SCAS • SCSA

Society of Canadian Aquatic Sciences
Société canadienne des sciences aquatiques

Issue 2 - June 2023

REFLECTIONS

In this issue:

Cover: Ryan Rimas (Ph.D student) and Jess Lerminiaux (research associate) of University of Regina sample agricultural dugouts in Saskatchewan. Photo credit: UofR Photography

Comments from the President of SCAS
Steven Cooke

We are so very fortunate to live in a country abutted by three oceans and covered with more wetlands, waterbodies, and watercourses than we can reasonably count. Indeed, the diversity and extent of aquatic systems and resources in Canada is astounding and the material of stories and postcards. There is a mosaic of actors involved as aquatic science stewards and professionals that work towards a better future for aquatic systems and the peoples that depend upon them for culture, livelihoods, nutrition, recreation, and more. The next generation of aquatic science professionals are in training and keen to take on the challenges that lay before them. There is also a growing recognition that Indigenous Peoples have long been excluded from decisions related to aquatic systems, despite sovereign rights. Moreover, the hubris associated with "Western science knows best" has failed to consider other knowledge systems and Ways of Knowing (such as Indigenous Science) that are equally valid. I finished my PhD in 2002 and, in the 20+ years since, have borne witness to many changes in what it means to be an aquatic science steward and professional. Yet, there is much more to do to ensure that we have an inclusive environment where all feel welcome and engage respectfully and meaningfully in aquatic science and practice. Similarly, we need to embrace the notion that the natural sciences alone are insufficient to inform decisions; domains and disciplines such as human dimensions, economics, law, policy, and conflict resolution go hand-in-hand with the natural sciences.

Our profession is hardly boring or stagnant... to say that there is a need for more highly trained individuals and engaged stewards is an understatement. We are witnessing rapid evolution of technology such as omics, artificial intelligence, and environmental DNA, that are yielding both opportunities and threats (e.g., ethical questions). We are told of the promise of the blue economy and to expect innovation and development in our oceans.

We have a new federal agency (the Canada Water Agency) being rolled out. Aquatic organisms continue to be classified as "at risk" by the Committee on the Status of Endangered Wildlife in Canada yet formal Species At Risk Act listings remain notably absent for some species/populations. More and more people are living in urban areas and are disconnected from nature. Harmful algal blooms are impeding the ability to swim, drink, and fish in our freshwater systems. Indigenous governments and communities are exercising their rights to self determination and aquatic management systems are being re-envisioned. Helping to enrich the training of students and post docs, providing professional development opportunities for scientists and practitioners, and creating spaces for diverse aquatic stewards to come together to learn and share with each other are core to what SCAS is and what we will strive to do.

SCAS President, Steven Cooke

It is still early days for SCAS. We are fortunate to build on the history of the Canadian Conference for Fisheries Research and the Society of Canadian Limnologists, but SCAS is more than simply a merger. SCAS provides an opportunity to take a step back and ensure that our activities best serve our members and the broader aquatic science and stewardship community. I am thankful that so many individuals have already engaged with SCAS by organizing symposia, contributing to the newsletter, serving on committees, assuming leadership roles, and providing input, ideas, and constructive criticisms for guidance. The SCAS leadership team continues to work on the foundational administrative, planning, and governance aspects inherent in any successful professional organization. We are launching new initiatives and working hard to ensure that everything we do considers a JEDII lens. It will take time (years!) to get everything right and we know that, at times, some of the desires of our members are at odds (e.g., cheaper meeting registration but with more benefits and supports for participants). Inflation has hit conference planning in a very real way – everything is more expensive – from insurance, to food, to audio-visual services.

We heard clearly from those that attended the 2023 SCAS meeting that conference registration cost, as well as hotel costs and travel, were uncomfortably high. Unfortunately, it is unlikely that we will be able to return to pre-covid conference costs. Accordingly, we are working to develop creative fundraising opportunities with a focus on supporting students in financial need, early career professionals, Indigenous community members, and other equity-deserving groups.

I could not be more excited about the future of SCAS and the future of our profession. There is much work to do but, through collaboration, partnerships, and the hard work of volunteers like you, I am confident we will get there. Our aquatic systems need us and the populus need us (even if they don't know we exist!). I encourage any and all of you to engage with SCAS in whatever way works. Please do not hesitate to reach out to me!

Steven Cooke, President of SCAS

Steven_cooke@carleton.ca; Cell = 613-867-6711

MSc students Brad Howell and Giulio Navarroli landing at a remote field site in Whiteshell Provincial Park's wilderness zone to conduct a SPIN net program for population stock assessment on Mantario Lake, Manitoba. Credit: Brad Howell

News from our Members

Dr. Allen Curry (University of New Brunswick) announces the Weaving Waters Expedition - https://mailchi.mp/9b4e1db248eb/cri-march-newsletter-13675497. Later this July, he'll embark on a solo boat expedition around the waterways of eastern North America to learn more about local people and their lives with water. This will be the capstone of his career with the Canadian Rivers Institute at University of New Brunswick. He plans to visit communities, meet local people, listen to their water stories, and share stories of his own from a lifetime on the water. Together they will co-create and weave this collective experience into a water reconciliation message for everyone. Follow along on Facebook - https://www.facebook.com/profile.php?id=100090469563185, Twitter @WeavingWaterExp, and the expedition's website www.weavingwatersexpedition.com.

