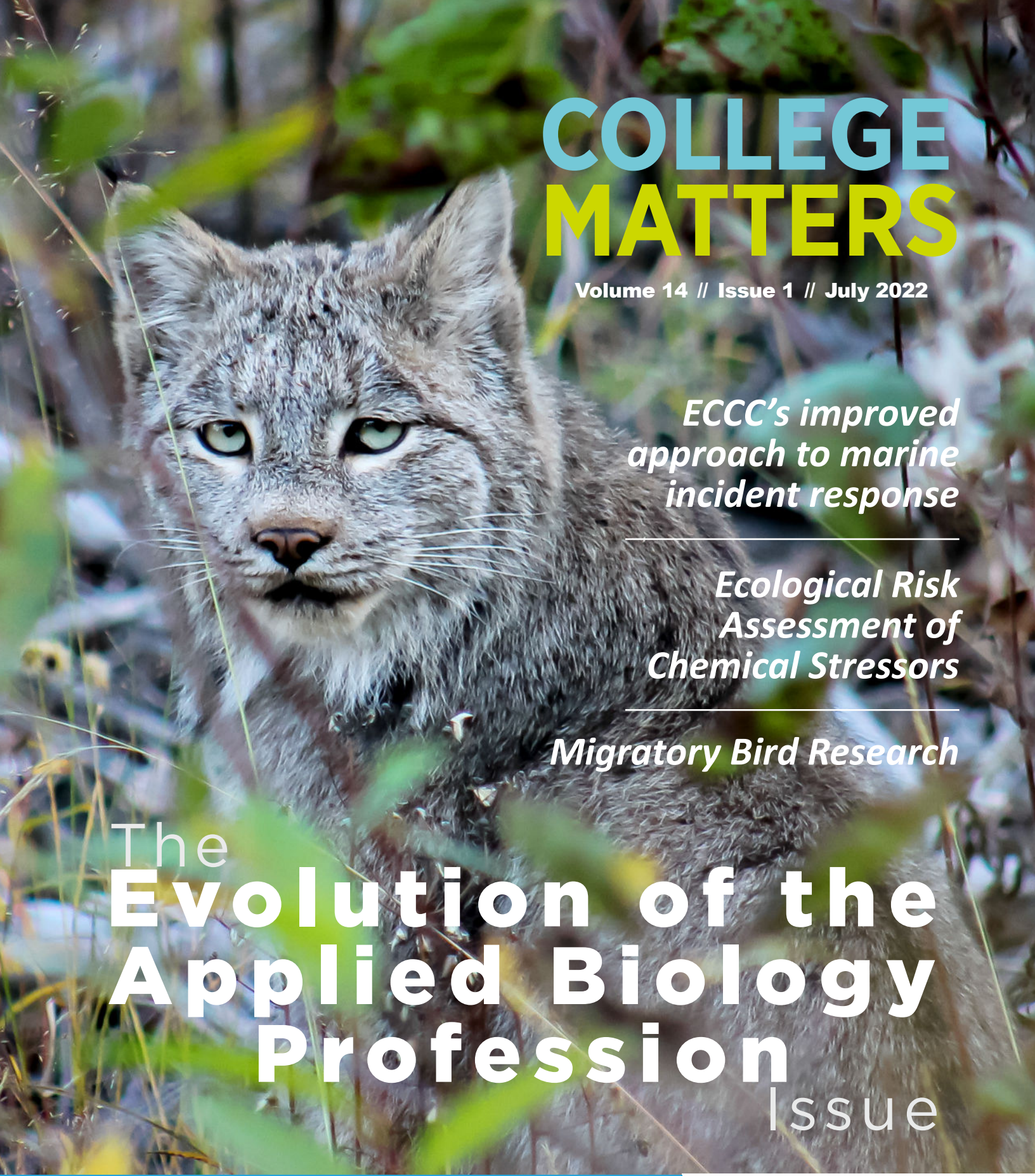


COLLEGE MATTERS

Volume 14 // Issue 1 // July 2022

ECCC's improved approach to marine incident response

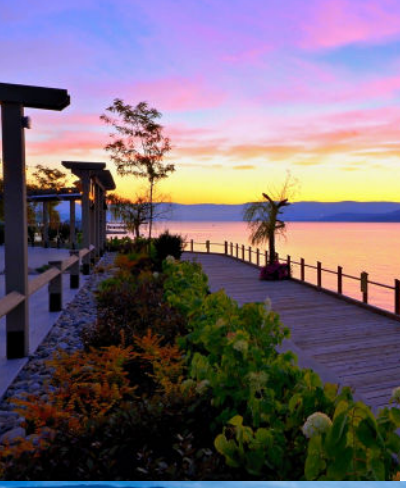
Ecological Risk Assessment of Chemical Stressors

Migratory Bird Research

The Evolution of the Applied Biology Profession Issue

We respect and acknowledge that the College's office and its registrants operate within the traditional territories of the Indigenous Peoples of BC.

COLLEGE OF APPLIED BIOLOGISTS
Professional Accountability



Save the dates!

2023 Conference & AGM in Kelowna, BC

The College's 2023 Conference will take place in Kelowna on April 13 & 14, 2023

MANTEO
ELDORADO RESORT

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***Disclaimer: the opinions expressed in *College Matters* do not necessarily represent those of the College, its Council, or other registrants.**

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ABOUT US

The College of Applied Biologists is the regulator of applied biology professionals in British Columbia. Established by government legislation in 2003, the College protects the public interest by ensuring that applied biology professionals—Registered Professional Biologists (RPBios), Registered Biology Technologists (RBTechs) and Applied Biology Technicians (ABTs)—meet rigorous standards of professional and ethical competency.

OUR VISION

Responsible resource management supported by accountable and trusted professionals.

Presidential Ponderings: Changes and Challenges

By Alexandra de Jong Westman, RPBio, President

IT IS SUCH an honour and a privilege to now serve as President of the College of Applied Biologists. I am excited for the 2022–2023 year, as it promises to be one of significant change—even beyond those changes we've already witnessed. These changes around us, be they social, technological, scientific, cultural or otherwise, require the College to navigate through increasingly complex landscapes that profoundly impact how applied biology professionals work and how we are regulated. This past year was a monumental shift for those practicing applied biology, when BC became the first jurisdiction to grant practice rights (reserved practice) to applied biology professionals. This not only provided current registrants with the formal acknowledgement of the critical role we play in managing the natural resources in BC, but also requires those not yet registered to seek registration with the College if practicing within the reserved practice scope in the ***Applied Biologists Regulation***. This is a massive step in furthering the College's ability to uphold the public interest.

> "The beauty of a living thing is not the atoms that go into it, but the way those atoms are put together."

I'd like to encourage all registrants to familiarize themselves with the ***Illustrative Documents*** in regards to reserved practice and to consider attending one of the ***College's webinars***.

I continue to be so thankful for our staff, Council and Committee members, who have been so involved in shaping those new landscapes. Because of those efforts, collaborative relationships have solidified with our partner regulatory bodies, which ensure we can face these new challenges and opportunities in a unified way. "The beauty of a living thing is not the atoms that go into it, but the way those atoms are put together." — Carl Sagan, *Cosmos* CM

The College's reserved practice outreach

As per the College's ***2022 reserved practice outreach plan***, the College has posted its full library of ***illustrative documents*** regarding reserved practice for applied biology.

The College will continue its outreach over the coming months by offering ***webinars*** throughout the summer of 2022 to inform registrants, employers and other stakeholders about the implementation of reserved practice and to answer questions about the process. The webinar content will primarily be the same for each session (although some elements made be added based on the results of previous sessions), so you won't need to attend every session:

August 3, 2022
August 10, 2022

Each session will offer you the opportunity to ask questions to staff and Council about reserved practice and the implications for practitioners, employers and the natural resource sector as a whole.

