



CANADIAN
WILDLIFE HEALTH
COOPERATIVE



State of Wildlife Health 2018-19
Changing the Conversation

INTRODUCTION

The CWHC is, at its roots, a surveillance organization. Surveillance systematically and continuously collects, analyses, and interprets signals to inspire action. We were founded to support and augment local, regional and national detection and analysis of wildlife disease trends and emerging threats. Today, our partners and supporters are as interested in what we detect as in what our assessments mean for policy and action. They want information mobilized to address underlying causes of harm and help avoid future problems. This 2018-19 State of Wildlife Health Report highlights how the CWHC is growing to meet all these needs. We highlight in this report examples of how we are transforming our capacities, building strategic partnerships, and inspiring conversations to encourage innovations that draw together information from various sources in new ways to meet modern expectations for wildlife health.

Canada's wildlife continues to be relatively healthy. Canadians should be confident that the wildlife that lives among them brings much more value than risk. I do, however, remain concerned about the challenges that lay ahead due to climate change, urbanization, habitat loss and diseases that are interacting to make it more challenging for wildlife to live their lives as nature intended.

There is a growing dissatisfaction with the use of wildlife surveillance largely in reaction to adverse events. There are new expectations to produce signals to protect wildlife and human health concurrently and proactively. This year's State of Wildlife Health Report illustrates how the CWHC supports the Pan-Canadian Approach to Wildlife Health by encouraging and applying innovative concepts and technology to better understand the determinants and drivers of health and disease while maintaining vigilance through our regional programs and partnerships.

The power of the CWHC comes from its cooperative nature. The strength of our Cooperative is seen daily in the enthusiasm and dedication at our national and regional offices as well as in the willingness of other wildlife health experts in academia, government and non-governmental organizations to contribute their views, data, and insights to improve Canada's understanding of wildlife health challenges and opportunities. Without this willingness to work together towards a common vision, the CWHC could not function.

The CWHC provides a unique national perspective on wildlife health; a perspective Canada relies on to meet many of its national and international obligations. We link surveillance, research and action to provide health assurances, improve preparedness, support response and enhance protection of wildlife health. We hope this year's report inspires conversations on the competencies, activities and partnerships needed to meet the vision of the Pan-Canadian Approach to Wildlife Health and ensure Canada's can address new challenges to wildlife arising from our rapidly changing world.

DR. CRAIG STEPHEN
CHIEF EXECUTIVE OFFICER



INTRODUCTION

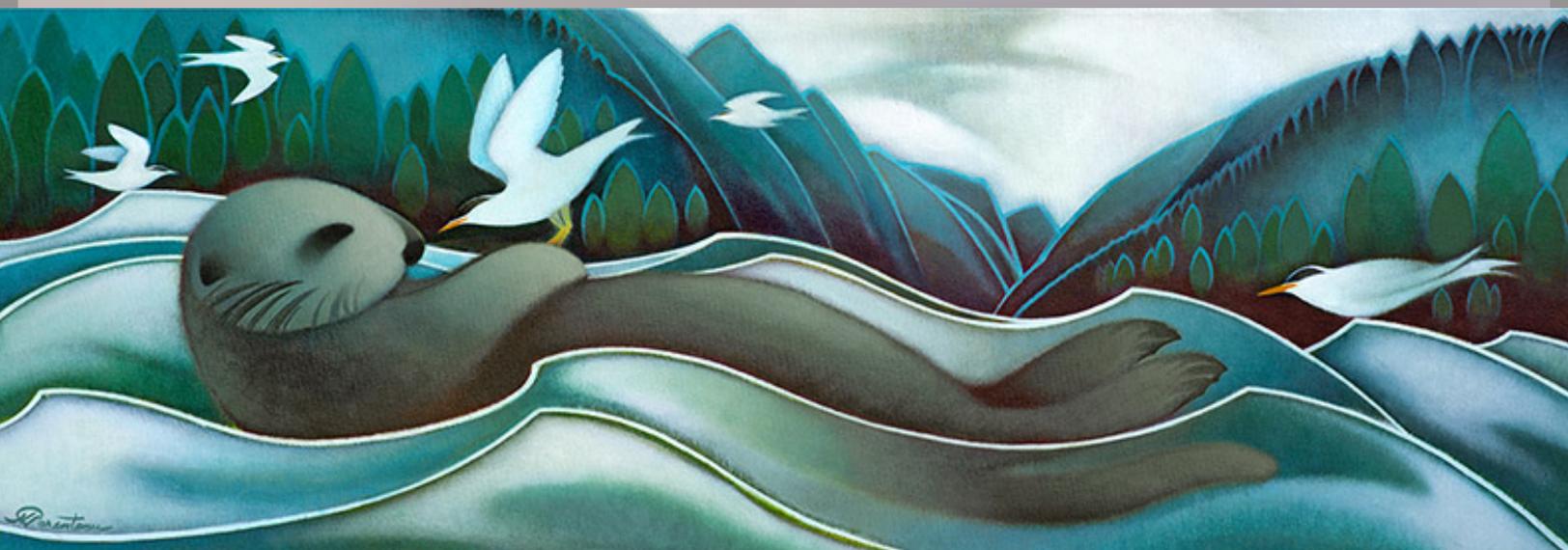
Across Canada and internationally, the CWHC is promoting and supporting decisions affecting wildlife health by fostering information technology, communications and governance innovations. Included in these innovations is our framework to deliver an effective and cost-efficient program. New ways of determining and communicating program impacts and relevance have positioned the CWHC and Canada as an international leader and influencer in wildlife health program and project management. New technologies, such as the CWHC Wildlife Health Information Platform (WHIP), and processes are being built and adopted by partners to more effectively deliver information to decision-makers while also ensuring the efficient delivery of the CWHC program and the highest quality of information being provided. Quality control and assurance initiatives and processes are embedded in these new technologies and we are developing performance standards and diagnostic protocols to measure the effectiveness of surveillance efforts which will allow us to adapt accordingly. This includes partnering with our OIE collaborating centre partner, the US National Wildlife Health Centre, on the development of cross border international case definitions. These innovations are necessary to meet the changing expectations for wildlife health surveillance.

There is growing demand for forecasting and early warning of emerging diseases threatening public health and agriculture. Wildlife diseases, especially when coupled with cumulative effects of other threats, such as habitat loss, are becoming more frequent and significant risks to endangered species. Expectations to describe and measure program outcomes are also increasing. A national wildlife surveillance program should generate knowledge to improve the effectiveness of policies and programs and inform management options. Performance standards attempt to show investments and activities are meeting expectations of public and/or private investors in wildlife disease surveillance services.