Dr. Yannick Huot (Sherbrooke University) was presented the Ramón Margalef Award for Excellence in Education by the Association for the Sciences of Limnology and Oceanography (ASLO) for his work on the LakePulse project.

Dr. Dianne Orihel (Queen's University) has been awarded the 2023 Yentsch-Schindler Award by ASLO. This award is presented to an early career scientist who has made outstanding and balanced contributions to research, education, and society.

Dr. John Smol (Queen's University) was awarded the Vega Medal this April by the Swedish Society of Anthropology and Geography. https://www.queensu.ca/gazette/stories/receiving-prestigious-vega-medal

CARS announces the publication of *Freshwater fisheries in Canada*

American Fisheries Society

CARS is happy to announce the publishing of *Freshwater fisheries in Canada: Historical and contemporary perspectives on the resources and their management* by American Fisheries Society Publishing. Canada is surrounded by three oceans and home to more freshwater lakes and rivers than can be reasonably counted. It is therefore not surprising that Canada has a plethora of freshwater fisheries and a long history of use and innovative strategies for managing them. This book is designed to follow a logical arc beginning with an overview of the Canadian landscape and the zoogeography and status of freshwater fish populations. Next, the book brings together reports on fisheries from across Canada—either at the provincial or regional scale (as dictated largely by ecoregion; e.g., the North, the Laurentian Great Lakes). Then, a number of issues and threats are presented that are useful in revealing the challenges and opportunities that exist for ensuring that freshwater fish populations are healthy and vibrant. We conclude with some reflective contributions, including short essays from some legendary fisheries professionals in Canada as well as a forward-looking piece by some early-career fisheries professionals. Taken together, this book will serve as a resource for those interested in learning about the past, present, and future of freshwater fishes and fisheries in Canada.

https://fisheries.org/bookstore/all-titles/professional-and-trade/freshwater-fisheries-in-canada/

The book is available at https://fisheries.org/bookstore/

A new decade for at-risk aquatic species and their legal protection

News from our publishing partner: Canadian Science Publishing

Implemented in 2003, the *Species at Risk Act* (*SARA*) is now entering its third decade of action in Canada. Today, there are more than 500 species listed, spanning biological taxonomy and terrestrial and aquatic systems. Countless numbers of researchers, communities, and agencies are working to understand these species and develop ways to protect them.
For aquatic species at risk, knowledge and policy guidance from the last 20 years can be found among the "pages" of the SCAS partner journals:

· Bias and delays in the *SARA* process for at-risk marine fishes *(Canadian Journal of Fisheries and Aquatic Sciences;* https://doi.org/10.1139/cjfas-2015-0030)

· The role of science advice in listing decisions for freshwater fishes under *SARA* (*FACETS;* https://doi.org/10.1139/facets-2020-0091)

· Future directions of reintroduction science and programs for *SARA*-listed fishes (*Environmental Reviews;* https://doi.org/10.1139/er-2019-0010)

· Mitochondrial DNA (mtDNA) genome sequences for spotted wolffish (*Canadian Journal of Zoology;* https://doi.org/10.1139/z06-191)

What will the next decade reveal and require for aquatic species at risk in Canada?

Share your perspectives in SCAS journals. To learn more, contact **Natalie Sopinka** (Journal Development Specialist) at **natalie.sopinka@cdnsciencepub.com**

Canadian Science Publishing

What does your research look like this summer?

Cleaning nets? Outdoor meetings? Editing drafts? Labeling tubes?

Tag @CJFAS on Twitter showing photos of your summer research!

PhD student Heather Bauer Reid makes a note of water temperature in Lake Scugog, Ontario in preparation for her research on intraspecific variation in fish metabolism. Credit: Imogen Bellinger

SCAS/SCSA 2024 Conference Announcement - February 21-24, Fredericton, New Brunswick

Sandra Ellis, Conference planning chair

Save the Date!

Stay current on the latest in aquatic sciences by attending the **2024 SCAS | SCSA Conference February 21-24, 2024, in Fredericton, New Brunswick!** The conference aims to bring together scientists, researchers, practitioners, policy makers, and community members from across Canada to exchange knowledge across disciplines in the aquatic sciences under the conference theme "From the Source to the Sea".

Stay tuned for more details, including the call for sessions!

Endangered Lake Chubsucker (left) and Pugnose Shiner (right) being studied by Jennifer Powell (PhD student) and Madeline Morrison (MSc student) at University of Toronto. Photo credit: J. Powell and M. Morrison

Thank you for a memorable 2023 conference!

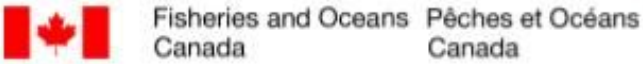
From Canadian Science Publishing

Despite the running rivers and blooming bulrush, it feels like February's inaugural meeting in Montreal happened only yesterday. The connections created with folks made the in-person launch of the SCAS x Canadian Science Publishing partnership truly awesome.

