



2019-20 ANNUAL REPORT

The largest natural history museum in Canada known for: nature inspiration and engagement; Arctic knowledge and exploration; species discovery and change; and a 14.6 million specimen collection housed at a 76-hectare research campus.

TABLE OF CONTENTS

MESSAGE FROM THE CHAIR	3
MESSAGE FROM THE PRESIDENT AND CHIEF EXECUTIVE OFFICER.....	6
CORPORATE OVERVIEW	10
OUR PEOPLE.....	17
ASSESSMENT OF RESULTS FOR 2019-20.....	20
SCIENTIFIC RESEARCH PROGRAM FOR 2019-20.....	28
COMMUNICATING RESEARCH RESULTS.....	43
SCIENTIFIC OUTREACH	58
INVOLVING THE COMMUNITY	67
MANAGING OUR FINANCIAL RESOURCES.....	74



Judith LaRocque

Chairperson

Message from the Chair

For the Canadian Museum of Nature, this was a year of scientific relevance.

Relevance—recognized, within the museum sector, as a major contributing institution to science research in Canada

Relevance—publishing our first ever Research Review, demonstrating our global scientific reach and impact

Relevance—applying our mission to the post-pandemic future

Scientific research is fundamental to the Canadian Museum of Nature's mission. The Museum is a national research leader with a scientific natural history collection of more than 14.6 million specimens and multi-disciplinary scientific laboratories, including the National Biodiversity Cryobank of Canada, situated at our Natural Heritage Campus in Gatineau, Quebec.

The National Natural History Collection, which the Museum curates and maintains, is the record in geospatial time of the earth, and the flora and fauna that populate it. The specimens and data associated with these records tell us the biological and geological story of our planet's evolution. As such, the collection forms a record over time that tracks environmental changes. And as climate has changed and is changing, for example, we can measure the impacts to life on Earth and present the evidence to understand interdependencies among species.

Our scientists are experts in botany, terrestrial and marine biology, mineralogy and palaeontology. They not only actively explore and discover but they also interpret the evidence of our collection to better understand what has changed, and what is now changing in our natural world. This knowledge is essential to understanding how we can sustainably manage our natural future.

The Museum's two centres of excellence—the Beaty Centre for Species Discovery and the Centre for Arctic Knowledge and Exploration—are especially relevant to two major environmental concerns: declining biodiversity and global warming.

Science has been the foundation of our Museum since its creation through the Geological Survey of Canada almost 180 years ago. Despite this legacy, museums have been overlooked as a key sector for scientific research on the national stage. A step in rectifying this oversight was the inclusion of museums in “Canada’s Innovation Leaders 2019” (footnote: Canada’s Innovation Leaders 2019, Research Infosource Inc.), a leading publication summarizing the research landscape and research spending in Canada.

Our presence in this publication for the first time places museums alongside corporations, universities and colleges, and hospitals as key research sectors for Canada. Research at the Canadian Museum of Nature was specifically highlighted, and this recognition was supported by an editorial from CEO Meg Beckel in the publication “Research Money” that explained our Museum’s relevance to research related to climate change and biodiversity.

The Museum also reported the impact of its research with the publication, for the first time, of its Research Review. This report documents the global reach of the Museum’s collection data in relevant research papers in 2018—whether authored by Museum scientists, by Museum scientists in partnership with other scientists or institutions, or by researchers not affiliated with the Museum. The findings are dramatic—there was more than 1 billion downloads of Museum specimen data from the Global Biodiversity Information Facility (GBIF) and our data was used in no less than 255 peer-reviewed published scientific papers. These articles demonstrate that our data contributes to the global knowledge base that informs understanding of biodiversity, climate change and natural capital, with repercussions for conservation and sustainability.

Of particular note this year, the Museum closed its doors to the public on March 14 in co-ordination with the other national museums, in response to the COVID-19 pandemic. Attendance was on track to exceed expectations for the year but was instead cut short as were all commercial revenue sources. As I write, the Museum remains closed, so 2020-21 promises to be very challenging indeed.



The Board of Trustees has been fully engaged in the governance of the Museum throughout the strategic successes of the year and the operational challenges at the end of the year. We will continue to work with senior leadership to ensure the Museum is ready to reopen and return to full operation when public health agency protocols indicate it is time.

It's interesting to note that in Canada's last major pandemic, the Spanish Flu of 1918-19, the House of Commons and Senate were convening in our own Victoria Memorial Museum Building. They had relocated there in 1916 following the fire that destroyed Parliament. So, within our walls, in response to the Spanish Flu, the national Department of Health was created, which now serves as a leading light in the current pandemic a century later.

As relevant as the foundation of the Department of Health is to our current wellbeing, so may be the relevance of our research and our mission to the post-COVID-19 world with respect to nature and our future wellbeing. The effort to contain COVID-19 depends on the primacy of scientific evidence, measurement, modelling, and research—and the application of that knowledge in active and co-ordinated solutions. This is precisely the model that will be required to address climate change and biodiversity loss—challenges for which the Canadian Museum of Nature, through evidence, knowledge and inspiration, contributes as a national and global player.

There will be brighter days to which we, as a relevant scientific institution, look forward to bringing light.



Margaret Beckel

President and Chief Executive Officer

Message from the President and Chief Executive Officer

While we adapt to the global crisis created by the COVID-19 pandemic, it is still inspiring to reflect on the year 2019-20 - our first complete year engaged in advancing our new global mission to save the world for future generations with evidence, knowledge and inspiration. In the spirit of that global mission, my reflections this year consider how we contributed to each component of the Museum's mission.

Evidence:

Exploring to collect, preserve and manage physical evidence of the flora, fauna and geology of Canada and the world across geography and over time. As such, the Museum "saves" the world for scientific study and public observation.

Over 20,000 scientifically significant **insect specimens** were received as a gift near year-end, leading to a worthwhile effort to find space for these important additions to the national collection. We are excited to have them on board!

The Museum continues to participate in the governance of the **Global Biodiversity Information Facility** (GBIF), the global body responsible for hosting billions of records of biodiversity data. The Canadian Museum of Nature data alone triggered 1.2 billion downloads.

The Geological Survey of Canada (GSC) continues its important work to database its collection before moving to the Museum's Natural Heritage Campus facility where it will be curated with the rest of the national geological and mineralogical collection.

Almost 4,000 visitors participated in the annual **Open House** at our research and collections campus in Gatineau. They explored the National Natural History Collection and our laboratories while engaging with research scientists, collections experts, conservators, library staff and public program staff. All hands were on deck, including IT and exhibits staff in costume as our mascot Martin the Moose.

The **National Biodiversity Cryobank of Canada** marked its first full year of operation, which included many tours with colleagues from museums, universities, government and NGOs.

Knowledge:

Undertaking original research or collaborating with other scientific institutions in Canada and abroad to develop new scientific knowledge, while providing physical or digital access to the Museum's national natural history collections for science communities in Canada and worldwide.

Museum research scientists spent over 350 days out **in the field** exploring, collecting and documenting the biodiversity and geodiversity of Canada and the world.

Papers, citations and other uses of the Canadian Museum of Nature collection were reported in the Museum's first annual **Research Review**. It reported that 255 scientific papers were published by Museum staff and associates and/or were enabled by the Museum's collection of 14.6 million natural history specimens.

Over 35 undergraduate, graduate and Ph.D. students were **mentored** by our research and collections experts. In so doing, they are training the next generation of collections-based research scientists.

Through our Scientific Training Program, an additional eight undergraduate and Masters students were supervised by Museum experts to learn more about collections-based research science.

Our scientific experts **contributed to global dialogue** on key scientific and environmental issues by providing insights on various reports and positions for diverse national and international scientific bodies. These included : the Convention on Biological Diversity (CBD); International Union for the Conservation of Nature (IUCN); Global Biodiversity Information Facility (GBIF); Society for the Preservation of Natural History Collections (SPNHC); Biodiversity Next!; and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).



Inspiration:

Building on the foundation of its extensive collections and research, and working with internationally renowned partners, the Museum uses its exhibitions, programming, digital outreach and internationally travelling exhibitions program to present scientific evidence and knowledge. These inspire new reflections and encourage actions that will “save the world” for future generations.

A successful beginning to the year was marked by the extension into April of our popular world-premiere exhibition ***Survival of the Slowest***, before it then moved on to venues in Halifax and the United States.

The 50th anniversary of the first lunar landing was commemorated in the summer by ***Moon at the Museum***, supported of the Embassy of the United States of America. Our own **Goodwill Moon Rock** from the 1972 Apollo 17 mission was put on display in the Earth Gallery, Luke Jerram’s spectacular 7-metrewide

3D moon sculpture was hung in our Queens’ Lantern, and the exhibition in our rotunda ***Michael Benson’s Otherworlds: Visions of our Solar System*** took our visitors on a journey beyond Earth. With natureIDEAS presentations and talks by some of Canada’s astronauts, the Museum was “out of this world”!

Inspired by the Ocean Plastics Lab exhibit from Germany presented the previous year, the **Water Gallery** was renovated and upgraded with a new **Ocean Plastics** exhibit, which included calls to action, and a new aquarium with jellyfish. This new section presents a natural sciences approach to the important story of the impact of micro plastics on life on our planet.

From the American Museum of Natural History, our summer special exhibition ***Pterosaur: Flight in the Age of Dinosaurs*** was a hit with visitors from the National Capital Region, across Canada and from around the world. Complementing the exhibition

was ***Jurassic Flight***, a multi-sensory virtual reality experience that let visitors “actually” fly! Combined with ***Butterflies in Flight*** and our 3D movies, there was something for everyone all summer. This was reflected in 97% visitor satisfaction and 97% likely to recommend the Museum in survey results.

Giving Northern curators a space to express their own story, the **Northern Voices Gallery**, within the **Canada Goose Arctic Gallery**, welcomed its second exhibition since opening in 2017. ***Qilalukkat!*** is a special exhibit adapted from the Prince of Wales Heritage Centre in the Northwest Territories and curated by Inuvialuit educator Myrna Pokiak – it tells the story of the sustainable harvesting of belugas as a way of life for the Inuvialuit people.

Our **Nature Sleepovers** program, popular with families and groups, was expanded to include nights for adults! Who can resist the chance to sleep with the dinosaurs?

Public engagement reached millions on-site, off-site and online. **Online**, find us at nature.ca. Or connect with us through social media on Twitter, Facebook, Instagram and YouTube. Outreach includes natureNEWS; natureSCOOP; natureBLOG; natureCONTENT and more. New this year, teachers can

find us on CBC’s educational network **Curio.ca** where 22 of the Museum’s videos and classroom materials present ***Arctic. Land of Change*** and ***Women in Science: At the Heart of Nature***.

And our winter special exhibition, ***Me & My Microbes: The Zoo Inside You***, sponsored by the W. Garfield Weston Foundation, University of Calgary, BioGaia and the Globe and Mail, was cut short when the Museum closed on March 14, 2020, along with all National Museums across Canada, in response to the global pandemic COVID-19.

And so, we end the year with our doors closed and a new reality. We are inspired by the year behind us and, now, more than ever, by the importance of our mission to the years ahead. “Saving the World with Evidence, Knowledge and Inspiration” is both our track record and our future.

CORPORATE OVERVIEW

The Canadian Museum of Nature pursues its national mandate as described in the *Museums Act*, within the context of the governance and accountability regime established in Part X of the *Financial Administration Act*.

The Museum's Board of Trustees and management are firmly committed to managing the public and private funds invested in the institution in a transparent, accountable manner, and to optimizing the value of the contribution the Museum makes to Canadians and Canadian society.

National museums are a key component of Canada's social and natural capital.

National museums reflect who we are as a country by virtue of what we value, save, share and protect: Art, History, Science & Innovation, Human Rights, Immigration and Nature. Canada's national museums have a local, national and international role. Local, as visitor destinations that inspire through evidence-based story telling. National and Global, as creators and distributors of Canada's stories, through outreach programs and events in cities across Canada and around the world. Through collection loans to museums, galleries, libraries and community centres, through collaborative research on natural and cultural heritage. With digital content in virtual exhibits, digital apps, on-line collections, downloadable resource materials and all social media platforms, through access to physical and digital content as source information for content producers in TV, Radio, Film, News, education, research and public policy. And finally, with international programming through exhibits, programs, collaborative research, conference presentations and content co-creation. National museums play a vital role as trusted sources of contextualized knowledge, as keepers of the record of our past and as catalyzers of conversations about our future aspirations.



The Canadian Museum of Nature is one of Canada's national museums, each committed to reflecting who we have been, who we are now and who we aspire to be as a country and as Canadians. Canada's national museums reflect what we value as a country and as citizens by virtue of what we collect, preserve, study and share knowledge about: Art, History, Human Rights, Immigration, Science & Innovation and Nature. As part of the portfolio of Canadian Heritage institutions, we reflect the past, contextualize the present and anticipate and inspire a better future.

The Canadian Museum of Nature became a Crown corporation on July 1, 1990 through the *Museums Act*. The Museum is named in Part 1 of Schedule III to the *Financial Administration Act* and is subject to the control and accountability requirements set out for Crown corporations in that *Act*. It reports to Parliament through the Minister of Canadian Heritage.

The Museum is responsible for two facilities, the Victoria Memorial Museum Building (VMMB) in Ottawa, ON, and the Natural Heritage Campus (NHC) in Gatineau, QC. The Museum's galleries and most of the exhibitions and programmes are offered at the VMMB. The NHC is situated on 76 hectares of land and was designed to provide the standards of safety, security and preservation necessary to safeguard Canada's natural history collection.

Vision

A sustainable natural future.

Mission

To save the world for future generations with evidence, knowledge and inspiration.

At the highest level, the mission of the Canadian Museum of Nature is nothing less than to support making the vision of a sustainable natural future a reality. As current trends of greenhouse gas emissions, mass species extinctions, and their causal factors run counter to this vision, the Museum's mission is one of inspiring change. We are an instrument, one of many working in concert within the scientific community, for providing the foundation required to foster the change required to "save the world". It is a foundation built on evidence, knowledge and inspiration, which are the mainstays of our work.

At a micro level, we are already "saving the world", as we build and maintain the National Natural History Collection, a scientifically active collection of over 14 million specimens which creates a geo-temporal record of nature – e.g. what is, and what is living on, the world where and when. From this evidence of the world and life on it, we can develop knowledge of interdependencies, a record of change, and a basis to understand impacts and where change is leading.

Position

A national museum of international first rank known for excellence in Arctic knowledge and species discovery and for evidence-based insights, inspiring visitor experiences and real engagement with nature's past, present and future.

Dynamic change is required to seize opportunities in the Museum's **nature inspiration**, Arctic knowledge and species discovery activities. Environmental trends will increase the value of the Museum's mandate over the planning period, but the Museum needs to adapt significantly to deliver. The ability to invest in change will be conditioned by the Museum's financial framework which demands new sources of revenue and efficiencies in order to sustain its operations.

The commemoration of the 150th anniversary of Confederation allowed the Museum to seize many opportunities to extend the reach and impact of our public engagement and our research and discovery programs.

The opening of the Canada Goose Arctic Gallery last year demonstrated the Museum's expertise in Arctic knowledge and exploration and it provided an inspiring space for learning about our natural world.

Fulfilling the Mission

Knowing more about nature gives us the tools to make better decisions about resources. It provides the basis for new technologies and developments, and promotes a better understanding of how we affect, and are affected by, the natural world.

The Museum is home to one of the world's largest and finest natural history collections. Comprised of 26 major science collections of more than 14.6 million specimens, the Museum's holdings cover four billion years of Earth history.

In addition to preserving these precious specimens for posterity, the collection is a vital resource for scientists, researchers and museums in Canada and around the world. For instance, by examining past patterns of species distribution, climate change and extinction, palaeobiology research helps scientists understand natural events that occur during environmental changes and assists in predicting future consequences.

At the Museum, we use the past to prepare for the future. Our specimens provide the backbone for our many special exhibitions and signature galleries, and they greatly enhance our educational programmes, designed for adults, teens and children, about the natural world.

Our Mandate

The Canadian Museum of Nature has its origins in the Geological Survey of Canada, which was formed in 1842. Nearly 150 years later, on July 1, 1990, the Museum became a Crown Corporation by an Act of Parliament.

The *Museums Act* was a significant event in the history of the Museum. With Crown Corporation status came a new name, a new “arms-length” status and an expanded mandate.

“The purpose of the Canadian Museum of Nature is to increase throughout Canada and internationally, interest in, knowledge of and appreciation and respect for the natural world by establishing, maintaining and developing for research and posterity a collection of natural history objects, with special but not exclusive reference to Canada, and by demonstrating the natural world, the knowledge derived from it and the understanding it represents.”

– from the *Museums Act*, Section II (1990, c. 3)



Putting Our Mandate to Work

The Canadian Museum of Nature's vision is to inspire understanding and respect for nature. We advance this vision by providing evidence-based insights, inspiring visitor experiences, and real engagement with nature's past, present and future.

Our Experience and Engagement division is leading our effort to deliver dynamic personal experiences, powerful dialogue and debate, expert narratives and extraordinary chronicles about our collections. A connection with the Museum promises to inspire connections with nature and explorations of our natural future.

Through the activities of our Research and Collections division, the Museum continues to conserve and maintain its natural history collections, for which it has developed considerable expertise in the areas of collection conservation and collection management. In the research area, activities are focused on major areas of interest and relevance to society. Our key efforts are directed towards the discovery of new knowledge, and the gathering and analysis of scientific information to increase our understanding of natural diversity.

The wealth of knowledge gained through our natural history collections and leading-edge research forms the core of the Museum's exciting exhibitions and educational initiatives. As a result, our public programmes engage Canadians in guided dialogues about nature and challenge fixed opinions and views. In all activities, we aim to interpret natural history and science themes in an exciting and interactive way. We seek to increase nature literacy and science literacy among Canadians of all ages.

Our Promise, Our Position, Our Approach

Our Promise

Those who connect with the Canadian Museum of Nature will be inspired by natural history to explore our natural future.

Our Position

We are a national museum of international first rank known for evidence-based insights, inspiring visitor experiences and real and relevant engagement with nature's past, present and future.

Our Approach

We advance and package our centres of excellence in Arctic Knowledge and Exploration and Species Discovery so they focus and anchor our research, collection and education programmes while raising our profile and position.

We identify and act on collaborations with local, national and international partners that advance the strategic positioning and objectives of the Museum.

We create and deliver enhanced and new programming options that keep current and attract new audiences.

We advance bold and consistent marketing, communications and identity campaigns that position the Museum in the eyes of key influencers and markets across Canada and around the world.

We advance the enterprise business model of operation with clear bottom-line metrics and management accountabilities.

We cultivate meaningful relationships with visitors, members, donors, partners and stakeholders who are philosophically and financially committed to the vision and mandate of the Museum and wish to play a part in its life and future.



OUR PEOPLE

Board of Trustees

The Board of Trustees is the Museum's governing body, responsible to Parliament through the Minister of Canadian Heritage. The 11 members are Governor-in-Council appointees from all regions of Canada. Through accountability and strategic policy and planning frameworks, the Board provides corporate direction and delegates authority to the President and CEO for the management of the Museum. In 2019-20, the Board met three times, either in person, by conference call or by videoconference. 7 meetings of the Committees of the Board were held.

Trustees are responsible for gaining an understanding of the purpose and function of the Canadian Museum of Nature as well as of the federal context in which the Corporation operates. In addition, Trustees fulfill a stewardship role in respect of the Corporation, establishing and contributing to a good working relationship with management and staff and productively assessing the performance of the CEO and the Board. The members of the Board serve as ambassadors for the Museum. They are each called on to govern, to give, and to galvanize support for the Museum. The Board is responsible for the governance and financial sustainability of the Corporation.

STANDING COMMITTEES

Executive Committee

Judith LaRocque, Chair

Mandate: The Executive Committee's sole purpose is to act for the Board on urgent matters arising between regular Board meetings in cases where it is not possible to convene a meeting of the Board, and to do other things as delegated by the Board to the Committee.

Audit and Finance Committee

Ron Calderoni, Chair

Mandate: The Audit and Finance Committee is responsible for overseeing the Canadian Museum of Nature's standards of integrity and behaviour, the integrity and credibility of the Canadian Museum of Nature's financial reports, and the systems and practices of internal control.

Governance and Nominating Committee

Glenn Sakaki, Chair

Mandate: The Governance and Nominating Committee is responsible for monitoring adherence to Board policies, monitoring when terms of office for members of the Board of Trustees expire and for recommending to the Board individuals to be encouraged to participate in the Government of Canada appointment process. The Committee also leads the annual review of the President's performance and provides oversight for key human resources policies approved by the Board.

BOARD OF TRUSTEES

Judith LaRocque

Chairperson
Hawkesbury, Ontario
(14-Dec-17 to 13-Dec-20)

Glenn Sakaki

Vice-Chairperson
Toronto, Ontario
(25-Mar-19 to 24-Mar-22)

Allan Adam

Paddockwood, Saskatchewan
(25-Mar-19 to 24-Mar-22)

Ron Calderoni

Boucherville, Quebec
(5-Apr-12 to 20-Feb-22)

Doug Feasby

Ottawa, Ontario
(06-Mar-14 to 1-Jun-19)
*replaced by Mandy Woodland

Stephen Greenberg

Westmount, Quebec
(15-Apr-19 to 14-Apr-23)

Heather Holden

Vancouver, British Columbia
(19-Jun-19 to 18-Jun-22)

Susan Knott

Vancouver, British Columbia
(10-Apr-14 to 9-Apr-20)

Alice McCarron

Halifax, Nova Scotia
(21-Dec-10 to 18-Jun-19)
*replaced by Heather Holden

Linda Nowlan

Vancouver, British Columbia
(25-Jun-18 to 24-Jun-21)

Judith Pereira

Toronto, Ontario
(25-Jun-18 to 24-Jun-21)

Christian Robin

Winnipeg, Manitoba
(25-Jun-18 to 24-Jun-21)

Mandy Woodland

St. John's, Newfoundland and Labrador
(2-Jun-19 to 1-Jun-23)

Corporate Secretary

Skye Cameron

EXECUTIVE STAFF

Margaret Beckel

President and Chief Executive Officer

Ailsa Barry

Vice President, Experience and Engagement

Charles Bloom

Vice President, Corporate Services

Mark Graham

Vice President, Research and Collections

Ikram Zouari

Chief Financial Officer

MANAGEMENT TEAM

Laura Evans

Director, Advancement

Jean-Marc Gagnon

Section Head, Zoology

Sonja Gonsalves

Director, Human Resources

Angeline Laffin

Director, Visitor Experience

Martin Leclerc

Director, Facilities and Protection

Lynn Gillespie

Section Head, Botany

Jordan Mallon

Section Head, Palaeobiology

Paula Piilonen

Section Head, Mineralogy

John Swettenham

Director, Marketing and Media Relations

Stacy Wakeford

Director, Content



ASSESSMENT OF RESULTS FOR 2019-20



Strategic Objectives, Activities and Results 2019-20

The 2019-20 plan delivered on the measures that indicate the Museum is advancing its rolling strategic plan focused on Arctic, species discovery, nature inspiration, campus excellence and presence, and a sustainable museum enterprise.

Attendance, membership, fundraising, collaboration, research activity, digitization and majority of performance measures achieved or exceeded target. The Board and management believe the strategic plan framework remains relevant and the right guide for future operations of the Museum. Building on the success of the first five years of a post renewal strategic plan, the Museum is advancing another five years within the same strategic plan framework focused on its core strengths and in the areas of activity with the greatest impact on the public's interest in and understanding of our natural world. These areas continue to reflect the current and ongoing strategic framework that is focused on Arctic, species discovery, nature inspiration, presence and excellence, and sustainable museum enterprise.

Strategic Objective #1:

Transform people's understanding of Canada's leadership in Arctic knowledge and its importance to our global natural future.

Outcome: Be a global museum leader that engages in and influences global dialogue about the Arctic and its importance to our collective future.

Signature projects during the planning period:

- Host a global Arctic science symposium
- Lead an Arctic collaborative knowledge creation and sharing international project
- Grow global digital data sharing through existing platforms and portals
- Recruit leading philanthropists as visible champions committed to the Arctic cause
- Engage new partners with established profile and alignment with the Museum to enhance public engagement

Results: We experienced a stable level of participants in Arctic programming, of funds raised, of experts sought out, of media stories about our Arctic research and of Arctic collection digitization. Since there is no comparable institution these metrics were created by and for the Canadian Museum of Nature in discussion with our previous internal auditor KPMG.

Performance Measures:

Outcome	Measure	2019-20 Performance Target	2019-20 Actual
Be a global museum leader in Arctic Knowledge and Exploration	Number of participants in Arctic themed experiences: gallery, travelling exhibit, program, digital	500,000	767,373
	Funds raised supporting Arctic research, collections and engagement programming	\$500,000	\$751,000
	Number of contacts with the Museum of Nature and its experts and collections for Arctic related content, expertise and collaboration	80	74
	Number of Arctic research publications by research associates and collaborators	20	5
	Percent of Arctic collections digitized	50%	55%
	Awareness of the Museum's Arctic content and expertise as measured by number of media mentions, stories, etc.	200	190

Strategic Objective #2:

Transform understanding of the relevance and influence of species knowledge to peoples' lives now and in the future.

Outcome: Be a national museum leader that contributes to the understanding of Canada's biodiversity and geodiversity.

Signature projects during the planning period:

- Grow scientific training program attracting talent from across Canada and around the world
- Promote the cryogenic collection with Museum frozen tissue samples and welcome samples from outside the Museum
- Invest in use of and promotion of the One World Collection hosted by the Smithsonian
- Invest in the International Union for Conservation of Nature (IUCN) programs and congress
- Develop a long-term plan for the expansion of the Natural Heritage Campus collections facility to accommodate future collections growth

Results: We experienced growth in the use of and reference to the national collection in research and popular publications as well as steady engagement in species description, new experts training, collections digitization and digital content downloads and retrievals.

Performance Measures:

Outcome	Measure	2019-20 Performance Target	2019-20 Actual
Be a national museum leader that contributes to the understanding of Canada's biodiversity and geodiversity	Number of publications	50	66
	Number of new species described by the Museum	20	44
	Number of new experts being guided by us	30	61
	Collection lots digitized number and percent	905,000 / 27%	903,983 / 26%
	Amount of data shared digitally through nature.ca	20 million	23.2 million
	Growth of collection	25,000	45,722

Strategic Objective #3:

Transform understanding and engagement with nature by leveraging expert narratives, extraordinary collections, personal experiences and powerful dialogue.

Outcome: Be a leader and collaborator in innovative and sustainable nature inspiration and engagement.

Signature projects during the planning period:

- Refresh content with new lenses on nature in collaboration with strategic partners including Indigenous partners as fundraising is confirmed
- Develop and deploy a digital engagement framework for public programs and advancement
- Invest in a refreshed approach to the national and international travelling exhibit program
- Grow the Museum's profile through collaborations with strategic public programming partners

Results: We experienced a levelling off of on-site and off-site attendance to reflect the re-entry of the Canada Science and Technology Museum in the marketplace locally and nationally. This levelling off was also reflected in memberships. Investments in new programming will increase visitor engagement and could lead to higher levels of donor funds and Board engagement through giving.

