2008 Wildlife Disease Manual for Lake Louise, Yoho, and Kootenay National Parks

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Purpose of This Manual

This manual was developed for three reasons:

1) To provide clear direction to Lake Louise, Yoho and Kootenay (LLYK) field unit staff on sampling for disease detection when investigating animal deaths;

2) To keep staff informed on potential wildlife diseases; and

3) To emphasize the necessary personal safety pre-cautions when handling diseased or dead wildlife.

There are two versions of this guide, this version (the master document) and a condensed handbook version. The condensed handbook version gives a summary of field necropsy instructions as well as sampling, shipping and safety requirements for the field.

This manual gives detailed information on wildlife diseases that are already in, or have the potential of infiltrating into the Mountain Parks. It includes a summary of diseases pertinent to the LLYK field unit. The wildlife disease summaries include information on target species affected by the disease, disease transmission to animals and humans, signs and symptoms of infection, sampling and safety precautions.

This guide is focuses on:

i) Wildlife and diseases/parasites found in the Lake Louise, Yoho and Kootenay National Parks and surrounding regions;

ii) Wildlife that are most likely to interact with people;

iii) Wildlife that are most likely to carry and possibly communicate disease;

iv) Wildlife diseases that are transmissible to humans either through contact or consumption (zoonotic diseases); and

v) Diseases most likely to spread in wildlife populations.

Laboratories and Diagnostic Facilities Available to the LLYK Field Units

The LLYK field unit does not have the lab facilities to conduct necropsies, and has limited resources for conducting field necropsies and/or transporting large carcasses. Hence, proper tissue sampling for wildlife diseases is imperative to tracking wildlife disease occurrences in the Mountain Parks.

The two main options for diagnostics and/or necropsies in the LLYK field unit are: the Abattoir in Banff and the Invermere Veterinary Hospital. Space in the walk-in freezer of the Banff Abattoir is limited, so it is recommended that the LLYK field unit send samples to Banff only when they are part of an established Parks surveillance program (i.e. CWD, West Nile, Avian Influenza, Liver Flukes etc.). The Abattoir has a veterinarian from the Calgary Zoo visit the Banff facility periodically to perform necropsies. Alternatively, samples are pooled and then submitted by Banff to the Canadian Cooperative for Wildlife Health Center (CCWHC) in Saskatoon or the Animal Disease Research Institute (ADRI) in Lethbridge for analysis.

The CCWHC, British Columbia and Alberta provincial authorities can also be used for laboratory analysis. However, these organizations should primarily be used for dead corvids or other birds, or for established provincial/national surveillance programs.

Other samples, which are not part of an established surveillance program, should be sent to the Invermere Veterinary Hospital for diagnostic services. Fecal samples can be analyzed for parasites in Invermere; all other samples will be sent to a different lab on behalf of the LLYK field unit.

Dr. Mark Zehnder of the Invermere Veterinary Hospital is available for field necropsies if necessary, but may require up to 24 hours advance notice. In the event where a carcass is flown from the back country to the front country, Dr. Zehnder will perform a necropsy at the Veterinary Hospital, and can store samples until ready for shipment. The Invermere Veterinary Hospital does not have the capacity to store large carcasses, but can store smaller animals and necropsied samples from larger mammals. Dr. Zehnder is also available for questions if the Parks and Provincial Wildlife Veterinarians are unavailable.

A new Veterinary College is opening in Calgary as of fall 2007, once up and running there will be the opportunity for a possible partnership between the Mountain Parks and the University of Calgary's Faculty of Veterinary Medicine.

Contact information for the above mentioned organizations, laboratories and shipping instructions can be found in Appendices A, & H.

Unless otherwise mentioned, the CCWHC surveillance and field necropsy forms found in Appendices C & D should be used to record information for all samples. If you are sending the forms to a lab other than the CCWHC, strike out the address at the top left hand corner of the form and write the appropriate lab name and/or address in its place. Ensure the occurrence number and date are recorded on both forms.

Appendix C also houses the BC West Nile Virus Surveillance form. This form should be used for BC birds found between June 1 and September 30. For the remainder of the year, any birds found in BC should be sent to the CCWHC. Dead birds found in Alberta should be sent to the CCWHC year round.

Wildlife Disease - Additional Considerations

Keep in mind that this is not a comprehensive guide of wildlife diseases. Should more information be required, see Appendix A for additional information and contacts.

Guide Updates

In order to keep current with the emergence of new diseases, this manual should be updated periodically. Updates are recommended at least every three years. Information on new surveillance programs and diseases can be obtained from conversations with the Parks Canada Agency Wildlife Health Specialist (Dr. Todd Shury) at 306-966-2930. The contacts and web-sources listed in Appendix A should also be reviewed.

Data Collection

Awareness is the first step in preventing a wildlife disease epidemic. Collecting baseline data on the causes of wildlife mortality assist in assessing the status of wildlife health. Baseline data provides a measuring stick that allows for the early detection of new and potentially lethal diseases in wildlife populations. Thorough and consistent data collection is a key step in preventing a disease outbreak in wildlife populations. Data collection can be completed on the Canadian Cooperative Wildlife Health Center (CCWHC) surveillance form found in Appendix C. Parks Canada and the CCWHC have signed a Memorandum of Understanding for data submission.

Suspicious Deaths

Suspicious deaths should trigger a field necropsy (DO NOT perform a field necropsy on an animal you suspect of having a zoonotic or infectious disease). Field notes should be completed

on Field Necropsy Forms in Appendix D. Positive results should be communicated to the Parks Canada Wildlife Health Specialist (Dr. Todd Shury) and where warranted, the Canadian Food Inspection Agency and/or provincial wildlife veterinarian(s) (see Appendix A).

Where a road mortality also displays signs of suspected disease, a necropsy should be performed. Otherwise, road mortalities do not trigger a field necropsy unless a surveillance program is underway.

Follow-up of suspicious causes of wildlife mortality should always be recorded for future analysis of trends. The Parks Canada Occurrence Tracking System (OTS) is being updated to include specific criteria for tracking wildlife mortality and disease. Finalization of the OTS updates is expected to occur sometime in 2009.

Habitat and Climate Change Implications

Under the current conditions of rapid natural and anthropogenic change in the north and the rest of Canada, parasitic infections and diseases will continue to emerge, conceivably at an accelerated rate (Kutz et al, 2004). Diseases can also potentially jump from one species to another species where the disease has not been previously seen.

New parasitic diseases and infections have been found in northern Canada ungulate populations due to rapid rates of change in climate resulting in warmer temperatures. The emergence of parasites and parasite-induced diseases (Table 1) is a very real threat to the stability of wildlife populations, as well as to human health.

Table 1 - Drivers for the Emergence of Wildlife Infectious Disease and Parasites

• Changes in the environment (geophysical, chemical, hydrological)	• Changes in the climate (warming climate)
• Shrinking habitats due to human development (alteration of landscape)	• Movement of people (the encroachment of people and their domestic animals on wildlife habitat)
• Situations causing higher concentrations of wildlife (common feed areas, mating season, watering areas)	• Movement of animals (migration, immigration, emigration)
• Increased interactions among people, wild and domestic animals, and parasites	• Movement of pathogens

Domestic Animal Implications

A number of wildlife diseases are transmitted from domestic animals. Ungulates are especially sensitive to diseases communicated from domestics. In LLYK this is of particular concern to the bighorn sheep and mountain goat populations. Examples of disease transmission from domestic animals to wildlife include:

- Chronic Wasting Disease introduced into Saskatchewan and Alberta wild and domestic cervid populations from farmed elk (CCWHC, 2004).
- Pneumonia-Lungworm complex and respiratory distress in bighorn sheep contracted from domestic sheep and goats. Cases have occurred in Banff, Kootenay, Yoho, Jasper, Waterton and Yellowstone National Parks.
- Conjunctivitis (pink eye) found in wild bighorn sheep populations contracted from domestic sheep and goats in Yellowstone National Park and Arizona State Parks.

- Tuberculosis (TB) in Riding Mountain and Wood Buffalo National Parks. Elk contracted TB in Riding Mountain from domestic cattle, and buffalo contracted TB from the introduction of plains bison into the area.

- West Nile Virus contracted by endangered sage grouse populations in Grasslands National Park.

- Parvovirus and the Canine Distemper Virus transferred from domestic dogs to wild canids.

- Horses are particularly susceptible to the West Nile Virus (WNV). Although transmission is primarily through mosquito bites, migratory birds act as a reservoir for the virus. Hence non-infected mosquitoes become infected after biting a WNV carrying bird and spread this to other mammals. As a preventive measure horses should be vaccinated against WNV.

Rehabilitation and Euthanasia

Parks Canada does not typically rehabilitate wildlife, respecting the natural processes which occur in the ecosystem. However, in some special cases, such as where a Species At Risk is injured, or where there is public will, an animal may be captured to attempt rehabilitation. If rehabilitation is considered, contact a veterinarian to seek further advice, Dr. Mark Zehnder at the Invermere Veterinary Hospital has rehabilitated wildlife in the past, particularly raptors. If capture and treatment does occur, ensure that all surfaces and equipment that comes into contact with the animal are cleaned and sterilized.

If an animal is moribound (not able to walk or continually falling down), or is showing any atypical neurological signs, it should be humanely euthanized. Where possible, avoid shooting the animals in the head and instead aim for the neck (where the first vertebrae joins the skull) to prevent damage to the brain. Again, if possible, take the animal in its entirety to the nearest diagnostic laboratory, or submit the head for analysis. Make sure to call the lab first.

Safety Precautions When Handling Carcasses

Personal Safety

All carcasses, whether the cause of death is known or unknown, should be handled as if they were harbouring potentially dangerous diseases. Precautions for personal safety should always be exercised. See Appendix G - Table 2 for a summary of personal protective equipment required when handling carcasses in the field. Ensure good hygiene both during and after handling animals and/or carcasses. In order to prevent contamination always use clean equipment during tissue sampling or necropsy. Wash hands thoroughly after completing procedures, and wash and sterilize equipment after use.

If you are immuno-compromised (sick) or have open wounds or lesions which are exposed, you should refrain from contact with wild animals until you have healed or can appropriately cover your wounds.

Zoonotic and Reportable and/or Infectious Diseases

Diseased wildlife should be handled in a manner that minimizes exposure to people and other wild and domestic animals. Before handling an animal two important safety pre-cautions always need to be considered:

1. ZOONOTIC DISEASES: Could this species have a disease that is transmissible to humans? The following are examples of wildlife diseases that can cause serious and fatal diseases in humans. For this reason the person handling the dead animal should always wear a mask and protective clothing (Munson, 1999).

- Rabies (in all mammals)
- Hydatid disease or echinococcosis (in ungulates and carnivores respectively)
- Anthrax (particularly in ungulates),
- West Nile Virus (effects birds, particularly corvids, but also effects mammals)
- Avian Influenza (in birds)

Cases of animal to human disease transmission in Canadian Parks include:

- Anthrax in Wood Buffalo National Park;
- Orf in Kootenay National Park; and
- Lyme disease in the St. Lawrence Islands (Ontario) and the Okanagan region (BC).

2. REPORTABLE AND INFECTIOUS DISEASES: Could this animal have a disease that is infectious to other wild animals or livestock? The following are examples of diseases that can spread to other animals and are considered reportable to the Canadian Food Inspection Agency (CFIA):

    - Anthrax
    - Avian Influenza
    - Bluetongue
    - Chronic Wasting Disease (CWD)
    - Rabies
    - Trichnellosis
    - *Tuberculosis (TB)

*Note- TB is infectious, but is not considered reportable by the CFIA.

To see a complete list of reportable diseases go to the CFIA website at: http://www.inspection.gc.ca/english/anima/animae.shtml

LLYK Wildlife Disease Sampling Program – Overview

The LLYK field units will be piloting a sampling program to establish wildlife disease as a measure of ecological health. LLYK field unit staff participation and commitment to this program is extremely important in the grand scheme of monitoring ecosystem health in the Mountain Parks and Montane Cordilleran bioregion.

The sampling program is divided into two categories, the: i) Established Sampling Program and the ii) Opportunistic Sampling Program.

i) The Established Sampling Program

The initial targets for the established sampling program will be the following infectious and zoonotic diseases:

1. Chronic Wasting Disease;
2. West Nile Virus; and
3. Avian Influenza (Highly Pathogenic).

These national and provincial programs already have substantial baseline data, stakeholder participation, sampling protocols, and annual analyses established.

ii) The Opportunistic Sampling Program

The other target for sampling will be infectious diseases found in LLYK bighorn sheep populations. This includes:

1. Pneumonia-lungworm complex
2. Orf; and
3. Conjunctivitis.

Consistent sampling for the above diseases through population monitoring will assist in developing baseline information imperative to monitoring bighorn sheep population health, identify trends and help to avoid epidemics. All bighorn sheep, regardless of cause of death, should be sampled.

Note, that in addition to the above programs, any animal found dead of suspicious circumstances on an ancillary basis should also be sampled as a part of the LLYK wildlife disease program.

Sampling Procedures

The following sampling procedures were adapted from three sources; Dr. Helen Schwantje's Post-mortem Protocol for Bighorn Sheep, 2006 (refer to Appendix E for flow-chart); Dr. Todd Shury's Bison Necropsy Protocol for Grasslands National Park, March 2007; and Dr. Linda Munson's "The Necropsy of Wild Animals", (Munson, 1999). For further information on sampling techniques refer to the "2007 edition of the Wildlife Disease Investigation Manual" published by the CCWHC. If in need of clarification on a wildlife disease or sampling situation, please contact the veterinarians listed in Appendix A.

Remember - before beginning a field necropsy, proper protective clothing should be worn including latex gloves, coveralls, apron and rubber boots (see Appendix G - Table 3 for recommended personal protective equipment (PPE) and necropsy equipment for the field.)

"Sampling methods and findings ALWAYS depend on the quality and amount of animal remains - colour and other changes vary with the type of injury and time after death when the animal is examined. The more post-mortems you do, the easier it will be to determine what it normal and what is not" (Schwantje, 2006).

Labeling

All containers and bags should be labeled using a waterproof marker. **Label all sample bags and containers**, place in one large labeled plastic bag and freeze to further add to security. As a rule, do not place fluids in bags and always use a container which can be sealed when collecting fluids. If there are separate samples which require refrigeration or are being stored at room temperature, ensure these are cross-referenced on the outside label of the frozen samples. Hold the surveillance form and field notes separately from the frozen samples. The following are requirements for labeling primary containment receptacles:

- Date
- Species
- Sex
- Approximate age
- Occurrence Number and
- Geographic Location (Park Name and/or GPS coordinates)
- Tissue identification or sample source(if applicable)
- Animal ID if available (ear tags, tracking collar etc.)
- Name and contact information of the person taking the sample/handling carcass

Field Post-mortems - Basic Sampling

The steps referenced in this section come from field postmortem protocols for sheep and bison. For more information, contact a wildlife veterinarian, or refer to the "2007 edition of the Wildlife Disease Investigation Manual" published by the CCWHC. See the following flowchart for a general overview of the field post-mortem process:

Remember if in the front or back country, the option to transport large carcasses via surface or air to the Invermere Veterinary Hospital by is available if a field necropsy cannot be performed.

