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Canadian Cooperative Wildlife Health Centre

Centre Canadien Coopératif de la Santé de la Faune

Newsletter Volume 6 - 2, Winter 1999

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New Staff Member/Quebec Regional Centre

Dr. André Dallaire obtained his DVM from the Faculté de médecine vétérinaire, Université de Montréal in 1988. He was in private practice for 4 years, working with small animals and exotic species in Rimouski and Québec City. Even at that time he was known to do « in house » necropsies. He returned to his *alma mater* to obtain a M.Sc. degree, studying chronic exposure of mustelids to methylmercury. His main interest was to evaluate ultrastructural changes in the kidneys of mink. This further increased his interest in pathology, to the point that he applied for a residency program in morphologic pathology at the Atlantic Veterinary College (University of Prince Edward Island) where he obtained the M.Sc degree, completing this program in June and joining the CCWHC in Saint-Hyacinthe in August. Dr. Dallaire can be reached at andre.dallaire.2@umontreal.ca or at (450)773-8521 extension 8346.

Road Salt and Small Birds (request for specimens)

Consumption of road salt is suspected to kill passerine birds throughout Canada but occurrence of this is poorly documented (CCWHC Newsletter 3[2].) Preliminary experiments by CCWHC and the Toxicology Research Centre, with funding from Environment Canada, indicate that behavioural changes can occur rapidly after ingestion of 1 or 2 salt granules. We want to document occurrence of salt toxicity under "natural conditions". People observing birds dead along roads where salt has been applied are encouraged to collect and freeze fresh carcasses. Blood samples from sick birds, to determine serum or plasma salt concentration, are also useful. Samples should be submitted to the nearest CCWHC regional centre. (Trent Bollinger - CCWHC, Western/Northern Regional Centre; Mark Wickstrom, Toxicology Research Centre, University of Saskatchewan).

International Cooperation in Wildlife Forensics

In September, P-Y Daoust (Atlantic Region) and G. Wobeser (Co-Director) attended a joint meeting of the North West Association of Forensic Sciences and the North American Wildlife Enforcement Group (NAWEG). Our participation was supported by the Commission for Environmental Cooperation (CEC), an organization established as a side agreement to the North American Free Trade Agreement. CEC strives to build cooperation among Mexico, the USA and Canada for conservation and environmental protection NAWEG is a network of wildlife enforcement officials from the 3 countries. One cooperative activity of CEC and NAWEG is improvement of wildlife forensic capacity in North America.

The 3 countries were represented at the meeting. The content was a blend of technical subjects, such as crime scene investigation and DNA methods, and planning international cooperation. An important step was production of a draft directory of wildlife forensic laboratories by NAWEG and CEC. It was agreed to establish a wildlife forensic working group in Canada and to determine what forensic capability is required for wildlife enforcement. CCWHC is part of the working group and will work with other laboratories to provide forensic service.

West Nile Virus and other Zoonotic Arboviruses in North America

West Nile Virus (WNV) caused epidemic disease in humans, horses and wild birds in the New York City area in August to October this year. This is its first recognized occurrence in North America, and media reports often implied that it is a new and unusually important threat to public health in the New World. WNV is indeed new and worthy of attention from public health agencies. It is, however, only an addition to a list of broadly similar viruses native to North America that cause similar disease in people. These viruses collectively are called "arboviruses"; "arbo", derived from "arthropod-borne", signifies that the viruses have life cycles that involve arthropod hosts (mosquitos and ticks) which transmit the viruses among vertebrates. "Arbovirus" is not a taxonomic classification; these viruses belong to several different taxonomic families but are similar in ecology, and in the diseases they cause in people.

Seven arboviruses that can cause human disease occur in Canada (Table 1). Western Equine Encephalitis Virus (WEE), Eastern Equine Encephalitis Virus (EEE), St. Louis Encephalitis Virus (SLE), Snowshoe Hare Virus (SSH), and Jamestown Canyon Virus (JCV), are transmitted by mosquitos. Powassan Virus (POW) and Colorado Tick Fever Virus (CTF) are transmitted by ticks. It is not known whether or not WNV, a mosquito-borne virus, has arrived in Canada from the outbreak in the bordering State of New York (investigations are currently underway).

Each virus lives in a cycle of transmission between its mosquito or tick host and a range of birds and/or mammals that are its normal vertebrate hosts. Normal hosts appear to suffer little or no clinical disease. Periodically, the viruses are transmitted to animals that are not their normal vertebrate hosts. These unusual hosts, which can include humans, sometimes become clinically ill from infection. The viruses are not contagious from person to person, nor do abnormal hosts carry enough virus in their blood to infect mosquitos. When these viruses produce illness, it can take the form of generalized, flu-like disease, or encephalitis (inflammation of the brain). Encephalitis can be fatal, and many who survive arbovirus encephalitis suffer permanent brain damage and debility. Thus, although these diseases are not common, they can be severe and, because they are caused by viruses, there are no drugs to treat them. There are no commercially-available vaccines to protect people against any of these arbovirus diseases, although vaccines are available to protect horses against WEE and EEE. Mosquito-vectored arbovirus infections in Canada are most common from mid-summer to fall; tick-borne arbovirus infections are most common in spring and summer.

