-based studies, such as

how systems function or interrelate. Components of the study can fit into on-going long-term studies.

The Alexander and Cora Munn Summer Research Award

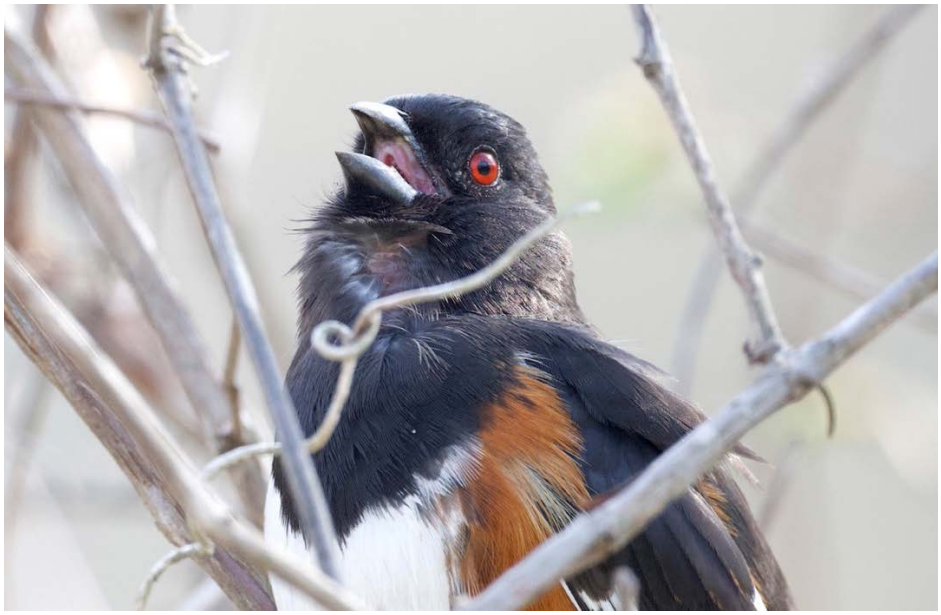
For Research in Conservation Biology or Environmental Preservation

This award was established to support undergraduate students who are working in the area of conservation biology or environmental preservation at QUBS. Preference will be given to students with an interest in woodlot and wildlife conservation.

The Kingston Field Naturalists' Award

For Research on Conservation Biology or Natural History

The Kingston Field Naturalists' Fund for Queen's University Biological Station was established in spring 2007 in memory of Dr. Robert Stewart, former Head of Microbiology at Queen's University, former KFN President and Honorary President, and former President of the Federation of Ontario Naturalists. The award is intended to benefit and encourage undergraduate students whose studies at QUBS focus on conservation biology or natural history. Recognizing the valuable and unique educational opportunity QUBS provides at a critical stage of a student's development, the KFN established the Fund in keeping with its mandate to stimulate public interest in nature and to acquire and provide knowledge of natural history. The Fund creates opportunities for students with good academic standing and demonstrated leadership skills to gain field experience at QUBS.



Singing male eastern towhee. Photo S.C. Lougheed

Opinicon Outreach

While the Elbow Lake Environmental Education Centre remains the major focus of our outreach activities (see below), we continue to host important outreach events at our Opinicon campus as well, including our spring-summer seminar series.

Opinicon Seminar Series

As always, we had an wonderful spring and summer public seminar series with talks on a variety of topics by graduate students, postdoctoral fellows, professors, and other experts. In 2020, due to pandemic restrictions of in-person gatherings, all 2020 seminars were pre-recorded by speakers and released on the QUBS YouTube channel on the dates below. There were 847 views of the videos in 2020. Seminars were also released biweekly, versus weekly in-person seminars.

Date	Speaker	Talk Title	Views in 2020
20 May	*Dr. Stephen Lougheed (Queen's University)*	Teaching in the tropics. Field course in a biodiversity hotspot - the Brazilian Atlantic Forests [pre-recorded].	134
3 June	Dr. Shelley Arnott (*Queen's University*)	Over-salting our land. Why we need to reduce road salt use. [pre-recorded].	66
17 June	Wenxi Feng (*PhD candidate, Queen's University*)	Using environmental DNA to map winter hibernacula in temperate freshwater turtles [pre-recorded]	28
1 July	Dr. Steve Cooke (*Carleton University*)	The science of catching and releasing fish. [pre-recorded].	605
29 July	Dr. Brandon T. Barton (*Mississippi State University*)	Predator-mediated effects of global change and the implications for food webs in the Anthropocene [pre-recorded].	14

QUBS Opinicon Open House

On what would have been our in-person Open House on June 28th 2020, we released a promotional video celebrating the 75th Anniversary of our founding, followed by the release of researcher focused films throughout the year. The complete playlist can be seen here. We are grateful for the expertise provided by Pinegrove Productions

who collected footage of researchers and field courses in 2019 and produced and edited the final films over the winter months for release in 2020. Obviously, we could not have predicted that our in-person events would be canceled due to the pandemic.