If you would like to schedule a meeting or information session with the College, please contact the College office at ***admin@cab-bc.org***.

Are we there yet?

By Chistine Houghton, Chief Executive Officer

"ARE WE THERE yet?" Anyone who has taken a trip with a small child or two has heard that refrain, and as we are now just a few weeks away from reserved practice coming into force for applied biology professionals, it is echoing (albeit silently) throughout the College of Applied Biologists.

Recognizing that the journey started back in the 1980s, this latest leg in evolving the professional governance of applied biology was initiated in October 2017 with the Professional Reliance Review. The College Council quickly recognized that, despite the extra workload that was coming, there was a real opportunity to better protect the public by enshrining practice rights (now reserved practice) into legislation.

It was recognized that it was critically important to have a flexible, innovative and inclusive process to develop the legal definition of reserved practice of applied biology, and to be transparent all the way along the road in communicating with all resource management practitioners—not just College registrants. It was also recognized that if the purpose of reserved practice was to better protect the public interest, then it was equally important to remove barriers to registration with the College while maintaining the standards and rigour in the credentialing process.

The objectives of maintaining standards and rigour, and removing barriers—seemingly contradictory objectives—were very big assignments. To start the work, the College established a Task Force in November of 2018 with a mandate to:

- review existing credentialing requirements for all categories with respect to implementation of reserved practice,
- better define scopes of practice for existing designations of applied biology professionals,
- develop options for pathways for existing non-registrants that have significant experience in applied biology, yet may not meet the full credentialing requirements, and
- develop options to consider regarding implementation of a limited license designation as a professional category.

"The objectives of maintaining standards and rigour, and removing barriers—seemingly contradictory objectives—were very big assignments."

Since then, there has been a lot of work done to accomplish these goals—not just by the first Task Force but by other Task Forces, Committees and staff that have tackled different aspects of this challenge. The results speak for themselves:

- Academic standards have been reviewed and evaluated, which has resulted in an update to course requirements that more clearly support the professional competencies that are best positioned to facilitate applied biology practitioners to protect the public interest in their work.
- For the Registered Professional Biologist (RPBio) designation, additional pathways were developed and approved by Council that recognize graduate, postgraduate and work experience through different streams.

- For the Registered Biology Technologist (RBTech) designation and the Applied Biology Technician (ABT) designation, clearer definitions of their scopes of practice were developed.

- An Applied Biology-Limited License (AB-LL) designation was created, which will allow practitioners who can demonstrate their competency in a specific area to become registrants and continue to practice as accountable resource professionals.

The College can be rightfully proud of the work it has done to get us to this moment in time. The many volunteers—whether on Council, committees or task forces—have put in countless hours of time, energy and expertise, which have been invaluable in getting the profession to this historic moment.

We are nearly at the point in time where British Columbia will become the first jurisdiction in the world to recognize applied biology as a profession that requires practitioners that have specific academic training, definable and measurable competencies, and are committed to adhering to ethical and continuing education standards. That is certainly an important milestone on the journey—but even on September 1st, we will not yet be all the way "there."

That is not to say that we have not come a long way in the journey. The idea championed by the founding members of what was to become the College of Applied Biology (now Biologists) has evolved into a mature, innovative and accountable professional regulator, and reserved practice is a huge achievement and an important next step in the evolution of the profession and of the College as a professional regulator. We need to take the time to celebrate that achievement, and after we have celebrated this accomplishment, we need to get back to work. CM

"The College can be rightfully proud of the work it has done to get us to this moment in time."

Pacific dogwood in bloom. Photo by Randy Bjorklund - Shutterstock.

College Introduces Indigenous Awareness Course

By College Staff

The course will meet requirements established in the *Professional Governance Act* to support reconciliation with Indigenous Peoples in British Columbia.

The College's mandatory training course in Indigenous Awareness is available for registrants to complete as of May 3, 2022. Registrants must also complete the new Code of Ethics and Professional Conduct course, which is also now available on the ***College's portal***.

All registrants will be required to take both courses over the next two and a half years. Registrants can voluntarily take the course at any time; however, to ensure that all registrants complete this mandatory training, they will be selected randomly beginning in July 2022 to complete the training in three different groups over the two- and a half-year period. If you are selected to complete the mandatory training courses, you will need to complete the courses in order to renew your registration.

> "If you are selected to complete the mandatory training courses, you will need to complete the courses in order to renew your registration."

The Indigenous Awareness course was developed by Indigenous Corporate Training and selected by the College's Mandatory Training Task Force. The Council convened the Task Force to provide recommendations on course material and, having identified topic areas for inclusion in the training, the Task Force recommended Indigenous Corporate Training's Indigenous Awareness course as the foundational training for registrants.

The course covers topics such as:

- Indigenous cultures in North and South America before arrival of Europeans
- The Royal Proclamation of October 1763
- The *British North America Act* and the *Indian Act*
- The Sixties Scoop
- The *Constitution Act* and Delgamuukw decision

Council has determined that the course is mandatory for all registrants to be in compliance with both the *Professional Governance Act* and the *BC Declaration on the Rights of Indigenous Peoples Act*. As of April 2022, all new applicants to the College must complete the Indigenous Awareness course as a condition of registration. Applicants must also complete the new Code of Ethics and Professional Conduct. CM

Frequently Asked Questions

Q **Why does the College have a mandatory course on Indigenous Awareness?**

A Under the *Professional Governance Act* (PGA), the College must establish requirements that support reconciliation with Indigenous Peoples in British Columbia (Act sec. 57 (1) (f)).

The mandatory training course will ensure that all applied biology professionals have a baseline level of training. (Continues on next page.)

Frequently Asked Questions (continues from previous page)

As applied biology professionals frequently collaborate and engage with Indigenous businesses, communities and governments, it is vital for practitioners to promote strong relationships and work towards reconciliation with Indigenous Peoples in compliance with the PGA and the *BC Declaration on the Rights of Indigenous Peoples Act*.

Q **Can I take the Indigenous Awareness course before July 2022 or before I'm selected?**

A Yes, you can. The course is available as of May 2022, and registrants may voluntarily complete the Indigenous Awareness and the updated Code of Ethics and Professional Conduct courses at any time.

Q **I have already taken training courses covering Indigenous topics, do I have to take the Indigenous Awareness course through the College?**

A Yes, Council has determined that the course is mandatory for all registrants to be in compliance with both the *Professional Governance Act* and the *BC Declaration on the Rights of Indigenous Peoples Act*.

Introducing New College Staff

Mike Engelsjord joined the College in March 2022 as Director of Practice. He will be supporting the Audit and Practice Review Committee (APRC) and be responsible for the development and implementation of the College's Audit and Practice Review, Mandatory Training and Continuing Professional Development (CPD) programs, and professional standards and guidelines.

Mike has worked in the field of biology for more than 25 years; the last 22, with the Department of Fisheries and Oceans (DFO) on protection of fish and fish habitat and aquatic species at risk, environmental assessment, permits and authorizations, and consultation. Prior to that, he worked as a restoration biologist, environmental consultant, and research assistant. He became an RPBio in 1999. Working to support responsible use and protection of the environment, and stewardship of natural resources are at the core of his values.

Mike was born in BC and has lived and worked in the province for his entire life except for a couple of years travelling after university. In his free time, he enjoys being outdoors, gardening, cooking and reading a good book.

COLLEGE MATTERS

The Evolution of the Applied Biology Profession Issue

FEATURE ARTICLES

The Evolution of the Applied Biology Profession

By Shona Lawson, RPBio, MSc

IN 2003, THE College of Applied Biologists was given authority to regulate, grant and protect titles of applied biology professionals in BC under the C*ollege of Applied Biology Act*[1]. The College is now nearing its next phase as a regulator—reserved practice. On September 1, 2022, the College's Registered Biology Technologists (RBTechs), Registered Professional Biologists (RPBios) and Applied Biologist - Limited Licensees (AB-LLs) will be granted reserved practice under the *Professional Governance Act* and Applied Biologists Regulation.

