



The Canadian Cooperative Wildlife Health Centre and surveillance of wild animal diseases in Canada

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Abstract — The Canadian Cooperative Wildlife Health Centre (CCWHC) was established in 1992 as an organization among Canada's 4 veterinary colleges, with a mandate to apply veterinary medicine to wildlife management and conservation in Canada. A major function of the CCWHC is nation-wide surveillance of wild animal diseases. Disease surveillance is conceived as consisting of 4 different activities: detection, diagnosis, information management, and use of information. In the CCWHC surveillance program, detection of disease is carried out by a wide range of professional and avocational field personnel, and much effort is expended to stimulate and support this activity. Diagnosis is done by personnel of provincial and federal veterinary laboratories and the CCWHC. Information management is achieved through a national database of wildlife disease incidents developed and maintained by the CCWHC. Use of information is enabled through established channels for distribution of information derived from the surveillance program to persons responsible for wildlife programs and policies, and to the public.

There has been a high demand for the services of the CCWHC since its establishment. The CCWHC responds to approximately 2000 requests for information annually, distributes its newsletter to over 1700 recipients, examines approximately 1200 wild animal submissions each year, and has accumulated records of over 5000 disease incidents in its database. Technical information from the CCWHC has benefited federal, provincial/territorial, and nongovernment wildlife agencies; endangered species recovery programs; federal and provincial veterinary services; and federal and provincial public health programs.

Résumé — Le centre coopératif canadien de la santé de la faune et la surveillance des maladies des animaux sauvages du Canada. Le centre coopératif canadien de la santé de la faune (CCCSF) a été fondé en 1992. C'est un organisme dont font partie les 4 écoles vétérinaires du Canada et qui a pour mandat d'appliquer les connaissances vétérinaires à la gestion et à la conservation de la faune au Canada. Une des fonctions primordiales du CCCSF consiste en la surveillance des maladies des animaux sauvages à l'échelle nationale. La surveillance des maladies comprend 4 activités : la détection, le diagnostic, la gestion de l'information et l'utilisation de l'information. Dans le programme de surveillance du CCCSF, la détection des maladies est réalisée par une grande diversité de professionnels et de personnels sur place, et un effort important est accompli pour stimuler et supporter cette activité. Le diagnostic est effectué par le personnel des laboratoires vétérinaires provinciaux et fédéraux et par le CCCSF. La gestion de l'information s'effectue à l'aide d'une banque

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nationale de données portant sur les cas de maladies de la faune. Cette banque est conçue et mise à jour par le CCCSF. L'utilisation de l'information se fait par des canaux de distribution provenant des programmes de surveillance et destinée aux personnes responsables des programmes et des politiques ainsi qu'au public en général.

Les services du CCCSF ont été fortement en demande depuis sa fondation. Le CCCSF répond annuellement à environ 2 000 demandes d'information, distribue son bulletin à plus de 1 700 personnes, examine chaque année environ 1 200 soumissions portant sur la faune et a accumulé à ce jour dans sa banque de données un répertoire de plus de 5 000 cas portant sur des maladies. L'information technique provenant du CCCSF a profité à des organismes fauniques fédéraux, provinciaux/territoriaux et non-gouvernementaux, à des programmes de rétablissement d'espèces menacées, à des services vétérinaires fédéraux et provinciaux et à des programmes de santé publique fédéraux et provinciaux.

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Introduction

The Canadian Cooperative Wildlife Health Centre (CCWHC) was established in 1992 as a joint project among wildlife specialists at Canada's 4 veterinary colleges. The primary objective of the CCWHC is to apply broad aspects of veterinary medical science to wildlife management and wildlife conservation in Canada. Surveillance of wild animal diseases, as defined in this paper, is a major activity of the CCWHC, and its surveillance program is the only national program of general disease surveillance in Canada. In this paper, the nature of disease surveillance is considered and the structure and function of the CCWHC are described.

Surveillance of disease

Surveillance of disease is always done for some purpose, and the purpose defines the dimensions and focus of each program. The purpose may be broad or narrow, and thus the programs may be local or regional, concerned with single species or multiple species, one disease or all diseases. The objectives of a surveillance program must be clearly defined and the program developed to achieve those objectives. There is no generic form of disease surveillance that serves all needs.