At its core, the CWHC is a community of practice with multiple partners providing a foundation for Pan-Canadian cooperation and innovation. Our operations have shown the effectiveness of this approach for the past 27 years. Through infrastructure, technology and expertise we seek to maximize capabilities that no single partner could maintain for the level of investment they make in the CWHC program. Our success in linking expertise found in our core partner institutions serves as an example of the power of a community of practice that provides a wider view of wildlife health than any one program could alone.

We are grateful for our host institutions, partners and network in enabling Canada and the CWHC to become leaders in wildlife health. Working to better define wildlife health and our impacts provides opportunities to tell our story and communicate information to society and decision-makers, to the benefit of wildlife and ourselves.

PATRICK ZIMMER
CHIEF OPERATIONS OFFICER



THE 2018-19 SITUATION

The CWHC has a unique eye on Canada's wildlife health situation. Diagnostic data generated in our regional centres, research done at our partner institutions, and contributions to our wildlife health intelligence platform, combine at the CWHC to provide a snapshot of wildlife disease in Canada. For a quarter of a century, consistent effort enhances meaningfulness and reliability in the surveillance signals being generated by the CWHC. Some insights into our program performance are included in this section along with a summary of some key surveillance findings.

EVENT	WHEN	NOTES
1st case of fatal Aleutian disease in a striped skunk in Quebec	Summer	The virus causing this disease has previously been found in British Columbia, Ontario and Nova Scotia
Human alveolar Echinococcosis discovered in Quebec	Fall	<i>Echinococcus multilocularis</i> had been found in southern Ontario but low surveillance efforts have not shown it in Quebec wildlife yet
1st case of CWD in Quebec	Winter	Found on a game farm. Provincial government and CWHC surveillance have not found a wildlife case to date
Newcastle disease in double-crested cormorants in Ontario and the Maritimes	Summer	Occasional outbreaks are not unknown in these regions
West Nile virus in a crow in Prince Edward Island	Summer	1st reported case in a wild bird in this province. Other wild bird cases were found in New Brunswick and Nova Scotia around the same time
1st case of fatal ranavirus in Quebec amphibians	Summer	Found in wood frogs and spotted salamanders
Lightning strike in Canada geese in Quebec	Summer	Acute clustered die-off involving several birds
Red fox mange in Prince Edward Island	Winter	<i>Sarcoptes scabiei</i> outbreak
Rabbit Hemorrhagic Disease in British Columbia	Winter	Feral and domestic rabbits affected. Origin of the disease is unknown
1st cases of ranaviruses in Ontario turtles	Summer	Snapping and wood turtles affected
Suspected new squirrel virus in Quebec	Fall	Unique coronavirus associated with pathological lesions
Scaly leg disease in pine grosbeaks in Alberta and Saskatchewan	Winter	Clinical diagnosis in birds captured for banding
<i>Mycoplasma gallisepticum</i> in house finches in Quebec	Winter	Detected in birds at feeders

EVALUATING THE CWHC SYSTEM

The CWHC is creating wildlife health surveillance standards by developing a framework to evaluate and communicate wildlife health information. We first engaged stakeholders in defining the goals and objectives of the program. The CWHC championed efforts within and outside of government to more explicitly define a cross-country standard for wildlife health programs. The result was the Pan-Canadian Approach to Wildlife Health which, for the first time, established national aspirations and objectives for wildlife health in Canada. We continue to support national and international conversations on this subject through discussion documents, invited presentations and peer reviewed publications.

In 2018, the CWHC began the process of creating its own performance standards to meet the expectations of the Pan-Canadian Approach. These standards will be used to; (i) assess our capacity to perform essential services; (ii) identify critical gaps in performance, (iii) inform partners of our role and the infrastructure and investment necessary to fulfill that role; (iv) track and measure accomplishment, (v) justify continued or expanded services and (vi) support claims that practices are valid and reliable.

THEME	ATTRIBUTE	MONITORING TARGETS
Situational Awareness	Samples examined reflect Canada's geographic, ecological and species diversity	Tracking changing patterns of sample submission
	Surveillance results are available in a timely fashion	Assessing the timeliness of report generation, information input and results sharing
	Information is shared with those who need to know quickly and accurately	Frequency and reach of technical reporting, alerts and social media reports
Decision Support	Access to and incorporation of contextual information to turn surveillance information into knowledge	Capacity to access and use contextual information to supplement surveillance outputs
	CWHC expertise is available to partners and supports decision making	Stability and growth of the CWHC core capacity and community of practice
	Contributions to identifying priorities, options for action and strategies to manage wildlife health	Requests for assistance and feedback on impacts of information products
Program Stability	Finances meet changing and growing needs	Financial status
	Human resources and infrastructure meet changing and growing needs	Number and diversity of the CWHC staff and community of practice and stability of relationships with host institutions

SITUATIONAL AWARENESS

For over 27 years the CWHC has facilitated an all of government approach, providing a foundation for Pan-Canadian situational awareness. It has informed policy across disciplines and helped Canada meet international obligations in conservation, public health and agriculture. Acknowledged by the OIE Performance of Veterinary Services evaluation, the CWHC is now considered critical national animal health infrastructure.

SITUATIONAL AWARENESS CONT.

As issues and needs change, we have worked to diversify and adapt our ability to collect and assess a wider array of information. For instance, new modules based on citizen science initiatives are being developed to provide a more comprehensive awareness of situations. The launch of our Wildlife Health Intelligence Platform (WHIP) this year signals important growth in the ways the CWHC can expand the geographic and species scope of our information. The WHIP also provide new capacity to collect and use information beyond our existing diagnostic and research findings.

