

Canadian Cooperative Wildlife Health Centre

ANNUAL REPORT 2009-2010



A Message from the Chair	3
About the CCWHC	4
Disease Surveillance	5
Information Services	7
Education	10
Response and Management	13
Financial Highlights	16
Staff and Associates	19
Board of Directors	20

Canadian Cooperative Wildlife Health Centre



Message from the Chair, Board of Directors

July 2010



It is with great pleasure that I present to you this Annual Report from the Canadian Cooperative Wildlife Health Centre (CCWHC) for the fiscal year of 2009-10. As the newly-appointed Dean of the Western College of Veterinary Medicine and new Chair of the CCWHC Board of Directors, I am delighted to become a participant in the CCWHC. I look forward to working with all of the CCWHC partners to ensure that the CCWHC continues to play its unique and essential role in managing health and disease issues in Canada. As I review the evolution and accomplishments of the CCWHC, I am impressed with its capacity to provide both regional and Canada-wide disease surveillance, education and research programs, and with the close collaboration among all levels of government, all five of Canada's veterinary colleges and a number of key non-government organizations that the CCWHC represents. Its role as a Collaborating Centre of the World Organization for Animal Health (OIE) brings an added connection to global issues of health and disease, and provides Canada with an important venue to making a difference on the world stage.

One sign of the strength of the CCWHC partnership is recent work by the Board of Directors to position the CCWHC for continued presence and operation in the decades ahead. A combination of internal discussion and external consultation has begun this process, and I now look forward to participating fully in the planning and implementation to come. Canada will need an active and strong CCWHC twenty years from now when the integration of disease management across animal, human and environmental health sectors will be ever more critical to society.

This Annual Report gives an account of the full range of CCWHC activities across the country, and highlights the role of university students as participants in the CCWHC program. These students will be the next generation of Canada's wildlife health experts, and the CCWHC's programs with its partner agencies form their training environment. This report also highlights the key role of wildlife disease surveillance and the early detection of disease concerns. Avian influenza still threatens society, no less now than in 2005. White nose syndrome in bats was detected in Canada just this spring. This disease has the potential to do great harm to the ecological balance among these small animals, the vast number of insects they would normally eat, and the cost of growing important agricultural crops. Where wild animal diseases are concerned, Canada definitely needs the vigilance, planning, prevention and response capacity that the CCWHC offers. I look forward to being part of this process, and to helping CCWHC meet Canada's needs.

Douglas Freeman
Dean
Western College of Veterinary Medicine



About the CCWHC

The Canadian Cooperative Wildlife Health Centre (CCWHC) is a university-based, inter-agency partnership through which Canada's Colleges of Veterinary Medicine, government agencies at all levels and non-government agencies pool their resources and expertise to reduce the economic and ecological costs and impacts of wild animal diseases in Canada.



What We Do

The CCWHC has four separate business lines, each carried out on regional and national scales. The first three business lines, Disease Surveillance, Information Services and Education are supported by annual contributions from CCWHC partner agencies and the universities, and constitute the CCWHC's core program. The fourth business line—Wildlife Disease Response and Management—is supported by separate funding arrangements for each component project and program.

Locations

The CCWHC has five university locations, each serving a large region of Canada. These include the Atlantic Regional Centre at the University of Prince Edward Island, the Quebec Regional Centre at the University of Montreal, and the Ontario and Nunavut Regional Centre at the University of Guelph. The four western provinces, the Yukon and the Northwest Territories are served collaboratively by CCWHC Centres at the Centre for Coastal Health at Nanaimo, BC, at the University of Calgary and at the University of Saskatchewan, which also hosts the CCWHC Headquarters Office.

Partners

The CCWHC partnership was established in 1992 with leadership from Environment Canada and the Canadian Wildlife Directors, and with additional financial assistance from the Max Bell Foundation.

In 2009-2010, the CCWHC partnership included four Government of Canada agencies: Environment Canada, the Public Health Agency of Canada, Parks Canada Agency, and the Canadian Food Inspection Agency. The partnership also included all provincial and territorial governments, representing Ministries of Fish & Wildlife, Environment, Agriculture and Health. Additional partners were: the University of Saskatchewan, the University of Guelph, the University of Montreal, the University of Prince Edward Island, the University of Calgary, and the Centre for Coastal Health, Ducks Unlimited Canada, the Canadian Wildlife Federation and Syngenta Crop Protection.

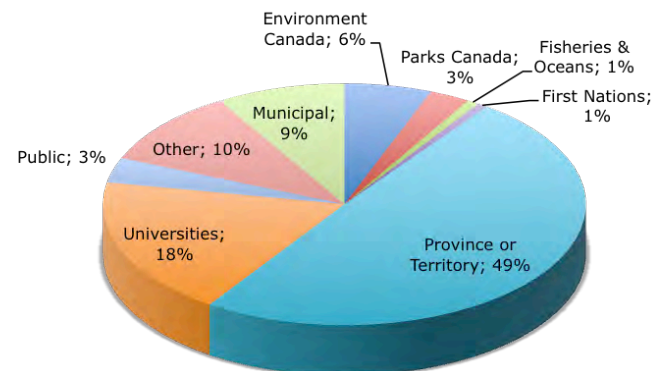
Disease Surveillance

Disease surveillance integrates four separate activities into a cohesive program: 1) Detection of diseases, 2) Identification of diseases (diagnosis), 3) Disease information management and 4) Communication. Disease detection is achieved through engagement and support of wildlife field personnel across the country. Disease identification is achieved through medical examination of specimens in fully-equipped veterinary diagnostic laboratories, primarily by CCWHC professional staff at the veterinary colleges but also elsewhere through collaboration with government laboratories. Disease information management is done through the CCWHC Information Technology Centre, which includes a national database for all surveillance data. Communication is achieved through a range of instruments: regular reports to the CCWHC Board of Directors and the Canadian Wildlife Directors Committee, web site, newsletter and special program reports.

Submissions to the core diagnostic program again increased in 2009-2010, with approximately 3,600 specimens examined, representing approximately 2300 distinct incidents, an increase of 3% from the previous year. The majority of submissions were derived from municipal, provincial and territorial governments, together representing 49% of submissions. Bird species comprised 63% of specimens, with mammalian species representing 31%; the remaining 5% of submissions were made up of amphibians, reptiles and fish. Submissions were quite evenly distributed across CCWHC diagnostic centres, with 32% of total specimens examined at the at the Quebec regional centre, 29% at the Ontario/Nunavut regional centre, 21% at the Western & Northern centre, and 18% at Atlantic regional centre.