Disease surveillance is a multifaceted activity involving many different people and areas of expertise. It is useful to consider surveillance as consisting of 4 different activities, namely, detection of disease, diagnosis of disease, management of information, and use of information, and of 2 different functional modes, passive surveillance and active surveillance. It also is useful to recognize that surveillance programs can have 2 different orientations, *general surveillance*, in which the occurrence of any and all diseases are of interest, and *limited surveillance*, in which only certain pre-identified diseases are of interest. For quantitative analysis, surveillance programs require data on the size, structure, and dynamics of the populations of interest.

Detection of disease

Surveillance begins with recognition by someone that disease may be occurring or that an agent with the potential to cause disease may be present. For disease in humans and domestic animals, detection most often is the work of health professionals. In surveillance of wild animal diseases, however, health professionals play a lesser role,

and detection depends on the observations and actions of field personnel, such as conservation officers, biologists, fisheries officers, foresters, fishermen, hunters, and naturalists. All disease surveillance programs must promote and support detection of disease by the frontline personnel most able and most likely to make these primary observations. In addition, barriers that inhibit or preclude effective detection must be identified and overcome. Common barriers to effective detection include lack of awareness by frontline personnel of the importance of their observations, distance and difficult transport arrangements between frontline personnel and diagnostic laboratories, and fees charged by diagnostic laboratories directly to frontline personnel for diagnostic examination of specimens. Detection involves not only recognition of illness and mortality, but also the recording of pertinent information, such as location, species, numbers affected and unaffected, and environmental circumstances, and the collection of specimens and samples required for diagnosis.

Diagnosis of disease

Diagnosis is the identification of diseases and their causes. Reliable diagnosis requires examination of specimens by appropriately trained professionals in properly equipped laboratories. General surveillance requires laboratories with the capability to detect all forms of disease and a broad array of disease-causing agents. It requires personnel able to identify known diseases and new diseases. In contrast, limited surveillance only requires the laboratory expertise sufficient to evaluate specimens for the few diseases of concern.

Management of information

To be useful, surveillance data must be assembled and analyzed. This can be a difficult task when data gathered during detection and diagnosis are widely dispersed among diverse participants, as is often the case. An active program to gather and computerize such data is a central requirement of a surveillance program. The assembled data must be in a form such that they can be searched and analyzed. Thus, construction of appropriate flexible computer programs for data storage and analysis is an initial task of great importance. Analysis of the data consistent with the objectives of the surveillance program must occur regularly. Information management is the

element that distinguishes a true surveillance program from being simply the sum of the routine activities of personnel involved in detection and diagnosis.

Use of information

The objectives of a surveillance program will not be met unless the assembled data are used for the purposes originally intended. Self-evident though this may seem, it is not true that the availability of information will be followed automatically by its use. The objectives of disease surveillance most often relate to government regulation, public policies, and other societal acts and decisions. Since the personnel involved in regulation and policy, as well as the public at large, seldom have expertise regarding the nature of disease or its surveillance, information from surveillance programs must be delivered to these groups in a form unobscured by jargon or technical language. A defined conduit for, and policy on, delivery of such information should be established at the earliest stages of a surveillance program.

The Canadian Cooperative Wildlife Health Centre

The CCWHC was established because of the perception by wildlife disease specialists at Canada's 4 veterinary colleges that the collective knowledge about wild animal diseases in Canada was insufficient to meet the needs of society. Existing knowledge was fragmentary and much of the data generated about the occurrence of disease in wild animals was not assembled or processed in such a way as to be usable. No national agency, public or private, had a mandate to undertake general surveillance of wild animal diseases. At the same time, health and disease issues were becoming increasingly important in wildlife management and conservation efforts (1). Health issues had emerged as key factors in efforts to save endangered species, such as the black-footed ferret and the whooping crane (2,3). Disease in populations of bison and elk in national parks had emerged as intractable management controversies (4,5). The intranational and international movement of wild animals and game-farm species had become a common practice in which disease issues had led both to controversial regulatory actions to limit the potential spread of diseases and to major epizootics (6-8). Lyme disease and bubonic plague had caused renewed concerns about wild animals as reservoirs for important zoonotic diseases.

In the United States, the Southeast Cooperative Wildlife Disease Study had been established in 1954 to address wildlife health issues in the southeastern United States, and a National Wildlife Health Laboratory (now the National Wildlife Health Center) had been established in 1973 within the U.S. Fish and Wildlife Service to address such issues nationally for lands and species under federal jurisdiction. The work of these organizations had resulted in regional and national perspectives on the occurrence and importance of various wild animal diseases and in continental management plans for some migratory species. These latter included management plans for some major diseases in which Canada could not fully participate because it lacked equivalent organized expertise.