At the booth or between talks, the research we learned about was incredible—halibut family trees, remote sensing, sediment cores, salmon on treadmills, gas emissions from thawing permafrost. The conversations on publishing ethics, community engagement, and academic-adjacent careers, all prompted reflection.
Thank you to all who made these experiences possible!

Best wishes to all student and early-career members this summer season of field, lab, and writing work!

THANK YOU TO OUR SUPPORTERS
MERCI À NOS PARTENAIRES

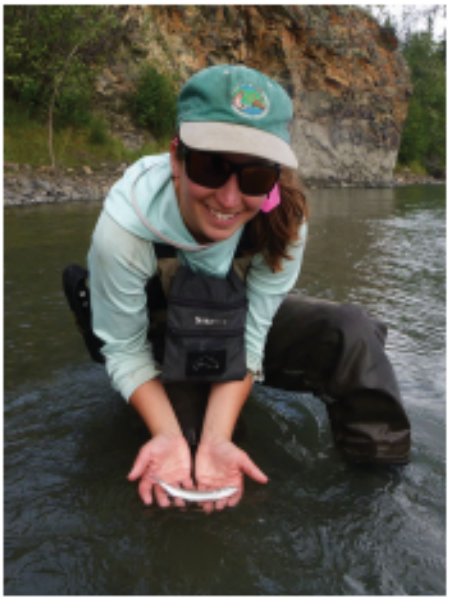


ABOUT US

At EDI Environmental Dynamics Inc., we enjoy what we do! Our growing team of nearly 170 employees is driven to deliver practical, cost-effective, environmental consulting services across western and northern Canada.

Our services include various assessments relating to fisheries and wildlife biology, aquatics, wetlands, water resources, and terrestrial ecosystem components; environmental management and monitoring; and permitting support. Sectors we often work in include renewable energy, oil and gas, mining, transportation, and urban development.

Along with building our reputation as people you can talk to and experts you can trust, we also try to focus on what matters. To this end, EDI has collaborated with Indigenous and non-Indigenous communities across western and northern Canada to build better projects and create lasting relationships. Some of our partnerships in these communities span 20 years! We take pride in providing technical support for a large range of community-driven initiatives and projects.



If you are looking for environmental services or a job opportunity with a company that focuses on teamwork, a positive environment, and adaptability to dynamic situations, feel free to stop by one of our offices or give us a call. We'd love the opportunity to speak with you. To find out more about EDI, please visit our website: edynamics.com

CONTACT US

Prince George 1-250-562-5412	Grande Prairie 1-780-532-5375	Vancouver 1-604-633-1891	Saskatoon 1-306-373-0594
Nanaimo 1-250-751-9070	Calgary 1-403-444-6489	Whitehorse 1-867-393-4882	Smithers 1-250-877-5520

Call for 2024 Award Nominations

Caleb Hasler, Awards committee chair

The Society of Canadian Aquatic Sciences / Société canadienne des sciences aquatiques is currently seeking nominations for two awards:

1. The Frank Rigler Award
2. The Peters' Award

The deadline for nominations is **July 15, 2023,** and should be sent to the **Awards Committee Chair, Caleb Hasler (c.hasler@uwinnipeg.ca).** Recipients will be announced by late fall (in time for abstract submissions for the 2024 conference).

The **Frank Rigler Award** was first presented in 1984 to recognize and honour major achievements in the field of limnology by Canadians or those working in Canada. Emphasis in selection is given to established aquatic scientists with a proven record of contribution to the field of aquatic sciences, whose work is widely recognized for its influence and importance. The winner of the award will give an overview on their research during the plenary session of the annual meeting and will receive complimentary registration at the meeting and a one-year membership with the Society.

A nomination for the Frank Rigler Award shall consists of:

1) A cover letter, not to exceed two pages in length (single-spaced, 12-pt Times New Roman font, 1-inch margins), describing clearly how the nominee has made a lasting contribution to the field of limnology, either as a Canadian citizen abroad or to the field of limnology in Canada. Contributions that should be highlighted in the nomination can include (but are not limited to) evidence of work that has a scope that is both broad and of high-impact; evidence of work that has directly influenced aquatic science policy, and major public outreach initiatives involving the candidate that increase awareness regarding the importance of freshwater resources to Canadians. The cover letter must also confirm the nominee's commitment to attend the upcoming society meeting and, if selected, present the Rigler lecture.

2) A CV covering the applicant's full scientific career that highlights employment history, publication record, funding held, contributions to training of students, invited lectures and contributions to public outreach, honours and prizes, and journal editorships and reviewing.

The **Peters' Award** recognizes the best aquatic sciences paper published in the preceding year by a Canadian student or a student working in Canada. The student must be an undergraduate or graduate student and must be the first author on the publication. A paper can be considered for the award if it is published within the period of one year prior to the deadline for nominations, and the first author is a student or has recently graduated. A paper is considered "published" once it is posted on-line by the journal or appears in hardcopy, whichever occurs first. A single body of work may only be considered for nomination once. The value of the award is $500 and a complimentary one-year membership in the Society, to be presented at the annual meeting where the student must present a summary of their paper.

A nomination for the Peters' Award consists of a submission of the paper, typically from the student's supervisor. Nominations may be accompanied by a cover letter (not to exceed one page, single-spaced, 12-pt Times New Roman font, 1-inch margins) outlining the quality, importance, and impact of the paper.

