

COLLEGE MATTERS

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COLLEGE OF
APPLIED BIOLOGY
Professional Accountability



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The 2019 College of Applied Biology Annual Conference will be held April 4-5, 2019 in Victoria.

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The College of Applied Biology was established by the Provincial Legislature in 2002 as the licensing and self-regulating organization for the practice of applied biology in British Columbia. The *College of Applied Biology Act* is the only self-regulating legislation for the practice of biology in North America.

OUR VISION

The College is a leading voice to promote and uphold scientific principles and methods in applied biology, and the principles of stewardship. We provide assurance to the public of professionalism in the practice of applied biology by our members.

PUBLISHED BY

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This publication is made available to every member of the College. Decisions of the College on matters of standards, policies and guidelines are published in this bulletin. The College therefore assumes that each member is aware of these matters.

Past issues are available at www.cab-bc.org/news/publications.

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By Brian Clark, RPBio, President

Presidential Ponderings




“In the midst of chaos, there is also opportunity,” so said Sun Tzu a couple thousand years ago.

Fast forward to 2017/2018 and the provincial government’s Professional Reliance Review. While the consultation process was chaotic and time consuming, the efforts of staff and Council convinced the government that the public interest could not be protected without right to practice legislation for applied biology professionals. This is big! This is the first jurisdiction in the world to recognize the importance of qualified professional applied biologists, technicians and technologists by ensuring that anyone practicing applied biology in British Columbia is registered with the College of Applied Biology and accountable to a consistent set of professional requirements and ethical standards.

This precedent took a lot of work over the last year working with government and our fellow associations involved in resource management in British Columbia. Thank you to all involved. I’d also like to recognize the past efforts and dedication that allowed us to take advantage of this opportunity. In 2018, government audited the College, looking at our governance structure and our ability to self-regulate through our Credentials, Audit and Discipline processes. We passed due to the hard work by staff and member volunteers over the last five years working on Council, Task Forces and Committees that brought the College’s standards and practices up to a level suitable for the regulation of BC’s natural resources.

And then there was the fellow who said we should be careful what we ask for...

Right to Practice is a great milestone but it, along with other components of the ***Professional Governance Act***, is going to take a lot of work to finalize the details and prepare for implementation. Starting in early December, the College will be participating with the provincial government and the other regulatory bodies in bi-weekly meetings that will take us through April 2019 and beyond.

Our recently approved Strategic Plan for 2019-2022 has prioritized these efforts along with two Task Force groups (Scope of Practice, Credentials) to tackle the implementation of right to practice for our registrants and the Practice Review Task Force to complete our Compliance Continuum. This is a large task for our organization and for staff. While we are actively looking at staffing resources to accommodate the needs of this engagement process, we will be relying on our members to volunteer to run for Council, sit on our statutory committees or our task forces. Don’t be shy. 



Towards Professional Governance: Regulation & Engagement

By Christine Houghton,
Executive Director

The proclamation of Bill 49—now officially the **Professional Governance Act**—marks a significant turning point for professional applied biology in British Columbia. Getting to this point has taken a considerable investment of the College's resources—Council, staff and money—to help steer the policy to try to achieve improvements to professional governance.

The most noteworthy change in the *Act* for applied biology practitioners is obviously the migration from a “Right to Title” to a “Right to Practice” profession, and while this is definitely an important and substantial change, it is not the only one of which professionals need to be aware.

The most immediate of those changes are currently out for public consultation in the Ministry of Environment and Climate Change Strategy's Intention Paper. Along with consulting on Right to Practice there are two other notably significant initiatives the government is intending to move forward with over the next year – the regulation of firms and mandatory declarations of professionals regarding conflict of interest and competency. While the College will be responding to the **Intentions Paper**, I would like to encourage all members (now officially registrants) to read the paper and offer their own response. **The deadline for submissions is March 4, 2019.**


As well it should be noted that the newly formed office of the Superintendent—and indeed the person holding that office—will have a broad mandate in being able to give directives to professional associations covered under the *Act* to implement governance improvements that are in “the public interest”. However, with no definition of what “the public interest” is, the College will need to remain vigilant to ensure that there is caution applied to exercising this power and to avoid any unintended consequences that would undermine the ability of regulatory associations to regulate and therefore negatively impact the public interest.

There are undoubtedly improvements to professional governance that the *Act* brings into effect. As well as Right to Practice the *Act* provides for greater penalties for Title (and eventually) Practice infringement, establishes a Professional Governance Advisory Committee in which the College will participate, and it enhances the governing Council's ability to enact bylaws that relate to CPD, **Codes of Ethics**, Practice Standards and Fees.

Over the next few months the College will be proactively engaging with you, our partners and government on some very specific initiatives. Most noteworthy will be: workshops on Scope of Practice; finalization and implementation of the Practice Review Program; reviewing credentialing and exploring pathways for practicing applied biologists who are not currently registered with the College

to become members without in any way eroding the high standards we have; and reviewing our *Code of Ethics* to ensure that they are in compliance with the new *Act*.

This is the time of year that we often take time to reflect on the year that was and as I do that I find myself very impressed by the dedication, abilities and professionalism of the College's Council, volunteers and staff and I am confident that we will continue to have a positive influence on the final outcome of the full implementation of the new governance regime.

I would like to wish you all a safe and happy holiday season and I look forward to working with you in 2019. 





By Derek Marcoux, RPBio, Registrar

Bill 49—Professional Governance Act

The past several months have been largely focused on the Professional Reliance Review and meetings conducted with the Province over the proposed legislation. While the representatives from the five regulatory organizations were under a confidentiality agreement with the Province, the new direction for professional governance has now been made public with the introduction of Bill 49.

The proposed new office of the Superintendent of Professional Governance and move toward right to practice for applied biology professionals will be a major focus for the Registrar's office over the next year and years to come.

There is an anticipated increase in application rates, as people that have not previously been registrants with the College are required to do so under the new legislation. To that end, a Credentials Task Force has been initiated to review the credentialing requirements and committee processes of the College. The task force will be holding an initial meeting in December, 2018. By November 2018, the task force will provide a report to Council that summarizes a 'go forward' plan with respect to any changes required in light of right to practice and credentialing of new registrants.

As well, I will be working closely with the Scope of Practice Task Force to ensure the entrance requirements for registration align with the areas of practice for biologists, technologists and technicians identified by the task force.

Credentials Committee update

At the September Council meeting, Council approved the appointments of four new members to the Credentials Committee. Tracey L'Espérance, RPBio; Francesca Knight, RPBio; Eric Demers; RPBio, and Brian Arquilla, RPBio are now members of the Credentials Committee. Congratulations!