However, it is not just the regulated profession that's seen an evolution, the education of practitioners and the practice itself have also experienced changes. Over the last decade or so a combination of factors, such as the implementation and amendments to environmental laws, regulations and policies, technological advancements, climate change, the use of natural resources and an increased local, national and global need, has brought the importance of the management, protection and conservation of natural resources to the forefront, not just here in BC but around the world.

This new approach has created a shift in the education and training of applied biology professionals away from more traditional educational curriculums, which focused on theory and life sciences, such as biology and chemistry, to broader more inclusive curriculums that include field courses, on-the-job training and a variety of applied sciences, such as geography, environmental science and natural resource management. Educational programs increasingly incorporate Indigenous Peoples and Traditional Knowledge. Now, more than ever, the options for education and training, such as co-op opportunities, field schools, online courses, on-the-job training, certificates and courses specific to conservation biology, are numerous. Shifts in education and training have been driven by an increased necessity for applied biology professionals with diverse skills and work experiences to work in a variety of professional roles from regulatory compliance to restoration to conservation.

Technological advancements, such as the use of drones, GIS and non-invasive techniques, have also changed the way natural resource data is being collected and managed. This improved ability to gather a variety of data in both accessible and remote, logistically hard-to-get-to areas—which can increase financial project costs too—permits the collection of data and information more frequently and in real time. Technological advancement has also increased our knowledge of natural resources, such as species and habitats distribution, food availability, migration routes and short- and long-term impacts to terrestrial and aquatic ecosystems, as well as the success of their management, as in the case of recovery and habitat restoration efforts.

> "It is not just the regulated profession that's seen an evolution, the education of practitioners and the practice itself have also experienced changes."

Most recently the COVID-19 pandemic, a zoonosis[2], coupled with extreme weather events over the same time period, have emphasized the importance of science, natural resources and their management, conservation and protection across the globe. Zoonosis and extreme weather events do not recognize borders and have far reaching impacts to basic life necessities, such as food supply, housing, jobs and health care. We will no doubt see the applied biology profession continue to evolve for a variety of reasons, including some we have yet to be aware of. Now is an exciting time to be a regulated applied biology professional, not just because of reserved practice but also because it's a profession that is constantly evolving, bringing new knowledge, skills and challenges. CM

1. Repealed Feb. 5, 2021, and replaced by the ***Professional Governance Act*** and ***Applied Biologists Regulation***.

2. Defined by the ***World Health Organization*** as any disease or infection that is naturally transmissible from vertebrate animals to humans.

The GAAP and Migratory Bird Research

By Guillermo Pérez, BNRSC, MSc
The GAAP Co-Founder and Program Co-Director

GROWING UP IN Chile, I always sensed that working in Nature was perceived as one of those dream careers, much like being an actor or a musician, but it needed a backup plan. So, to my delight, migrating to Canada in my late teens allowed me to see that working as a biologist was an accessible and culturally respectable career. This is a story about why biology matters to me and the evolution of my career as a biologist.

After 18 years of living, working and studying in Canada, obtaining a diploma in Forestry, a degree in Natural Resources Science and a master's in science (studying bird migration), I moved with my wife—a veterinarian whom I met in Canada—back to Chile in early 2009 to work together on the impacts of free-roaming domestic dogs on people, the environment and animals, under Veterinarians Without Borders Canada. Much to our surprise, this opened the flood gates to a world full of complexities because this issue was deeply intertwined with the social, medical and environmental sciences, including biology. As an evolution of all this work, and in an effort to determine the best approach to creating long-lasting change, in 2014 my wife and I founded our own not-for-profit organization in Chile, ***The Global Alliance for Animals and People (The GAAP)***, under the mission of "connecting humans, animals, and the environment to create a healthier and more sustainable world in the Americas."

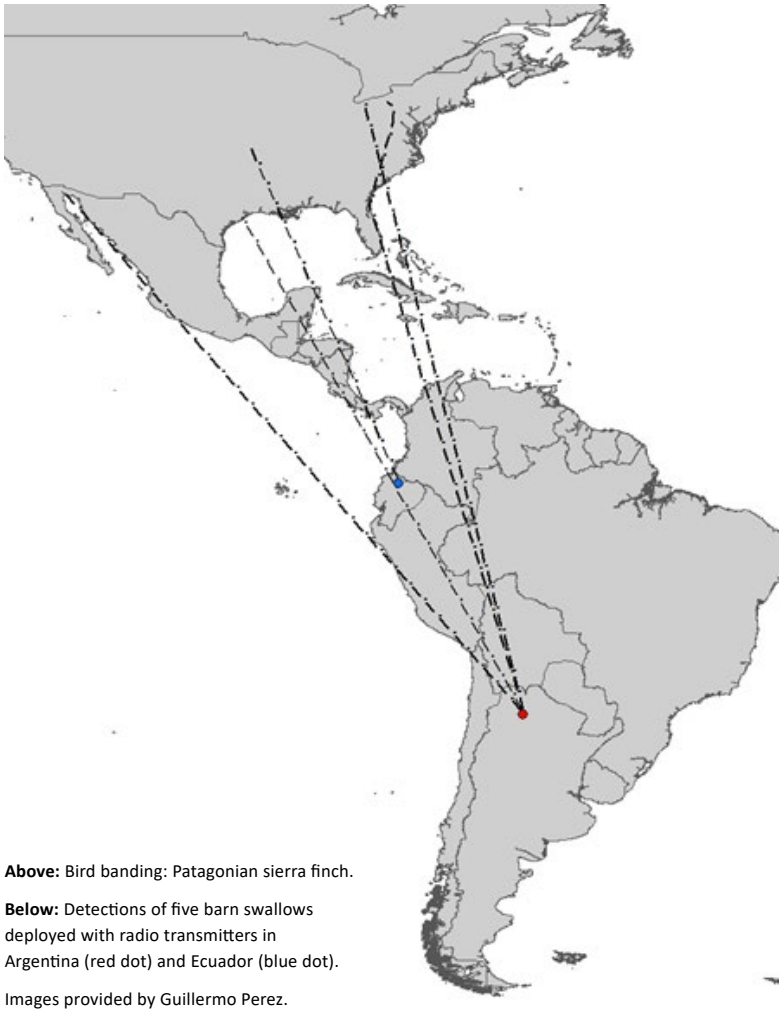
So much like the birds I studied during my time in Canada, my own long-distance migration between Canada and Chile opened a path towards thinking globally and acting locally. Through the breadth of The GAAP's current projects, we are able to protect threatened local ecosystems and learn

Studying free roaming dog behaviour in southern Chile. Photo by Guillermo Perez.

about interwoven human and animal health implications on a much larger scale. We have chosen to emphasize a ***One Health*** strategy, which unites multiple disciplines across the human-animal-environment interface to produce long-term mitigation strategies for the complex health problems facing our world. The GAAP has implemented projects in Canada, Chile and Guatemala in the areas of veterinary services, One Health education, outdoor and environmental education, conservation and research.

Migratory Bird Research

The GAAP's migratory bird research evolved from our initial free-roaming dog research. While we continue to value research, we have broadened our scope and we are currently collaborating with Environment and Climate Change Canada to investigate migratory bird connectivity, habitat use and occupancy of aerial insectivorous birds during the non-reproductive period. Populations of migratory aerial insectivores have declined by an estimated 59% since the 1970s in Canada and ~32% across North America. By 2020, nine of the 31 species in this guild, including swallows, swifts, nightjars and flycatchers, were listed under Canada's *Species at Risk Act* (SARA). In order to better understand the potential threats on the non-reproductive grounds, we are collaborating with local Latin American biologists and naturalists to coordinate the nano tagging of barn swallows and a large-scale habitat sampling of migratory swallows. We are finishing our second year of sampling and have completed 1,200 point-counts in 46 ecoregions across 10 countries, from Belize and Guatemala to the southernmost tip of Chile. Based on the handful of barn swallows we have detected by Motus towers, our preliminary data show birds that spend part of the non-reproductive period together in Argentina and Ecuador migrate to different breeding locations in North America.