Western Equine Encephalitis Virus has been reported across south-central Canada from approximately Lake Superior to the Rocky Mountains, but also has occurred in BC. Disease in humans and horses has occurred most often in SK and MB. WEE normally cycles among passerine birds and several species of mosquito. WEE causes encephalitis in people and horses from time to time but the incidence in humans and horses varies greatly from year to year. An epidemic occurred in the prairie provinces in 1941 in which 1094 human cases were recorded. In 1937-38, 52,500 horses suffered clinical disease and 15,000 died. However, most people infected with WEE suffer only mild disease or no disease at all. Children are more likely to suffer disease than are adults; approximately half of children under 1 year of age become ill if infected, while slightly less than 1in 1,000 people aged 14 years or older become ill if infected. The mortality rate from WEE is reported to range from 8 to 15% in people who develop clinical disease.

Eastern Equine Encephalitis Virus has been detected in ON and PQ, but the centre of its distribution is the eastern and southeastern United States. The virus normally cycles among birds and a bird-feeding mosquito. Of North American arboviruses, EEE appears to be the most severe human pathogen; approximately 33% of people who develop EEE encephalitis die of the disease, and many survivors are permanently incapacitated. However, EEE is not a common human disease; there have been only 153 cases recorded in the United States in the past 35 years. EEE causes periodic epidemic mortality in horses, and also causes severe disease in some wild and domestic birds, including whooping cranes (*Grus americana*). This has been an important problem in establishment of captive and wild populations of whooping cranes east of the Mississippi.

St. Louis Encephalitis Virus, named for St. Louis, MO, has caused human disease in MB, ON and PQ,and was found once in a mosquito in SK. SLE is widely distributed throughout the USA, Mexico, Central and South America. Like WEE and EEE, SLE virus cycles among wild birds and bird-feeding mosquitos. Disease in Canada due to SLE is not common; 66 human cases occurred in a short-lived epidemic in southern ON in 1975, and there were four cases in 1976. One clinical case of disease and serological evidence of non-symptomatic infection in people was reported in PQ during the 1970's, and there was a confirmed case in MB in 1975. It is estimated that < 1% of human infections with SLE result in recognizable disease; when disease occurs, 5% to 30% of affected people die. Elderly people are at greatest risk of severe disease if infected with SLE virus. Disease caused by SLE has not been recognized in wild or domestic animals.

Powassan Virus, first recognized in a fatal case of encephalitis in a child in Powassan, ON in 1958, normally cycles among ticks and wild mammals, particularly rodents. In Canada, POW has caused clinical disease in people in ON and PQ, and has been isolated from wild mammals and ticks in ON. Antibodies against POW have been reported in wild animals from BC, AB, ON and NS. It has been found in three species of tick (*Ixodes marxi, I. cookei,* and *Dermacentor andersoni*) in ON. Human disease from POW virus is rare. About 10% of people who have developed disease from infection with POW have died as a result. No epidemics of disease due to POW have been reported.

Snowshoe Hare Virus is a mosquito-borne virus reported from all 10 provinces, the YT and the NT. (There appear to be no reports from the area that now is Nunavut). It cycles normally among wild mammals and mosquitos. Human exposure to the virus, based on antibodies, has been documented in BC, AB, SK, MB, ON, PQ, NB and NS, and human disease (all non-fatal) has occurred in ON, PQ, NB and NS. Cases of non-fatal disease in horses have been reported in SK and ON. Antibodies to the virus occur in a wide range of mammals, including hares, rodents, carnivores and ungulates. The virus has been found in many species of mosquito.

Jamestown Canyon Virus is closely-related to SSH. It has been found in NF, PQ, ON, MB and SK, and has caused a case of human disease in ON and in the NT. It cycles normally among mosquitos and wild mammals; white-tailed deer (*Odocoileus virginianus*) appear to be the most important natural host. Relatively little is known about this virus. In a series of 12 human cases reported in 1981, 11 recovered and one died.