QUBS Community Dinner

Due to pandemic public health restrictions, and the 2020 closure of the QUBS kitchen, we were unable to host what would have been the 13th Annual Community Dinner at QUBS.

Fabulous Fall Fungi

The Queen's University Biological Station did not host the annual Fabulous Fall Fungi workshops in 2020.

Other Opinicon Outreach Activities

A public talk was hosted online by QUBS on November 12th 2020. *What does the Earth Ask of Us?* with distinguished Professor of Environmental Biology Dr. Robin Wall Kimmerer (SUNY College of Environmental Science and Forestry). Funding support from Mathematics, Science, Technology and Education (MSTE), NSERC PromoScience, and the Queen's University Office of Indigenous Initiatives. We are showered every day with the gifts of the Earth and yet we are tied to institutions which relentlessly ask what more can we take? Drawing on both scientific and Indigenous knowledges, this talk explored the covenant of reciprocity, how might we use the gifts and the responsibilities of human people in support of mutual thriving in a time of ecological crisis.

The generous sponsorship support for this event reflects the desire within the Queen's community and across Canada, to see the decolonization of knowledge production in science, technology, engineering, and mathematics (STEM) fields. The live event was well attended with over 750 individuals in attendance from across the country and elsewhere, and over 1048 registrants for the event. The recording of the event was available for a short time on the QUBS YouTube channel and widely shared and watched. The recording of the talk is available upon request, when used for teaching purposes. Dr. Kimmerer's conversation with QUBS researchers following the public talk provided QUBS with guidance regarding how to bring Indigenous ways of knowing and being alongside Western scientific principles in the Ontario Science curriculum. Five attendees to the webinar were randomly selected and

gifted a print copy of New York Times Paperback Non-fiction Best Seller "*Braiding Sweetgrass: Indigenous Wisdom, Scientific Knowledge and the Teaching of Plants*".

We were unable to host any in-person public events at our Opinicon campus in 2020. However, we did host 7 virtual public programs, listed below in the ELEEC Virtual Events section.

Infrastructure, Renovations and Maintenance

Despite the COVID-19 health & safety restrictions, we were able to undertake various infrastructure and stewardship projects this year at our Opinicon campus. As always, we will not list all upgrades here, but the larger projects included the replacement of several failing roofs on various buildings, with the most notable being the installation of a new metal roof on the Brown Lab. This was also another intensive year for flooring projects across campus as we refinished the entire hardwood floor in the dining room and 'servery' area of the Raleigh Robertson Biodiversity Centre, as well as installed new vinyl flooring in several more office spaces on the lower level. As part of our multi-year renovation plan focusing on refurbishing our aging boathouse, which began in 2019 with an upgrade to the electrical service, this year we carried out significant concrete repairs to the floor and foundation. We also constructed a new set of concrete stairs as well as a small pathway to improve access to the lower level of the boathouse. Further, work was done to brighten and protect the exterior of the boathouse paint as well as installing a new, and updated, QUBS sign. We have made the transition from using regular latex paint products to a pure linseed oil paint without solvents. Using linseed oil paint reduces future maintenance costs and will improve the longevity of the wood siding (a penetrating paint, not a surface coating). Moreover, as this is a naturally derived product, it is non-toxic for fish and wildlife, helping us reduce our environmental impact at QUBS. As with most years, improvements to our network of climate stations were a priority. Raft stability has been a reoccurring issue, and as such, we constructed two new floating platforms to house the climate stations at both Lindsay Lake and Long Lake. These new rafts are significantly larger with heavier weights affixed to the lake bottom to increase stability. 2020 was also a significant year for stewardship projects at Opinicon. This year we constructed two more boardwalks, one located along the blue trail within the Skycroft trail system. This boardwalk extends across a marshy creek area along the trail, which is home to a diversity of plants and animals including several species of salamander. The second boardwalk that was built is located along the Queen's Point Trail and extends across a smaller section of Cow Island Marsh on

Opinicon lake. This boardwalk provides an excellent platform to observe the various species of waterbirds that inhabit the Cow Island wetland.

An aquatic mesocosm lab facility was constructed near Warner Lake funded through a CFI John R. Evan Leaders Fund awarded to Dr. Diane Orihel. Some lower floor upgrades at the Hughson farmhouse also took place in 2020, so it can be used as an additional stand-alone accommodation for users.

Before and after. The QUBS Boat house with a fresh coat of paint and a new sign. Photo: S. Nobrega.

Work on the Bracken Tract Grassland Rehabilitation Stewardship project continued in 2020. In mid-November 2020, applying traditional farming techniques, four planting beds were prepared for seeding (~100ft length and ~40 ft in width) in a designated 1 hectare corner of the 4-hectare plot. A mixture of seeds (native wildflowers, upland forage and meadow seeds) was applied with the hope of germination in spring.