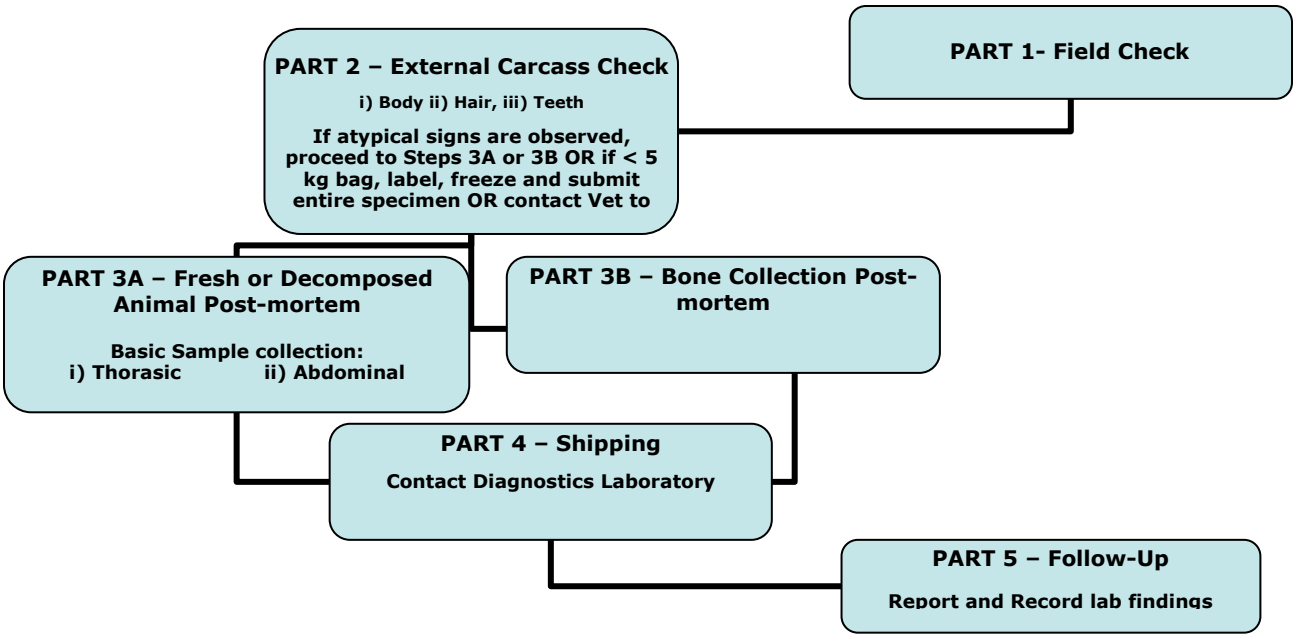
After performing Part 1 and 2, the field and external carcass checks, if the animal is determined to be too large to submit to in its entirety to a lab for necropsy there are three choices;

i) In the front country, contact veterinarian Dr. Mark Zehnder to request a necropsy. After Dr. Zehnder has confirmed availability, load the animal into the warden vehicle and bring to the Invermere Veterinary Hospital. Ensure that all proper paperwork accompanies the carcass.

ii) In the back country, contact veterinarian Dr. Mark Zehnder to request a necropsy. After Dr. Zehnder has confirmed availability, arrange for air transport of the animal, via helicopter, to an area where the animal can then be transported to the Invermere Veterinary Hospital. Ensure that all proper paperwork accompanies the carcass.

iii) Perform a field necropsy. See Appendix I.

Flow Chart Summary For Field Post-mortems in LLYK Parks:



Part 1 – Field Check

In all cases:

- Record the date and the names of the postmortem team/person.

- Be observant and take lots of photographs at different scopes and angles with good lighting.

- Record all information and animal data on surveillance (Appendix C) and field necropsy forms (Appendix D). You may also require a water resistant field notebook and pen.

- Assess environmental conditions (Is there more than one animal dead? Is there any evidence of a lightning strike, or toxic food source?).

- Note the recent weather conditions that could have caused animal deaths (i.e. flood, electric storm, big snow, drought, etc.).

- Note the ambient temperature.

- Note the position of the carcass (i.e. lying on back or side, in a sawhorse position, etc.) and the geographic location (park, roadside, GPS coordinates, stream, etc.).

- Note any other findings in as much detail as possible.

If one or more animal is found dead for no apparent reason, or is found dead near a water source, and/or there is bloody discharge from the nose, mouth or anus, DO NOT conduct a necropsy or cut open the carcass. There is a possibility the cause of death could be due to a zoonotic disease or reportable disease, such as anthrax. If this is the case call the CFIA, Parks or provincial wildlife veterinarians. If necessary, quarantine, remove, or restrict access to the animal and site.

Part 2 – External Carcass Check

Step 1- Assess the Condition of the Animal - Observe Outside of Carcass for:

i) **Body Condition**

- If the animal is thin, then an angular rump and prominent backbone will be seen (there is also often a rough haircoat).

- Estimate amount of fat deposits under skin and around organs, especially kidneys and heart.

- Estimate the muscle mass of the animal.

- If possible, determine nutritional status of the animal; take weight (if possible) and/or body length and girth.

- Note the condition of hooves - worn or overgrown.

RECORD AND PHOTOGRAPH WHAT YOU SEE

ii) **Hair/Coat Condition**

Look for:

- Missing hair/fur and abnormal looking skin or lumps.

- External parasites. If parasites (i.e. nematodes or ticks) are present, preserve in 70% ethyl alcohol and label. If a tapeworm is present, preserve it in 10% formalin. If in doubt, preserve the parasite in question in each solution.

- Wounds or broken bones/legs.

- Discharges or blood at mouth, nose or anus, vulva, mammary gland or other orifices.

- Diarrhea or feces on hind legs or tail.

- Other signs of trauma or evidence that the animal was struggling for a period of time prior to death?

- Note any bites, wounds or other signs of predation. If wounds are present, look for bruising and bleeding in the tissues near the wounds which would indicate that they occurred before the animal died. Otherwise these wounds were most likely caused from the carcass being scavenged.

RECORD AND PHOTOGRAPH WHAT YOU SEE

iii) **Teeth Condition**

- Examine mouth for condition of teeth.

- Look for irregular or worn teeth (often seen in older, thin or animals with mouth or jaw injuries).

- Look for broken or missing teeth.

RECORD AND PHOTOGRAPH WHAT YOU SEE

If the field and external carcass check indicate that the animal died of suspicious causes; or if a specific disease surveillance program is in effect, proceed to the next steps. If the animal is under 5 kg freeze and submit the whole specimen OR contact the Invermere veterinarian to arrange for a necropsy.

Part 3A - Fresh or Decomposed Animal Field Post-mortem

If possible, recover the whole carcass for veterinary post-mortem. If it is not possible to recover the whole carcass do a field post-mortem.

Assess the Condition of the Animal - Observe Inside of Carcass:
Remember that for adequate preservation, tissue should be preserved in a container holding formalin at a ratio of 10 parts formalin to one part tissue (10:1), unless otherwise stated.

Note that lung and other samples can be stored in formalin for microscopic examination (histology) OR chilled and/or frozen for bacterial or viral culture (microbiology and virology). See below for a summary of what tissue samples can be stored in formalin.

Routine Tissues for Preservation (10% buffered formalin)

- Heart
- Lung
- Trachea
- Tongue
- Thyroid gland
- Muscle tissue
- Liver
- Pancreas
- Kidney
- Adrenal gland
- Spleen
- Esophagus
- Bladder
- Reproductive organs (uterus, testes)
- GI tract (representative portions of)
- Rumen, abomasum ,jejumun, ileum, colon and rectum
- Stomach content
- Parasites, in both 70% ethyl alcohol and 10% formalin

i) Thorasic examination - Open chest

- Lay animal on right side with left side up.

- Cut skin over breastbone (sternum) and peel skin back.

- Cut ribs over sternum and bend as many ribs back as possible to access lungs or, pull up on front leg by cutting muscles in the armpit, and remove the half of ribcage under the leg.

- Preferably, photograph lungs in place.

- Carefully examine the lungs for any discoloured areas and palpate them thoroughly for lumps or abnormal cysts or abscesses.

- Collect any abnormal lung tissue in both a Whirl-Pak™ or ziplock bag and in a container filled with 10% formalin. Two representative areas of lung (4 cm x 4 cm) from front lung lobe to the top of the back lobe should be routinely preserved in formalin regardless of abnormal findings. Note any hemorrhage, air pockets or fluid (edema).OR, remove entire set of lungs with heart, save, and photograph.

- Note any abnormalities in the lungs or heart and collect any abnormal fluid that is found in the thorax in a red top tube or syringe.

- Place the two lung tissue samples in labeled ziplock or Whirl-Pak™ bag(s) and in formalin, label and seal. Keep chilled or freeze immediately.

RECORD AND PHOTOGRAPH WHAT YOU SEE

ii) Abdominal Examination - Open abdomen

- Cut the belly skin and peel back.

- Cut carefully through the thin muscle along the edge of ribs and at the mid-line and fold back, avoid cutting into stomach or intestines. Although gastrointestinal (GI) tracts are not typically examined in the field, if doing so remove the stomach and intestines first but open last to prevent contamination of the necropsy site.

- Photograph the inside of the abdomen before removing any samples.

- Observe and note the amount of body fat around kidneys, intestines and under skin.

- Examine the abdominal surface of the diaphragm and save any abnormal muscle tissue in formalin.

- Remove portions of liver and kidney (4 x 4 cm), and place in two separate ziplock or Whirl-Pak™ bags and freeze. You will also need to take a sample of the adrenal gland.

- Remove a fecal samples (10 to 20 pellets or a fist-sized scat sample) from the rectum and place in a ziplock or Whirl-Pak™ bag, label, and freeze.

- Examine uterus for pregnancy in females.

- Look for abnormalities such as accumulation of blood or fluid and photograph and/or take serum samples.

- If possible, collect abnormal fluids in a sterile red-top blood collection tube or a syringe using sterile technique (refer to the 2007 edition of the CCWHC Wildlife Disease Investigation Manual) and label.

- Visually inspect the heart, trachea, esophagus, tongue, thyroid gland, muscle tissues, pancreas, spleen, bladder, reproductive tract and GI tract for any abnormalities.

- Collect 2 samples of tissues from the above listed organs, including any abnormal tissues, no smaller than 1X1 cm, place one sample in 10% formalin and the other in a ziplock or Whirl-Pak™ bag and freeze at -20 °C

- Make note of colour and consistency or GI contents, including rumen and abomasum (in ungulates), intestines and rectum.

- Note the amount of food in the digestive tract, and take a fist sized sample of the stomach contents in a leakproof container. Label and freeze.

- Mediastinal and bronchial lymph nodes from the thorax should be examined with any abnormal lymph tissue saved in both formalin and a ziplock or Whirl-Pak™ bag for mycobacterial culture

- Observe and slice through in other locations the major lymph nodes of the abdominal cavity. If abnormal lesions are observed, save half the lymph node in formalin and half in a ziplock or Whirl-Pak™ bag, and freeze.

RECORD AND PHOTOGRAPH WHAT YOU SEE

iii) Head and tongue – (typically not required, for information purposes only)

- Make two incisions on either side of the tongue from the ventral side of the jaw in order to cut out the tongue. Grasp the tongue and pull, cutting away at the back of the tongue to remove the entire trachea, tongue and lung pluck (a term that refers to the organs of the chest), place in a zip-lock or Whirl-Pak™ bag and label.

- If surveillance is required for Chronic Wasting Disease or other neurological diseases – saw off the head below the first cervical vertebrae, place in a labeled zip-lock, Whirl-Pak™ or garbage bag, label, and freeze for submission to lab.

RECORD AND PHOTOGRAPH WHAT YOU SEE

Part 3B –When it is Not Possible to Recover the Whole Fresh or Decomposed Carcass

Bone Collection to Assess the Condition of the Animal:

Recover:

i) A large leg bone (especially if frozen or dead > 1 month and the bone is whole):

- Preferentially collect the femur (upper hind leg) or humerus (upper front leg).

- Bone collection helps determine body condition by assessment of percentage of bone marrow fat.

- Place samples in zip-lock or Whirl-Pak™ bags, label and freeze. If some bones are too large to contain in a zip-lock bag, use a fresh garbage bag and ensure it is labeled.

ii) Skull or lower jaw - for age, sex and tooth condition:

- Place samples in zip-lock or Whirl-Pak™ bags, label and freeze.

RECORD AND PHOTOGRAPH WHAT YOU SEE

Part 4 – Shipping Samples for Diagnostics

1. Contact the laboratory before shipping (Invermere Veterinary Hospital, Abattoir in Banff, or other). See Appendix H for a summary of lab contacts.

2. Check Transportation of Dangerous Goods (TDG) regulations for shipping tissue samples. See Appendix I for a suggested list of TDG labels for the wildlife diseases listed in this manual.

3. Include copies of the completed submission/surveillance, and field necropsy forms (see Appendix C & D) with the specimen(s). Ensure the forms are placed in a separate ziplock bag. Details for properly packaging samples are listed below and can also be found in the 2007 CCWHC Wildlife Disease Investigation Manual.

4. Transport Canada requires three levels of packaging for specimen submission. These three levels (primary, secondary, tertiary) are detailed below.

5. All samples should be handled with care and placed in LEAKPROOF and unbreakable primary containers or bags so that dangerous infectious materials do not leak during transport. Seal containers with Parafilm or sealing tape to prevent leakage. Label the receptacles appropriately (see Appendix G - Table 7, for a list of recommended packing and transport materials).De-contaminate the outside of the receptacle (i.e. use Clorox or Lysol wipes).

6. Ensure the surveillance/submission forms (or copies of these) are placed in a separate plastic bag for protection from spills.

7. Formalin–fixed samples can be kept at a cool room temperature until shipped. Formalin samples should not be frozen. Formalin–fixed tissues are considered an "Exempt Animal Specimen" TDG categorization for shipping because they have been biologically inactivated.

8. Samples should remain in their respective room-temperature, chilled or frozen state during shipping.

9. When shipping, place the sealed primary container(s)/bag(s) into a ziplock bag or a larger secondary container with enough absorbent material to absorb fluids in case of a spill.

10. Place the secondary container inside of a sturdy cardboard box for shipping. If the secondary container contains multiple primary containers from the same animal (such as serum or blood samples) each primary container must be wrapped or separated to prevent breakage. Make sure the samples are easily distinguishable from packing material (i.e. don't wrap tubes in newspaper and then use newspaper as packing material). If required, de-contaminate the external surface of the secondary container or bag.

11. If the sample weighs less than 10 lbs, the tertiary packaging can be a rigid cardboard box. If the sample weighs more than 10lbs, or contains large volumes of liquid, use a rigid plastic container, such as a cooler, for tertiary packaging. Make sure the tertiary containment is filled with packing material such as packing peanuts or crumpled newspapers.

12. Frozen samples must be shipped in insulated containers (i.e. a cooler) and by express carrier. Pack specimens in dry ice or with ice blocks outside of the secondary container. The outside of the box must be labeled with "Dry Ice", UN1845, and the net quantity of dry ice (in kg) should be noted to write on the outside of the box. The use of re-useable frozen gel packs is preferable to dry ice for safety, storage and cost efficiency reasons

13. It is best to ship frozen, chilled and fixed samples separately. If they must be shipped together then insulate the fixed tissues from freezing by wrapping in newspapers. Ensure that there is no spillage of the formalin-fixed samples onto the frozen or chilled samples, as this will make culturing for viruses or bacteria impossible.

14. If samples with different TDG categories are pooled, then the outside of the tertiary packaging should indicate each TDG category with its respective sample. Remember, each sample should be packed in a separate secondary containment bag For example, a shipment with mixed samples could look like this:

    Category A, Infectious Substance Affecting Humans, UN 2814,
    Suspected West Nile Virus – entire bird;
    Category A, Infectious Substance Affecting Animals O*nly*, UN
    2900 – Chronic Wasting Disease – white-tail deer head; and
    Exempt Animal Substance – bighorn eye in 10% formalin
    solution.

15. If the sample is not suspected of being an infectious disease or is in formalin, the outside package labeling only needs to indicate:"Exempt Animal Specimens" Detailed TDG labeling on the outside of the shipping box/container is only required if an infectious disease is actually suspected.