Disease Surveillance

Sources of Animals Examined





Review of the Hook Lake Wood Bison Recovery Project

In 2008-09, Dr. Chelsea Himsforth undertook an epidemiological review of the Hook Lake Project as a collaboration between the CCWHC and the Government of the Northwest Territories. Detailed herd records were used to assess how BTb might have entered the captive herd, after a 2.5 year-old captive born animal was discovered to be infected with BTb in 2005, the first case in the history of the project. The review also consisted of an analysis of the performance of the various diagnostic tests for BTb that were used during the Project. The origin of BTb infection in the Project herd could be traced convincingly to one founder animal introduced to the herd as a new-born calf. It is most likely that this infection occurred at the time of birth but that it remained latent and undetected for years despite frequent testing. It was clear from analysis of all test results that none of the tests for BTb could reliably certify a bison not to be infected with BTb. This analysis is consistent with other assessments of tests for BTb in wild animal species. While it is possible to identify infected herds with such tests, it is not possible to determine the infection status of individual animals.

Summer 2009 Atlantic salmon (*Salmo salar*) mortality in the Saint-Jean River, Gaspésie, Québec

Some of the best known Atlantic salmon rivers in the world are found on the Gaspé Peninsula in the Province of Québec. Beginning around June 24th, many salmon that had entered the Saint-Jean River were observed with ulcers on the skin of the head and fins, many of which were covered with fungal growth. As the season progressed, more than 100 dead salmon were found along this river, which represented approximately about 20% of the entire population that entered the river in 2009. This level of mortality caused serious concern, particularly in this species which has been in severe decline, and an investigation was launched. It was discovered that the three main channels of the river were completely obstructed by log jams. Salmon passing up the river were required to pass through a complex labyrinth of logs to reach their spawning group upstream. It was concluded that passage through the spaces among the logs resulted in skin abrasions which subsequently became infected with fungus. Future monitoring of salmon rivers in the province should help identify any trends in the occurrence of this syndrome.



Highlights Disease Surveillance

Information Services

CCWHC responded to a wide range of requests for information and advice from partner agencies in 2009-2010. These included participation in regional, national and international meetings, participation on committees, and reports on specific issues. The CCWHC also provided information to the public by responding directly to inquiries, publishing a semi-annual Newsletter, providing media interviews, and maintaining an informational website: www.ccwhc.ca

Regional Examples

Maritime Marine Animal Assistance Network
 Expert witness for the Crown – Wildlife Related Litigation
 Parks Canada Eastern Animal Care Task Force
 Nova Scotia Mainland Moose Recovery Team
 West Nile Surveillance Regional Committees
 Provincial Rabies Advisory Committees
 Regional/Provincial Chronic Wasting Disease Surveillance and Research Planning Committees
 Provincial/Territorial Avian Influenza Advisory Committees
 Northwest Territories Wildlife Care Committee
 Saskatchewan Epidemiology Association
 Prairie Diagnostic Services: member - Board of Directors
 Provincial committee for the surveillance of Hemorrhagic Septicemia Virus
 Ontario Animal Health Committee
 Needs Assessment: White Nose Syndrome Surveillance in Western Canada

National Examples

Vector-borne Diseases Sub-issue Group (PHAC)
 National Steering Committee on West Nile Virus (PHAC)
 Arctic and Northern Non-enteric Zoonotic Diseases Sub-issue Group (PHAC)
 West Nile Virus and other Vector-borne Diseases Issue Group (PHAC)
 Canadian Rabies Committee Sub-issue Group (PHAC)
 Canadian Zoonotic Influenza Sub-issue Group (PHAC)
 Public Health & Climate Change Expert Advisory Committee (PHAC)
 Aquaculture Association of Canada
 Canadian Animal Health Laboratories Network
 Canadian Animal Health Surveillance Network
 Canada's Inter-agency Wild Bird Influenza Survey
 Animal capture drug advice, acquisition and distribution to wildlife agency personnel

Animal Determinants of Emerging Disease (ADED): National Zoonoses Rounds
 National Aquatic Animal Health Program Steering Committee
 Canadian Wildlife Federation Issues Forum
 Fur Institute of Canada (representative of the Canadian Association of Zoo and Wildlife Veterinarians on the Board of Directors)
 Fore-CAN: Foresight for Canadian Animal Health Systems Mapping Workshop (CFIA)

International Examples

OIE Collaborating Centre on Wildlife Disease Surveillance and Monitoring, Epidemiology and Management
 OIE Working Group on Wildlife Diseases
 OIE ad hoc Group on Wildlife Disease Notification
 Canada-USA-Mexico Tri-lateral Committee on Surveillance for Avian Influenza in Wild Birds
 Wildlife Disease Informatics Working Group
 Participatory Epidemiology Network for Animal and Public Health
 US Fish & Wildlife Service Federal-State White Nose Syndrome Consultation
 North American Rabies Management Plan
 Sri Lanka: Developing Wildlife Disease Monitoring Capacity
 Panama: Smithsonian Bioserves as Listening Posts for EID's
 Scientific Advisory Board: Centre for Rapid Influenza Surveillance and Research (NIAID - USA)
 Wildlife Disease Association Student Forum
 Tajikistan: Ecology Monitoring of Murine Rodents for Parasitic and Infectious Diseases
 Caribou Health Monitoring Video

Information Technology Centre

THE CCWHC Information Technology (IT) Centre provides on-going support and service to the entire CCWHC, primarily in the areas of database and application development. 2009 saw a continued shift in focus from an older system to a new more flexible database. This database is being used by all CCWHC sites as well as by some partner agencies and individual researchers. CCWHC holds over 200,000 records of wildlife disease occurrences in its database systems. The Centre also provides on-going support, training and advisory services to the CCWHC at large and is engaged in several national and international initiatives to promote the sharing and use of wildlife disease data, including collaborations with researchers across Canada, the United States, Central and South America and Europe.

Information Services (Continued)

Publications and Reports

Publications:

Piché, C., L. Measures, C. Bédard, **S. Lair**, Bronchoalveolar lavage and pulmonary histopathology in harp seals (*Phoca groenlandica*) experimentally infected with *Otstrongylus circumlitus*. *Journal of Wildlife Diseases*. In press, 2009.

Desmarchelier, M., A. Santamaria-Bouvier, **G. Fitzgerald, S. Lair**. Mortality and morbidity associated with gunshots in raptorial birds from the province of Quebec: 1986 to 2007. *Canadian Veterinary Journal*, 51: 70-74, 2010.

Desmarchelier, M., **S. Lair**, A. Defarges, M. Lécuyer. Esophageal stricture in a cougar (*Puma concolor*). *Journal of Zoo and Wildlife Medicine*, 40(2): 328-331, 2009.

Kutz, S.J., E.J. Jenkins, A.M. Veitch, **J. Ducrocq**, L. Polley, B. Elkin, **S. Lair**. The Arctic as a model for anticipating, preventing, and mitigating climate change impacts on host-parasite interactions. *Veterinary Parasitology*, 163: 217-228, 2009.

St Leger, J.A., L. Begeman, M. Fleetwood, S. Frasca, M.M. Garner, **S. Lair**, S. Trembley, M.J. Linn, K.A. Terio. Comparative Pathology of Nocardiosis in Marine Mammals. *Veterinary Pathology*, 46(2):299-308, 2009.