Infrastructure Improvements and Maintenance at ELEEC:

- New wall oven and cook top installed in Main Pavilion
- Carpeting removed and vinyl floor installed in Cabins 5 & 6
- Carpeting removed and pine floor installed in Staff Cabin
- 6 raised beds built for pollinator garden
- Rec Hall deck fully re-supported
- Floating dock re-surfaced

May 16th 2020. A large beaver dam failed, and the pond drained into Elbow Lake. Photos: S. Nobrega

Opinicon Teaching

OUPFB and Other Field Courses

Given the COVID-19 public health and safety restrictions, we were unable to host any in-person field courses at our Opinicon campus.

Field Trips for Lecture-based Courses and Other Teaching Activities

Queen's University:

- BIOL 212 - Scientific Methods in Biology (January 18th & February 1st), led by instructor Anna Rooke (Queen's University)

Opinicon Conferences, Meetings and Retreats

- Monaghan Lab retreat (February 18th – 19th), coordinated by Dr. Jacqueline Monaghan (Queen's University)

Elbow Lake Environmental Education Centre

We hosted 10 education events, 8 of which were open to the public. We had 266 participants, 83 of which were youth. The Lawson Foundation provided support for our Outreach and Teaching Coordinator position and for the purchase of outreach materials. The Community Foundation of Kingston and Area provided support for our Navigating the Landscape initiative, a GPS and geocaching program as well as busing subsidies. This provided the materials for the deployment of 10 geocaches on the Elbow Lake land base. We received funding support (Helen McCrea Foundation) for an educational pollinator garden at Elbow Lake (6 raised beds). South Frontenac Township, TD Friends of the Environment Fund, and the Community Foundation of Kingston and Area provided support to install an accessible trail along a section of the Elbow Lake Red Trail. The current trail will be converted into a wheelchair-accessible trail (expanding its width, creating a firmer and more even substrate, adjusting the grade) and will take visitors through several habitat types, ending at a beaver pond. Working with local Indigenous Knowledge Keepers and Elders, QUBS is also creating four interpretive signs that will be installed along the trail. The signs will highlight plants and animals important to local Indigenous groups and provide translations for

Anishinaabemowin and Kanien'kéha language learners. To accompany these signs, there will be virtual app stations for visitors to learn more about the highlighted plants and animals and listen to words and traditional stories from both cultures, translated in both languages. A sign will also be placed at the beginning of the trail to explain the project and the traditional land use of this area before European settlement.

We hosted one public event in person this year (prior to pandemic), our Family Ice Fishing event on February 17, 2020. It brought 100 participants for a beautiful sunny day on the lake. Because of COVID-19 restrictions most of our public events were virtual. We were unable to host any families overnight this year and didn't host our usual Family Night events in July and August. Instead, we hosted virtual public events with invited guest speakers. The 7 public events ran between May and August and had a total of 221 participants.

ELEEC Outreach Activities

Eco-Adventure Camp

Camp staff: Director- Ruth Bryce, Assistant Director- Malcolm Douglas-Stewart, Counsellors- Joanne Rae, Skye Jamieson, and Amanda Miller. There were 54 regular campers and 11 Leaders in Training. Camp was delivered in a virtual platform and campers/LITs took part in activities from home and connected to camp leaders through Zoom.

Secondary School Visits

We had 2 school groups attend from 2 different schools. In total we hosted 43 students and 4 teachers.

Other ELEEC Outreach Activities

- Family Ice Fishing (16 February 2020): 100 participants

ELEEC Virtual Outreach Activities

All virtual events were hosted live on Zoom with a Question and Answer at the end of each event. They were also posted on the QUBS YouTube Channel for viewing afterwards.

- Identifying cavity and stick nests and their Occupants with Ian Fife from Bird Studies Canada (21 May 2020): 59 participants, 96 online views as of December 31, 2020
- An Introduction to Our Wild Pollinators with Dr. Jessica Forrest from U of Ottawa (4 June 2020): 60 participants, 129 online views as of writing of December 31, 2020
- Invasive Species in the Frontenac Arch with Megan Quinn from Nature Conservancy of Canada (18 June 2020): 18 participants, 46 online views as of writing of December 31, 2020
- Species at Risk in Canada: Lending a Helping Hand with James Pagé from Canadian Wildlife Federation (2 July 2020): 38 participants, 45 online views as of December 31, 2020
- Reptiles, Amphibians, and You with Kenny Ruelland from Reptile and Amphibian Advocacy (16 July 2020): 21 participants, 24 online views as of writing of this report
- Black Bass 101 with Aaron Zolderdo from QUBS (30 July 2020): 13 participants, 35 online views as of December 31, 2020
- Medicine Walk at Elbow Lake with Deb St. Amant from Queen's University (13 August 2020): 12 participants, 64 online views as of writing of December 31, 2020

Pine warbler. Photo: S.C. Lougheed

Spring beauty. Photo: S.C. Lougheed

Table 1: Categorical breakdown of user-days for both Opinicon and Elbow Lake campuses.