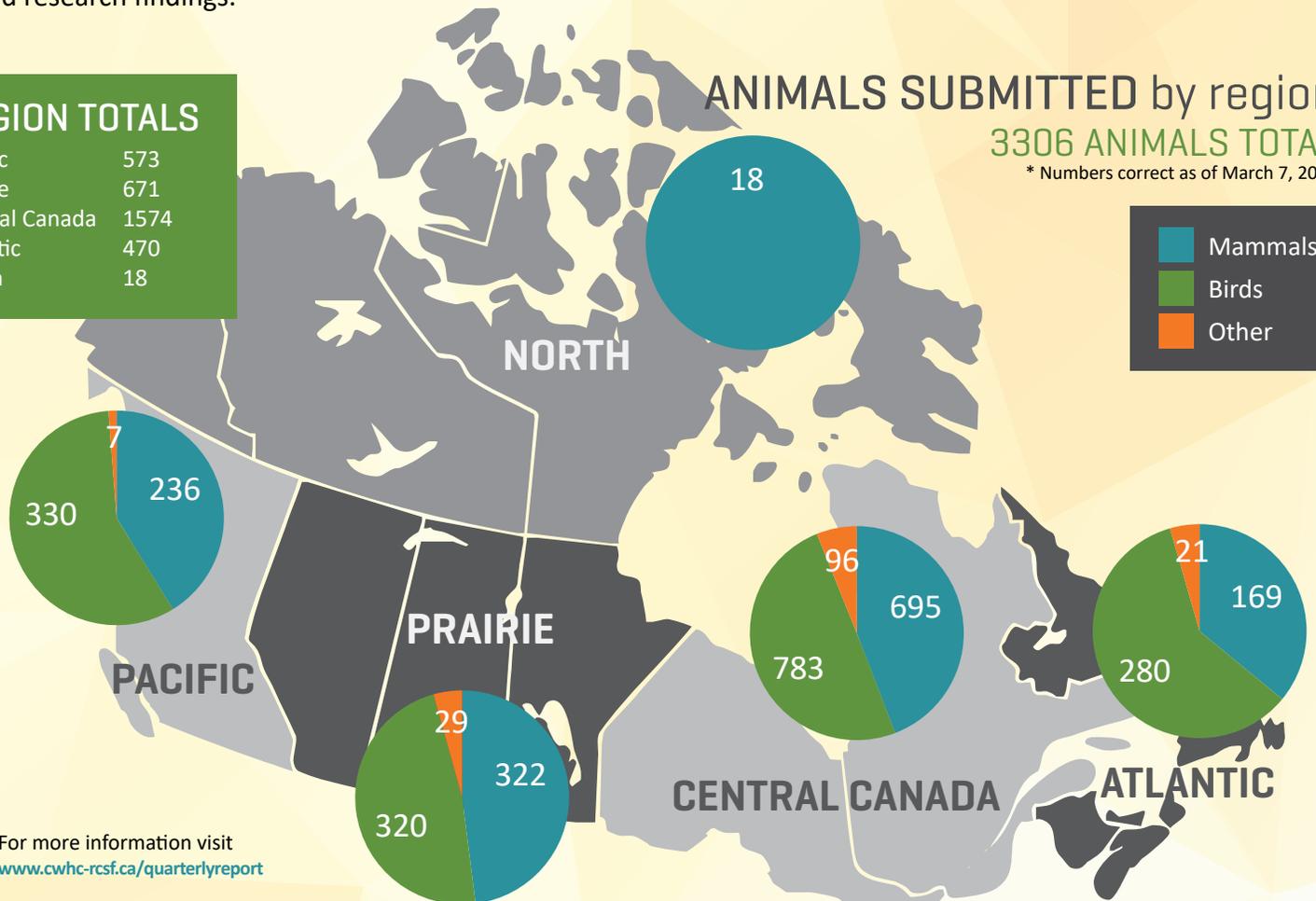
REGION TOTALS

Pacific	573
Prairie	671
Central Canada	1574
Atlantic	470
North	18

ANIMALS SUBMITTED by region

3306 ANIMALS TOTAL

* Numbers correct as of March 7, 2019



For more information visit www.cwhc-rcsf.ca/quarterlyreport

RABIES

Examined	1493
Positive	17

WHITE-NOSE SYNDROME

Examined	187
Positive	8

AVIAN INFLUENZA

Examined	1731
Positive	56

CHRONIC WASTING DISEASE

Examined	2268
Positive	349

BOVINE TUBERCULOSIS

Examined	375
Positive	0

CANINE DISTEMPER VIRUS

Examined	156
Positive	38

SNAKE FUNGAL DISEASE

Examined	28
Positive	1

NEWCASTLE DISEASE

Examined	582
Positive	15

WEST NILE VIRUS

Examined	1779
Positive	169

AVIAN CHOLERA

Examined	477
Positive	0

AVIAN BOTULISM

Examined	372
Positive	3

DECISION SUPPORT

We are increasingly being asked to undertake special projects and targeted surveillance to answer specific questions or issues that are directly applicable to preparedness or response decisions and actions. Our scanning surveillance program provides a consistent look that not only helps see long-term trends but also has proven effective at detecting emerging diseases. The infrastructure, capacities and relationship required for scanning surveillance provides a cost-effective foundation from which to launch a large number and variety of special projects. Scanning surveillance activities enhance program efficiency by helping to better allocate effort and resources for targeted surveillance by identifying higher risk settings. Together these activities help our partners recognize the need to act or, when no action is needed, provides assurances of safety.

Special projects funding now makes up over half of all CWHC revenues. While this reflects the versatility and value of CWHC expertise, it is also reflective of a decline in core support, upon which special projects are dependent to deliver their results in a cost-effective and timely manner.

To meet the growing need for a greater diversity of expertise, we continue to grow our community of practice and international collaborations that provide new insights, information and partnerships to generate recommendations to support decisions. This cross-disciplinary and multi-purpose role of the CWHC is reflected in the diversity of expertise, publications and presentations we make.



54 COMMITTEES

13 regional
36 national
5 international



92 AFFILIATES

40 staff
20 associates
32 graduate students



30 STRATEGIC REPORTS

Also secured Minister's approval
of the Pan-Canadian approach



72 PRESENTATIONS

22 Canadian
16 North American
34 international



81 PUBLICATIONS

8 book chapters
64 peer-reviewed articles
9 technical reports

PROGRAM STABILITY - FINANCES

The CWHC is increasingly dependent on special projects for ongoing operations. Overall revenue decreased by approximately 25% this year because several large projects came to a close or are in their last year of funding. This in turn has necessitated reductions in human resources to avoid net financial losses.

Ongoing shrinkage of support for core programs is compromising program delivery, particularly in two of our regional centres in Western Canada that joined the Cooperative as self-funded nodes. There is a growing gap between increasing demands and emerging issues and shrinking investments. Special projects and reductions in human resources have been required to address this gap and avoid net financial losses.

PROGRAM STABILITY - FINANCES CONT.