Founding principles

We considered a national program of general wildlife disease surveillance to be Canada's most pressing, long-term need. This would provide the inventory of diseases, causal agents, and affected species essential to management and conservation programs. Canada's large geographic area and modest tax base required that the surveillance program make maximum use of all existing surveillance activities. Such activities should not be duplicated but should be recruited into a cooperative program, with small strategic additions of human and financial resources. Because Canada's cadre of professional and avocational field personnel would be relied upon for detection of disease, considerable effort would be required to stimulate the interest of field personnel in disease as an aspect of nature and to provide the tools, information, and education such personnel would require to participate in disease surveillance. Pathologists at each of Canada's veterinary colleges would provide a core of diagnostic services for wildlife specimens, but the cooperation of provincial and federal veterinary diagnostic laboratories would also be sought. A national database of wildlife disease incidents would be required to manage the information derived from detection and diagnostic activities. Direct involvement of all of Canada's wildlife agencies in the operation of the surveillance program would be essential to both secure the cooperation of field personnel and assure that the information derived from surveillance would be available to those responsible for wildlife.

Establishment

A general plan for a national program in wild animal diseases was proposed to Canada's federal, provincial, and territorial wildlife directors in 1987. The Max Bell Foundation of Toronto offered \$150 000 over 3 y to help to establish the CCWHC, and the proposal was approved in principle in 1987, with provincial and territorial funding made contingent upon provision of funds by Environment Canada. Federal funds were committed in 1992 and the CCWHC began operation on the basis of a 5-year agreement.

Structure

The CCWHC consists of 5 units: 4 Regional Centres of Wildlife Health Services located at Canada's 4 veterinary colleges and a Headquarters Office located at the Western College of Veterinary Medicine in Saskatoon. Each Regional Centre serves the geographic region served by its host college (Figure 1). A faculty member with a special interest in wild animal diseases directs each Regional Centre. Additional faculty members at each college participate in the work of the CCWHC, and a small number of full-time and part-time positions for professional, technical, and secretarial staff are supported by CCWHC funds. Formal cooperative arrangements also exist with Lakehead University, Thunder Bay, Ontario, and the Centre for Coastal Health, Vancouver, British Columbia. The Headquarters Office provides central administration for the CCWHC and coordinates national activities. Governance is provided by a board of directors, consisting of representatives of sponsoring organizations, including the dean of

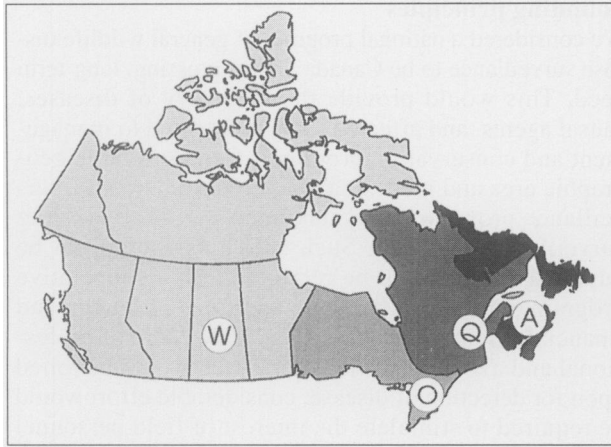


Figure 1. Regions of Canada served by the 4 Regional Centres of the Canadian Cooperative Wildlife Health Centre. A — Atlantic Regional Centre, Charlottetown, Prince Edward Island.; Q — Quebec Regional Centre, St-Hyacinthe, Quebec; O — Ontario Regional Centre, Guelph, Ontario; W — Western and Northern Regional Centre and Headquarters Office, Saskatoon, Saskatchewan.

Table 1. Mandate of the Canadian Cooperative Wildlife Health Centre

1. Provision of information about wild animal diseases to all sectors
2. Development and operation of a national database of wildlife health information
3. Diagnosis of diseases in free-ranging wildlife
4. Field investigation of wildlife disease incidents
5. Educational programs in wildlife health and disease

one of the veterinary colleges, and chaired by the director general of the Canadian Wildlife Service. Two codirectors provide overall administration to the CCWHC.

Wildlife disease surveillance in Canada

A 5-point mandate was established for the CCWHC at its inception (Table 1). These points constitute the primary elements of its major activity: a national program of general wildlife disease surveillance. "Wildlife" is defined as free-living fish, amphibians, reptiles, birds, and mammals. The objectives of the surveillance program are to define fully the inventory of diseases, disease-causing agents, host species, and their geographic and temporal distributions in Canada; to monitor changes in this inventory over time; and to maintain a system capable of detecting new or emerging diseases. These data are analyzed with the objective of identifying diseases that may influence wildlife management and conservation programs, or may affect the health of domestic animals or humans. A further objective is to make accurate technical information on wildlife health and disease readily available to wildlife professionals and to the public.