The College received 10 expressions of interest to participate on the Credentials Committee. A merit-based assessment was used to ensure representation of the committee across the breadth of expertise required to review new applications in applied biology. We would like to thank all registrants that put their name forward.

As well, three expressions of interest were received from existing Credentials Committee members to sit as vice-chair. In the November Council meeting, Council approved Sean Sharpe, RPBio as Vice-Chair of the committee.

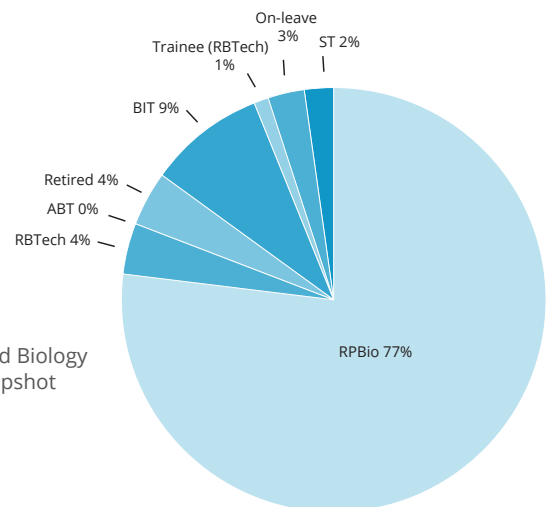
Registrant Snapshot

The proportion of registrants in each category remain similar from June 2018 and our total membership is just over 2370 people. Roughly three-quarters of the membership are RPBios (77%). RBTech and ABT members are about 4%, and our trainee members (BITs, RBTechs, and ABTs) comprise about 10%. We currently have 2 ABT members in the College.

Applications update

As of November 2018, we have received 253 applications. The average applications received over the past several years is about 270 applications per year. August and November had notable increases in application numbers being received at the office in 2018.

Since June 2018, 57% of the new applications received have been for RPBio registration, 35% have been for Biologist in Training, and 6% for RBTech or ABT categories. The balance of applications have been for in-training or student registration. 



College of Applied Biology
Membership Snapshot
November 2018



By Hon. George Heyman,
Minister of Environment and Climate
Change Strategy

Professional Governance Act

Professional Governance Act to Give Practice Rights to Qualified Professionals

It was the hard work and dedication of the College of Applied Biology and other professional bodies that led to the successful passage of the new *Act* and creation. The passage of Bill 49 in British Columbia's parliament this past fall means applied biologists are able to gain official recognition of their practice rights, and British Columbians will have assurance that anyone practicing as a biologist is accountable to a consistent set of professional requirements and ethical standards.

The *Professional Governance Act* and establishing the Office of the Superintendent of Professional Governance is an important step towards an enhanced professional reliance model that increases transparency, and upholds the public interest and the highest environmental standards.

Biologists are a critical part of overall natural resource management and environmental protection in British Columbia. From contaminated sites, to forestry operations, to the environmental assessment process, to mitigating the impacts of mining and tailings ponds, biologists are involved in myriad different ways in BC's natural resource development.

The College of Applied Biology makes sure that its members practicing in BC have the necessary knowledge, skills, and accountability. Now, government wants to ensure anyone practicing as a biologist is accountable in the same way – by requiring any practicing biologist to register with the College and adhere to its standards, practices, and ethical code.

The *Act* will also enable practice rights for the BC Institute of Agrologists and the Applied Science Technologists and Technicians of BC


It will take a couple of years for the *Act* to be fully implemented, and that's where you come in. Government has posted an intentions paper asking for input on the regulations that will modernize the governance of professionals and we welcome your comments.

Granting practice rights to all five professions governed by the *Professional Governance Act* will be a complex process that won't happen overnight. There are various approaches that could be taken to do this, all of which are outlined in the intentions paper. Regardless of the approach taken, it will include an assessment of each profession's scope of practice, and where there is overlap, government is expecting we will all work together to jointly administer and oversee that overlap.

It was the hard work and dedication of the College of Applied Biology and other professional bodies that led to the successful passage of the new *Act* and creation of the Office of the Superintendent. Your College is now continuing that work by participating in discussions that will lead to the successful implementation of this new governance model for professions.

I am grateful for the everyday work of biologists, and the College, that gets us closer to our collective goals—to improve and reinforce the trust British Columbians have in our qualified professionals and to provide industry with the certainty needed to continue to generate jobs and economic growth.

The response to our efforts to date has been encouraging. I look forward to working with you as we move forward with granting practice rights for the College.

I invite you to have your say on the **Professional Governance Act Intentions Paper**. A copy of it and a questionnaire can be found at <https://engage.gov.bc.ca/professionalreliance/>. 

Welcome New Lay Member




Theresa Fresco

Theresa Fresco is the Manager of the Greater Vancouver— Sea to Sky Region of the **Fraser Basin Council (FBC)**. Prior to this role, Theresa served in various positions within FBC including Assistant

Regional Manager for the Upper Fraser office based in Prince George (2016-2018) and Program Coordinator for the Watersheds and Water Resources Program based in the Vancouver office (2012-2016).

Theresa's background includes work in the areas of watershed sustainability and collaborative watershed governance. This includes six years of coordination and research support for the formation, launch and continued operations of the Nechako Watershed Roundtable, a collaborative initiative aimed at protecting and improving the health of the Nechako River Basin. She has also served as the manager of the Prince George Air Improvement Roundtable from 2016 to 2017. In her current role, Theresa serves as the Program Manager for Salmon Safe Communities as part of Salmon-Safe BC, an eco-certification program that is co-led by FBC and Pacific Salmon Foundation.


Theresa has a Master's degree from the University of British Columbia's School of Community and Regional Planning and a Bachelor's degree in Geography and English Literature from the University of the Fraser Valley. In addition to her research and work across BC, she has worked and lived in the Philippines, Ireland, Japan and Mexico. 

New Members: Credentials Committee

Tracey L'Espérance, RPBio #2404

I have been a practicing RPBio since 2013. After graduating from Simon Fraser University in 2004 I worked in experimental biology in the fields of ecotoxicology and foreshore intertidal geochemistry. I moved into consulting and became an environmental scientist investigating and remediating contaminated sites. Ten years later, I am a practicing environmental risk assessor with Hemmera in Burnaby, specializing in human health and ecological risk assessment with clients in mining, land development, government and infrastructure, among others.