Above: Bird banding: Patagonian sierra finch.

Below: Detections of five barn swallows deployed with radio transmitters in Argentina (red dot) and Ecuador (blue dot).

Images provided by Guillermo Perez.

While our projects at The GAAP span the Americas, our main headquarters is situated in Valdivia, Chile, a strategic location given that it is home to two globally important ecosystems: i) the Valdivian Temperate Rainforest, a top-36 biodiversity hotspot, and ii) the Carlos Anwandter Wetland Sanctuary, Chile's first Ramsar site. The holistic

One Health approach of our programs means we centre these ecosystems in all of our projects, from considering how the health and management of companion animals impacts wildlife, to using education to connect people with Nature, and even protecting habitats of threatened frog species. Our work has expanded as we have continued to recognize the interdependence of the health of animals, people and our environment. At the same time, we are still learning about different facets of the same issues. For example, in the near future we would like to combine our experience and expertise to look at the impact of free-roaming dogs on overwintering migratory shorebirds. There is much left to learn about these complex, interrelated issues, and we are eager to research, implement programs and continuously improve to create a healthier and more sustainable planet.

> "Our work has expanded as we have continued to recognize the interdependence of the health of animals, people and our environment."

Positive impacts

Another important facet that has evolved from my role as a biologist is directing our Outdoor and Environmental Education program. By means of fun activities like kayaking and birdwatching, we develop kids' social and emotional competencies, like collaboration, empathy and resilience. Our approach uses fun and games to create a safe, respectful and interactive environment raising the importance of emotional intelligence to learn and discuss environmental issues. These experiences become a platform for kids to think about and connect with themselves, others and Nature.

The positive impacts we have made through the GAAP, and will continue to make, are possible thanks to our generous partner organizations like ***Veterinarians International***, Dogs Trust Worldwide, Lush Cosmetics, Environment and Climate Change Canada and our committed individual donors. If you would like to learn more about our work and how you can make a difference, please visit our website (***https://thegaap.org***) and follow the social media platforms for the project(s) of your choice. CM

Learning about aquatic environments in our Outdoor and Environmental Education program. Photo by Guillermo Perez.

Practice of Biology Applied to Ecological Risk Assessment of Chemical Stressors

By Meara Crawford, RPBio, and Beth Power, RPBio
Azimuth Consulting Group Inc.

BIOLOGY IS APPLIED within ecological risk assessments to assess the effects of chemicals on environmental health using tools that span a wide range in levels of biological organization, from molecular and sub-cellular scales to whole ecosystems. The various tools rely on information collected through field-based studies, laboratory-based analyses and desktop-based investigations. The role of the risk assessor, many of whom are registered with the College of Applied Biologists in British Columbia, is to characterize overall risk to organisms in the environment by integrating the information that was developed through the various tools across disciplines and biological scales.

This article describes the role of applied biology and biologists in assessing risks to environmental health from exposure to chemicals in British Columbia (BC) and Canada.

What is ecological risk assessment?

Ecological risk assessment is a framework to evaluate the potential for a stressor to cause adverse effects to the environment and the possible magnitude or severity of those effects. This framework can be applied to any environment stressor, including factors like temperature, disease, habitat quality and quantity, seasonality of flow, and chemicals. This article is focused on chemical stressors.

How the practice of ecological risk assessment has changed over time

The framework for ecological risk assessment of contaminants is credited as being established in the "Red Book" from the United States National Research Council (1983). While the overall framework persists, the practice of ecological risk assessment of contaminants has since evolved. Increasingly, input from specialists is incorporated in risk assessments, and we are becoming more forward thinking in considering ecosystem remediation and resilience. For contaminated ecosystems, for example, there have been calls to consider ecological restoration and resilience early in the risk assessment process (Hull et al. 2016) and to expand the goal of risk assessment to not only characterize risk, but also to contribute toward remediation. For example, the relative overall risk from exposure to contaminants can be balanced against possible risk to habitat quality and availability posed by remediation options that might involve removing contaminated soil and, in doing so, might remove potentially critical habitat. For further information on history of risk assessment in BC, there is a pre-recorded presentation available ***here***[1].

Regulation and related policy for contaminant-related risk assessment have also changed over time. It was formally introduced in BC in 1996 with the Contaminated Sites Regulation, and has become increasingly standardized over time. This, coupled with technical scrutiny and documentation, supports process transparency and contributes toward protecting the public interest.

Current applications for ecological risk assessment

Ecological risk assessment of chemicals is used in many different contexts within BC and Canada. Some examples include:

- Risk assessments conducted under Canada's Chemicals Management Plan to determine if a chemical substance is considered a Toxic Substance under the *Canadian Environmental Protection Act*.
- Risk assessment of pest control products required for registration of new pesticides under Canada's *Pest Control Products Act*.
- Site-specific risk assessments of environmental contamination at an individual property that occurred in the past or is ongoing. Site specific risk assessments of contaminated sites include those conducted under the British Columbia

Contaminated Sites Regulation, as well as under Canada's Federal Contaminated Sites Action Plan.

- Predictive risk assessments conducted for environmental assessments that evaluate future situations by modelling future contaminant concentrations and then quantitively assess the risks to human and ecological health.

The general process and tools for conducting ecological risk assessments are similar across the various applications. All contexts require similar skill sets, knowledge about how organisms can be exposed to contaminants and knowledge about the effects of those exposures.

Steps to conduct an ecological risk assessment

Several steps in the risk assessment process are common to current guidance in BC and most jurisdictions:

- **Problem formulation,** which tees up the setting and scope of the risk assessment. In this step, risk assessors first identify contaminants and specific organisms or groups of organisms that may be present on the site. Then a conceptual model of how the organisms may be exposed to the contaminants is developed.

- **Exposure assessment,** which determines concentrations of contaminants in environmental media that are representative of conditions that organisms may be exposed to. These exposures may be measured directly in the media or estimated based on models like bioaccumulation models and food chain models.

- **Effects assessment,** which determines the benchmarks to which exposures will be compared. These benchmarks represent exposures that are not expected to cause an unacceptable level of effect to organisms. Benchmarks can represent different types of possible effects. For example, are the possible effects from exposure expected on an acute or chronic timescale? Are survival, growth or reproduction possibly affected by exposure to contaminants?

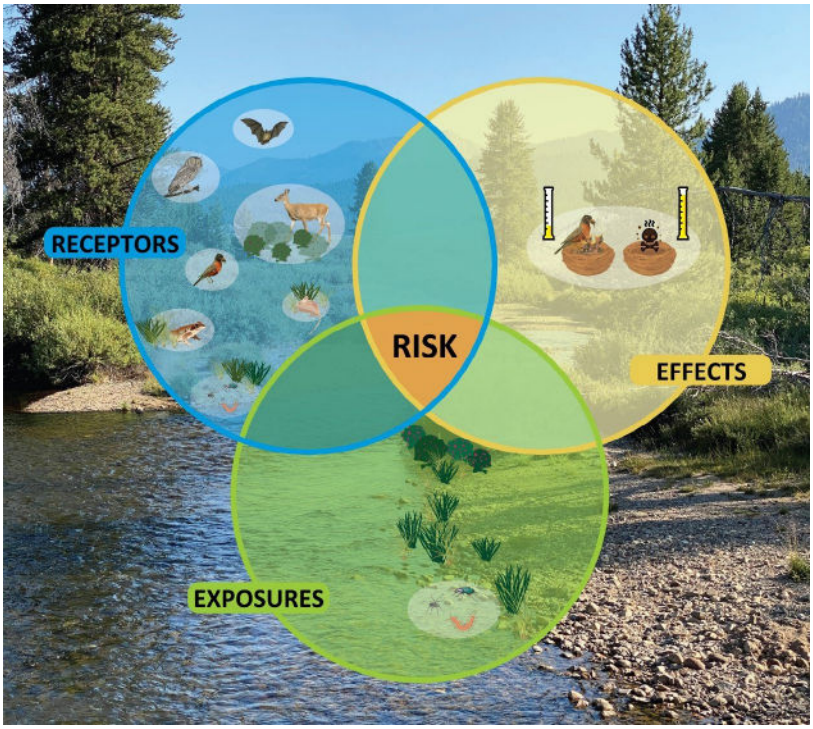


Figure 1. The risk assessment process involves describing the possible nature and magnitude of toxicological effects that may occur when receptors (i.e., organisms) are exposed to contaminants at the concentrations found in the environment. This figure illustrates examples of receptors, effects, and exposure media (e.g., sediment, soil, water and dietary items like plants and invertebrates) that may be evaluated in a risk assessment; the same principles apply for humans or other ecological scenarios. Image provided by Azimuth Consulting Group Inc.