REVENUES

	General	Targeted	Total
Canadian Food Inspection Agency	150,000	261,568	411,568
Environment and Climate Change Canada	440,000	258,118	698,118
First Nations and Inuit Health Branch	4,972		4,972
Fisheries and Oceans		91,810	91,810
Parks Canada	150,000	23,328	173,328
Public Health Agency of Canada	240,000	9,000	249,000
BC Agriculture		46,102	130,252
BC Environment	10,000		10,000
BC First Nations Health Authority		7,500	7,500
BC Forests, Lands & Natural Resource Operations	10,000		10,000
Genome British Columbia		138,343	138,343
Investment Agriculture Foundation of BC		100,460	100,460
Manitoba		34,580	
New Brunswick	10,259	3,500	13,759
Newfoundland & Labrador	21,700	1,369	23,069
Northwest Territories	16,000	10,000	26,000
Nova Scotia	9,500		9,500
Nunavut	15,000		15,000
Ontario - Agriculture, Food and Rural Affairs		50,000	50,000
Ontario - Health and Long Term Care	100,000		100,000
Ontario - Natural Resources	80,000	119,999	199,999
PEI - Environment	4,735		4,735
PEI - Health		2,050	2,050
Québec - Ministère des Forêts, de la Faune et des Parcs	105,000	66,023	171,023
Québec - Ministère de l'Agriculture, des Pêcheries et de l'Alimentation	35,000		35,000
Québec - Ministère de la Santé et des Services sociaux		10,000	10,000
Saskatchewan Agriculture and Food		65,243	65,243
Saskatchewan Environment	41,309	116,992	158,301
Yukon	14,000		14,000
Canadian Wildlife Federation	2,500		
University of British Columbia		10,746	
University of Calgary Faculty of Veterinary Medicine			60,000
University of Calgary			84,857
University of Guelph			211,111
University of Montreal			211,111
University of Prince Edward Island			211,111
University of Saskatchewan			261,000
Western College of Veterinary Medicine	11,000	7,000	18,000
Miscellaneous Income/Fee-for-service		25,000	25,000
TOTAL REVENUE	\$ 1,470,975	\$ 1,458,731	\$ 4,005,220

EXPENSES

	General	Targeted	Total
Salaries and Benefits	1,074,316	839,158	2,360,474
Equipment	12,387	82,690	395,077
Diagnostic Costs	165,782	144,668	427,600
Operations	64,792	80,635	145,427
Travel	40,541	23,850	64,391
Other	23,583	10,837	293,609
Overhead	191,047	94,524	285,571
TOTAL EXPENSES	1,572,448	1,276,362	3,972,150
REVENUE LESS EXPENSES	\$ (101,473)	\$ 182,369	\$ 33,070



EFFICIENCIES

Efficiencies and partnerships result in considerable cost savings on administrative services, leaving most revenue for program delivery. Federal government investment in CWHC core programs is provided by 4 main agencies; Environment and Climate Change Canada, the Public Health Agency of Canada, Parks Canada, and the Canadian Food Inspection Agency. It represents approximately 56% of total cash funding. Provinces, territories, universities and fee-for-services provide an additional 20 to 25% of funds. The remaining support is realized through in-kind contributions from host institutions that provide infrastructure, equipment, administration and staff/expertise support. This partnered funding approach plus well-established collaborations with federal, provincial, and territorial agencies allows for more outputs at a fraction of the cost of other national wildlife health programs that operate on a centralized, stand-alone model.

The synergies gained by sharing CWHC infrastructure and resources across regions and projects reduces the cost per project and activity. If each disease-specific objective was addressed separately, at full-cost-recovery, the cost of undertaking surveillance for issues such as rabies, West Nile Virus, Avian Influenza, Chronic Wasting Disease and others would be considerably higher than the comprehensive CWHC program as a whole and much more costly than any one partner's contribution to the CWHC program. Decreasing resources for the core program may necessitate greater cost-recovery on targeted outputs, thereby reducing the value of current efficiencies.

RABIES

Rabies surveillance costs the CWHC approximately \$750,000 to \$1M annually, including diagnostics and necropsy services, data management, reporting, communications as well coordination and expert advice. Overall, partner contributions range from \$4735 to \$440000. The CWHC can provide surveillance and health intelligence for this single disease by taking advantage of cost savings derived from the scanning surveillance infrastructure and by using submitted samples to address multiple partners objectives.



WHITE NOSE SYNDROME [WNS]

WNS is one of the most significant health issues ever faced by the wildlife community. WNS surveillance is entirely reliant on the CWHC core surveillance program with no additional or targeted funding (the exception being early funding from the Ontario Provincial government). The cost to the CWHC for a full health assessment and WNS testing is approximately \$350 per bat. In the 2018 calendar year the CWHC examined 235 bats at an overall cost of over \$82,000. CWHC data management, program leadership, and communications teams support the WNS effort, also at no extra cost of partners. Additional efficiencies are achieved as each bat is not only examined for WNS, but receives an overall assessment, with the majority also being tested for rabies and other diseases. Working in partnership with provincial governments and regional researchers, the CWHC was the first to discover WNS in NL, NS, NB, PE, QC, ON and MB and remains the only group of individuals with the capacity and expertise to conduct this surveillance in Canada.



HEALTH INTELLIGENCE

FROM SURVEILLANCE TO INTELLIGENCE

Health intelligence is one of four pillars of the Pan-Canadian Approach to Wildlife Health. It is used to capture and mobilize knowledge to support decision-making to improve the health of the population. It is the guiding philosophy of the CWHC.

The historic approach to wildlife health has often been reactive and followed a 'disease-by-disease' sequence. Consequently, problems were rarely addressed in their early stages and response options were few. Health intelligence uses qualitative and quantitative data from multiple sources to build a picture of population health. By generating, collecting, and analyzing a variety of information, health intelligence can foster collaboration, partnerships and consultation. CWHC health intelligence relies on diagnostic and investigative capacity to track wildlife disease trends and assess their significance along with information on the determinants of wildlife health. The resulting assessments are mobilized through our growing capacity to interpret and communicate intelligence outputs.

This section highlights some of our health intelligence innovations that help describe the state of wildlife health in Canada.

ROLLING OUT THE WILDLIFE HEALTH INTELLIGENCE PLATFORM

Our new WHIP – Wildlife Health Intelligence Platform - was rolled out and tested in 2018-19. The deployment of the WHIP will allow for more regular quality assurance assessments, ease the entry of information into the central database, improve the consistency and variety of information entered, and be adaptive to emerging issues while tending to our routine scanning surveillance needs.

The core concept of the WHIP is the need to have a health information management system that can be tailored to the special needs of regional centres, specific diseases and an increasing number of international users. The WHIP is designed to accommodate a wider suite of information in one location, including diagnostic data, citizen science, population data and research results. In addition to the WHIP being used by the CWHC, the Dutch Wildlife Health Centre, US Northeast Wildlife Disease Cooperative, and the Asian programs of the Wildlife Conservation Society are adopting the WHIP.