Ludwig, A., M. Bigras-Poulin, P. Michel, **D. Bélanger**. Risk factors associated with West Nile virus mortality in American crow populations in southern Quebec. *Journal of Wildlife Diseases*, 46(1): 195-208, 2010

Himsworth CG, Elkin BT, Nishi JS, Neimanis AS, **Wobeser GA**, Turcotte C, **Leighton FA**. An outbreak of bovine tuberculosis in an intensively managed conservation herd of wild bison in the Northwest Territories. *Canadian Veterinary Journal*. In Press (Accepted February 19, 2009).

Himsworth CG, Elkin BT, Nishi JS, Epp T, Lyashchenko KP, Surujballi O, Turcotte C, Esfandiari J, Greenwald R, **Leighton FA**. Comparison of test performance and evaluation of novel immunoassays for tuberculosis in a captive herd of wood bison naturally infected with *Mycobacterium bovis*. *Journal of Wildlife Diseases*. In Press (Accepted July 23, 2009).

Himsworth CG, Gurney KEB, Neimanis A, **Wobeser G, Leighton FA**. 2009. An outbreak of West Nile Virus infection in captive Lesser Scaup (*Aythya affinis*) ducklings. *Avian Diseases* 53: 129-134.

Wong, M., J. Toth, S. Haney, M.G. Tyshenko, S. Darshan, D. Krewski, **F.A. Leighton**, D. Westaway, S.S. Moore, M. Ricketts, and N. Cashman. 2009. PrioNet Canada: A network of centres of excellence for research into prions and prion diseases. *Journal of Toxicology and Environmental*

Health 72:1000-1007.

Wobeser G, Campbell GD, Dallaire A, McBurney S. 2009. Tularemia, plague, yersiniosis, and Tyzzer's disease in wild rodents and lagomorphs in Canada: a review. *Canadian Veterinary Journal* 50:1251-1256.

Al-Hussinee L, Huber P, Russell S, LePage V, Reid A, Young KM, Nagy E, Stevenson RMW, **Lumsden JS**. (2010). Viral hemorrhagic septicemia virus (VHSV) type IVb experimental infection in rainbow trout, *Oncorhynchus mykiss* (Walbaum) and fathead minnow, *Pimphales promelas* (Rafinesque). *Journal of Fish Diseases* 33:347-360.

Huber P, Petrie B, Allen S, **Lumsden JS**. (2010). Viral hemorrhagic septicemia virus IVb inactivation by UVC and storage viability at 4°C and -20°C. *Journal of Fish Diseases* 33:377-380.

Garver K, Al-Hussinee L, Edes S, Hawley L, Lord S, Stevenson RMW, Contador E, LePage V, Souter B, Schroeder T, Wright E, **Lumsden JS**. First identification of koi herpes virus (KHV) in wild common carp in Canada. Submitted to *Journal of Wildlife Disease*, February 2010.

Al-Hussinee L, Lord S, Stevenson RMW, Casey RN, Groocock GH, Britt KL, Kohler GA, Wooster GA, Getchell RG, Bowser PR, **Lumsden JS**. Immunohistochemistry and pathology of viral hemorrhagic septicemia virus, type IVb associated with mortality in multiple Great Lakes fish. Submitted to *Diseases of Aquatic Organisms*, December 2009.

Dutton, C.J., M.Quinnell, L. R. Lindsay, J. DeLay, and **I.K. Barker**. 2009. Paraparesis in a polar bear (*Ursus maritimus*) associated with West Nile Virus infection. *Journal of Zoo and Wildlife Medicine* 40: 568-571.

Rocke, T.E., and **I. K. Barker**. 2010. Proposed link between paralytic syndrome and thiamine deficiency in Swedish gulls not substantiated. *Proceedings of the National Academy of Science* 107 (4): www.pnas.org/cgi/doi/10.1073/pnas.0912119107

Velarde, R., S.E. Calvin, D. Ojkc, **I.K. Barker**, and É. Nagy. 2010. Avian Influenza Virus H13 Circulating in Ring-Billed Gulls (*Larus delawarensis*) in Southern Ontario, Canada. *Avian Diseases* 54(s1): 411-419.

Parmley, J., S. Lair and F.A. Leighton. 2009. Canada's inter-agency wild bird influenza survey. *Integrative Zoology*. 4: 409-417.

Pasick, J., Y. Berhane, H. Kehler, T. Hisanaga, K. Handel, J. Robinson, D. Ojkc, F. Kibenge, M. Fortin, R. King, A. Hamel, D. Spiro, **J. Parmley**, C. Soos, E. Jenkins, A. Breault, D. Caswell, C. Davies, J. Rodrigue, K. McAloney, and **F. Leighton**. 2010. Avian Influenza Surveillance in

Information Services (Continued)

Publications and Reports (Continued)

Canadian Wild Birds 2005 to 2007. *Avian Diseases* 54(s1): 440-445.

Vrbova L, **Stephen C**, et al 2010 (in press). Systematic Review of Surveillance Systems for Emerging Zoonoses. *Transboundary and Emerging Diseases*

Stephen C, DiCicco E, Munk B. 2009. British Columbia's fish health regulatory framework's contribution to sustainability goals for salmon aquaculture. *Ecohealth* 5(4):472-81

Stephen C. 2009. The challenge of integrating ecosystem health throughout a veterinary curriculum. *J Veterinary Medical Education*. 36(1): 145-151

Daoust, P-Y., S. McBurney, D.L. Godson, M.W.G. Van de Bildt and A.D.M.E. Osterhaus. 2009. Morbillivirus-associated encephalitis in free-living lynx (*Lynx canadensis*) and bobcats (*L. rufus*) of eastern Canada. *Journal of Wildlife Diseases* 45(3): 611-624.

Reports:

Séguin, G., S. Lair, A. Dallaire. Bœufs musqués (*Ovibos moschatus*) du Nunavik: état de santé et sécurité alimentaire. Presented to Société Makivik, Kuujuaq, August 2009.

Larrat, S., S. Lair. Implantation chirurgicale d'émetteurs satellitaires sur des garrots d'Islande (*Bucephala islandica*) dans la ZEC Chauvin. Presented to Environment Canada. June 2009.

Ducrocq, J., S. Lair. Pathological analysis of skin samples from forty-six caribou (*Rangifer tarandus*) of the Akia-Maniitsoq herd in Greenland. Presented to the Greenland Institute of Natural Resources. June 2009.

Ducrocq, J., S. Lair. Pathological analysis of skin and tissue samples from twenty-five caribou (*Rangifer tarandus*) of the Bluenose West Herd, NWT. Presented to the Wildlife Division, Environment and Natural Resources, Government of the Northwest Territories, January 2010.

Ducrocq, J., S. Lair. Pathological analysis of skin samples from sixty-four caribou (*Rangifer tarandus*) from the Southampton Island herd, Nunavut. Presented to the Department of Environment, Nunavut Government. July 2009.