Francesca Knight, RPBio #1648

I have been and RPBio since 2003, and have recently retired from DFO, where I served as a senior habitat biologist for 8 years. I have worked in both the public sector (local and federal government) and the private sector (environmental consulting) in my 20+ year career as an aquatic biologist. Currently, I serve as the president of the **Squamish River Watershed Society**, an environmental non-profit focused on habitat restoration. I am interested in sitting on the Credentials Committee because in my many years as a busy working biologist, I felt I never had the time to give back to our College. In addition, I have always been interested in the development of the technical qualifications necessary to become an RPBio. My areas of practice primarily include aquatic biology (fisheries, amphibians, and aquatic/riparian habitat), aquatic toxicology and ecological risk assessment (fish, invertebrates, and amphibians), environmental policy review and development, ecologically sound stormwater management, environmental impact assessment (aquatic habitats), and statistics to support these various areas of expertise. 

New Members: Credentials Committee

Brian Arquilla, MSc, RPBio #2396

I am the Principal Consultant and Senior Ecologist with Mountain Pacific Environmental Consultants Ltd based in Vernon, BC. For the past twenty years I have conducted environmental science throughout Canada, United States, the Caribbean, and Oceania. Career experience has included leading multidisciplinary environmental assessments, species and habitat protection planning, ecological resource inventories, Indigenous community land use planning, mining resource development, energy and renewables development, transportation planning, contaminated site management, public policy and resource economics, and federal Protected Areas Strategies. A broad array of clients have included Indigenous communities, Parks Canada, Public Works and Government Services Canada, Indigenous and Northern Affairs Canada, Shell Canada Ltd., De Beers Canada Inc., Newmont Mining Corporation, Rio Tinto Group, BC Hydro, BC Regional Districts, Government of the Northwest Territories, and Vanuatu Department of Environmental Protection and Conservation. Presentations have included federal panel hearings, governmental review boards, Indigenous communities, international academic conferences, and university programs. I have earned an MSc in Wildlife Ecology at Louisiana State University following a BSc from the University of Western Ontario in Ecology and Evolution. I look forward to joining the Credentials Committee to assist in ensuring the College's professional reliance, accountability, and due diligence.

Eric Demers, RPBio #1832

I have been a Registered Professional Biologist with the College since 2006. I have been employed as a biology professor at Vancouver Island University (VIU) since 2000, and as Chair of the Biology Department since 2016. I have also acted as Bachelor of Science Degree Advisor since 2007, where I advise students about their academic progression and career objectives. Recently, I spearheaded the application for accreditation of the VIU Major in Biology with the College. Through these various positions and activities, I have developed strong working knowledge of the College and the credential requirements for membership. My biological discipline expertise spans the fields of freshwater ecology, fisheries biology, ornithology, and environmental monitoring. I have taught or currently teach upper-level courses in each of these disciplines. I have also conducted consulting work in fisheries biology, and I actively engage undergraduate students in biological research and monitoring. Since 2013, I have operated the VIU Bird Banding project where I train students in field ornithology. My volunteer activities include conducting a variety of bird surveys for Bird Studies Canada and other organizations. 

Call for AGM Resolutions

In accordance with Rule 3.18 and 3.19 of the [College of Applied Biology Rules](#), resolutions are being solicited for discussion and action at the 2019 Annual General Meeting of the College of Applied Biology on April 5, 2019, at the Delta Ocean Point Resort in Victoria, BC. All voting members of the College are eligible to submit resolutions. Resolutions must be received no later than 4:00 pm on March 8, 2019.

Submissions should be outlined in the following form:

A. In that (outline issue or problem)

B. Be it resolved that (state the resolution)

C. Discussion (present points concerning the need, logic or benefit of the resolution).

Please contact the Registrar if you are considering putting a resolution forward. More information about Resolutions is posted on the [College website](#).

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Dues Notice and Special Levy

Online Payments for 2019 Dues are Now Being Accepted

Payments can be made online with Visa or MasterCard:
Pay now <https://payments.cab-bc.org/college-dues/>

Please note that the College's online payment system uses the most secure technology available and is compliant with all requirements governing online financial transactions.

- > Click on the appropriate Membership Type category.
- > You'll be prompted to agree with the 3 mandatory declarations. Online payments cannot be processed without agreeing to the declarations.

Reminder: The deadline to pay your dues is December 31, 2018. Late fees come into effect in January 2019.

College members who previously requested a paper invoice will be mailed their dues invoices using the addresses the College currently has on file. Please ensure your contact information is up to date so your dues invoice is sent to the correct email or postal address. To check whether your contact information is current, Log into the Members Area. <https://www.cab-bc.org/user/login?destination=/frontpage>

If you wish to change your password, you'll need to be logged in using your College assigned credentials. To change your password, access "Update Your Profile" in the User Panel, and enter your new password in the password box in your profile. Be sure to click "Save" at the bottom of your profile.

If you encounter any problems, or you do not have your College assigned password, please refer to your information package from when you became a member or [contact the office for assistance](#).

View answers to frequently asked questions regarding dues <https://www.cab-bc.org/faqs/dues-questions> or contact the Registrar at 250-383-3306, Ext 2, or by email at registrar@cab-bc.org.


Special Levy on 2019 Dues

In October 2017, the College issued a Citation against a member and a Discipline hearing was held in June 2018. The allegations against the member included conflict of interest, denigrating another professional, and breaches in professional practice.

In 2003, the College established a contingency legal fund. In 2013 there was a reallocation of monies to increase the fund to \$350,000. Further investments topped the legal fund at approximately \$400,000. The 2018 Discipline hearing has resulted in approximately \$150,000 in expenses. [See FAQ for more details](#).

On September 14, 2018, the College Council determined that a special levy will be applied to the 2019 dues as authorized by Section 19 of the [College of Applied Biology Act](#). The special levy will be used to replenish the legal fund to its minimum level of \$350,000 set by Council in 2013. The levy will not be used for any operational activities. The special levy is to be paid with the 2019 Dues and will apply to College members as follows:

- > RPBio: \$50
- > RBTech: \$25
- > ABT: \$15

For more information about the special levy, see Frequently Asked Questions https://www.cab-bc.org/sites/default/files/faq_special_levy_2019_dues_forwebsite_final_2.pdf 



Updated Strategic Plan: 2019-2022

The College's existing **Strategic Plan** covered the period 2016-2018 so this year it was time to update the Plan for the next three years. A Strategic Plan is an important guidance document that provides a clear focus to set the direction of an organization and evaluate progress. In other words, Strategic planning provides a road map to help you get from where you are now to where you want to be. One significant advantage of a Strategic Plan is that it provides a shared sense of purpose for staff, Council and Committees.