WHIP-ENABLED PROJECTS

SPATIAL ANALYSIS OF WHITE NOSE SYNDROME

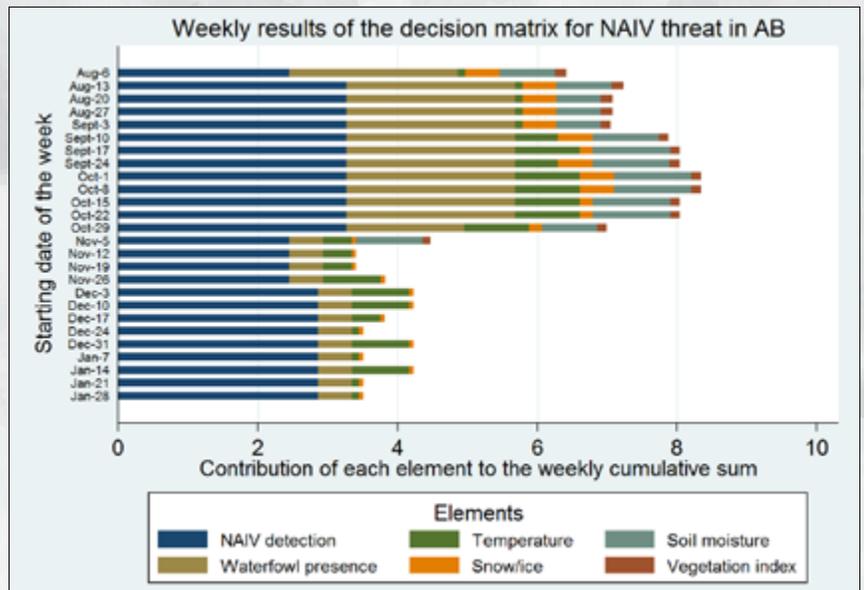
Incorporating wildlife data into spatial analysis can be a challenging task. WHIP spatial analysis development benefits from a collaboration between our national office and Wilfrid Laurier University. Spatial analysis involves measuring the relationships between the locations of events and modelling their relationships to underlying factors that explain their distribution. MSc student Lauren Yee used white-nose syndrome (WNS) in Ontario to explore challenges and opportunities for spatial analysis using CWHC historical data. She adapted species distribution models to reduce spatial bias when examining factors related to white-nose syndrome in bats observed in Ontario. Lauren's models showed how access to areas based on proximity to roads created biases in wildlife health data. Her insights will help in future analyses of patterns uncovered in the WHIP as well as inform WNS surveillance. (see: <https://scholars.wlu.ca/etd/2040/>)

AVIAN INFLUENZA [AI] INTELLIGENCE PILOT PROJECT

We undertook a pilot study to see if an AI intelligence program could generate proactive information that could influence biosecurity decisions and actions. Small sample sizes, biased geographic representation of wild bird samples, delays in testing, and incomplete information about the host populations and environmental drivers of risk limit our ability to fully characterize shifting AI threats. Logistical and financial constraints limit the design and implementation of wild bird surveillance systems capable of repeatedly and reliably documenting the emergence or occurrence of AI strains. Too often, information on virus types, in the absence of nearby evidence of virus spill-over from wildlife, is insufficient to motivate the necessary biosecurity actions by poultry farmers or farm employees.

The purpose of our AI intelligence program was not to predict the next wild bird AI incursion, but rather to provide timely, contextual information about changing wild bird AI threat levels. We first met with stakeholders to understand what types of information farmers and other decision makers valued. We then developed cost effective ways to routinely access and integrate those data. In collaboration with CWHC associate Dr. Colin Robertson and collaborator Dr. Michele Anholt, automated "web-crawlers" were developed to search key internet sites and scan social media to find clues suggesting changing risks. Information on wild bird movement, water on the land, and waterfowl habitat was combined with CWHC surveillance findings and other on-line signals of virus presence into a visual summary shared with decision makers. maybe use a screen shot for a graphic

The pilot project proved to be a technical success. Project participants felt this AI intelligence system provided new insights and could support AI threat communication in their organizations. But it was clear that ongoing operations required regular and sustained human intelligence inputs to help turn the data into actionable information.



WHIP-ENABLED PROJECTS

CITIZEN SCIENCE

It is impossible for any single program to have its fingers on the pulse of all wildlife in the second largest country in the world with the longest coastline and 3 oceans. Like many environmental programs, the CWHC is examining ways to use the eyes and ears of people on the land and on the water to report signals of changing wildlife health.

CASE STUDY FROM SCANNING SURVEILLANCE TO ACTION AND PREVENTION: TRICHOMONOSIS IN SONGBIRDS

Since the detection of this disease in 2007 in finches and other songbird species that frequent backyard birdfeeders, CWHC scientists and associates have been working to understand the parasite's transmission and role of bird feeders. Public communication and education played a key role in documenting this diseases and inspiring citizen action. CWHC Atlantic, CWHC Quebec and the CWHC National Office provided maps and disseminated science-based recommendations for healthy bird feeder practices to prevent further spread of trichomonosis and other diseases (see <http://www.cwhc-rsf.ca/trichomonosis.php>). Public awareness campaigns resulted substantial numbers of citizen observations as well as encouraged citizen action to prevent the spread of the disease by taking down bird feeders in summer months.



FOCUSSING ON HEALTH

Health is a ubiquitous management goal but is rarely defined in management documents. Without a definition, wildlife health remains an amorphous concept making planning, management, and measurement of health goals very challenging. The following vignettes describe how the CWHC is innovating by expanding its interests and influence towards a comprehensive health program that not only asks the question, “why are some populations sicker than others”, but also asks, “why are some populations healthier than others?”

WHAT IS WILDLIFE HEALTH?

CWHC graduate student Dr. Diana Sinclair completed a scoping literature review and found most wildlife health publications looked at health either as the ‘absence of disease’ or failed to clearly define what health was. Fewer than 10% of papers looked at health as a multifactorial entity. Her ongoing research is exploring opportunities to develop a shared vision of wildlife health for Ontario that resonates with regulators, veterinarians, biologists and researchers.

CWHC graduate student Julie Wittrock explored the question of how to operationalize the growing calls to view wildlife health as a cumulative effect that creates capacity for wildlife to cope with all the challenges they confront in a rapidly changing world. Her research used literature and expert opinion to build an evidence-based conceptual model of wildlife health involving multiple interacting factors that extend beyond the disease and pathogen focus. She found 7 themes associated with fish and wildlife health; (i) the biological endowment of the individual and population; (ii) the animal’s social environment; (iii) the quality and abundance of the needs for daily living; (iv) their abiotic environment; (v) sources of direct mortality; and (vi) changing human expectations. This health model is helping guide our development of a proactive health intelligence approach.

HARM REDUCTION

Too often, contentious wildlife health issues get stuck in scientific uncertainty and social conflict, which together lead to inaction. CWHC’s Dr. Craig Stephen is focussing significant effort towards adapting and applying the concept of harm reduction from public health to environmental and wildlife health issues. His conception of harm reduction as options to minimize harms through non-judgemental strategies that enhance skills and knowledge to live safer, more sustainable, healthier lives, is helping guide new policies, programmes and practices in Canada and internationally.