The Qu'Appelle Long-Term Ecological Research Program: A 30 year view of prairie surface waters

Cale Gushulak and Peter Leavitt,
University of Regina

The Qu'Appelle Long-Term Ecological Research Program (QU-LTER) was established in 1994 by Peter Leavitt as part of a new limnological research enterprise at the University of Regina. Initially focusing on the lakes of the 52,000 km^2 Qu'Appelle River catchment in southern Saskatchewan, the program now includes many of the major lake ecosystems in province's grasslands. Now celebrating its 30th field season, the QU-LTER is part of the Institute of Environmental Change and Society (IECS; www.iecs-uregina.com) and is the longest running aquatic LTER program based at a Canadian university.

Research under the QU-LTER umbrella comprised five interactive research avenues. First, the core activities include biweekly sampling (May-September) of 75 parameters in seven lakes joined by the Qu'Appelle River to understand how natural and anthropogenic processes interact to regulate the structure, function, and sustainability of freshwaters. Second, the Saskatchewan Lake Survey (SLS) conducts seasonal analysis of another 21 lakes representing all key grassland habitats. Third, over 100 fresh and saline lakes are surveyed on a decadal basis within a 245,000 km^2 area to establish the landscape patterns of water quality and ecosystem structure. These data are also used in our fourth avenue to calibrate long-term satellite records of prairie surface waters and evaluate historical trends in production and bloom formation since the early 1980s. Finally, paleolimnological studies of fossil pigments, diatoms, and stable isotopes are conducted in many of our study lakes to map out the historical effects of land use change, and evaluate the effects of global warming on Canada's largest agricultural region.

Research within the QU-LTER incorporates mass-balance studies, laboratory and *in situ* mesocosm experiments, heat budgets, advanced chemical analyses, satellite analyses, whole-ecosystem experiments, contaminant transport, statistical modeling, and paleoecology. Like much of IECS, the program looks at the direct, indirect, and reciprocal interactions between the natural environment and human society, particularly focusing on climate and land-use effects. Over the past decade, researchers have been focusing on greenhouse gas (GHG) fluxes over a range of prairie waterbodies, from farm ponds to wetlands, lakes, and massive reservoirs. As well, we have had a particular focus on the unique role of nitrogen in degrading water quality and promoting toxic phytoplankton blooms in phosphorus-rich lakes. Evidence of nitrogen-driven eutrophication from the QU-LTER resulted in the City of Regina upgrading its wastewater treatment plant with biological nitrogen removal technology in 2017. Having demonstrated that N removal improved water quality in N-limited rivers, the QU-LTER will continue to monitor the recovery of downstream lakes (so far, so good!).

The hierarchical nature of the QU-LTER platform improves our ability to detect mechanisms underlying observed ecosystem processes. Routine measurements and experiments within the core Qu'Appelle lakes are easily scaled upwards to a larger freshwater district (~150,000 km^2) represented by the SLS, as well as the entire grasslands region of Saskatchewan – a biome characteristic over 7 million km^2 worldwide. Similarly, long-term data are used to calibrate both fossil records of environmental change, as well as well-known (LandSat, Sentinel) and emerging (Planet) remoting sensing platforms, thereby improving these applications in other lake regions.

Based on Treaty 2, 4, and 6 territories, the QU-LTER program also provides resources for the Neyewak, Anistabih, Nakota, Dakota, Lakota, and Metis peoples to better protect inherent and treaty rights, and protect prairie waters.

Lakes, reservoirs, and wetlands sampled in the QU-LTER program in the prairies of southern Saskatchewan. Photo credit: A. Sprott, H. Sauer, M. Van Eaton, and D. Bateson

Together, this hierarchical approach provides a critical understanding of factors that regulate the health of aquatic ecosystems and allows development of sophisticated strategies to protect, conserve, and manage lake ecosystems, particularly those in western Canada. The QU-LTER is now the cornerstone of University of Regina's Institute of Environmental Changes and Society. IECS was founded in 2010 to understand and anticipate how changes in climate and anthropogenic activities interact to regulate aquatic ecosystems through a variety of multi-disciplinary perspectives. IECS is a highly collaborative institute and has developed projects and consultations with Indigenous Nations, multiple governmental agencies, and other academic institutions.

IECS welcomes new opportunities for collaborations and project development, including those using the 30-year QU-LTER dataset. If you are interested in collaborating, or are looking for graduate study opportunities, please contact IECS co-directors:

Dr. Peter Leavitt: peter.leavitt@uregina.ca
Dr. Kerri Finlay: kerri.finlay@uregina.ca

or visit our webpage https://www.iecs-uregina.ca/

Method Highlight: Larval Light Trapping

Jennifer Powell,
PhD candidate, University of Toronto

Studying larval fish can be quite the challenge due to their tiny size and tendency to hide in dense vegetation or sediments. Numerous sampling techniques have been developed to capture these newly hatched fishes, often at least partially specialized to different sampling environments or the species of interest. Using a fine mesh net to do either tows or drift net sampling in areas with sufficient flow are some of the more common sampling techniques. However, tow net sampling is often not possible in areas with dense vegetation as they can quickly snag or become clogged with debris. Larval light trapping is a passive sampling technique that can be used in low-flow environments and a range of vegetation conditions, including areas where tow net sampling would not be possible.