The new Strategic Plan was developed with a Task Force consisting of members of the Executive Committee plus Lay member, Jim Bayles. An all-day facilitated session was held in June to develop updated Vision and Mission statements, and to identify College Values and Goals. The draft Plan was further refined with Council in September 2018 and the final version was formally approved by Council on November 23, 2018.

Based on the new Strategic Plan, the College has defined the following key components:

Our Vision: Responsible resource management supported by accountable and trusted professionals

Our Mission: To serve the public by regulating applied biology professionals

Our Values: Informed by science: We adhere to high standards of practice that are grounded in science and follow the **Principles of Stewardship**

- > Ethical: We take a fair, transparent and judicious approach to the application of College processes
- > Accountable: We are responsive and transparent in our relationships with the public, employers and College members
- > Collaborative: We build relationships with others to protect the public interest

Strategic Goals:


Goal 1: Enhancing Accountability and Transparency

Goal 2: Building Trust and Awareness

Goal 3: Strengthening Strategic Partnerships

Goal 4: Reinforcing a Healthy and Progressive Organization

The College will distribute the Plan to registrants in early 2019 for an opportunity to encourage discussion. We encourage all registrants to read the short plan and provide their thoughts on the following questions:

1. In what ways might the goals and initiatives in the draft strategic plan impact you?
2. What would you like the College to consider as we plan to take action on this draft strategic plan? 

Using eDNA To Support Freshwater Fish Monitoring

By Morgan Hocking, Senior Environmental Scientist, Ecofish Research Ltd., RPBio #2752
Adam Lewis, President, Ecofish Research Ltd., RPBio #494

DETERMINING THE DISTRIBUTION and abundance of species provides an essential input to sustainable resource decision making by federal, provincial, municipal and First Nations governments in Canada. However, consistent species detection can be challenging and has drawbacks related to cost, invasive survey methods, worker safety and sometimes data quality.

An emerging method in aquatic resource management involves the detection of aquatic species through the collection of water samples and the subsequent extraction of environmental DNA (eDNA) that has been shed to the environment (Picture 1). The eDNA material is filtered from the water and identified in a genetics laboratory using a taxonomic-specific DNA assay. Although the eDNA method has only recently been introduced, it has already proven its value in various applications, such as determining invasive species (Darling and Mahon 2011), locating rare and endangered species (Thomsen et al. 2012), and in assessing community composition (Kelly et al. 2014). eDNA methods have also begun to be used to estimate freshwater fish biomass (Takahara et al. 2012) and for determining presence of stream salmonids (McKelvey et al. 2016; Wilcox et al. 2016). There is therefore tremendous potential for the application of the eDNA methodology to augment current methodologies such as electrofishing, night snorkeling, and bank walks for monitoring freshwater fish in British Columbia.

Despite the promise of the eDNA application, there are several areas where additional research is required to prove its utility in fish community monitoring: 1) species-specific eDNA assay development for priority fish species, 2) the refinement and standardization of field sampling protocols for fish eDNA, and 3) field and experimental validation of the methods, including tests of the fish biomass threshold for consistent fish eDNA detection and the influence of environmental variables such as stream flow, water temperature, and water chemistry on fish eDNA detection.

Ecofish Research Ltd. (Ecofish) is partnering with the Dr. Caren Helbing lab web.uvic.ca/~chelbing/ at the University of Victoria to support development of eDNA as a tool for monitoring freshwater fish in BC. We have recently been awarded a Collaborative Research and Development Grant (CRD) from the Natural Sciences and Engineering Research Council of Canada (NSERC) to support this eDNA research collaboration. Dr. Helbing uses a novel design that features quantitative real-time polymerase chain reaction (qPCR) eDNA processing (Veldhoen et al. 2016). A part of the CRD collaboration also involves species-specific DNA assay development for several priority fish species, including Bull Trout, Dolly Varden, Cutthroat Trout, Rainbow Trout, Coho Salmon, and Eulachon. Assay development for Bull Trout and Dolly Varden is underway, while assays for the remaining species have now been designed and can begin to be used for fish eDNA detection.

However, before eDNA can be fully adopted by managers and agencies, significant field validation of the eDNA methods are required. For example, what is the threshold fish biomass for consistent eDNA detection? How should fish eDNA data be interpreted in moving water when the signal could be derived from further upstream? Can eDNA data be used to approximate fish biomass? Ecofish conducts traditional sampling for salmonids, eulachon and other fish species in numerous streams in BC and maintains an integrated database of fish distribution, abundance and body size as well as data related to sampled stream habitats such as flow, water quality, and spawning habitat. Ecofish and UVic are working together within the CRD to pair fish biomass and stream habitat data with eDNA sample collection at a number of sites so that we can begin to address these important limits to current interpretation.


A final tip for working with eDNA data is that the results can be influenced by the methods used for data collection. For example, eDNA detection can be influenced by equipment contamination, filtering method, volume of water filtered and preservation method (among others) and therefore



Picture 1: Water samples for eDNA fish species detection from an Ecofish study stream

it is essential to standardize and measure all aspects of the collection procedure. Protocols should also provide information related to the experimental design of data collection, such as the number of replicates per site and stream location and the environmental data required to be collected. Ecofish and UVic are working together to help solve these and other issues and contribute to the development of standardized field protocols for eDNA sample collection (e.g., Hobbs and Goldberg 2017).

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eDNA—Seeing the Unseen

By Jared Hobbs, RPBio #1324, Senior Technical Expert, Hemmera, and Caren C. Helbing, PhD, University of Victoria

ENVIRONMENTAL DNA (eDNA) methods are based on the premise that living species continually shed genetic material into their environment. Sampling for eDNA allows for the detection of difficult-to-find species without physically disturbing or visually observing them during a survey. The term “eDNA” is commonly used in reference to sampling methods that integrate testing for eDNA in samples collected from natural environments. These methods were first applied in France in 2008 (Ficetola et al. 2008). Now, over a decade later, application of eDNA methods continues to grow exponentially in North America and Europe with hundreds of published studies available in the literature (Herder et al. 2014).