HARM REDUCTION CONT.

Harm reduction and wildlife welfare

The harm reduction concept was applied to a case study of population welfare of the threatened Cowichan lamprey. Wildlife population welfare was defined as coherence between the species' adapted capacities and the realities of its current environment. Due to prevailing uncertainties and the inability to remove critical threats to this species, actions to protect its welfare instead needed to focus on securing critical environmental and social assets that also bolstered social needs and the needs of other species in the shared environment. This assets focus was well suited to developing consensus for harm reduction action

Harm reduction and urban wildlife

Harm-reduction based health intelligence was also explored as the next step in the evolution of urban wildlife surveillance. Three strategies were identified to foster this evolution; (1) expand from only tracking a single species or a single threat to also tracking factors that increase the vulnerability of the pests and people in a shared urban setting; (2) be integrative and recognize that multiple concurrent harms are affecting people, pests and other species in their shared environments; and (3) develop new collaborative approaches to prevent or mitigate persistent harms from persistent pests without eliminating the pests. Harm reduction-based intelligence could better equip city planners and pest managers to identify opportunities to act in advance of significant and concurrent harms to people, infrastructure, and wildlife.

Harm reduction in policy

CWHC harm reduction concepts influenced new policy approaches to managing open net pen salmon farms in British Columbia through recommendations to the government by a multisectoral advisory council. The Council's report can be found [here](#).

CASE STUDY THE EVOLUTION OF OUR WHITE-NOSE SYNDROME PROGRAM

White-nose syndrome (WNS) is seriously impacting hibernating bat populations from Manitoba to Newfoundland and Labrador. The CWHC is tracking this emerging disease, identifying vulnerable populations, harmonizing response with a national program, assessing health data and communicating evidence-based advice to management decision-makers.

Our response to WNS has grown from the initial focus on disease detection to the recovery of the affected endangered bat populations. To this end, our National Office and Atlantic Regional Centre are using funds from Environment and Climate Change Canada's Habitat Stewardship Program for a project titled; "Bats roosting in anthropogenic structures: Building a better understanding in Prince Edward Island and Newfoundland and Labrador through stewardship and outreach". Two endangered bat species, the little brown myotis and Northern myotis, use human occupied buildings to roost during the spring, summer and early fall. These are primarily maternity roosts for the little brown myotis, and to a lesser extent the Northern myotis, that are important areas where these species can raise their young. The project's goals were to protect and conserve the bats' roosts by addressing people's responses upon finding bats in their buildings.

Public outreach and engagement was achieved through our bat hotline reporting system, supporting and training the Nuisance Wildlife Control Operators (NWCOS) to ensure the profession is fully aware of its stewardship role in protecting endangered bat species, and developing Best Management Practices (BMPs) on the removal of bats from buildings in a manner that will protect the health of bats and those people residing within the buildings. Calls to the hotline helped to discover new hibernacula, generate signals that sparked local investigations for possible new of occurrences of WNS, inspired media attention and increase submissions of sample for WNS testing.

The project was done in close consultation and collaboration with the officials responsible for wildlife, human health and animal health. Outreach to the NWCOS profession, indigenous communities and the general public resulted in better understanding and support of bats roosting in buildings. It encouraged management activities that balance human health considerations with a high degree of protection of important concentration areas for endangered bat species. The bilingual BMPs for managing bats in buildings were provided to resource managers, NWCOS and the general public and are available on the WNS resources page of the [CWHC website](#).



HEALTH ASSESSMENT PROJECTS

HEALTH OF MUSKOXEN IN NUNAVIK, QUÉBEC

Muskox is an iconic species for the Arctic ecosystem and for the Inuit culture. Several populations of muskoxen are declining in Canada. The Nunavik muskoxen population in Northern Québec resulted from the introduction of approximately fifty animals from Ellesmere Island. The impact of this introduction on the Nunavik ecosystem is the subject of a study undertaken by Caribou Ungava and by the Ministère des Forêts, de la Faune et des Parcs. As part of this study, muskoxen were equipped with satellite collars to track their movements. The CWHC-Québec team conducted a health assessment of the captured animals. The very high pregnancy rate (94%) and the presence of several calves in the groups were indicators of good reproductive successes. Testing did not detect evidence of exposure to *Brucella sp.* or *Coxiella burnetii*, two pathogens reported in other muskoxen populations. On the other hand, blood tests suggested that 41% of the examined animals had been exposed to *Erysipelothrix rhusiopathiae*, a bacterium that has recently been implicated in mortality of muskoxen in Nunavut. Antibodies against *Besnoitia sp.*, a protozoan affecting the skin, and eggs of the great liver fluke (*Fascioloides magna*) were present in about half of the animals. Muskoxen are most likely “spill over hosts” for these two parasites, which are very common among caribou sharing this ecosystem. The health assessment suggested that the introduction of muskoxen has not created a health risk for Nunavik migratory caribou populations.



WILDLIFE HEALTH ASSESSMENT: SEAL HEALTH PROJECTS (2017-PRESENT)

Seals are sources of food and income as well as sentinels for environmental pathogens and toxins. Dr. Pierre-Yves Daoust at the CWHC Atlantic Regional centre is leading a collaborative assessment of seal health working with local communities and hunters in Nunavut and with a large group of collaborators.

The goals of the project are to: 1) collect baseline information on health of ringed seals in Baffin Island region; 2) better understand concerns of northern communities related to animal health and its potential impact on public health; and, 3) increase capacity of northern communities to directly participate in investigations of health issues that may affect their wildlife resources or public health now and in the future. The project involves working with hunters in Pond Inlet and Iqaluit to collect samples from ringed seals to test for pathogens or contaminants that have significance to both animal and human health. One component of the project (led by CWHC MSc Student, Enooyaq Sudlovenick) incorporates Inuit Knowledge (Inuit Qaujimagatuqangit) on ringed seal health, seal hunting and consumption practice, and changes in seal abundance. The project includes a survey of select heavy metals and pathogens, including arsenic, cadmium, lead and mercury, serology for *Brucella*, *Leptospira*, *Erysipelothrix*, *Toxoplasma*, fecal cultures for *Salmonella*, *Listeria*, pathotypes of *E. coli* and presence of *Trichinella* in muscle.