Detection

The surveillance program depends entirely on field personnel for detection of disease, and the CCWHC directs much of its activity and budget toward recruiting, stimulating, and maintaining the interest and participation of field personnel. Lectures, workshops, and short

courses on wild animal disease topics are presented to provide relevant information about health and disease. A pocket-sized handbook (9) has been published in both French and English as a basic tool and guide for people in the field. This manual contains practical information on collection of field data and specimens, whom to contact for help in all regions of Canada, basic precautions to avoid infection or injury, forensic issues, euthanasia, dissection, and carcass disposal. A CCWHC Newsletter, in French and English, is published 2 or 3 times each year. Each issue contains informative articles about particular diseases or health issues, as well as descriptions of disease incidents that have occurred recently in each region. The newsletter is distributed free of charge. A toll-free telephone number is maintained to provide field personnel with access to advice and assistance regarding their detection activities. No charge is made to field personnel for consultations or diagnostic examinations of wild animal specimens. These costs are covered by the global budget provided by the CCWHC's sponsors (In general, provincial diagnostic laboratories also do not charge their provincial wildlife personnel for diagnostic examinations). The results of diagnostic examinations are reported as quickly as possible to the people who provide the specimens, thereby providing feedback to their detection efforts.

Diagnosis

The veterinary diagnostic facilities and associated specialist laboratories of each veterinary college are available to the CCWHC for diagnosis of wild animal diseases on a cost-recovery basis. This support, through access to facilities and the discretionary time of faculty, makes possible the provision of diagnostic services at a fraction of the cost that would pertain if independent laboratories for these services had to be built, equipped, staffed, and operated. Diagnostic services are also provided by provincial and federal veterinary laboratories across the country. Thus, a broad range of veterinary diagnostic expertise of the highest quality is applied to the diagnosis of wild animal diseases in Canada.

Information management

The CCWHC has developed a national database of wildlife disease incidents. The database uses a relational database program (Paradox, Borland International, Scotts Valley, California, USA). Forty-four fields for information are available (Table 2). Diagnostic data are coded using the hierarchical coding system developed by the Veterinary Laboratory Services Branch of the Ontario Ministry of Agriculture, Food and Rural Affairs. The database can be searched by any combination of fields. Currently, only disease incidents from which specimens have been examined by the CCWHC or by provincial diagnostic laboratories are entered into the database. The database contained approximately 5000 records as of April 1996.

In addition to the national database, the CCWHC assembles and disseminates information regarding wildlife health and disease through telephone consultations and its newsletter. Regional Centres issue wildlife disease advisories to regulatory authorities regarding disease occurrences of particular importance

Table 2. Information fields within the Canadian Cooperative Wildlife Health Centre wildlife disease database

Incident information	Specimen information	Diagnostic information
Incident No.	Specimen number	Diagnosis tentative/final
Cross-reference numbers	Species (common and scientific names)	Primary diagnosis Category of diagnosis ^c
Location	Wild or captive	Coded diagnoses
Province/territory	Age	Data ownership ^d
UTM grid ^a	Weight Length (fish)	Pathologist Agency
Number present	Sex	Necropsy date
Number dead	Condition when found	
Number ill	Date of death	Summary ^e
Number submitted	How stored Date submitted	History ^e Necropsy ^e
Date found or reported	Type of specimen ^b	Histology ^e
Finder	Number examined	Bacteriology ^e
Finder's address	Submitter Agency responsible	Parasitology ^e Toxicology ^e Virology ^e Interpretation ^e

^aUniversal Transverse Mercator coordinates

^bWhole carcass, tissues, serum, etc.

^cBroad categories, such as, "infectious disease," "trauma," used in annual summaries

^dThe CCWHC reserves the right to release or publish data in summary form but will release detailed information on individual records only if permission to do so has been given in advance or is obtained subsequently from the person or agency that supplied the data

^eThese are text fields containing complete descriptive information regarding the diagnostic examination of the specimen

to their jurisdictions, and special reports to sponsoring agencies are prepared upon request.

Use of information

The objective of the surveillance program of the CCWHC is to make surveillance data available to the public and to those responsible for policies and procedures applied to wildlife management and conservation, domestic animal health, and public health. The CCWHC has no direct role in shaping government policies and regulations, nor has it such a role in nongovernment wildlife organizations. Nonetheless, the CCWHC has been successful in providing information to those responsible for policies and regulations, so that health and disease issues are included in the decision-making process. The governance structure of the CCWHC also ensures that both government and nongovernment wildlife agencies are informed regularly.