ALTHOUGH IT HAS been successfully applied in terrestrial ecosystems (e.g., sharp-tailed snakes on Saltspring Island, BC (Laura Matthias, pers. comm.)), the use of eDNA methods is particularly advantageous in aquatic systems as DNA is transported from the source (organism) throughout the aquatic environment affording broader detection relative to conventional methods (e.g., physical search methods such as electrofishing, or time constrained surveys for amphibious taxa). This affords scientists an advantage as DNA from the focal taxa is temporarily suspended in the water column and can be easily sampled. eDNA methods are now widely accepted for detecting inconspicuous (aquatic and semi-aquatic) species with secretive ecologies, particularly for species with discontinuous distributions or species that occur in low population abundance. In addition, eDNA methods confer several notable, practical advantages:

Improved cost-effectiveness relative to conventional methods. Conventional methods require repeated sampling to match the detection rate afforded by a single brief sample using eDNA methods

- > Less invasive than conventional methods with reduced/eliminated risk of pathogen transfer

- > Reduced observer bias (i.e., errors associated with differing levels of observer experience) and reduced bias associated with survey effort (i.e., inconsistent application of sample effort)
- > Simultaneous rapid survey of multiple species, and archived samples can be retroactively analyzed for additional species
- > No permits required (no requirement to handle target taxa)
- > Survey is feasible during relatively broader timing periods

Despite these advantages, eDNA information also has some limitations. eDNA cannot provide precise information on abundance and density of target taxa, nor can it furnish precise detail on the duration, frequency, and physical proximity of species use in an area, since eDNA can be transported or may persist in an aquatic environment for a short period of time (7 – 58 days) after an organism has left the area (Dejean 2011, Jerde 2011)¹. Despite their limitations, researchers should not overlook the considerable advantages of eDNA methods for “presence/not-detected” surveys of aquatic and semi-aquatic taxa. Perhaps due to decades-old familiarity, some researchers dismiss eDNA methods without examining the inherent limitations of conventional methods. When scrutinized, conventional methods often have a far greater false negative rate. Mark-recapture studies in published literature showed detection probabilities varied between 2% to 31% (Lyon et al. 2014); by contrast a review of detection probabilities using eDNA methods on fish demonstrate detection probabilities are typically greater than 90% (Herder et al. 2014). It seems prudent to consider new methods as they evolve if they afford greater rigour and better control of Type 1 and Type 2 errors.

¹ Persistence time varies as degradation rates are heavily influenced by temperature and UV exposure.





Figure 1:
Rocky Mountain tailed frog

For example, when applied to tailed frog surveys, eDNA methods yielded a ten-fold higher detection rate relative to conventional methods (Hobbs et al. 2018 (submitted)). In a five-year study on Rocky Mountain tailed frog (Figure 1), we detected 16 new occurrences in just 17 field days (Hobbs and Adams 2016). For context it took eight years of demanding physical searches using time-constrained search methods at 713 sites to document extant occurrences of Rocky Mountain tailed frog in 19 reaches (Hobbs et al. 2015, Hobbs and Adams 2016, 2017). Legal conservation designations (Wildlife Habitat Areas) are now being established on the merits of eDNA detections alone —this demonstrates a high level of support from biologists within the BC government.

Uptake of eDNA methods in applied practice by QEPs has overcome some key challenges that are often associated with paradigm shifting ideologies; however, there remain some key challenges in the path to progress. In that context, adoption of these methods in BC is slowed by faulty applications that may ‘poison the well’. Solutions that promise instantaneous (in-field) results that fail to incorporate valuable, more rigorous lab practices should be examined closely. Lab-based methods also need to adopt practices that ensure rigorous development and validation of eDNA lab ‘tests’ (primers and probe sets used to test for presence of a species’ DNA). Sample testing must incorporate strong controls for sample inhibition as well as degradation and must consider binomial

error rates to ensure adequacy in the number of technical replicates conducted on each sample.² Finally, practitioners need to seek formal training to learn from available collective knowledge to avoid introducing methodological errors during study design and implementation.³ Standardization during implementation is encouraged during all aspects of an eDNA study, including design, field implementation/collection, lab testing, interpretation and reporting.⁴

To date, eDNA studies focused on methodological advancement, in conjunction with conservation-oriented objectives, have been funded by BC Ministry of Environment and Climate Change, Forests, Lands, Natural Resource Operations and Rural Development, Canadian Wildlife Service, Interdepartmental Recovery Fund, Fish and Wildlife Compensation Program, Habitat Conservation Trust Fund, National Research Council-Industrial Research Assistance Program, BC Innovation Council, Maxxam Analytics, Ecofish and Hemmera Envirochem. Project proponents, working in conjunction with dozens of QEPs from several companies, have also funded and adopted eDNA studies to more efficiently ascertain accurate information for management of aquatic and semi-aquatic species. Their collective support and input have served to rapidly advance development of eDNA methods, and generate valuable proof-of-concept data in BC, Alberta and Yukon.

Continued on page 24

² For example, Veldhoen et al. (2016) recommends conducting eight technical runs per sample and testing each sample for plant/algae (common in natural aquatic systems) DNA to confirm sample viability before testing for target taxa; this controls for degradation and inhibition to reduce false-negative error rates.

³ eDNA methods training is available through Natural Resources Training Group— eDNA Course

⁴ Hobbs and Goldberg (2017), with contributions from Helbing have authored a provincial standard for the BC Ministry of Environment to guide appropriate collection methods of aquatic eDNA samples.

Right to Practice Legislation FAQ

1. What is included in the new legislation?

- > New requirements for a merit-based process to run for Council
- > Increased public representation required on Councils
- > Right to Practice for applied biology professionals
- > Bylaws in the public interest can be changed without going to referendum (i.e. Bylaws around ***Code of Ethics***, Practice Standards, Fees, and CPD)
- > New office will provide oversight on governance issues (not practice)
- > Additional provisions regarding *Code of Ethics*
- > New provision to regulate firms and businesses
- > Standardized structure will be required for Council and Committees across natural resource regulators

For more details, see the press release and backgrounders prepared by the provincial government.

2. When does the new bill come into effect? The legislation was introduced in the provincial legislature on October 22, 2018 and was passed in the fall 2018. Not all provisions will come into effect at proclamation—many, such as Right to Practice, will come into effect with a regulation at a later point. Government anticipates that the new governance regime will be fully implemented within 5 years.

3. Does the new Act mean the College is losing its authority?

No. The College will maintain its existing authority over all statutory obligations including Credentials, Audit & Practice Review programs, and Discipline. While the new Act may bring some shifts for consistency between regulatory associations, the College's programs remain intact.

4. Is the new Act a result of deficiencies found in College procedures? No. The government did not identify any deficiencies in the College's statutory policies and procedures based on the government audit conducted in fall 2017. One area for improvement was noted to be Practice Review and the College is currently developing a Practice Review program to be implemented in 2019.