Performance Measures:

Outcome	Measure	2019-20 Performance Target	2019-20 Actual
Be a leader and collaborator in innovative and sustainable nature inspiration and engagement	Number of visitors attending the VMMB and travelling exhibit experiences	1.2 million	780,030
	Number of Membership households	7,000	6,637
	Visitor engagement (surcharge ticket purchase)	40% highly engaged	41%
	Number of organizations collaborating with the Museum for content and experience creations	100 collaborations	55
	Funds raised in support of nature inspiration, content and experiences	\$1,510,000	\$2,343,839
	Board engagement in advancement programs percent and funds raised	80% / \$100,000	78% / \$1,055,000

Strategic Objective #4:

Play a vital role on the national and global stage to advance understanding and respect for nature.

Outcome: Be a known, respected, active and called upon player locally, nationally and globally.

Signature projects during the planning period:

- Invest in the Museum's role with the Ocean Literacy Coalition and in natural resource literacy program with office space, office support, senior executive time and content support. Ongoing throughout the planning period.
- Invest in national and international external relations program with government, non-governmental organizations and industry including provincial museums in Canada, natural history museums with an Arctic research program, Nature Conservancy of Canada, corporations from the natural resources sector
- Invest in science writing and communications for media, Government and stakeholder audiences if funding is secured through fundraising efforts
- Invest in global conferences and forums with Museum experts as speakers and the Museum as sponsor such as Arctic Science Summit Week, Biodiversity Next, Mineralogical Association of Canada. Ongoing throughout the planning period.
- Refresh the Nature Inspiration Awards national recognition program to reflect current trends in nature conservation

Results: The Museum's presence and impact on the national and global stage is directly related to the number of scientific experts available to share knowledge. We expected and saw the level of activity remain stable to reflect no increase in research staff.

Performance Measures:

Outcome	Measure	2019-20 Performance Target	2019-20 Actual
Be a known, respected, active and called upon player locally, nationally and globally	Number of roles in national and international collections management, research and visitor experience bodies	30	71
	Number of active external relations partners with national reach	5	5
	Number of Museum presentations at conferences and workshops	30	71
	Digital stories/views	5 / 100,000	32 / 43,173
	Open House attendance	4,000	3,842
	Number of media mentions and stories	1,500	1,362

Strategic Objective #5:

Evolve the museum enterprise model to embrace new technology, data analysis and employee engagement.

Outcome: Be a global leader in sustainable museum enterprise model application and development.

Signature projects during the planning period:

- Management and Artificial Intelligence in the Museum context
- Develop data analytics approach for Sustainable Museum Enterprise (SME) across all enterprise and corporate services units to ensure we have a financially sustainable business model
- Evolve the enterprise model toward a 30% earned revenue framework by growing fundraising and admissions revenue each year
- Evolve the talent management framework to accommodate a need for a nimble, adaptable workforce comfortable with change guided by the management succession plan and the business plans for each department
- Support the launch of the Canadian Museum of Nature Foundation

Results: Earned revenues, penetration of the tourism market and growth of fundraising (advancement) revenues advanced well during this fiscal. The year end closure of the Museum due to COVID-19 impacted year end tourist visitor numbers modestly. Staff engagement in professional development and training tracked ahead of plan due to management encouragement and subscription to the GC Campus program.

Performance Measures:

Outcome	Measure	2019-20 Performance Target	2019-20 Actual
Be a known, respected, active and called upon player locally, nationally and globally	Earned revenue as % of total budget	27%	26%
	Penetration of tourist market	11%	10.2%
	Advancement revenue as % of earned revenue	17%	20%
	Number of experience connections per FTE	20,000	18,701
	Percent of staff engaged in professional development and training	21%	45%
	Align the performance management and succession plans to support the enterprise model with the skills and human resource practices needed	Combined and integrated approach to human resource development and management	Fully integrated PMP and succession plan. Health and wellness framework underway. Implemented new Health and Wellness tools. Provided additional health and wellness support during COVID-19 pandemic.

The image features an abstract background composed of several overlapping rectangles in various shades of green. A prominent dark green rectangle is on the left side. Another dark green rectangle is at the top left, with a smaller, slightly lighter green rectangle nested within its top-right corner. To the right of these, there is a large, light green rectangle that contains the text. The overall composition is minimalist and modern.

SCIENTIFIC RESEARCH PROGRAM

Scientific Research Program for 2019–20

The Museum has Research Scientists, Curators and Senior Research Assistants who create and develop this program of work. Each of the multi-year projects draws upon the resources of the Museum as well as contributions from a significant list of collaborators.

This list is a reference to understand the topics being investigated, the range of activities, and who is involved. The information in this document is summarized from the pages of the detailed research proposals (available upon request), and also provides links to the corresponding Research and Collections web-pages at nature.ca.

This fiscal year, there is a total of 18 projects. New scientists who are in the process of being hired will establish their activities at a later date.

For those using this guide and comparing between years, the proposals presented are continued from last year, and in many cases the abstracts have been improved, the titles may have been tweaked, and the list of collaborators and students have been updated, as has the related travel.

Mineralogy

1.

Title: The Speciation and Evolution of Alkaline Environments: Trace Elements, Accessory Minerals and Magma

Principal Investigator: P.C. Pilonen (<https://nature.ca/en/research-collections/research-projects/evolution-alkaline-environments>)

Abstract: The foci of this study are extremely evolved suites of highly alkaline basalts and syenitic rocks. These rocks record melting in specialized environments at various depths within our planet, coupled with *extreme* evolution, that together produce exotic and sometimes economic deposits of rare metals such as niobium, zirconium, thorium and rare-earth elements. The complex chemistry of the deposits is typically concentrated in accessory minerals; consequently, studies concentrating on the chemistry of these minerals are among the best ways to trace the evolution of their hosts. Key goals of the study are to determine *how* these elements behave during the generation and evolution of magmas, and to discover *new ways* that these elements and their mineral hosts can be *used* to study the generation and evolution of magmas.

Other Researchers Involved: Henrik Friis (Oslo Museum, Norway), A.O. Larsen (Norsk Hydro, Norway), D. Henry (Museum Victoria, Australia), M. Danisik (Curtin University, Western Australia), J. Valley (University of Wisconsin), L. Sutherland (Australian Museum, Sydney, Australia), D. Oulette, M. Weeks (Angkor Gold Corp.), Ministry of Mines & Energy (MME), Cambodia; Institute of Technology Cambodia (ITC), Phnom Penh, Cambodia; E. Matchan, D. Phillips (Univ. of Melbourne, Australia), T. Tucker, R. Tibbit, R. Rothenburg.

2.

Title: Atomistic processes in mineral growth and stability: investigations into nanomineral behaviour and mechanisms of compositional zoning

Principal Investigator: A. J. Lussier

Abstract: Analytical advances have greatly enhanced our ability to characterize complex Earth materials. However, despite the resulting insight into mineral occurrences in geological systems, there is comparatively less understanding of the complex atomic mechanisms that govern their growth and stability. Developing such an atomic scale understanding of mineral processes would allow refined interpretations of emplacement histories as well as predictions of future behaviours. The work proposed here endeavours to elucidate such fine-scale processes as they: (1) link the behaviours of nanoscale and macro-scale mineral species in diverse geological (and biological) systems; and (2) relate structure to composition of chemically-zoned single crystals.

Other Researchers Involved: G. Poirier, R. Rowe (CMN), Dr. Michael Schindler, Elizabeth Turner (Earth Sciences, Laurentian University), Dr. Tracey Lowen (Research Scientist, Dept. Fisheries Oceans), Dr. Dirk Schumann (Scientist, FIBICS Inc. Ottawa, ON), Dr. Frank C. Hawthorne (Geological Sciences, University of Manitoba).



Palaeobiology

1.

Title: Species coexistence and change during the Late Cretaceous of North America

Principal Investigator: Jordan Mallon (<http://nature.ca/en/research-collections/research-projects/palaeo-ecology-canadian-dinosaurs>)

Abstract: The Late Cretaceous period of North America (-85–66 Ma) witnessed an explosion in dinosaur diversity, followed by a decline in some groups leading up to the end-Cretaceous mass extinction. Internal processes, like niche partitioning, and external processes, like sea level and climate change, are among the factors that have been invoked to account for the rise and subsequent fall of dinosaur diversity. Addressing these matters may therefore shed light on related conservation issues today. My approach combines fieldwork with integrative and collaborative research to investigate the evolution and palaeoecology of Canadian dinosaurs within this broader context.

Other Researchers Involved: Emily Bamforth (Royal Saskatchewan Museum, Regina, Saskatchewan), Don Brinkman (Royal Tyrrell Museum of Palaeontology, Drumheller, Alberta) David Eberth (Royal Tyrrell Museum of Palaeontology, Drumheller, Alberta) David Evans (Royal Ontario Museum/University of Toronto, Toronto, Ontario) Jim Farlow (Indiana University–Purdue University Fort Wayne, Indiana), Andrew Farke (Raymond M. Alf Museum of Paleontology, Claremont, California) Danielle Fraser (Canadian Museum of Nature, Ottawa, Ontario) Alexis Karme (University of Helsinki, Helsinki, Finland), Donald Henderson (Royal Tyrrell Museum of Palaeontology, Drumheller, Alberta) Robert Holmes (University of Alberta, Edmonton, Alberta) James Loughry (Valdosta State University, Valdosta, Georgia), Randall Nydam (Midwestern University, Glendale, Arizona) Attila Ósi (Eötvös University, Budapest, Hungary) Michael Ryan (Cleveland Museum of Natural History, Cleveland, Ohio) Craig Scott (Royal Tyrrell Museum of Palaeontology, Drumheller, Alberta) Darren Tanke (Royal Tyrrell Museum of Palaeontology, Drumheller, Alberta) François Therrien (Royal Tyrrell Museum of Palaeontology, Drumheller, Alberta), Tim Tokaryk (Royal Saskatchewan Museum, Regina, Saskatchewan) Matthew Vavrek (University of Alberta, Edmonton, Alberta) Xiao-Chun Wu (Canadian Museum of Nature, Ottawa, Ontario) Xing Hai (China University of Geosciences, Beijing, China); Scott Rufolo (research assistant), Alan McDonald (technician), Susan Swan (technician), Shyong En Pan (technician), Emily Stott (volunteer) and Perry Mallon (volunteer).

2.

Title: Taxonomy and systematics of Canadian Cenozoic (66 Ma – present) high latitude mammals

Principal Investigator: Danielle Fraser

Abstract: Over the past 66 Ma, the Arctic has experienced the most extreme climate changes on Earth. However, Cenozoic Arctic mammal faunas remain relatively poorly known, limiting our understanding of when and why modern patterns of biodiversity evolved. The goal of this research project is therefore to characterize the biodiversity of high latitude mammals during the Miocene and Pliocene using *inter alia* field-based, phylogenetic, and comparative approaches as means of understanding the: i) evolution of latitudinal diversity gradients in the Western Hemisphere and ii) role the Arctic has played as both a cradle and museum for mammal biodiversity.

Other Researchers Involved: Meghan Balk (Smithsonian NMNH), Emily Bamforth (Royal Saskatchewan Museum), Andrew Barr (George Washington University), Antoine Bercovici (Smithsonian NMNH), A. Kay Behrensmeyer (Smithsonian NMNH), Jessica Blois (University of California, Merced), Robert Boesseneker (INSERT), Morgan Churchill (University of Wisconsin), Mark Clementz (University of Wyoming), Andrew Du (University of Chicago), Jonathan Geisler (New York Institute of Technology), Nicholas Gotelli (University of Vermont), Root Gorelick (Carleton University), Christopher Hassall (University of Leeds), Sora Kim (University of Kentucky), S. Kathleen Lyons (University of Nebraska), Hillary Maddin (Carleton University), Jordan Mallon (Canadian Museum of Nature), Brian McGill (University of Maine), Joshua Miller (University of Cincinnati), Lauren Sallan (University of Pennsylvania), Silvia Pineda-Munoz (Smithsonian NMNH), Andy Simpson (Smithsonian NMNH), Felisa Smith (University of New Mexico), Laura Soul (Smithsonian NMNH), Jessica Theodor (University of Calgary), Amelia Villaseñor (University of New Mexico), Peter Wagner (University of Nebraska), Jeffrey Welker (University of Alaska), Scott Wing (Smithsonian NMNH), Grant Zazula (Yukon Palaeontology Program) as well as Natalia Rybczynski, Margaret Currie, Marisa Gilbert, Alan McDonald (CMN).

3.

Title: I. Vertebrate faunal changes within a paleo-environmental context during the Triassic and Early Jurassic in south-western China and western Canada. II. The impact of environmental changes during the Cretaceous and the Paleogene on the vertebrate faunas in China and Alberta, Saskatchewan, and Manitoba, Canada.

Principal Investigator: Xiao-Chun Wu (<http://nature.ca/en/research-collections/research-projects/reptiles-mesozoic-era>)

Abstract: I-Studies of the marine reptiles from the Triassic of China and Canada will be significant to our understanding of faunal changes during the Triassic and the Tr-J transition from marine to terrestrial environments in a global scale.

II-Studies of vertebrate faunas (mainly dinosaurs and crocodiles) of the Cretaceous and Paleogene in Canada and China may have a significant impact on the diversity and number of dinosaurs and other vertebrates before and after the K-Pg extinction.

Information derived from the two projects can be used to answer questions, such as the magnitude of those extinctions, climate-environmental changes, and faunal exchanges and correlations between North America and Asia during the Tr-J and K-Pg transitions, respectively.

Other Researchers Involved: C. Li, H.-I. You, and Q.-h. Shang, Institute of Paleontology and Paleoanthropology, Chinese Academy of Sciences; T. Wang, Land and Mineral Resources of Lufeng County, China; T. Sato, Tokyo Gakugei University, L.-j. Zhao, Zhejiang Museum of Natural History, China; P. Currie, University of Alberta; S. Chatterjee, Texas Tech University; R.-f. Wang, Shanxi Geological Museum, China; Y.-N. Cheng and H.-y. Shan, National Museum of Natural Sciences, Taiwan; S. Nesbitt and M. Stoker, Virginia Tech; D. Brinkman and D. Eberth, Royal Tyrell Museum of Palaeontology; L. Xu, Henan Geological Museum, China; J.-c. Lu and Q. Ji, Geological Institute of Chinese Academy of Geological Sciences; H. Ouyang and Y.-I. Zhu, Chongqing Museum of Natural History, China; T. Tokaryk, Royal Saskatchewan Museum; H. Xing, Beijing Museum of Natural history, China; J. Mallon, A. McDonald, S. Swan, M. Currie, M. Gilbert, and S. Rufolo, CMN.



Botany

1.

Title: Biodiversity of the Canadian Arctic Flora; Vascular Plants and Lichens

Principal Investigators: Lynn Gillespie (<http://nature.ca/en/research-collections/research-projects/canadian-arctic-flora-biodiversity-change>), Dr. Jeffery Saarela (<http://nature.ca/en/research-collections/research-projects/canadian-arctic-flora-biodiversity-change>), and Dr. Troy McMullin

Abstract: This research program aims to increase knowledge of the diversity of Canadian Arctic vascular plants and lichens, which is fundamental to understanding how the Arctic flora may be impacted by environmental change, and provides baseline data for conservation, ecological monitoring, and predictive modeling studies. The main goals of the program are to produce a new flora treating all Canadian Arctic vascular plant species; characterize biodiversity of Arctic lichens and produce a checklist of Canadian Arctic lichens; produce DNA barcode data for Canadian Arctic vascular plants and lichens; undertake field expeditions to the Arctic to conduct floristic studies of botanically underexplored regions; analyse patterns of species and genetic diversity across the Canadian Arctic; and conduct systematic studies of taxonomically problematic species complexes.

Other Researchers Involved: CMN - P. Sokoloff, G. Levin, R. Bull, J. Doubt, L. Sharp, C. Deduke, M. Paradis, J. Lee, S. Ponomarenko; NatureServe, Yukon Environment, Whitehorse - B. Bennett; Université de Montréal Institut de recherche en biologie végétale - L. Brouillet; University of Oslo - A. Brysting, R. Elven, H. Solstad; Agriculture Canada - J. Cayouette, J. Macklin, T. Smith; University of Manitoba - B. Ford; University of Alaska - S. Ickert-Bond, D. Murray; University of Ottawa - J. Starr; U.S. Fish and Wildlife - S. Talbot; University of Victoria - G. Allen; Royal Botanic Gardens, Hamilton - J. Pringle; Waterloo University - S. Shiff.

2.

Title: Taxonomy and phylogenetics of grasses (Poaceae) and their monocot relatives

Principal Investigator: Jeffery M. Saarela (<http://nature.ca/en/research-collections/research-projects/taxonomy-phylogenetics-grasses-poaceae-their-relatives>)

Abstract: I conduct taxonomic and phylogenetic research on grasses, sedges and their relatives. I conduct collections-based studies, which provide comprehensive baseline data on plant nomenclature, morphology, and distribution in time in space, providing up-to-date information that is critical for understanding and monitoring organismal responses to environmental change. I use DNA sequence data to produce DNA-based identification tools, identify major lineages and reconstruct their evolutionary relationships, develop and clarify taxonomic classifications, characterize patterns of molecular evolution, and understand patterns of morphological change within and among lineages. I make extensive field collections, and all material is deposited in the National Herbarium of Canada.

Other Researchers Involved: CMN – R. Bull, P. Sokoloff, M. Paradis, S. Ebata; National Museum of Natural History, Smithsonian Institution – P. M. Peterson, R. J. Soreng; W. Szafer Institute of Botany, Polish Academy of Sciences – B. Paszko; Northern Illinois University – M. Duvall; Stockholm University, Sweden – A. Humphreys.

3.

Title: Phylogenetic and molecular systematics of flowering plants with a focus on grasses and spurges: species discovery and evolutionary history

Principal Investigator: Lynn Gillespie (<http://nature.ca/en/research-collections/research-projects/understanding-evolutionary-history-flowering-plants>)

Abstract: This research program aims to increase our knowledge of the systematics and evolution of flowering plants, focusing on the grass tribe Poeae and the spurge family Euphorbiaceae. I use phylogenetic analyses of molecular data and detailed morphological studies to assess current taxonomy and classification, explore the evolution of morphological and ecological traits, and examine historical biogeography. The goals are to understand evolutionary relationships over time and space, devise new classifications reflecting phylogenetic history, discover species and genera new to science, and produce taxonomic revisions and floristic treatments.

Other Researchers Involved: CMN – R. Bull, P. Sokoloff, G. Levin, L. Sharp, M. Paradis, S. Ebata; Departamento de Biodiversidad y Gestión Ambiental, Universidad de León, Spain – A. Alonso; Portsmouth University, UK / University of Alaska – W. S. Armbruster; Namik Kemal University, Turkey – E. Cabi; Middle East Technical University, Turkey – M. Dogan; Department of Conservation, New Zealand – P. de Lange; Instituto de Botánica Darwinion, Argentina – L. Giussani; Tomsk State University, Russia – M. Olonova; Landcare Research, New Zealand – R. Smitsen; Botany Dept. Smithsonian Institution, Washington DC – R. Soreng, K. Wurdack; Netherlands National Herbarium, Naturalis – P. van Welzen.

4.

Title: Freshwater micro-organism diversity and environment (FMODE): multi-proxy approach to systematics, global biodiversity, Arctic toxicology, impact assessment and environmental change using conventional and genetic markers

Principal Investigator: Paul B. Hamilton (<http://nature.ca/en/research-collections/research-projects/freshwater-micro-organisms-systematics-biodiversity-toxicolog>), **Supervising Scientist:** Lynn Gillespie, Section Head

Abstract: Diatoms are markers of habitat integrity, anthropogenic impacts and environmental change. This research is within two strategic themes (directive to inspire understanding & respect for nature). Diversity in environmentally stressed systems will be aligned with Canadian and global biodiversity. Impacts of mercury and organic contaminants will be assessed in the Canadian Arctic. The taxonomy of *Neidium*, *Pinnularia*, *Surirella* and *Nitzschia* will be studied. Diatoms are biomarkers for nutrient and metal pollution. A multi-proxy protocol will be taken to evaluate cryptic species using morphology and gene barcoding. The objective is to link global microbial biodiversity with environmental health and biogeography.

Other Researchers Involved: CMN - N. Rybczynski, R. Bull, V. Assinewe, E. Farlam, S. Perrin, W. Schliwen, J. Holmes; University of Ottawa - F.R. Pick, J. Starr; Universidad Católica Boliviana, Bolivia - E.A. Morales; Agarhar Research Institute, India - B. Karthick, Dr. Alalananda; University of Windsor - G.D. Haffner; Guizhou Normal University, China - C. Zhi; INRS Université d'avant-garde, Québec - I. Lavoie; Brown University, USA - J. Russell; Southwest University, China - L. Zang; Laval University - R. Pienitz, Institute of Biology, Faculty of Natural Sciences, Republic of Macedonia - Z. Levkov, University of Utrecht, Netherlands - A. Cvetkoska, Georgia College and State University - K. Manoylov, the Natural History Museum - D.M. Williams, Academy of Natural Sciences of Drexel, USA - M. Potapova, Belgium Botanical Gardens - B. Van de Vijver, Geological Survey of Canada - J. Galloway, P. Outridge, M.-C. Williamson; Dept. of Fisheries & Oceans - G. Stern; Tanulako University, Indonesia - F.Y. Tantu, J. Nilawati; Freelance Environmental Services, Spain - S. Pla-Rabes; Agriculture and Agri-food Canada - J. Maklin, D. Lapen.



5.

Title: The biogeography, ecology, and taxonomy of Canadian lichens

Principal Investigator: Troy McMullin

Abstract: The aim of my research program is to advance our knowledge of the Canadian lichen biota. I will conduct interdisciplinary collection-based research throughout the country with a focus on regions, habitats, and species that are poorly understood. My objectives are to: 1. develop regional base-line data for areas with knowledge gaps, 2. address taxonomic uncertainties using morphometrics, metabolite determinations, and phylogenetic analyses, and 3. resolve unknown questions in lichen ecology.

Other Researchers Involved: from CMN - I. Brodo, R. Bull, C. Deduke, J. Doubt, C. Freebury, L. Gillespie, C. Lewis, G. Levin, T. Narlock, J. Saarela, P. Sokoloff; Nova Scotia Museum of Natural History - F. Anderson, New York Botanical Garden - J. Allen and J. Lendemer, Canadian Forest Service, NL - A. Arsenault, Institute for Applied Ecology New Zealand - H. Braid, Nova Scotia Environment - R. Cameron, University of Guelph - B. Dorin, Ministère des Forêts, de la Faune et des Parcs, QC - J. Gagnon, Dr. D. Haughland - Royal Alberta Museum, Biodiversity Institute of Ontario - N. Ivanova and S. Newmaster, Chu Cho Environmental, BC - S. Rapai, Saint Mary's University, NS - D. Richardson, University of Maine at Fort Kent - S. Selva, Memorial University, NL - Y. Wiersma.

6.

Title: Bryophytes of Canada

Principal Investigator: Jennifer Doubt (<http://nature.ca/fr/recherche-collections/projets-recherche/bryophytes-canada>)

Supervising Scientist: Lynn Gillespie (<http://nature.ca/fr/recherche-collections/scientifiques/michel-poulin>)

Abstract: This research on mosses, liverworts and hornworts supports the understanding of plant diversity and conservation in Canada, and builds a key strength of the National Herbarium of Canada. Bryophytes provide all the ecosystem services that plants provide worldwide, while also filling unique roles specific to their distinctive size and biological traits, making life possible in extreme terrestrial environments, notably the Arctic. Bryophytes have yet to be studied in detail in most parts of Canada, creating abundant opportunity for discovery and meaningful contribution to natural history knowledge.

Other Researchers Involved: CMN - P. Sokoloff, T. McMullin, J. Saarela, L. Gillespie, C. Hyslop, L. Ovenden, Ontario Ministry of Natural Resources - E. Snyder, Independent Bryologists - J. Faubert, Linda Ley, CMN - P. Sokoloff, T. McMullin, C. Hyslop, L. Ovenden, Ontario Ministry of Environment and Climate Change - M. Dixon, University of Alberta - R. Belland, PEI Department of Agriculture and Forestry - R. Curley, Canadian Wildlife Service, Yukon - S. Cannings, Yukon Conservation Data Centre - B. Bennett, Ontario Ministry of Natural Resources and Forestry - M. Oldham, Université de Québec en Abitibi-Témiskamingue - N. Fenton, University of Guelph - M. Kuzmina, Université Laval - J.C. Villareal, Northwest Territories Department of Environment and Natural Resources - S. Carriere.

7.

Title: Species diversity, biogeography and taxonomy of red algae in Canada

Principal Investigator: Amanda Savoie

Abstract: The goal of this research program is to increase our knowledge of red algal species diversity, biogeography, and evolutionary relationships in Canada. I will conduct collections-based research, using a combination of molecular and morphological techniques to accurately identify known taxa, describe new species, and monitor species distributions along the Arctic, Atlantic and Pacific coastlines of Canada. Red algal systematics will be revised using a molecular phylogenetic approach, resulting in a better understanding of evolutionary relationships within this group. This work will help document the changes occurring in the Canadian arctic, and will add to our knowledge of biodiversity in Canada.

Other Researchers Involved: CMN - P. Sokoloff, R. Bull, J. Doubt, P. Hamilton, L. Sharp; C. Brooks (University of New Brunswick, NB), K. Cripps (University of New Brunswick, NB), Dr. T. Bringloe (University of New Brunswick, NB), Dr. P. Díaz-Tapia (University of A Coruña, Spain), Dr. C.W. Schneider (Trinity College, Connecticut), Dr. G.W. Saunders (University of New Brunswick, NB), Dr. M.J. Wynne (University of Michigan, MI).



Zoology

1.

Title: Systematics of New World Weevils (Coleoptera: Curculionidae)

Principal Investigator: Robert S. Anderson (<http://nature.ca/en/research-collections/research-projects/taxonomy-weevils-americas>)

Abstract: This ongoing project on the systematics of weevils of the New World uses standard methods of morphological systematics to assess the taxonomy, classification, distribution and natural history for various taxa. The primary focus will be on systematics, biogeography and evolution of the fauna of leaf litter, particularly those members of the tribe Lymantini (Molytinae) as well as on Tropiphorini from southwestern USA. Primary target areas for study are Central America, the West Indies and North America. Studies will include taxonomic revisions, descriptions of new species, biogeographic assessments of endemism and species richness and faunal reviews. Opportunities for collaboration on molecular studies will be pursued where appropriate.

Other Researchers Involved: CMN – F. Genier, S. B. Peck, A. Smith; Montana State University – M. Ivie, Agriculture Agri-Foods Canada – P. Bouchard, H. Douglas; – C. W. O'Brien, Centro oriental de Ecosistemas y Biodiversidad (BIOECO), Cuba – A. Deler Hernandez, F. Cala Riquelme; Institute of Sciences, Beijing – R. Zhang; Arizona State University – N. Franz; University of Arizona – W. Moore; San Carlos University, Guatemala – M. Barrios.

2.

Title: Living on the cold ocean floor: biodiversity and the effects of icebergs, natural gas and resource extraction

Principal Investigator: Kathleen Conlan (<http://nature.ca/en/research-collections/science-experts/kathleen-e-conlan>)

Abstract: This research explores the diversity and patterns of marine life on various ocean floors: the Arctic, Antarctic, Australia and the abyssal deep. Numerous unusual and unknown species are being discovered and community patterns are being assessed in relation to impacts from iceberg groundings, natural gas seeps and hydrocarbon extraction. The results will enhance our understanding of the diversity and dynamics of life on the seafloor and will help us to predict responses to climate change and seafloor resource extraction.