- **Risk characterization,** which integrates information developed during the problem formulation, exposure assessment and effects assessment steps to synthesize conclusions about possible risk to organisms from exposure to contaminants. Risk characterizations are typically accompanied by a measure of uncertainty, which can be quantitative or qualitatively described as being low, moderate or high.

The potential for risk occurs where the concentrations to which receptors (i.e., organisms or groups of organisms) may be exposed overlaps with concentrations that can cause effects, as illustrated in **Figure 1**.

Risk assessment is often an iterative process. In the first pass at a risk assessment, conservative simplifications are often made. Then, if risk is still present, or if uncertainty is high, subsequent iterations refine risk estimates by incorporating additional data and tools.

Tools for ecological risk assessment across levels of biological organization

Risk assessors use a wide range of tools to pair measures of exposure with measures of effects. These pairings are referred to as lines of evidence. Here are some examples of different biology-based tools that provide the basis for forming lines of evidence in an ecological risk assessment:

- Concentrations in environmental media like water, sediment and soil, which can be compared to benchmarks (e.g., environmental quality standards, criteria and guidelines that are derived by provincial and federal governments) that are intended to protect ecological and human health from adverse effects.
- Concentrations of contaminants in tissues, like in terrestrial invertebrates shown in **Figure 2a and b**, which can be used to calculate a chemical dose to which wildlife or other organisms may be exposed through their diet.
- Toxicity tests and bioassays, in which test organisms are exposed to contaminants or environmental media and their responses are measured (example of a toxicity test with amphibians in **Figure 2c**). A number of different endpoints may be measured depending on the test organism and study design. Possible endpoints range from subcellular (gene expression), to cellular (cytotoxicity), to tissue (histopathology), to organ (organ weight), to whole organisms (body weight, survival, reproductive outputs). A number of standard toxicity test protocols are established for terrestrial and aquatic environments. These standard methods may also be modified and customized for specific applications.
- Taxonomy, which provides population and community level information that identifies and enumerates species that are present in the environment. This tool can be used in aquatic environments to evaluate benthic infauna and epifauna, periphyton, aquatic plants, phytoplankton, zooplankton and fish. This tool can also be used in terrestrial environments to evaluate soil mesofauna (invertebrates living within the soil), plants, and other organisms. Taxonomic metrics like abundance, species richness and biomass can be paired with exposure measurements like water or soil concentrations, or compared across a spatial gradient of exposure or between exposed sites and reference sites.
- Field surveys, which provide information on the scale of individuals to populations to ecosystems. For example,

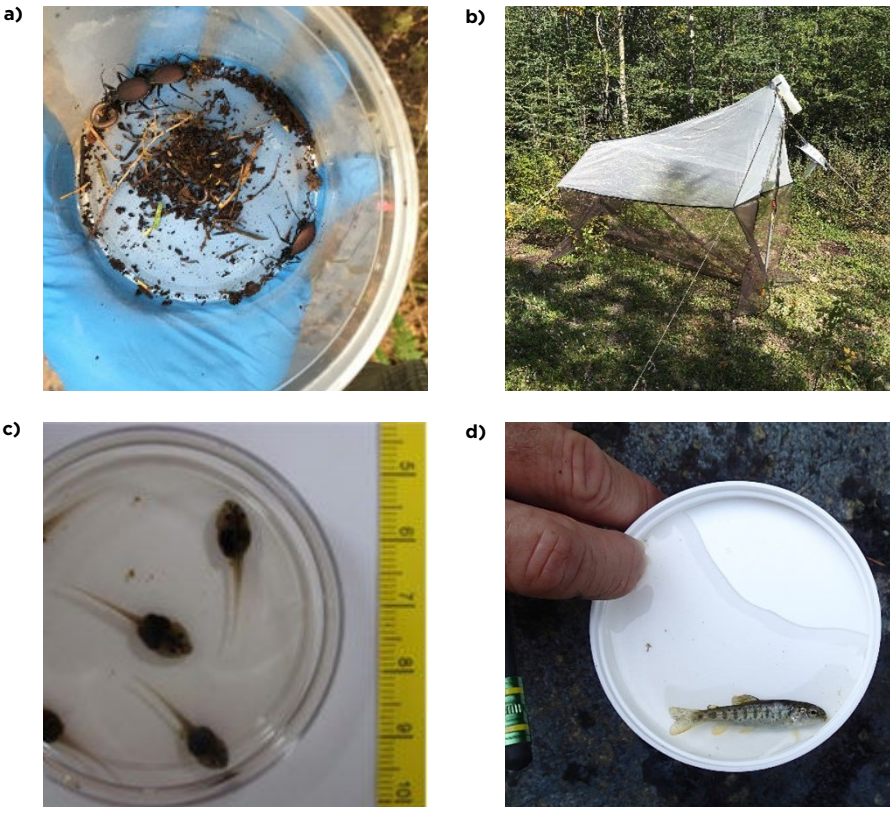


Figure 2. Some examples of tools used within ecological risk assessment of chemical stressors:

a) Ground-dwelling and

b) flying terrestrial invertebrates samples were collected, and their tissues were analyzed for chemicals. These invertebrate tissue concentrations provide information to assess potential effects to invertebrate communities and also to estimate chemical exposure through diet for other organisms like insectivorous birds and mammals that eat these invertebrates.

c) Northern leopard frog (Lithobates pipiens) tadpoles from a laboratory-based sediment toxicity test using standard test methods. The survival, growth and development of the tadpoles were measured over the 10-day test duration.

d) Salmonid observed during in-stream survey work in support of an ecological risk assessment.

Note: Images provided by Azimuth Consulting Group Inc.

fish health, including metrics like weight and length, can be measured during a fish survey (e.g., **Figure 2d**). Plant communities can be surveyed for spatial coverage, composition and indicators of stress (e.g., stunted growth or yellowing foliage). A field survey can evaluate the quality of habitat for fish and wildlife (birds, mammals, amphibians or reptiles); for example, is the habitat suitable for foraging, nesting, burrowing, over-wintering or other uses?

- Environmental DNA (or eDNA), which is a subcellular tool that can help identify certain organisms, including several amphibians and fish species, that may be present in the environment and therefore would require further evaluation of their exposure and effects.

- Various modelling tools that can be used in risk assessment, such as wildlife population models that estimate a population's response to chemical exposures.

Available tools range in level of precision from highly quantitative, such as data from chemistry laboratory analyses, to more qualitative and subjective, such as data from field surveys of overall terrestrial ecosystem health. These tools also vary in terms of their ecological relevance, their power to resolve magnitude of effect, spatial extent and temporal duration, and their specificity to effects caused by exposure to contaminants as distinguished from effects caused by other stressors.