5. I am currently a College member, how will Right to Practice affect me? If you are already a College member, your membership status will not change.

6. I am interested in becoming a College member but I don't have the required courses and I don't want to go back to school. What are my options? The College is currently working on developing new pathways for people practicing applied biology to come into compliance with the new legislation by becoming regulated under the College.

7. I have worked as a Biologist for many years, why do I need to join the College now? Once the new regulation comes into effect, you will be legally required to be a member of the College to practice applied biology in BC.

8. Does Right to Practice mean I can't work as a biologist unless I am a College registrant? Like the medical and health care professions, you will be required to become a registrant of the College to practice applied biology in BC.


9. Does Right to Practice legislation apply outside of BC? No, the new legislation and Right to Practice only apply to professionals working in BC. If you live outside of BC, you must be a registrant of the College if you wish to conduct work in applied biology in BC.

10. Will Right to Practice come into effect immediately?

No. Registrants, non-member practicing biologists, and the public at large will be consulted on Right to Practice. The College will work with government to establish a reasonable time frame for the Right to Practice regulation to come into effect. Government has launched a consultation process and registrants were notified.

11. If I live and practice outside of BC, how will this new legislation affect me? If you are a College member, you will still have the same rights and obligations that you had prior to the Act coming into effect. Your status with the College will not change and you still have the benefits of being part of a regulated body of professionals.

BEST PRACTICES

- 12. Has the College communicated with members on the Professional Reliance Review process and on Right to Practice?** Yes, the College has been communicating with members regularly since the government initiated the Professional Reliance Review in 2017. Updates were provided to members through several mechanisms including *College Connections*, *College Notice*, and *College Matters*. All updates were also posted to a webpage accessible from the College's main website. In addition, professional reliance was the theme of the College's 2018 annual conference. Right to Practice has been consistently communicated as one of the tenets of the College's position to protect the public interest, refer to the College's position paper submitted to government in December 2017.
- 13. What are the benefits of Right to Practice?** The benefit of having Right to Practice is the recognition that everyone working as a professional will have the same level of oversight. Right to Practice is an important step in the evolution of the profession of applied biology. In addition, because only registered professionals will have right to practice, the public can be assured that practitioners are meeting high standards thereby enhancing public trust.
- 14. Other than Right to Practice, what other changes will have the potential to impact the College and its members?** There are other potentially important changes that will modify some of the College's governance policies and procedures such as implementing a more structured merit-based process to help determine who runs for Council, changes to statutory committees to bring them in line with other regulators, and the regulation of firms. The College has already initiated a review of its current governance **Rules** and policies to identify what may need to change to align with the new *Act*. The College will work with government and other regulators to determine a reasonable time frame for these changes to take effect.
- 15. What happens when the College of Applied Biology Act is repealed?** The College will conduct policy analyses and will do a full legal review of any proposed legislation. Communicating with members and the public will be a priority. The **Act** will stay in place until the new statute comes into effect. Then the *Act* will be replaced by new regulations under the larger statute. Government anticipates that the new governance regime will be fully implemented within 5 years.
- 16. Will other regulated professionals now have Right to Practice too?** Foresters and engineers in BC already have Right to Practice. Under this new regulation, professional agrologists and applied science technologists will also be granted Right to Practice.
- 17. Will the College increase annual dues as a result of the new legislation?** The College will need to assess the situation. This will depend on several factors, including the additional functions required by the new legislation and the staff capacity needs of the College.
- 18. What activities will be considered "applied biology"?** The College has initiated a Task Force to look at Scope of Practice for applied biology in order to define the types of work and activities that fall within this field. Members of the Task Force include Council members with a range of professional experience in applied biology. As part of this Task Force, the College will be engaging with registrants for input in 2019.
- 19. How can I provide my input?** The government posted an ***Intentions Paper*** on the new legislation on October 31. Feedback on specific aspects of the legislation will be collected until March 4, 2019 at 4pm. In addition, you can ***contact the College office*** anytime if you have specific comments or questions (see Question 17).
- 20. Who can I contact if I have more questions?** For questions about the new *Act*, please call or email Christine Houghton, Executive Director at ***ExecutiveDirector@cab-bc.org*** (250) 383-3306 ext 1. For questions about credential requirements to the College, please contact Derek Marcoux, Registrar at (250) 383-3306 ext 2 ***Registrar@cab-bc.org***. 

New Registered Professional Biologists (RPBio)

Kylie Anderson	3089
Katharina Batchelar	3103
Shannen Beckinsale	3086
Tyson Berkenstock	3091
Alejandro Borjas	3106
Andrea Buckman	3098
Demitria Burgoon	3099
Holly Clermont	3095
Daniel Coulton	3082
Bruna Cruz	3094
Heidi Currier	3096
Daniel Denesiuk	3092
Joanna Deunk	3085
Hossameldin Elalkamy	3102
Trevor Friesen	3081
Jennifer Ings	3080
Maryam Khoshnoodi	3075
Rebecca Martone	3077
Daniel Moats	3104
Jorgelina Muscatello	3101
Brent Piche	3079
Jayaprabandh Pudota	3078
Tyler Ray	3084
Rebecca Rozander	3090
John Sherrin	3093
Kilian Stehfest	3088
Anne Sutherland	3100
Spencer Taft	3105
Brett van Poorten	3087
David Vey	3097
Amy Wiebe	3083
Tashana Winnicky	3076

New Enrolled Biologists In Training (BIT)

Charlotte Adamson	1105
Kimberly Armour	1099
Amina Chawalla	1095
Mario Cottone	1096
Sean Engelking	1092
Gladys Estrella-Guemez	1101
Brittany Huber	1100
Matthew Jones	1102
Mitchell Kloppenburg	1103
Janice Kwo	1094
Gina Le Bel	1098

Stephen Maley	1106
Kathleen McMahan	1090
Rachel Myers	1097
Stewart Pearce	1104
Matt Robinson	1093

New Registered Biology Technologists (RBTech)

Claude Cartelier	112
Nicole Lavoie	110
Hannah Nieman	111

New Enrolled Technologists In Training (Trainee(RBTech))

Gabriel Garcia	65
Dave Muhlert	66
Miranda O'Hanley	68

New Student Biologists

Sammy Al-Khalifa	248
Kahlen Dofher	252
Samantha Fuller	247
Blaire Smith	251
Alexandras Terrick	250

Recently Returned (Re-instated) Members

<i>RPBio</i>	
Melissa Collier	2120
Carly Foster	2766
Michael Simpson	2074
Patricia Swan	2200