Other Researchers Involved: University of Saskatchewan – A. Aitken; Geological Survey of Canada, Bedford Institute of Oceanography, Dartmouth – S. Blasco; Moss Landing Marine Laboratories, California – S. Kim, R. Kvitek; Senckenberg Institute and Museum, Germany – P. Martinez Arbizu, S. Brix; Museum für Naturkunde, Berlin – O. Coleman; Royal Belgian Institute of Natural Sciences – C. De Broyer; Dankook University, South Korea – Y.-H. Kim; University of Lodz, Poland – A. Jażdżewska.

3.

Title: Population dynamics, trophic relationships, and comparative morphology of Arctic micromammals

Principal Investigator: Dominique Fauteux

Summary: This project involves a collaborative and multidisciplinary approach to studying population dynamics, trophic relationships and comparative morphology of Arctic micromammals. Our knowledge of the diversity and role of micromammals in the Arctic tundra is still unknown. The collaborative approach will provide a better understanding of how the Arctic ecosystem works by joining the expertise of each team. Three sites will be monitored to understand the spatial and temporal dynamics of lemming population cycles and to document a poorly understood micromammal species in the literature, the Ungava lemming.

Other researchers involved: CMN - K. Khidas, N. Alfonso, G. Rand; Université Laval: G. Gauthier, F. Dominé; Université du Québec à Rimouski: D. Berteaux, J. Bêty; Université de Sherbrooke: D. Gravel; Moncton University : N. Lecomte, M.-A. Giroux; Tromsø University (Norway) : R. Ims, N. Yoccoz, D. Ehrich; Aarhus University (Denmark): N.M. Schmidt; University of Burgundy: O. Gilg; Russian Academy of Sciences in Moscow: A. Sokolov, N. Sokolova; Polar Knowledge Canada in Cambridge Bay: J.-F. Lamarre. Ministère des Forêts, de la Faune et des Parcs du Québec: A. Massé; Université de Montréal, Faculté vétérinaire: P. Leighton.



4.

Title: Ecology and Taxonomy of Northwest Atlantic/Arctic Marine Invertebrate Species

Principal Investigator: Jean-Marc Gagnon (<http://nature.ca/en/research-collections/research-projects/ecology-taxonomy-northwest-atlantic-marine-species>)

Abstract: This research project contains four collaborative activities that examine taxonomic, biogeographic and ecological questions for North Atlantic and Arctic species of crustaceans, mollusc and polychaete. The first activity looks at population differentiation and distribution for the Lady Crab (*Ovalipes ocellatus*) in the Northwest Atlantic; a collaboration with DFO- Moncton. The second activity was started in June 2012, with Barcode of Life and DFO (IML, Mont-Joli) researchers, comparing morphological traits and DNA information for scavenging amphipods of the northwest Atlantic and Canadian Arctic. The third activity (with a Ph.D. candidate from Florida) aims to describe a new *Chaetopterus* species (Polychaeta) from the St. Lawrence Estuary. The fourth activity (with DFO-Halifax and Florida researchers) is a continuation of the research on the newly described species of giant file clam, *Acesta cryptadelphe*. New data from the US continental slope of the Northwest Atlantic will result in the description of the distribution of the latter species.

Other Researchers Involved: Department of Fisheries and Oceans – M. Hanson, E. Kenchington; University of Guelph – A. Radulovici; Florida State University Coastal and Marine Laboratory – Dr. S. Brooke; University of Florida – J. Moore.

5.

Title: Characterizations Morphogenetics of Grands Carnivores and Implications in their Conservation in Canada

Principal Investigator: Kamal Khidas (<http://nature.ca/en/research-collections/research-projects/morphogenetic-characteristics-large-carnivores-canada-implica>)

Summary: Morphogenetic characteristics and variation are studied in Canada's Lynx, Gray Wolf, Polar Bear and Brown Bear to identify significant evolutionary units and possibly validate taxa, formerly described or to be revealed, by elucidating the mechanisms of adaptation and evolution (microevolution) of populations. An important part of these studies is the influential environmental factors and the revelations that will be made about the impacts of spatial habitat configurations and environmental changes on the distribution of these units. It will ultimately be possible to refine conservation strategies for these species.

Other researchers involved: Laurentian University, Sudbury - F. Mallory, M.V. Chevasco; Trent University, Peterborough - J. Bowman, M. Prentice; New Brunswick Museum, Saint John and Texas Tech University, Texas - H. M. Huynh; Ontario Ministry of Natural Resources and Forestry, J. Bowman; and CMN - R. Bull, L. Allen.

6.

Title: Native freshwater mussels of Canada: taxonomy, distribution & decline

Principal Investigator: André L. Martel (<http://nature.ca/en/research-collections/research-projects/freshwater-mussels-marine-mussels-canada-studies-taxonomy-dis>)

Abstract: This research focuses on a speciose yet declining group of bivalve molluscs within Canada, native freshwater mussels (Unionacea). (1) Species differentiation and taxonomy are studied by comparative morphology of siphonal apertures of adults, early shell morphology, as well as by mtDNA. (2) Distribution is assessed during field surveys in selected rivers and lakes. (3) Temporal changes in freshwater mussel communities are evaluated, with emphasis on species loss, by comparing results from recent field surveys with past surveys and historical collection records, as well as by evaluating the impact of the invasive zebra mussel and changes in fish communities (host fishes).

Other Researchers Involved: CMN - J. Madill, R. Bull, N. Alfonso, G. Poirier; Ottawa River Keeper - M. Brown; Parc de la Gatineau - I. Beaudoin-Roy; New Brunswick Museum - Dr. D. McAlpine; Ministère du Développement Durable, de l'Environnement, de la Faune et des Parcs du Québec - N. Desrosiers and A. Paquet; Royal British Columbia Museum - H. Gartner and Rick Harbo; BC Ministry of Environment - G. Wilson; Kenauk Forest Institute- B. Nowell; Nature Conservancy Canada - G. Bell and M. Ihrig.



COMMUNICATING RESEARCH RESULTS

Research and Collections Staff

Museum staff published 66 refereed articles, which are reviewed by other scientists in the field before they are published. Articles by Beaty Centre for Species Discovery Postdoctoral Fellow T.M. Onuferko are included under staff. A subset of staff publications is listed under Research/Museum Associates when a Research/Museum Associate is the first author. Museum staff published 46 non-refereed articles, including abstracts. Names in boldface are Museum staff members. Publications are listed in the language in which they are written.

Refereed publications

Journal articles and book chapters

Anderson, R.S. 2019. *Eurhamphus pancinii*, a new species of the genus *Eurhamphus* Shuckard, 1838 (Coleoptera: Curculionidae: Molytinae: Orthorhinini) from West Papua. *Zootaxa*, 4613:596–599. <https://doi.org/10.11646/zootaxa.4613.3.12>

Anderson, R.S. 2019. Introduction: Remembering A.T. Howden and H.R. Burke. *The Coleopterists Bulletin*, 73:765–772. <https://doi.org/10.1649/0010-065X-73.4.765>

Anderson, R.S. 2019. Taxonomic revision of the genus *Paranametis* Burke 1960 (Coleoptera: Curculionidae: Entiminae; Byrsopagini). *The Coleopterists Bulletin*, 73:966–974. <https://doi.org/10.1649/0010-065X-73.4.966>

Anderson, R.S. and C.W. O'Brien. 2019. Revision of the genus *Laccoproctus* Schoenherr (Coleoptera: Curculionidae: Molytinae; Conotrachelini) with new species from Mexico and Guatemala. *The Coleopterists Bulletin*, 73:945–961. <https://doi.org/10.1649/0010-065X-73.4.945>

Anderson, R.S. and M.A. Alonso-Zarazaga. 2019. *Apion carrorum*, Anderson & Alonso-Zarazaga, new species, the first representative of the genus *Apion* Herbst (Coleoptera: Brentidae: Apioninae) in North America. *The Coleopterists Bulletin*, 73:889–892. <https://doi.org/10.1649/0010-065X-73.4.889>

Chamorro, M.L. and **R.S. Anderson**. 2019. *Vauricia howdenae*, a new genus and species of Rhinostomina from the oriental region with a key to world genera of Orthognathini (Curculionidae, Dryophthorinae). *The Coleopterists Bulletin*, 73:875–883. <https://doi.org/10.1649/0010-065X-73.4.875>

- Clark, W.E., H.R. Burke, R.W. Jones and **R.S. Anderson**. 2019. The North American species of the *Anthonomus squamosus* species group (Coleoptera: Curculionidae, Curculioninae, Anthonomini). The Coleopterists Bulletin, 73:773–827. <https://doi.org/10.1649/0010-065X-73.4.773>
- Cortes-Hernandez, K. and **R.S. Anderson**. 2019. Two new species of *Isodrusus* Sharp, 1911 (Coleoptera: Curculionidae: Entiminae: Tanymericini). The Coleopterists Bulletin, 73:940–944. <https://doi.org/10.1649/0010-065X-73.4.940>
- Haran, J., Cocquempot, C. and **R.S. Anderson**. 2019. *Lignyodes helvolus* (LeConte, 1876), une espèce associée aux frênes nouvellement établie en France continentale (Coleoptera: Curculionidae). L'Entomologiste, 75(5):309–311.
- Korotyaev, B.A. and **R.S. Anderson**. 2019. *Ceutorhynchus howdenae* Korotyaev and Anderson (Coleoptera: Curculionidae), a new species of weevil from subarctic Canada. The Coleopterists Bulletin, 73:884–888. <https://doi.org/10.1649/0010-065X-73.4.884>
- Pentinsaari, M., **R.S. Anderson**, L. Boroweic, P.B. Bouchard, A. Brunke, H. Douglas, **A.B.T. Smith** and P. Hebert. 2019. DNA barcodes reveal 63 overlooked species of Canadian beetles (Insecta, Coleoptera). Zookeys, 894:53–150. <https://doi.org/10.3897/zookeys.894.37862>
- Schmidt, E., **D. Fauteux**, J.-F. Therrien, G. Gauthier and Y. Seyer. 2020. Improving diet assessment of Arctic terrestrial predators with the size of rodent mandibles. Journal of Zoology <https://doi.org/10.1111/jzo.12756>
- Tóth, A.B., S.K. Lyons, W.A. Barr, A.K. Behrensmeyer, J.L. Blois, R. Bobe, M. Davis, A. Du, J.T. Eronen, J.T. Faith, **D. Fraser**, N.J. Gotelli, G.R. Graves, A.M. Jukar, J.H. Miller, S. Pineda-Munoz, L.C. Soul, A. Villaseñor and J. Alroy. 2019. Reorganization of surviving mammal communities after the end-Pleistocene megafaunal extinction. Science, 365:1305–1308. <https://doi.org/10.1126/science.aaw1605>
- Génier, F.** 2019. Endophallites: a proposed neologism for naming the sclerotized elements of the insect endophallus (Arthropoda: Insecta). Annales de la Société entomologique de France (N.S.), 55:482–484. <https://doi.org/10.1080/00379271.2019.1685907>
- Génier, F.** and P. Moretto. 2019. A new species of *Onitis* Fabricius, 1798 from south-Oeastern Africa (Coleoptera, Scarabaeidae, Scarabaeinae, Onitini). ZooKeys, 900:23–29. <https://doi.org/10.3897/zookeys.900.39284>
- Génier, F.** 2019. On the identity of *Canthon imitator floridanus* Brown, 1946 (Coleoptera: Scarabaeidae: Scarabaeinae). The Coleopterists Bulletin, 73:300–306.
- Daniel, G.M. and **F. Génier**. 2019. A preliminary checklist of the dung beetle species of Mozambique (Coleoptera: Scarabaeidae: Scarabaeinae). Catharsius: la revue, 19:25–32.
- Cardinal-McTeague, W.M., K.J. Wurdack, E.M. Sigel and **L.J. Gillespie**. 2019. Seed size evolution and biogeography of *Plukenetia* (Euphorbiaceae), a pantropical genus with traditionally cultivated oilseed species. BMC Evolutionary Biology, 19:29. <https://doi.org/10.1186/s12862-018-1308-9>
- Wasowicz, P., A.N. Sennikov, K.B. Westergaard, K. Spellman, M. Carlson, **L.J. Gillespie**, **J.M. Saarela**, S.S. Seefeldt, B. Bennett, C. Bay, S. Ickert-Bond and H. Vare. 2020. Non-native vascular flora of the Arctic: Taxonomic richness, distribution and pathways. Ambio, 49:693–703. <https://doi.org/10.1007/s13280-019-01296-6>
- Hamilton, P.B.**, K. Stachura-Suchoples, W.-H. Kusber, A. Bouchard and R. Jahn. 2019. Typification of the puzzling diatom species *Neidium iridis* (Neidiaceae). Plant Ecology and Evolution, 152:392–401. <https://doi.org/10.5091/plecevo.2019.1601>
- Hamilton, P.B.**, **A.M. Savoie**, C.M. Sayre, O. Skibbe, J. Zimmermann and **R.D. Bull**. 2019. Novel *Neidium* Pfitzer species from western Canada based upon morphology and plastid DNA sequences. Phytotaxa, 419:39–62. <https://doi.org/10.11646/phytotaxa.419.1.3>
- Bouchard, A.J., **P.B. Hamilton**, **A.M. Savoie** and J.R. Starr. 2019. Molecular and morphological data reveal hidden diversity in common North American *Frustulia* species (Amphipleuraceae). Diatom Research, 34:205–223. <https://doi.org/10.1080/0269249X.2019.1704889>
- Caput Mihalic, K., I. Galovic, C.E. Wetzel, L. Ector, N. Illijanic, S. Miko, A. Wishherman, **P.B. Hamilton** and Z. Levkov. 2020. *Envekadea vранаensis* sp. nov., a new diatom species (Bacillariophyta) from the lacustrine Holecene sediments of Lake Vrana, Croatia. Nova Hedwigia, 110:1–29. https://doi.org/10.1127/nova_hedwigia/2019/0561

- Cantonati, M., S. Poikane, C.M. Pringle, L.E. Stevens, E. Turak, J. Heino, J.S. Richardson, R. Bolpagni, A. Borriani, N. Cid, M. Čtvrtilíková, D.M.P. Galassi, M. Hájek, I. Hawes, Z. Levkov, L. Naselli-Flores, A.A. Saber, M.D. Cicco, B. Fiasca, **P.B. Hamilton**, J. Kubečka, S. Segadelli and P. Znachor. 2020. Characteristics, main impacts, and stewardship of natural and artificial freshwater environments: Consequences for biodiversity conservation. *Water*, 12:260. <https://doi.org/10.3390/w12010260>
- Kim Tiam, S., I. Lavoie, F. Liu, **P.B. Hamilton** and C. Fortin. 2019. Diatom deformities and tolerance to cadmium contamination in four species. *Environments*, 6:102. <https://doi.org/10.3390/environments6090102>
- Levkov, Z., D. Vidakovic, A. Cvetkoska, D. Mitic-Kopanja, S. Krstic, B. Van de Vijver and **P.B. Hamilton**. 2019. Observations on the genus *Muelleria* (Bacillariophyceae) from the Republic of North Macedonia. *Plant Ecology and Evolution*, 152:293–312. <https://doi.org/10.5091/plecevo.2019.1611>
- Long, S., **P.B. Hamilton**, H.J. Dumont, L. Rong, Z. Wu, C. Chen, Y. Guo, J. Tang, J. Fan, C. Li and T. Zhang. 2019. Effect of algal and bacterial diet on metal bioaccumulation in zooplankton from the Pearl River, South China. *Science of the Total Environment*, 675:151–164. <https://doi.org/10.1016/j.scitotenv.2019.04.141>
- Steele, R.E., R.T. Patterson, **P.B. Hamilton**, N.A. Nasser and H.M. Roe. 2020. Assessment of FlowCam technology as a potential tool for rapid semi-automatic analysis of lacustrine Arcellinida (testate lobose amoebae). *Environmental Technology & Innovation*, 17:100580. <https://doi.org/https://doi.org/10.1016/j.eti.2019.100580>
- Vidaković, D., Z. Levkov and **P.B. Hamilton**. 2019. *Neidiopsis borealis* sp. nov., a new diatom species from the mountain Shar Planina, Republic of North Macedonia. *Phytotaxa*, 402:21–28. <https://doi.org/10.11646/phytotaxa.402.1.3>
- Huynh, H.M., **K. Khidas**, **R.D. Bull** and D.F. McAlpine. 2019. Morphological and craniodental characterization of bobcat × Canada lynx (*Lynx rufus* × *L. canadensis*) F1 hybrids from New Brunswick, Canada. In R.D. Bradley, H.H. Genoways, D.J. Schmidly and L.C. Bradley (eds.). From field to laboratory: a memorial volume in honor of R.J. Baker. Special Publications, Museum of Texas Tech University, 71:427–440.
- Prentice, M.B., J. Bowman, D.L. Murray, C.F.C. Klütsch, **K. Khidas** and P.J. Wilson. 2019. Evaluating evolutionary history and adaptive differentiation to identify conservation units of Canada lynx (*Lynx canadensis*). *Global Ecology and Conservation*, 20:e00708. <https://doi.org/10.1016/j.gecco.2019.e00708>
- Pekov, I.V., **I.S. Lykova**, A.A. Agakhanov, D.I. Belakovskiy, M.F. Vigasina, S.N. Britvin, A.G. Turchkova, E.G. Sidorov and K.S. Scheidl. 2019. New arsenate minerals from the Arsenatnaya fumarole, Tolbachik volcano, Kamchatka, Russia. XII. Zubkovaite, Ca₃Cu₃(AsO₄)₄. *Mineralogical Magazine*, 83(6):879–886. <https://doi.org/10.1180/mgm.2019.33>
- Pekov, I.V., N.V. Zubkova, V.O. Yapaskurt, D.I. Belakovskiy, **I.S. Lykova**, S.N. Britvin, A.G. Turchkova and D.Yu. Pushcharovsky. 2019. Kamenevite, K₂TiSi₃O₉•H₂O, a new mineral with microporous titanosilicate framework from the Khibiny alkaline complex, Kola Peninsula, European Journal of Mineralogy, 31:557–564. <https://doi.org/10.1127/ejm/2019/0031-2825>
- Pekov, I.V., N.V. Shchipalkina, N.V. Zubkova, V.V. Gurzhiy, A.A. Agakhanov, D.I. Belakovskiy, N.V. Chukanov, **I.S. Lykova**, M.F. Vigasina, N.N. Koshlyakova, E.G. Sidorov and G. Giester. 2019. Alkali sulfates with apthitalite-like structures from fumaroles of the Tolbachik Volcano, Kamchatka, Russia. I. Metathenardite, a natural high-temperature modification of Na₂SO₄. *The Canadian Mineralogist*, 57(6):885–901. <https://doi.org/10.3749/canmin.1900050>
- Strayer, D.L., B.V. Adamovich, R. Adrian, D.C. Aldridge, C. Balogh, L.E. Burlakova, H.B. Fried-Petersen, L.G. Tóth, A.L. Hetherington, T.S. Jones, A.Y. Karatayev, **J.B. Madill**, O.A. Makarevich, J.E. Marsden, **A.L. Martel**, D. Minchin, T.F. Nalepa, R. Noordhuis, T.J. Robinson, L.G. Rudstam, A.N. Schwalb, D.R. Smith, A.D. Steinman, J.M. Jeschke. 2019. Long-term population dynamics of dreissenid mussels (*Dreissena polymorpha* and *D. rostriformis*): a cross-system analysis. *Ecosphere*, 10(4): e02701. <https://doi.org/10.1002/ecs2.2701>
- Mallon, J.C.** 2019. Competition structured a Late Cretaceous megaherbivorous dinosaur assemblage. *Scientific Reports*, 9:15447. <https://doi.org/10.1038/s41598-019-51709-5>



Mallon, J.C., J.R. Bura, D. Schumann and P.J. Currie. 2020. A problematic tyrannosaurid (Dinosauria: Theropoda) skeleton and its implications for tyrannosaurid diversity in the Horseshoe Canyon Formation (Upper Cretaceous) of Alberta. *The Anatomical Record*, 303:673–690. <https://doi.org/10.1002/ar.24199>

Gordon, I.J., H.H.T. Prins, **J.C. Mallon**, L.D. Puk, E.B.P. Miranda, C. Starling-Manne, R. van der Wal, B. Moore, W. Foley, L. Lush, R. Maestri, I. Matsuda and M. Clauss. 2019. The Ecology of Browsing and Grazing in Other Vertebrate Taxa. *In* I.J. Gordon and H.H.T. Prins (eds.). *The Ecology of Browsing and Grazing II*, Springer International Publishing, Cham. pp. 339–404. https://doi.org/10.1007/978-3-030-25865-8_15

Carpenter, M., T.M. Brown, T. Bell, **A.L. Martel** and E. Edinger. 2020. Chapter 16 - Geomorphic features and benthic habitats of a subarctic fjord: Okak Bay, Nunatsiavut, Labrador. *In* P.T. Harris and E. Baker (eds.). *Seafloor Geomorphology as Benthic Habitat* (Second Edition), Elsevier, pp. 303–317. <https://doi.org/10.1016/B978-0-12-814960-7.00016-6>

McMullin, R.T. 2019. Lichens and allied fungi added to the list of rare species inhabiting the Carden Alvar Natural Area, Ontario. *Natural Areas Journal*, 39:212–225. <https://doi.org/10.3375/043.039.0208>

McMullin, R.T. 2019. New and interesting Canadian lichens and allied fungi II: Reports from British Columbia, New Brunswick, Nova Scotia, Nunavut, Prince Edward Island, Ontario, and Quebec. *Opuscula Philolichenum*, 18:396–419.

McMullin, R.T. and A. Arsenault. 2019. Lichens and allied fungi of Hall's Gullies: A hotspot for rare and endangered species in Newfoundland, Canada. *Northeastern Naturalist*, 26:729–748. <https://doi.org/10.1656/045.026.0405>

McMullin, R.T., K. Drotos, D. Ireland and H. Dorval. 2018 [2019]. Diversity and conservation status of lichens and allied fungi in the Greater Toronto Area: results from four years of the Ontario BioBlitz. *Canadian Field-Naturalist*, 132:394–406. <https://doi.org/10.22621/cfn.v132i4.1997>

McMullin, R.T., Y.F. Wiersma, S.G. Newmaster and J.C. Lendemer. 2019. Risk assessment and conservation strategies for rare lichen species and communities threatened by sea-level rise in the Mid-Atlantic Coastal Plain. *Biological Conservation*, 239:108281. <https://doi.org/10.1016/j.biocon.2019.108281>

Allen, J.L. and **R.T. McMullin**. 2019. Modeling algorithm influence on the success of predicting new populations of rare species: Ground-proofing models for the Pale-Belly Frost Lichen (*Physconia subpallida*) in Ontario. *Biodiversity and Conservation*, 28:1853–1862. <https://doi.org/10.1007/s10531-019-01766-z>

Allen, J.L., **R.T. McMullin**, E.A. Tripp and J.C. Lendemer. 2019. Lichen conservation in Canada and the United States. *Biodiversity and Conservation*, 28:3103–3138. <https://doi.org/10.1007/s10531-019-01827-3>

England, J.K., C.J. Hansen, J.L. Allen, S.Q. Beeching, W.R. Buck, V. Charny, J.G. Guccion, R.C. Harris, M. Hodges, N.M. Howe, **R.T. McMullin**, E.A. Tripp and D.P. Waters. 2019. Checklist of the lichens and allied fungi of Kathy Stiles Freeland Bibb County Glades Preserve, Alabama, USA. *Opuscula Philolichenum*, 18:420–434.

Forno, M.D., L. Kaminsky, R. Rosentreter, **R.T. McMullin**, A. Aptroot and R. Lücking. 2019. A first phylogenetic assessment of *Dictyonema* s.lat. in southeastern North America reveals three new basidiolichens, described in honor of J.D. Lawrey. *Plant and Fungal Systematics*, 64:383–392. <https://doi.org/10.2478/pfs-2019-0025>

Gockman, O., S.B. Selva and **R.T. McMullin**. 2019. The first report of *Chaenothecopsis perforata* from North America. *Opuscula Philolichenum*, 18:52–57.

Lendemer, J.C., R.C. Harris and **R.T. McMullin**. Studies in Lichens and Lichenicolous Fungi – No. 22: The identities of *Lecidea deminutula*, var. *L. olivacea inspersa*, *L. virginensis* and *Thelenella humilis*. *Opuscula Philolichenum*, 18:90–101.

Paquette, H., N.B. van Miltenburg, S.B. Selva and **R.T. McMullin**. 2019. The calicioids of Forillon National Park, Quebec, Canada. *Opuscula Philolichenum*, 18:58–73.

Wiersma, Y.F. and **R.T. McMullin**. 2019. Out with proxies, in with biodiversity. *Frontiers in Ecology and the Environment*, 17(7):371–373. <https://doi.org/10.1002/fee.2087>

Wiersma, Y.F., **R.T. McMullin** and J.H. Sleep. 2019. Model systems to elucidate minimum requirements for protected areas networks. *Scientific Reports*, 9:19594. <https://doi.org/10.1038/s41598-019-56142-2>

Dorval, H.R. and **R.T. McMullin**. 2019 [2020]. Lichens and allied fungi of Sandbar Lake Provincial Park, Ontario. *Canadian Field-Naturalist*, 133(3):206–215. <https://doi.org/10.22621/cfn.v133i3.2209>

Paquette, H.A. and **R.T. McMullin**. 2020. Macrolichens of Forillon National Park, Quebec, Canada. *Northeastern Naturalist*, 27(16):1–35. <https://www.eaglehill.us/NENOnline/articles/NENA-mon-16/mon-16-Paquette.shtml>

Rinas, C. and **R.T. McMullin**. 2019. *Alectoria solediosa* new to Quebec from Mont-Mégantic. *Evansia*, 36(4):135–138. <https://doi.org/10.1639/0747-9859-36.4.135>

Onuferko, T.M. 2019. A review of the cleptoparasitic bee genus *Epeolus* Latreille, 1802 (Hymenoptera: Apidae) in the Caribbean, Central America and Mexico. *European Journal of Taxonomy*, 563:1–69. <https://doi.org/10.5852/ejt.2019.563>

Onuferko, T.M., P. Bogusch, R.R. Ferrari and L. Packer. 2019. Phylogeny and biogeography of the cleptoparasitic bee genus *Epeolus* (Hymenoptera: Apidae) and cophylogenetic analysis with its host bee genus *Colletes* (Hymenoptera: Colletidae). *Molecular Phylogenetics and Evolution*, 141:106603. <https://doi.org/10.1016/j.ympev.2019.106603>

Ferrari, R.R., **T.M. Onuferko**, S.K. Monckton and L. Packer. 2020. The evolutionary history of the cellophane bee genus *Colletes* Latreille (Hymenoptera: Colletidae): Molecular phylogeny, biogeography and implications for a global infrageneric classification. *Molecular Phylogenetics and Evolution*, 146:1–16. <https://doi.org/10.1016/j.ympev.2020.106750>

Kirkland, C.L., M. Danišík, R. Marsden, **P. Piilonen**, M. Barham and L. Sutherland. 2020. Dating young zircon: A case study from Southeast Asian megacrysts. *Geochimica et Cosmochimica Acta*, 274:1–19. <https://doi.org/10.1016/j.gca.2020.01.013>

Saarela, J.M., **P.C. Sokoloff**, **L.J. Gillespie**, **R.D. Bull**, B.A. Bennett and **S. Ponomarenko**. 2020. Vascular plants of Victoria Island (Northwest Territories and Nunavut, Canada): a specimen-based study of an Arctic flora. *Phytokeys*, 141:1–330. <https://doi.org/10.3897/phytokeys.141.48810>

Da Silva, L.N., **J.M. Saarela**, **P.C. Sokoloff**, L. Essi and T.T. De Souza-Chies. 2020. *Chascolytrum serranum* (Poaceae: Pooideae: Poeae: Calothecinae), a new microendemic species from Campos de Cima da Serra, southern Brazil. *Phytotaxa*, 435:41–49. <https://doi.org/10.11646/phytotaxa.435.1.5>

Wu, X.-C., J.-R. Shi, L.-Y. Dong, T. D. Carr, J. Yi and S.-C. Xu. 2020. A new tyrannosauroid from the Upper Cretaceous of Shanxi, China. *Cretaceous Research*, 108: 04357. <https://doi.org/10.1016/j.cretres.2019.104357>

Yang, T.-R., J. Wiemann, L. Xu, Y.-N. Cheng, **X.C. Wu** and M. Sander. 2019. Reconstruction of oviraptorid clutches illuminates their unique nesting biology. *Acta Palaeontologica Polonica*, 64:581–596. <https://doi.org/10.4202/app.00497.2018>

Reports

McMullin, R.T., J.L. Allen and J.C. Lendemer. 2019. *Sulcaria badia*. The IUCN Red List of Threatened Species 2019: e.T80703097A80703100. <https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T80703097A80703100.en>

McMullin, R.T., J.L. Allen and J.C. Lendemer. 2019. *Sulcaria isidiifera*. The IUCN Red List of Threatened Species 2019: e.T70386122A70386125. <https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T70386122A70386125.en>

Non-refereed publications

Journal papers

Deduke, C., A. Arsenault, C.-J. Pasiche-Lisboa and **R.T. McMullin.** 2019. Survey of the lichen-forming ascomycetes collected during the 2018 NL Foray, *Omphalina*, 10(2):10–17.