16. If submitting a specimen as part of a surveillance program, but it is not suspected of having an infectious disease "Exempt Animal Specimen" TDG classification can be used. (I.e. a deer head is submitted for CWD, but the deer was not known to exhibit any signs of CWD).

17. The outside of the box should be labeled with:
    - A return address;
    - Arrows drawn on the outside of the box pointing to the top;
    - A label indicating "surface transport" or "air transport";
    - An itemized list of the package contents;
    - Proper TDG labeling, with a specific diamond shaped label indicating either:
        - Category A - Infectious Substance Affecting Humans, UN 2814;
        - Category A - Infectious Substance Affecting Animals *Only,* UN 2900;
        - Category B – Biological Substance, UN 3373; or
        - Exempt Animal Specimen (if contained in formalin or is not suspected of an infectious disease) and if it is not packaged with any samples in the above categories.
        - See Appendix I for assistance with TDG classifications

18. If dry iced was used, the outside of the box must be labeled with "Dry Ice", UN1845, and the net quantity of dry ice (in kg) should be indicated. It is preferable to use gel freeze packs because they present no safety risk.

For more information on shipping see Appendix F – Packing/Shipping Instructions for the Submission of Specimens to the CCWHC in Saskatoon by courier/mail.

Part 5 – Follow Up

Ensure that laboratory results are entered into the Occurrence Tracking System and/or the Wildlife Mortality Database (currently maintained by Wildlife Data Technician Shelagh Wrazej). Positive results from any lab other than the CCWHC should be communicated to Parks Canada Wildlife Health Specialist Dr. Todd Shury. Proper follow-up is crucial to tracking the emergence or outbreak of disease in Mountain Park wildlife populations.

Carcass Disposal and/or Baiting

Using dead ungulates or other animals as bait for traps should occur only once the proper field and external carcass checks have taken place. Animals that have died from suspicious causes should not be used as bait as there is the potential to spread wildlife diseases if an infected animal is scavenged.

Carcasses can be left on-site to be scavenged if:

- There are no public safety concerns;
- No gross lesions of disease are found upon surveillance/necropsy; and
- The on-site location is not in a high visitor use area.

If disposing of the carcass in a landfill ensure it is either double-bagged or, that it can be buried several feet deep where it will not be disturbed. Do not dispose of the carcass in a manner where it could be handled again.

Carcasses with infectious diseases should be buried 2 meters deep and covered with a disinfectant to prevent scavenging.

Summary of Wildlife Diseases (in Alphabetical Order)

See Appendix B for summary tables of wildlife diseases. Note- this summary is not comprehensive and is only meant to be a guide, speak to a veterinarian listed in Appendix A if there are further questions.

Anthrax

Commonly Affected Species: Bison and cervids but can be found in all mammals.

Causative Agent: *Bacillus anthracis* bacteria, it produces highly resistant and infectious spores which reproduce rapidly and survive outside the host.

Geographic Range: In Canada, anthrax has been reported in bison and the bears who had scavenged them in NWT and NE Alberta. During the Saskatchewan summer of 2006, over 780 cattle and ungulates died due in 150 separate locations due to anthrax.

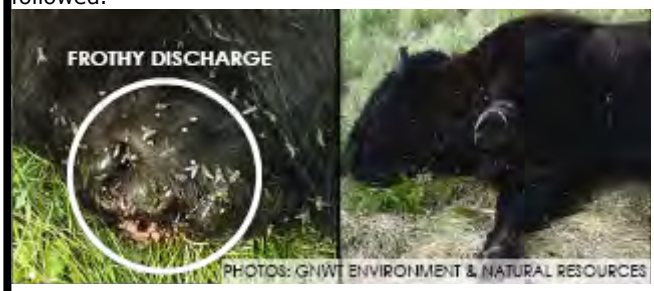
Mountain Parks Occurrence/Significance:
Anthrax outbreaks have occurred since 1962 in Wood Buffalo National Park, the latest event occurring in 2001 resulting in at least 41 bison dead.

Seasonality: Most prevalent in late summer (outbreaks occur in dry summers followed by periods of rain) but can occur year-round.

Wildlife Symptoms of Infection:
Living animals may be slow, weak, disoriented, show signs of fever and breathing difficulties and may die within hours to days. Dead animals bloat and decompose quickly. There may be a frothy, bloody discharge from the mouth, nose & anus. Bison killed by anthrax are often found in a "saw-horse position".

Transmission to Wildlife:
Infected animals and carriers shed anthrax spores in urine and feces. Anthrax may also be spread through the bites of fleas and mosquitoes. Birds and animals scavenging an anthrax carcass can cause the dispersement of anthrax spores dependent on environmental conditions.

Risk for Mountain Parks: *Low* - the potential for an anthrax outbreak occurring in Mountain Parks at this time is low. However all dead wildlife should be considered as potential anthrax kills and proper safety procedures followed.



Safety: All precautions should be taken to avoid exposure; anthrax is a severe zoonotic disease and when inhaled is fatal.

Sampling: The carcass of a dead animal suspected of having anthrax should not be opened or touched! Immediately report to the CFIA, the Regional Wildlife Biologist, Parks Canada Wildlife Health Specialist, and Provincial wildlife veterinarians.

Although not recommended for field staff, suspected cases of anthrax can be sampled via a blood smear, made from nicking an ear or other available vein and checking for the virus before the carcass is opened. Carcasses with anthrax or other infectious disease should be buried 2 m deep and covered with a disinfectant to prevent scavenging.

Transmission to Humans: Occurs through open cuts, open sores and scratches, through absorption into mucous membranes (eyes), from inhaling spores from contaminated materials such as hides, dust and grass and from ingestion.

Human Symptoms of Infection: If you have any of the following symptoms after contact with an animal, seek medical attention immediately.

Cutaneous (skin) Anthrax - Is the most common type of anthrax infection in humans. Symptoms include: small painless sores such as blisters or an ulcer with a black center. If identified early, these symptoms can be treated with antibiotics.

Inhalation (lung) Anthrax - This is the most serious type of anthrax infection. Symptoms include: fever, sore throat, cough, shortness of breath, chest pain, general ill-feeling and breathing difficulties which lead to death.

Gastrointestinal (digestive) Anthrax – Symtoms include: fever, loss of appetite, vomiting, diarrhea and stomach pain.

Sources: (Miller, Dawson & Schwantje, 2003), (BC MoE & Stitt, 2006), (Gainer & Saunders, 1989), ("Anthrax Outbreak", 2001) & (Kerr, 2006)

Avian Flu (Avian Influenza)

Commonly Affected Species*:* Birds (wild migratory species and domestic), less commonly pigs and on rare occasions humans. Note - corvids ARE NOT a natural carrier of avian flu.

Causative Agent: Contagious disease of animals caused by a virus (H5, H5N1 (extremely aggressive) and H7).

Geographic Range: Asia, Kazakstan, Mongolia, Turkey, Romania. As of Feb 9, 2007, the Canada Wild Bird Survey reports there are no bird (or human) cases of avian influenza in Canada.

Mountain Parks Occurrence/Significance: No occurrences as of yet.

Seasonality: Potentially year round with emphasis in the spring and fall migrations.

Wildlife Symptoms of Infection: Signs of illness in birds includes: excessively watery eyes, swollen head and eyelids and ruffled feathers. H5N1 has evolved into a flu virus strain that is deadlier and infects more species than any previously known flu virus strain. It continues to evolve, becoming both more widespread and more deadly. H5N1 avian influenza in humans is still a rare disease, but has the potential to evolve into a pandemic in North America.

Transmission to Wildlife: Wild waterfowl have been a natural reservoir of all influenza A viruses, with no apparent harm, for centuries. Considerable evidence suggests that migratory birds can introduce low pathogenic H5 and H7 viruses to poultry flocks, which then mutate to the highly pathogenic forms. Domestic ducks then excrete large quantities of highly pathogenic H5N1 virus without showing signs of illness, perpetuating transmission to other birds. The H5N1 virus (highly pathogenic) has expanded its host range, infecting and killing mammalian species previously considered resistant to infection with avian influenza viruses.

Risk for Mountain Parks: *Moderate* **-** Although there are no cases in Canada *yet,* it is imperative that the proper safety precautions are followed when handling live or dead birds. The virus can spread quickly. Domesticated poultry can catch an avian flu virus adapted to migratory waterfowl, it can then rapidly mutate into a form that kills 90% of an entire flock in days, and then spread to other wild and domestic flocks with the same lethality.

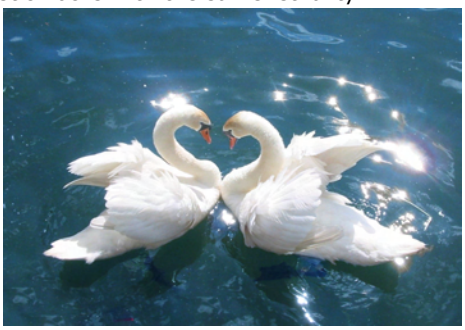


Photo credit: English Wiki: en:Image:Swans.jpg http://en.wikipedia.org/wiki/Avian_flu - Swans are a carrier of H5N1

Safety: If in contact with wild birds, wear heavy gloves or use a doubled plastic bag and avoid contact with blood, body fluids and feces. Wash hands with soap and warm water. Always work in a well-ventilated environment. Dispose of gloves and all potentially contaminated material immediately in an appropriate manner (i.e. sealed in plastic bags).

Sampling*:* Immediately report to CFIA. Submit the whole bird to laboratory. The specimen can be frozen. If banding, or if collecting blood, fecal, or tissue samples, wear gloves and handle samples hygienically. Use appropriate disinfectants to wash equipment or any potentially contaminated surface. If birds appear sick, consult with a veterinarian before handling them or (if alive) bringing them into a facility. All birds, even apparently healthy ones, should be quarantined before exposure to other wildlife or people.

Transmission to Humans: In general, human cases are related to close contact with infected live or dead poultry. While the risk of human infection with avian influenza viruses remains low, individuals should be cautious when handling wild birds and be aware of the potential for disease transmission among birds, and from birds to people. Direct contact with infected poultry, or surfaces and objects contaminated by their feces is considered the main route of human infection. Though rare, instances of limited human-to-human transmission of H5N1 and other avian influenza viruses have occurred. Data from these incidents suggest that transmission requires very close contact with an ill person.

Human Symptoms of Infection: The incubation period for H5N1 avian influenza ranges from 2 to 17 days. Initial symptoms include a high fever, usually with a temperature higher than 38°C, and influenza-like symptoms. Early symptoms are: diarrhea, vomiting, abdominal pain, chest pain, and bleeding from the nose and gums. Breathing difficulties, including pneumonia, develop around day 5 following initial symptoms. The health of persons infected with the H5N1 virus deteriorates rapidly and multi-organ failures are common. Thus far, more than half of those infected with the virus have died. Most cases have occurred in previously healthy children and young adults. If you become ill while handling birds or shortly thereafter, see your doctor. Inform your doctor that you have been in contact with wild birds.

Sources: ("Avian Influenza", 2006), ("Fact Sheet", 2006), ("bird flu", 2006), & ("Canada's Wild Bird", 2007)

*Avian Pox*Bacterial Pneumonia *(Mannheimia haemolytica)*

Commonly Affected Species*:* Birds, most commonly songbirds, upland game birds, marine birds and raptors. It has been found in upwards of 60 different species.

Causative Agent: Skin disease caused by a virus.

Geographic Range: Worldwide, including BC.

Mountain Parks Occurrence/Significance: Avian pox is endemic in some birds, and is also viewed as an emerging new disease in other species. There is potential for birds in Mountain Parks to contract and spread the virus.

Seasonality: Occurs throughout the year, and is more prominent with conditions that lead to increased mosquito populations, and where conditions lead to high concentrations of birds (i.e. feeding stations).

Wildlife Symptoms of Infection: Symptoms can be displayed either on the skin (cutaneous) or internally (wet). *Cutaneous symptoms* include birds with wart-like nodules on featherless areas of the body, including the feet and legs, the margins of the eyes and base of the beak. These growths can grow and form clusters which can impair sight, breathing and feeding. Birds may appear weak and emaciated if the nodules are impeding feeding. Laboured breathing may be observed where air passageways are blocked.

Immature birds are most frequently infected with pox virus. Complications due to pox lesions can result in further infections and death. However, birds may fully recover, with minor scarring, provided they are able to feed.

Wet avian pox is more common in domestic poultry than wild birds. Symptoms include lesions around mucous membranes of the mouth and lesions in the upper digestive and respiratory tracts. Weak body condition from wet pox can makes infected birds more vulnerable to predation.

Risk for Mountain Parks: *Moderate* - based on the migratory nature of birds and the ease with which the disease spreads.

Photo Credits: Wildlife Pathology, New York State Dept of Environmental Conservation.
Photo 1 –House Finch with Avian Pox lesion on eye
Photo 2 – Raptor foot with Avian Pox lesions

Safety: Follow all safety precautions. If birds with suspected avian pox are handled and other live birds are to be handled in the future, any surfaces or equipment that infected birds have come in contact with should be cleaned with a 10% household bleach solution to prevent the spread of the disease.

Sampling: Initial diagnosis is based on the appearance of wart-like lesions on the body, but pox must be confirmed through microscopic examination. Submission of the whole bird or affected body parts are needed for virus isolation and specimens should be frozen if held more than a day before being shipped to a lab.

Transmission to Humans: There is no evidence that the Avian pox virus can infect humans.

Transmission to Wildlife: Mosquitoes and birds acting as carriers can spread the disease at bird feeders and through migratory flyways. Avian pox can be acquired by: transfer from infected hosts via mosquito bites or through direct contact with surfaces or air-borne particles (mucous membranes or skin abrasions). The Avian pox virus can survive considerable dryness; therefore dust particles containing the virus can remain infective for extended periods.

Sources: (Miller, Dawson & Schwantje, 2003) & (Schwantje, "Avian Pox" 2003)

Commonly Affected Species*:* All mammals can be affected; however bighorn sheep and mountain goats are particularly sensitive.

Causative Agent: Bacteria (formally known as *Pasteurella haemolytica).*

Geographic Range: Infects wild and domestic mammals worldwide, although bighorn sheep are particularly susceptible.

Mountain Parks Occurrence/Significance: Pneumonia has occurred in Rocky Mountain bighorn sheep populations, with serious consequences. Pneumonia is a major threat to the Mountain Parks populations. Populations have been known to decline by 50% following an outbreak. Epidemics have occurred in 1981-84 in BC, Alberta and Montana bighorn populations. Sheep in LLYK have been known to die of pneumonia-lungworm complexes.

Seasonality: Can occur year round; higher incidences of occurrence in times of physiological stress or when large congregations occur.

Risk for Mountain Parks: *High* – Bighorn sheep and mountain goats are highly susceptible to pneumonia, especially when environmental conditions are poor and herds reach a larger size, such as is the case with the Kootenay Bighorn herd.

Safety: Follow all safety precautions, including wearing a respiratory mask.

Sampling: Lung tissue culture samples indicate if pneumonia is the cause of mortality. Biopsy the lung tissue, place in sterile container, label and freeze. Serum sampling (i.e. plasma samples) may also be useful in determining if the pneumonia bacteria are present.

Transmission to Humans: Although this can be considered a zoonnotic disease, pneumonia infections of wild mammals have few implications for public health. Bacteria can be transmitted to humans via animal bites, scratches or by wound contamination. Reasonable caution should be followed when handling animals.