2020 QUBS User-Day Statistics	
DAY-USE TYPE	**Total**
Research (Internal, Queen's)	315
Research (External)	693
Teaching Activities	121
Conferences, Meetings, Workshops	5
Private Bookings	331
OUTREACH	
Programs (Opinicon)	0
Programs (Elbow)	147
Campers & LIT's (Elbow)	307
Virtual	1507
Total User-Days	**3426**

Nature Conservancy of Canada

Despite the challenges of the COVID-19 pandemic, the Nature Conservancy of Canada (NCC) was pleased to sustain and grow our relationship with the Queens University Biological Station in 2020. NCC and QUBS continued our ongoing dialogue about conservation issues, research, and opportunities in the Frontenac Arch Biosphere Reserve. We worked together as co-owners of the 460-hectare Elbow Lake Environmental Education Centre. Once again, NCC rented office space at QUBS, allowing the Eastern Ontario stewardship team to work collaboratively, and have easy access to equipment. Despite pandemic restrictions, one NCC technician was able to

stay onsite in QUBS accommodation and use the office space to complete data analysis tasks. This arrangement allowed NCC to maintain a staff presence in the heart of the Frontenac Arch, which was vital for completing essential fieldwork. NCC field teams saw success removing invasive species (including Buckthorn, Garlic Mustard, and Dog-strangling Vine), assessing species at risk (including Eastern Whip-poor-wills, Blanding's Turtles, and Gray Ratsnakes), and planning visitor infrastructure projects. NCC maintained a close relationship with QUBS staff as ever-changing public health recommendations shaped how the facilities could be accessed.

Opinicon Research Summaries

❖ **Lonnie Aarssen** *(Biology, Queen's University)*

Research projects:

1. Effects of long-term resource manipulation in old-field vegetation
2. Long-term vegetation monitoring in woodland deer exclosures
3. Relationships between plant traits, fitness and abundance in vegetation

Funding: NSERC Discovery Grant
Students and field assistants:

1. Jenna Finley (M.Sc. candidate, Queen's University) Completed in 2020
2. Riley Gridzak (M.Sc. candidate, Queen's University)
3. Kelly Balfour (M.Sc. candidate, Queen's University)
4. Zoe Kane – (field assistant, Queen's University)

Undergraduate theses:

None in 2020

Graduate theses:

1. Finley JV (MSc awarded in 2020) Do species with strong apical dominance incur a cost in terms of suppressed potential fecundity or biomass?
2. Riley Gridzak (M.Sc. in progress) Are taller plant species generally more successful when resource competition is more intense in herbaceous vegetation?
3. Kelly Balfour (M.Sc. in progress) Are shorter species more shade tolerant in herbaceous vegetation?

Published articles based on work conducted at QUBS:

1. Miranda J, Finley J, Aarssen L (2020) Leafing intensity predicts fecundity allocation in herbaceous angiosperms. Folia Geobotanica 54: 191-198.

❖ Shelley A. Arnott *(Biology, Queen's University)*

Research projects:

1. Examining zooplankton community responses to sequential multiple environmental stressors: How prior exposure and timing of exposure influence responses to high salinity and acute thermal stressors

Funding: NSERC

Students and field assistants:

1. Xinyu Sun (Ph.D candidate, Queen's University)
2. Andrea O'Halloran (B.Sc candidate, Queen's University)

Undergraduate theses:

None in 2020

Graduate theses:

1. Greco, Danielle (2020). The interactive effects of road salt and nutrients on zooplankton communities. MSc Thesis, Queen's University.

Published articles based on work conducted at QUBS:

1. Sinclair, J.S., J.L. Lockwood, S. Hasnain, P. Cassey, and S.E. Arnott. 2020. A framework for predicting with non-native individuals and species will enter, survive, and exit human-mediated transport. Biological Invasions 22:217-231. https://doi.org/10.1007/s10530-019-02086-7

❖ Gabriel Blouin-Demers *(Biology, University of Ottawa)*

Research projects:

1. Genetic, behavioural and physiological responses of painted turtle populations exposed to human-made barriers and boat activities.
2. Efficiency of lights to reduce turtle bycatch in fishing nets.

Funding: NSERC strategic project grant on the Rideau Canal Waterway, postgraduate NSERC grant (Audrey Turcotte) and Ottawa Field-Naturalists' Club (Audrey Turcotte).

Students and field assistants:

1. Audrey Turcotte (Ph.D candidate, University of Ottawa)
2. Amélie Lessard (B.Sc. candidate, University of Ottawa)
3. Manon Veselovsky (B.Sc candidate, University of Ottawa)

Undergraduate theses:

1. Veselovsky, M (B.Sc. Completed 2020) Do lights detract freshwater turtles from entering commercial fishing nets?

Graduate theses:

1. Turcotte, A (PhD. In progress) Genetic, behavioural and physiological responses of painted turtle populations exposed to human-made barriers and boat activities.