Mallon, J.C. 2019. Sauropods under one (very high) roof. *Peer Community in Paleontology*, 100003. <https://doi.org/10.24072/pci.paleo.100003>

Wiersma, Y.F. and **R.T. McMullin.** 2019. How to discriminate one old-growth forest from another. *Omphalina*, 10(1):20–23.

Scientific Presentations (Abstracts)

Anderson, E.B. 2019. [Abstract]. Don't touch the pretty ones: Destructive sampling protocols in the Canadian Museum of Nature's Mineral Collection. 34th Annual Meeting for the Society for the Preservation of Natural History Collections, The Field Museum, Chicago, USA, 25–31 May.

Anderson R.S., J.M. Saarela and D. Shorthouse. 2019. [Abstract]. Documenting collections use: The 2018 Science Report of the Canadian Museum of Nature. Annual Meeting of the Entomological Collections Network, St. Louis, Missouri, p. 5, 16–17 November.

Bull, R.D. and **M. Graham.** 2019. [Abstract]. The National Biodiversity Cryobank of Canada: a genomic resource collection for global biodiversity research. Sentinel North 2019 Scientific Meeting, Laval, Quebec, 26–28 August.

Bull, R.D. and **M. Graham.** 2019. [Abstract]. The National Biodiversity Cryobank of Canada. Canadian Society of Zoologists Annual Meeting, University of Windsor, Ontario, 13–17 May.

Fauteux, D., G. Gauthier, R. Ims, A. Stien, N.G. Yoccoz and E. Fuglei. 2019. [Abstract]. Winter overcompensation in Arctic rodents. ArcticNet Annual Scientific Meeting 2019, Halifax, Nova Scotia, 2–5 December.

Fauteux, D., G. Gauthier, J. Bêty, D. Berteaux, M.J. Mazerolle, N. Coallier and M.-C. Cadieux. 2019. [Abstract]. Evaluation of invasive and non-invasive methods to monitor lemming abundance in the Canadian Arctic. Arctic Science Summit Week, Arkhangelsk, Russia, 23–28 May.

Fauteux, D. 2019. [Abstract]. Populations pulsatiles des micromammifères arctiques: influence de la prédation et des changements climatiques. Conférences BORÉAS, Rimouski, Quebec, 18 octobre.

Gillespie, L.J., J.M. Saarela, R.T. McMullin, P.C. Sokoloff and **R.D. Bull.** 2019. [Abstract]. Biodiversity of the Canadian Arctic flora: New floristic discoveries represent critical baseline biodiversity data. Botany 2019, Tucson, Arizona, USA, 27–31 July.

Wasowicz, P., A.N. Sennikov, K.B. Westergaard, K. Spellman, M. Carlson, **L.J. Gillespie, J.M. Saarela,** S.S. Seefeldt, C. Bay, S. Ickert-Bond and H. Väre. 2019. [Abstract]. Non-native plant species in the changing Arctic. The Iceland Biology Conference 2019, Reykjavik, 17–19 October.

Hamilton, P.B. 2019. [Abstract]. From milking diatoms to toxins, genomes and beyond. Where are diatomist's heading in the 21st century. Dutch Diatom Symposium, Brussels, Belgium, 10–13 October. [plenary talk]

Hamilton, P.B. 2019. [Abstract]. Diatoms and algae of Canada: a website documenting the diversity of Canada. 25th North American Diatom Symposium, Rock Eagle, Georgia, USA, p. 75, 31 July – 4 August.

Hamilton, P.B., K. Stachura-Suchoples, W.-H. Kusber, A. Bouchard and R. Jahn. 2019. [Abstract]. Typification of the puzzling diatom species *Neidium iridis* Ehrenberg including DNA for the diatom library. 25th North American Diatom Symposium, Rock Eagle, Georgia, USA, p. 73, 31 July – 4 August.

Bouchard, A., **P.B. Hamilton,** J. Starr and **A. Savoie.** 2019. [Abstract]. Molecular and morphological data reveal hidden diversity in common North American *Frustulia* species (Amphipleuraceae). 25th North American Diatom Symposium, Rock Eagle, Georgia, USA, p.74, 31 July – 4 August.

Hendrycks, E.A. and M.H. Thurston. 2019. Two new species of the rare, deep-sea genus *Vemana* (Amphipoda: Vemanidae) from the northeast and southeast Atlantic. 19th International Colloquium on Amphipoda, Dijon, France, 26–30 August.

Lussier, A.J., W. Wight and **T.S. Ercit.** 2019. [Abstract]. Fluor-elbaite from the Leduc Pegmatite in Quebec, Canada. Geological Society of America Meeting, Phoenix, Arizona, USA, 22–25 September.

Mallon, J.C., B.E. Christison and D.H. Tanke. 2019. [Abstract]. The early history of dinosaur hunting in Canada (1874–1889). *Vertebrate Anatomy Morphology Palaeontology*, 7:33.

Campione, N., **J.C. Mallon**, R. Benson and A. Evans. 2019. [Abstract]. On the potential to reconstruct a dietary continuum in dinosaurs. Society of Vertebrate Paleontology Meeting Program and Abstracts, 73.

Wyenberg-Henzler, T.C.A. and **J.C. Mallon**. 2019. [Abstract]. Ontogenetic niche shifts in megaherbivorous dinosaurs of the Late Cretaceous of North America. *Vertebrate Anatomy Morphology Palaeontology*, 7:55.

Martel, A.L., J. Geist, A. Paquet, S. Hemprich, **J.B. Madill** and **N. Alfonso**. 2020. [Abstract]. Discovery, distribution of population, juvenile habitat, and genetic studies of the Eastern Pearlshell Mussel, *Margaritifera margaritifera*, in the Kenauk Forest, near Montebello, Quebec. 2020. In T.J. Morris, K.A. McNichols-O'Rourke and S.M. Reid (eds.). Proceedings of the 2019 Canadian Freshwater Mollusc Research Meeting: December 3–4, 2019, Burlington, Ontario. Canadian Technical Report of Fisheries and Aquatic Sciences, 3352:17.

Martel, A.L., N.E. Binnie, A. Fytche, **N. Alfonso** and **J.B. Madill**. 2020. [Abstract]. Population ecology and preferential habitat of the SARA-listed Hickorynut in the Ottawa River: recent SCUBA surveys near Waltham, Québec. In T.J. Morris, K.A. McNichols-O'Rourke and S.M. Reid (eds.). Proceedings of the 2019 Canadian Freshwater Mollusc Research Meeting: December 3–4, 2019, Burlington, Ontario. Canadian Technical Report of Fisheries and Aquatic Sciences, 3352:18.

McMullin, R.T., **L.J. Gillespie**, **J.M. Saarela** and **P.C. Sokoloff**. 2019. [Abstract]. Lichens and allied fungi of Nunavut: establishing a baseline in a changing environment. Botany 2019, Tucson, Arizona, USA, 27–31 July.

McMullin, R.T. and Y.F. Wiersma. 2019. [Abstract]. Seeing the forest for the trees: using lichens in forest conservation. Botany 2019, Sky Islands and Desert Seas, Tucson, Arizona, USA, 27–31 July.

Paquette, H. and **R.T. McMullin**. 2019. [Abstract]. Macrolichens of Forillon National Park, Quebec, Canada. Botany 2019, Sky Islands and Desert Seas, Tucson, Arizona, USA, 27–31 July.

Paquette, H., N.B. van Miltenburg, S.B. Selva and **R.T. McMullin**. 2019. [Abstract]. The Calicioids of Forillon National Park, Quebec, Canada. Botany 2019, Sky Islands and Desert Seas, Tucson, Arizona, USA, 27–31 July.

Onuferko, T.M. 2019. [Abstract]. *Epeolus*: one genus or two genera? Resolving the taxonomic position of the mostly Neotropical “*Trophocleptria* group”. 8th Southern Ontario Bee Researchers Symposium, York University, Toronto, Ontario, 26 August.

de Keyser, C., **T.M. Onuferko**, J. Thomson and J.S. MacIvor. 2019. [Abstract]. Spatiotemporal variability in bloom supports greater bee diversity in cities. British Ecological Society Annual Meeting, ICC Belfast, Belfast, Northern Ireland, 12 December.

de Keyser, C., **T.M. Onuferko**, J. Thomson and J.S. MacIvor. 2019. [Abstract]. Spatiotemporal variability in bloom supports greater bee diversity in cities. CSEE, ESC, & AES 2019 Joint Meeting, Fredericton Convention Centre, Fredericton, New Brunswick, 20 August.

Rufolo, S. 2019. [Abstract]. Completing the zooarchaeological picture of rural responses to urban developments in the early Bronze Age Khabur Basin of Syria. 14th International meeting of the Archaeozoology of Southwest Asia and Adjacent Areas Working Group of the International Council for Archaeozoology, Barcelona, Spain, 3–7 June.

Rufolo, S., **J.C. Mallon**, **M. Currie**, T. Dudgeon, **A. McDonald**, **S. Swan** and T. Wyenberg-Henzler. 2019. [Abstract]. New contributions to the ceratopsid record of the Dinosaur Park Formation from recent fieldwork along the South Saskatchewan River, Alberta. Society of Vertebrate Paleontology Meeting Program and Abstracts, 183.

Saarela, J.M., **P.C. Sokoloff**, **L.J. Gillespie**, **R.D. Bull**, B.A. Bennett and **S. Ponomarenko**. 2019. [Abstract]. Vascular plant biodiversity of Victoria Island (Northwest Territories/Nunavut, Canada): A new collections-based baseline based on 100+ years of floristic exploration. ArcticNet Annual Scientific Meeting ASM 2019, Halifax Convention Centre, Halifax, Nova Scotia, 2–5 December.

Sokoloff, P.C. 2019. [Abstract]. Beyond the gallery: Arctic research and outreach at the Canadian Museum of Nature. Science Writers and Communicators of Canada Annual Meeting, Winnipeg, Manitoba, 23–25 May.



Sokoloff, P.C., J.M. Saarela, J. Doubt, L. Sharp and R.T. McMullin. 2019. [Abstract]. Archival Fieldwork: new Arctic plant biodiversity from backlogged herbarium specimens. ArcticNet Annual Scientific Meeting 2019, Halifax, Nova Scotia, 2–5 December.

Sokoloff, P.C., M. Graham, R.T. McMullin, N. Alfonso, R. Bull, O. Dare, J. Doubt, M. Edwards, C. Fox, P.B. Hamilton, E.A. Hendrycks, L. Kresky, J. LaRoche, R. Moore, P. Piilonen, V. Sahanatien, M.Y. Tsang, P. Van Buren, M. Wong and J.M. Saarela. 2019. [Abstract]. A 23 000 km transect: new Arctic plant and lichen collections from the Canada C3 Expedition. ComSciCon 2019 Flagship Workshop, San Diego, USA, 11–13 July.

Reports

Anderson, R.S. and J.M. Saarela. 2019. Canadian Museum of Nature Research Review 2018. Canadian Museum of Nature, Ottawa, Ontario. Pp.32. Available from https://nature.ca/pdf/2018_research-review_e.pdf, https://nature.ca/pdf/2018_research-review_f.pdf

Fontaine-Topaloff, J., **D. Fauteux** and **K. Khidas.** 2020. Clé d'identification des poils des musaraignes du Québec. Rapport final. Musée canadien de la nature et Ministère des forêts, faune et Parcs du Québec. 19 pages + Annexe A.

McMullin, R.T. 2019. President's Message. Field Botanists of Ontario Newsletter, 31(2):2.

McMullin, R.T. 2019. President's Message. Field Botanists of Ontario Newsletter, 31(3):2.

Saarela J.M. 2019. Publications Committee. Pp. 93. *In*: Lepage D., (ed.). Minutes of the 140th Annual Business Meeting of the Ottawa Field-Naturalists' Club, 8 January 2019; and Annual Reports of OFNC for October 2017–September 2018. Canadian Field-Naturalist, 133(1):88–95. <https://doi.org/10.22621/cfn.v133i1.2337>

Halliday, W.D. and **J.M. Saarela.** 2019. James Fletcher Award for The Canadian Field-Naturalist Volume 132. Canadian Field-Naturalist, 133:85.

Blog Posts

Bull, R.D. and W. Vincent. 2020. Freezing Arctic microbes for the future. Canadian Museum of Nature Blog. <https://canadianmuseumofnature.wordpress.com/2020/02/19/freezing-arctic-microbes-for-the-future/>, 19 February.

Onuferko, T.M. 2019. Bees and wasps: Providing ecosystem services with a point. Canadian Museum of Nature Blog. <https://canadianmuseumofnature.wordpress.com/2019/04/03/wasps-ecosystem-services/>, 3 April.

Other

Fauteux, D. 2019. Populations pulsatiles des micromammifères arctiques : influence de la prédation et des changements climatiques. Conférences ISFORT, Vidéo publiée, <https://isfort.uqo.ca/conferences/populations-pulsatiles-des-micromammiferes-arctiques-influence-de-la-predation-et-des-changements-climatiques/>

Sokoloff, P.C. 2019. Diverse plants, diversity in botany. Plantae.org. <https://community.plantae.org/path/5277540829945137009/article/5275440831229068883/diverse-plants-diversity-in-botany>, 18 June.

Research/Museum Associates

Dr. G.W. Argus, Merrickville, ON
Dr. F. Brodo, Ottawa, ON
Dr. I. Brodo, Ottawa, ON
Mr. D.F. Brunton, Ottawa, ON
Dr. M. Caldwell, Edmonton, AB
Dr. F. Chapleau, Ottawa, ON
Dr. B. Coad, Ottawa, ON
Dr. S. Cumbaa, Ottawa, ON
Dr. S. Ercit, Ottawa, ON
Mr. G. Fitzgerald, Ottawa, ON
Mr. R. Gault, Clayton, ON
Dr. D. Gray, Metcalfe, ON
Dr. J. Grice, Ottawa, ON
Mr. M. Hardy, Quebec, QC
Dr. R. Harington, Ottawa, ON
Dr. S. Hinić-Frlog, Gatineau, QC
Dr. R.B. Holmes, Edmonton, AB
Dr. M.A. Ivie, Montana, USA
Mr. J. Lauriault, Gatineau, QC
Dr. D. Leaman, Maberly, ON
Dr. G. Levin, Chelsea, QC
Mr. C. Lewis, Kingston, ON
Dr. H. Maddin, Ottawa, ON
Dr. P. Outridge, Ottawa, ON
Mr. M. Picard, Osgoode, ON
Dr. J. Kukalová-Peck, Ottawa, ON
Dr. S. Peck, Ottawa, ON
Dr. S. Ponomarenko, Ottawa, ON
Dr. M. Poulin, Gatineau, QC
Dr. C. Renaud, Ottawa, ON
Dr. M. Ryan, Ohio, USA
Dr. N. Rybczynski, Chelsea, QC
Dr. T. Sato, Tokyo, Japan
Dr. F. Schueler, Oxford Station, ON
Dr. A.B.T. Smith, Ottawa, ON
Dr. K. Stewart, Ottawa, ON
Dr. K. Tanoue, Fukuota, Japan
Dr. R.R. Waller, Ottawa, ON
Mrs. W. Wight, Ottawa, ON
Dr. M.-C. Williamson, Ottawa, ON
Dr. G.D. Zuzula, Whitehorse, YT

Refereed publications

Journal articles, books and book chapters

Brodo, I.M. and T. Tønsberg. 2019. *Opegrapha halophila* (Opegraphaceae), a new lichen species from coastal British Columbia, Canada, and Alaska, U.S.A. *The Bryologist*, 122:457–462. <https://doi.org/10.1639/0007-2745-122.3.457>

Brodo, I.M., M. Halderman and J. Malíček. 2019. Notes on species of the *Lecanora albella* group (Lecanoraceae) from North America and Europe. *The Bryologist*, 122:430–450. <https://doi.org/10.1639/0007-2745-122.3.430>

Brunton, D.F. 2019 [2019]. Distribution and taxonomy of *Isoetes tuckermanii* ssp. *acadiensis*, comb. nov. (Isoetaceae) in North America. *Canadian Field-Naturalist*, 132:360–367. <https://doi.org/10.22621/cfn.v132i4.2084>

Brunton, D.F. 2018 [2019]. Swimming as a potentially important emergency capability of White-throated Swifts (*Aeronautes saxaltis*) engaged in aerial mating. *Canadian Field-Naturalist*, 132:386–388. <https://doi.org/10.22621/cfn.v132i4.2034>

Brunton, D.F. 2019. A practical technique for preserving specimens of duckmeal, *Wolffia* (Araceae). *Canadian Field-Naturalist*, 133:139–143. <https://doi.org/10.22621/cfn.v133i2.2108>

Brunton, D.F. and H. Bickerton. 2018 [2019]. New records for Mosquito-fern (*Azolla cristata*; Salviniaceae) in Canada. *Canadian Field-Naturalist*, 132:350–359. <https://doi.org/10.22621/cfn.v132i4.2033>

Bickerton, H. and **D.F. Brunton**. 2019. Crazy Horse Bog: A small gem on the Carp Ridge with a new plant species for the City of Ottawa. *Trail & Landscape*, 53:17–23.

Brunton, D.F., **P.C. Sokoloff**, J.F. Bolin and D.F. Fraser. 2019. *Isoetes laurentiana*, sp. nov. (Isoetaceae) endemic to freshwater tidal marshes in eastern Quebec. *Botany*, 97:571–583. <https://doi.org/10.1139/cjb-2019-0037>

Caldwell, M.W. 2019. The origin of snakes: morphology and the fossil record, CRC Press, Taylor & Francis Group, Boca Raton. 300 pp.

- Garberoglio, F.F., R.O. Gómez, T.R. Simões, **M.W. Caldwell** and S. Apesteguía. 2019. The evolution of the axial skeleton intercentrum system in snakes revealed by new data from the Cretaceous snakes *Dinilysia* and *Najash*. *Scientific Reports*, 9:1276. <https://doi.org/10.1038/s41598-018-36979-9>
- Garberoglio, F.F., S. Apesteguía, T.R. Simões, A. Palci, R.O. Gómez, R.L. Nydam, H.C.E. Larsson, M.S.Y. Lee and **M.W. Caldwell**. 2019. New skulls and skeletons of the Cretaceous legged snake *Najash*, and the evolution of the modern snake body plan. *Science Advances*, 5:eaax5833. <https://doi.org/10.1126/sciadv.aax5833>
- Hsiou, A.S., R.L. Nydam, T.R. Simões, F.A. Pretto, S. Onari, A.G. Martinelli, A. Liparini, P.R.R. Martínez, M. Soares, C.L. Schultz and **M.W. Caldwell**. 2019. A new genus and species of cleosaurid from the Triassic (Carnian) of Brazil and the rise of spheodontians in Gondwana. *Scientific Reports*, 9:11821. <https://doi.org/10.1038/s41598-019-48297-9>
- Jiménez-Huidobro, P. and **M.W. Caldwell**. 2019. A new hypothesis of the phylogenetic relationships of the Tylosaurinae (Squamata: Mosasaurioidea). *Frontiers in Earth Science*, 7:47. <https://doi.org/10.3389/feart.2019.00047>
- Jiménez-Huidobro, P., R.A. Otero, S. Soto-Acuña and **M.W. Caldwell**. 2019. Reassessment of cf. *Plotosaurus* from the upper Maastrichtian of Chile, with comments on the South American distribution of halisaurine mosasaurs. *Cretaceous Research*, 103:104162. <https://doi.org/10.1016/j.cretres.2019.06.008>
- Kellner, A.W.A., **M.W. Caldwell**, B. Holgado, F.M.D. Vecchia, R. Nohra, J.M. Sayão and P.J. Currie. 2019. First complete pterosaur from the Afro-Arabian continent: insight into pterodactyloid diversity. *Scientific Reports*, 9:17875. <https://doi.org/10.1038/s41598-019-54042-z>
- Etzler, F.E. and **M.A. Ivie**. 2019. *Platyparadonus*, a new circum-Caribbean genus of sand-associated Negastrinae (Coleoptera: Elateridae). *Proceedings of the Entomological Society of Washington*, 121:15-25. <https://doi.org/10.4289/0013-8797.121.1.15>
- Ferreira, V.S., O. Keller, M. Branham and **M.A. Ivie**. 2019. Molecular data support the placement of the enigmatic *Cheguevaria* as a subfamily of Lampyridae (Insecta: Coleoptera). *Zoological Journal of the Linnean Society*, 187:1253-1258. <https://doi.org/10.1093/zoolinnean/zlz073>
- Kundrata, R., **M.A. Ivie** and L. Bocak. 2019. *Podabrocephalus* Pic is the morphologically modified lineage of Ptilodactylinae (Coleoptera: Elateriformia: Ptilodactylidae). *Insect Systematics and Evolution*, 50:147-161. <https://doi.org/10.1163/1876312X-00002190>
- LeBlanc, A.R.H., S. Apesteguía, H.C.E. Larsson and **M.W. Caldwell**. 2020. Unique tooth morphology and prismatic enamel in Late Cretaceous spheodontians from Argentina. *Current Biology*, <https://doi.org/10.1016/j.cub.2020.02.071>
- Leblanc, A.R.H., S.R. Mohr and **M.W. Caldwell**. 2019. Insights into the anatomy and functional morphology of durophagous mosasaurines (Squamata: Mosasauridae) from a new species of *Globidens* from Morocco. *Zoological Journal of the Linnean Society*, 186:1026-1052. <https://doi.org/10.1093/zoolinnean/zlz008>
- Mekarski, M.C., D. Japundžić, K. Krizmanić and **M.W. Caldwell**. 2019. Description of a new basal mosasauroid from the Late Cretaceous of Croatia, with comments on the evolution of the mosasauroid forelimb. *Journal of Vertebrate Paleontology*, 39:e1577872. <https://doi.org/10.1080/02724634.2019.1577872>
- Mekarski, M.C., S.E. Pierce and **M.W. Caldwell**. 2019. Spatiotemporal distributions of non-ophidian Ophidiomorphs, with implications for their origin, radiation, and extinction. *Frontiers in Earth Science*, 7:245. <https://doi.org/10.3389/feart.2019.00245>
- Palci, A., M.N. Hutchinson, **M.W. Caldwell**, K.T. Smith and M.S.Y. Lee. 2019. The homologies and evolutionary reduction of the pelvis and hindlimbs in snakes, with the first report of ossified pelvic vestiges in an anomalepidid (*Liotyphlops beui*). *Zoological Journal of the Linnean Society*, 188:630-652. <https://doi.org/10.1093/zoolinnean/zlz098>
- Palci, A., **M.W. Caldwell**, M.N. Hutchinson, T. Konishi and M.S.Y. Lee. 2020. The morphological diversity of the quadrate bone in squamate reptiles as revealed by high-resolution computed tomography and geometric morphometrics. *Journal of Anatomy*, 236:210-227. <https://doi.org/10.1111/joa.13102>
- Paparella, I., A.R.H. LeBlanc, M.R. Doschak and **M.W. Caldwell**. 2020. The iliosacral joint in lizards: an osteological and histological analysis. *Journal of Anatomy*, 236:668-687. <https://doi.org/10.1111/joa.13132>

Strong, C.R.C., T.R. Simões, **M.W. Caldwell** and M.R. Doschak. 2019. Cranial ontogeny of *Thamnophis radix* (Serpentes: Colubroidea) with a re-evaluation of current paradigms of snake skull evolution. Royal Society Open Science, 6:182228. <https://doi.org/doi:10.1098/rsos.182228>

Coad, B.W. 2019. Review of the gobionids of Iran (Family Gobionidae). Iranian Journal of Ichthyology, 6(1):1-20.

Coad, B.W. 2019. Review of the tenches of Iran (Family Tincidae). Iranian Journal of Ichthyology, 6:82-91.

Coad, B.W. 2020. Review of the East Asian minnows of Iran (Family Xenocypridae). Iranian Journal of Ichthyology, 7(1):1-67.

Esmaeili, H.R., G. Sayyadzadeh, F. Zarei, S. Kafaie and **B.W. Coad**. 2020. Phylogeographic pattern and population structure of the Persian stone loach, *Oxynoemacheilus persa* (Heckel 1847) (family: Nemacheilidae) in southern Iran with implications for conservation. Environmental Biology of Fishes, 103:77-88. <https://doi.org/10.1007/s10641-019-00934-y>.

Reist, J., **B.W. Coad**, **N. Alfonso** and C. Sawatzky. 2019. Database of the distribution of marine fishes of Arctic Canada. Ocean Biogeographic Information System, Fisheries and Oceans Canada and the Canadian Museum of Nature, http://geo.abds.is/ipt/resource?r=dfo_amfd

Johanson, Z., K. Trinajstić, **S. Cumbaa** and **M.J. Ryan**. 2019. Fusion in the vertebral column of the pachyosteorhynchid arthrodire *Dunkleosteus terrelli* ('Placodermi'). Palaeontologia Electronica, 22.2.20A:1-13. <https://doi.org/10.26879/872>

Grice, J.D., **A.J. Lussier**, H. Friis, **R. Rowe**, **G. Poirier** and Z. Fihl. 2019. Discreditation of the pyroxenoid mineral name "marshallsussmanite" with a reinstatement of the name schizolite NaCaMnSi₃O₈(OH). Mineralogical Magazine, 1-28. <https://doi.org/10.1180/mgm.2019.21>

Groat, L.E., A. Brand, J. Cempirek, **J. Grice** and **W. Wight**. 2019. Emerald from the Anuri Prospect, Nunavut, Canada. Journal of Gemmology, 36(7):584-585.