Recently Retired Members

<i>RPBio</i>	
Terrence Antoniuk	1029
William Golding	1466
Jackie Porteous	2584

New On Leave Members

<i>BIT</i>	
Hajar Courteau	666
Suzanne Hopkinson	711
Kara Przewczek	702

<i>RBTech</i>	
Kristi Inman	101
<i>RPBio</i>	
Isaac Anderton	1787
Mariah Arnold	2966
Lise Galand	2516
Andrea Gielens	2451
Susan Latimer	403

Recently Resigned Members (since August 2018)

<i>BIT</i>	
Lori-Ann Etchart	922
Ayase Grant	733
Katryna Montgomery	892
Rebecca Seifert	718

<i>RPBio</i>	
Douglas Burles	1681
Greg George	1331
Sharon Jeffery	2844
Naomi Nichol	2828
Gerald Oliver	133
Dale Seip	473
Victoria Stevens	374

<i>RPBio (Ret)</i>	
Gary Taccogna	789

<i>Trainee (RBTech)</i>	
Lena Ware	21

Recently Removed Members (since October 2018)

<i>RPBio</i>	
Clayton Brenton	1636

MEMBER PROFILES



Member Danny Catt, MSc, RPBio #653

What inspired you to pursue a career in applied biology?

I have had the very good fortune, in both high school and at the post-secondary level, to have had outstanding teachers: Adriane Carr at Langara, Mark Angelo at BCIT, and Alton Harestad at SFU are just a few examples. They inspired me not only by their teaching, but by what they were doing to make the province, and the world, a better place. My dream as a boy was to work in parks, and after my first year studying at BCIT I got a seasonal job as a naturalist for Parks Canada. My career in Kootenay National Park (KNP) spanned a dozen years and gave me a range of experiences. KNP was also the field location for my graduate research. I was offered the opportunity to teach at BCIT while a grad student and realized it was something I loved doing. That was almost 30 years ago.

Could you describe your role as an instructor at BCIT? How else do you apply your expertise?

There is so much that I love about my role as an instructor at BCIT. Every day is different. Every year new students join our program and they bring diverse backgrounds, experiences, passion, and energy. They inspire me and challenge me. I quickly learned that if you want to teach, you need to learn, so I am always learning!

On a regular basis, we are out in the field connecting our students with the real world. In many cases, the natural resource staff from government and industry that we connect with are graduates of the ***Fish, Wildlife & Recreation (FWR)*** program. Grads are fisheries officers, conservation officers, park rangers, wildlife or fisheries technologists or biologists, environmental consultants, and the list goes on. Seeing graduates following their passions and finding employment in the areas of fisheries, wildlife, and parks is undoubtedly one of my favorite parts of the job.

When I'm not teaching, I am able to follow personal interests that are external to academia. I work with adventure travel and eco-tourism companies in BC and other parts of Canada. Through the trips I do, with clients from all over the world, I can connect with a whole different audience. I am then able to take these experiences from the Arctic, the BC Coast, or the Serengeti back to the classroom. This is also something that makes my role fulfilling.

“As professional biologists, we all need to ensure we meet our CPD requirements. Attend conferences. Meet and engage with natural resource biologists...and volunteer if you have the time.”

How has the RPBio designation benefited you in your career?


The RPBio designation has been valuable to me throughout my career. Some jobs that I have applied for have required it. The RPBio designation also provides credibility to the profession and to my background in the field of biology.

And, truth be told, the RPBio designation does push us up one step on the salary scale at BCIT.

What advice do you have for other members who are beginning their careers as professional biologists or seeking profession development?

I have a few thoughts to share with fellow members in the academic sector. Connect your students with biologists working in the field. Get outside. This is one of the ways that FWR faculty keep up to date on technology, issues, government initiatives, and industry trends. As professional biologists, we all need to ensure we meet our CPD requirements. Attend conferences. Meet and engage with natural resource biologists. Take courses to keep your skills current and volunteer if you have the time. I had the great pleasure of volunteering with BC Parks this past summer, and I learned so much.

Another way to get CPD credit is to volunteer with groups like the Scientists and Innovators in the Schools program (SIS for short) coordinated by Science World. In a week or so, I will be with a grade 6 class in Vancouver as a visiting scientist organized by SIS – great fun! Community organizations, like the Stanley Park Ecology Society (SPES), the Alouette River Management Society (ARMS), and many others, are always looking for volunteers with backgrounds in applied biology.

No matter which path one chooses, my advice would be the same. Follow your passions. Most of us choose a career in applied biology because we have an interest in, or love of, the natural world. Engage the community – volunteer with SIS and moreover, volunteer in general. Always remember that the planet is what we are working for -- and what keeps us alive. We need to protect it. 


The Editorial Board is seeking content for upcoming editions of *College Matters* and the *College Connections* e-newsletter.

>> Do you know someone who should be profiled in the Members section of *College Matters*?

>> Are you doing great field work that you want our registrants to read about in the Features section of *College Matters*?

>> Do you have photos of wildlife or natural environments that you think would look great in *College Matters* or *College Connections*?

If your answer to any of these questions is yes, we want to hear from you! Email the Communications Coordinator at ea-comm@cab-bc.org to tell us what you have to share. The Editorial Board is appreciative of all submissions and will use best judgement in terms of editing content for length, appropriateness and placement in publications.

Note that supplying the Editorial Board with any content, and particularly photos, is assumed to grant release of this property for use in the College of Applied Biology's publications, including College Matters, College Connections, College Notice, any of the College's social media channels, and any future publications which are designed and published in whole or in part by the College of Applied Biology. 



Member Sue MacDonald RPBio #1674

Photo Credit: H. Davis

What led you to consider applied biology as a career?

Fresh out of high school, environmentally-minded and loving animals I decided to enrol in university intending to get a BSc in biology and to continue to veterinary school. A job working at a vet clinic dissuaded me of that notion and some keen young professors in plant/forest biology at the University of Victoria encouraged an interest in plants as well as animals. I took a wide variety of biology courses leading to a general BSc in Biology.

What compelled you to work in the forestry sector?

I had never even considered the forest industry for a career. I didn't know a lot about it and was, in fact, somewhat opposed to it (yes, I attended logging protests). I spent the first two years out of university not able to find biology work and wondering if I should consider a career change. I found myself working in a retail plant nursery and as a naturalist and park maintenance person in a provincial campground. The first job I found doing biology work was for a small independent biological consulting company working in the forest industry on Northern Vancouver Island. I loved the work -- outside in the forest learning about owls, plants, and woodpeckers. Plus, I was learning how to drive a 4x4, pull a chain, use a prism, and was

getting an inside view of the forest industry. It was exciting and I didn't look back.