Wildlife Symptoms of Infection: Bighorn sheep are thought to be highly susceptible to disease carried by domestic sheep. Bighorn sheep exhibiting signs of pneumonia include coughing (snuffles), nasal discharge and poor body condition. Depression, anorexia, blood-tinged discharge from mouth or nose, dropped ears, coughing and/or respiratory distress may occur in wild ruminants. Death is often the first or only sign reported. Lesions can occur in the thorax area and occasionally bacteria can be tested through blood samples or smears. Affected portions of the lungs are firm and dark red-grey. Tonsils, cervical and thoracic lymph nodes may appear enlarged. Domestic ruminants appear to be resistant to many bacteria strains that are highly pathogenic to wild ruminants. Consensus is that domestic sheep and bighorn sheep must be kept separate in order to maintain healthy bighorn populations.

Carcasses or tissues from wild mammals infected with pathogenic bacteria should not be fed to other animals and be disposed of properly.

Transmission to Wildlife: Transmission of *M. haemolytica* requires nose to nose contact or transfer of mucus through coughing or sneezing (inhalation) or from ingestion. Exposure can also occur from bite or scratch wounds. Pneumonia bacteria are relatively vulnerable in the environment; however, contaminated feces and urine, or common water and feeding areas can act as sources of infection for hours to weeks. Recent studies indicate that the bacteria may remain viable up to 12 hours in moist soils (i.e. around watering holes). Bighorn and domestic sheep are attracted to each other, which greatly increases the potential for close contact and disease transmission. Translocation of animals from one wild herd to another is also a concern. Pneumonia outbreaks typically result in mortality of most individuals within the herd. All age classes of bighorn are affected. Efforts to reduce the likelihood of spreading disease to other bighorn sheep include killing the infected bighorns. Following the outbreak, lamb survival and subsequent recruitment remains low for two to 15 years. Pre-disposing factors, like trauma, severe weather events, crowding, stress, or other diseases (such as lungworm) can lead to pneumonia occurrences in bighorn sheep. Stress induced suppression of host immunity is believed to be the underlying mechanism triggering pneumonia infections.

Source: (United States, 2006), (Williams, 2001) & (McDaniel, 2001)

Besnoitiosis

Commonly Affected Species: Can affect both wild and domestic herbivores (intermediate hosts). *B. tarandi* has been seen in Caribou located in BC, and mule deer in other provinces. The definitive hosts (carnivores) are unknown**.**

Causative Agent: Parasite

Geographic Range: Around the world.

Mountain Parks Occurrence/Significance: Caribou populations in BC and AB are considered threatened under the Species at Risk Act. The potential of a parasitic infection that could lead to the deterioration of herd health is of concern.

Seasonality: Warmer months of the year.

Wildlife Symptoms of Infection: Infected animals usually appear healthy and signs can vary: cysts observed in eyes of caribou may be present. A high density of cysts on the skin cause cracks (lesions) allowing for infection. Severe lesions can cause hair loss, fluid seepage and hemorrhage on the joints of lower limbs, face and nasal cavity and sometimes in the eye (the white of eye may look like sandpaper). The thickening of skin in nasal passages can obstruct breathing.

Risk for Mountain Parks: *Low to Moderate* - dependent on the stability and numbers of caribou herd.

Safety: Follow all safety precautions.

Sampling: Submission of lower limb or examination of the white of the eye can be used for diagnosis.

Similar Diseases: Lesions from severe Besnoitiosis may resemble sarcoptic mange, bacterial dermatitis and ringworm.

Transmission to Humans: There are no known human health concerns with Besnoitia infection.

Transmission to wildlife: Parasitic eggs are produced and excreted in the feces of infected species and contaminate vegetation, which is then ingested by herbivores. Transmission between intermediate and definitive hosts may occur through insect bites.

Source: (Miller, Dawson & Schwantje, 2003)

Chronic Wasting Disease (CWD)

Commonly Affected Species: Deer and elk (cervids)

Causative Agent: A progressive degenerative disease of the brain, associated with the presence of an abnormal protein called a prion.

Geographic Range:
Wild cervids: Saskatchewan Colorado, Wyoming, South Dakota, Wisconsin, Nebraska, New Mexico and Illinois

Captive cervids: Saskatchewan, Alberta, Colorado, Nebraska , Montana, Wyoming, Kansas, South Dakota, Oklahoma and Minnesota. CWD HAS NOT been found in BC.

Mountain Parks Occurrence/Significance: CWD is an emerging disease, the number and distribution in wild and captive cervids has been steadily increasing since its initial discovery in captive deer in Colorado in the 1960's. To date, CWD has **not** been found in any Parks. Concern occurs where any animal capture and/or translocation programs exist. In 2006 the first cases of CWD in wild white-tailed deer were confirmed in Alberta, near the Saskatchewan boarder.

Seasonality: Year-long

Risk for Mountain Parks: *Moderate* - Surveillance programs are in effect in the provinces and states affected by CWD. Surveillance programs are in effect in BC, AB, and within the Parks Canada Agency.

Safety: Follow all safety precautions.

Sampling: Immediately report to CFIA. The disease is confirmed by isolating the abnormal prion protein from brain stem or lymphoid tissues of dead animals. Biopsies of the retropharyngeal tonsils in live animals can determine if the prion is present. Surveillance programs require the heads of all deer, regardless of cause of death, to be submitted. Deer heads go to the ADRI in Lethbridge.

Transmission to Humans: There is currently no scientific evidence that CWD affects humans. However, CWD and BSE (Bovine Spongiform Encephalopathy) "mad cow disease" are similar nervous system diseases and there is evidence to suggest that BSE affects humans.

Wildlife Symptoms of Infection: Signs last from weeks to months until the animal dies; however some animals may not show clinical signs for years. Lack of coordination, separation from other animals in the herd, excess salivation, depression, unusual behaviour, paralysis, weight loss, difficulty swallowing, increased thirst and urination and pneumonia are all symptoms. The species barrier may not completely protect other cervids, such as moose, from CWD.

Transmission to Wildlife: Captive deer transfer the disease from animal to animal. In rare instances CWD can be passed from mother to offspring. The most likely means of transmission is between animals that are in close contact with each other. Saliva, urine and feces are the most likely direct routes of transmission. Transmission is facilitated by baiting and artificial feeding, or the creation of any environment where numerous animals are in close contact for an extended period of time. The paddocks that housed infected domestic cervids passed on CWD infection to new elk and mule deer placed into the paddocks, indicating that the CWD agent can survive in the environment and transmit the disease. All infections are believed to be fatal.

Source: (Miller, Dawson & Schwantje, 2003), (BC MoE & Stitt, 2006), (ASPB, 2007) & (Bollinger et al, 2004)

Conjunctivitis (Pink eye)

Commonly Affected Species*:* Wild and domestic mammals, including humans. Rocky Mountain bighorn sheep are particularly sensitive.

Causative Agent: Common varieties of conjunctivitis are viral and bacterial.

Geographic Range: Worldwide

Mountain Parks Occurrence/Significance: The threat of an outbreak is very real. Outbreaks have not occurred in LLYK parks. In the 1980's Yellowstone National Park's endangered bighorn sheep population contracted bacterial pink eye from domestic goats. This resulted in a 60% mortality rate due to sheep dying of complications related to blindness caused by untreated bacterial pink eye infections. Blind sheep fell to their deaths or were hit by vehicles.

Seasonality: Can appear at any time but spreads faster with humid conditions.

Wildlife Symptoms of Infection:
Bacterial pink eye: Can be painful and red, eyes and eyelids can swell, there is a moderate to large amount of discharge, usually yellow or greenish in colour.

Viral pink eye: Has more of a watery discharge, and is associated with influenza symptoms (i.e. coughing), eyelids may be swollen. Persistent pink eye (conjunctivitis) can be the sign of a different underlying illness.

Transmission to Wildlife:
Bacterial conjunctivitis – most often caused from the mammal's own skin, others sources are due to infection from the environment or from contact with infected mammals. Bacterial pink eye can be contracted from domestic sheep and goat herds. Infectious forms of pink eye are highly contagious.

Viral conjunctivitis - is spread via the air or through contact with contagious viruses (such as influenza) so that pink eye is often associated with upper respiratory tract symptoms. This form of pink eye can be associated with infection of the cornea. Viral pink eye is also highly contagious.

Risk for Mountain Parks: *Moderate to High* - the possibility of pink-eye occurrences on a case-by-case basis is probable in the Mountain Parks, with potentially serious consequences.

Safety: Follow all safety precautions, ensure the disinfection and laundering of all equipment, clothing, and exposed surfaces.

Sampling: Two swabs can determine if an animal, live or dead, has conjunctivitis (the swabs and their appropriate receptacles will be provided). First use a sterile swab to wipe the conjunctiva (the membrane that covers the white part of the eye and lines the eyelids). Suspect pathogens are then cultured in a microbial medium. Second, use a non-sterile swab to rub the cells lining the conjunctiva. This swab can determine the presence of bacteria through smears on bacterial slides. If the animal is dead, lesions, the eyelid, or the conjunctiva can be preserved in formalin and submitted to the lab.

Transmission to Humans:
Infectious forms of pink eye are highly contagious and are spread by direct contact with infected wildlife or through environmental exposure. Pink eye can both be infectious or non-infectious.

Human Symptoms of Infection: Redness, irritation and watering of the eyes are symptoms common to all forms of conjunctivitis. Itch is variable. *Bacterial conjunctivitis* is due to the common pus-producing bacteria. It causes grittiness/irritation and a stringy, opaque, grey or yellowish discharge that may cause the lids to stick together (matting), especially after sleeping. *Viral conjunctivitis* is often associated with an infection of the upper respiratory tract, or a sore throat. Its symptoms include watery discharge and variable itch. The infection usually begins with one eye, but may spread easily to the other eye.

Source: (Wikipedia, 2006), (Taylor et al, 1993), (Yellowstone, 1999-2003), (Arizona, 2006) & (MedicineNet, 2005)

Distemper or Canine Distemper Virus (CDV)

Commonly Affected Species*:* Domestic and wild carnivores (foxes, mustelids, raccoons, bears, coyotes and wolves).

Causative Agent: Infectious and contagious viral disease.

Geographic Range: Worldwide, but can be localized depending on host species.

Mountain Parks Occurrence/Significance: Research in Banff National Park indicates that 100% of wolves sampled had CDV anti-bodies. Outbreaks in BC have occurred in coyotes and wolves, and were associated with outbreaks in domestic dogs**.**

Seasonality: Most cases are observed in the spring and involve young of the year who have not been exposed to the virus.

Wildlife Symptoms of Infection: Symptoms vary depending on the species, age, health of immune system, strain of the virus and environmental conditions. Young animals are the most susceptible. Incubation of CDV ranges from 1 week to 1 month, duration of the disease ranges from 1- 6 weeks, ending either in death or recovery. Signs of infection include: depression and pus-like discharge from the eyes and nose, coughing, fever, vomiting, diarrhea, lack of appetite, and particularly for mustelids, the thickening of the skin on the nose, lips, eyelids, ears, anus, and foot pads. The central nervous system can also be infected. The signs include: abnormal behaviour, convulsions, seizures, paralysis, lack of coordination, and wandering.

Carcasses suspected to have CDV should not be used as bait and should be properly disposed of to prevent scavenging.

Risk for Mountain Parks: *Moderate* – CDV infection rates are high in Mountain Parks. While animals do recover, the risk of an epidemic is probable where dense populations exist.

Safety: As a preventative measure all animals suspected of having distemper should be handled as if they have rabies. Follow all safety precautions.

Sampling: Submit the entire animal to confirm the disease.

Similar to Other Diseases: Neurological symptoms of CDV are similar to those of animals with rabies.

Transmission to Humans: CDV is not believed to be a risk for humans.

Transmission to Wildlife: Primarily through contact with body fluids containing the virus or through aerolization of the virus (i.e. from an infected animal coughing). The virus then spreads to the lymph nodes, where it is circulated throughout the body, damaging the immune system. The virus can also be found in parts of the GI tract and liver. After recovery, the virus can still be shed into the environment for several months from the healed animal. However CDV is fragile in the environment, so close association is required to transmit from affected to non-affected animals. CDV can be inactivated in the environment by ultraviolet light, heat, drying and common disinfectants.

Source: (Miller, Dawson & Schwantje, 2003), (Shury, Personal Communication, 2007)

Epizootic Hemorrhagic Disease (EHD), Bluetongue Virus (BTV) and Adeno Virus

Commonly Affected Species: EHD and Bluetongue affect domestic and wild ungulates, primarily white-tailed and mule deer, less frequently elk and bighorn sheep. Adenovirus affects wild and captive black and white-tailed deer, mule deer, and has been found in woodland caribou in Quebec and in captive moose at the Toronto Zoo.

Causative Agent: A viral disease, EHD, Bluetongue and Adenovirus have similar signs and symptoms (each cause hemorrhaging) and are caused by different strains of the *Orbivirus*.

Geographic Range: Worldwide. EHD has been reported in free- range ungulates in North America and has been confirmed in bighorn sheep and white-tailed deer in the Okanagan region of BC. The geographic occurrence of Bluetongue and Adenovirus is similar to that of EHD.

Mountain Parks Occurrence/Significance: There has been no known occurrence of EHD in the LLYK parks. Bluetongue cases in North America include white-tailed deer located in the Okanagan in 1999, and in bighorn sheep in the late 60's (Texas) and early 70's (Colorado). There was an Adenovirus outbreak in California in 1993 which killed over 1000 mule deer. This virus is moving northward and in 2006 was found in black-tailed fawns in Waterton National Park.

Seasonality: Occurs in late summer and early fall. EHD is thought to be related to seasonal wind patterns moving insect EHD and Bluetongue carriers from the USA northward and during the summer months when midges are more prevalent. Viral transmission is also more active during rainy periods. Adenovirus is thought to be more prevalent when stressors or crowded conditions are present.

Risk for Mountain Parks: *Moderate-High* - based on low probability of EHD or Bluetongue occurring, but a high impact on wildlife populations if it does occur. Adenovirus is more likely to occur in the Mountain Parks.

Photo Credit: The Southeastern Cooperative Wildlife Health Center
Swollen Tongue

Safety: Follow all safety precautions. Disinfect all equipment that comes into contact with potentially infected animals.

Sampling: Suspected Bluetongue cases should immediately be reported to the CFIA. Lab diagnostics will determine if the animal is affected by EHD or Bluetongue. The whole body should undergo a post-mortem necropsy. Immunological tests from tissues of the spleen, lymph nodes, lung or bone marrow can verify if EHD is present, as can blood collected with anti-coagulant. The above listed tissues should be refrigerated (NOT FROZEN), and transported at 4°C. Follow the same procedures for Adenovirus until more research is published on this disease.

Transmission to Humans: The EHD and Bluetongue virus cannot be transmitted to humans. It is currently unknown if Adenovirus can be transmitted to humans.

Wildlife Symptoms of Infection: The severity of EHD is variable with each affected herd and may be related to herd immunity. Signs are variable and range from none to sudden death. All ages are susceptible and mortality can be as high as 90% in some deer herds. Sick and dead animals are often found near water. Other external signs include: swelling of face, tongue, neck and conjunctiva of the eyes, lack of appetite, weakness, lack of coordination, excessive salivation and nasal discharge (which is often blood-tinged), bloody diarrhea, and lameness. Internal symptoms are extensive hemorrhaging in the skin, GI tract, heart and testicles. Ulcers can form in the tissues of the mouth, tongue and stomachs. Animals often have breathing difficulties and will be found lying down. They can also have overgrown or cracked hooves. *Bluetongue* symptoms in wild ruminants varies from acute fatal hemorrhaging, swollen lips, tongue, and lower jaw, lameness, and weight loss (observed in white-tail deer) to no visible symptoms (such as in elk). *Adenovirus* also causes similar effects as EHD and Bluetongue. Fawns are particularly susceptible to Adenovirus, more so than juveniles and adults. Death due to starvation or bacterial infection is commonly seen with Adenovirus.