New information and tools become available to risk assessors as science evolves. Biologists and other specialists from a broad range of disciplines and areas of expertise all contribute to collecting and developing the necessary information to conduct an ecological risk assessment. Overall, the merits and limitations of the various tools must be weighed when selecting which tools are most suitable for a given risk assessment. Ideally, when assessors develop risk characterizations, they consider multiple lines of evidence through a weight of evidence approach.

An example of how biology and ecology influence an organism's exposure to contaminants

The amount of a chemical an organism is exposed to depends on numerous factors. These factors include diet (e.g., insectivore, herbivore, carnivore), the types of habitats the organism occupies and feeds in (aquatic, terrestrial, marine or a combination), the amount of time or the likelihood of it spending time in different areas of varying habitat quality and the size of its home range relative to the size of habitat within an area of contamination. For example, organisms with small home-ranges are typically expected to have higher exposure to contaminants than organisms with large home ranges. Risk assessments, therefore, require biologist expertise to help identify who is home, who is eating what, who might be most sensitive to contamination and how might they be exposed. Examples of factors that could contribute to characterizing chemical exposure for an organism (e.g., moose) are illustrated in **Figure 3.** To characterize risk, the estimated exposure dose would be paired with a dose, likely from a literature-based source, that has been associated with adverse effects like reduced survival, growth or reproduction.

Who assesses ecological risk from environmental contamination?

Risk assessors include professionals of various backgrounds and designations, such as agrologists, chemists, engineers, toxicologists

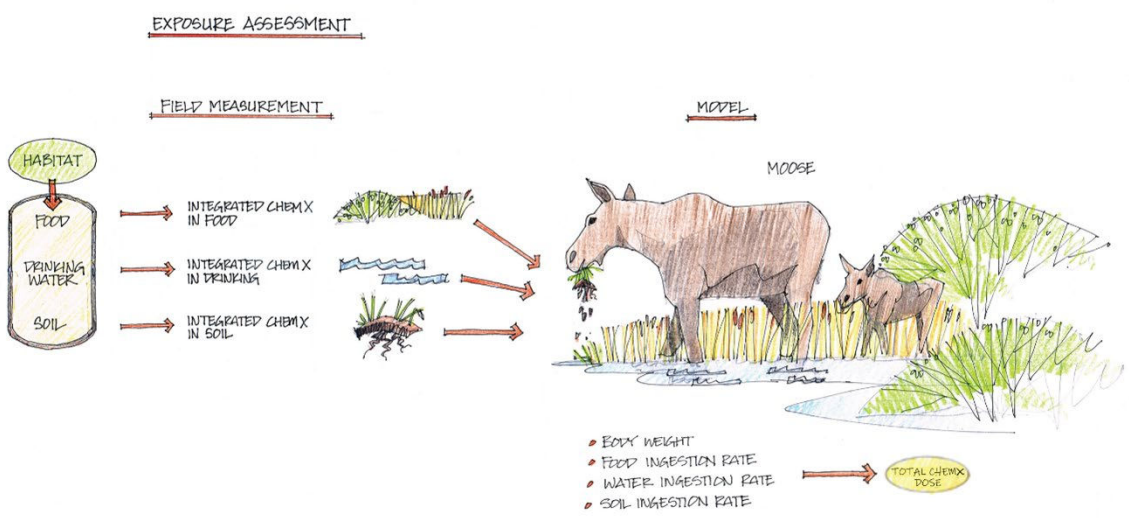


Figure 3. Conceptual model illustrating an organism's exposure to contaminants. *Note*: Figure provided by Azimuth Consulting Group Inc. and prepared by Derrill Shuttleworth.

and biologists both registered and not registered with the College of Applied Biologists. Many of the 3035 registrants[2] of the College of Applied Biologists practice in areas related to risk assessment of chemical stressors for both ecological and human health. In the registry for the College of Applied Biologists, registrants self-identified several practice areas related to risk assessment of environmental contaminants, including:

- Toxicology: 132 registrants
- Contaminated sites assessment and/or management: 237 registrants
- Assessment (environmental impact, risk, ecological, habitat, riparian areas)[3]: 1840 registrants.

These categories provide an indication of number of biologists that practice in areas *related* to ecological risk assessment. However, this list is not exhaustive and does not directly capture ecological risk assessment nor may it capture registrants that are specialists in other areas that contribute to ecological risk assessment but do not consider it as their primary practice area. Because of the broad range of skills and expertise that contribute to ecological risk assessment of contaminants, it is likely there are many more registrants practicing in this realm than captured by the three categories above.

Integration and outcomes

The practice of ecological risk assessment requires a broad understanding of many practice areas within biology and other disciplines. The risk assessor's role involves integrating information from experts and others across a range of topics, including:

- Biologists specialized in birds, mammals, fish, amphibians, reptiles, invertebrates, bats, vegetation, aquatic ecosystems, species at risk and other specialty practice areas.
- Other professionals regulated under the *Professional Governance Act*, including engineers and site investigators, who characterize a site in terms of concentrations of contaminants in abiotic media through which receptors (i.e., organisms) may be exposed.
- Professionals registered with other organizations, such as toxicologists certified with the American Board of Toxicology, professional chemists and veterinarians.
- Non-registered professionals from other specialized disciplines, such as forensic chemists, geomatics analysts and data scientists.
- Scientists from analytical chemistry, toxicological and other laboratories, and academic researchers with specific expertise.
- Members of the public.
- Indigenous organizations and community members.
- Regulatory agencies.
- The regulated community, including clients who fund the work.

In addition to characterizing risk and uncertainty, the risk assessment process also supports risk management and risk communication. Importantly, the process should focus on solutions and identifying the information needed to make a decision or support a management action. For example, the outcomes of risk assessment could include support for obtaining permits by developing site-specific water quality criteria or threshold levels as early warnings that would trigger management actions.

Here in BC, we can be proud of having a long-standing community of risk assessors, many of whom are members of the College of Applied Biologists, practicing risk assessment to a high standard. Ecological risk assessment is also a practice area where one can enjoy continued growth throughout their career, as there is always something new to learn when applying biology and the various risk assessment tools in each new project and ecosystem. CM

1. Presentation on history of risk assessment in BC: ***https://www.azimuthgroup.ca/wp-content/uploads/2022/04/a.fikart-rpic-history-of-ra-in-bc.mp4***

2. The BC College of Applied Biologists registry was searched on February 10, 2022. On that date, the registry included 3,035 registrants across all practice areas from all categories and statuses, and it included 56 registrants who did not identify any practice area.

3. Within the registry, the "Assessment" practice area broadly includes assessment of environmental impact, risk, ecological, habitat and riparian areas.

REFERENCES

Hull, R. N., S. N. Luoma, B. A. Bayne, and J. Iliff et al. 2016. 2016. Opportunities and Challenges of Integrating Ecological Restoration into Assessment and Management of Contaminated Ecosystems. I*ntegrated Environmental Assessment and Management*, 12 (2): 296-305.

United States National Research Council. 1983. *Risk Assessment in the Federal Government: Managing the Process*. National Academy Press, Washington, DC.

ECCC's improved approach to marine incident response prioritizes data and technical support

By Megan Willie, RPBio, MSc

I JOINED ENVIRONMENT AND Climate Change Canada in 2018 as part of the Government of Canada's ***Oceans Protection Plan***. The Oceans Protection Plan aims to protect Canada's coasts while supporting essential marine economic activities; it centres around four primary themes:

(1) improving our marine safety systems,

(2) preserving and restoring marine ecosystems,

(3) creating stronger partnerships with Indigenous and coastal communities, and

(4) developing a strong evidence base to improve our decision-making around marine protections.