The value of wildlife disease surveillance

The target annual budget of the CCWHC is \$550 000 (the actual annual budget has varied from \$350 000 to \$500 000), exclusive of the very considerable annual support in the form of facilities and faculty time provided by the veterinary colleges and their home universities. What does society derive from such expenditure? Demand for the services offered by the CCWHC during its 1st 4 y indicates that the organization is serving a very real societal need. Annual requests for information from all sectors now exceed 2000 per year. Approximately 1200 wild animal specimens are submitted annually to

the CCWHC for diagnosis, and 15 to 30 field investigations are carried out. Over 1500 copies of the handbook (9) have been purchased for field personnel. The Newsletter is distributed to over 1700 recipients. Short courses have been attended to capacity, and there have been hundreds of additional requests for the printed notes developed for these courses. The CCWHC provided Canada's expertise in wild animal diseases to the Commission for Environmental Cooperation in its investigation of mortality of migratory waterfowl at the Silva Reservoir, Mexico, in 1995 and is the principal source of information for the Working Group on Wildlife Diseases of the International Office of Epizootics.

The surveillance data assembled by the CCWHC has found wide application in the 3 intended areas: wildlife health, domestic animal health, and public health. Knowledge of wild animal diseases in Canada has improved; new diseases, such as canine distemper in bobcats, lungworm in muskoxen, and poisoning of eagles with certain insecticides, have been documented; and the distribution and host-range of well-known disease-causing agents have been clarified. Technical information regarding diseases and the risks they might pose has been provided to recovery programs for endangered species, translocation programs for wild and domestic animals, management programs for waterfowl, and agencies responsible for environmental quality. Surveillance data have implicated pollutants as causal factors in disease incidents, but have also shown some widely publicized accusations of such associations to be erroneous. The CCWHC has monitored

the occurrence and distribution of infectious diseases of importance to agriculture, such as Newcastle disease in cormorants and infection with *Mycoplasma gallisepticum* in song birds, and it participates in programs to monitor rabies, brucellosis, and tuberculosis, among others. The CCWHC has undertaken active surveillance programs for Lyme disease in Ontario and hantavirus, tularemia, and plague on the prairies, and has assembled data on the occurrence of a wide range of zoonotic agents.

The veterinary profession also has benefited from the establishment of the CCWHC. At the veterinary colleges, there has been improved access to wildlife-related teaching materials for undergraduate and graduate programs and a greater public recognition of the veterinary profession's role in environmental issues. Research programs based on data from wildlife disease surveillance have been initiated at all 4 colleges. Cooperation among the colleges associated with the CCWHC has fostered further coordination and joint projects, including establishment of the cooperatively offered elective course in ecosystem health. New career opportunities for veterinarians in wildlife health have been created, both directly within the CCWHC and indirectly by demonstrating the important role of veterinarians on the multidisciplinary teams engaged in wildlife management and conservation.

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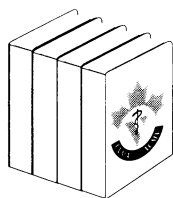
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- ◆ Petersen GV. *Proceedings of Cattle Sessions, Second Pan Pacific Veterinary Conference*. Veterinary Continuing Education, Massey University, New Zealand, 1996. 313 pp. ISSN 0112-9643. \$50.00 US
- ◆ Petersen GV. *Proceedings of Equine Sessions, Second Pan Pacific Veterinary Conference*. Veterinary Continuing Education, Massey University, New Zealand, 1996. 170 pp. ISSN 0112-9643. \$40.00 US

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- ◆ Ritchie BW, Harrison GJ, Harrison LR, eds. *Avian Medicine: Principles and Application*. Wingers Publishing, Lake Worth, Florida, 1997. 809 pp. ISBN 0-9636996-5-2. \$69.00 (+SH) US
- ◆ Tilley LP, Smith FWK. *The 5 Minute Veterinary Consult: Canine and Feline*. Williams and Wilkins, Baltimore, Maryland, 1997. 1287 pp. ISBN 0-683-08257-4. \$75.00 US
- ◆ Tully TN, Shane SM. *Ratite Management, Medicine, and Surgery*. Krieger Publishing Company, Melbourne, Florida, 1996. 214 pp (cloth). ISBN 0-89464-874-8. \$59.00 US