Transmission to Wildlife: EHD and Bluetongue are transmitted through the bites of midges or "no-see-ums" that bite an infected animal and then spread the virus to subsequent hosts. The virus then enters the blood stream where blood vessels are damaged leading to numerous small and large hemorrhages. Waterfowl act as a reservoir for EHD. Adenovirus is shed from the nasal and oral secretions, feces and urine of infected animals.

The carcasses of animals that die from the above disease should not be used as bait and be disposed in a manner where they cannot be scavenged.

Source: (Miller, Dawson & Schwantje, 2003), (Indiana, 200X), (McDaniel, 2001), (CFIA, 2003), (CFIA, 2005), (Boyce et.al, 2000), (Shilton et.al, 2002) & (Woods et.al, 1999)

Filarial Worms

Commonly Affected Species: Bears. Note a different species of filarial worms can also occur in Cervids.

Causative Agent: Parasitic worm, *Dirofilaria ursi.*

Geographic Range: Worldwide including BC & AB

Mountain Parks Occurrence/Significance: Common parasite routinely found in bears everywhere, including Parks.

Seasonality: Throughout the year.

Wildlife Symptoms of Infection:
Long, white & slender roundworms found under the skin of black and grizzly bears.

Transmission to wildlife: Black flies spread worms to new hosts; however *D. ursi* does not appear to cause disease in bears or other species.

Safety: Follow all safety precautions.

Sampling:
D. ursi infections can be diagnosed either by examining blood smears or by finding adult worms in locations beneath the skin or surrounding internal organs of bears.

Risk for Mountain Parks: *Low* **-** Occurrences commonly occur, but the consequences appear low. There are no real health issues for infected animals. However, because filarial worms are common, parks staff should be aware of their presence.

Female *Dirofilaria ursi* being removed from subcutaneous connective tissue.

Photo Credit: Ontario Ministry of Natural Resources

Transmission to Humans: Potentially through black fly bites, although this is extremely rare.

Human Symptoms of Infection: These worms rarely cause illness in people, although infection with *D. ursi* can occur resulting in the formation of small nodules under the skin.

Source: (Miller, Dawson & Schwantje, 2003) & (BC MoE & Stitt, 2006)

Giant Liver Fluke

Commonly Affected Species: Cervids

Causative Agent: A flatworm fluke called *Fascioloides magna.*

Geographic Range: Rocky Mountains of BC and AB, and other regions in Canada and the US. *F. magna* infections are most common around wetlands.

Mountain Parks Occurrence/Significance: Cases of liver fluke are common in Mountain Parks.

Seasonality: Occurs in late summer and fall where seasonal changes in moisture and temperature affect the snail population.

Wildlife Symptoms of Infection: Animals rarely show external signs, however livers may be swollen and lumpy. Purple-gray oval-shaped worms (flukes) may be seen in liver. Liver damage is usually minor but increases with age and number of flukes present. Animals infected with the adult fluke may be healthy or be in poor condition, appearing drowsy, depressed, with poor appetite. Distended abdomens have been observed in infected elk.

Risk for Mountain Parks: *High* – high probability of occurrence in the Mountain Parks cervid populations due to high prevalence of wetland and moist areas where snails are present.

Photo Credit: Western College of Veterinary Medicine

Safety: Follow all safety precautions.

Sampling: Infection can be verified through examination of the liver for adult flukes or on the basis of finding eggs in fecal material.

Transmission to Wildlife:
Occurs where cervids (hosts) congregate for extensive periods of time with a suitable population of snails (i.e. wetlands). Snails pass on the fluke larvae to cervids. The transfer of the fluke from wild populations to domestic sheep and cattle herds is possible.

Human Symptoms of Infection: Humans are not at risk.

Source: (Miller, Dawson & Schwantje, 2003) & (BC MoE & Stitt, 2006)

Hantavirus Pulmonary Symptom (HPS)

Commonly Affected Species: Rodents, especially deer mice. Rats and other kinds of wild mice can also carry HPS.

Causative Agent: Virus

Geographic Range: Western Canada and USA

Mountain Parks Occurrence/Significance: Due to the nature of work that Parks staff perform in addition to the high probably of exposure to mice, HPS could be considered an occupational hazard.

Seasonality: Year-long.

Wildlife Symptoms of Infection: Hantavirus is usually transmitted by wild rodents. Mice who are carriers of HPS appear to be unaffected by any symptoms. The virus is only demonstrated through antigens in affected carriers.

Transmission to Wildlife: The transmission of HPS between mice and other animals is poorly understood at this time. Research indicates that mammals that share habitats with, or predate on HPS carriers may become infected. However, only rodent hosts shed large enough quantities of the virus into the environment to be considered a carrier.

Risk for Mountain Parks: *Moderate* - The disease is considered to be extremely rare – less than 10 cases have been reported in BC since 1994. However, the consequences of HPS are severe. In North America, about 1 out of 3 people with HPS have died.

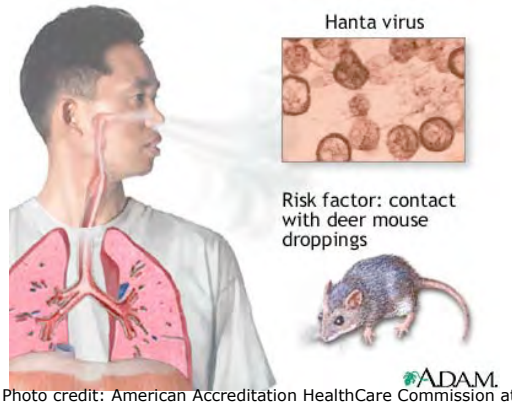


Photo credit: American Accreditation HealthCare Commission at http://health.allrefer.com/health/hanta-virus-hanta-virus.html

Safety: Follow all safety precautions. This includes wearing protective clothing, goggles and using respiratory protection devices. Always wash your hands after touching rodents or their droppings. See **cleaning procedures** listed on this page.

Sampling: Submit the whole mouse. Double bag, label and freeze. Suspected hantavirus mice are considered as a biological hazard, and (TDG) standards apply.

Eliminate Risk: Minimize the presence of mice by eliminating potential food and nesting sources. Seal entry points into buildings (use metal flashing if possible). Cut grass, brush and dense shrubbery around buildings. Elevate sheds, woodpiles, garbage bins and out-buildings, store hay on pallets. Keep woodpiles and garbage bins 30 m from buildings. Other deterrents include sprinkling peppermint or Irish Spring soap shavings where you suspect mice are gaining entrance. Rodents do not like these smells.

Cleaning procedures: When cleaning a building you suspect has been a long-standing home to rodents, first allow the area to ventilate for at least 30 minutes. Sweeping or vacuuming the floor aerolizes virus particles and makes their inhalation much more likely. Instead, wet down shelves, floors and other potentially contaminated areas with a liquid disinfectant or a 10% bleach solution (1 part bleach to 10 parts water). Pour solution carefully onto debris to avoid aerolizing any virus present and do not use a sprayer. Once wet, remove all materials with a wet towel. When finished, mop and sponge down the area again with disinfectant. If you find any dead rodents or rodent droppings, cover them liberally with disinfectant before removing them. Double bag all of the soiled cleaning materials, (along with any dead rodents or droppings) and bury the bags in a hole 0.5-1m deep. Alternatively, waste can be burnt or deposited in the trash where no animal or human can expose the contents. Make sure to disinfect traps after dead animals have been removed. Ensure that you disinfect your gloves before taking them off and disposing of them. Wash hands when finished.

Transmission to Humans: Hantavirus is a rare and potentially fatal virus that is acquired when inhaled on dust particles from mouse feces, dried urine, saliva or nesting materials of infected rodents. In rare cases, it may spread through small breaks in the skin or by rodent bites. The disease does not spread from one person to another. The risk of catching HPS is low. However, people who live in areas where the virus is present and who come in contact with rodent burrows or are exposed to rodent excretions on a regular basis are at risk for HPS. The virus is shown to be viable for two to three days at normal room temperature, exposure to sunlight decreases virus viability while freezing temperatures increase virus viability.

Human Symptoms of Infection: HPS begins as a flu-like illness. In the early stages of the disease, a person may have a fever, sore muscles, headaches, nausea, vomiting and have shortness of breath. Most patients need to go to the hospital and get intensive care. As the disease gets worse, fluid builds up in the lungs, making it harder to breath. One in three people who have contracted HPS die.

Source: (Miller, Dawson & Schwantje, 2003), C MoE & Stitt, 2006), (Williams et al., 2001), (Hantavirus.net, 1998), (CDC, 2006), BCCDC, 2005), & (Aho, 2007)

Hydatid Disease (Echinococcus in Canines)

Commonly Affected Species: Canines (primary host) and cervids (intermediate host) particularly moose, caribou, elk and bighorn sheep.

Causative Agent: Tapeworms- where adult worms live and grow in canine intestines and larval worms form cysts in varied internal organs.

Geographic Range: Across Canada.

Mountain Parks Occurrence/Significance: Common in both primary and intermediate hosts throughout Parks.

Seasonality: Carnivores act as reservoirs year-long, herbivores obtain infection when consuming contaminated vegetation.

Wildlife Symptoms of Infection: Affected cervids often have large fluid-filled cysts in the lungs or liver. Compression and damage to tissues, such as the lungs, may cause debilitation due to the animal's reduced ability to breath and cause loss of body condition.

Transmission to Wildlife: Adult worms live and grow in infected canine's intestines, while larval worms are found in cervids. Adult worms have no detrimental effect on the carnivore host; however, larval cysts may cause problems in the host. Eggs dry out easily and can die within two hours in direct sunlight.

Carcasses with suspected infection should not be used to bait other animals and be disposed of properly.

Risk for Mountain Parks: *Moderate* – larvae are commonly found in elk and moose in Parks. In canines such as wolves, adult tapeworms are not routinely looked for but are usually present in carnivore intestines.

Safety: Follow all safety precautions.

Sampling: Tapeworm can be verified on the basis of finding eggs in the fecal matter of infected carnivores. Cystic larval stages in cervids are identified by examining cysts in tissues. These tissues can be sent to a laboratory for verification.

Transmission to Humans: Cysts found in the liver and lungs of affected animals are not infectious to people. However, eggs are shed in canine feces and stick to fur, and these eggs can infect people. Humans can become infected from handling infected carnivores or carnivore pelts that are contaminated with feces. Symptoms get worse with time and depend on which organ is infected. Humans cannot be infected from cervid intermediate hosts.

Human Symptoms of Infection: The severity of symptoms depends where worms form cysts: cysts formed in the brain can result in death because of pressure on brain tissue, cysts in the lungs result in a fever and breathing difficulties, and cysts in the abdomen cause liver damage resulting in abdominal pain and jaundice. Left untreated this parasite can result in death. If you have any health concerns after handling canine carcasses consult your doctor. Infection can be treated with anti-parasitic drugs or through surgical removal of cysts.

Source (Miller, Dawson & Schwantje, 2003) & (BC MoE & Stitt, 2006)

Leptospirosis

Commonly Affected Species: Rodents, beavers, deer and raccoons.

Causative Agent: Bacteria

Geographic Range: Worldwide

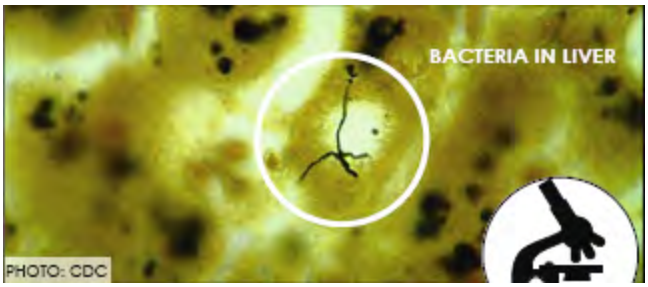
Mountain Parks Occurrence/Significance: Leptospirosis has been found in elk in Banff National Park. Results indicated that 93% of elk were infected by leptospirosis. However, clinical symptoms were not observed.

Seasonality: Most cases occur in August through September in North America.

Wildlife Symptoms of Infection: Infection is believed to be uncommon, and most infected animals have no symptoms. The incubation period is anywhere from two to 20 days. Internal organ damage occurs, particularly in the kidneys, liver and spleen (they become enlarged). The whites of the animal's eyes can appear jaundiced. Vomiting, fever, failure to eat, reduced urine output, unusually dark or brown urine, and lethargy are also signs of the disease.

Transmission to Wildlife: Transmitted by the ingestion of urine from an infected animal. Infection can also occur when infected urine comes into contact with abraded skin or mucous membranes. Urine can contaminate standing water, soil and vegetation. The bacteria is contagious as long as it remains moist.

Risk for Mountain Parks: *Unknown*



Safety: Follow all safety precautions, including wearing gloves and washing hands afterwards. If you need to wade into water, wear boots.

Sampling: Blood samples can indicate if leptospirosis antibodies are present. Other samples for analysis include kidney and/or liver biopsies. Urine analysis can also be used on both living and dead animals.

Transmission to Humans: Leptospirosis is spread through contact with the urine or tissues of infected animals. This includes the consumption of food, water, soil or vegetation contaminated by infected urine. It can also be contracted through the exposure of open wounds or mucus membranes to contaminated water. The disease is not spread from person to person. This disease is common among people who are immersed in water for a prolonged period of time (i.e. water sports).

Similar Diseases: Leptospirosis has wide range of symptoms which can be hard to diagnose. Similar diseases include influenza, hepatitis, viral meningitis, and malaria.

Human Symptoms of Infection: Most people will not have symptoms. When symptoms do occur they appear after four to 14 days of incubation and include; a high fever, severe headaches, chills, muscle aches and vomiting. Other symptoms can include jaundice, red eyes, abdominal pain, diarrhea and a rash. If untreated, symptoms can include kidney damage, liver failure, breathing problems, headache and a stiff neck. While rare, fatalities can occur if not treated.

Source: (BC MoE & Stitt, 2006), (Wikipedia, 2007) & (Shury, Personal Communication, 2007)

Lungworm (Protostrongylus stilesi)

Commonly Affected Species*:* Bighorn sheep, mountain goats and other mammals.

Causative Agent: Parasitic nematode (*Protostrongylus stilesi).*

Geographic Range: Mirrors bighorn sheep distribution.

Mountain Parks Occurrence/Significance: Lungworm is known to occur in the bighorn sheep in the LLYK Parks. Death results, usually in association with pneumonia.

Seasonality: Varies seasonally, peaking in females prior to lambing and in males during rut.

Wildlife Symptoms of Infection: The larval stages of lungworm can cause significant damage to lung tissue. Large concentrations of the parasite cause respiratory stress and can create lesions in the lungs and bronchial passages and predispose the host sheep to pneumonia. Lungworm infections have been known to cause major mortalities in some populations. High levels of lungworm can cause high mortality in bighorn lambs. Many bighorn herds are infected with lungworm and pneumonia bacteria; healthy herds are usually able to cope with this disease, whereas unhealthy herds cannot. In weakened, stressed, or young bighorn, the lungworm lesions provide suitable sites for pneumonia-bacteria infection. Some studies suggest that there is a trade-off between parasite resistance and reproductive effort in both sexes of bighorn sheep.

Risk for Mountain Parks: *High* - If environmental conditions compromise the Mountain Parks bighorn sheep health, lungworm could further weaken herd health, causing high mortality from lungworm-pneumonia complex or other infections.

Safety: Follow all safety precautions.

Sampling: Lung tissue can be biopsied and stored in both formalin and 70% ethyl alcohol solutions for analysis.

Transmission to Humans: None known.