Larval light traps utilize the phenomena of phototaxis, whereby a light source will affect a fish's swimming behaviour. Phototaxis can allow us to draw larvae out of difficult to sample vegetation or sediments and into the trap where they can be collected. This seems fairly straight forward, but there can be a number of difficulties when choosing a light source as fishes have been found to react differently to different coloured lights, with some swimming towards certain colours (positive phototaxis) and away from others (negative phototaxis) (Xu et al. 2022). As well, different wavelengths of light can travel further in water, with the colours with the shorter wavelengths (i.e. blue and greens) better able to penetrate the water while the longer wavelengths have the worst penetration (i.e. red and orange), meaning different colours could be sampling different sized areas. Finally, when it comes to the properties of the types of light sources used for light traps (e.g. glowsticks, waterproof flashlights, bulbs connected to a power outlet, etc.), the intensity of the lights can vary widely, which also affects the sampling area. Even when using different colours of the same type of product, the intensity can vary significantly. So, there are lots of things to keep in mind before choosing the light source for light trapping experiments.

Larval light traps come in a variety of shapes and sizes, but typically consist of several plexiglass cylinders cut to create a 'C' shape fixed to a floating top and a collection pan or base with a collection sleeve on bottom. The cylinders are placed to leave a small gap between each one to allow the entry of the larvae into the trap. A clear tube in the center of the trap allows the light to be added. Once placed in the water, the trap floats just below the surface held up by its buoyant top, radiating light into the water column, and is held in place by tethering the trap to a piece of rebar driven into the sediment or other fixed structure.

Another issue that I am currently investigating is the potential negative impact non-larval fishes may have on the presence of larvae within the trap. In some recent sampling work, we noticed a lot of juvenile sunfishes (primarily *Lepomis* spp. with some Largemouth Bass (*Micropterus salmoides*)) getting into the traps. As *Lepomis* have laterally flattened bodies, fairly large individuals can swim through the small gaps between the cylinders, whereas most other juvenile and adult fishes are unable to enter. Analysis of the data we collected from these traps also found that almost all the traps which had larvae did not contain juveniles and vice versa, suggesting that the juveniles are either consuming the larvae in the traps, or deterring the larvae from entering when juveniles are present.

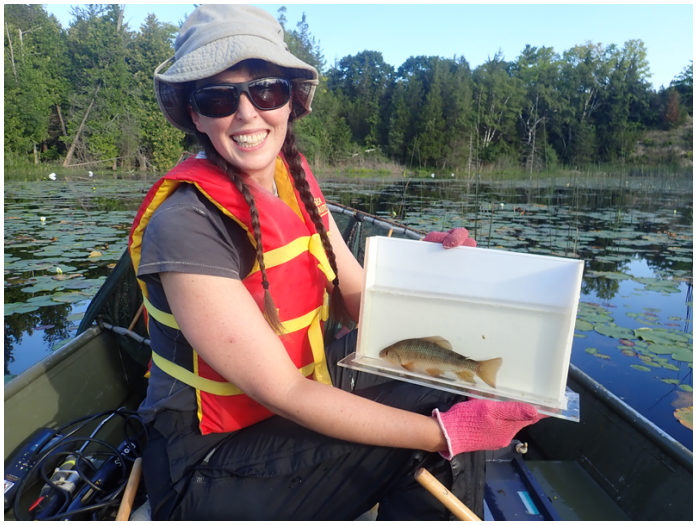
As a result, this year I am conducting a trial to see if wrapping a black plastic mesh with 1 cm x 1 cm openings around some of the traps will both A) exclude juvenile sunfishes, and B) improve the overall larvae catch when compared to traps without the mesh. An Australian exclusion experiment used a 3 mm x 3 mm square mesh around their traps and found that no larvae were found in the presence of adults and that excluding adults from the traps increased the overall number of larvae captured (Vilizzi et al. 2008). I chose to go with a slightly larger mesh size as our study is also interested in older larvae and very young juveniles so wanted to ensure they were not excluded from the traps. So far, the results have been promising, with juvenile *Lepomis* only being captured in the non-mesh traps

Method Highlight: Larval Light Trapping (cont.)

and several visual confirmations of the juveniles showing interest in the mesh-traps, but not being able to enter. Larvae of a variety of sizes have been found in both the mesh and non-mesh traps, so the mesh does not prevent larvae from entering. Whether the mesh has an impact on overall larval catch still remains to be seen, as there are many hours of eye strain picking larvae out of jars between me and that data, but I am hopeful that the use of exclusion mesh may provide an effective solution to reduced larval light trap sampling efficiency in the face of high sunfish presence.