Calviño, C.I. and **G.A. Levin**. 2019. A new species of *Eryngium* (Apiaceae, Saniculoideae) from the USA. Systematic Botany, 44:446-450. <https://doi.org/10.1600/036364419X15562052252261>

Montero-Muñoz, I., **G.A. Levin** and J.M. Cardiel. 2020. Four new species of *Acalypha* L. (Euphorbiaceae, Acalyphoideae) from the West Indian Ocean Region. Phytokeys, 140:57-73. <https://doi.org/10.3897/phytokeys.140.50229>

Montero-Muñoz, I., J.M. Cardiel and **G.A. Levin**. 2020. Discovery of three new species of *Acalypha* L. (Euphorbiaceae, Acalyphoideae) from Madagascar and their conservation status. Systematic Botany, 45:122-130. <https://doi.org/10.1600/036364420X15801369352379>

Lewis, C.J. 2019. *Heterodermia leucomela* (L.) Poelt discovered in Ontario, Canada for the first time in over 150 years. Evansia, 36:30-38. <https://doi.org/10.1639/0747-9859-36.2.30>

Lewis, C.J. and M. Schultz. 2019. *Lempholemma syreniarum* (Lichinaceae), a new species from Ontario, Canada. The Bryologist, 122:423-429. <https://doi.org/10.1639/0007-2745-122.3.423>

Dudgeon, T.W., **H.C. Maddin**, D.C. Evans and **J.C. Mallon**. 2020. Computed tomography analysis of the cranium of *Champsosaurus lindoei* and implications for the choristoderan neomorphic ossification. Journal of Anatomy, 236:630-659. <https://doi.org/10.1111/joa.13134>

Outridge, P.M., G.A. Stern, **P.B. Hamilton** and H. Sanei. 2019. Algal scavenging of mercury in preindustrial Arctic lakes. Limnology and Oceanography, 64:1558-1571. <https://doi.org/10.1002/lno.11135>

Lindström, S., H. Sanei, B. van de Schootbrugge, G.K. Pedersen, C.E. Leshner, C. Tegner, C. Heunisch, K. Dybkjær and **P.M. Outridge**. 2019. Volcanic mercury and mutagenesis in land plants during the end-Triassic mass extinction. Science Advances, 5:eaaw4018. <https://doi.org/10.1126/sciadv.aaw4018>

Wang, F., **P.M. Outridge**, X. Feng, B. Meng, L.-E. Heimbürger-Boavida and R.P. Mason. 2019. How closely do mercury trends in fish and other aquatic wildlife track those in the atmosphere? - Implications for evaluating the effectiveness of the Minamata Convention. Science of the Total Environment, 674:58-70. <https://doi.org/10.1016/j.scitotenv.2019.04.101>

Peck, S.B. and J. Cook. 2019. The Leiodidae (Coleoptera) of the Biologia Centrali-Americana, with descriptions of new species. The Coleopterists Bulletin, 73:78-84. <https://doi.org/10.1649/0010-065X-73.1.78>

Peck, S.B., P. Gnaspini and A.F. Newton. 2020. Updated catalog and generic keys of the Leiodidae (Insecta: Coleoptera) of the Neotropical region ("Latin America": Mexico, the West Indies, and Central and South America). 2020, 4741 <https://doi.org/10.11646/zootaxa.4741.1.1>

Gnaspini, P. and **S.B. Peck**. 2019. Redescription of the 'older *Adelopsis*' species (Coleoptera: Leiodidae: Cholevinae: Ptomaphagini) based on the analysis of type specimens. *Zootaxa*, 4696:1-62. <https://doi.org/10.11646/zootaxa.4696.1.1>

Gnaspini, P., **S. B. Peck**, C. Antunes-Carvalho, M. Perreau, E. C. Gomyde. 2020. To be or not to be a tibial comb: A discussion on the (past) use of tibial armature in tribal/subtribal organization in Cholevinae (Coleoptera: Leiodidae). *Papeis avulsos de zoologia*, 60 (special): e202060(s.i.).202018. <https://doi.org/10.11606/1807-0205/2020.60.special-issue.18>

Ponomarenko, S., D. McLennan, D. Pouliot and J. Wagner. 2019. High resolution mapping of tundra ecosystems on Victoria Island, Nunavut – application of a standardized terrestrial ecosystem classification. *Canadian Journal of Remote Sensing*, 45:551-571. <https://doi.org/10.1080/07038992.2019.1682980>

Poulin, M., V. Méléder and J.-L. Mouget. 2019. Typification of the first recognized blue pigmented diatom, *Haslea ostrearia* (Bacillariophyceae). *Plant Ecology and Evolution*, 152:402-408.

Prasetya, F.S., R. Gastineau, **M. Poulin**, C. Lemieux, M. Turmel, A.D. Syakti, Y. Hardivillier, I. Widowati, Y. Risjani, I. Iskandar, T. Subroto, C. Falaise, S. Arsad, I. Safriti, J.-L. Mouget and V. Leignel. 2019. *Haslea nusantara* (Bacillariophyceae), a new blue diatom from the Java Sea, Indonesia: morphology, biometry and molecular characterization. *Plant Ecology and Evolution*, 152:188-202. <https://doi.org/10.5091/pleveo.2019.1623>

Renaud, C.B. and P.A. Cochran. 2019. Post-metamorphic feeding in lampreys. *In* M.F. Docker (ed.). *Lampreys: Biology, Conservation and Control: Volume 2*, Springer Netherlands, Dordrecht. pp. 247-285. https://doi.org/10.1007/978-94-024-1684-8_3

Buckley, M., C. Lawless and **N. Rybczynski**. 2019. Collagen sequence analysis of fossil camels, *Camelops* and c.f. *Paracamelus*, from the Arctic and sub-Arctic of Plio-Pleistocene North America. *Journal of Proteomics*, 194:218-225. <https://doi.org/https://doi.org/10.1016/j.jprot.2018.11.014>

Fletcher, T.L., L. Warden, J.S. Sinninghe Damsté, K.J. Brown, **N. Rybczynski**, J.C. Gosse and A.P. Ballantyne. 2019. Evidence for fire in the Pliocene Arctic in response to amplified temperature. *Climate of the Past*, 15:1063-1081. <https://doi.org/10.5194/cp-15-1063-2019>

Paterson, R., J.X. Samuels, **N. Rybczynski**, **M.J. Ryan** and **H.C. Maddin**. 2019. The earliest mustelid in North America. *Zoological Journal of the Linnean Society*, 188:1318-1339. <https://doi.org/10.1093/zoolinnean/zlz091>

Paterson, R.S., **N. Rybczynski**, N. Kohno and **H.C. Maddin**. 2020. A total evidence phylogenetic analysis of pinniped phylogeny and the possibility of parallel evolution within a monophyletic framework. *Frontiers in Ecology and Evolution*, 7:457. <https://doi.org/10.3389/fevo.2019.00457>

Lewis, J.H., D.F. McAlpine and **A.B.T. Smith**. 2019. *Gryllus veletis* (Orthoptera: Gryllidae) in New Brunswick: first detection in Maritime Canada. *Northeastern Naturalist*, 26:N18-N20. <https://doi.org/10.1656/045.026.0214>

Stewart, K.M., G. Keddie, **S. Rufolo**, R. Wigen, S. Crockford and A. Blais-Stevens. 2019. The Maplebank Site: new findings and reinterpretation on the Late Holocene Pacific Northwest Coast. *The Journal of Island and Coastal Archaeology*, <https://doi.org/10.1080/15564894.2018.1555194>

Stewart, K.M., O.M. Kovalchuk, O.A. Goskova and N.V. Pogodina. 2019. Late Pleistocene fish remains from the Rurubu River, Tanzania. *Journal of Vertebrate Paleontology*, 39:e1639055. <https://doi.org/10.1080/02724634.2019.1639055>

Urano, Y., Y. Sugimoto, **K. Tanoue**, R. Matsumoto, S. Kawabe, T. Ohashi and S.-i. Fujiwara. 2019. The sandwich structure of keratinous layers controls the form and growth orientation of chicken rhinotheca. *Journal of Anatomy*, 235:299-312. <https://doi.org/10.1111/joa.12998>

Waller, R.R. 2019. Collection risk assessment. *In* L. Elkin and C.A. Norris (eds.). *Preventive Conservation: Collection Storage*. Society for the Preservation of Natural History Collections, New York, pp. 59-90.

Waller, R.R. 2019. Minerals, gems, and meteorites. *In* L. Elkin and C.A. Norris (eds.). *Preventive Conservation: Collection Storage*. Society for the Preservation of Natural History Collections, New York, pp. 872-873.



Elkin, L. and **R.R. Waller**. 2019. Storage at a glance: Framework and definitions. *In* L. Elkin and C.A. Norris (eds.). Preventive Conservation: Collection Storage. Society for the Preservation of Natural History Collections, New York, pp. 848–851.

Hawks, C.A. and **R.R. Waller**. 2019. Skin, leather, and parchment. *In* L. Elkin and C.A. Norris (eds.). Preventive Conservation: Collection Storage. Society for the Preservation of Natural History Collections, New York, pp. 888–890.

Norris, C.A. and **R.R. Waller**. 2019. Bone, antler, ivory, and teeth. *In* L. Elkin and C.A. Norris (eds.). Preventive Conservation: Collection Storage. Society for the Preservation of Natural History Collections, New York, p. 853.

Rose, C.L., C.A. Hawks and **R.R. Waller**. 2019. A preventive conservation approach to the storage of collections. *In* L. Elkin and C.A. Norris (eds.). Preventive Conservation: Collection Storage. Society for the Preservation of Natural History Collections, New York, pp. 43–55.

Eberle, J., J.H. Hutchinson, K. Kennedy, W. von Koenigswald, R.D.E. MacPhee and **G. Zazula**. 2019. The first Tertiary fossils of mammals, turtles, and fish from Canada's Yukon. *American Museum Novitates*, 3943:1–28.

Plint, T., F.J. Longstaffe and **G. Zazula**. 2019. Giant beaver palaeoecology inferred from stable isotopes. *Scientific Reports* 9:7179. <https://doi.org/10.1038/s41598-019-43710-9>

Tseng, Z.J., **G. Zazula**, and L. Werdelin. 2019. First fossils of hyenas (*Chasmaporthetes*, Hyaenidae, Carnivora) from North of the Arctic Circle. *Open Quaternary*, 5(1):6. <https://doi.org/10.5334/Oq.64>

Schwartz-Narbonne, R., F. Longstaffe, K. Kardynal, P. Druckenmiller, K. Hobson, C. Jass, J. Metcalfe and **G. Zazula**. 2019. Reframing the mammoth steppe: Insights from analysis of isotopic niches. *Quaternary Science Reviews*, 215:1–21. <https://doi.org/10.1016/j.quascirev.2019.04.025>

Non-refereed publications

Book

Horvath, L., **R.A. Gault**, E. Pfenninger-Horvath and **G. Poirier**. 2019. Mont Saint-Hilaire: History, Geology, Mineralogy, The Canadian Mineralogist, Special Publication 14. Mineralogical Association of Canada, Quebec, QC, 644 pp.

Scientific Presentations (Abstracts)

Levin, G.A. 2019 [Abstract]. The Flora of North America: moving from hard copy to digital information sharing. Botany 2019, Tucson, Arizona, USA, 27–31 July.

Dudgeon, T.W., **H.C. Maddin**, D.C. Evans and **J.C. Mallon**. 2019. [Abstract]. Confirmation of the choristoderan neomorphic ossification and its developmental and functional origin. Vertebrate Anatomy Morphology Palaeontology, 7:20.

Outridge, P.M., G.A. Stern, **P.B. Hamilton** and H. Sanei. 2019. [Abstract]. Algal scavenging of mercury in preindustrial Arctic lakes. 25th North American Diatom Symposium, Rock Eagle, Georgia, USA, p. 31, 31 September – 4 October.

Fifield, R., J. Henderson, and **R.R. Waller**. 2019. [Abstract]. Centering value in collection care. American Institute for Conservation 2019 Annual Meeting: New Tools, Techniques, and Tactics in Conservation & Collection Care. Uncasville, Connecticut, USA, 12–17 May.

Waller, R.R. 2019. [Abstract]. Applying social discounting to cultural property risk analysis. Society for Risk Analysis Annual Meeting: Analysis in the Data Analytics Era. Arlington, Virginia, USA, 8–12 December.

Wight, W., A.J. Lussier and **T.S. Ercit**. 2019. [Abstract]. Canadian gem tourmaline and the Leduc mine. Proceedings 36th International Gemmological Conference, 98–101, Nantes, France, 30 August.

Other

Brunton, D.F. 2019. The Ramsay Prairie: High plains of the Ottawa Valley. Trail & Landscape, 53:29–34.

Brunton, D.F. 2018 [2019]. [Book review]. (Wunderlin, Hansen and Franck. 2018). Flora of Florida Volume V (Dicotyledons, Gisekiaceae through Boraginaceae). Canadian Field-Naturalist, 132:68. <http://doi.org/10.22621/cfn.v132il.2121>

Brunton, D.F. 2019. [Book review]. (Wunderlin, Hansen and Franck. 2019). Flora of Florida Volume VI (Dicotyledons, Convolvulaceae through Paulowniaceae). Canadian Field-Naturalist, 133:70. <https://doi.org/10.22621/cfn.v133il.2343>.

Brunton, D.F. and M.J. Oldham. 2019. [Book review]. (Palmer. 2018). Michigan Ferns & Lycophytes. Canadian Field-Naturalist, 133:68–69. <https://doi.org/10.22621/cfn.v133il.2351>

Waller, R.R. 2019. Fundamental requirements for historic house preservation risk management. In: D. Forleo (ed.), Preventive Conservation in Historic Houses and Palace Museums: Assessment Methodologies and Applications, conference proceedings organised by the Public Establishment of the Palace, by the National Museum of the Palace of Versailles, the Association of European Royal Residences and the Research Centre of the Palace of Versailles, in collaboration with the International Committee for Historic House Museums. Silvana Editoriale, Milan, pp. 16–25.

Waller, R.R., A. Siegel, K. Schöne and A. Dohrmann. 2019. Identifying and estimating risks to cultural property. Pp. 60–66 In: kultur!gut!schützen! SiLK – SicherheitsLeitfaden Kulturgut. Available at: http://www.konferenz-kultur.de/SLF/tagungen/Tagungsband_KULTURGUTSCHUETZEN_2018.pdf

The background features an abstract geometric design composed of several overlapping rectangles in two shades of blue: a medium teal and a darker navy blue. The rectangles are arranged in a way that creates a sense of depth and structure. One large teal rectangle is on the left, another is at the top left, and a third is at the top right. A horizontal teal bar spans the width of the page, containing the text. Below this bar, a large dark blue rectangle occupies the bottom half of the page.

SCIENTIFIC OUTREACH



Scientific Outreach

The research and collections experts at the Canadian Museum of Nature have a full range of responsibilities from field work to preserving specimens, sequencing DNA, running a library and archives, unearthing fossils, describing the chemical formula and structure of minerals, discovering new species, loaning specimens, and creating and sharing data about everything under our care. One of the great things about these experts is that it is also their job to tell stories about their work. Not just to their peers but to the general public, students, teachers and special interest clubs. All in the interest of making science and natural history better known to everyone. The following is a list of their outreach activities for 2019-20.

BOTANY

Bull, Roger

Students on Ice (SOI) 2019 Arctic Expedition

Botanical workshop

NU

2019 Workshop of the terrestrial multidisciplinary distributed observatories for the study of Arctic connections (t-MOSAIC) project

Presentation on the Museum's National Biodiversity Cryobank

QC

Doubt, Jennifer

Field Botanists of Ontario AGM

Keynote speaker

ON

Macoun Club Meeting

Presentation on bryophytes

ON

Arctic Biodiversity Symposium

Presentation on Arctic plants

ON

Hamilton, Paul

University of Basel seminar

Presentation entitled: Algae with, metals, scavenging, mining and economics; where do they meet?"

Switzerland

McMullin, Troy

Prince Edward Country Field Naturalists' meeting

Presentation entitled: The secret life of lichens

ON

Eagle Hill Institute seminar

Seminar entitled: Lichen ecology and identification

USA

Eagle Hill Institute seminar

Seminar entitled: Old-growth forest lichens and allied fungi, with a focus on calicioids

USA

Harvard University - Friends of the Farlow Annual Botany Lecture

Lecture entitled: Adventures in lichenology

USA

Ottawa Public Library Science Day

Presentation entitled: Introduction to lichens

ON

Mississippi Madawaska Land Trust Field Trip

Presentation entitled: Lichens of Blueberry Mountain

ON

High Park Nature Centre Workshop

Workshop entitled: High Park Lichens: Discover the "corals" of the forest.

ON

Toronto Conservation Authority Presentation

Presentation entitled: Introduction to lichens

ON

Poulin, Michel

Annual Meeting of Marine Experts, Circumpolar Biodiversity Monitoring Program

Updates from sea ice biota expert network, CBMP-marine group

Greenland

Annual Meeting, TaxMArc project led by Norwegian scientists

Presentation entitled: Life in Arctic sea ice biota

Norway

ASLO, Ocean Science Meeting, San Diego, USA

Presentation entitled: Harmful algae in the Canadian Arctic: The phantom menace?

USA

Université du Québec à Rimouski

Training on marine phytoplankton

QC

**Robillard, Cassandra;
Deduke, Chris**

**Ottawa-Carleton District School Board
Science Teacher's PD Day**

Presentation entitled: Herbaria 2.0: New adventures in old collections

ON

Saarela, Jeff

Botanica Private Speaker Series

Presentation entitled: Climate change in the Arctic: Evidence from plants.

ON

Savoie, Amanda

Ocean Wise Ocean Bridge Program

Participated in a "living library" event about marine biology, marine conservation, molecular analyses and seaweed

ON

Sokoloff, Paul

Moon at the Museum! Panel Discussion

Moderated a panel with K. Howells from the Planetary Society and J. Hansen, Canadian Space Agency Astronaut, on the moon landing 50th anniversary celebrations

ON

The Science Behind Beer

NatureIDEAS presentation at the Manitoba Museum.

MB

Royal Canadian Institute for Science Talk Series

Presentation entitled: Botanizing "Mars": learning about Earth while preparing for the Red Planet

ON

Exploring by the Seat of Your Pants Webinar

Presentation entitled: Plants and lichens from the top of Canada: Arctic botany at the Canadian Museum of Nature

ON, AB

National Wildlife Research Centre Seminar Series

Seminar entitled: Plants and lichens from the top of Canada: Arctic botany at the Canadian Museum of Nature

ON

ArcticNet Annual Scientific Meeting 2019

Presentation entitled: Tales from the field!

NS

CSIM

Leckie, Carolyn

American Institute for Conservation - Materials Working Group Meeting

Presented a progress report by the Selections & Specification Sub-Group at the American Institute for Conservation- Materials Working Group (AIC-MWG) Meeting

USA

Smith, Elizabeth

Digital Preservation Discussion Group

Discussion about the working tools for digitization and digital preservation

QC

Book Launch and Speakers series at Memorial University

Presented on P.H.Gosse's manuscript "Entomologia Terrae Novae"

NL

Tudor, Sean

University of Maine Lecture Series

Guest lecture for Canadian Studies/Environmental History class

USA

The Spectre of Extinction in Museums - Lecture

Presentation at D. Jorgensen's talk "The Spectre of Extinction in Museums" hosted by Carleton University, Public History department

ON

MINERALOGY

Anderson, Erika

Donor luncheon

Minerals and mineral market for Mont Saint-Hilaire

ON

Carleton University, Earth Sciences, internship opportunities

Cox internship at the Canadian Museum of Nature

ON

Lussier, Aaron

Canadian Micro-Mounters Association

Invited Talk: "Tourmaline - keeper of secrets"

ON

CBC Radio - Element of Surprise

Guest speaker on Silicon

ON

Geological Society of America 2019 AGM

Presentation entitled: Fluor-elbaite from the Leduc Pegmatite in Quebec

USA

Lykova, Inna

MIG group, Ottawa Lapsmith & Mineral Club

Presentation entitled: Time from a mineral perspective

ON

Poirier, Glenn

University of Ottawa Phys 5130

Lecture on electron microscopy at University of Ottawa

ON

LET'S TALK science program

Presentation on electron microscopy

ON

PALAEOBIOLOGY

Currie, Margaret

Macoun Club meeting

Presentation on 2019 field work on the Old Crow River, Yukon Territory

ON

Fraser, Danielle

Long Ago Yukon seminar series

Presentation entitled: Conservation palaeobiology: what fossils can tell us about the past, present, and future

YT

Bank of Canada Museum panel discussion

Presentation entitled: What fossils can tell us about the past, present, and future of climate change

ON

Geological Society of America annual meeting

Presentation entitled: Assessing mammal functional diversity using body mass

USA

Geological Society of America annual meeting

Presentation entitled: The historic response of grey wolves to climate change: a case study from Northern Alberta

USA

International Congress of Vertebrate Morphology

Presentation entitled: Creodonts and carnivorans of the Late Eocene (Chadronian) Cypress Hills formation occupied different dietary niches

Czech Republic

International Congress of Vertebrate Morphology

Presented a co-authored talk at entitled: Effectiveness of Caribou antlers as ecological indicators

Czech Republic

Ohio State University Speaker Series

Presentation entitled: The role of biotic interactions in the evolution of Cenozoic (66 Ma - present) mammal communities

USA

Mallon, Jordan

Exploring by the Seat of Your Pants Webinar

Presentation entitled: What it's like to be a Palaeontologist

ON, AB

Canadian Society of Vertebrate Palaeontology Annual Meeting

Presentation entitled: The early history of dinosaur hunting in Canada (1874-1889)

AB

Judith River Formation Symposium

Presentation entitled: The early history of dinosaur hunting in Canada (1874-1889)

USA

Presentation at Poltmore Elementary School

Presentation entitled: What it's like being a Palaeontologist

QC

Lecture at Carleton University

Lecture entitled: How we know what we know about dinosaur ecology

ON

Science Literacy Week at Ottawa Public Library

Guest speaker on kids' dino trivia

ON

Rufolo, Scott

Long Ago Yukon natural history society's speakers' series.

Presentation entitled: Exploring Inuit origins and identity: An archaeological path to reconciliation

YK

Wu, Xiao-Chun

Shanxi Museum of Geology, Guest speaker series

Public talk entitled: The origin and early history of turtles

China

ZOOLOGY

Alfonso, Noel

Macoun Field Club weekly meeting (youth section of the Ottawa Field-Naturalists' Club)

Presentation on Ichthyology at the Canadian Museum of Nature

ON

Peterborough Field Naturalists Club

Speaker at AGM of the Peterborough Field-Naturalists Club

ON

Anderson, Robert

Entomological Collections Network annual meeting

Presented the 2018 Science Report of the Canadian Museum of Nature

USA

Entomological Society of America annual meeting

Presentation entitled: Weird, wonderful weevils

USA

Conlan, Kathy

Curiosity Collider program

Career profile in "Making Waves" by Filmmaker and Artist M. Markowsky (Emily Carr University of Art) and scientist J. Shiller (UBC)

BC

Fauteux, Dominique

POLAR Speaker Series

Presentation entitled: Life under the snow: unlocking the black box of lemming winter ecology

NU

Tales in the Field (MCN-Polar Knowledge reception) during ArcticNET 2019

Presented for "Tales in the Field"

NS

CALAS Annual meeting

Presentation entitled: Population cycles of lemmings: the importance of predation

ON

Salluit's cooperative information kiosk

Hosted a kiosk explaining field work with community members

NU

Réunion à huis-clos pour les chercheurs de l'Île Bylot

Research on lemmings on Bylot Island: new perspectives

QC

Gagnon, Jean-Marc

Les Innovateurs à l'école, Programme Technoscience Outaouais

Presentations to five school groups

QC

Hendrycks, Ed

18th International Colloquium on Amphipoda

Organized & moderated Workshop entitled: How many species?

France

Ilves, Katriina

Macoun Field Club weekly meeting (youth section of the Ottawa Field-Naturalists' Club)

Presentation on Ichthyology at the Canadian Museum of Nature

ON

Ocean Bridge Living Library

Presentation on fish biodiversity, evolution, and conservation at the Canadian Museum of Nature

ON

The County, Naturally (radio show on County FM)

Interviewed by P. Stagg to describe work as an ichthyologist and a woman in science

ON

Martel, André

Ottawa Riverkeeper-ORK. 2019 Annual Public Meeting

Keynote speaker. Presentation on the freshwater mussel fauna of the Ottawa River, with emphasis on the Hickorynut mussel and its link with the sturgeon

ON

2019 Symposium of the Freshwater Molluscs Conservation Society - FMCS

Discovery of a unique pattern in the papillae of siphonal apertures among pearl shell mussels (Margaritiferidae)

USA

2019 colloque annuel de l'Association Francophone des Sciences-ACFAS, Univ. du Québec en Outaouais (UQO)

Symposium on the health of the St. Lawrence River. Talk on freshwater mussels at risk in the St. Lawrence and in the Ottawa River

QC

Tessier, Stéphanie

Society for the Preservation of Natural History Collections

Presented a poster about digitization

USA



INVOLVING THE COMMUNITY



Donors, Partners, Sponsors

CMN offers its gratitude and appreciation to those individuals, organizations and corporations who choose to direct their support in service of nature. With the generosity of these vial contributors, we are saving the world for future generations through evidence, knowledge and inspiration. Thank you for helping connect people with nature through exhibitions, education, engagement and scientific research!

The CMN offers special recognition for the generosity of our transformational donors whose impact endures.