Larrat, S., S. Lair. Évaluation de l'état de santé des poissons utilisant le canal de rejet de la centrale de Gentilly-2 lors d'arrêts et de redémarrages du réacteur - printemps 2009. Presented to Hydro-Québec Production. June 2009.

Russell S, **Lumsden JS**. (2009). Lake Winnipeg; assessment of fish health. Final report for the International Joint Red River Commission.

Pollock S, **Stephen C**. 2010. Why you should get to know your local veterinarian. *BC Medical Journal*. 52(1):15

Hammel. L., **Stephen, C.**, Bricknell, I., O. Evensen. 2009 "Salmon Aquaculture Dialogue Working Group Report on Salmon Disease" commissioned by the Salmon Aquaculture Dialogue, World Wildlife Fund. available at <http://www.worldwildlife.org/site/PageNavigator/SalmonSOIForm>

Education

The CCWHC furnishes educational programs to its agency partners and to its host universities. Agency personnel are offered presentations and workshops on a range of topics related to wild animal health and disease. CCWHC staff participate in courses offered to undergraduate and post-graduate students at its host universities. The CCWHC also furnishes teaching material, research projects and graduate student supervision to each university. Special courses in wild animal health and disease are offered to veterinary students at each of the veterinary colleges.

Educational Summary

Education is a key activity for the CCWHC. Education supports disease surveillance through instruction and engagement of wildlife field personnel and the public, and creates wildlife health specialists through university programs. Educational workshops, held nationally and internationally, promote the ongoing professional development of wildlife health professionals, the development of programs and the interchange of knowledge, while addressing current issues affecting the health of wildlife and domestic animals and human and ecological health. University-based academic programs supported by the CCWHC provide a steady flow of valuable teaching material and learning opportunities for undergraduate and graduate students, while also benefiting government agencies by contributing to the education of highly qualified personnel and by contributing to projects that address management and policy issues of direct interest to CCWHC partner agencies.

In 2009-2010, the CCWHC hosted its second National Workshop for Wildlife Health Professionals in Ottawa focusing on animal welfare and the One World One Health concept. In its role as a Collaborating Centre of the World Organization of Animal Health (OIE), the CCWHC participated in a number of training workshops as well as engaged in consultations in Asia concerning the development of wildlife health management programs. In total, almost 300 hours of instruction were provided to partner agencies in 2009-2010 and well over 500 hours were invested in student teaching and scientific presentations. In total, the CCWHC directly supported and/or supervised 24 graduate student projects, ranging from the study of Besnoitiosis in caribou in Nunavut and Quebec to the development of tools to assess the long-term stress of various wildlife species.

A Selection of Graduate Student Programs

Guyline Séguin, MSc candidate (University of Montreal) – Guyline is currently engaged in analyzing the microbiological characterization of isolates of *Pasteurella multocida* obtained from Eider ducks during epidemics of avian cholera. Guyline's work should enable us to better understand the epidemiology of this disease which is associated with high mortalities in this species of sea duck.



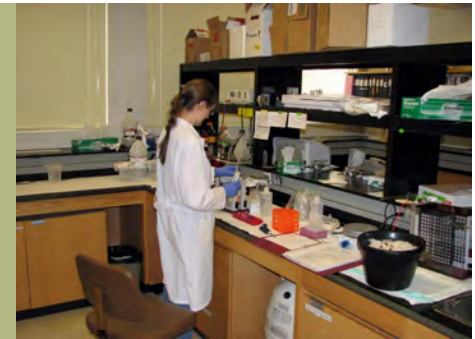
Julie Ducrocq, MSc candidate (University of Montreal) – Julie is currently studying the epidemiology of besnoitiosis, a disease caused by a protozoan parasite, in caribou. This disease is of particular concern to Inuit communities due to their dependence on healthy caribou herds. Julie is looking at the dispersion of this parasite in different herds of barren-ground caribou and is attempting to identify factors that are driving the occurrence and severity of these infections.





Bryan Macbeth, PhD candidate (University of Saskatchewan) – Bryan Macbeth is a student in the Department of Veterinary Biomedical Sciences at the University of Saskatchewan supervised by David Janz and Marc Cattet. Bryan’s graduate research topic is development and validation of a hair cortisol assay for assessment of long-term stress in grizzly bears, polar bears, and caribou.

Ruth Carlson, PhD candidate (University of Saskatchewan) – Ruth Carlson is a student in the Department of Veterinary Biomedical Sciences at the University of Saskatchewan co-supervised by David Janz and Marc Cattet. Ruth’s graduate research topic is development and validation of a protein microarray for detection of long-term stress in skin biopsy samples collected from grizzly bears and polar bears.



Pat Curry, PhD candidate (University of Calgary) – Pat is involved in the validation of the use of blood samples collected on filter paper as a valid screening method for better understanding caribou disease. The overall objective is to develop a diagnostic tool that is practical in harsh climates, versatile, and can facilitate widespread disease surveillance in order to monitor changes in disease patterns over time, ensure food safety, and inform caribou management practices.

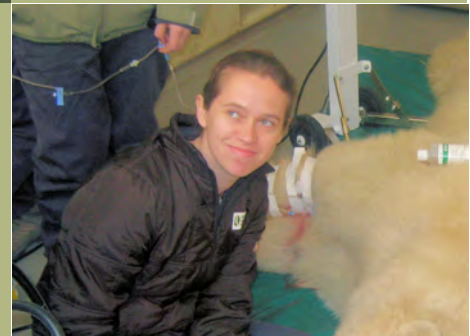


Nathan de Bruyn, MSc candidate (University of Calgary) –Nathan’s research involves the validation of non-invasive molecular tools to identify gastrointestinal (GI) nematodes in wildlife. Climate change, habitat alteration and animal translocations are altering the distribution of GI nematodes in wildlife; it is hoped that this research will enable a broader understanding of wildlife health and potentially mitigate human-mediated spread of disease.



Samantha Allen, MSc graduate (University of Guelph) –Samantha compared the prevalence and patterns of antimicrobial resistant bacteria and resistance genes in generic *Escherichia coli* and *Salmonella* isolated from samples collected from wild small mammals living on farms, residential, landfill, and natural areas. Resistant bacteria were found from all environmental areas, with the greatest prevalence occurring in animals on farm sites.

Charlene Berkvens, DVSc candidate (University of Guelph) – Charlene is enrolled in the Zoo Medicine and Pathology Residency at the Toronto Zoo/University of Guelph. Her research focuses on the validation of an enzyme immunoassay for cortisol and corticosterone concentrations in mammal hair, bird feathers and in skin sheds of snakes, aimed at expanding the range of species in which stress of moderate duration can be evaluated in a minimally invasive way.



Garry Gregory, MSc candidate (University of PEI) – Garry is involved in a collaborative study examining the potential factors contributing to a perceived decline in muskrat populations on Prince Edward Island. Predation, disease and habitat contamination are currently being examined as prime causes and it is expected that the findings will be incorporated into management decisions aimed at restoring muskrat populations to traditional levels.