Colorado Tick Fever Virus cycles naturally among ticks and wild rodents and lagomorphs in western mountains at elevations between about 1,200 and 3,000m. It has been reported in AB and BC. It has been found in 8 species of tick, but the predominant tick vector is *Dermacentor andersoni,* and the distribution of CTF parallels that of *D. andersoni* at these elevations. CTF has never occurred as an epidemic in people, but occurs regularly at a low rate among people who share its habitat. About 10% of snowshoe hares (*Lepus americana*) sampled around Ottawa in 1962 had antibodies to CTF or some related virus, but this is well outside of the established range of CTF. Although fatal human cases of CTF infection have occurred, they are rare; only about 0.2% of people with clinical illness fail to recover.

West Nile Virus - Until 1999, WNV occurred only in Africa, Europe and southwestern Asia. It was first recognized in a human in West Nile Province, Uganda, in 1937. From 3% to 15% of people with WNV encephalitis die of the disease. The elderly are more likely to suffer severe disease. Of North American arboviruses, WNV is most closely related to SLE, so much so that the 1999 outbreak in New York was first thought to be an outbreak of SLE. Like SLE, WNV cycles normally among wild birds and bird-feeding mosquitos. The arrival of WNV in North America was first evident as mortality of wild birds, especially common crows (*Corvus brachyrhynchos*), followed by birds in a zoo. The first affected human entered hospital on 12 August. No linkage was made between disease in birds and people until veterinary and medical teams independently came to the conclusion that both were caused by SLE-like viruses. As of 21 October 1999, 56 human cases of WNV encephalitis had been identified in the New York outbreak, and 7 people had died. Twenty cases in horses had been identified as of 21 October, 2 died and 7 were destroyed. As of 27 October, WNV had been identified in 18 species of wild bird. Not all of these birds died of the infection, but they carried the virus. Crows appear to be the most susceptible North American species thus far recognized, and large die-offs have been reported. WNV had not been found in wild birds in Canada as of 23 November 1999.

It is assumed that WNV arrived in North America very recently and that it was imported by accident in association with some form of commerce. For the next year or so, surveillance for WNV will be intense in Canada and the U.S., particularly in spring 2000 when the virus may be carried north with migrating birds. Wildlife personnel should be especially vigilant regarding wild bird mortality, particularly of crows. Specimens should be collected, frozen if necessary, and submitted to the CCWHC or nearest provincial veterinary laboratory. Large-scale mortality of wild birds has not been associated with WNV infection in the Old World. Whether New World crows or other species will suffer significant mortality from WNV in the future, or will develop immunity sufficient to make the impact of WNV unimportant, remains to be seen. From the public health perspective, WNV is another encephalitis - causing arbovirus to add to the list. It merits attention, surveillance and intelligent management, but not panic.

Table 1.Arboviruses in Canada that have caused human disease (West Nile Virus [WNV] shown for comparison)

Virus	Virus family	Occurrence in Canada	Vertebrate Host	Arthropod Host
WEE	Togaviridae	BC,AB,SK,MB,ON	Wild birds	Mosquitos
EEE	Togaviridae	ON, PQ	Wild birds	Mosquitos
SLE	Flaviviridae	SK[1],MB,ON,PQ	Wild birds	Mosquitos
WNV	Flaviviridae	None known[2]	Wild birds	Mosquitos
POW	Flaviviridae	BC,AB,ON,QC,NS	Wild mammals	Ticks
SSH	Bunyaviridae	ALL provinces,YT,NWT	Wild mammals	Mosquitos
JCV	Bunyaviridae	NWT,SK,MB,ON,QC,NF	Wild mammals	Mosquitos
CTF	Reoviridae	BC,AB	Wild mammals	Ticks

[1] Only a single virus isolation from a mosquito in SK
[2] As of 30 November 1999

Disease Updates

Canada-wide Epidemic of Winter Tick in Moose

In late winter and spring of 1999, many moose (*Alces alces*) across Canada died in association with heavy infestations of the winter tick (*Dermacentor albipictus*). Information on this epidemic is incomplete, but there is clear evidence of occurrence from coast to coast across the boreal forest and forest fringe. High mortality of moose and tick-associated hair loss in surviving moose was reported from NB, ON, MB, SK, AB and BC. As examples of the problem, 16 dead moose were reported in Algonquin Park (ON) from 13 March to 20 April, and many more dead moose were found in the spring and summer. The proportion and severity of hair loss in moose surveyed from the air in ON was the worst ever noted in the 15 years this survey has been carried out. Margo Pybus, NRS-Fish and Wildlife, compiled field office reports for AB. [1] There were 1130 occurrence reports: 92% of moose had severe hair loss, 28% were dead and 43% of dead moose were calves. The female to male ratio among affected moose was 2:1. Early, warm spring weather with little snow cover, and hot summer weather appear to be conditions leading to high survival of female and larval winter ticks on the ground, and high rates and intensities of infection of moose in the fall. This results in epidemic disease when the ticks mature to adults on moose in late winter and spring the following year. Unfortunately, these climatic predictors of moose mortality from winter tick suggest that mortality may be high again in late winter and spring of 2000; spring was early and warm in many areas, and the summer hot in much of Canada's moose habitat in 1999. (CCWHC staff).