CWHC AS A NATIONAL ASSET

The CWHC is developing sustainable skills, organizational structures, resources and commitments to protect and improve wildlife health. We do this by fostering a community of practice to identify the conditions needed to achieve health improvement and to ensure that this can be multiplied and sustained over time. Built from the foundation of our regional centres, the national office of the CWHC works to 'tell the story' of wildlife health from a national perspective, champion efforts to turn our collective wisdom into change and continually improve the quality and breadth of collective knowledge we produce and share.

ONTARIO 2018 ENVIRONMENTAL PROTECTION REPORT – ENVIRONMENTAL COMMISSIONER OF ONTARIO

Ontario is benefitting greatly from its partnership with the CWHC at a very small cost. Without the CWHC, the Ontario government would have to find a way to replace the expertise and services it provides, undoubtedly at a much higher price. However, there are no formal commitments to sustained funding of the CWHC, which precludes effective strategic planning and makes the program vulnerable. Without the essential work that the CWHC does, Ontario's wildlife would be at a much greater risk from disease. **The ECO recommends that the provincial government provide a formal commitment to sustained funding to the Canadian Wildlife Health Cooperative.** When it comes to the shared health of Ontarians and our wildlife, it is critical that we are not penny wise and pound foolish.

THE HONOURABLE EUGENE F. WHELAN GREEN HAT AWARD

In September of 2018, retired CWHC Atlantic Regional Director, Dr. Pierre-Yves Daoust was honoured at the University of Prince Edward Island Founders Day with The Honourable Eugene F. Whelan Green Hat Award. The award recognizes those who have made an extraordinary contribution to the Atlantic Veterinary College and we're thrilled that Pierre-Yves has been recognized in this way. his contribution to the establishment of the CWHC, it was only fitting that he be named the first regional director of the organization's Atlantic region node, serving in that role until his retirement in 2017. His leadership as director of the CWHC Atlantic node has positioned the Atlantic Veterinary College as the major centre of wildlife health expertise in the region.



THE PAN-CANADIAN APPROACH TO WILDLIFE HEALTH

The Pan-Canadian Approach to Wildlife Health provides us an opportunity to modernize wildlife health programs so they are better situated to address grand challenges to biodiversity and society. It is a new opportunity to: (i) harmonize wildlife health capacity across Canada; (ii) more efficiently use shared platforms, infrastructure and expertise; and (iii) bolster ability to detect emerging threats while promoting partnerships to anticipate problems and sustain healthy populations in advance of harm. It presents a vision of health as a resource to protect the socioeconomic, cultural, and ecological value of wildlife.

In the Spring of 2018, all federal, provincial and territorial Ministers responsible for biodiversity and conservation approved the Approach. The Canadian Wildlife Health Cooperative has championed this modernization of wildlife health over the past 4 years, working closely with government and non-governmental partners to advocate for a new way to effectively respond to up-and-coming threats to conservation, public health, and economies from climate change, emerging diseases, globalization, and changes to organizational capacities.

The Approach addresses four challenges. First is the challenge of crossing disciplinary and administrative boundaries. Wildlife health issues cross many fields and jurisdictions. In the absence of a single champion, wildlife health can become lost. The second challenge arises from the rapidly changing social and environmental conditions that are creating new wildlife health threats to conservation, public health and economic opportunities. Thirdly, we are challenged in providing assurances throughout the second largest country in the world that human activities are not negatively affecting wildlife health, or that wildlife health is not a risk to us. The fourth challenge is our increasing reliance on ad hoc programs without sustainable or predictable resource.

The CWHC activities align with the 4 pillars of the Approach. The first is health intelligence. The second is wildlife health stewardship to develop and support coordination and management of expertise and capacity across Canada, providing independent advice, and helping achieve policy goals. Innovation is the third pillar. It involves research and knowledge transfer that lead to new public policy and practices to forecast ways to prevent adverse wildlife health outcomes and sustain confidence and access to the services wildlife provide to Canadians. The fourth pillar promotes openness, transparency and integrity through integrated governance to facilitate effective collaboration and promote performance orientation in program delivery. A national advisory group and implementation committee began working in early 2019 on the business case to secure the necessary investment to realize the goals of the Pan-Canadian Approach.



GOVERNANCE AND PERFORMANCE OF A NATIONAL PROGRAM

The Pan-Canadian Approach to Wildlife Health provides the opportunity to reflect on what Canada needs from a national wildlife health program. The CWHC along with international partners started to answer this question in a paper published by the World Organization for Animal Health. The paper describes five key attributes of national programmes: (1) being knowledge and science based; (2) fostering cross-nation equivalence and harmonisation; (3) developing partnerships and national coordination; (4) providing leadership and administration of national efforts and (5) capacity development. Proposed core purposes include: (1) documenting and communicating the national wildlife health status; (2) leading national planning; (3) centralising information and expertise; (4) developing national networks leading to harmonisation and collaborations; (5) developing wildlife health workforces and (6) centralising administration and management of national programmes. These features are reflected in the pillars and goals of the Pan-Canadian Approach.

The accuracy, efficiency and comparability of surveillance depends upon the adoption of consistent standards. There are unique challenges in establishing a standard for surveillance in wildlife; unrepresentative access to the populations at risk, biased case ascertainment, the lack of properly validated diagnostic tests, inaccurate or missing denominator data, lack of standard case definitions and diagnostic protocols, regulatory restrictions, ecological complexities, and fiscal constraints are but some of the factors that prevent the direct application of standards from domestic animals or public health to wildlife surveillance. These constraints necessitate convenience and opportunistic sampling, making it difficult to apply surveillance performance standards from public health or domestic animal health. Performance expectations are needed to show public return on investment when assessing the adequacy of surveillance efforts. In the absence of finding guiding literature or legislation, we proposed, in an upcoming paper in the Canadian Veterinary Journal, a suite of factors the CWHC is starting to use to establish criteria and variables we are using to assess our surveillance system's performance. These factors underpin the information presented above on the state of our surveillance system.

CASE STUDY REVISITING CHRONIC WASTING DISEASE (CWD)

New research suggesting non-human primate susceptibility to CWD combined with the outbreak of the disease in farmed red deer in Quebec and the northward progression of CWD into boreal caribou ranges have re-invigorated discussion about the need for a new approach to manage this expanding epidemic. New insights into environmental exposure risks continue to be uncovered to reveal ever increasing niches for the CWD to persist and be spread in the environment. The finding of CWD in Norwegian reindeer resulted in new concerns about risks to caribou, which are critical for northern food security and are species at risk. Health Canada and some provincial organizations have recommended hunters test cervids for CWD before consumption. The burden of testing has fallen to organizations, including the CWHC, with a primary mandate for wildlife disease surveillance and not food safety. Insufficient capacity and inherent delays in the testing process can create challenges in meeting the expectations of public health organizations and hunters. These changes are driver calls for a re-evaluation of Canada's approach to CWD management.