Sylvain Larrat, DES Residency Program (University of Montreal) – Sylvain is currently involved in the Wildlife Health Management Residency Program offered by the CCWHC Quebec regional center. One of the projects Sylvain has been involved with is the investigation of the newly described “red-vent syndrome” in Atlantic salmon. The impact of this condition, which can potentially be transmitted to people, on the population of salmon is unclear at this time.

Education (Continued)

CCWHC International

By accepting the designation as a Collaborating Centre of the World Organization of Animal Health (OIE) in 2007, the CCWHC also accepted a responsibility to share its knowledge and expertise with some of the 175 OIE member countries, as time and resources permit. In 2009-10, the CCWHC responded to several requests for international engagement. CCWHC developed a 40-page course manual for the OIE for a series of training workshops for government personnel responsible for reporting wildlife disease occurrences to the OIE. CCWHC staff participated directly in two of these workshops, held in Panama for the Americas and in Tanzania for portions of Africa and the Middle-East, and the course manual was used in a third workshop for eastern Europe. Other presentations were made at a workshop held by the Pan-American Health Organization, also in Panama, and in Uganda and Rwanda. In partnership with Environment Canada and Veterinarians Without Borders Canada, the CCWHC helped bring to Canada two wildlife biologists from Ecuador to learn techniques to capture and sample wild waterfowl for avian influenza surveillance. In partnership with the Centre for Coastal Health, CCWHC staff participated in a mission to China associated with development of policies to manage avian influenza, and secured funds for a feasibility study for the creation of a wildlife health management centre collaboratively among ministries of the Government of Sri Lanka and the University of Peradeniya. The CCWHC database continues to be used by the Dutch Wildlife Health Centre to manage its surveillance data, and is under consideration for use by WildTech, an international research project in wildlife disease surveillance and technology of the European Union. CCWHC personnel serve on several OIE advisory groups.



Canada-China consultative group on policy for management of avian influenza, Beijing, 2009. CCWHC participants were Drs. Craig Stephen and Ted Leighton.

CCWHC Workshop for Wildlife Professionals

On February 23-24, 2010 the CCWHC hosted a two-day workshop for wildlife health professionals. The purpose of the workshop was to bring together individuals active in the fields of wildlife health and disease management nationally and engage them in discussions surrounding two broad themes; animal welfare issues in wildlife management, research and harvest and the One World One Health concept. In addition, the workshop was designed to elicit feedback and comments pertaining to the CCWHC program.

The workshop was held at Carleton University, Ottawa, ON and facilities were made available with the assistance of Environment Canada and the National Wildlife Research Centre. The workshop attracted 70 participants from across Canada as well as representatives from the United States. Day One was comprised of presentations and discussions designed to advance the concept of wildlife welfare and to identify approaches to integrate wildlife welfare considerations into the design and implementation of management, research and harvest activities while ensuring that these activities can continue efficiently in the long term. A report on the meeting is being prepared and will include the questions that were raised during the workshop. It is hoped that the document will serve as an "animal welfare benchmark" for agencies and organizations, and as a work in progress upon which to develop future work on wildlife welfare in Canada and abroad. The survey document will be available for download from the CCWHC website (www.ccwhc.ca/index.php) in the near future.

The morning of day two was presented in conjunction with the Public Health Agency of Canada (PHAC), and was a discussion pertaining to the wildlife aspects of the "One World One Health" (OWOH). The Public Health Agency is formulating a substantial policy initiative around the OWON concept and this session was organized to capture input from Canada's wildlife health professionals gathered at the workshop. The OWOH concept proposes an international and interdisciplinary approach to disease surveillance, monitoring, prevention, control and mitigation that incorporates environmental conservation, and recognizes linkages among human, animal and ecosystem health. Expert advice and engagement of professionals in all 3 broad categories of health is required for its success.

The third component of the workshop and the subject of the afternoon of day two consisted of a consultative process to engage participants in providing immediate input to the CCWHC as it formulates its work agenda for the coming year and beyond. This feedback will assist the CCWHC to plan its activities in order to support the needs of its partner agencies over time.

Disease Response and Management

In 2009-2010, the CCWHC responded to several important wildlife disease issues with targeted programs of enhanced surveillance, research and participation in the disease management actions of partner agencies. CCWHC personnel also participated in research to extend knowledge of wildlife health and welfare in Canada. Many of these targeted programs also enhance the capacity of the CCWHC core program (business lines 1-3).

Disease Response and Management activities in 2009-2010 were centered around Avian Influenza surveillance in wild birds, Rabies Surveillance in Eastern Canada, West Nile Virus surveillance and research projects, surveillance for White-nose syndrome among bats in Ontario and Quebec, as well as Chronic Wasting Disease surveillance and research. The CCWHC also was involved in wildlife health research within the Foothills Research Institute Grizzly Bear Program and Scandinavian Brown Bear Project, surveillance and monitoring of fish pathogens, and in several International Polar Year projects.

Response and Management Activities

Wildlife Disease Surveillance, First Nations & Inuit Health
 West Nile Virus Surveillance
 Chronic Wasting Disease Surveillance in Saskatchewan
 Animal Health Surveillance for Early Detection of Emerging Infectious Disease Risks
 Surveillance for Highly Pathogenic Avian Influenza Wild Birds in Ontario
 Surveillance for Avian Influenza in the Prairie Pothole Region of Canada – with USDA
 Avian Influenza Viruses from Wild Birds in Northeastern North America – with USGS
 Avian Influenza Management Policy Initiative with the Chinese Academy of Agricultural Sciences
 Scientific Solutions to Reduce the Impact of Viral Hemorrhagic Septicemia Virus on the Great Lakes
 Spring Viremia of Carp Detection by PCR
 Global Avian Influenza Network for Surveillance: Data Sharing Project
 Chlamydia-like Agent as a Cause of Mortality in Lake Trout
 PCR for Fish Mortality Testing/Fish Mortality Diagnosis
 CircumArctic Rangifer Monitoring and Assessment Network
 The Suitability of Dried Blood on Filter Paper for the Detection of pathogens in Northern Caribou and Reindeer
 Epidemic Diseases in Double-crested Cormorants
 Canada's Inter-agency Wild Bird Influenza Survey
 PrioNet Canada: Research Management Committee
 PrioNet Canada: Theme leader - Chronic Wasting Disease
 PrioNet Canada: CWD Tissue Bank
 Whole-genome Sequencing of Avian Influenza Viruses
 Engaging Communities in the Monitoring of Zoonoses, Country Food Safety and Wildlife Health
 International Polary Year (IPY)
 Assessment of Disease Status of Bison in the MacKenzie Bison Sanctuary, Northwest Territories
 Muskox Health Assessment, Victoria Island and Adjacent Mainland, Nunavut
 Relationships Between Environmental Change and Wildlife Population Performance
 Biomarkers of Long-term Stress in Wildlife
 Health Assessment of the Beluga Whales from the St. Lawrence Estuary
 Raccoon Rabies Surveillance in Quebec
 Community-based Collections of Arctic Barren-ground Caribous (CARMA/IPY)
 Nova Scotia Moose Recovery Program
 Health Assessment of Northern Fulmars in the Northwest Atlantic
 Assessment of Stunning and Bleeding Methods Used During the Grey Seal Hunt in Nova Scotia
 Investigation of Muskrat Decline on Prince Edward Island
 Consultation for the Establishment of a Marine Animal Response Network for the Gulf and Maritime region
 Assessment of the Health Status of Green and Leopard Frogs on PEI
 Disease assessment in Yukon Muskrats
 Predicting and Detecting Anthrax in Wood Bison in Northern Canada
 White Nose Syndrome Surveillance in Ontario and Quebec
 Tick and Lyme Disease Surveillance on Vancouver Island
 Potential Effects of Invasive American Bullfrogs on Drinking Water Quality
 Risk of Canada and Cackling Geese to Public and Livestock Health
 Obstacles and Opportunities for Animal Disease Surveillance in Sri Lanka
 Oral Rabies Vaccinal Efficacy
 Prevalence of "red-vent syndrome" in Atlantic Salmon
 Antimicrobial Resistance in Wildlife
 Ecological Studies of Wildlife Reservoirs of Zoonotic Diseases
 Surveillance for Disease Agents of Public Health and Agricultural Significance in Wildlife Living on Farms in Ontario
 Transmission Dynamics of Lyme Disease in St. Lawrence Islands National Park
 Emergence of Trichomoniasis in Wild Finches of the Canadian Maritime Provinces: A Potential Welfare Issue Associated with Feeding and Watering Birds – Pilot Study
 Prevalence of *B. dendrobatidis* in PEI Wild Frogs