Transmission to Wildlife: Both bighorn sheep and mountain goats are highly susceptible to infection from lungworm. Bighorn sheep accidentally ingest snails (who are hosts to lungworm larvae) while they graze. The larvae penetrate the intestinal wall and travel to the lungs where they become adults. Lungworms lay eggs in the lungs, which hatch and the young larvae enter the air passages where they are coughed up and swallowed. Lungworm larvae are excreted in fecal pellets and seek host snails. Larvae can remain viable in fecal matter for up to 14 months. Habitat factors that improve the survival of lungworm larvae, their intermediate host (terrestrial snails) or their rate of ingestion will increase lungworm loads in bighorns. Higher animal infection rates have been associated with higher soil moisture levels. The transmission of the lungworm parasite between wild and domestic sheep has not been documented, but is thought possible.

Source: (Strubel, 2000), (BCMWLP, 2004), (McDaniel, 2001), (Pelletier et al., 2005)

Moose Measles

Commonly Affected Species: Canines, bears, cougars, cervids, particularly moose, but including bighorn sheep.

Causative Agent: A parasitic tapeworm (*Taenia krabbei).*

Geographic Range: Northern areas around the world.

Mountain Parks Occurrence/Significance: Moose measles is a common parasite found in wildlife across the northern hemisphere.

Seasonality: Year-long.

Wildlife Symptoms of Infection: Adult worms live and grow in the intestines of infected carnivores. Affected herbivores will have small white cysts (2-4 mm), usually in muscle and connective tissue. This is a very common parasite and is considered to be relatively harmless to wildlife.

Transmission to Wildlife:
Adult tapeworms live in the intestines of affected carnivores. Eggs are shed in the feces, dropping on the ground or vegetation. If the eggs are eaten by grazing herbivores, the larvae migrate to various muscles including the heart. Once they reach the muscle, the larvae stop moving and enter a resting stage until their host animal gets eaten by a carnivore. In the gut of the carnivore the larvae develop into adults, continuing the life cycle.

Cysts in fresh unfrozen meat can infect other animals if consumed. However, the carcass can be frozen to kill cysts.

Risk for Mountain Parks: *Low* – while this parasite is common, it is relatively harmless to wildlife.

Photo Credit: Western College of Veterinary Medicine

Safety: Follow all safety precautions.

Sampling: White cysts in infected animal muscle tissue are visible to the human eye. Tissue containing cysts can be stored in a formalin solution. Adult tapeworms in carnivores can be found in the intestine, or eggs can be found in the feces.

Transmission to Humans: The cysts contain juvenile worms that do NOT infect people. People are not at risk. Tapeworm larvae are destroyed through cooking the infected muscle tissue.

Source: (BC MoE & Stitt, 2006) & (SRD, 2004)

Orf (Contagious Ecthyma) or Soremouth

Commonly Affected Species: Wild ungulates, especially bighorn sheep and goats, as well as domestic sheep and goats.

Causative Agent: A parapox virus.

Geographic Range: Present in areas of southern BC in some populations of bighorn sheep and mountain goats.

Mountain Parks Occurrence/Significance: In 1952, the disease was first recognized in North America in the Banff bighorn sheep population. The last outbreak in BC occurred in the East Kootenay Columbia Lake bighorn sheep herd in the winter of 1999-2000.

Seasonality: Usually reported during rut when conspecific animals, that is animals belonging to the same species, are in close association. Also reported during the winter when animals congregate around road salt or salt blocks or any situation where humans are in contact with animals more closely (i.e. hunting, where people can observe symptoms at a higher frequency).

Risk for Mountain Parks: *High* - Orf has occurred in the Kootenay bighorn sheep population and neighboring bighorn sheep herds. The risk of infection increases as the herd population size increases.

PHOTO: DR. HELEN SCHWANTJE, B.C. MINISTRY OF ENVIRONMENT

Safety: Follow all safety precautions. Wash hands and clothes after contact. Orf is considered an occupational hazard to those who handle wild and domestic sheep and goats.

Sampling: Scabs and the tissue immediately surrounding the scabs can be submitted to a lab for diagnostics. Place in sterile container, label and freeze.

Wildlife Symptoms of Infection: Infected animals have obvious single or multiple crusty lumps and/or lesions on their lips. Lesions can also occur on the face, udder, inside the mouth, and above the hooves. Infected animals may appear restless, nervous and show excessive licking of the lips and nostrils as well as scratching of the head. If mouth lesions are severe enough animals will not feed and lameness may occur from lesions on the foot. Animals under physiological stress (such as poor body condition) are also more susceptible. Affected animals usually recover, however, in severe outbreaks death may occur in younger animals. Young animals are more likely to be affected by the parapox virus & may have difficulty nursing leading to loss of condition or death by starvation. Death is rare and is usually associated with secondary infections.

Transmission to Wildlife: Orf is likely to be transmitted when there is direct contact with the virus or scabs containing the virus. Coarse feed or salt blocks which can irritate/abrate oral tissues are thought to increase the likelihood of transmission. Situations that foster the amount of contact between infected and non-infected animals increase the likelihood of contracting the virus (including contact between wild bighorn sheep and domestic sheep and goats). The parapox virus is endemic in some populations of bighorn sheep and mountain goats, where immunity cycles are based on environmental and herd health conditions. The virus is very resistant to environmental conditions and has been recovered from crusts after 12 years. Scab material remaining in sheep/goat habitat may serve as a reservoir for infection. Initial scabs form 7 days after infection followed by 10 days of pustules turning to scabs. After 3 weeks lesions begin to subside and typically do not scar. Short-term immunity of up to 5 months is thought to occur following an infection.

Human Symptoms of Infection: Symptoms include: red skin lesions on the hands, arms or face, swollen painful lymph nodes and a mild fever. Skin lesions usually go away within 6 weeks without scarring, but it is advised to consult a doctor for proper diagnosis and treatment.

Transmission to Humans: Through direct contact between humans and infected animals, especially if open wounds contact infected skin areas of the animal.

Source: (Miller, Dawson & Schwantje, 2003), (BC MoE & Stitt, 2006) & (Schwantje, "Contagious Ecthyma" 2003)

Parvovirus

Commonly Affected Species: Wild and domestic carnivores, particularly dogs, cats, coyotes and wolves (canids).

Causative Agent: Virus

Geographic Range: Occurs worldwide, but each geographic area has a specific host animal. In BC potential wild hosts include: raccoons, foxes, bears, and mustelids.

Mountain Parks Occurrence/Significance: Outbreaks in BC have occurred in coyotes and wolves, associated with outbreaks in domestic dogs. Studies in Banff National Park indicate that the infection rate of parvovirus occurs in 60% of the coyote and wolf populations. Coyotes in the Banff field unit have been suspected of having parvovirus before being euthanasized.

Seasonality: Occurs throughout the year, but most often in the late spring and early summer when there is an abundance of young of the year.

Wildlife Symptoms of Infection: After 4-5 days from initial exposure, infected animals may seem anemic from blood loss, dehydrated, depressed, tired and lack appetite, This is followed by fever, vomiting and diarrhea. Parvoviral diarrhea is watery, pasty or porridge like, foul-smelling and often contains blood and mucous. Animals that resume eating within 3-4 days after infection usually survive; most animals that die will do so within 4-5 days. Infected animals can shed the virus for up to 2 weeks after apparent recovery. In animals greater than 4 weeks of age the virus targets and damages the intestinal walls. In animals less than 4 weeks of age the parvovirus infects the developing brain and/or heart, but does not affect the GI tract.

Risk for Mountain Parks: *Moderate* – young of the year are at the most risk from mortality due to parvo.

Photo Credit: Western College of Veterinary Medicine

Safety: Follow all safety precautions. Areas contaminated with feces suspected of containing parvovirus should be cleaned with a bleach solution.

Sampling: Parvovirus is usually detected in the feces; diagnosis of parvovirus can be made during post-mortem examination of the gastrointestinal tract. Carcasses should be isolated from other canids and incinerated or buried deeply.

Transmission to Wildlife: Occurs through the ingestion of viral particles passed in the feces of an infected animal, rather than through direct contact. The parvovirus is stable when frozen, and is capable of surviving for at least several month under dark, cool and moist conditions.

Transmission to Humans: No evidence suggests that humans can be infected from parvovirus.

Source: (Miller, Dawson & Schwantje, 2003) & (Schwantje, "Parvovirus" 2003), (Shury, Personal Communication, 2007)

Plague

Commonly Affected Species: Fleas, rodents, mink, martin, bobcat, lynx, rabbits and squirrels.

Causative Agent: Bacteria

Geographic Range: A rare disease in BC last seen in the 1980's near Kamloops and the Okanagan Valley. It occurs worldwide, and is primarily a flea transmitted disease perpetuated by rodents.

Mountain Parks Occurrence/Significance: There have been no known occurrences of the Plague in Parks. However, gray literature studies on the ground squirrel population in Waterton National Park indicate positive findings of the Plague from serum samples.

Seasonality: Unknown.

Wildlife Symptoms of Infection: Signs during outbreaks in rodents include: swollen and/or rotting lymph nodes and multiple red spots on the skin and organs.

Transmission to wildlife: Transmission is through flea bites, or through direct contact with an infected animal (such as scavenging, where abrasions come into contact with an infected area, or, in rare cases, through inhalation). Animals can be infected by eating infected tissues. Infected fleas remain in burrows, and other animals that burrow (primarily rodents) tend to have the highest rates of infection. Spill-over from rodents to other species often results in outbreaks.

Observation of symptoms in wild mammals is unlikely; the discovery of dead animals is more common. Lesions can occur but vary in extent. Other symptoms include: swollen lymph nodes near the bite (flea or oral puncture), abscesses near the bite, muscle soreness, loss of appetite, fever, depression, rotting of lymph tissues, and edema in the lungs. Death may rapidly occur before the appearance of clinical symptoms. A rapid, large decline of colonized rodents is suggestive of the Plague.

Risk for Mountain Parks: *Low to Moderate* – however, with the northward expansion of insects in Canada due to a warming climate, there is the possibility of the Plague filtering into LLYK in the future. In fact, the threat may already exist, as the plague antibody is thought present in most rodent populations.

Safety: Follow all safety precautions, including appropriate dress to avoid flea bites, wearing a proper filter mask and eye protection. Wash hands after contact with a potentially infected animal. Plague suspects should be dusted with carbamate or pyrethrin insecticides to kill fleas.

Sampling: Collect a representative sample of fleas (mature, immature, male, female) off fresh affected mammals. DO NOT ATTEMPT TO COLLECT TISSUE SAMPLES. Animals surviving infection develop serum antibodies that can be used for diagnosis of exposure. Detection of antibodies in the blood of carnivores has been used to monitor plague activity in areas where Plague is normally found.

Similar Symptoms: Other bacterial infections, such as tularemia and pneumonia may have similar symptoms, although do not cause the same high mortality rates as the Plague.

Transmission to Humans: Humans are infected through infected flea bites, through contact with abscesses on infected animals, being bitten or scratched by an infected animal, or inhaling infectious airborne droplets (although very rare). Human infection has been reported from contact with the skinning of newly dead animals. The Plague bacterium is viable in soft tissue for up to one week and for longer in infected bone marrow.

Human Symptoms of Infection: If infected, medical attention is required. The bubonic form (resulting from a flea bite) results in fever and general illness, swollen/painful and hot lymph nodes, and inflammation around the flea bite. Both septicemic (in the blood - causing discolouration of blood under the skin hence known as "the Black Death") and pneumonic (lung) forms of the Plague result in fever and signs of shock, breathing problems, including a cough, excessive bleeding (hemorrhaging) and ultimately lead to death.

Source: (Miller, Dawson & Schwantje, 2003), (BC MoE & Stitt, 2006), (Shury, Personal Communication, 2007)

Rabies

Commonly Affected Species: Any mammal, especially bats, but including foxes, raccoons, skunks, wolves and coyotes.

Causative Agent: Virus that affects the nervous system of mammals.

Geographic Range: Insect-eating bats are the main rabies carrier in BC, and the disease is rare. Skunks can also act as a rabies reservoir. Rabies occurs world-wide.

Mountain Parks Occurrence/Significance: There has been one suspect case of rabies reported in a coyote found in the Banff Field Unit.

Seasonality: Primarily occurs during the spring and summer months when bats are most active.

Wildlife Symptoms of Infection: Affected animals may be found dead, may be weak or show unusual behaviour. Initial behaviour includes: a loss of appetite and retraction from contact, followed by a loss of fear or unusual friendliness. Signs progress into excitation, aggression (the phase where other animals are likely to be attacked), depression, lack of coordination, abnormal vocalizations, appearance of nocturnal creatures during the day (i.e. bats), signs of choking or inability to drink or swallow food (hydrophobia), excessive drooling or frothing at the mouth, convulsions, paralysis and ultimately death. In carnivores, the evidence of having attacked porcupines may also be seen. All bats should be considered a potential source of rabies. Abnormal behaviour for bats includes being found during the day or on the ground. Bats may get sick and die before being observed or showing symptoms found in other mammals.

Transmission to Wildlife: Rabies is primarily transmitted between animals by biting, where the virus is transmitted through the saliva. Rabies can also be acquired if licked by an infected animal or if infected saliva comes into contact with mucous membranes. Infection may be slow, with signs occurring from over a week to over a month after exposure.

Risk for Mountain Parks: *Low* - "spill over" of rabies to terrestrial mammals from bats has occurred in BC and AB, but rabies has never been maintained in wild population of terrestrial mammals.

Safety: Follow all safety precautions, including a rabies vaccination. If bitten or scratched by a suspected animal, clean and flush the wound with soap and water, disinfect site with 50-70% alcohol and seek medical attention immediately. Contact the nearest health authority and provincial wildlife veterinarian to inform them of the situation.

Sampling: Intact brain tissue is the key diagnostic tool in confirming rabies infection. If an animal suspected of having rabies must be destroyed, it is important that it NOT be killed by gunshot to the head. Other forms of euthanasia must be considered.

If possible submit the entire carcass for testing. Specimens can be frozen. For small animals such as bats, skunks and foxes, double-bag the entire animal and place in a leak-proof container. For larger specimens the head can be submitted. Diagnosis of rabies is done by the Canadian Food Inspection Agency laboratory in Lethbridge, Alberta. Ensure proper TDG requirements are met. The rabies virus does not persist in the external environment and the virus is rapidly inactivated through exposure to most detergents, chemicals, ultraviolet radiation, strong acids and bases, and direct sunlight.

Transmission to Humans: Humans can get rabies through the bite or scratch of an infected animal, or from the saliva of an infected animal that touches eyes, nose, mouth or skin wounds.

Human Symptoms of Infection: Rabies is serious and fatal disease; seek treatment as soon as possible if in contact with a rabid animal. Rabies is a viral disease that causes inflammation of the brain (encephalitis) and can also lead to pneumonia. Symptoms may not be detected for weeks, months or years. Symptoms may start with: pain, tingling, or itching near the exposure site followed by fever, chills, fatigue, vertigo, muscle aches, including a stiff neck, an inability to drink (hydrophobia) and irritability. Additional symptoms can include: high fever, confusion, agitation, seizures, coma, headache, paralysis, and lack of coordination. Left untreated, rabies is always fatal.

Source: (Miller, Dawson & Schwantje, 2003), (BC MoE & Stitt, 2006) & (Schwantje, "Rabies" 2003), (Shury, Personal Communication, 2007)

Racoon Roundworm (Baylisascaris)

Commonly Affected Species: Mainly raccoons, but occurs in all mammals, including birds (considered as abnormal hosts). Other roundworms can affect skunks, badgers and bears, but raccoon roundworm is the most infectious to people.

Causative Agent: Parasitic roundworm (nematode).

Geographic Range: Mirrors that of raccoons. Raccoon infection rates in SW BC are 61%. As the popularity of raccoons as pets rises and they are brought to new locations, their geographic range continues to expand.

Mountain Parks Occurrence/Significance: Raccoon roundworm has not been found in Mountain Parks.