[1] Pybus, M. 1999. Moose and ticks in Alberta: a die-off in 1998-99. Occas. Pap. No. 20, Fish.Wildl. Mgmt. Div., AB Environ. (available from Information Centre, Tel. 780 422 2074).

Atlantic Region

Mortality among great black-backed and herring gulls in the Maritime provinces

Starting in mid summer and extending well into fall 1999, the Atlantic regional centre has received more calls about, and submission of, dead gulls than in previous years from widely scattered regions of the maritimes, including the north shore of NB, eastern PEI, and the south shore of NS. Fourteen great black-backed gulls (*Larus marinus*) (11 immatures, 3 adults) and 6 herring gulls (*L. argentatus*) (3 immatures, 3 adults) were submitted for necropsy. Of these, 18 birds were severely emaciated, and 16 had various degrees of respiratory aspergillosis, in most cases severe. One bird died from acute trauma and may have been shot. The cause of death of one adult herring gull was not determined. Starvation was considered to be the primary cause of death. Respiratory aspergillosis is an infectious disease caused by the fungus *Aspergillus*. Spores of this fungus are widespread in the environment but generally cause disease only in birds whose defense mechanisms have been weakened by stress or starvation. The diagnosis of primary starvation is supported by the predominance of immature birds in the submissions, since less experienced birds would likely be the first to suffer from reduced food availability. The large proportion of great black-backed gulls also suggests that the food shortage was tied to the marine environment, because these birds do not exploit urban areas and agricultural fields as much as the lighter and more agile herring gulls and ring-billed gulls (*L. delawarensis*).

These widely dispersed and more or less simultaneous instances of starvation among gulls suggest a pattern common to the waters around all three Maritime provinces. However, further interpretation is impossible without specific information on the current dynamics of the gull populations. If there was an actual reduction in food supply available to gulls in the marine environment, this must not have been felt until after the young had fledged from the breeding colonies. Otherwise, nestlings would have suffered the brunt of food shortage, and mortality would have been much less conspicuous to the general public. Conversely, fledging rates may have been particularly high this year, providing a larger pool of immature, inexperienced, birds which were unable to fend for themselves. Lastly, greater awareness of the existence of CCWHC's Atlantic regional centre may have increased the reporting rate for these mortalities. Although this is possible, people who called about mortalities emphasized the unusual number of dead birds, as compared to what had been observed in previous years.

Although this apparently widespread mortality among gulls remains unexplained, it illustrates one value of the disease surveillance program provided by the CCWHC, namely its function as a repository of information on wildlife health gathered from different regions. Individual submitters were originally concerned that the mortality among gulls reflected local problems, such as environmental pollution, until they learned about the far more widespread nature of these mortalities. (Pierre-Yves Daoust and Scott McBurney, CCWHC - Atlantic region; Tony Lock, Canadian Wildlife Service, Dartmouth, NS).

Intraspecific killing in common loons

On May 6 1999, two common loons (*Gavia immer*) were observed fighting viciously nearly all day on a lake on Cape Breton Island, NS. At approximately 6:00 pm, the observer, passing on his boat by the area where the birds had fought earlier that day, saw a dead loon in the water. It was an adult female in good body condition. The only lesions identified grossly were of an acute traumaticnature and consisted of extensive hemorrhage in the subcutaneous tissue along the right flank and the base of the right leg and, intraabdominally, around both kidneys. There was a single puncture wound in the skin above the right flank and possibly extending through the abdominal wall.

Common loons are well known for their aggression toward each other, particularly during the breeding season, and also for attacking and killing young birds of other species (e.g., Common loon kills ducklings. McGrath 1989,. Blue Jay 47(3): 145-6). However, instances of intraspecific killing rarely are witnessed. Over the years, we have also observed a few common loons with focal areas of subcutaneous inflammation associated with embedded small feathers near the caudal region of the keel bone. We have interpreted these lesions as having resulted from conspecifics swimming underwater and striking with their beaks the underside of the body of these birds. (Pierre-Yves Daoust, CCWHC - Atlantic region; Terry Power, NS Department of Natural Resources).