Canada's Inter-Agency Wild Bird Influenza Survey

Canada's national survey for avian influenza viruses in wild birds began in 2005 and has continued each year. The 2009-10 Survey consisted of national vigilance for highly-pathogenic strains of the virus based on testing of wild birds found dead. This basic Survey was augmented by a robust provincial survey for viruses in apparently health live wild birds carried out by the Province of Newfoundland and Labrador and by additional testing of live wild birds in Canada supported by the National Wildlife Health Centre of the U.S. Geological Survey and by the U.S. Department of Agriculture (APHIS). Analysis of samples from live wild birds collected in 2009 was not completed as of 1 April 2010. A total of 2243 dead birds were tested in 2009-10 with 20 or 1% testing positive. A total of 3276 samples were collected from a variety of species of live birds. Thus far, 183 infections with avian influenza have been detected, but just over 1000 samples remain to be tested.

Disease Response and Management

Ecology of *Besnoitia tarandi* in Circumartic Barrenground Caribou

Besnoitia tarandi is a protozoan parasite regularly encountered in the skin of free-ranging caribou. The ecology of this parasite and its impact on the health of its intermediate host, the caribou, is poorly understood. Anecdotal reports by subsistence and recreational hunters over the last few years suggest that the prevalence and intensity of *B. tarandi* infection has increased in some North American barrenground caribou populations. As part of the CircumArctic Rangifer Monitoring and Assessment Network, the CCWHC conducted an epidemiological assessment of infection by this parasite in several North American caribou herds. Results of this study support the probable role of biting insects in the transmission of this protozoan and have shown that in general caribou from the *Rivière-aux-feuilles* (Québec) are either less resistant to this parasite or are exposed to higher parasitic pressure. Post mortem examination of caribou in poor body condition from the *Rivière-aux-feuilles* herd suggested that the clinical signs were likely a consequence of intense infections by *B. tarandi*. In addition, the frequent occurrence of inflammatory changes in the testes associated with *B. tarandi* cysts suggests that this parasite might also affect fertility of infected males. These findings show that the relationship between this parasite, its host and the changing Arctic environment is worth further investigation.



Photo Copyright The National Geographic Society

Scandinavian Brown Bear Collaboration

In 2009, the Foothills Research Institute Grizzly Bear Program (FRIGBP), Scandinavian Brown Bear Project (SBBP), and Canadian Cooperative Wildlife Health Centre (CCWHC) formalized an agreement to collaborate in research efforts on brown bears in western Canada (Alberta) and Scandinavia, and to share knowledge, expertise, and technological developments to enhance management and conservation objectives within each location. The development of a partnership was prompted by recognition of important similarities and differences between the two projects. Both have long histories – 11 years for the FRIGBP and 25 years for the SBBP, both focus on brown bears in human-dominated boreal landscapes and, in both areas, brown bears face similar pressures relating to human activities, e.g., resource extraction, agriculture, urbanization, and recreation. In Scandinavia, however, brown bears have recovered from the brink of extinction increasing from little more than 130 animals in Norway and Sweden in the 1930's to over 3,200 animals in 2008, most of which now inhabit Sweden. In contrast, the long-term persistence of brown bears in Alberta is seriously threatened with less than 600 bears estimated to remain in the province, a land area that is approximately 50% larger than the area of Sweden. Undoubtedly, wildlife managers who are now implementing recovery actions in Alberta stand to benefit from learning how Scandinavian managers have achieved remarkable success in brown bear population recovery and re-colonization.



White Nose Syndrome in Hibernating Bats

Since 2008 the CCWHC, in partnership with provincial and state agencies has, conducted active surveillance for White Nose Syndrome (WNS) in Ontario and Quebec. WNS, associated with infection by the fungus *Geomyces destructans*, was not confirmed in Ontario bat hibernacula during the late winter of 2009, although a few bats with typical facial and wing lesions were observed in two locations. However, in 2010, its presence was confirmed in numerous localities in the eastern part of the province as well as locations in southern portion of Quebec, with the first cases detected in early March. High mortality, with large numbers of day-flying bats during the hibernation period, were observed in the Faraday area, south of Bancroft, and in the town of Kirkland Lake in northeastern Ontario. This is the most northerly location from which this disease has been diagnosed. In Quebec WNS has been confirmed in the Outaouais region and suspected in the Abitibi-Témiscamingue region. WNS is not considered to be a threat to human health, however, since 2007 it has been known to cause mass mortalities among bat populations, particularly in northeastern United States where over one million bats have died as a result of the syndrome. Given the important role that bat species play in regional ecosystems, including the consumption of large quantities of insects that could otherwise harm humans or crops, this syndrome is of significant concern.



Financial Highlights

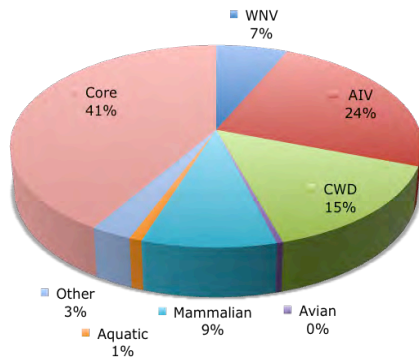
In 2009-2010, the CCWHC had total cash revenues of \$3,506,979, a decrease of 21% from 2008-2009. Core Program revenues (business lines 1-3) comprised \$1,449,762 or 41% of the total, comparable to funding levels in 2008-2009. Revenues from Response and Management activities (business line 4), mostly from targeted research programs, comprised \$2,057,217 or 59% of total revenue.