Seasonality: Late spring and early summer.

Wildlife Symptoms of Infection: Immature (larval stages) of the worm migrate through tissues and can cause extensive damage in the host. Adult worms are found in the small intestine of the raccoon. The worm can occur in both raccoons and other mammals. Symptoms are rarely observed in raccoons, but if observed, tends to occur in the young of the year rather than adults. *In Raccoons* – larval migration may cause local areas of inflammation and tissue damage where adult worms can cause damage by blocking the small intestine. Otherwise there are no detrimental effects on raccoons.

In abnormal hosts, depending on the organ affected, tissue damage by larvae can result in cysts forming in the muscles, liver and lungs OR can result in severe neurological signs including imbalance, circling and abnormal behaviour. In abnormal hosts there are usually no symptoms if the larval parasite does not enter the brain. Effects correlate with the number of eggs ingested, the number of larvae entering the brain, the extent of migration within the brain, and the size of brain relative to the size of the parasites.

Clinical Signs in Abnormal Hosts:
Small Mammals **–** Depression, lethargy, nervousness, unkempt coat, tremors in the front paws, head or body tilts that gets progressively worse, falling over, circling, posterior paralysis, blindness, laying in its side.
Large Mammals – Signs have not been observed in large mammals except in zoos.
Birds – Poor grip reflexes, lack of coordination, inability to fly, loss of flight control. Falling and wing and leg paralysis.

Risk for Mountain Parks: *Low* - no raccoons have been found in the Mountain Parks as of yet**.**

Photo Credit: CDC

Safety: All safety precautions should be followed. Minimizing the potential exposure to raccoon feces is the best risk reduction measure. Exclusion of humans from areas of high raccoon inhabitation may be warranted.

Sampling: Infection is confirmed by finding eggs in the fecal material of live raccoons. Roundworms found in the intestines of raccoons can be submitted. For other mammals, tissue containing small "cysts" should be submitted to a lab in a 70% ethyl alcohol solution.

Similar Diseases: Neurological symptoms are very similar to rabies and other wildlife diseases that affect the central nervous system including: pesticide exposure, trauma, sarcosystosis (in birds), and bacterial and/or viral inflammation of the brain.

Transmission to Wildlife:
In Raccoons - Adult worms produce eggs that are shed in raccoon feces. Infective eggs are ingested by young raccoons OR after eating another animal that has larvae in its tissues. Larvae migrate via the bloodstream through the liver to the lungs. The larvae are then coughed up, swallowed and mature into adults in the small intestine. *In Abnormal Hosts* – Other animals forage in areas where there is infected feces and ingest larvae or eggs. Larvae hatch in the gut and migrate erratically through tissues such as the lung, liver, heart, the eyes and central nervous system. This causes tissue damage. Within a month, larvae develop within the eggs, which can persist in the environment for years. The eggs are resistant to common disinfectants. Burning is thought to be the most effective method of destroying the eggs.

Human Symptoms of Infection: Raccoon roundworm infection in humans can cause severe damage in the eyes and brain and in extreme cases death. Clinical signs include; skin irritation from larvae migrating within the skin, eye and brain tissue damage due to the random migration of the larvae, nausea, lethargy, lack of coordination, and loss of eyesight.

Transmission to Humans: Raccoon roundworm is transmissible to people and central nervous system damage has been reported in humans.

Source: (Miller, Dawson & Schwantje, 2003), (BC MoE & Stitt, 2006) & (Shury, Personal Communication, 2007)

Sarcocystosis (Rice Breast Disease)

Commonly Affected Species: Birds, most commonly in waterfowl such as mallards, northern pintails, northern shovelers, teals, gadwells, and American black ducks. It can also occur in domestic and wild mammals.

Causative Agent: Parasite

Geographic Range: Mirrors the range of afflicted waterfowl.

Mountain Parks Occurrence/Significance: *Sarcocystosis* is a common and incidental finding in Parks.

Seasonality: Infect birds year-round, but most commonly reported during hunting season.

Wildlife Symptoms of Infection: *Sarcocystosis* is a non-fatal infection mostly observed in adult birds. Severe infections can result in loss of muscle tissue leading to lameness, weakness and paralysis. Symptoms seen internally are cream coloured cysts resembling grains of rice which run in parallel with muscle striations. Cysts are most commonly found in the breast muscle of birds but can also be seen on the heart and limb muscles.

Transmission to Wildlife: Birds ingest water contaminated with the feces of carnivores that contain parasitic eggs. The parasite develops in the intestines of the bird, infects the bloodstream and is then carried to the voluntary muscles where juvenile cysts form. When a carnivore ingests infected muscle tissue from a bird the parasite then reaches maturity in the intestines of the new host, producing more eggs. The eggs can persist in the environment for extended periods of time.

Do not use infected meat for bait and ensure proper disposal.

Risk for Mountain Parks: *Low* – although it is a widespread disease commonly found in waterfowl, it has relatively minor consequences.

Safety: Follow all safety precautions, including proper hygiene, to ensure no cross-contamination of surfaces or equipment occurs.

Sampling: The visible presence of cysts within muscle tissue is often sufficient to diagnose this disease in birds. In most other mammals the disease is found microscopically. Whole birds should be submitted for diagnosis, or alternatively frozen samples of muscle tissue preserved in 10% formalin solution can also be submitted.

Transmission to Humans: In rare cases, humans have been infected, however *Sarcocystis* presents little health hazard to humans as the parasite is destroyed by cooking.

Human Symptoms of Infection: It is unknown how *Sarcocystosis* can affect humans so precaution should be used at all times.

Source: (Miller, Dawson & Schwantje, 2003) & (BC MoE & Stitt, 2006), (Shury, Personal Communication, 2007)

Sarcoptic Mange

Commonly Affected Species: Canines, cats, bears and mustelids.

Causative agent: Parasitic mites called *Sarcoptes scabiei.*

Geographic Range: Found throughout the world.

Mountain Parks Occurrence/Significance: The impact of this parasite on populations is not known. It is thought that the mites are present in the population from year to year, with outbreaks occurring when population densities are high. Mange has been reported in coyotes in the LLYK field unit.

Seasonality: Observed throughout the year but most commonly observed in the winter months when hair loss can be life-threatening.

Wildlife Symptoms of Infection: Affected animals show varying degrees of hair loss, usually on the legs & tail, but it can occur over most of the body in severe cases. Infection typically begins on elbows and towards the tips of the ears moving on to larger body areas. Mange infections are characterized by oily skin, crusting, hair loss, lesions and scab formation. Some animals may have thickened skin. Affected skin is itchy and self-scratching is evident. Badly affected animals are in poor body condition, and may be weak and fearless of people or easily approached, usually while seeking shelter. Mange in wild species predominantly affects younger animals. Severely affected carnivores may scavenge more, and may ultimately die from complications with mange infections or exposure to the elements in winter.

Risk for Mountain Parks: *Low to Moderate* **–** Mange is commonly found in the Mountain Parks. The risk of an epidemic varies with yearly seasonal conditions.

Photo Credit: Western College of Veterinary Medicine

Safety: Follow all safety precautions. Isolate carcasses and bedding. Rubber gloves and protective clothing should be worn when handling wildlife with skin conditions. Infected animals and people can be treated with the repeated application of pesticides.

Sampling: Identification of the mite from deep skin scrapings or skin biopsy of the affected area. Mites cannot be seen with the naked eye. The entire animal may be submitted for necropsy, or portions of the skin may be preserved in 10% formalin.

Transmission to Wildlife: Mange is highly contagious resulting from the direct or indirect transfer of mites (i.e. through bedding materials), usually between the same species. Mites can remain infective without a host for extended periods of time.

Transmission to Humans: Possible, but the risk is low and infection are rare and short lived. Transmission is through direct contact from infected animals.

Human Symptoms of Infection: Itchy skin rashes and redness at the site when contact was made with infected animals (hands and arms). Mange is short in duration and can be treated. Ensure it is not human mange (scabies) which can be more difficult to treat. Mange can be passed on to pets.

Source: (Miller, Dawson & Schwantje, 2003), (BC MoE & Stitt, 2006) & (Schwantje, "Mange" 2003), (Shury, Personal Communication, 2007)

Ticks and Disease

Commonly Affected Species: Ticks (carrier) and subsequent hosts (all mammals), particularly small rodents and lagomorphs in the tick larval and nymph stages and moose, deer, and bighorns in the adult stages.

Causative Agent: Bacteria *Borrelia burgdorferi* causes Lyme disease and is carried by the Western black-legged tick (found near coastal BC) and the black-legged tick (found in eastern Canada and the US). There are several species of ticks in BC, including the Rocky Mountain wood tick and the winter tick.

Geographic Range: Different tick species are present throughout the provinces of British Columbia, Alberta and elsewhere in North America.

Mountain Parks Occurrence/Significance: Ticks prefer habitat that includes wooded regions and areas with tall grass. As Parks staff work in these areas on a daily basis, tick bite prevention is a significant concern.

Seasonality: Dependent on species, but can be year long ("winter ticks" as adults in the winter and other species in the spring, summer, and fall).

Wildlife Symptoms of Infection: A single moose can carry tens of thousands of winter ticks, resulting in significant blood loss and skin irritation. The moose rubs and scratches its skin leading to hair loss over the neck and body by early spring (known as "ghost moose'). Heavy tick loads can weaken animals through direct blood loss, and through loss of body heat due hair loss, potentially leading to death. Young moose are particularly vulnerable. Other ungulates, such as bighorn sheep, elk and deer species appear to carry fewer ticks and are rarely affected adversely. Ticks are easiest to spot when they are feeding on a host, where the mouth is inserted beneath the skin and the posterior body remains outside of the host. Once fully engorged with blood, the tick detaches and drops onto vegetation.

Risk for Mountain Parks: *Moderate* **-** Steps to prevent tick bites are warranted as ticks carry a range of infectious diseases including: Rocky Mountain spotted fever, tick paralysis, relapsing fever tularemia, and Lyme disease. The species of tick carrying Lyme disease is not currently present in Mountain Parks; but has recently (June 2007) been found in Edmonton, Alberta.

Thin Emaciated Moose Dead of Effects From Winter Tick
Photo Credit: F. Matejka

Safety: When working in the field, wear light-coloured clothing, tuck shirt into pants and tuck pants into boots or socks. Put insect repellent containing DEET on uncovered skin and containing Permethrin onto clothing. Check clothing and scalp when leaving an area with ticks. Check your whole body in good lighting; if possible have someone check hard-to-see areas. A vaccine to prevent Lyme disease is available in Canada, but it is not 100% effective.

Removing a Tick: Use tweezers or forceps to gently get a hold of the tick as close to the skin as possible. Don't touch the tick with your hands. Without squeezing the tick, steadily lift it straight off the skin – DO NOT jerk it out. Make sure that all the tick is removed, and look for other ticks. Once the tick(s) is removed, clean the bite area with soap and water and then disinfect the wound with antiseptic cream. Wash hands with soap and water.

Transmission to Humans: Directly though tick bites

Sampling: Save the live tick along with a damp cotton ball in a container with a tight fitting top. Label the container with the date shipped, name and address of the person bitten, what species the tick was found on, what part of the body was bitten, and what part of the province the tick came from. Also include the name and address of family physician. Send for lab testing to: BC Center for Disease Control, Vector-Borne Disease Laboratory, 655 West 12th Ave, Vancouver BC, V5Z 4R4

Transmission to Wildlife: Ticks have one of two different life cycles, utilizing either one or three hosts for development into adults. *One-host ticks* (i.e. winter tick) hatch in the early spring and rest until fall, when they climb on vegetation and wait for a passing host. The larval tick stays on the host, molting into a nymph by late fall, feeding, then molting into an adult by late winter. Mating occurs on the host, and the female feeds one last time before dropping to the ground to lay her eggs before dying. *Three host ticks* (such as the wood tick or the Western black-legged tick) emerge in spring as adults from ground and seek large hosts for a blood meal and mating. Females drop to the ground when ready to lay eggs. When the larvae hatch they climb vegetation and wait for a suitable small host. After feeding, the larvae drop off, molt to nymphs, find another host, feeds, then drops off to molt into an adult. Each life stage can survive for up to three years without a host. Three host ticks can carry and transmit infectious diseases between species. The best case of this is Lyme disease (in humans) carried by the Western black-legged tick, found in Coastal BC, Ontario, and recently Alberta.

Human Symptoms of Infection: General symptoms of tick bites include: edema, chronic sores, ulcers at bite site, fever, mild rashes and headaches. In some cases paralysis may occur, starting in the feet and legs and working its way to the upper body, arms and head. This paralysis can develop from within a few hours to several days. Symptoms of Lyme disease include: fever, headache, muscle and joint pains, and fatigue or weakness of muscles in the face. A skin rash that can look like a "Bull's Eye" which is 5 cm in diameter may develop, particularly at the location of the bite. If you experience any of these symptoms after being bitten by a tick seek medical assistance immediately.

Source: (Schwantje "Ticks", 2003), (Miller et al, 2003),(Samuel et al, 2001), (Leighton, 2000), (Ab, 2007) & (BCCDC, 2002)

Trichinellosis

Commonly Affected Species: Carnivorous mammals and birds, particularly bears, wolves and cougars.

Causative Agent: Parasitic roundworm.

Geographic Range: Worldwide except Australia and Antarctica.

Mountain Parks Occurrence/Significance: Cases of Trichinellosis are common in the Mountain Parks.

Seasonality: Throughout the year.

Wildlife Symptoms of Infection: *Trichinella* is primarily a disease of carnivores with scavenging or cannibalistic tendencies. Wildlife rarely show signs of disease. In wildlife, the disease occurs at two stages of infection with the following symptoms:
In the Muscle – muscle pain, edema, fever, and large burdens of cysts caused by larvae which can lead to death.
In the Intestines - adult worms may cause hemorrhaging.

Risk for Mountain Parks: *Moderate to High* – Trichinellosis is common in Parks and is a zoonotic disease.

Safety: Follow all safety precautions.

Sampling: Immediately report to CFIA. Muscle tissues containing larval cysts should be submitted for diagnosis. Cysts may be difficult to see with the naked eye; however, active muscles such as the tongue, diaphragm and jaw muscles usually contain the highest concentrations of infective larvae.

Transmission to Humans: Humans can contract Trichinella from eating improperly cooked meat. Freezing meat is not a reliable way of killing the roundworm adults, larvae or eggs.

Transmission to Wildlife: Transmission between hosts occurs when infected meat is consumed. Cysts containing larva are eaten, the larvae migrate to the intestinal wall of the new host and form new cysts where they mature into adults and mate. New larvae move via the bloodstream to muscle tissue where they remain until the host is eaten – thereby infecting a new host. Cysts may remain in muscle tissue for 6-12 months and can survive after the death of the hosts, infecting scavengers.

Infected carcasses should not be used as bait.

Human Symptoms of Infection: In humans, symptoms are: edema around the eyes, fatigue, aching joints, muscle pain, vomiting, diarrhea, fever, itchiness and lesions of the skin. More serious cases in humans have resulted in breathing difficulties, inflammation of the brain and heart failure. Prescription drugs are available to treat *Trichinellosis*. Treatment should begin as soon as possible.

Source: (Miller, Dawson & Schwantje, 2003) & (BC MoE & Stitt, 2006) & (Shury, Personal Communication, 2007)

Tuberculosis (TB) and Avian Tuberculosis

Commonly Affected Species: Bison, cervids, birds and mammals including humans.

Causative Agent: A bacterial disease. In bison it is called *Mycobacterium bovix,* and in birds *Mycobacterium avium.*

Geographic Range: In BC and AB the species of most concern in wood bison.