What does your job entail and what is your favorite aspect of your role?

At Western Forest Products I have a diverse job. I work with operational staff to ensure legal and stewardship commitments are met. I coordinate and deliver species at risk training and help create systems and processes to encourage and enable the management of wildlife, wildlife features, and habitat. I assist the forest managers and answer questions on how to manage around species at risk, wildlife features, or habitat that they find or work around in the field. I work with government and other stakeholders to develop spatial reserves such as ungulate winter range and old growth management areas. I create and maintain the spatial and non-spatial wildlife data, ensuring wildlife habitat areas are accurately mapped and that the information is accessible. I coordinate our habitat identification and monitoring programs – for example, marbled murrelet habitat low-level aerial surveys, goshawk surveys, owl monitoring – and get some amazing days in the field!

I am a generalist and enjoy learning new things. There is always the opportunity to learn something new: a new species to manage, a new way of managing, legal policy to interpret and bring to the ground, new technology for collecting and maintaining data. I also get to interact with a wide variety

of people from forest managers and loggers to the public, scientists, consultants, First Nations, and more. It's always interesting (and sometimes challenging) getting to meet and work with people of different backgrounds and perspectives.

How has the RPBio designation benefited you in your career?

The RPBio designation got me to where I am today. While I loved being in the field, I wanted to be home more and took a GIS job. I enjoy GIS work, and use it a lot in my daily job now, but sitting at a desk doing it full time was not for me. During the two years I was working as a GIS technician I received my RPBio designation. I was working for Western Forest Products and when they heard I was an RPBio they asked if I would like to start doing some biology work as well. This was a perfect opportunity to combine two jobs that I enjoyed doing. I do believe I wouldn't have been given the opportunity if I had not received my RPBio designation.

What advice do you have for young members beginning their careers as professional biologists who may want to break into your industry sector?

Be open and honest, ask questions. Don't be afraid to explore new opportunities and go in unexpected directions. Take the opportunity to learn new things, it's an exciting career as things are constantly changing!

If you have the opportunity, learn some GIS and other technology skills and explore learning some communication skills.

Learn about forestry field and management work, it's easier to influence a decision when you recognize the issues or

challenges someone faces in their job and you approach it with some understanding.


Listen to others and have respect for all sides of the issue. People are interesting and everyone has a reason and story for their view -- and it's not always what you think. We can all learn a lot from listening to those we least expect to gain something from. People often surprise me! 



Photo Credit - E. McClaren

“ There is always the opportunity to learn something new: a new species to manage, a new way of managing, legal policy to interpret and bring to the ground...It's always interesting getting to meet and work with people of different backgrounds and perspectives. ”



In Memoriam: Brent Gurd, PhD, RPBio #2006

Photo Credit: Bert Brink


THE BRITISH COLUMBIA BIOLOGY COMMUNITY has recently lost a rigorous scientific thinker and strong conservation advocate in the passing of Dr. Brent Gurd.

Brent was born and raised in Toronto, and received both his BSc (1992) and MSc (1996) degrees in Biology at the University of Guelph. Subsequently he relocated to Vancouver, where he earned a Ph.D. at Simon Fraser University in 2005. Brent had a varied and rich professional career, including employment with the Ontario African Lion Safari, the Yukon government, the government of the Northwest Territories, Nature Canada, and most notably with the British Columbia Ministry of Forests, Lands, and Natural Resource Operations and Rural Development since 2008.

Brent's academic and professional experience resulted in significant scientific contributions to the fields of ecology and conservation, including numerous publications in high-profile journals. Areas of interest included: reserve design for conservation of mammals in eastern North America, expanding the theory of island biogeography, and his paradigm-shifting work on the feeding ecology and adaptive radiation of dabbling ducks.

During his time with the BC government, Brent finalized the establishment of the 1,000 hectare Lhá:It/Harrison-Chehalis Wildlife Management Area, led the establishment of the South Coast Conservation Land Management Program, and was the Principal Investigator studying the cause of marsh recession on Sturgeon and Robert Banks on the Fraser River Delta. Brent was also a trusted and highly-respected resource for the public and professional colleagues alike regarding wildlife management issues in relation to the Wildlife Act.

Brent was a “pure thinker” in that he applied the scientific process in a systematic and rigorous manner that was as objective as a biologist can be. He was constantly challenging assumptions and took nothing for granted, and in that way, significantly improved any research or management project he was a part of.

Brent had a quick wit and a kind heart, and will be missed by his professional colleagues across BC and Canada. Brent is survived by his wife Sandra Webster, and his two children Trevor and Lauren Gurd .



In Memoriam: Robert (Bob) Chapman, RPBio #1783


September 27, 1963–August 31, 2018

Editor's Note: From memorial service, solemnly reprinted with permission from Joanne Rushby.

BOB WILL BE GREATLY MISSED by mother Shirley Chapman of Grimsby Ontario, daughter Riley Chapman of Vancouver, BC, and Riley's mother, Joanne Rushby, Bob's partner for 28 years.

Bob was born and raised in Grimsby. He and Joanne moved to British Columbia in 1994. Bob attended Selkirk College and earned a diploma in Wildlife technology. He began working with RL&L Environmental Services Ltd. As a fish and wildlife technician in the mid 1990's. Bob's career advanced as he became a Registered Professional Biologist and took on many major projects as a crew leader. He later became a manager of the Castlegar office following RL&L's merging with Golder Associates Ltd. While with Golder, Bob became an Associate with the firm and was appointed manager of Golder's BC Biological Section. After his departure from the company in 2016, Bob continued to work as a private consultant until his passing. As a private consultant, Bob was able to return to the fieldwork that he enjoyed and at which he was exceptionally talented.

Bob was an avid curler and golfer, and an active member of the Castlegar Rotary Club. Bob loved the outdoors and enjoyed paddling, cross-country skiing, snowshoeing, and hiking with his dogs and many friends. He was an avid birder and enjoyed bird watching trips and owl surveys, particularly with his daughter Riley when she was young.

Bob has many friends in Castlegar and within Golder Associates, where he contributed much of his career to mentoring staff across British Columbia. His sense of humour, social skills, and his ability to teach and learn while having fun will be missed by all who knew him. 



COVER PHOTO:

Photo by Cliff Nietvelt, RPBio, Great Horned Owl in Squamish Valley,
Graphic design template by Rocketday Arts

eDNA—Seeing the Unseen

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