Quebec Region

Poxvirus and multiple tumors in a grey squirrel

A grey squirrel (*Sciurus carolinensis*), about 4 ½ weeks old, was found in a backyard in Montréal. The animal was caught by a dog; the owner managed to free it and sent it to a rehabilitation center for animals (Urban Animals Advocates). The animal was treated for shock but, unfortunately, died a few hours later, and was submitted for necropsy to the CCWHC - Quebec Region. The animal was markedly thin and had cutaneous lacerations over the cranium. The major gross findings were many whitish soft masses on the skin and round, slightly firmer, whitish masses that encompassed at least 50-60% of the lung. Microscopically, the skin lesions were consistent with fibropapilloma. Both epidermal cells and fibroblasts contained intracytoplasmic acidophilic inclusion bodies compatible with those caused by a poxvirus. The lung masses were also tumours (bronchoalveolar adenomas). Epithelial cells within these masses contained intracytoplasmic acidophilic inclusions, as did fibroblasts within the liver and cells of the epithelium and glands of the tongue. It is possible that death of this individual was related to shock and cardiorespiratory collapse, considering the extent of the pulmonary lesions.

Poxviruses cause tumors or tumor-like lesions in humans and in a variety of other animal species, including Yaba disease in African monkeys, *Molluscum contagiosum* in man, lumpy skin disease in cattle and myxomatosis in rabbits. Spontaneous fibromas of the skin have been described in grey squirrels and a case of numerous skin fibromas in a moribund juvenile grey squirrel was reported (O'Connor *et al*, JAVMA, 177: 792-795) in which fibromatous proliferations in the wall of the alimentary tract, a lymph node and the heart were also described. That animal also had tumours in the kidney and lung. All lesions had acidophilic intracytoplasmic inclusions bodies. The authors reported that multifocal tumors, similar to those in our case, developed only in juvenile squirrels, suggesting the immune system of the host might inadequately interact with the virus. Unfortunately in this case, other immature individuals from the same nest were not available for evaluation. (André Dallaire, CCWHC - Quebec Region).

Circovirus infection in a rock dove

A female rock dove (*Columba livia*), found in a park in Westmount (Montréal) had rapid, difficult breathing and tremors. The bird collapsed, died and was submitted for necropsy. It was in good body condition. The crop was distended by corn kernels admixed with a whitish fluid. Its wall was markedly thin and friable. Other internal organs were unremarkable. Microscopically, lymphoid nodules of the bursa of Fabricius were hyperplastic and the center of many nodules contained large cells with prominent blue cytoplasmic inclusions. These occasionally filled the entire cytoplasm of the cells. Using electron microscopy, virus particles arranged into paracrystalline arrays compatible with a circovirus infection, were found in the inclusion bodies. In a section of duodenum, small coccoid organisms were seen adhering to the brush border of enterocytes. The organisms were round, slightly basophilic and measured approximately 2.0 to 3.0 um in diameter (suggestive of *Cryptosporidium* sp).

Circovirus infection has been reported in racing pigeons and commercial pigeon breeders (Paré *et al*, 1999, Can Vet J, 40:659-662). The pigeon circovirus may be similar to the psittacine circovirus (agent of Psittacine Beak and Feather Disease) in causing immunodeficiency and associated secondary infections (Woods *et al*, 1994, J Vet Diagn Invest 6:156-164). Autolysis within intestinal sections precluded determining precisely the extent of crytosporidiosis infection, but one could speculate that the circovirus infection might have predisposed this individual to intestinal cryptosporidiosis. *Cryptosporidium* has usually been associated with respiratory problems in domestic birds. We are not aware of any previous report of circovirus infection in a "free ranging " rock dove from an urban environment. (André Dallaire, CCWHC - Quebec Region).

Fatal *Sphaeridiotrema* sp infection in lesser scaup - part II

Five lesser scaup (*Aythia affinis*) found dead in November 1998 on the shore of the Saint-Lawrence

River, in a park in Montréal, had hemorrhagic enteritis associated with numerous trematodes (*Sphaeridiotrema pseudoglobulus)* in the intestine (CCWHC Newsletter 6 (1). Dead ducks were again reported along the shores of the Saint-Lawrence River in an urban park in the Montréal area this fall. Extremely weak moribund birds were also observed. Wildlife agents reported that possibly 45 to 50 ducks were dead. Most were lesser scaup.

Thirteen lesser scaup and one black duck (*Anas rubripes*) were submitted for necropsy to the CCWHC - Quebec Region. All had similar gross findings. Many were in poor body condition and had pale skeletal muscles. The intestinal content varied from greenish to hemorrhagic and contained many flukes. In some individuals, the intestinal mucosa was covered with layers of a fibrinonecrotic material. The parasites were small trematodes compatible with *Sphaeridiotrema* sp. The heart in some birds also had poorly delineated pale foci that were areas of myocardial necrosis associated with Gram + cocci. The intestinal loops with obvious enteritis often had a predominantly Gram + bacterial flora with abundant cocci. These findings suggest that generalized bacterial infection resulted from the parasitic enteritis. The poor body condition noted in most birds along with the pallor of the skeletal musculature indicates the enteritis was a long standing problem. (André Dallaire, CCWHC - Quebec Region).