Articles:

1. Bergman JN, Beaudoin C, Mistry I, Turcotte A, Vis C, Minelga V, Neigel K, Lin HY, Bennett JR, Young N, Rennie C, Trottier LL, Abrams AEI, Beaupré P, Glassman D, Blouin-Demers G, Garant D, Donaldson L, Vermaire JC, Smol JP & Cooke SJ. 2021. Historical, contemporary, and future perspectives on a coupled social-ecological system in a changing world: Canada's historic Rideau Canal. Environmental Reviews. https://doi.org/10.1139/er-2021-0026

2. Turcotte A, Blouin-Demers G & Garant D. 2021.Exploring the effect of 195 years-old locks on species movement: landscape genetics of painted turtles in the Rideau Canal, Canada. Conservation Genetics. Accepted pending revision.

❖ **Grégory Bulté** *(Biology, Carleton University)*

Research projects:

1. Demography of the Northern Map Turtle
2. Overwintering behaviour and physiology of the Northern Map Turtle

Funding: NSERC Discovery grant and Carleton University

Students and field assistants:

1. Jessica Robichaud (M.Sc. candidate, Carleton University)

Undergraduate theses:

None in 2020

Graduate theses:

Robichaud (M.Sc. In progress) Overwintering behaviour and physiology of the Northern Map Turtle

Published articles based on work conducted at QUBS:

1. Bulté G, B Huneault, & G Blouin-Demers. 2021. Free ranging male northern map turtles use public information when interacting with potential mates. Ethology. 127:995-1001.

2. Bulté G , M Léveillée, G Blouin-Demers, SJ Cooke, S Bertram. 2020. Observations on the short-term effects of motorboat disturbance on the use of basking sites by female northern map turtles. Chelonian Conservation and Biology. 19: 302-304.

❖ **Vincent Careau** *(Biology, University of Ottawa)*

Research projects:

1. Performance, behaviour, and energetics of white-footed mice

Funding: Discovery Grant from NSERC

Students and field assistants:

1. Merlin Caron-Levesque (M.Sc. candidate, University of Ottawa)

2. Nathalie Kermany (M.Sc. candidate, University of Ottawa)
3. Phoenix Sandrock (B.Sc. candidate, University of Ottawa)
4. Alyssa Pogson (B.Sc. candidate, University of Ottawa)

Undergraduate theses:

None in 2020

Graduate theses:

1. Fieldler A (M.Sc. Completed 2020) Maximal and resting metabolic rates in in white-footed mice, *Peromyscus leucopus*.
2. Kermany N (M.Sc awarded in 2019) Worked on the behavioural ecology of white-footed mice
3. Caron-Levesque (M.Sc in progress) Works on the energetic trade-offs associated with parasitism in white-footed mice

Published articles based on work conducted at QUBS:

None in 2020

❖ Robert Colautti *(Biology, Queen's University)*

Research projects:

1. Rapid evolution in purple loosestrife (Lythrum salicaria)
2. Microbiome survey of blacklegged ticks (Ixodes scapularis)

Funding:

1. NSERC Discovery
2. New Frontiers Research Fund Exploration Grant

Students and field assistants:

1. Samara Manzin (B.Sc. candidate, Queen's University)
2. Damian Bourne (B.Sc. candidate, Queen's University)
3. Dale Moskoff (B.Sc. candidate, Queen's University)
4. Mimi li (B.Sc candidate, Queen's University)

Undergraduate theses:

None at QUBS in 2020

Graduate theses:

Sit E (M.Sc. in progress) Growth variation and life history trade-offs of the invasive plant *Lythrum salicaria*

Published articles based on work conducted at QUBS:

None at QUBS in 2020

❖ Steven J. Cooke *(Biology & Environmental Science, Carleton University)*

Research projects:

1. Evaluation of the costs of predation in wild centrarchid fish (black bass and sunfish)

2. Examination of the effects of light pollution on wild fish.

3. Evaluation of the spatial ecology of wild fish in the Rideau Canal waterway.

4. AquaTrax Learning: A free, curriculum-based resource for teaching that brings the movement of wild animals into classrooms across Canada

Funding: NSERC, NSERC PromoScience

Students and field assistants:

1. Luc Larochelle (M.Sc. candidate, Carleton University)
2. Peter Holder (Ph.D candidate, Carleton University)
3. Auston Chor (B.Sc. candidate, Carleton University)
4. Connor Reeve (M.Sc candidate, Carleton University)

Undergraduate theses:

None in 2020

Graduate theses:

1. Larochelle L (M.Sc. in progress) Ice fishing handling practises and their effects on post-release behaviour of largemouth bass.