Within Environment and Climate Change Canada, I took on a role as a Wildlife Emergency Response Coordinator in the Pacific Region. Here, I joined a newly established national team whose goal is to provide legislative, scientific and technical support to enhance the government's capacity for response during marine pollution incidents across the country. My Coordinator role has been an exciting opportunity, allowing me to apply my past professional experiences working on impact assessments for major coastal oil and gas developments, as well as outcomes from my academic research on hydrocarbon exposure in marine birds.

A large part of our team's efforts in recent years has been to develop national standards of practice for responding to pollution incidents with known or potential impacts to wildlife. We are on the cusp of publishing online the National Wildlife Emergency Response Framework, a series of guidance documents addressing essential elements of wildlife emergency response. The Framework is an important first step for Environment and Climate Change Canada to establish a nationally consistent standard for how governments,

Above: Megan marking a storm-petrel nesting burrow on Storm Islands, Northwest Vancouver Island, after returning a recently GPS-tagged bird back to its nest. Photo by Greg McClelland.
Left: The view from Petrel Island, Northwest Haida Gwaii. Photo by Megan Willie.

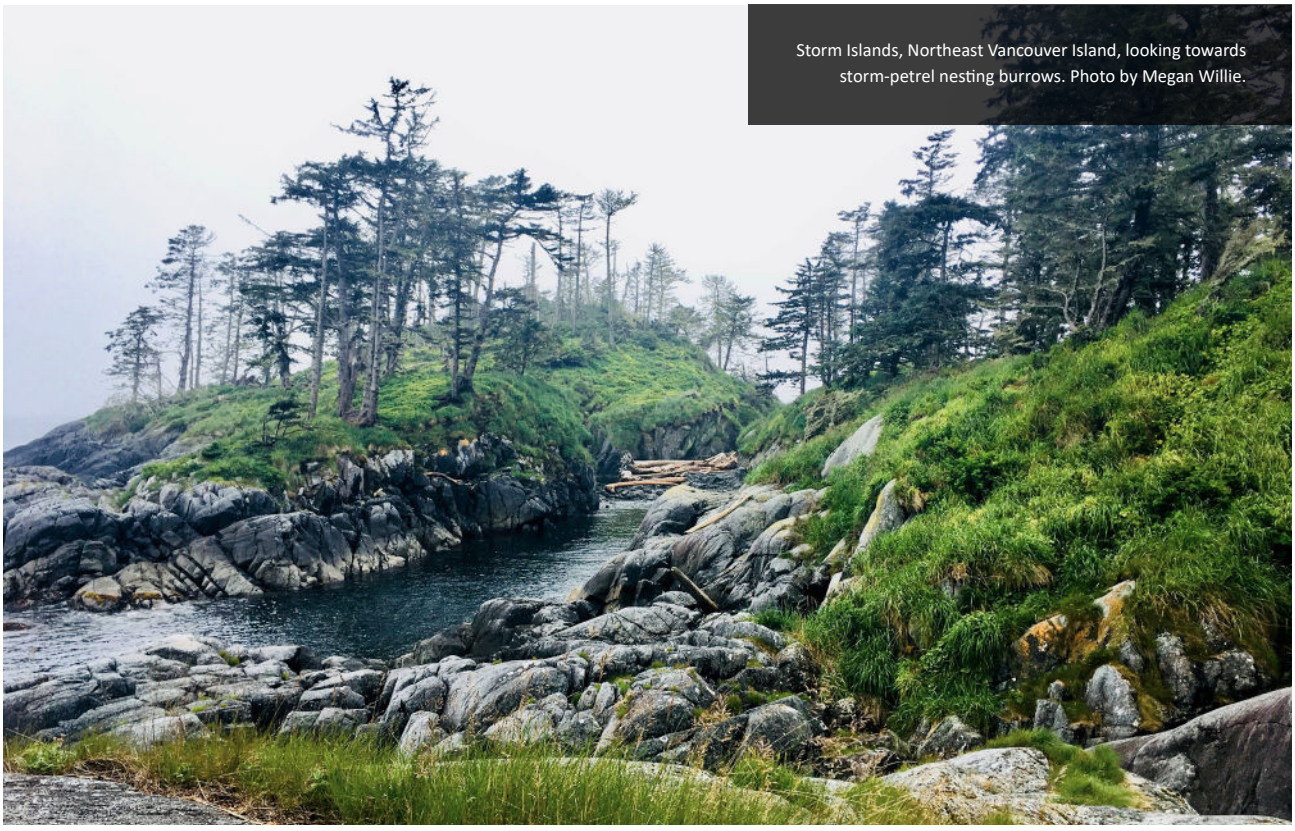
industry, response organizations and communities work together to protect wildlife and its habitat.

Another area of significant growth under the Oceans Protection Plan has been Environment and Climate Change Canada's investment in coastal research, strengthening the evidence base by which we make decisions to protect sensitive environmental resources during marine pollution events. Since 2016, colleagues have collected more than 16,000 km of coastal shoreline aerial imagery, more than 2,000 km of aerial and at-sea marine bird data and completed GPS tracking studies for priority avian species. Some of these datasets are also being made publicly available on the Government of Canada's ***Open Data*** portal.

I've been fortunate enough to participate first-hand, having spent several weeks on remote seabird colonies in Haida Gwaii, flying over the major flocks of sea ducks and gulls that descend on Pacific herring spawns along the Vancouver and Southern Gulf Islands, and witnessing marine birds amass in the productive ocean currents at Swiftsure Bank. When I consider these spectacular natural events through the lens of my role as a Wildlife Emergency Response Coordinator, it underscores for me the ways in which small and remote areas of our coasts are critical to supporting essential habitats and significant percentages of national and global populations of wildlife.

> "Since 2016, colleagues have collected more than 16,000 km of coastal shoreline aerial imagery, more than 2,000 km of aerial and at-sea marine bird data and completed GPS tracking studies for priority avian species."

Improved coverage of environmental sensitivities data in BC, and having these data readily available to response professionals like myself, has marked a significant improvement in Environment and Climate Change Canada's ability to prepare for, and accurately assess potential impacts



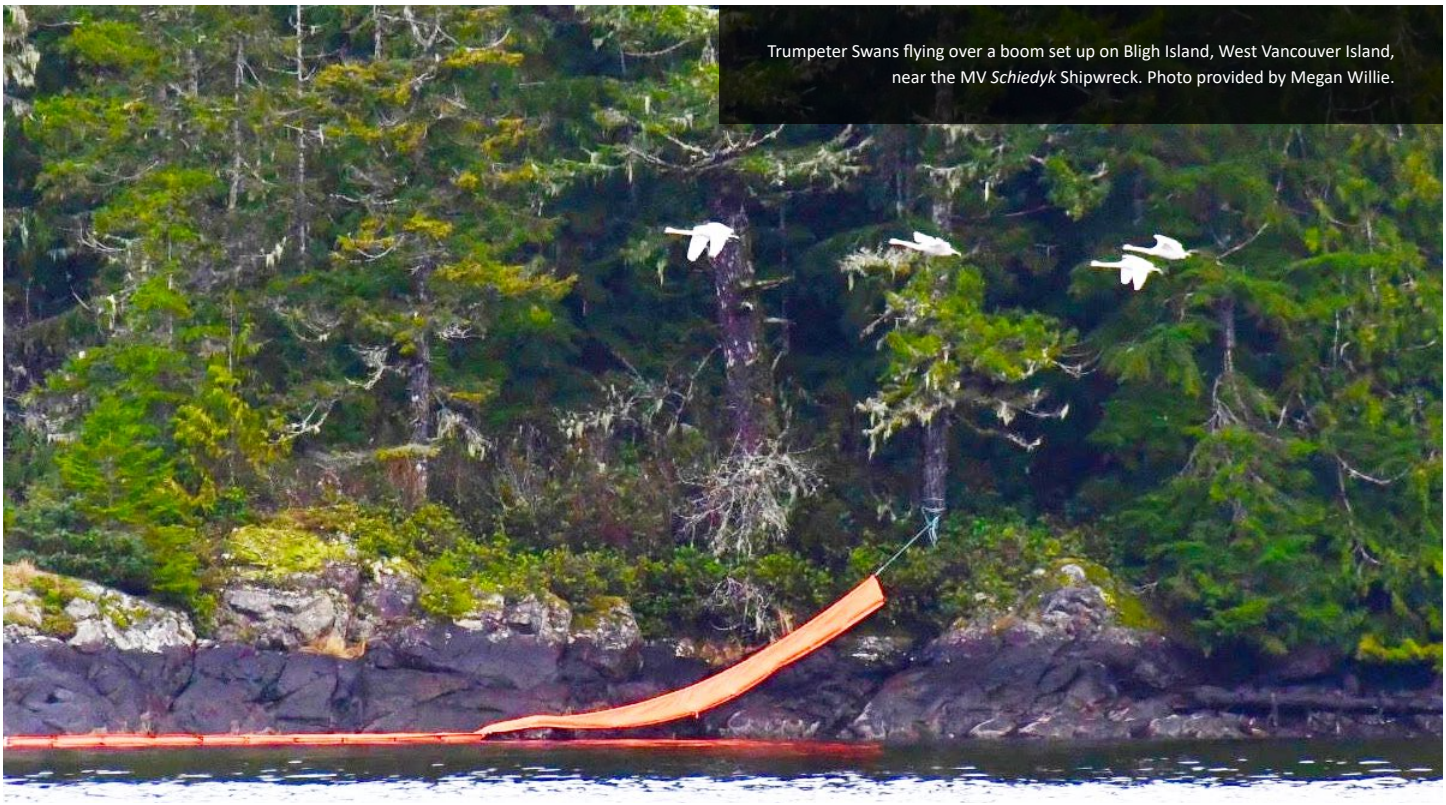
Storm Islands, Northeast Vancouver Island, looking towards storm-petrel nesting burrows. Photo by Megan Willie.