Ontario Region

Botulism type E in fish-eating birds, Lake Erie and Lake Huron

Significant numbers of mainly fish-eating birds have died this autumn on southeastern Lake Huron and along the northwest shore of Lake Erie in ON. On Lake Erie, minor mortality was noted throughout September, with an increase about 28 September that persisted for a few days, and a larger episode beginning 26 October that subsided in mid-November. About 90% of birds found were red-breasted mergansers (*Mergus serrator*), though horned grebes (*Podiceps auritus*), diving ducks, ring-billed, herring, and Bonaparte's (*L. philadelphia*) gulls, and common loons also were affected. Mortality was likely 1000's of birds, with 1-2 carcasses per 10 m of beach in some localities. On Lake Huron, beached carcasses were observed beginning about 14 October, with a notable increase on 23-24 October. Approximately 90% were common loons. Fewer mergansers, grebes, red-throated loons (*G. arctica*), some diving ducks, ring-billed and Bonaparte's gulls also were reported. Based on carcass counts, at least 700 loons died. Live sick loons had flaccid paralysis, and some were rehabilitated and released.

Earlier, in late July and early August, many gulls and sanderlings (*Crocethia alba)* were found dead on beaches at Point Pelee (Lake Erie) after a large fish die-off in the area. We were unable to confirm botulism in these birds, but no other disease was recognized.

Testing of samples is ongoing. Botulism type E has been confirmed in common loons from Lake Huron, mergansers from both lakes, and ring-billed gulls from Lake Erie. Samples from the earlier summer incident on Lake Erie will be retested in an attempt to confirm that botulism was present at that time. The clinical signs, the lack of other lesions and the circumstances under which mortality occurred, all suggest that the late July-early August die-off of gulls and shorebirds was due to botulism, acquired from eating dead fish or invertebrates which scavenged fish carcasses. The fact that botulism was confirmed in gulls on the US side of the lake which died at this time strengthens this suspicion.

Other follow-up work includes identification of the fish being consumed, by examination of otoliths in fish remains in bird gizzards. There were reports of dead sturgeon (*Acipenser* sp.) washed up on shore during this same time period. One sturgeon, from southern Lake Huron tested positive for type E botulism. A mink farm in the area which was feeding fish from Lake Erie experienced significant mortality from botulism. The strain involved, however, has been identified as type B. It is unclear what the connection, if any, between this event and the die off of birds might be.

Type E botulism is associated with fish, and the majority of birds involved in these outbreaks were fish-eaters or scavengers. Even diving ducks, which are primarily mollusc feeders, had fish in their digestive tracts at the time of death. At this time of year, large rafts of migrating loons, mergansers and diving ducks rest and feed offshore in the affected areas. Episodes of type E botulism are periodically recurrent in fish-eating birds, especially loons, on the Great Lakes in late fall [see Brand et al.1988, J.Wildl. Dis. 24: 471-476,]. We diagnosed botulism as the cause of a smaller die-off of common loons in the Kettle Point-Grand Bend area in fall 1998. What is unclear are the circumstances under which fish become toxic. No unusual fish mortality has been detected in association with the episodes on Lakes Erie and Huron, and loons, mergansers and horned grebes would not be expected to consume dead fish.

There has been considerable speculation concerning the possible roles of changes of climate, water temperature, water levels, floral and faunal shifts, in causing this epidemic, which, while not unprecedented, is unusual. The factors involved in outbreaks of type E botulism are not understood, and it is a problem that deserves further investigation. It may be an under-reported or often unrecognized disease. Dozens, rather than hundreds of loons were found dead on Lake Huron at approximately the same time in 1998. Botulism was confirmed in these birds, but the strain was not typed. In 1994, botulism was diagnosed in herring and ring-billed gulls from Goderich, also in the same area, during late November and early December. Typing of the strain was not attempted. Mortality in gulls, particularly on a small scale or in a restricted locality, may go undetected or may not raise the same concern as a similar event in a species such as the common loon. Loons are present within the region only during a restricted time period during migration, whereas gulls are potentially exposed over a much longer period of time.

The investigation, diagnosis, and communication of results, involved personnel from many public and private agencies, including birders, wildlife rehabilitators, staff of the Ministry of Natural Resources, ON Provincial Parks, ON Ministry of Health, Parks Canada, Canadian Wildlife Service, Health Canada, Bird Studies Canada, the Animal Health Laboratory of the University of Guelph and the Ontario regional laboratory of the CCWHC. (Douglas G. Campbell & Ian K. Barker, Ontario Region, CCWHC)

Gull mortality - Kitchener

A warehouse in Kitchener, ON, with a flat, gravel-topped roof (approximately 450,000 ft^2), has become a roosting and loafing site for thousands of ring-billed and herring gulls. It is not clear whether the site has been used for nesting, or whether birds colonized the site after fledging of young at other colonies. Since late August, personnel at the plant have dealt with ongoing mortality of birds on and near the roof. When the problem first became apparent, plant staff removed > 80 kg of carcasses, feathers and bones, representing > 300 carcasses. Since then, several carcasses have been picked up daily. An estimated 100 birds died during October, and 5-10 birds died per day during September. Birds were still dying in low numbers in mid-November.