Vilizzi, L., Meredith, S. N., Sharpe, C. P., & Rehwinkel, R. (2008). Evaluating light trap efficiency by application of mesh to prevent inter- and intra-specific in situ predation on fish larvae and juveniles. *Fisheries Research*, *93*(1–2), 146–153. https://doi.org/10.1016/j.fishres.2008.03.011

Xu, J., Sang, W., Dai, H., Lin, C., Ke, S., Mao, J., Wang, G., & Shi, X. (2022). A Detailed Analysis of the Effect of Different Environmental Factors on Fish Phototactic Behavior: Directional Fish Guiding and Expelling Technique. *Animals: An Open Access Journal from MDPI*, *12*(3), 240. https://doi.org/10.3390/ani12030240



Jennifer Powell, PhD candidate, University of Toronto

Larval light trap *in situ* during the night. The light causes phototaxis in larval fish which allows for sampling. Photo credit: J. Powell

The traps are secured to a support column driven into the lake sediment. Photo credit: J. Powell

Canada risks falling behind in aquatic science research when graduate students and postdocs aren't paid a living wage

Ben R. Collison, Justin A.G. Hubbard, Heather Bauer Reid

Marine, coastal, and freshwater ecosystems across Canada are changing rapidly due to a host of anthropogenic pressures. Much-needed solutions to these boundary-spanning problems require scientific evidence from ongoing research at all scales, from microscopic to global. Canadian universities are currently responsible for a large proportion of research and development across all sectors, with graduate students and postdoctoral fellows playing a leading role in aquatic sciences to help solve pressing real-world issues. Students and postdocs are crucial personnel in research; however, these personnel are chronically underpaid, which is a problem that has been gaining more attention in recent years.

On May 1, 2023, students, researchers, and professors at universities and research centers across Canada participated in a walk out to protest the current funding situation and continued lack of change. Unfortunately, the rising costs of living and tuition combined with stagnant public funding have left many of these researchers facing "serious financial concerns," drawing their time away from solving problems and towards making basic ends meet. A 7,000-signature open letter and online petition calling for an increase in federal scholarship funding was tabled in the Government of Canada Parliament last fall. Budget announcements this spring brought no change, with some scholarships still at 2003 levels, meaning they have not kept up with the 48% inflation rate increase over the last 20 years and currently fall below the poverty line.

The affordability crisis for graduate students and postdocs is likely exacerbated by recent costs of food and shelter rising significantly above general inflation (4.4%). One-bedroom rentals have increased 15.5% to an average of $1811 across 35 Canadian cities compared to May of 2022. Canada's Food Price Report explains "At 7%, our forecast a year ago was considered by many to be alarmist, yet here we are with a food inflation rate above 10%."

How do we go about solving this issue affecting Canadian researchers, including those in the aquatic sciences? The authors of a study of the financial challenges of graduate students in Canada recommend six actions: 1) Increasing federal funding through research grants and scholarships; 2) stipend standardization and establishment of transparency policies with university departments; 3) expansion of graduate student eligibility for scholarships with the aim of better funding for underrepresented groups and international students; 4) index graduate student funding to the consumer price index; 5) removal of limits to working outside of studies; and 6) further investigate how EDI factors impact graduate student and postdocs' financial struggles. The authors also propose a method for university departments to determine minimum stipends for graduate students: Minimum stipend = Tuition + average cost of rent + $550/month other expenses + $500/month for PhD students. The reason for additional funding for PhD students was that they are more likely to have dependents and greater expenses. Based on this calculation the authors at the time of their study suggested a minimum stipend of $48,197.28 for PhD and $42,197.28 MSc students at the University of Toronto.

The Federal Advisory Panel recommended increasing funding for graduate students and postdoctoral fellows to levels that are competitive internationally. It is not difficult to see why this is a recommendation. The salary range for the average full-time PhD student in Germany is €4,053 - €5,701, or $5893 - $8290 CAD per month, depending on their year of study, a range with a starting value above Canada's prestigious Vanier scholarship ($50,000 CAD per year). Comparisons such as these highlight how most Canadian students and postdocs are not even paid a living wage, while equivalent

researchers elsewhere may make considerably more. If the Canadian government and Canadian institutions want to retain Canadian researchers, they will have to increase the pay of graduate students and postdoctoral fellows to internationally competitive levels.

Academic wages in Canada also face competition with other career alternatives. Canadian researchers found that 85.7% of their survey respondents expressed they have felt stress or anxiety about their finances, 35.9% felt concern over being able to afford enough food, and 30.7% said they seriously considered leaving their studies to pursue other careers due to financial concerns. Canadian graduate students and postdocs feel serious anxiety over their finances and this may lead them to make alternative career choices simply to be able to afford to live.

While increasing graduate and postdoctoral wages for competitive ends may be useful, there is also benefit in thinking and arguing for better compensation we should not forget that Canadian graduate students and postdocs, like everyone else, deserve a good standard of living in their own right, regardless of the compensation provided by competitors.

In aquatic sciences, government funding provides support for graduate students and postdoctoral fellows to conduct fieldwork, attend conferences, network with other scholars, and ultimately produce scientific insights that can be provided to policy makers and the broader scientific and public communities. Moreover, these valuable personnel should be paid appropriately to maintain a good quality of life. The affordability crisis for graduate students and postdoctoral fellows has been building in recent years such that a high quality of life is at risk or out of reach, as so many aspects of life have become more expensive yet academic pay has stagnated. This is disheartening to students and researchers, and may force them to choose alternatives that provide greater security. We know the policies that could be enacted to alleviate the financial strains that face graduate students and postdoctoral fellows. But do we have the political, social, and institutional will to implement them? Graduate students showed up in great numbers this May to voice their will, now it is time for our government and institutions to answer the challenge.