2. Reeve C (M.Sc. in progress) Assessing largemouth bass winter biology using biologgers

Published articles based on work conducted at QUBS:

1. Bergman, J.N., C. Beaudoin, I. Mistry, A. Turcotte, C. Vis, V. Minelga, K.L. Neigel, H-S. Lin, J.R. Bennet, N. Young, C. Rennie, L.L. TroUer, A.E.I. Abrams, P. Beaupre,

D. Glassman, G. Blouin Demers, D. Garant, L. Donaldson, J. Vermaire, J.P. Smol, S.J. Cooke. In Press. Historical, contemporary, and future perspectives on a coupled social-ecological system in a changing world: Canada's historic Rideau Canal. Environmental Reviews. 00:000-000.

2. LaRochelle, L., A.D. Chhor, J.W. Brownscombe, A.J. Zolderdo, A.J. Danylchuk and S.J. Cooke. In Press. Ice-fishing handling practices and their effects on the short-term post-release behaviour of Largemouth Bass. Fisheries Research. 00:000-000.

3. Hlina, B.L., D.M. Glassman, A.D. Chhor, B.S. Etherington, C.K. Elvidge, B.K. Diggles and S.J. Cooke. In Press. Hook Retention But Not Hooking Injury Is Associated With Behavioral Differences In Bluegill. Fisheries Research. 00:000-000.

4. Reid, C.H., A.E.I. Abrams, A.J. Zolderdo, J.D. Midwood, E.D. Stevens, T.W. Moon and S.J. Cooke. In Press. A local analgesic, lidocaine, did not affect short-term welfare during electroanesthesia of a teleost fish. Transactions of the American Fisheries Society. 00:000-000.

5. Trahan, A.T., A.D. Chhor, M.J. Lawrence, J.W. Brownscombe, D.M. Glassman, C.H. Reid, A.E.I. Abrams, A.J. Danylchuk, and S.J. Cooke. In Press. Do carbonated beverages reduce bleeding from gill injuries in angled Northern Pike? North American Journal of Fisheries Management. 00:000- 000.

6. Abrams, A. E. I., A. J. Zolderdo, E. J. I. Lédée, M. J. Lawrence, P. E. Holder, and S. J. Cooke. 2021. Dispersal patterns of Largemouth Bass and Smallmouth Bass following early-, mid-, and late season fishing tournaments in an eastern Ontario lake. North American Journal of Fisheries Management 41:1454–1464.

7. Trahan, A.T., Chhor, A. D., LaRochelle, L., Danylchuk, A. J., and Cooke, S. J. 2021. Influence of artificial lure hook type on hooking characteristics, handling, and injury of angled freshwater gamefish. Fisheries Research. 243:106506.

8. Cooke, S.J., C.J.A. Cooke, J.T.H. Cooke, B.W.C. Cooke, A.J. Danylchuk and J.W. Brownscombe. 2021. Efficacy of dehooking tools for the removal of hooks from the jaw region of angled fish. Fisheries Research. 240:105965.

9. Mistry, I., C. Beaudoin, J. Kotecha, H. Evans, M. Stevens, J.C. Vermaire, S.J. Cooke and N. Young. 2021. AcXon research to improve water quality in Canada's Rideau Canal: How do local groups reshape environmental governance? Local Environment: The International Journal of Justice and reshape environmental

governance, Local Environment: The International Journal of Justice and Sustainability. 26(5):575-594.

10. Latchem, E., C.L. Madliger, A.E.I. Abrams and S.J. Cooke. 2021. Does aquatic light at night alter the subsequent diurnal behavior of a teleost fish? Water, Air & Soil Pollution. 232:71.

❖ Ryan Danby (Environmental Studies and Geography & Planning, Queen's University)

Research projects:

1. Vegetation Dynamics and Historical Ecology of the Frontenac Arch
2. Atlas of Environmental Change for the Algonquin-to-Adirondacks Conservation Corridor

Funding: School of Environmental Studies; Queen's SWEP program

Students and field assistants:

1. Michelle Cohen (MES candidate)
2. Lydia Villanyi (Summer Work Experience Program intern)

Graduate theses:

1. Cohen, M. In progress. Woody plant encroachment on granite barrens in the Frontenac Arch, Eastern Ontario. Master's thesis, School of Environmental Studies, Queen's University.

2. Stefanuk, M. 2019. Productivity and phenology of forests in the Algonquin-to-Adirondacks corridor: climatic drivers and recent trends. Master's thesis, School of Environmental Studies, Queen's University.

Articles:

None in 2020

❖ **Roslyn Dakin** *(Biology, Carleton University)*

Research projects:

1. Avian flight behaviour and insectivory

Funding: NSERC Discovery grant

Students and field assistants:

1. Roslyn Dakin (PI, Carleton University)

Undergraduate theses:

None in 2020

Graduate theses:

None in 2020

Published articles based on work conducted at QUBS:

None in 2020

❖ **Elizabeth Gow** *(Integrative Biology, University of Guelph)*

Research projects:

1. Estimating densities and occupancy of free-roaming cat populations in relation to bird species abundance

Funding: Liber Ero

Students and field assistants:

1. Elizabeth Gow (Post-doctoral researcher, University of Guelph)

Undergraduate theses:

None in 2020

Graduate theses:

None in 2020

Published articles based on work conducted at QUBS:

None in 2020

❖ Paul Grogan *(Biology, Queen's University)*

Research projects:

1. Interaction of simulated atmospheric nitrogen deposition and soil texture on plant productivity in Ontario hay grasslands – Stoke's Field
2. Bottom-up and top-down controls on plant community composition and productivity in temperate grasslands – Bracken Tract (collaboration with Lonnie Aarssen)
3. The impacts of increases in deer browsing on plant community structure and soil processes in S.E. Ontario – Pangman Tract (collaboration with Lonnie Aarssen)

Funding: NSERC Discovery grant

Students and field assistants:

1. Meghan Hamp (M.Sc. candidate)
2. Kayleigh Casmey (Summer Work Experience Program intern)
3. Sarah Gordon (M.Sc. candidate)
4. Mike Hann (Undergraduate thesis student)

Undergraduate theses:

1. Hann, Michael (B.Sc. completed 2020) Effects of Experimentally Altered Precipitation and NPK Fertilization on soil ammonium, nitrate, and phosphate fluxes in a mesic old-field meadow grassland

Graduate theses:

1. Hamp, M. (M.Sc. In progress) Ecosystem-level responses to increased atmospheric nitrogen deposition in an Ontario hay grassland
2. Gordon, S. (M.Sc. In progress) Title not yet determined.

Published articles based on work conducted at QUBS:

None at QUBS in 2020

❖ **Manisha Kulkarni** *(Biology, University of Ottawa)*

Research projects:

1. Landscape ecology of deer ticks and its associated Lyme disease pathogen in peri-urban environments

Funding: NSERC

Students and field assistants:

None at QUBS in 2020

Undergraduate theses:

None at QUBS in 2020

Graduate theses:

None at QUBS in 2020

Published articles based on work conducted at QUBS:

1. Guillot C, Badcock J, Clow K, Cram J, Dergousoff S, Dibernardo A, Evason M, Fraser E, Galanis E, Gasmi S, German GJ, Howse DT, Jardine C, Jenkins E, Koffi J, Kulkarni M, Lindsay LR, Lumsden G, McKay R, Moore K, Morshed M, Munn D, Nelder M, Nocera J, Ripoche M, Rochon K, Russell C, Slatculescu A, Talbot B, Thivierge K, Voordouw M, Bouchard C, Leighton P. Sentinel surveillance of Lyme disease risk in Canada, 2019: Results from the first year of the Canadian Lyme Sentinel Network (CaLSeN). Can Commun Dis Rep. 2020 Oct 1;46(10):354-361. doi: 10.14745/ccdr.v46i10a08. PMID: 33315999; PMCID: PMC7723316.

❖ **Daniel Lefebvre & Yuxiang Wang** *(Biology, Queen's University)*

Research theme/project:

1. Biomanipulation of cyanobacteria with snails.

Funding: Ontario Centre of Excellence - Ontario Jiangsu International Research Development Program

Students and field assistants:

1. Michelle Kong (M.Sc candidate, Queen's University
2. Kelly Piedrahita (M.Sc candidate, Queen's University)

Graduate theses:

1. Kong, M. MSc in progress. Measuring the efficiency of the bioremediation of cyanobacterial harmful algal blooms using *Viviparus georgianus*.
2. Piedrahita, K. MSc in progress. Biomanipulation of cyanobacteria with the mystery snail.

Published articles based on work conducted at QUBS:

None at QUBS in 2020

❖ Stephen C. Lougheed *(Biology & Environmental Studies, Queen's University)*

Research projects:

1. Conservation genomics, mito-nuclear discordance and metapopulation dynamics in trilling chorus frogs (*Pseudacris triseriata* and *P. maculata*) in Canada
2. Urban versus rural bat diversity using acoustic recorders (with John Ratcliffe, University of Toronto and Isabelle Mandl, postdoctoral associate at Queen's University)
3. Island versus mainland population differentiation in northern watersnakes using reduced representation genotyping
4. Nesting ecology of temperate turtles

Funding:

1. NSERC Discovery grant
2. Baillie Family Chair in Conservation Biology
3. Ontario Ministry of Transportation

Students and field assistants:

1. Meghan Britt (M.Sc candidate, Queen's University)
2. Ying Chen (Ph.D. student, Queen's University)

3. Matthew Macpherson (M.Sc candidate, Queen's University)
4. Lesley Rudy (M.Sc candidate, Queen's University)
5. Arjun Augustine (B.Sc. candidate, Queen's University)

Undergraduate theses:

1. Meghan Ewing. B.Sc. Honours. You Are What You Eat. Comparing blood parasite presence across genera of snakes with different life histories.
2. Kestrel DeMarco ENSC B.Sc. Honours. Assessing the usefulness of DNA barcoding at biological field stations.