Sick birds are weak or paralyzed. Some display a unilateral wing droop, others are weak and unable to fly. Plant staff report progression from inability to fly to dorsal recumbency and death. CCWHC personnel have visited the site and examined small samples of clinically affected, live birds on 3 occasions. Findings in the two species are quite different.

Both juvenile and adult herring gulls were examined. Body condition was variable. Two birds in poor condition had aspergillosis (a fungal infection of the lungs). The others had no significant gross lesions. A sample of pooled serum tested negative for botulism. Attempts to isolate virus from kidney, brain and pancreas were unsuccessful. Serological tests showed no evidence of exposure to influenza virus, while all birds had detectable titres to paramyxovirus I, ranging from 1:8 to 1:128. Histologically, there was occasional very mild non-suppurative inflammation of peripheral nerves and ganglia, and interstitial inflammation in the kidneys.

In contrast, all ring-billed gulls examined were emaciated juveniles. Two had severe aspergillosis; the others had no significant gross lesions. Histologically, 4 of 6 birds had large basophilic inclusion bodies in lymphoid cells of the bursa of Fabricius, spleen, and lymphoid tissue of the large intestine. By electron microscopy, these were identified as viral particles, compatible with circovirus. Pooled serum samples were negative for botulism. The three birds tested for antibodies to paramyxovirus I all had titres ranging from 1:8 to 1:32. No birds had detectable antibodies to avian influenza, although an influenza virus was isolated from one bird. This virus was typed as H13 by the Canadian Food Inspection Agency (Winnipeg). No other virus was isolated from these birds.

Emaciated juvenile ring-billed gulls are seen commonly in ON in late summer and early fall. Birds examined in the past have tested negative for exposure to pesticides and related compounds, and to known infectious agents. The conclusion has been that the birds died of emaciation due to a shortage of food at this time of year. This may be the case, but the presence of a circovirus suggests that there may also be underlying disease that contributes to the condition of the birds. Retrospective examination of earlier cases suggests that circovirus- like inclusions were present in birds at least as far back as 1983. Circoviruses are a relatively recently recognized family of viruses associated with loss of body condition and increased susceptibility to infectious agents, a pattern of disease compatible with what is seen in the juvenile ring-billed gulls.

The influenza virus isolated from one bird is of a strain, H13, that is strongly associated with gulls, and has been previously isolated from gulls from many locations. It is unclear whether there are pathogenic effects associated with its occurrence. It is surprising, and perhaps significant, that all birds tested had detectable antibodies to paramyxovirus I (Newcastle Disease virus). The titres were low, but, in comparison, of 149 gulls and terns tested in ON during the 1992 epizootic, only 1 had detectable antibody .

It appears that the ring-billed gulls are dying as the result of a combination of factors that likely includes emaciation, infection with a circovirus and opportunistic infections such as aspergillosis. In contrast, it is not clear what is causing the death of herring gulls, and further investigation is required. (Douglas G. Campbell, Ontario Region, CCWHC) [Editor's note: Juvenile ring-billed gulls with lesions of circovirus infection, and from one of which influenza virus was isolated, also were found in SK this autumn].

Western/Northern Region

Pneumonia and Septicemia in Dall's sheep, Mackenzie Mountains, NT, 1999

In June, a 10-year-old Dall's ewe (*Ovis dalli)*, was found dead in the Mackenzie Mountains (65°3' N, 127°41'W). Findings included severe chronic bronchopneumonia, pleuritis, dehydration and emaciation. Microscopically, adult parasites, larvae, and eggs, associated with granulomatous inflammation, were present in the lungs. The bacterium *Arcanobacterium pyogenes* was cultured from several organs.

In July, an 8-year-old ewe was found dead in another area of the Mackenzie Mountains (64°20'N, 128°00'W). It also had severe chronic broncho-pneumonia, as well as severe dental abnormalities. Microscopically, adult parasites, larvae and eggs were seen in the lung. There was a mixed infection of *A. pyogenes* and a *Mannheimia granulomatis*-like organism. A few *Protostrongylus* sp. larvae were detected in the feces.