Core Program revenue (business lines 1-3) from the Government of Canada accounted for \$880,000 or 61% of the total, while core revenue from the provinces and territories accounted for \$544,762 or 38%. Contributions from other non-government organizations and individuals accounted for the remaining \$25,000 or 1%.

Response and Management revenues (business line 4) were primarily comprised of federal government funding (64%), provided primarily by the Canadian Food Inspection Agency, the Public Health Agency of Canada, PrioNet Canada (Network Centres of Excellence), NSERC-CRD, and Environment Canada. Provincial and foreign governments and the Universities provided the remaining 36%, with major contributions from Saskatchewan's Ministry of Environment, the Ontario Ministries of Natural Resources and Agriculture Food and Rural Affairs, the Government of Quebec, and the United States Department of Agriculture and the United States Geological Survey.

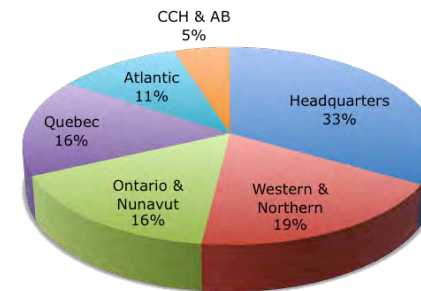
Total Revenue

All Business Lines



Total Expenses

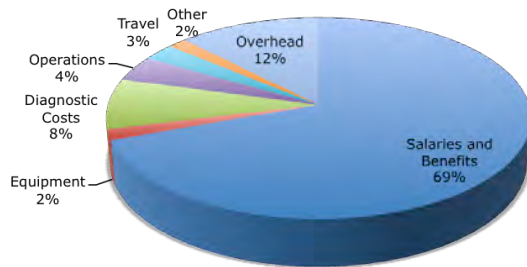
All Business Lines by Region



Expense	2009 - 2010 Core Expenses by Region						
	HO	W & N	ON/NU	OC	Atlantic	CCH & AB	Total
Salaries and Benefits	\$ 628,701.93	\$ 151,100.00	\$ 281,286.42	\$ 303,609.06	\$ 246,189.87	\$ 15,500.00	\$ 1,626,387.28
Equipment	\$ 15,469.39	\$ 9,890.00	\$ 5,300.00	\$ 6,226.00	\$ 391.00		\$ 37,276.39
Diagnostic Costs	\$ -	\$ 56,841.23	\$ 58,949.00	\$ 37,930.00	\$ 30,538.00		\$ 184,258.23
Operations	\$ 27,282.61	\$ 7,850.00	\$ 20,707.00	\$ 22,675.00	\$ 4,602.00	\$ 7,500.00	\$ 90,616.61
Travel	\$ 9,176.71	\$ 2,040.00	\$ 10,535.00	\$ 25,261.00	\$ 8,024.00	\$ 6,500.00	\$ 61,536.71
Other	\$ 37,920.85					\$ 10,000.00	\$ 47,920.85
Overhead	\$ 96,603.72	\$ 34,158.18	\$ 56,516.61	\$ 59,355.16	\$ 43,461.73	\$ 5,925.00	\$ 296,020.41
Subtotal	\$ 815,155.21	\$ 261,879.41	\$ 433,294.03	\$ 455,056.22	\$ 333,206.60	\$ 45,425.00	\$ 2,344,016.48
Cost Recovery	\$ 351,563.55	\$ 99,742.56	\$ 94,214.13	\$ 117,564.00	\$ 140,636.82	\$ 8,425.00	\$ 812,146.06
Total	\$ 463,591.66	\$ 162,136.85	\$ 339,079.90	\$ 337,492.22	\$ 192,569.78	\$ 37,000.00	\$ 1,531,870.42

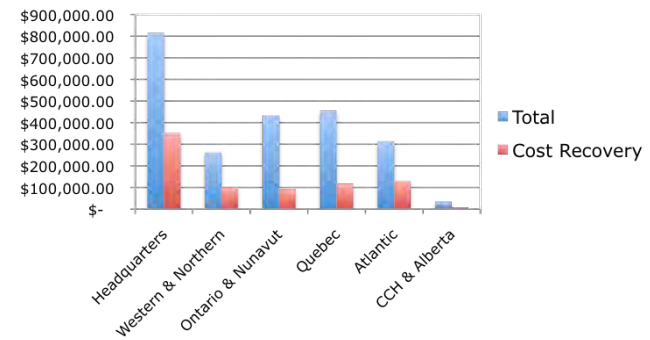
Core Expenses

Business Lines 1-3 by Category



Core Expenses

Business Lines 1-3 Cost Recovery



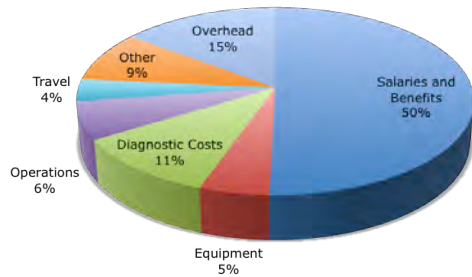
Core Expenditures and Cost Recovery

In 2009-2010, the cost of delivering the CCWHC core program, including the National Wildlife Disease Surveillance Program and Educational and Informational Services (business lines 1-3) exceeded \$2,300,000.

Funding for the core program totaled only \$1,449,762, creating a shortfall of \$894,254 or 38%. Fortunately, the CCWHC was able to capitalize on synergies between the core program activities and Response and Management activities to recover a total of \$812,146 (35% of total core expenditures). The final cost of delivering the core program, after cost recovery, was \$1,531,870.

Total Expenses

All Business Lines by Category



Cash Revenues in 2009-2010 included \$1,449,762 in support of the core program and a further \$2,057,217 for targeted research programs. In total, CCWHC revenues for 2009-2010 were \$3,506,979.