Graduate theses:

1. Matthew Macpherson. M.Sc. Evaluating conservation strategies for a threatened population of gray ratsnakes (*Pantherophis spiloides*)
2. Meghan Britt. M.Sc. Male advertisement calling tactics in northern and southern populations of spring peepers (*Pseudacris crucifer*)

Published articles based on work conducted at QUBS:

1. Cicchino, A.S. N. A Cairns, G. Bulté, and S.C. Lougheed. 2020. High and dry: Trade-off in arboreal calling in a treefrog mediated by local environment, Behavioral Ecology. 31: 132-139.
2. Feng, W., G. Bulté and S.C. Lougheed. 2020. Environmental DNA surveys help to identify winter hibernacula of a temperate freshwater turtle. *Environmental DNA*. 2: 200-209.

❖ Elizabeth and Scott MacDougall-Shackleton *(Biology & Psychology, Western University)*

Research projects:

1. Ecoimmunology, ecophysiology, and behavioural ecology of migratory songbirds

Funding: NSERC Discovery Grant

Students and field assistants at QUBS in 2020:

1. Garth Casbourn (Ph.D. candidate, Western University)

Graduate theses:

1. Grieves, Leanne (Ph.D. defended April 2020) Chemical communication in songbirds. https://ir.lib.uwo.ca/etd/6926/

2. Posliff, Chris (M.Sc. defended May 2020) Correlations in movement behaviours over large and small geographic scales in song sparrows *Melospiza melodia*. https://ir.lib.uwo.ca/etd/7027/

Articles (both submitted in 2020, published in 2021):

1. Boyd RJ, Denommé MR, Grieves LA & EA MacDougall-Shackleton. 2021. Stronger population differentiation at infection-sensing than infection-clearing innate immune loci in songbirds: different selective regimes for different defences. *Evolution*. https://doi.org/10.1111/evo.14368

2. Grieves LA, Gloor GB, Kelly TR, Bernards MA & EA MacDougall-Shackleton. 2021. Preen gland microbiota of songbirds differ across populations but not sexes. *Journal of Animal Ecology* 90: 2202-2212.

❖ Bryan D. Neff *(Biology, Western University)*

Research projects:

1. Evolutionary Ecology of Sunfish

Funding:

1. NSERC Discovery grant
2. NSERC RTI Operations (collaborative effort)
3. NSERC RTI Category I (Neff & Pitcher)

Students and field assistants:

1. Emma Churchman (M.Sc. candidate, University of Western Ontario)
2. Dr. Tim Hain (Field assistant, University of Western Ontario)
3. Peter Baker (B.Sc. candidate, University of Western Ontario)

Undergraduate theses:

None at QUBS in 2020

Graduate theses:

1. Churchman E (M.Sc. in progress) Neuroendocrinology of sunfishes during the reproductive period.

Published articles based on work conducted at QUBS:

1. Silveira L, SR Garner, and BD Neff. 2020. Similarity at the major histocompatibility complex class II does not influence mating patterns in bluegill (*Lepomis macrochirus*). Behavioral Ecology and Sociobiology. 74:38.

❖ Diane Orihel *(Biology, Queen's University)*

Research projects:

1. The effects of OSPW-derived NAFCs on yellow perch feeding and antipredator behaviour
2. Ingestion of microplastics by tadpoles in a model system

Funding:

1. Queen's Research Opportunities Funds
2. Canada Foundation for Innovation
3. Environment and Climate Change Canada Grant and Contribution

Students and field assistants:

1. Jessie Reynolds (M.Sc candidate, Queen's University)
2. Samantha Gene (Phd candidate, Queen's University)

Undergraduate theses:

None in 2020

Graduate theses:

1. Reynolds, J. (2021) The toxic effects of oil sands contaminants on fish. M.Sc. thesis.

Published articles based on work conducted at QUBS:

1. Reynolds, J.S., B.L. Jackson, B.N. Madison, C.K. Elvidge, R.A. Frank, C.T. Hasler, J.V. Headley, L.M. Hewitt, K.M. Peru, S.B. Yakimowski, and D.M. Orihel. Exposure of fathead minnow embryos to organic compounds from oil sands tailings has adverse effects on survival, development, and behavior that persist into larval stages. *Environmental Toxicology and Chemistry* (in review).

Other:

1. (16/09/20) The Conversation: Orihel D., Reynolds J. New technology makes wastewater from the oilsands industry safer for fish. https://theconversation.com/new-technology-makes-wastewater-from-the-oilsands-industry-safer-for-fish-144628

2. (25/09/20) Oil sands tailings ponds are toxic. Canadian-made nanotech could help fix that. Bob McDonald, CBC Quirks and Quarks. https://www.cbc.ca/radio/quirks/sep-26-tailings-pond-detoxification-baboon-friendship-and-longevity-ancient-dna-in-dirt-and-more-1.5736876/oil-sands-tailings-ponds-are-toxic-canadian-made-nanotech-could-help-fix-that-1.5736882

Iris. Long Lake. Photo by S.C. Lougheed