In September, an 11.5 year old ram was collected by a hunter (64°20'N, 129°30'W). It was lethargic, in close proximity to another ram in acute respiratory distress, and both were being ostracized by healthy rams. Only a portion of lung was examined, from which *A. pyogenes* was cultured. A few degenerate dorsal-spined larvae were also recovered from the lung. On the same day, another outfitter reported three dead sheep, which appeared to have died from natural causes with no evidence of predation.

Arcanobacterium pyogenes has been isolated from pneumonia in bighorn sheep (*Ovis canadensis)*, and is presumed to be stress-associated. The finding of the *M. granulomatis*-like organism was unexpected. Using routine biochemical tests, this bacterium would have been characterized as *M. haemolytica*-like. The bacterium has been submitted for genetic testing to determine if it is indeed *M. granulomatis*, an organism that has been isolated from bovines in Brazil and hares.

The significance of these cases is not known. This is the first time in 24 years of non-resident hunting that dead sheep have been reported to the wildlife managers. Census data paints a promising picture of the health of the Mackenzie Mountain Dall's population, with excellent lamb-ewe ratios and stable overall counts. Despite this reassurance, we have concerns about the possibility of unrecognized mortality due to pneumonia, which is one of the major mortality factors in bighorn sheep.

To address the paucity of data on normal parasitic and bacterial fauna of Mackenzie Mountains Dall's sheep, wildlife managers of this region, in partnership with the CCWHC/WCVM, are launching a project in 2000, involving planned collections, opportunistic hunter-killed data, and complete necropsy of natural mortalities. (Emily Jenkins, Susan Kutz, Department of Veterinary Microbiology, University of Saskatchewan, Alistair Veitch, Brett Elkin, Department of Resources and Economic Development, NT).

Crash-landing Cranes

In mid September, 1999 AB Natural Resources Service (NRS) in High Prairie received a call from the public concerning dead sandhill cranes (*Grus canadensis*) in a ditch near Kinuso, AB (55°15' N, 115°30' W), adjacent to the south shore of Lesser Slave Lake. Four dead adult birds were collected, frozen, and submitted to the Alberta Agriculture Regional Veterinary Diagnostic Laboratory in Edmonton. Many dead grasshoppers were found in the vicinity of the dead birds and there was evidence of recent herbicide application in the area. At necropsy, the birds were in good body condition, although there was extensive autolysis in the carcasses. All four had extensive trauma to the sternum. There were multiple fractures and extensive hemorrhage around the heart, pleura, and thoracic inlet. There were no external wounds nor wing, head, or leg injuries. There was no evidence that these birds had ingested grasshoppers or any other recent food. Lesions in all four were consistent with death due to blunt trauma to the ventral surface and it appears these cranes simply flew into the ground. We have seen this on a few other occasions in other species. It seems to occur at dawn or dusk when there is heavy overcast sky and thick ground fog, particularly during migration periods. It seems the avian navigational systems are fouled by the fog and birds simply are not aware that the ground is so close. As a result, they crash-land. Similar conditions also can result in collisions with vertical objects in the flight path. Further investigation by the local officer verified that a few days prior to the birds being reported, there had been thick fog that virtually obscured visibility at ground level. (M.J. Pybus, Wildlife Disease Specialist, Alberta NRS-Fish and Wildlife and D.K. Onderka, Veterinary Pathologist, AB Agriculture, Food, and Rural Development, Edmonton)

Mountain Sheep in British Columbia

Beginning in the summer of 1998, a group of Rocky Mountain bighorn sheep which spends much of their year in a coal mine pit had a high percentage of animals with episodes of dry coughing. It was hot, dry and dusty, and the coughing was not thought unusual until a ram was found dying. Several animals were found sick or dead in the next several months and ill animals were shot for necropsy and sample collection. Chronic pneumonia with abscessation was present in all examined, with histological patterns of a chronic inflammatory reaction, considered to be suggestive of a viral or mycoplasma infection. The population had never experienced obvious mortality like this before, so an intensive monitoring program was developed and instituted throughout the rut and winter. No significant mortality was seen and the outbreak appeared to be self-limiting. The pattern of disease was consistent with an infectious agent of high morbidity, low mortality, with secondary bacterial invasion. We were unable to identify the primary agent but fortunate in seeing a limited effect.

Another study was initiated to evaluate reports of hair loss in a small wintering population of Stone's sheep (*Ovis dalli stonei)*. The animals were confirmed to be infested with *Dermacentor albipictus,* the winter tick, with significant hair loss in several animals. Samples were collected for health testing and three animals were radiocollared. The study is hoped to be continued as a pilot for Stone's sheep health evaluation and to identify the reasons why this tick is so numerous and causes such intense reaction in sheep in this area. (H. Schwantje, BC Ministry of Environment, Lands and Parks).

Online @ http://wildlife1.usask.ca/newsletters/newsletter6-2.htm