The CWHC is working with partners to build the case to invest in new approaches and capacities to better meet public expectations and to promote early action to prevent spill-over of this disease into caribou. A threat assessment using the CWHC Wildlife Health Situation and Response Analysis tool was undertaken to support recommendations for federal investment in caribou protection. The CWHC also contributed to working groups aimed at bringing together key thinkers in this field to re-consider options for action that can contain this epidemic. Our Western and Northern Regional centre continues to undertake research and support provincial partners deliver their cervid CWD screening program.



PARTNERS

The CWHC is to be able to provide an unparalleled program with impacts from the local to international level because of our partners and funders. Special thanks go to the institutions hosting our national and regional centres. The expertise, infrastructure, support, and goodwill they provide is essential for our continued success and impacts. The diversity and consistency of our financial partners speaks highly to the value seen in the CWHC. Their ongoing support is greatly appreciated. Our growing suite of associates and affiliates and other collaborators found throughout Canada is helping us expand our access to the wisdom needed to fulfill our growing mandate. No report could be complete without thanking the staff and regional directors of the CWHC without whom none of this could happen.

PARTNER



HOST INSTITUTION



STAFF AND ASSOCIATES

CWHC NATIONAL OFFICE

Craig Stephen - Chief Executive Officer
Patrick Zimmer - Chief Operating Officer
Kevin Brown - Information Services Manager
Bevan Federko - Programmer/Analyst
Marnie Zimmer - Knowledge Mobilization Officer
Nadine Kozakevich - WCVF Finance Manager
Jordi Segers - National White-Nose Syndrome Coordinator

CWHC BRITISH COLUMBIA

Chelsea Himsworth - Regional Director
Helen Schwantje - Regional Director
Kaylee Byers - Assistant Regional Director
Stephen Raverty - Veterinary Pathologist
Victoria Bowes - Veterinary Pathologist
Ann Britton - Veterinary Pathologist
Glenna McGregor - Veterinary Pathologist

CWHC ALBERTA

Susan Kutz - Regional Director
Jamie Rothenburger - Veterinary Pathologist/Acting Regional Director

CWHC WESTERN/NORTHERN

Trent Bollinger - Regional Director
Lorraine Bryan - Veterinary Pathologist
Marnie Zimmer - Wildlife Biologist
Colin Letain - Wildlife Technician
Bridget Enright - Wildlife Technician

CWHC ONTARIO/NUNAVUT

Claire Jardine - Regional Director
Brian Stevens - Veterinary Pathologist
Lenny Shirose - Biologist
Dan Hughes - Communications and Project Coordinator
Laura Dougherty - Wildlife Technician

CWHC QUÉBEC

Stéphane Lair - Regional Director
Kathleen Brown - Lab Manager
Judith Viau - Wildlife Technician
Viviane Casaubon - Wildlife Technician
Pauline Delnatte - Veterinary Pathologist/Clinician
Rozenn Le Net - Veterinary Resident
Émilie L. Couture - Veterinary Resident

CWHC ATLANTIC

Megan Jones - Regional Director
Laura Bourque - Veterinary Pathologist
Scott McBurney - Veterinary Pathologist
Darlene Weeks - Wildlife Technician
Fiep de Bie - Wildlife Technician
Tessa McBurney - Wildlife Technician

ASSOCIATES

Colin Robertson (Wilfred Laurier University)
Todd Shury (Parks Canada)
Brett Elkin (Government of Northwest Territories)
Gordon Stenhouse (Foothills Research Institute)

ASSOCIATES

Owen Slater (University of Calgary Faculty of Veterinary Medicine)
Susan Cork (University of Calgary Faculty of Veterinary Medicine)
Judit Smits (University of Calgary Faculty of Veterinary Medicine)
Nigel Caulkett (University of Calgary Faculty of Veterinary Medicine)

ASSOCIATES/AFFILIATES

Heather Fenton (Associate)
Emily Jenkins (Affiliate)

ASSOCIATES

Jane Parmley (Department of Population Medicine, OVC)
Dale Smith (Associate Director - retired)
Ian Barker (Regional Director - retired)

ASSOCIATES/AFFILIATES

Rozen Le Net (student U of M)
Benjamin Lamglait (student U of M)
Karine Béland (student U of M)
Marion Jalenques (student U of M)
Émilie L. Couture (Zoo de Granby)

ASSOCIATES

Pierre-Yves Daoust (Atlantic Veterinary College)
Spencer Greenwood (Atlantic Veterinary College)
David Overy (Nautilus Bioscience Canada – Atlantic Veterinary College)
María Forzán (Atlantic Veterinary College)
Gary Conboy (Atlantic Veterinary College)
Raphaël Vanderstichel (Atlantic Veterinary College)
Ted Leighton (Western College of Veterinary Medicine)
Dave McRuer (Parks Canada)

NATHALIE PARENTEAU - VISUAL ARTIST

A huge thanks to Nathalie Parenteau for the use of her fantastic artwork throughout this report.

When asked how her images take form, Northern artist Nathalie Parenteau promptly replies: "They take shape on their own. I just scratch the canvas with the paint brush and there they are". Or so it seems.

Born in Montréal, Québec, Nathalie has retained the dramatic artistic tradition of the French Canadian culture. Emerging from a family background which cherished the arts, she found her artistic path at an early age. A love of nature and solitude also provided the fertile breeding ground for a rich and varied painting career. She arrived to this station after several detours which include volunteering with a youth group for a year after high school; living in the Yukon wilderness in tepees, wall tents, cabins and drafty trailers; earning a bachelor of sciences in biology at the University of Western Ontario; and traveling the globe. She now lives in Whitehorse, Yukon, where she works as a professional artist and shares her life with fiancé Peter, and Cozette, their intriguing terrier.

Although her painting subjects seem to have the eerie property of having their own will, Nathalie admits to spending significant amounts of time with each painting to reach a subtle balance in both composition and tones. Her keen sense for melodrama has found the perfect outlet in this work. After viewing a painting, people often remark to feeling destabilized, of being pulled out of the known world and being put face to face with a new reality. Her work reach both genders at a deep and unconscious level and can be best describe as universal in its appeal.

Nathalie's style is easily recognizable and is collected by people from all over the world. She works both in acrylics and oils and is known for her sensitive representation of the subject in its environment. Her work is sold extensively across Canada and the United States.

Please visit www.nathalieparenteau.com to see more of Nathalie's artwork and order prints or original paintings.

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CONTACT US

Toll-free: 1.800.567.2033
Fax: 1.306.966.7387
Email: info@cwhc-rccsf.ca

www.cwhc-rccsf.ca

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healthywildlife.ca