LIFETIME

Ross Beaty Family	Vancouver	BC
Donald V. Doell	Grafton	ON
Anonymous	St-Mathieu-de-Beloeil	QC
Anne & Henry Howden	Ottawa	ON
Jarmila Kukalová-Peck	Ottawa	ON
Ole Johnson	Ottawa	ON
Jo-Cy & Edward Lee	Toronto	ON
Loretta & Frank Ling	Rockcliffe	ON
Estate of Viola R. MacMillan	Bradford	ON
Andrew B.T. Smith	Kanata	ON
Stewart B. Peck	Ottawa	ON

\$ 1 000 000 +

Anonymous	Mississauga	ON
The Globe and Mail	Toronto	ON

\$100 000-\$999 999

William L. Ashby	Oshawa	ON
Canada Goose Inc.	Toronto	ON
CMN Research & Collections	Gatineau	QC
Corus Entertainment	Toronto	ON
Joan Parrott	Port Hope	ON
Polar Knowledge Canada	Ottawa	ON
The Government Of Nunavut	Iqaluit	NU
The W. Garfield Weston Foundation*	Toronto	ON
University of Ottawa	Ottawa	ON

\$25 000-\$99 999

Ashbury College	Ottawa	ON
Beau's All Natural Brewing Company	Vankleek Hill	ON
BioGaia (Ferring Inc.)	Toronto	ON
Canada Life*	Winnipeg	MB
Canadian Museum of Nature Foundation	Ottawa	ON
Elizabeth & Rob S. Crosbie*	St. John's	NL
Crosbow Enterprises Ltd*	St. John's	NL
Robert Douglas Cudney*	Toronto	ON
Embassy of the United States of America	Ottawa	ON
Enbridge*	Calgary	AB
Environment Funders Canada	Toronto	ON
Fisheries and Oceans Canada	Ottawa	ON
Martin Hardy	Quebec	QC
Kenneth M. Molson Foundation*	Toronto	ON
Northfield Capital Corp*	Toronto	ON
Natural Sciences and Engineering Research Council of Canada	Ottawa	ON
Ottawa Community Foundation	Ottawa	ON
Pattison Outdoor Advertising	Ottawa	ON
Power Corporation of Canada	Montréal	QC
Scotts Canada Ltd.	Mississauga	ON
Turnbull Family Community Building Foundation	Ottawa	ON
University of Calgary	Calgary	AB

\$5000-\$24 999

Barrett Family Foundation	Toronto	ON
Constance Benner & John Swettenham	Ottawa	ON
Michelle & Ron Calderoni	Boucherville	QC
Canadian North	Kanata	ON
Dymon Group of Companies	Ottawa	ON
Karen McLachlan Hamilton & Paul B. Hamilton	Nepean	ON
The Hawley Family	Ottawa	ON
Imagi Outaouais	Gatineau	QC
Susan & Lyall Knott	Vancouver	BC
Judith A. LaRocque & André Lavoie	Hawkesbury	ON
Le Droit	Ottawa	ON
New West Public Affairs*	Calgary	AB
Linda Nowlan	Vancouver	BC
Ontario Power Generation Inc.	Toronto	ON
Orkin Canada	Ottawa	ON
Ottawa Citizen	Ottawa	ON

Partnership Group For Science And Engineering (The)	Ottawa	ON
Beverly & Glenn Sakaki	Oakville	ON
Hon. Monte Solberg*	Calgary	AB
The Walrus	Toronto	ON
Judy Young & Arthur Drache	Ottawa	ON

\$1000-\$4999

Luc Barbe	Rockland	ON
Anne & Herb Breau	Ottawa	ON
Rebecca & Matthew Bromwich	Ottawa	ON
Don Bubar	Toronto	ON
The Michael Decter Family Foundation	Toronto	ON
Hélène Desgagnés & Peter Lovisek	Ottawa	ON
Laura Evans & Tony Giovando	Ottawa	ON
Patti & Doug Feasby	Carp	ON
Keri Fisher & Sean Rhoads	Kemptville	ON
Debra & Mark Graham	Wakefield	QC
Patricia Grattan & M. Ian Bowmer	Ottawa	ON
Peter Harrison	Orleans	ON
Alison Holt & Innes van Nostrand	Oakville	ON
Greg Huyer & Scott Rufolo	Ottawa	ON
Insectarium de Montréal	Montréal	QC
Ronald A. Javitch	Montreal	QC
J. Peter Johnson	Ottawa	ON
Inez Kettles & Johannes Hill	Ottawa	ON
Martin Leclerc	Gatineau	QC
Barbara Liddy	Ottawa	ON
George Mannard	Toronto	ON
Joanne Papineau	Gatineau	QC
Judith Pereira	Toronto	ON
Robertson Martin Architects	Ottawa	ON
Janelle & Christian Robin	Winnipeg	MB
Royal Botanical Gardens	Hamilton	ON
Susan R. Rust	Gloucester	ON
Anonymous	Ottawa	ON
Anonymous	Manotick	ON
Jeffrey Smith	Merrickville	ON
Stephen & Benita Greenberg Fund at the Jewish Community Foundation of Montreal	Montreal	QC
The David H. Laidley Foundation	Westmount	QC
Anonymous	Ottawa	ON
Ikram Zouari & Shafaat Ali Khan	Ottawa	ON

\$100-\$999

Robert Alvo	Ottawa	ON
Catherine & Robert Anderson	Ottawa	ON
Stéphanie Beaulac & Pierre-Olivier Corbeil	Ottawa	ON
Morgan Berson	Ottawa	ON
C. Ann Bird	Almonte	ON
Myriam Bloom & Victor Rabinovitch*	Ottawa	ON
Cheryl & Gerald Brown	Swartz Creek	MI
Michael Carlon	Ottawa	ON
Nathalie Choquette	Gatineau	QC
Marissa Croteau	Richmond	ON
Vinko Culjak-Mathieu	Montréal	QC
Anonymous	Ottawa	ON
Elizabeth de Vries	Bainsville	ON
Margaret H. Dickenson	Ottawa	ON
Dillon Consulting Ltd*	Ottawa	ON
Joan Doubt	Deep River	ON
Julia Elvidge	Ottawa	ON
Ashley Fearnall	Ottawa	ON
Stella Firko	Ottawa	ON
Anne Marie Jeannette Fraser	Gatineau	QC
Sharon Godsell	Ottawa	ON
Anonymous	Ottawa	ON
Alison Gozna & Daniel Brazeau	Nelson	BC
Prem Grainger	Ottawa	ON
Mary Ann & Vaughn Guy	Ottawa	ON
Hilary Hampson & Mike Barber	Ottawa	ON
Saxon Harding	Nepean	ON
Heidi Hauver & Andrew Waitman	Ottawa	ON
Kirsteen & Dan Hebert	Ottawa	ON
Anonymous	Monmouth Beach	NJ
Emma Khazzam	Ottawa	ON
Elizabeth Kipp	Orleans	ON
Robert Lafrance	Ottawa	ON
Dolores Lilley	Ottawa	ON
Jacquelynne A. Mansell	Ottawa	ON
Anonymous	Ottawa	ON
Pascale Massot	Ottawa	ON
Claire McCartney	Ottawa	ON
Douglas Mooers	Ottawa	ON
Dawn & Peter Morand	Ottawa	ON
Monica & Ralph Nevins	Nepean	ON

Anonymous	Ottawa	ON
Michael Nogrady	Ottawa	ON
Jacqueline Parai	Ottawa	ON
Sherry & Martin Passfield	Stittsville	ON
Bronwyn Pavey	Ottawa	ON
Catherine & Trevor Pound	Ottawa	ON
Debra Pugh	Ottawa	ON
Jay-Dee Purdie	Ottawa	ON
Justin Quan	Mississauga	ON
Wilma & John W. Reynolds	Kitchener	ON
Indrojit Roy	Westmount	QC
Sarah Smale	Ottawa	ON
John Smith	Martintown	ON
Leslie Stobbart & Daniel Gilbert	Ottawa	ON
Kirsten Strom	Ottawa	ON
Studio Signs Visual Media	Ottawa	ON
Evelyn & Brian Swan	Orleans	ON
Anonymous	Nepean	ON
Paul Tye	Ottawa	ON
Natalia Uscinowicz & Michal Samborski	Ottawa	ON
Jeanie Warnock & John Ogilvie	Avonmore	ON
Suzanne Warwick & Chris Reynolds	Ottawa	ON
Kenneth Watkins	Ottawa	ON
Anonymous	Ottawa	ON
John Stephen Wilson	Deux-Montagnes	QC
Miao Yang & Peng Zhang	Kanata	ON

LEGACY

Anonymous	Ottawa	ON
Anne & Herb Breau	Ottawa	ON
Anonymous	Ottawa	ON
Greg Huyer & Scott Rufolo	Ottawa	ON
Anonymous	Ottawa	ON
Barbara Liddy	Ottawa	ON
Anonymous	Nepean	ON
Anonymous	Winnipeg	MB
J. Douglas Scott	Ottawa	ON
Peter Tarassoff	Beaconsfield	QC
Anonymous	Ottawa	ON
Anonymous	Ottawa	ON

* Donors to the Canadian Museum of Nature Foundation



MANAGING OUR FINANCIAL RESOURCES

The Canadian Museum of Nature (the “Museum”) pursues its national mandate as described in the *Museums Act*, within the context of the governance and accountability regime established in Part X of the *Financial Administration Act*. The Museum’s Board of Trustees and management are firmly committed to managing the public and private funds invested in the institution in a transparent, accountable manner, and to optimizing the value of the contribution the Museum makes to Canadians and Canadian society.

Management Discussion and Analysis

Financial Overview

The Museum’s mission extends, through public engagement, to inspire people to know, engage with, and care for, nature with a hope that in turn will lead them to engage with finding the right path for our natural future. The 2019-20 fiscal provided further opportunities to strengthen the Museum’s programs of research and discovery while sharing the knowledge locally, nationally and internationally through onsite, offsite and online visitor experiences. A theme for 2019-20 was positioning the Museum as a vital player in the global mission to save the world for future generations with evidence, knowledge and inspiration. This communications theme is enabling the Museum to profile the value and impact of its collections, scientific research and public engagement programs. During 2019-20, over 436,000 visitors came through the Museum doors, and millions more engaged through visits to its travelling exhibits in locations across Canada and abroad, or by simply visiting the Museum’s web site nature.ca.

Through a combination of revenue generation and expenditure reduction measures implemented over the past years, the Museum has made significant progress towards achieving financial sustainability. In order to maintain financial sustainability, the Museum will strive to increase self-generated revenues by 5% annually while limiting increases in expenditures to 1% annually. Revenue generation measures in 2019-20 included:

- continuing with the roll out of the next phase of the Museum’s fundraising and development strategy, with the goal of raising \$25 million over five years;
- implementing a plan to increase earned revenues by capitalizing on the VMNB’s commercial operations, especially in the areas of attendance and membership fees, rental of facilities, ticketed programs, boutique and parking;
- expanding the Museum’s virtual presence and attract new audiences through the use of digital strategies including digital storytelling, digital apps, digital collections, digital natureART exhibits and downloadable teacher resources;

- enhancing existing marketing and awareness campaigns, including the Museum's social media marketing campaign;
- building and strengthening the Museum's exhibitions and public education programming with a view to continuously diversifying its audience base;
- evolving the business model for the travelling exhibitions program at the Museum; and
- monetizing the physical assets of the Museum at the VMMB and NHC sites.

To enable that outcome, the Museum is shifting from an appropriation dependant operating model to a sustainable museum enterprise operating model. This shift is meant to foster innovation and calls for new skills and accountabilities for staff and volunteers since growth and new programs will be earned revenue growth dependant rather than appropriation growth dependant. The ongoing challenge for the Museum is ensuring this shift happens at the required pace through recruitment, training and performance management.

An example of this shift to a sustainable museum enterprise operating model is the success of the live *Butterflies in Flight* temporary exhibition. In addition, the success of *Pterosaur: Flight in the Age of Dinosaurs* major temporary exhibition opened from June 15, 2019 to September 2, 2019 featuring fossils, life-sized models, interactive games and engaging displays that immerse visitors in the world of pterosaurs. Both exhibitions with the successful 3D Theatre offer aided the Museum to partially offsetting the drop in surcharge revenue during the summer due to higher members attendance. The

Museum also experienced higher members attendance for its major temporary exhibition *Me and My Microbes: The zoo inside you* opened from December 20, 2019 to March 14, 2020 exploring the human microbiome and engaging visitors through videos, games, art installations and sensory experiences. Higher membership revenue during the year helped the Museum offset the decrease in surcharge revenue related to major temporary exhibitions.

The Museum also continued its *Nature Nocturne* and *Nature Tastes* evenings targeting the key young adult segment to attract new visitors within a new context. Again, this year, both programs have contributed to the increase in revenue. These adult only evenings continue to be a successful program and a new perspective on the Museum as a place for young adults. The aforementioned revenue generation measures are in addition to those initiated in previous years such as the introduction of a new pricing structure for admissions, surcharges for major temporary exhibitions and value-based pricing for education programs. Other important initiatives were new programming such as Nature Scoop, Nature Sleepovers, Birthday parties, a new hybrid model for the Nature Boutique, automated parking and aggressive membership marketing. 2019-20 was another successful year for memberships sold reaching 6,637 members, 1,637 above target. Furthermore, the Museum continued its revenue generating initiative from collections storage and management service fees and facility leasing fees to fund strategic investments in the *Centre for Arctic Knowledge & Exploration* and the *Centre for Species Discovery*.

An important element of a current and relevant visitor experience will be the continuous investment in foundational research to deepen the understanding of our audience, a key step to ensure public offers are strategically developed for maximum return. The Museum continues to focus on increasing and enhancing all touch points of the visitor journey to create a world-class offer that deepens engagement and increases loyalty. The Museum also continues to effectively manage the visitor flow through frontline employee and volunteer engagement and intelligent signage. It also increases revenue from ancillary operations and aligns all commercial offerings within the Museum's mission and mandate.

The Museum continuously reviews its program, its means of delivery and its supporting activities to ensure they remain relevant to Canadians. Family Programming department refreshed its offer and increased its volunteer base to increase and improve public reach and engagement during key periods and to continue to attract those visitors who are not motivated by our special temporary exhibitions.

Furthermore, the Museum continues to identify and act on opportunities for collaboration with the other national museums that improve effectiveness and efficiency. The national museums now have a systematic approach for identifying and advancing co-procurement projects, cooperative exhibit scheduling and cooperative marketing projects. In addition, the National Museum's Passport introduced in August 2016, with an offer that targets tourist visitors to the National Capital, saw continued strong growth in 2017 and further promotion in external markets in 2018 and beyond.

Operational objectives include ensuring there is a strategic approach to digital output, and an ongoing and efficient operation of the Museum's online presence across its website and social media channels. During 2019-20, the Museum continued to refine and improve digital performance measures and data collection methods to provide relevant and timely tactical and strategic information to guide decisions on content and user experience.



Building a high-performance advancement operation focused on developing a pipeline of annual, sponsorship and major gift prospects and donors is an important element of the sustainable museum enterprise operating model and to the success of the Museum in the future. The Museum's advancement strategy focuses on building support from individual, corporate and foundation donors that includes a naturePATRON fundraising program and a National Nature Council major gift program to raise the Museum's profile and raise funds in support of the Museum's position as a leader in Arctic research and species discovery. Advancement programs fund both operations and special projects such as galleries, fieldwork, scientific equipment and landscaping.

During 2019-20, the Museum finalized its \$4.6 million strategic acquisition of Mont Saint-Hilaire mineral collection. The Canadian Cultural Property Export Review Board confirmed its outstanding significance and national importance. Of this amount we received a donation value of \$1.1 million.

In the fall of 2016, a group of individuals incorporated the Canadian Museum of Nature Foundation (the "Foundation") as a not-for-profit corporation. This Foundation was granted charitable status in the fall of 2017. The Foundation's role is to design and implement a strategy and development plan that will raise as much financial support as possible to advance the mandate and vision of the Museum with a focus on major donations. In 2019-20, the Foundation raised \$1,362,173 and made a contribution to the Museum of \$170,000.

The Museum was successful in significantly expanding its pipeline of potential donors, while acknowledging that much more work needs to be done to achieve a robust group of prospective supporters to achieve the \$25 million overall fundraising goal over five years. In 2019-20, total support raised from individual and corporate donations, sponsorships, memberships, collaborations, and in-kind support for research and collections and from the media amounted to \$6.4 million, exceeding the annual goal of \$6.1 million. These cash and in-kind commitments secured through the Museum's fundraising activities are broader in scope than the contributions recognized on the Museum's Statement of Operations.

In spite of the progress towards achieving financial sustainability, addressing the financial pressures related to operating the two facilities under its stewardship remains the most critical issue facing the Museum, as it is still vulnerable to the impact of inflation on key inputs such as utilities and property taxes.

Budget 2016 provided funding to help Canada's national museums address immediate operational and capital pressures including the gap between established appropriations provided for payment in lieu of taxes (PILT) purposes and the actual amount of PILT being paid, and deferred recapitalization projects, primarily those related to immediate health and safety issues.



Through budget 2016, the Museum received the last instalment of \$2.17 million in 2019-20 to address the backlog of health and safety and other recapitalization needs, and \$0.3 million was to address the gap between the level of funding it currently receives in appropriations and the PILT level that is due to PSPC each year, based on estimates for 2016 provided by PSPC. This, however, does not offset the \$1.0 million in property taxes paid on the Gatineau site. The costs of managing the Museum's two buildings have increased since the completion of the renovated VMMB. The Museum has in place a number of strategies designed to manage both known and anticipated pressures. An enterprise risk management approach is being used to manage these strategies and pressures in support of the vision to inspire understanding and respect for nature.

On March 11, 2020, the World Health Organization (WHO) declared the outbreak of a strain of the novel coronavirus (COVID-19) as a pandemic which has resulted in a series of public health and emergency measures to combat the spread of the virus.

To support social distancing efforts, national museums across Canada collectively closed their doors to visitors' effective March 14, 2020 until further notice. The closure during the busiest time of the year has had a financial impact on the Museum revenue generation and operations. The duration and impact of the COVID-19 pandemic remain unclear at this time. It is

not possible to reliably estimate the full effect of the outbreak on the Museum results of operations and financial condition at this time. Management is actively monitoring the effect on the Museum's financial condition and probing ways to address potential financial impacts. On June 18, 2020, the Government of Canada announced emergency funding to assist the museum sector of which \$5.9 million has been allocated to help the Corporation maintain essential services and be ready to reopen to the public and staff once precautionary measures are lifted based on the guidance from the Public Health Agency of Canada.

Financial Performance

REVENUE AND PARLIAMENTARY APPROPRIATIONS

Revenue and parliamentary appropriations decreased to \$45.8 million in 2019-20 from \$46.2 million in 2018-19 with appropriations representing 74% of the total in 2019-20 compared to 75% in 2018-19.

In 2019-20, the Museum had an earned revenue target of 27% of base operating costs excluding specimen donations and in-kind sponsorships. Attendance reached 436,000 (462,000 in 2018-19), 26,000 below target due to the Museum closure in March. Consequently, the Museum, did not meet its earned revenue target instead it achieved 26% of base operating costs (25% in 2018-19).

Parliamentary Appropriations

On an accrual basis, parliamentary appropriations decreased by \$1.3 million to \$33.5 million in 2019-20 from \$34.8 million in 2018-19, mainly due to the variation in deferred capital appropriations.

Admission and Program Fees

Revenue associated with admission and program fees increased by \$0.2 million to \$5.2 million in 2019-20 from \$5.0 million in 2018-19. Included in admission and program fees are the surcharges related to the Museum's major temporary exhibitions which in 2019-20 included *Butterflies in Flight*, *Pterosaur: Flight in the Age of Dinosaurs* and *Me and My Microbes: The zoo inside you*. This increase is substantially due to membership revenue. 2019-20 was another successful year for memberships sold reaching 6,637 members, 1,637 above target. On an accrual basis, membership revenue includes \$693,351 of membership revenue recorded for the year ended March 31, 2020.

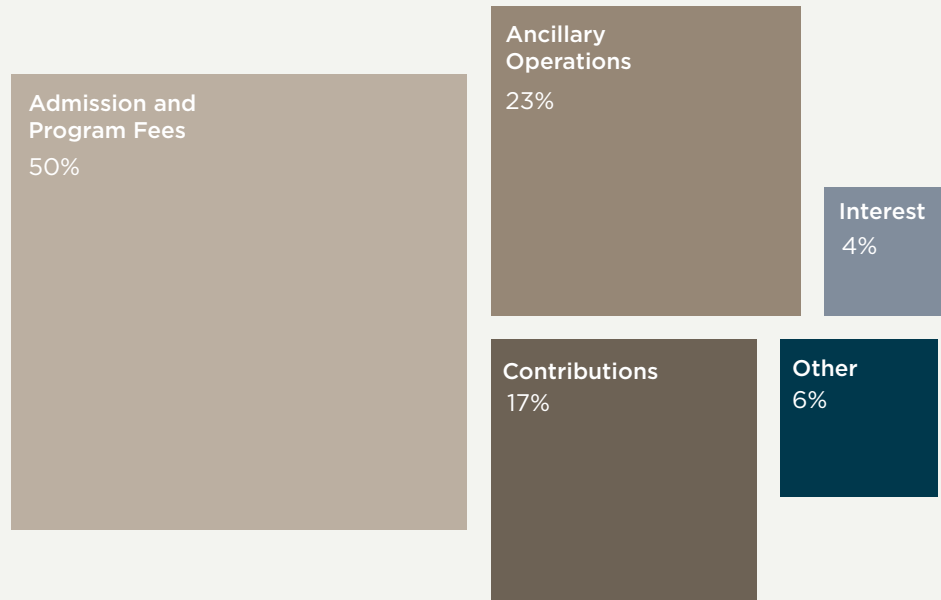
Fees from programs delivered at the Museum have totaled \$0.6 million in 2019-20 compared to \$0.7 million in 2018-19, the \$0.1 million decrease is mainly due to the decrease in revenue related to *Nature Nocturne* evenings. Road construction around the Museum and the closure due to COVID-19 affected nocturne attendance and therefore its revenue.

Ancillary Operations

Revenue associated with ancillary operations includes rentals of facilities, boutique sales, cafeteria leases, and parking. Revenue from ancillary operations increased by \$0.1 million to \$2.3 million in 2019-20 from \$2.2 million in 2018-19. The \$0.1 million increase is mainly due to the increase in revenue related to the Nature Boutique and Nature Café offset by a decrease in rentals of facilities revenue.

Revenue

(Excluding parliamentary appropriations and in-kind sponsorships and specimen donations)



Contributions

Contributions recognized as revenue vary from year to year based upon the resources required to fund research, collections and public education programs including installing new permanent galleries. On an accrual basis, contributions including donations, sponsorships, in-kind sponsorships and specimen donations increased by \$0.9 million to \$3.8 million in 2019-20 from \$2.9 million in 2018-19. The increase is mainly due to \$1.6 million increase in specimen donations substantially related to Mont Saint-Hilaire collection. This increase is offset by \$0.3 million decrease in recognized restricted contributions related to the arctic digitization project. The remainder of the year-over-year difference is due to the variation in the deferred contributions used for the purchase of capital assets.

Interest

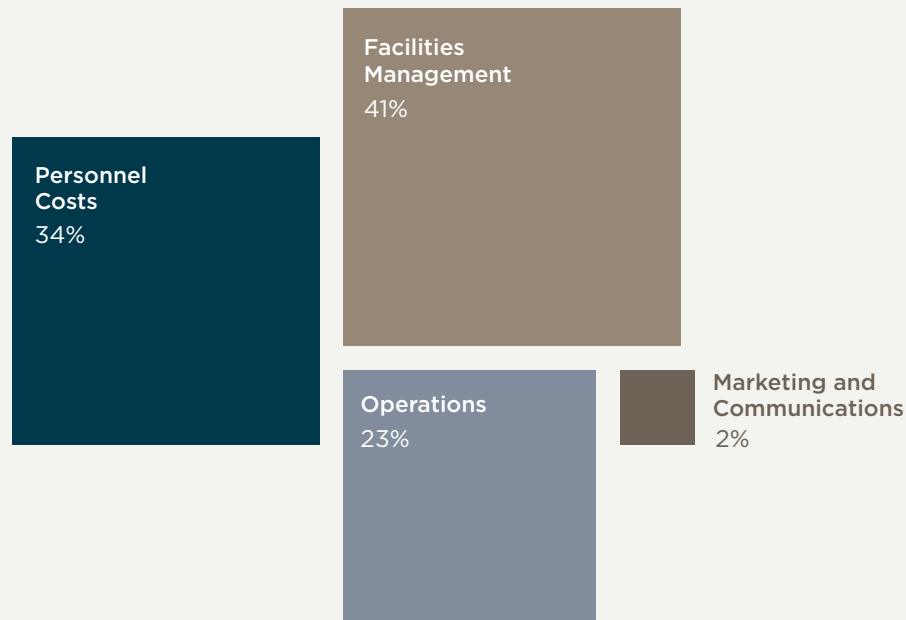
Interest revenue on cash and restricted cash held in the Museum's bank account totaled \$0.4 million in 2019-20, the same as 2018-19.

Other

Other revenue decreased by \$0.3 million to \$0.6 million in 2019-20 from \$0.9 million in 2018-19 mainly due to lower revenue generated from travelling exhibitions and scientific services.

Expenses

(Excluding in-kind sponsorships and specimen donations)



EXPENSES

Expenses increased by \$5.0 million to \$49.1 million in 2019-20 from \$44.1 million in 2018-19.

Inspiration and Engagement

Inspiration and engagement increased to \$11.8 million in 2019-20 from \$11.7 million in 2018-19. The increase of \$0.1 million is mainly due to higher personnel costs.

Collections Care and Access

Collections care and access increased to \$8.2 million in 2019-20 from \$3.2 million in 2018-19. The increase of \$5.0 million is mainly due to \$3.5 specimen purchase, \$1.1 million specimen donations related to Mont Saint-Hilaire mineral collection and \$0.4 million additional specimen donations which included a collection of birdwing and morpho butterflies and beetles.

Research and Discovery

Research and discovery increased to \$5.1 million in 2019-20 from \$4.6 million in 2018-19. The \$0.5 million increase is mainly due to higher training and research costs some of which are funded through restricted donations.

Internal Support Services

Internal support services increased to \$6.1 million in 2019-20 from \$5.9 million in 2018-19. The \$0.2 million increase is attributable to higher information management infrastructure and systems expenses and personnel costs.

Buildings and Grounds

Expenses related to the Museum's buildings and grounds decreased to \$17.9 million in 2019-20 from \$18.7 million in 2018-19. The \$0.8 million decrease is mainly attributable to lower property management costs related to both buildings substantially due to higher capitalization, lower interest on capital lease obligation and lower utilities expenses.

NET RESULTS OF OPERATIONS

The net results of operations generated a deficit of \$3.3 million in 2019-20, which can be attributed to the following:

- Excluding in-kind sponsorships, on a net basis the Museum recorded \$0.4 million in admission and program fees and ancillary operations below forecast due to the Museum closure as a result of COVID-19.
- The Museum recorded \$3.5 million in Mont Saint-Hilaire mineral specimens purchased for the collection recorded as an expense.
- The Museum recorded \$0.6 million savings in payment in lieu of taxes related to the VMMB building.

FINANCIAL SITUATION

Assets

Cash decreased by \$2.8 million to \$15.7 million in 2019-20 from \$18.5 million in 2018-19. This decrease is mainly attributable to the \$3.5 million Mont Saint-Hilaire mineral specimens purchased for the collection offset by \$1.5 million in restricted investment disbursed from the Ottawa Community Foundation and timing difference in payment of invoices.

Capital assets decreased by \$5.0 million to \$170.8 million in 2019-20 from \$175.8 million in 2018-19 due to amortization expense of \$9.3 million offset by acquisition of capital assets of \$4.3 million.

Liabilities

Deferred revenue, contributions and parliamentary appropriations decreased by \$0.9 million to \$6.3 million in 2019-20 from \$7.2 million in 2018-19. This increase is mainly attributable to capital parliamentary appropriations received in current year through Budget 2016 and deferred for future capital projects.

Deferred capital funding decreased by \$4.0 million to \$158.9 million in 2019-20 from \$162.9 million in 2018-19 as deferred capital funding is recognized as revenue at the same pace as the amortization of the corresponding capital assets.

Accumulated Deficit

The accumulated deficit of \$5.4 million as at March 31, 2020, is mainly due to the accounting treatment related to the Museum's Natural Heritage Campus located in Gatineau, Quebec, which is recorded on the Statement of Financial Position as an obligation under capital lease. This accounting treatment has kept the Museum's accumulated deficit in a deficit position for many years due to the interest expense on the capital lease obligation being higher in the earlier years than in the years closer to the end of the lease term. Accordingly, the accumulated deficit related to this accounting treatment has begun reversing this year until it will be fully eliminated by the end of the lease term in 2031. This does not impact the Museum's cash flow or financial stability in any way.