Canadian Cooperative Wildlife Health Centre		Statement of Revenues & Expenses	
REVENUES	Core (General)	Special Projects	2009/2010
			Total Revenues
Canadian Food Inspection Agency	130,000	395,241	525,241
Canadian Institutes of Health Research		28,000	28,000
Environment Canada	400,000	15,000	415,000
First Nations and Inuit Health		4,996	4,996
Fisheries and Oceans		30,000	30,000
Foothills Research Institute		11,935	11,935
NSERC-CRD		97,927	97,927
Parks Canada	110,000		110,000
ProNet Canada		280,000	280,000
Public Health Agency of Canada	240,000	476,624	716,624
Alberta			
Alberta - Community Development	4,000	1,500	5,500
Alberta - Fish and Wildlife	5,000	2,000	7,000
British Columbia	19,000		19,000
Manitoba	10,000		10,000
New Brunswick			
New Brunswick - Fish & Wildlife	10,259	3,617	13,876
New Brunswick - Health	10,259	4,711	14,970
Newfoundland & Labrador	21,700		21,700
Northwest Territories	16,000		16,000
Nova Scotia			
Nova Scotia - Agriculture		4,667	4,667
Nova Scotia - DNR	9,500		9,500
Nova Scotia - Health	7,000	9,378	16,378
Nunavut	12,000		12,000
Ontario			
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	115,998	195,998
Prince Edward Island			
PEI - Environment	4,735	1,050	5,785
PEI - Health		5,761	5,761
Quebec			0
MAPAQ	50,000		50,000
MRNF	50,000	7,000	57,000
MSSS	80,000	60,260	140,260
Saskatchewan			
Saskatchewan Agriculture and Food		38,815	38,815
Saskatchewan Environment	41,309	240,000	281,309
Yukon	14,000		14,000
Ducks Unlimited	12,000		12,000
Canadian Wildlife Federation	10,000		10,000
Syngenta	3,000		3,000
Universities		8,700	8,700
United States Department of Agriculture		86,952	86,952
United States Geological Survey		59,800	59,800
Miscellaneous Income		17,285	17,285
TOTAL REVENUE	1,449,762	2,057,217	3,506,979
			2009/2010
EXPENSES			Total Expenditures
Salaries and Benefits	982,243	855,934	1,838,178
Equipment	41,263	139,920	181,184
Diagnostic Costs	147,147	245,075	392,223
Operations	90,507	149,843	240,350
Travel	65,517	72,616	138,133
Other	36,734	147,989	184,724
Overhead	163,247	369,953	533,200
TOTAL EXPENSES	1,526,660	1,981,330	3,507,990
Revenue less Expenditures	-76,898	75,887	-1,011

Staff and Associates

Atlantic Region

Director Pierre-Yves Daoust

Professional
Maria Forzán
Scott McBurney

Technical
Fiep de Bie
Darlene Weeks

Associates
Gary Conboy
Marion Desmarchelier
David Groman
Fred Kibenge

Quebec Region

Director Stéphane Lair

Professional
André Dallaire
Julie Ducrocq
Sylvain Larrat
Guylaine Séguin

Technical
Kathleen Brown
Viviane Casaubon
Audrey Daigneault St-Germain
Mélanie Laquerre
Judith Viau

Associates
Christian Bédard
Denis Bélanger
Guy Fitzgerald
Nick Ogden
Alain Villeneuve

Ontario and Nunavut Region

Director Ian Barker

Professional
Douglas Campbell
Cheryl A. Massey

Technical
Leonard Shirose
Kate Warnick
Melanie Whalen

Clerical
David Cristo
Carol-Lee Ernst

Associates
D. Bruce Hunter
Claire Jardine
John Lumsden
Jane Parmley
Dale A. Smith

Western and Northern Region

Director Trent Bollinger

Professional
Lorraine Bryan
Gary Wobeser

Wildlife Biologist
Christine Wilson
Marnie Zimmer

Technical
Valeriana Harris
Justin Meaden
Elsie-Dawn Parsons
Nathan Wiebe

Associates
Janet Hill
Emily Jenkins
Vikram Misra
Catherine Soos

Alberta Region

Director Susan Kutz

Professional

Craig Stephen

Technical
Dean Brown

Associates
Nigel Caulkett
Carmen Fuentealba
Oscar Illanes
Amy Warren

Centre for Coastal Health

Director Craig Stephen

Professional
Tyler Stitt

Associates
Jenny Dawson-Coates

Headquarters Office

CCWHC Executive Director Ted Leighton

Director Patrick Zimmer

IT Manager Kevin Brown

Professional
Marc Cattet

Accountant
Nadine Kozakevich

Technical
Doug Bornyk
Derek Harder
Doug Jodrell
Chris Pinel

Clerical
Jacqui Brown

Associates
Gordon Stenhouse

The CCWHC Board of Directors

Pierre Bérubé, Directeur du développement de la faune, Québec, MRNF
 Ron Bjorge, Director, Fish & Wildlife, Alberta Sustainable Resource Development
 John Blake, Director, Wildlife Division, Newfoundland & Labrador
 Kevin Callele, A/Executive Director, Fish and Wildlife Branch, Saskatchewan Ministry of Environment
 Jack Dubois, Wildlife Director, Wildlife & Ecosystem Protection Branch, Manitoba Conservation
 Susan Fleck, Director, Wildlife Management Division, Northwest Territories Environment & Natural Resources
 Drikus Gissing, Director, Wildlife Services, Nunavut Department of Sustainable Development
 Kaaren Lewis, Director, Biodiversity Branch, British Columbia Ministry of Water, Land and Air Protection
 Dan Lindsey, Director, Fish & Wildlife Branch, Yukon Department of Environment
 Wade Luzny, Executive Vice President, Canadian Wildlife Federation
 Cameron Mack, Director, Fish and Wildlife Branch, Ontario Ministry of Natural Resources
 Kate MacQuarrie, Director, Fish & Wildlife Division, Prince Edward Island Department of Environment
 Henry Murkin, Chief Biologist, Ducks Unlimited (Canada)
 Virginia Potter, Director General, Canadian Wildlife Service Environment Canada
 Mark Raizenne, Director General, Centre for Food-borne, Environmental and Zoonotic Infectious Diseases,
 Public Health Agency of Canada
 Charles Rhodes (Chair), Dean, Western College of Veterinary Medicine, University of Saskatchewan
 Tony Ritchie, Executive Director, Animal Health Directorate, Canadian Food Inspection Agency
 Mike Sullivan, Director, Fish & Wildlife Branch, New Brunswick Department of Natural Resources
 Julie Towers, Director, Wildlife Division, Nova Scotia Department of Natural Resources
 Stephen Woodley, Chief Scientist, Ecological Integrity Branch, Parks Canada

The CCWHC Executive

Ted Leighton, Executive Director
 Patrick Zimmer, Headquarters Director
 Kevin Brown, Information Technology Manager
 Ian Barker, Ontario and Nunavut Regional Director
 Trent Bollinger, Western and Northern Regional Director
 Pierre-Yves Daoust, Atlantic Regional Director
 Susan Kutz, Alberta Regional Director
 Stéphane Lair, Quebec Regional Director
 Craig Stephens, Executive Director Centre for Coastal Health

Canadian Cooperative Wildlife Health Centre

Concept, Editorial, Design and
 Production – Patrick Zimmer

Canadian Cooperative Wildlife Health Centre, Headquarters Office
 Room 2683 – Western College of Veterinary Medicine
 University of Saskatchewan
 52 Campus Drive
 Saskatoon SK Canada S7N 5B4

Visit ccwhc.ca to learn more about the
 Centre's work across Canada and
 internationally

ph (306) 966-5099
 National Information Line (in Canada only): 1-800-567-2033