from, marine pollution events. These data, alongside the essential cultural and socio-economic information we integrate from Indigenous and local communities, allow the response community to make informed recommendations on response priorities and strategies.

The benefits of having established national response standards and improved access to environmental sensitivities data were evident during the ***2020-21 MV Schiedyk Shipwreck and Bulk Oil Removal operation***. Over a seven-month period, the Government of Canada, the BC Ministry of Environment and Climate Change Strategy and the Mowachaht/Muchalaht First Nation worked together to remove 60 tonnes of heavy fuel and diesel slowly leaking from fuel reserves onboard a historic shipwreck in Nootka Sound. The ongoing containment and removal of leaked fuel, in combination with the ever-present threat of a large release from tank reserves, posted a persistent hazard to marine resources in the area. We were able to apply some of our newly collected data in the early stages of this incident, an area that otherwise would have sparse information available, in order to prioritize local coastal areas to protect. These data also allow us to re-evaluate priorities over time, accounting for seasonal changes in wildlife distribution, as well as other seasonal cultural and socio-economic considerations. Throughout the MV *Shiedyk* Shipwreck response, I was also able to provide advice on strategies to prevent impacts to wildlife, drawing from both local wildlife data and the standards set forward in the National Wildlife Emergency Response Framework.

Our activities to date are just a starting point. With the publication of the National Wildlife Emergency Response Framework, my colleagues and I will increase outreach to other parts of government, industry, communities and response organizations to support the adoption of these resources and for their use during environmental impact assessments. Many areas of BC's coasts also continue to be a gap in knowledge of environmental sensitivities. To that end, we continue to work closely with Indigenous and coastal communities to expand our research programs and support collection of information on important local resources.

As we look to the future and consider how marine industries are evolving across Canada's coasts, we are also preparing to adapt our focus to address emerging issues. This includes concerns related to addressing wrecked and abandoned vessels in Canadian waters, imports and exports of hazardous and noxious substances and increased maritime traffic in the Canadian north. Advancing marine ecosystem protections in Canada concurrently with marine economic development will pose unique challenges in the future. Our need to apply biological data and knowledge for informed decision-making is ever increasing and will be a priority for our scientific community in the coming years. CM



Trumpeter Swans flying over a boom set up on Bligh Island, West Vancouver Island, near the MV *Schiedyk* Shipwreck. Photo provided by Megan Willie.

Dana Quayle Becker

Dana Quayle Becker was a career biologist who grew up and worked on Vancouver Island until 1992. She was then hired during the first round of Forest Ecosystem Specialist hirings and was based in Mackenzie for a number of years. Her later career included ecosystem-based work for a northern First Nation, consultant work back on Vancouver Island, and finally work as a biologist for the Alberta Ministry of Transportation in Edmonton.

Dana loved her work and always exhibited a high degree of professionalism. She also loved colour, beautiful art and healthy food. She was an excellent cook and a proficient seamstress. Curiously, she always owned a white polydactyl cat.

Dana passed away in Edmonton on July 23rd, 2021, at the age of 63. She was a caring and loyal friend to those close to her, and we miss her greatly.

Submitted by Joanne Vinnedge and Kelly Schellenberg

Requiem for Restoration

By Gerry Leering, RPBio (Ret.)

PROFESSIONAL PRACTITIONERS UNDERTAKING habitat improvements must promote that going backwards is not appropriate—therein let's have a *requiem* for restoration.

Restoring a piece of furniture, car or damaged basement is commonly accepted and undertaken. Their known pre-existing condition makes this possible, so, by definition, restoration can be the act of restoring, renewing, reviving or reestablishing. This restoration term is used inappropriately way too often in discussing natural and/or ecological environment improvements. Typically, there is limited recognition or acknowledgement that changing bio-physical conditions preclude the ability to recreate natural habitat to earlier site conditions. Suggesting that ecological characteristics can be reestablished fails to account for our changing climate with weather extremes now occurring ever more frequently.

British Columbia's record heat dome last summer and the January 2021 Texan deep freeze are two recent examples of extreme weather events. These weather patterns are now better regarded and cited as being climate change. Professional practitioners dealing with natural environments concede that climate change is real and a strong influencer on future conditions.

The opening abstract line of A systematic review of ecological attributes that confer resilience to climate change in environmental restoration (Timpane-Padgham et al 2017)[1] states, "Ecological restoration is widely practiced as a means of rehabilitating ecosystems and habitats that have been degraded or impaired through human use or other causes." Rehabilitating ecosystems acknowledges damage and that reparation is needed, but that bringing the natural habitat back to original conditions is not possible. The changing culture of silviculture (Achim et al 2021)[2] details the considerations being made in the face of climate change to better ensure healthy timber stands for future generations to harvest.

Currently, many scientists speak of natural habitat restoration for ecological enhancement. I challenge all colleagues to avoid the use of this restoration term as this does not recognize that one cannot rebuild habitat to what once existed. Climate change and resultant hydrologic adjustments prevent this. One cannot re-create natural habitat that has been damaged from climate change or development, e.g., the latest Lower Mainland and Merritt flood events on infrastructure from atmospheric rivers. I implore the use of more appropriate terms such as rehabilitation, revitalization or resilience, and promotion of building back better to any site. Acknowledge that restoration is not attainable. Give the public a better understanding that reflects the science today, acknowledging that climate change is occurring, and all improvements must need to be more adaptable to this change—hence resilient.

Climate change will see our snowcapped mountains disappear and leave us with enduring features, such as barren peaks and dry valley basins, with little time for species to adapt to these new conditions. Touting restoration is going backwards—better to focus on future conditions that demand resilience planning. Consider using bio-engineered designs (i.e., nature-based solutions) that acknowledge things must be built back better. CM

1. Timpane-Padgham BL, Beechie T, Klinger T (2017). *PLoS ONE* 12(3): e0173812. https://doi.org/10.1371/journal.pone.0173812

2. Achim et al., *Forestry* 2021; 1–10, https://doi.org/10.1093/forestry/cpab047

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