OBJECTIVES FOR 2020-21 AND BEYOND

The Canadian Museum of Nature is a leading research facility with demonstrated national and international leadership in Arctic knowledge and exploration, and in species discovery and change. The need for applying this research, as accessed through the national and global networks of knowledge that it supports, will become increasingly important. Canada's heightened role in the global dialogue about the environment and climate change will raise expectations for the national museum of natural history and natural sciences to continue to contribute to the body of knowledge about nature's past, present and future based on the evidence of nature collected over time.

A theme for the 2020-21 to 2024-25 planning period is leveraging the Museum's position as a national leader and global influencer in Arctic knowledge and species discovery for impact on visitor understanding of the natural world. This theme will enable the Museum to profile the value and impact of its collections, scientific research and public engagement programs. In 2020-21, the Museum plan is to make strategic investments in its global presence at the International Union for the Conservation of Nature (IUCN) World Conservation Congress, in scientific talent by mentoring more students, new natural sciences content by presenting a new exhibit *Planet Ice* and refreshed visitor experiences by investing in the Boutique. In 2020-21, the gap in funds to operate the two facilities under the stewardship of the Museum is the most critical issue facing the Museum. This is the result of a decision in 1994 to transfer the custody of Museum land and buildings to the Museum from Public Works and Government Services Canada without indexing.

The 2020-21 to 2024-25 Corporate Plan confirms five strategic objectives:

- Transform people's understanding of Canada's leadership in Arctic knowledge and its importance to our global natural future and be a global museum leader that engages in and influences global dialogue about the Arctic and its importance to our collective future. The focus of this fiscal will be on the new *Planet Ice* exhibit.
- Transform understanding of the relevance and influence of species knowledge to peoples' lives now and, in the future, and be a national museum leader that contributes to the understanding of Canada's biodiversity and geodiversity. The focus of this fiscal will be on the IUCN World Conservation Congress.
- Transform understanding and engagement with nature by leveraging expert narratives, extraordinary collections, personal experiences and powerful dialogue and be a leader and collaborator in innovative and sustainable nature inspiration and engagement. The focus of this fiscal will be on the refresh of the digital engagement strategy.
- Play a vital role on the national and global stage to advance understanding and respect for nature and be a known, respected, active and called upon player locally, nationally and globally. The focus of this fiscal will be the launch of the CBC Curio Education content.
- Evolve the museum enterprise model to embrace new technology, data analysis and employee engagement and be a global leader in sustainable museum enterprise model application and development. The focus of this fiscal will be support of the public launch of the Canadian Museum of Nature Foundation.

The strategic directions for the Museum acknowledge the intent to be a leading source of natural history knowledge and scientific inquiry for scientists and the public, thus contributing a distinctly Canadian perspective to the global body of knowledge.

The Museum will disseminate the results of this scientific inquiry, thus helping inspire Canadians to act conscientiously about the natural environment. As a public institution, the Museum also wishes to continue to demonstrate accountability, value and fiscal effectiveness through achieving measurable, meaningful results.

These measures combined with the continuing support of the Government of Canada and a highly motivated and skilled team will allow the Museum to continue to fulfill its mandate to “...*increase throughout Canada and internationally, interest in, knowledge of and appreciation and respect for the natural world...*”

The Museum’s mandate also feeds into a global natural history and nature conservation vision to save the world for future generations with evidence, knowledge and inspiration.

On March 11, 2020, the WHO declared the COVID-19 outbreak as a pandemic based on the rapid increase in exposure globally. As a result of this, effective March 14, 2020 and based on public health recommendations, the Museum along with the other national museums have made the decision to close the museums across Canada to visitors and all other groups until further notice. Internal operation such as research, exhibit development and essential services such as animal care will continue throughout the period of closure.

The pandemic and closure have had and will continue to have a significant impact on the Museum’s revenue generation and operations. The duration and impact of the COVID-19 pandemic remain unclear at this time. It is not possible to reliably estimate the full effect of the outbreak on the Museum results of operations and financial condition at this time. Management is actively monitoring the effect on the Museum’s financial condition and probing ways to address potential financial impacts. On June 18, 2020, the Government of Canada announced emergency funding to assist the museum sector of which \$5.9 million has been allocated to help the Corporation maintain essential services and be ready to reopen to the public and staff once precautionary measures are lifted based on the guidance from the Public Health Agency of Canada.

RISK ANALYSIS

The Museum has in place an enterprise risk management framework designed to effectively and proactively manage the risks that could prevent the Museum from achieving its objectives. The Museum Corporate Plan identifies four risks and their related mitigation strategies. The risk mitigation step involves development of mitigation strategies designed to manage, eliminate, or reduce risk to an acceptable level, ideally low. Once a strategy is implemented, it is continually monitored to assess its efficacy with the intent of revising the course of action if needed.

Summary of key risks and mitigation strategies are as follows:

1. Structural Deficit - Risk that the structural deficit will continue to increase due to expenses increasing at a greater rate than revenue, such as utilities, property, taxes and general inflation and due to the impacts of the COVID-19 pandemic on visitor attendance and associated revenues. This is mitigated by a continuous process of expenditure review, admission revenue monitoring and earned revenue growth.
2. Advancement - Risk that a limited donor pipeline may constrain financial resources available to support the investment required for initial implementation of the Museum's strategic objectives. This is mitigated by a comprehensive advancement program that identifies, cultivates, solicits and stewards donors and prospects, led by a team of fundraising professionals and a new group of committed fundraising volunteers and board members.
3. Succession - Risk that a significant number of employees are eligible for retirement resulting in the loss of corporate memory and key skills. To mitigate this risk the Museum developed and monitors a succession plan that includes skills development.
4. Budget 2016 - Risk that capital projects funded through Budget 2016 would not be completed on time and on budget to meet the required scope. Quarterly tracking internally will ensure the Museum fulfills its spending commitments.

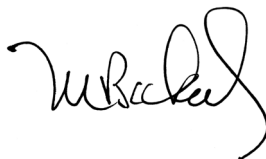
Management's responsibility for financial reporting

Management is responsible for establishing and maintaining a system of books, records, internal controls and management practices to provide reasonable assurance that: reliable financial information is produced; the assets of the Corporation are safeguarded and controlled; the transactions of the Corporation are in accordance with the relevant legislation, regulations and by-laws of the Corporation; the resources of the Corporation are managed efficiently and economically; and, the operations of the Corporation are carried out effectively.

Management is also responsible for the integrity and objectivity of the financial statements of the Corporation. The accompanying financial statements were prepared in accordance with Public Sector Accounting Standards. The financial information contained elsewhere in this annual report is consistent with that in the financial statements.

The Board of Trustees is responsible for ensuring that Management fulfils its responsibilities for financial reporting and internal control. The Board exercises its responsibilities through the Audit and Finance Committee, which includes a majority of members who are not officers of the Corporation. The Committee meets from time to time with Management, the Corporation's internal auditors and the Office of the Auditor General of Canada to review the manner in which these groups are performing their responsibilities and to discuss auditing, internal controls, and other relevant financial matters. The Board of Trustees has reviewed and approved the financial statements following the audit of the Office of the Auditor General of Canada.

The financial statements have been audited by the Auditor General of Canada. The report offers an independent opinion on the financial statements to the Minister of Canadian Heritage.



Margaret Beckel

*President and Chief
Executive Officer*



Ikram Zouari, CPA, CGA

Chief Financial Officer

June 25, 2020
Ottawa, Canada



Office of the
Auditor General
of Canada

Bureau du
vérificateur général
du Canada

INDEPENDENT AUDITOR'S REPORT

To the Minister of Canadian Heritage

Report on the Audit of the Financial Statements

Opinion

We have audited the financial statements of the Canadian Museum of Nature (the Corporation), which comprise the statement of financial position as at 31 March 2020, and the statement of operations, statement of changes in accumulated deficit and statement of cash flows for the year then ended, and notes to the financial statements, including a summary of significant accounting policies.

In our opinion, the accompanying financial statements present fairly, in all material respects, the financial position of the Corporation as at 31 March 2020, and the results of its operations and its cash flows for the year then ended in accordance with Canadian public sector accounting standards.

Basis for Opinion

We conducted our audit in accordance with Canadian generally accepted auditing standards. Our responsibilities under those standards are further described in the *Auditor's Responsibilities for the Audit of the Financial Statements* section of our report. We are independent of the Corporation in accordance with the ethical requirements that are relevant to our audit of the financial statements in Canada, and we have fulfilled our other ethical responsibilities in accordance with these requirements. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

Other Information

Management is responsible for the other information. The other information comprises the information included in the Annual Report, but does not include the financial statements and our auditor's report thereon.

Our opinion on the financial statements does not cover the other information and we do not express any form of assurance conclusion thereon.

In connection with our audit of the financial statements, our responsibility is to read the other information and, in doing so, consider whether the other information is materially inconsistent with the financial statements or our knowledge obtained in the audit or otherwise appears to be materially misstated. If, based on the work we have performed, we conclude that there is a material misstatement of this other information, we are required to report that fact. We have nothing to report in this regard.

Responsibilities of Management and Those Charged with Governance for the Financial Statements

Management is responsible for the preparation and fair presentation of the financial statements in accordance with Canadian public sector accounting standards, and for such internal control as management determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, management is responsible for assessing the Corporation's ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless management either intends to liquidate the Corporation or to cease operations, or has no realistic alternative but to do so.

Those charged with governance are responsible for overseeing the Corporation's financial reporting process.

Auditor's Responsibilities for the Audit of the Financial Statements

Our objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with Canadian generally accepted auditing standards will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

As part of an audit in accordance with Canadian generally accepted auditing standards, we exercise professional judgment and maintain professional skepticism throughout the audit. We also:

- Identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.
- Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Corporation's internal control.
- Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by management.
- Conclude on the appropriateness of management's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Corporation's ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in our auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify our opinion. Our

conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause the Corporation to cease to continue as a going concern.

- Evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.

We communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

Report on Compliance with Specified Authorities

Opinion

In conjunction with the audit of the financial statements, we have audited transactions of the Canadian Museum of Nature coming to our notice for compliance with specified authorities. The specified authorities against which compliance was audited are Part X of the *Financial Administration Act* and regulations, the *Museums Act* and regulations, the by-laws of the Canadian Museum of Nature, and the directive issued pursuant to section 89 of the *Financial Administration Act*.

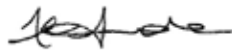
In our opinion, the transactions of the Canadian Museum of Nature that came to our notice during the audit of the financial statements have complied, in all material respects, with the specified authorities referred to above. Further, as required by the *Financial Administration Act*, we report that, in our opinion, the accounting principles in Canadian public sector accounting standards have been applied on a basis consistent with that of the preceding year.

Responsibilities of Management for Compliance with Specified Authorities

Management is responsible for the Canadian Museum of Nature's compliance with the specified authorities named above, and for such internal control as management determines is necessary to enable the Canadian Museum of Nature to comply with the specified authorities.

Auditor's Responsibilities for the Audit of Compliance with Specified Authorities

Our audit responsibilities include planning and performing procedures to provide an audit opinion and reporting on whether the transactions coming to our notice during the audit of the financial statements are in compliance with the specified authorities referred to above.



Firyal Awada, CPA, CA
Principal
for the Auditor General of Canada

Ottawa, Canada
25 June 2020

Statement of Financial Position

	at March 31 2020	at March 31 2019
<i>(in thousands of dollars)</i>		
Assets		
Current		
Cash and cash equivalents (Note 3)	15,700	18,475
Restricted cash (Note 3)	440	332
Restricted investments (Note 5)	237	1,516
Accounts receivable		
Trade	634	734
Government departments and agencies (Note 18)	332	183
Canadian Museum of Nature Foundation (Note 19)	-	91
Inventories	192	164
Prepaid expenses	777	1,164
	18,312	22,659
Collections (Note 4)	1	1
Employee advances (Note 24)	476	505
Restricted investments (Note 5)	1,308	1,500
Investments (Note 6)	941	968
Capital assets (Note 7)	170,769	175,802
	191,807	201,435
Liabilities		
Current		
Accounts payable and accrued liabilities		
Trade	4,737	4,724
Government departments and agencies (Note 18)	335	632
Obligation under capital lease (Note 8)	1,175	1,065
Deferred revenues, contributions and parliamentary appropriations (Note 9)	6,254	7,233
Employee future benefits (Note 10)	230	223
	12,731	13,877
Obligation under capital lease (Note 8)	22,768	23,943
Deferred capital funding (Note 11)	158,851	162,879
Employee future benefits (Note 10)	2,900	2,889
	197,250	203,588
Accumulated Deficit		
Unrestricted	6,582	9,932
Investment in capital assets (Note 12)	(12,025)	(12,085)
	(5,443)	(2,153)
	191,807	201,435

The accompanying notes form an integral part of the financial statements.

Contractual Obligations, Contractual Rights and Contingencies (Notes 20, 21 and 22).

Approved by the Board of Trustees:

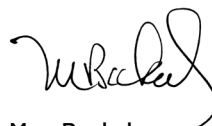


Judith A. LaRocque
Chair of the Board of
Trustees




Ron Calderoni, CPA, CA
Chair of the Audit and
Finance Committee

Recommended by Management:



Meg Beckel
President and Chief
Executive Officer



Ikram Zouari, CPA, CGA
Chief Financial Officer

Statement of Operations for the year ended March 31

<i>(in thousands of dollars)</i>	2020	2019
Revenue		
Admission and program fees (Note 15)	5,169	4,962
Ancillary operations (Note 16)	2,313	2,240
Contributions (Note 17)	3,633	2,762
Contributions from the Foundation (Notes 17 & 19)	170	91
Interest and Investment Income	448	405
Other	647	903
	12,380	11,363
Expenses (Note 25)		
Inspiration and engagement	11,808	11,697
Collections care and access	8,232	3,195
Research and discovery	5,045	4,546
Internal support services	6,149	5,949
Buildings and grounds	17,889	18,738
	49,123	44,125
Net result of operations before government funding	(36,743)	(32,762)
Parliamentary appropriations (Note 14)	33,453	34,763
Net result of operations	(3,290)	2,001

The accompanying notes form an integral part of the financial statements.

Statement of Changes in Accumulated Deficit for the year ended March 31

<i>(in thousands of dollars)</i>	Unrestricted	Invested in capital assets	2020	2019
Accumulated deficit, beginning of year	9,932	(12,085)	(2,153)	(4,154)
Net result of operations	(3,290)	-	(3,290)	2,001
Net change in investment in capital assets (Note 12)	(60)	60	-	-
Accumulated deficit, end of year	6,582	(12,025)	(5,443)	(2,153)

The accompanying notes form an integral part of the financial statements.

A statement of remeasurement gains and losses has been excluded as there have been no remeasurement gains or losses.

Statement of Cash Flows for the year ended March 31

<i>(in thousands of dollars)</i>	2020	2019
Operating activities		
Cash receipts - customers and donors	9,374	9,719
Cash receipts - parliamentary appropriations	25,975	26,900
Cash disbursements - employees	(16,287)	(15,672)
Cash disbursements - suppliers	(18,598)	(16,143)
Interest received	420	384
Interest paid	(2,436)	(2,536)
Cash (used in) provided by operating activities	(1,552)	2,652
Capital activities		
Acquisition of capital assets	(3,720)	(2,427)
Cash used in capital activities	(3,720)	(2,427)
Investment activities		
Decrease in restricted investment	1,500	-
Cash provided by investing activities	1,500	-
Financing activities		
Obligation under capital lease	(1,065)	(964)
Parliamentary appropriations received for purchase of capital assets	2,170	4,280
Cash provided by financing activities	1,105	3,316
(Decrease) increase in cash and restricted cash	(2,667)	3,541
Cash and cash equivalents, beginning of year	18,475	15,076
Restricted cash, beginning of year	332	190
Cash and cash equivalents and restricted cash, end of year	16,140	18,807
Cash and cash equivalents, end of year	15,700	18,475
Restricted cash, end of year	440	332
Cash and cash equivalents and restricted cash, end of the year	16,140	18,807

The accompanying notes form an integral part of the financial statements.

Notes to the Financial Statements for the year ended March 31, 2020

1. Authority and Mission

The Canadian Museum of Nature (the "Corporation") was established by the *Museums Act* on July 1, 1990. It is an agent Crown corporation named in Part I of Schedule III of the *Financial Administration Act* (FAA) and is not subject to the provisions of the Income Tax Act. The Corporation is classified as a government not-for-profit organization (GNPO).

The Corporation's mission is to increase, throughout Canada and internationally, interest in, knowledge of and appreciation and respect for the natural world by establishing, maintaining and developing for research and posterity a collection of natural history objects, with special but not exclusive reference to Canada, and by demonstrating the natural world, the knowledge derived from it and the understanding it represents.

Brief descriptions of the Corporation's activities are as follows:

- **Inspiration and engagement**

The Corporation develops and maintains exhibitions, programs, the nature.ca website, electronic and print publications, revenue generating activities and other activities to foster an understanding of, and respect for, nature.

- **Collections care and access**

The Corporation acquires, develops, preserves and makes accessible collections of natural history specimens, objects and information to meet the growing needs of the public and private sectors for research, education and informed decision-making about the natural world.

- **Research and discovery**

The Corporation studies the past and helps Canadians prepare for the future by conducting systematics and applied research, and by developing and maintaining networks and linkages with Canadian and international science communities.

- **Internal support services**

The Corporation develops and implements the policies, processes and an accountability structure to oversee the fulfilment of its mandate, including governance, strategic direction, corporate services, monitoring of corporate performance, and reporting to Parliament.

- **Buildings and grounds**

The Corporation provides secure and functional facilities that meet all safety and building code requirements. Among these facilities is the renovated Victoria Memorial Museum Building that furthers the vision and mandate of the Corporation.

On July 16, 2015, the Corporation was directed by the Governor General in Council (P.C. 2015-1105) pursuant to Section 89 of the FAA to align its travel, hospitality, conference and event expenditure policies, guidelines and practices with Treasury Board policies, directives and related instruments on travel, hospitality, conference and event expenditures in a manner that is consistent with its legal obligations, and to report on the implementation of this directive in the Corporation's Corporate Plan. Effective February 1, 2017, the Corporation has complied with this directive and has aligned its policies and practices to the Treasury Board policies, directives and related instruments for travel, conference, hospitality and event expenditures.

2. Significant Accounting Policies

A) Basis of Presentation

The financial statements have been prepared in accordance with Canadian Public Sector Accounting Standards (PSAS), and reflect the application of the Section 4200 series for GNPOs.

B) Inter-Entity Transactions

Inter-entity transactions are transactions between commonly controlled entities. Inter-entity transactions, other than restructuring transactions, are recorded on a gross basis and are measured at the carrying amount, except for the following:

- i) Inter-entity transactions are measured at the exchange amount when undertaken on similar terms and conditions to those adopted if the entities were dealing at arm's length, or where costs provided are recovered.
- ii) Goods or services received without charge between commonly controlled entities are unallocated costs not recovered by the recipient and not recorded by the Corporation. Services received by the Corporation without charge include audit services from the Office of the Auditor General of Canada and pension services from Public Services and Procurement Canada.

C) Measurement Uncertainty

The preparation of financial statements in accordance with PSAS requires Management to make estimates and assumptions that affect the reported amounts of assets and liabilities at the date of the financial statements and the reported amounts of revenue and expenses for the year. Employee future benefits, the estimated useful lives of capital assets, and the fair market value of specimens donated to the collections are the most significant items for which estimates are used. Actual results could differ significantly from those estimated. These estimates are reviewed annually and as adjustments become necessary, they are recorded in the financial statements in the fiscal year in which they become known.

D) Inventories

Inventories are valued at the lower of cost and net realizable value. Inventory cost is determined by using the weighted average cost method, and net realizable value is based on retail price.

E) Collections

The Corporation holds and preserves invaluable collections of natural history specimens for the benefit of Canadians, present and future. The collections are shown as an asset in the Statement of Financial Position at a nominal value of \$1,000 due to practical difficulties in determining a meaningful value for these assets. Specimens purchased for the collections are recorded as an expense in the year of acquisition.

F) Capital Assets

- Capital assets are recorded at cost, including material, equipment and other expenses acquired for the purpose of the design and the development of permanent exhibitions.
- Assets recorded as capital leases are initially recorded at the present value of the minimum lease payments at the inception of the lease.
- Land and building owned by the Government of Canada and that are under the control of the Corporation are recorded at their estimated cost.

Asset	Useful life
Victoria Memorial Museum Building	40 years
Property under capital lease	35 years
Collection cabinets and compactors	
Furnishings and office equipment	10 years
General equipment	
Permanent exhibitions	
Research equipment	
Building improvements	5 to 25 years
Leasehold improvements	5 years to end of lease term
Computer equipment	3 years

Amortization is calculated on a straight-line method using rates over the estimated useful life of the assets, except for leasehold improvements which are amortized on a straight-line basis over the shorter of the term of the lease agreement and the asset's useful life.

When conditions indicate that an asset no longer contributes to the Corporation's ability to provide its services, the cost of the asset is written down to its residual value, if any.

G) Employee Future Benefits

i) Pension benefits

Substantially all the employees of the Corporation are covered by the public service pension plan (the "Plan"), a contributory defined benefit plan established through legislation and sponsored by the Government of Canada. Contributions are required by both the employees and the Corporation to cover current service costs. Pursuant to legislation currently in place, the Corporation has no legal or constructive obligation to pay further contributions with respect to any past service or funding deficiencies of the Plan. Consequently, contributions are recognized as an expense in the year when employees have rendered service and represent the total pension obligation of the Corporation.

ii) Severance benefits

Employees are entitled to severance benefits up to March 31, 2012, as provided for under labor contracts and conditions of employment.

The severance benefit obligation for employees who retire or resign, that accrued up to March 31, 2012 and remains unpaid, is measured using the projected benefit method. The actuarial gains (losses) are recognized on a systematic basis over the expected average remaining service life of the related employee group.

Other event driven termination benefits are recognized in the period when the event that obligates the Corporation occurs.

iii) Sick leave benefits

The Corporation provides sick leave benefits for employees that accumulate but do not vest. The Corporation recognizes a liability and an expense for sick leave in the period in which employees render services in return for the benefits. The cost of the accrued benefit obligations related to sick leave entitlement earned by employees is actuarially determined using the projected benefit method prorated on service and Management's best estimate of inflation, discount rate, employee demographics and sick leave usage of active employees. Actuarial gains (losses) are recognized on a systematic basis over the remaining service life of active employees covered by these sick leave benefits.

H) Restricted investments

Restricted Investments within the Ottawa Community Foundation (OCF) established as spend-down fund are recorded at amortized cost in the Statement of Financial Position. Spend-down amounts and investment income distributed from the fund for the purchase of depreciable capital assets are recorded as deferred revenues in the Statement of Financial Position.

Service fees charged by the OCF for the management of the fund are recorded as expenses in the Statement of Operations in the year incurred.

I) Investments

Investments within OCF established as 10-year term fund are recorded at amortized cost in the Statement of Financial Position.

Service fees charged by the OCF for the management of the fund are recorded as expenses in the Statement of Operations in the year incurred.

J) Revenue Recognition

i) Admission and program fees, ancillary operations and other revenues

Revenues from admission and program fees, ancillary operations, and other revenues are recognized when persuasive evidence of an arrangement exists between the two parties, goods have been delivered or services have been provided to the customers, price is fixed and determinable and collection is reasonably assured. The Corporation also records deferred revenue when amounts are received in advance of providing goods and services.

ii) Contributions

Contributions are comprised of donations received from individuals, foundations and corporations. The Corporation applies the deferral method to recognize its contributions as applicable for not-for-profit organizations.

Unrestricted contributions are recognized as revenue in the Statement of Operations when received or receivable if the amount to be received can be reasonably estimated and collection is reasonably assured.

Contributions externally restricted for specific projects or expenses are deferred in the Statement of Financial Position and recognized as revenue in the Statement of Operations in the fiscal year in which related obligations are fulfilled and the related expenses are incurred.

Investment income related to restricted contributions is first recorded in the Statement of Financial Position as deferred revenues and then recognized as revenue in the Statement of Operations in the fiscal year in which the related expenses are incurred.

iii) In-kind sponsorships and specimen donations

In-kind sponsorships involve obtaining non-financial support for a project, activity or product in return for substantial public relations benefit. An in-kind sponsorship is recognized if the contributed good or service is used in the normal course of operations and would otherwise have been purchased, and once the exchange has taken place. In-kind sponsorships are recorded at their fair market value as contributions with an offset to the related expense in the Statement of Operations.

Specimens donated to the collections are recorded as contributions with an offsetting expense to collections care and access at fair market value, when the following three criteria are met: i) a fair market value has been established for the specimen; ii) the acquisition has been approved; and iii) transfer of the specimen's title to the Corporation has taken place.

iv) Parliamentary appropriations

The Government of Canada provides financing to the Corporation through parliamentary appropriations.

- The parliamentary appropriations for operating expenditures are recognized as revenue in the fiscal years for which they are approved.
- The parliamentary appropriations for the purchase of depreciable capital assets are recorded as deferred parliamentary appropriations in the Statement of Financial Position. When the depreciable capital assets are purchased, the portion of the parliamentary appropriations used for acquisition of these capital assets is then reclassified as deferred capital funding in the Statement of Financial Position and recognized as revenue in the Statement of Operations on the same basis as the amortization of the corresponding capital assets.
- Parliamentary appropriations for specific expenses are recorded as deferred parliamentary appropriations in the Statement of Financial Position and recognized as revenue in the Statement of Operations in the fiscal year in which the related expenses are incurred.

The Corporation is required to report on the spending of appropriations in its annual report.

v) Restricted investments

Spend-down amounts and investment income distributed from the fund for the purchase of depreciable capital assets are recorded as deferred revenues in the Statement of Financial Position. When the depreciable capital assets are purchased, the portion of the revenues used for acquisition of these capital assets is then reclassified as deferred capital funding in the Statement of Financial Position and recognized as revenue in the Statement of Operations on the same basis as the amortization of the corresponding capital assets. Spend-down amounts and investment income distributed from the fund for specific expenses are deferred in the Statement of Financial Position and recognized as revenue in the Statement of Operations in the fiscal year in which related obligations are fulfilled and the related expenses are incurred.

vi) Investments

Investment income distributed from the term fund is recognized as revenue in the Statement of Operations.

K) Volunteer Services

Volunteers contribute a significant number of hours every year. Due to the difficulty of determining their fair value, those contributed services are not recognized in the financial statements.

L) Financial Instruments

The Corporation's financial assets and financial liabilities are measured at cost or amortized cost. Financial assets include cash and cash equivalents, restricted cash, restricted investments, investments and accounts receivable while financial liabilities include accounts payable and accrued liabilities.

Financial instruments are tested annually for impairment at the financial statements date, and any permanent impairment is reported in the Statement of Operations.

Transaction costs are added to the carrying value of items in the cost when they are initially recognized.

M) Allocation of Expenses

The Corporation does not apply the method of allocating costs for the purpose of distributing expenses between functions.

3. Cash and Cash Equivalents and Restricted Cash

Cash and Cash equivalents and restricted cash consist of balances with banks.

Restricted cash includes deferred contributions. Restricted cash accounts are managed in accordance with the donor's wishes and are invested in accordance with the Investment Policy of the Corporation.