Graduate students protest for a living wage in Montreal on May 1, 2023. Photo credit: Sozos Michaelides

A new collection in the open-access journal *FACETS* highlights the diverse research and practice contributing to the recovery of aquatic species at risk across Canada, both freshwater and marine.

Submissions are welcome on topics spanning taxonomic groups (federally or provincially/territorially listed) and approaches used in species at risk recovery strategies and their recent advances, including population monitoring, habitat restoration, delineation of habitat requirements and tolerances, reintroduction, and strategies for threat monitoring and mitigation.

Guest edited by: Steven Cooke, Christine Madliger, Trevor Pitcher, and Marco Rodriguez

Submission deadline is October 31, 2023. Learn more at https://www.facetsjournal.com/topic/progress-and-priorities-for-the-recovery-of-aquatic-species-at-risk-in-canada

Announcing SCAS' New Webinar Series: AquaSeries

Christine Madliger, Webinar committee chair

Join us this fall for a series of webinars spanning topics such as tools for aquatic science practitioners, inclusive networking, and fostering engagement in conservation. Co-organized with the SCAS Student Committee, these webinars are designed to encourage active participation and bring together professionals and community members in the aquatic sciences across all career stages. Keep an eye on the SCAS website - https://www.scas-scsa.ca/ - and Twitter @SCAS-SCSA for more details about the next webinar being organized for September.

David L.G. Noakes special issue of *Environmental Biology of Fishes*

Margaret Docker,
University of Manitoba

Dr. David L.G. Noakes

In May, *Environmental Biology* of Fishes published a special issue commemorating the life and work of Dr. David L. G. Noakes (right), the long-time Editor-in-Chief of the journal and a mentor, colleague, and friend to many (https://link.springer.com/journal/10641/volumes-and-issues/106-5).

The 28 articles in the special issue include personal tributes and syntheses of his scientific contributions, as well as research articles on topics and taxa—especially charrs and Pacific salmon—near and dear to David's heart. David passed away in December 2020, but his legacy lives on.

Method Highlight: Field Physiology

Jessica Reemeyer,
PhD candidate, McGill University

My research focuses on the effects of environmental stressors on Canadian freshwater fish species at risk. Much of my research has been field based, investigating the physiological performance of fish in the Old Ausable Channel, near Grand Bend, Ontario. The Old Ausable channel is home to multiple imperilled fish, but my research has focussed on the threatened Pugnose Shiner (*Miniellus anogenus*) and endangered Lake Chubsucker (*Erimyzon sucetta*). My work explores how these fish are coping with heat waves in the summer that are increasing in frequency and severity due to climate change, as well as low dissolved oxygen (hypoxia) and how these factors interact to affect fish.

Jessica Reemeyer in front of the trailer right after it was delivered, about to unpack the equipment.

Working in the field can be difficult in the best of times but can be especially hard when you're trying to use methods that are normally done in a lab setting. Thankfully, our collaborator at the University of Windsor, Dr Trevor Pitcher, lent us his research trailer for my 2022 field season. I spent five months collecting data for this project, and it probably would not have been possible without the research trailer.

Method Highlight: Field Physiology (cont.)

For my work, we measured thermal tolerance (CTmax) and hypoxia tolerance (Pcrit) of fish right beside our sampling sites. This involved catching fish in the channel, holding them in the trailer, measuring their physiology, and releasing them back into the channel after recovery from the experiment. Being so close to our sampling sites meant we didn't have to worry about transporting the fish or the stress associated with that and allowed us to release fish back to where they were caught, meaning that we could measure many more species at risk than would normally be permitted if we were sacrificing the fish.

Multiple students are continuing work in the Old Ausable this year (PhD student Jennifer Powell, MSc student Madeline Morrison, and undergraduates Madeline Boys and Katie Moffat), aided again by the wonderful research trailer. If you're interested in this work you can follow them on their outreach Facebook page: Lambton Shores Endangered Fish Adventure, where you can also find past posts about my work.

Blackchin Shiner (congener of threatened Pugnose Shiner) in one of the respirometry chambers used to measure hypoxia tolerance (Pcrit).

Did you know?

To support expansive readership of the thoughts that expand our own, Perspective articles in the *Canadian Journal of Fisheries and Aquatic Sciences* are made freely accessible online upon publication at no cost to the authors.

Markelle Morphet (PhD candidate, University of Toronto) priming an eDNA autosampler for deployment in Geogrian Bay, near Meaford, Ontario. Photo Credit: M. Morphet

We're on Instagram!
@scas_scsa

Communications committee

Follow our new Instagram account @scas_scsa for news, updates, and opportunities in all things aquatic sciences in Canada.

Do you have content you want to share with the Society? Contact the communications committee at SocCanAqatSci@gmail.com to organize an Instagram takeover and highlight the work you do and life you lead as an aquatic scientist.