As per the Corporation's Investment Policy, operating funds shall be invested in short-term money market instruments that are rated AA or better and guaranteed by the Government of Canada, a provincial government or the Canadian Imperial Bank of Commerce (CIBC). The investment vehicles consist of banker's acceptances, promissory notes and term deposits. Exceptions to the investment policy require the Board of Trustees approval.

During this fiscal year, the Corporation did not have investment vehicles and did not earn interest on investment vehicles (2018-19 - nil), the entire amount being held in cash.

The Corporation holds funds in trust on behalf of the Canadian Ocean Literacy Coalition. As of March 31, 2020, these funds represented \$18,442 (2019 - \$18,533). However, they are not recorded in the financial statements.

4. Collections

The natural history collections consist of 3.4 million specimen lots, and grew by 45,722 specimen lots this fiscal year (2018-19 - 21,305). These are exceptional scientific resources that are available nationally and internationally for research, exhibits and education.

The Corporation maintains multiple collection groupings, with the major collections as noted below divided into four discipline-related groups:

- the Earth Sciences collection (minerals, rocks, gems, fossils),
- the Vertebrates collection (mammals, birds, fish, amphibians and reptiles),
- the Invertebrates collection (molluscs, insects, crustaceans, parasites, annelids), and
- the Botany collection (algae, vascular plants, bryophytes, lichens).

The collections are managed and cared for through a collection risk assessment process that seeks to preserve the value of collections and uses a rational process for the establishment of priorities for their care. The Corporation has incurred \$6.2 million in 2019-20 (2018-19 – \$2.8 million) for the management, protection and conservation of its collections.

During the year, the Corporation purchased \$3.5 million (2018-19 – \$33,115), and acquired through donation \$1.7 million (2018-19 – \$118,040), of specimens for the collections.

There were no sales of specimens related to the collections during the year (2018-19 – nil).

5. Restricted Investments

On February 23, 2017, the Corporation received a philanthropic gift of \$4 million from the Ross Beaty family in Vancouver, which will enhance the Museum's national research and collections efforts focused on species discovery. Three million of the \$4 million gift is restricted to support the creation of a national cryogenic facility and the digitization of the Corporation's collections.

On April 26, 2017, the Corporation established a \$3 million spend-down fund within the OCF in order to maximize earnings while meeting the Museum's needs. With a spend-down fund, the capital is invested in the OCF's investment pool, with the intention of paying out the capital in agreed upon intervals, until the fund is fully depleted. This option allows the spend-down schedule to be determined by the Museum, while also providing flexibility for its own needs, with similar pay out and approach as for endowed funds. The OCF investment pool is mainly comprised of cash and short-term deposits, bonds and debentures and equities. \$1.5 million was paid out to the Corporation during 2019-20 (nil – 2018-19).

The fair market value of the spend-down fund amounts to \$1,565,581 according to the OCF's March 31, 2020 investment statement.

The investment income on spend-down fund during the year is \$210,527 (2018-19 – \$71,638). Service fees for the management of the fund expensed during the year is \$56,476 (2018-19 – \$55,153).

6. Investments

On October 4, 2017, the Corporation established a \$1 million 10-year term fund within the OCF in order to maximize earnings and create the Arctic Post-Doctoral Fellowship for Arctic Knowledge and Exploration. The principal amount is invested in the OCF's investment pool. In the event that the Corporation decides not to maintain the Fellowship, the fund shall be transferred back to the Corporation.

The fair market value of the term fund amounts to \$947,026 according to the OCF's March 31, 2020 investment statement.

The investment income on term fund during the year is \$30,109 (2018-19 – \$23,299). Service fees for the management of the fund expensed during the year is \$13,979 (2018-19 – \$13,299).

7. Capital Assets

<i>(in thousands of dollars)</i>			March 31 2020	March 31 2019		
	Cost	Accumulated amortization	Net book value	Cost	Accumulated amortization	Net book value
Land	627	-	627	627	-	627
Victoria Memorial Museum						
Building	204,783	63,946	140,837	204,783	58,929	145,854
Property under capital lease	35,040	23,799	11,241	35,040	22,805	12,235
Permanent exhibitions	10,351	5,267	5,084	10,122	4,228	5,894
Leasehold improvements	12,104	7,338	4,766	10,995	6,984	4,011
Research equipment	4,855	2,780	2,075	4,805	2,470	2,335
Collection cabinets and compactors	3,840	2,511	1,329	3,840	2,401	1,439
Building improvements	4,726	3,619	1,107	4,099	3,089	1,010
General equipment	1,143	446	697	1,056	337	719
Computer equipment	4,479	4,057	422	4,619	3,491	1,128
Furnishings and office equipment	1,540	1,414	126	1,530	1,365	165
Work in progress - Assets	2,458	-	2,458	385	-	385
	285,946	115,177	170,769	281,901	106,099	175,802

The amortization expense for the year amounts to \$9,281,000 (2018-19 - \$9,536,000). During the year, the Corporation retired fully amortized computer equipment for \$203,000. During the prior year, the Corporation did not sell or retire assets.

8. Obligation Under Capital Lease

The Natural Heritage Campus houses the Corporation's natural history collections and administrative functions, on the Corporation's site in Gatineau, Quebec. The Corporation is acquiring the building through a lease purchase agreement with a term of 35 years. It is committed to pay rent under all circumstances and in the event of termination of the lease, at the Corporation's option or otherwise, pay sufficient rent to repay all financing on the building. Management intends to completely discharge its obligation under the lease and obtain free title to the building in 2031, after the Corporation uses its right to purchase the building for ten dollars.

Future minimum lease payments in aggregate, under the financing obligation are as follows:

<i>(in thousands of dollars)</i>		March 31 2020	March 31 2019
Total minimum future payments	(1)	40,250	43,750
Deduct: Imputed interest		(16,307)	(18,742)
Present value of financing obligations	(2)	23,943	25,008
Current portion		1,175	1,065
Long term portion		22,768	23,943
		23,943	25,008

1) The amounts payable under the capital lease are based on the fixed interest rate of 9.88%, for a period of 35 years, established at the time of signing the lease.

2) The present value of the capital lease obligation based on a current market interest rate of 8.75% is estimated at \$25 million.

Future minimum lease payments, by year under the financing obligation are as follows:

<i>(in thousands of dollars)</i>	2021	2022	2023	2024	2025	thereafter
Future minimum payments	3,500	3,500	3,500	3,500	3,500	22,750

9. Deferred Revenues, Contributions and Parliamentary Appropriations

Deferred revenues, contributions and parliamentary appropriations were as follows:

<i>(in thousands of dollars)</i>	March 31 2020	March 31 2019
Deferred contributions from non-government sources	1,925	1,979
Deferred parliamentary appropriations	3,888	4,715
Total deferred contributions and parliamentary appropriations	5,813	6,694
Deferred revenues – goods and services	441	539
	6,254	7,233

Changes in the deferred revenues, contributions and parliamentary appropriations were as follows:

<i>(in thousands of dollars)</i>	March 31 2020	March 31 2019
Balance, beginning of year	7,233	4,908
Add:		
Restricted contributions received	421	400
Restricted parliamentary appropriations received	2,170	4,280
Deferred revenue for the provision of goods and services	1,044	1,141
	3,635	5,821
Less:		
Restricted contributions recognized	(475)	(1,450)
Restricted parliamentary appropriations spent	(2,998)	(917)
Deferred revenue for the provision of goods and services recognized	(1,141)	(1,129)
	(4,614)	(3,496)
Balance, end of year	6,254	7,233

10. Employee Future Benefits

i) Pension benefits

The Corporation and all eligible employees contribute to the public service pension plan (the "Plan"). The Plan provides benefits based on years of services and average earnings at retirement. The benefits are fully indexed to the increase in the Consumer Price Index. The Corporation's and employees' contributions to the Plan during the year were as follows:

<i>(in thousands of dollars)</i>	2020	2019
Corporation's contributions	1,254	1,187
Employees' contributions	1,216	1,198

The President of the Treasury Board of Canada sets the required employer contributions based on a multiple of the employees' required contribution. The required employer contribution rate for 2020 was dependent on the employee's employment start date. For employment start dates before January 1, 2013, the Corporation's contribution rate effective at year end was 1.01 times (2018-19 – 1.01) the employee's contribution; and for employment start dates after December 31, 2012, the Corporation's contribution rate effective at year end was 1.00 times (2018-19 – 1.00) the employee's contribution.

The Government of Canada holds a statutory obligation for the payment of benefits relating to the Plan. Pension benefits generally accrue up to a maximum period of 35 years at an annual rate of 2 percent of pensionable service times the average of the best five consecutive years of earnings. The benefits are coordinated with Canada/Quebec Pension Plan benefits and they are indexed to inflation.

ii) Severance benefits

Since April 1, 2012, employees no longer accumulate severance benefits payable upon resignation or retirement. Employees were given the option to be paid the full or partial value of benefits earned at that date or to defer this payment until their departure from public service. The severance benefit liability represents the portion that employees chose to defer. This benefit plan is unfunded and thus has no assets, resulting in a plan deficit equal to the accrued benefit obligation. Benefits will be paid from future appropriations. The estimated average remaining service period of the employees is 7 years. The actuarial loss of severance benefits is amortized over 7 years.

Information about the Plan, evaluated by an actuary as at March 31, 2020, is as follows:

<i>(in thousands of dollars)</i>	2020	2019
Accrued severance benefits obligation, at the beginning of year	638	631
Interest cost on benefit obligation	11	13
Actuarial loss on obligation	1	1
Severance benefits paid during the year	(15)	(7)
Accrued severance benefits obligation, end of year	635	638
Short term portion	95	97
Long term portion	540	541
	635	638

Assumptions in the actuarial evaluation include a discount rate of 0.87% (2018-19 – 1.69%), as well as an inflation rate of 1.5% (2018-19 – 2.00%). Included in the severance benefits obligation is a non-amortized actuarial loss of \$22,821 (2018-19 – \$4,545).

iii) Sick leave benefits

The Corporation has recorded an obligation related to sick leave benefits for its employees. The estimated average remaining service period of the employees is 14 years. The actuarial gain of sick leave benefits is amortized over 14 years.

Information on these benefits, evaluated by an actuary as at March 31, 2020, is as follows:

<i>(in thousands of dollars)</i>	2020	2019
Sick leave obligations, at the beginning of year	2,474	2,352
Current service cost	145	166
Interest cost on benefit obligation	22	33
Actuarial gain on obligation	(90)	(63)
Sick leave used during the year	(56)	(14)
Sick leave benefits, end of year	2,495	2,474
Short term portion	135	126
Long term portion	2,360	2,348
	2,495	2,474

Assumptions in the actuarial evaluation include a discount rate of 1.26% (2018-19 – 1.78%) as well as an inflation rate of 1.50% (2018-19 – 2.00%). Included in the sick leave obligation is a non-amortized actuarial gain of \$1,092,260 (2018-19 – \$1,252,658).

11. Deferred Capital Funding

Deferred capital funding represents the portion of the parliamentary appropriations and contributions from non-government sources used to purchase depreciable capital assets.

The deferred capital funding consists of the following:

<i>(in thousands of dollars)</i>	March 31 2020	March 31 2019
Used for acquisitions:		
Deferred capital contributions from non-government sources	1,905	2,361
Deferred capital funding through parliamentary appropriations	156,946	160,518
	158,851	162,879

Changes in the deferred capital funding balance are as follows:

<i>(in thousands of dollars)</i>	March 31 2020	March 31 2019
Balance, beginning of year	162,879	169,522
Add: Capital asset acquisitions	4,248	1,892
Less amounts recognized as revenue:		
Contributions	(501)	(499)
Parliamentary appropriations	(7,775)	(8,036)
	(8,276)	(8,535)
Balance, end of year	158,851	162,879

12. Investment in Capital Assets

The investment in capital assets consists of the following:

<i>(in thousands of dollars)</i>	March 31 2020	March 31 2019
Capital assets	170,769	175,802
Less amounts financed by:		
Capital lease	(23,943)	(25,008)
Deferred capital funding	(158,851)	(162,879)
	(12,025)	(12,085)

The net change in investment in capital assets is calculated as follows:

<i>(in thousands of dollars)</i>	March 31 2020	March 31 2019
Capital asset additions	4,248	1,892
Add: repayment of obligation under capital lease	1,065	964
Less: capital assets financed with deferred capital funding	(4,248)	(1,892)
Capital assets purchased with the Corporation's funds	1,065	964
Amortization of deferred capital funding	8,276	8,535
Amortization of capital assets	(9,281)	(9,536)
Net change in investment in capital assets	60	(37)

13. Endowment Restrictions

An endowment fund for Systematic Entomology was received from Anne and Henry Howden in the principal amount of \$305,000, as well as a significant entomological collection. The endowment was established to enable professional studies and research of entomological collections for the Corporation. The principal amount was transferred to the OCF in 2014. In the event that the Corporation decides not to maintain entomological collections, the Systematic Entomology Endowment Fund shall be transferred, along with any entomological collections, to the Royal Ontario Museum.

On February 23, 2017, the Corporation received a large philanthropic gift of \$4 million from the Ross Beaty family in Vancouver, which will enhance the Museum's national research and collections efforts focused on species discovery. One million of the \$4 million gift was endowed through the OCF to create the Beaty Post-Doctoral Fellowship for Species Discovery, which will fund post-doctoral scientists to investigate species at risk. For the remaining \$3 million, the Corporation established a spend-down fund within the OCF as detailed in Note 5.

The net investment income earned on resources held for endowment during the year is \$55,678 (2018-19 - \$55,679). The total accumulated amount of deferred investment income earned is \$92,794 (2018-19 - \$85,253). During the year, \$48,059 was recognized in the Statement of Operations (2018-19 - \$30,547).

14. Parliamentary Appropriations

To achieve its mission, the Corporation relies on government funding. This government funding is comprised as follows:

<i>(in thousands of dollars)</i>	2020	2019
Appropriations received and receivable:		
Operating and capital budgets	28,981	31,081
Supplementary budgets	72	34
	29,053	31,115
Portion of parliamentary appropriations received in current year deferred for future capital projects	(3,888)	(4,715)
Previous year's appropriations used in current year to complete specific projects	4,715	1,353
Appropriations used to purchase depreciable capital assets	(4,202)	(1,026)
Amortization of deferred capital funding	7,775	8,036
Appropriations recognized during the year	33,453	34,763

15. Admission and Program Fees

Admission and program fees are comprised as follows:

<i>(in thousands of dollars)</i>	2020	2019
Admission fees – general	3,026	2,950
Admission fees – temporary exhibitions	814	748
Memberships	693	525
Programs	636	739
	5,169	4,962

16. Ancillary Operations

Ancillary operations are comprised as follows:

<i>(in thousands of dollars)</i>	2020	2019
Parking	903	906
Rental of facilities	664	707
Boutique revenues	677	598
Cafeteria leases	69	29
	2,313	2,240

17. Contributions

Contributions are comprised as follows:

<i>(in thousands of dollars)</i>	2020	2019
Cash contributions and sponsorships	1,533	2,134
In-kind sponsorships	408	510
Specimen donations	1,692	118
Contributions	3,633	2,762
Contributions from the Foundation	170	91
	3,803	2,853

18. Related Party Transactions

The Corporation is related to all Government of Canada departments, agencies and Crown corporations. In addition to those related party transactions disclosed in Note 19, the Corporation conducted transactions with these entities in the normal course of operations, under the same terms and conditions that applied to outside parties and recorded at the exchange amount.

<i>(in thousands of dollars)</i>	2020	2019
Revenues from Government of Canada related parties:		
Ancillary operations	-	4
Other	35	72
	35	76

<i>(in thousands of dollars)</i>	2020	2019
Expenses with Government of Canada related parties:		
Personnel costs	1,652	1,518
Real property taxes	1,177	1,217
Professional and special services	4	162
Information management infrastructure and systems	13	14
Marketing and communications	8	10
Freight and cartage	10	7
Repairs and maintenance	1	1
	2,865	2,929

The following balances with Government of Canada related parties were outstanding at the end of the year:

<i>(in thousands of dollars)</i>	2020	2019
Due from related parties	332	183
Due to related parties	335	632

Services received by the Corporation without charge include audit services from the Office of the Auditor General of Canada and pension services from Public Services and Procurement Canada as indicated in Note 2B.

The Corporation's related parties also include its key management personnel which consist of 5 members of its senior management team and 11 members of its Board of Trustees, and their immediate family members. Transactions with these individuals, excluding compensation arrangements, include contributions of \$49,275 (2018-19 - \$50,875), recorded at exchange amounts.

19. Canadian Museum of Nature Foundation

The Canadian Museum of Nature Foundation (the "Foundation") was incorporated under *the Canada Not-for-profit Corporations Act* on November 29, 2016. The purpose of the Foundation is to receive or maintain funds and to transfer from time to time all or part therefor or the income therefrom to the Corporation. This is a separate and distinct legal entity and non-share Capital Corporation. On September 28, 2017, the Foundation received its registered charitable status under the *Income Tax Act*.

The Foundation's role is to design and implement a strategy and development plan that will raise as much financial support as possible to advance the mandate and vision of the Corporation with a focus on major donations. In 2019-20, the Foundation received \$1,030,517 (2018-19 - \$70,548) and made a contribution to the Corporation of \$170,000 (2018-19 - \$90,542).

The Corporation and the Foundation are related by virtue of the Corporation's economic interest in the Foundation. The Corporation is considered to have significant influence based on the Foundation's purpose being integrated with that of the Corporation, the Corporation's involvement in the Foundation strategic planning, the development of the Foundation's fundraising priorities, and the significant amount of funds to be raised by the Foundation for the benefit of the Corporation.

In 2019-20, direct expenses related to the setting up of the Foundation absorbed by the Corporation and recorded directly in the Corporation's financial statements were in the amount of \$4,922 (2018-19 - \$16,736).

The Corporation does not allocate the costs relating to building and equipment maintenance, administration services, and information technology to other functions of the Corporation and to the Foundation. These administrative support costs provided without charge to the Foundation are estimated at \$37,280 (2018-19 - \$20,000). The financial statements of the Foundation have not been consolidated in the Corporation's financial statements and are available upon request.

As at March 31, 2020, the amount due from the Foundation to the Corporation was nil (2018-19 - \$90,542).

20. Contractual Obligations

As of March 31, 2020, the Corporation has contracts for the operation and maintenance of the building, professional and special services, information management infrastructure and systems, marketing and communications, and exhibitions with a remaining value of \$5,901,000 (2018-19 – \$7,044,000). Estimated future minimum payments under these contracts for the next 5 years are as follows:

<i>(in thousands of dollars)</i>	2021	2022	2023	2024	2025
Future minimum payments	4,521	703	323	169	185

21. Contractual Rights

As of March 31, 2020, the Corporation has various revenue contracts including rentals of public spaces, leases of office and storage space, collection management and care services, food services agreements and travelling exhibition fees.

Major contractual rights that will generate revenues in future years and that can be reasonably estimated are summarized in the table below. As of March 31, 2020, the estimated future minimum receipts under these contracts amounts to \$680,000 (2018-19 – \$1,089,000). The estimated future minimum receipts under these contracts for the next 5 years are as follows:

<i>(in thousands of dollars)</i>	2021	2022	2023	2024	2025
Lease space at the National Heritage Campus	146	148	-	-	-
Collection management and care	269	117	-	-	-
	415	265	-	-	-

22. Contingencies

In the normal course of its operations, the Corporation becomes involved in various claims or legal actions. Some of these potential liabilities may become actual liabilities when one or more future events occur or fail to occur. To the extent that the future event is likely to occur or fail to occur, and a reasonable estimate of the loss can be made, an estimated liability and an expense are recorded in the Corporation's financial statements.

As of March 31, 2020, and March 31, 2019, there were no claims against the Corporation.

23. Financial Instruments

Financial Risk Management

The Corporation has exposure to the following risks from its use of financial instruments: credit risk, market risk and liquidity risk.

The Corporation uses an enterprise risk management approach to manage risks proactively and prudently. The Corporation's Board of Trustees and Management ensure that an accountability regime, a governance structure, and systems are in place to appropriately manage risks through the systematic consideration of risk at the functional level. Management, in a timely and proactive manner will identify, assess, mitigate and monitor risks that may prevent the Corporation from achieving its objectives and priorities.

i) Credit risk

The credit risk is one party to a financial instrument that causes a financial loss for the other party by failing to meet its financial commitments. Such risks arise principally from certain financial assets held by the Corporation consisting of accounts receivable, cash and cash equivalents (unrestricted and restricted) and investments (unrestricted and restricted).

The maximum exposure to credit risk of the Corporation at March 31, 2020 is the carrying value of these assets.

Accounts receivable

The Corporation is exposed to credit risk, through its normal commercial activities, on its accounts receivable of \$966,000 (2018-19 – \$1,008,334). Accounts receivables from Government of Canada departments, agencies and Crown corporations comprise 34% (2018-19 – 27%) of the Corporation's accounts receivable, and no allowance has been provided for these amounts. In order to reduce this risk, the Corporation closely monitors the issuance of credit and collection of commercial clients, and the concentration of this risk is also minimized because the Corporation has a large and diverse customer base.

As at March 31, 2020, \$51,644 were past due (2018-19 – \$108,378), an allowance of \$412 has been provided (2018-19 – \$1,365 provided). The allowance for doubtful accounts is based on an account by account analysis that considers the aging of the account and the current creditworthiness of the customer. Accounts which have exceeded 120 days are considered past due.

Cash, investments, and restricted cash and investments

The Corporation manages its credit risk surrounding cash, investments, and restricted cash and investments by dealing solely with reputable banks and organizations, and utilizing an investment policy and risk management framework to guide their investment decisions. During 2017-18, the Corporation invested \$3 million contributions and \$1 million cash to earn investment income with the objective to maintaining safety of principal and maximizing earnings while meeting the Museum's needs. The Corporation monitors the performance and the status of its investments on a quarterly basis. In a year of negative investment performance, the Corporation may decide to hold the distribution of the capital and investment income of its funds to a further year with a positive return in order to mitigate credit risk. \$1.5 million was paid out to the Corporation during 2019-20.

ii) Liquidity risk

Liquidity risk is the potential inability to meet financial obligations as they become due. The Corporation manages this risk by maintaining detailed cash forecasts, as well as long-term operating and strategic plans. The management of liquidity requires a constant monitoring of expected cash inflows and outflows which is achieved through a forecast of the Corporation's liquidity position, to ensure adequacy and efficient use of cash resources. The Corporation's financial liabilities are due within three months of the date of the Statement of Financial Position.

iii) Market risk

Market risk is the risk that the fair value or future cash flows of a financial instrument will fluctuate because of changes in market prices, whether those changes are caused by factors specific to the individual financial instrument of its issuer, or factors affecting all similar financial instruments traded in the market. The Corporation is exposed to market risk on its investments and restricted investments. The Corporation monitors closely the performance of its investments and restricted investments to ensure market risks are being mitigated.

In a year of negative investment performance, the Corporation may decide to hold the distribution of the capital and investment income of its funds to a further year with a positive return. Market risks comprise three types of risk: Currency risk, Interest rate risk, and Price risk.

Currency risk

Currency risk is the risk that the fair value of future cash flows of a financial instrument will fluctuate because of changes in foreign exchange rates. The Corporation is exposed to currency risk on its investments and restricted investments. Currency risk is managed by hedging the portfolio with forward currency contracts or through portfolio diversification which acts as a hedge on its own. The Corporation's currency risk is not considered significant.

Interest rate risk

Interest rate risk is the risk that the fair value of future cash flows of a fixed income investments will fluctuate because of changes in market interest rates. The Corporation is exposed to interest risk on its investments and restricted investments. The Corporation's interest rate risk is not considered significant.

Price risk

Price risk is the risk that the fair value of future cash flows of a financial instrument will fluctuate because of changes in market prices. The Corporation is exposed to price risk on its investments and restricted investments. Price risk is managed through portfolio diversification. The Corporation's price risk is not considered significant.

24. Employee advances

On January 10, 2018, the Corporation implemented payment in arrears, an industry-standard payroll practice. All employees who were paid on a bi-weekly basis under the previous payroll system, received a one-time transition payment in the same manner as their regular pay. The transition payment ensured that no employee would experience financial hardship because of the transition to payment in arrears. This one-time payment was equal to an employee regular pay received on December 28, 2017 and recorded as employee advances on the Statement of Financial Position. The Corporation will recover this payment when the employee leaves. The recovered amount will include all applicable deductions.

As at March 31, 2020, employee advances due to the transition to payment in arrears amount to \$476,252 and no allowance has been provided for this amount (2018-19 - \$504,510).

25. Summary of Expenses by Object

<i>(in thousands of dollars)</i>	2020	2019
Personnel costs	16,044	15,239
Amortization of capital assets	9,281	9,536
Objects for collections	5,215	151
Professional and special services	3,975	4,121
Operation and maintenance of buildings	3,930	4,481
Interest on capital lease obligation	2,436	2,536
Real property taxes	2,293	2,392
Information management infrastructure and systems	1,599	1,503
Marketing and communications	1,167	1,241
Exhibitions	1,055	1,229
Repairs and maintenance	865	683
Travel	569	510
Cost of goods sold - natureBOUTIQUE	332	294
Freight and cartage	89	60
Other	273	149
	49,123	44,125

26. Comparative Figures

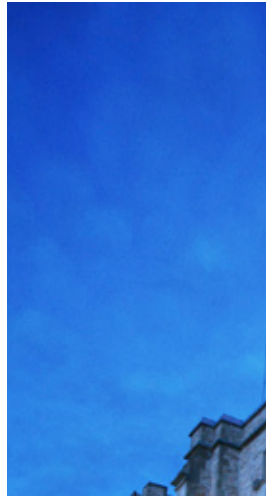
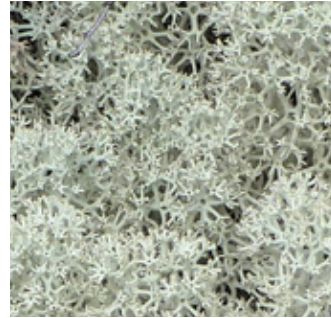
Certain comparative figures have been reclassified to conform to the current year's presentation.

27. COVID-19 and subsequent events

On March 11, 2020, the WHO declared the COVID-19 outbreak as a pandemic based on the rapid increase in exposure globally. As a result of this, effective March 14, 2020, and based on public health recommendations, the Corporation along with the other national museums made the decision to close the museums across Canada to visitors and all other groups until further notice. Internal operation such as research, exhibit development and essential services such as animal care have continued and expect to continue throughout the period of closure.

The Corporation has considered the impact of this event on the valuation of its assets and has determined that assets are appropriately valued and that no impairments are required.

The pandemic and closure have had and will continue to have a significant impact on the Corporation's revenue generation and operations. The duration and impact of the COVID-19 pandemic remain unclear at this time. It is not possible to reliably estimate the full effect of the outbreak on the Corporation results of operations and financial condition at this time. Management is actively monitoring the effect on the Corporation's financial condition and probing ways to address potential future financial impacts. On June 18, 2020, the Government of Canada announced emergency funding to assist the museum sector of which \$5.9 million has been allocated to help the Corporation maintain essential services and be ready to reopen to the public and staff once precautionary measures are lifted based on the guidance from the Public Health Agency of Canada.



Canadian Museum of Nature
nature.ca

Victoria Memorial Museum Building
240 McLeod Street, Ottawa, Ontario

Natural Heritage Campus
1740 Pink Road, Gatineau, Quebec

Information
613-566-4700 or 1-800-263-4433