Prioritizing species through evolutionary lenses

Bruno Soares,
University of Toronto

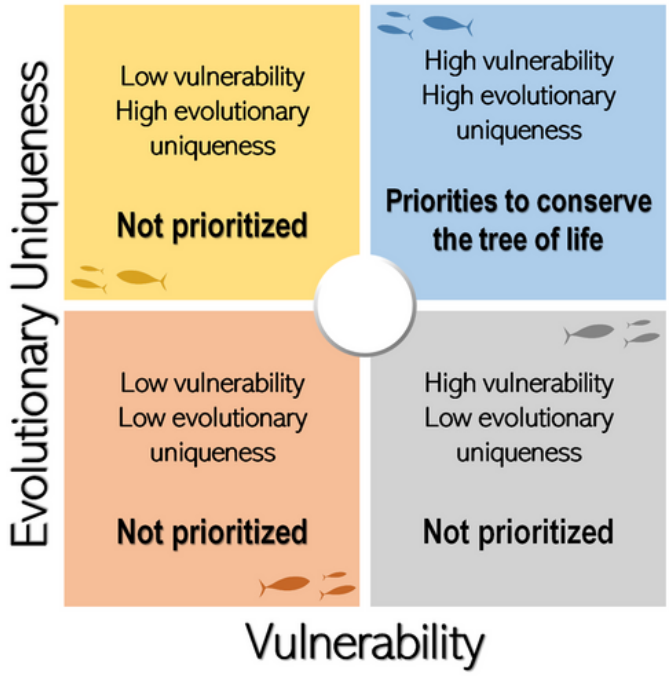
Bruno Soares

There are many perspectives on why we should conserve biodiversity, but most institutional efforts are based on the perceived importance of species as providers of ecosystem services, such as pollination or climate regulation.

These efforts often overlook cultural values, the ethical imperative to preserve species, and the option values for the future. Nonetheless, considering all these factors in conservation planning is challenging due to the difficulty of measuring and assigning weights to each species. A tentative approach, not meant to be final, to address this is by quantifying the amount of phylogenetic history contained in sets of species and how unique these species are in terms of their evolutionary history.

Species are not evolutionarily independent, and their phenotypic and ecological attributes depend, to some extent, on their phylogenetic relationship. Closely related species tend to exhibit similarities due to niche conservatism mechanisms that limit phenotypic diversification or through neutral models of evolution. Consequently, some authors argue that conserving the greatest amount of evolutionary diversity would also ensure the preservation of a substantial amount of ecosystem services, as well as phenotypic or functional diversity, thus safeguarding future options. One approach to protecting a significant portion of the tree of life is through the conservation of phylogenetically unique species.

To determine which species should be prioritized for the protection of the tree of life, one approach is to integrate endangerment/vulnerability metrics with phylogenetic information. Current prioritization lists that incorporate phylogenetic information primarily focus on flagship species or rely on the conservation status provided by the IUCN, but this approach is limited to a few specific clades and does not account for species' intrinsic vulnerability. To overcome this limitation, my collaborators and I are adapting a phylogenetic uniqueness measure to incorporate a weighted assessment of species' intrinsic vulnerability. The proposed index involves multiplying each node's branch length by the sum of the vulnerability scores of its descendant nodes. Subsequently, the phylogenetic vulnerability is calculated for each species as the sum of the values associated with all its parental nodes. The index yields higher values for species that are either vulnerable or belong to highly vulnerable, phylogenetically unique clades.



Visualization of evolutionary prioritization of species conservation

We applied our approach to all known species of bony fishes on a global scale, utilizing a synthesis tree and FishBase's vulnerability index. FishBase's vulnerability takes into consideration various life

history traits, assigning higher scores to species with traits that render them vulnerable to fishing, such as extended longevity and larger size at first maturity. Within the context of Canadian bony fishes, it would be particularly crucial to prioritize the conservation of species like the Bowfin (*Amia calva*), the Tarpon (*Megalops atlanticus*), and the Goldeye (*Hiodon alosoides*). These species belong to unique evolutionary lineages, comprising one or more species that exhibit high vulnerability to fishing and other impacts related to life history traits.

The loss of the prioritized species in the given scenario would result in an unequal loss of the bony fish tree of life. Notably, one of these species, the Tarpon, is currently listed as vulnerable on the Red List of Endangered Species, stressing the need to allocate resources towards its conservation.

Therefore, we propose the inclusion of phylogenetic-based prioritization indices are incorporated in existing conservation approaches to ensure the preservation of different branches of the tree of life.

Crawford Lake: A potential site for the Anthropocene boundary

Crawford Lake (Milton, Ontario) is one of nine sites being considered to mark the onset of the Anthropocene Epoch.

Krysten Lafond (M.Sc., Queen's University) and Francine McCarthy (Brock University) examine a freeze core from Crawford Lake.

Field crews from Carleton and Brock universities prepare to take a sediment core.

The finely laminated sediments of Crawford Lake. Photo credits: R.T. Patterson

For more information on Crawford Lake and the other candidate Anthropocne boundary sites see this special issue of *The Anthropocene Review:*

https://journals.sagepub.com/toc/ANR/current

Recent Citings

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Thank you to all members who submitted their updates for this issue of REFLECTIONS

If you have news, updates, new papers, reports, projects, or ideas for highlights or other articles for our next issue please send them to the Communications committee at SocCanAquatSci@gmail.com

The next issue of REFLECTIONS will be circulated in December 2023