Mountain Parks Occurrence/Significance:
TB has occurred in wood bison both in and outside of Wood Buffalo National Park and in elk in Riding Mountain (RM) National Park. The disease has also appeared in a number of cattle herds and in elk near RM park. Bovine TB was introduced into wildlife populations through contact with domestic animals.

Avian TB exists in small numbers of free-ranging wild birds and is found in species that associate with domestic birds. It is also found in scavengers or wherever there are major concentrations of birds.

Seasonality: Throughout the year.

Wildlife Symptoms of Infection:
Cervids – this is a slowly debilitating disease; general symptoms include weakness, loss of appetite, weight loss and fevers. Affected animals may show no symptoms or may be in poor body condition. Abscesses often develop and may discharge pus through the skin or mucous surfaces. Lesions may mineralize with age but may be difficult to find early on. Enlarged lymph nodes are seen. Although rare, TB can break directly through the skin of an infected animal. Small multiple round gritty lumps in lymph nodes and on lungs & rib cage are typical.

Birds -Infected birds are often emaciated, weak and lethargic, exhibiting signs of wasting muscles. Other symptoms can include diarrhea, lameness and an unkempt appearance. Abscesses and nodules may be seen around the eyes, at the wing joints, on the legs, side of face, and the base of the beak (this can resemble avian pox). Nodules are crumbly and yellow-white-grey in colour and are embedded in the infected organs. Clusters of nodules may also appear on affected organs. Lesions can occur on the lungs or the intestines. Infected birds often have enlarged livers and spleens. Some infected birds have died without any obvious signs.

Risk for Mountain Parks: *Low to Moderate* – Although there are serious implications for cervids if TB is contracted, the probability of TB spreading to the Mountain Parks is low. Animals that feed in larger groups, such as elk, tend have higher rates of infection than those who feed alone or in smaller groups. TB occurrence in birds is considered to be lower than in cervids.

Safety: Follow all safety precautions, including appropriate respiratory gear.

Sampling: Necropsy and microscopic analysis by a veterinarian is required. Lung and lymph node tissue samples can be submitted for cervids. If bird carcasses or tissues cannot be submitted to a lab quickly, tissues may be preserved in 10% buffered formalin solution. The whole carcass of the bird is preferred, but the leg can be removed at the hip joint, wrapped in clean aluminum foil, placed in a plastic bag, frozen and shipped to a designated lab.

Transmission to Humans:
Humans can get bovine TB from inhaling bacteria or through cuts or abrasions in the skin after being in close contact with an infected animal. The disease gets worse with time and is fatal if untreated. Bovine TB is one the most infectious forms of TB, but can be easily killed by a weak solution of bleach, and is also heat sensitive. Humans are considered resistant to Avian TB, but some cases do occur. Avian TB is considered non-contagious, and infection is more likely to occur in persons with suppressed immune systems.

Transmission to Wildlife:
Cervids - Sick animals shed bacteria through breathing, coughing or sneezing. New hosts are infected when they inhale or ingest bacteria (including carnivores). Inhalation establishes itself in the lungs and spreads to the nearest lymph nodes. Ingestion establishes itself in the pharynx or small intestine and spreads to the nearest lymph nodes.

Birds - Avian TB is common in captive birds and is transmitted by direct contact with infected birds, ingestion of contaminated feed and water, or contact with a contaminated environment. Inhalation of the bacteria can cause respiratory tract infections.

Human Symptoms of Infection: If lesions are located on the lungs symptoms include: prolonged illness with fever, cough (occasionally coughing blood), night sweats and weight loss. If lesions are on the intestines, symptoms include stomach pain and diarrhea. Symptoms get worse with time and untreated disease can be fatal. People who have a compromised immune system are most at risk**.**

Source: (Miller, Dawson & Schwantje, 2003), (BC MoE & Stitt, 2006), & (Shury, Personal Communication, 2007)

Tularemia (Francisella tularensis)

Commonly Affected Species: Ticks, where *F. t. palaeartica* affects aquatic rodents such as beavers, voles and muskrats. *F. t. tularensis* affects lagomorphs (hares & rabbits).

Causative Agent: Bacteria; with two different sub-species: *F. t. palaeartica* and *F. t. tularensis.*

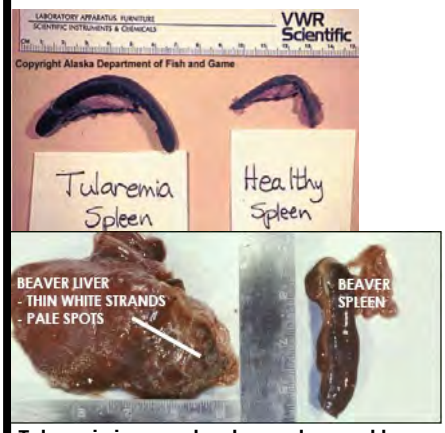
Geographic Range: *F. t. palaeartica* infection primarily occurs in Canada, most often in aquatic habitats (wetland and boreal forests). The most recent occurrences in BC were found in dead beavers in 2003. *F. t. tularensis* occurs in terrestrial habitats and has not yet been reported in Canada.

Mountain Parks Occurrence/ Significance: No cases of tularemia have been recorded on the LLYK mortality database. However, there is evidence of outbreaks in rodents in Waterton National Park.

Seasonality: Ticks are present from approx. May to September and disappear during the fall and winter months. However, the disease is still present through the year if it has a mammalian host.

Wildlife Symptoms of Infection: Affected animals may be sick or dead, or can be in good body condition. Tularemia is often fatal; however, it can infect hosts without apparent ill-effect. These unaffected hosts remain infected for extended periods of time, serving as reservoirs of infection. Sensitive species tend not to display clinical signs of illness before death occurs. Less sensitive species exhibit signs of lethargy, depression and fever as the disease progresses. An ulcer may form at the point of entry of the bacteria. Tularemia is most often recognized during post-mortem examination. Symptoms include an enlarged liver or spleen, with tiny pale spots & thin white strands present on the organs or abdominal cavity.

Risk for Mountain Parks: *Low to Moderate* – Cases have been found in interior BC and in Waterton National Park. Tularemia is transferred through ticks and has the potential of filtering into Mountain Parks with host range expansion.



Tularemia in snowshoe hare spleen and beaver liver and spleen
Source: Randy Zarnke of the Alaska Department of Fish and Game

Safety: Follow all safety precautions when dealing with dead rodents and ensure appropriate dress in order to avoid tick bites. Inspect yourself for ticks after returning from the field. Vaccination against tularemia may be warranted in high-risk areas, or if working with aquatic or terrestrial rodents.

Sampling: The entire carcass of the dead animals should be bagged, chilled or frozen and submitted for necropsy. The diagnosis requires laboratory culture and bacteria identification from affected tissues (such as the spleen or liver). Ensure proper TDG standards are followed.

Similar Diseases: Similar lesions in animals can be observed in animals infected with plague, and/or other bacterial infections.

Transmission to Wildlife: *F. t. palaeartica* transmission occurs directly through water contaminated from carcasses of animals that have died of tularemia. The bacteria may remain infectious for weeks to months following contamination. Transmission may also occur through contact with feces, urine or body parts of infected animals. *F. t. tularensis* spreads primarily through infected ticks bites.

Infected carcasses should not be used as bait and be disposed of properly.

Transmission to Humans: Tularemia can be passed on to humans through bites or scratches from infected wildlife or through contact with feces, urine or body parts of infected animals. It can also be contracted from inhaling infected material, or drinking contaminated water. Human exposure typically results from skinning carcasses. It can also be contracted directly though the bite of an infected tick.

Human Symptoms of Infection: Symptoms appear up to 14 days after initial infection, and include: sore throat, a fever with chills, headache, stomach pain, vomiting, diarrhea, swollen painful lymph nodes, and an ulcer at the site of the tick bite or animal bite/scratch. Inhalation of infected material can lead to pneumonia. Early treatment of tularemia is available with antibiotics. Seek medical attention immediately if you suspect you may have tularemia, which can be confirmed through a blood test.

Source: (Miller, Dawson & Schwantje, 2003), (BC MoE & Stitt, 2006), (Schwantje, "Tularemia" 2003) & (Shury, Personal Communication, 2007)

West Nile Virus (WNV)

Commonly Affected Species: Birds, especially corvids (crows, blue jays, gray jays magpies and ravens), amphibians, domestic poultry, domestic mammals (particularly horses) and humans.

Causative Agent: A virus spread by the bite of an infected mosquito.

Geographic Range (Note- The geographic range of WNV expands annually): Canada (as of 2005, no cases have been found in BC, 6 bird cases have been found in Alberta), USA, Africa, West Asia Europe and the Middle East.

Mountain Parks Occurrence/Significance: WNV can be contracted while conducting field research as well as exposure to a diseased animal through contaminated equipment that pierces the skin. WNV can have serious implications on corvid, raptor and songbird populations. Grasslands National Park endangered Sage Grouse populations have been affected by WNV**.** No known cases have been reported in the Mountain Parks.

Seasonality: The period of greatest risk of infection for birds is in the spring. For people, horses and other mammals it is in late summer and early fall.

Wildlife Symptoms of Infection: In North America, WNV has proven to be a fatal disease in many species of native birds, including hundreds of thousands of corvids (who are highly susceptible to severe disease when they become infected) and a few species of mammals. Eagles, hawks and owls are the most commonly affected species other than the corvids. Positive WNV diagnoses have also been found in robins, eastern bluebirds, cedar waxwings, merlins, American kestrals, eastern gray squirrels, red squirrels and the endangered sage grouse. On the other hand, many species clearly survive infection with little or no evidence of disease and, in many species, some individuals become ill and may die when infected while many other infected individuals suffer no illness at all.

Transmission to Wildlife: The normal cycle of WNV is between mosquito bites to birds; however, other mammals can also be infected through bites. Mother to fetus infection has also occurred. Note: if banding birds, gloves should be changed or decontaminated with 70% ethanol or other appropriate substance after handling each bird to avoid transmission from one bird to another. Do not re-use contaminated bags or other holding, carrying, or restraining devices**.**

Risk for Mountain Parks: *Moderate* – Surveillance programs are conducted on a regular basis in both BC and AB to assess and report on the WNV situation in Canada.

Photo Credit – Canadian Cooperative Wildlife Health Center

Safety: It is best to assume that any specimen could be infectious and to take proper precautions at all times. Wear all safety equipment, dispose or disinfect of all sampling equipment properly. Minimize the generation of aerosols (such as the vigorous spraying of water on carcasses or work surfaces) and disinfect any exposed surfaces. Vaccinations are available for people and horses.

Sampling: If bagging a dead bird, grasp the bird with your gloved hand protected by several layers of leak-proof plastic bags and then turn the bags inside out over the bird. Handle the bird so that beak or claws do not puncture the bags or gloves. After the bird is appropriately contained, wash your gloved hands and then your bare hands. The plastic bag containing the bird should be closed tightly and refrigerated (not frozen) if it can be delivered to a laboratory within 24-36 hours. If longer than this time is required, the bagged dead bird should be frozen and delivered in a frozen state (do not allow it to thaw). Neither refrigeration nor freezing will kill the virus, so always assume tissues or specimens contain live viruses. Birds found between June 1st and Oct 31st can be sent to the BC provincial labs (see Appendix C). Before of after these dates, or if found in AB, the specimen can be sent to the CCWHC lab.

Transmission to Humans: WNV is most often spread to humans through the bite of an infected mosquito. WNV may be shed from the body and oral cavities of birds; therefore avoid contact with feces, feces-contaminated feathers or the urinary or genital tracts. People can be infected if their skin is penetrated or cut while handling infected birds, tissues or fluids. If bites, cuts or punctures occur, promptly wash hands thoroughly, apply antiseptic and report the incident to your supervisor.

Human Symptoms of Infection: If signs of illness occur from 3 to 14 days after exposure to a suspect bird or mosquito bite, prompt medical evaluation and consultation with public health authorities should be sought. Most human infections cause either mild flu-like symptoms or no symptoms at all. Mild symptoms may include fever, fatigue, headache, and muscle or joint pain. Although rare, some people may become severely ill. Severe symptoms include high fever, stiff neck, disorientation, tremors, muscle weakness and paralysis. Severely affected person may develop encephalitis, meningitis or meningoencephalitis (inflammation of the brain and /or spinal cord). Severe cases may be fatal. Persons over the age of 50 are at a higher risk of severe illness.

Source: (Miller, Dawson & Schwantje, 2003), ("2005 West Nile", 2005), (Ornithological, 2003), (Alberta, 2006), (Michigan, 2001-2006), (NIOSH, 2005), (CCWHC, 2003), (BCCDC, 2007) & (Canadian Food, 2004)

Appendix A - Additional Information and Contacts

Below are contacts available for further questions on wildlife diseases and parasites:

i) Parks Canada LLYK Field Unit Wildlife Biologist (Alan Dibb) at 250-347-6158.

ii) Parks Canada Agency Wildlife Health Specialist (Dr. Todd Shury) at 306-966-2930.

CCWHC Lab number: 306-966-5815
CCWHC - Shipping Address:
Canadian Cooperative Wildlife Health Center, c/o Veterinary Pathology
Western College of Veterinary Medicine
52 Campus Drive
University of Saskatchewan
Saskatoon, SK S7N 5B4

iii) Jasper Parks Canada Agency Veterinarian (Dr. Geoff Skinner) at 780-852-6226.

iv) Invermere Veterinarian (Dr. Mark Zehnder) at 1-877-342-7007.
Emergency cell number 1-250-342-5263
Shipping Address:
Unit #5, Lot 13 Industrial Road #2
Box 2004
Invermere, BC V0A 1K0

v) Abattoir in Banff, Wildlife Specialist (Jesse Whittington) at 403-762 -1402.
Alternative Contact: Blair Fyten at 403- 762-1438
Banff Abattoir - Shipping Address:
Banff National Park Warden Office
Box 900
Banff, AB T1L 1K2

vi) Bighorn sheep- domestic livestock issues contact David Zehnder at 250-342-0325.

vii) The British Columbia Provincial Wildlife Veterinarian (Dr. Helen Schwantje) at 250-953-4285 or Helen.Schwantje@gov.bc.ca

Lab number: 1-800-661-9903
BC Provincial Laboratory- Shipping address:
Animal Health Center, Corvid Surveillance Program
1767 Angus Campbell Road
Abbotsford, BC V3G 2M3

viii) The Alberta Provincial Wildlife Disease Specialist (Margo Pybus) at 780-427-3463 or margo.pybus@gov.ab.ca

Alberta Fish and Wildlife Offices – AB provincial surveillance programs require samples be submitted to the nearest Alberta Fish & Wildlife office:
http://www.srd.gov.ab.ca/fishwildlife/contacts.aspx#local

ix) Canadian Food Inspection Agency (CFIA), Cranbrook location (for reporting high risk infectious diseases (Dr. Shirley McDonald) at 250-417-2293. Alternative CFIA offices close to the LLYK parks are Calgary 403-292-4301 and the Animal Disease Research Institute in Lethbridge at 403-382-3120.

x) University of Calgary s Faculty of Veterinary Medicine (Dr. Susan Kutz) at University Office 403-210- 3824; the Zoo office at 403-355-6608 or skutz@ucalgary.ca

xi) Author of the 2007/08 Wildlife Disease Manual for LLYK (Sarah Boyle) at 250-349-5831 or sarah.boyle@community.royalroads.ca

Additional references can also be found on the World Wide Web:

i) Laboratory supplies provider utilized by the Parks Canada Agency http://www.vwrcanlab.com/

ii) The CCWHC associated laboratory is Prairie Diagnostic Services (PDS). Call 306-966-7397, or for more information on laboratory fees and courier rates visit: http://www.usask.ca/pds/fee_guide.html

iii) Manual of Common Diseases and Parasites in Northern British Columbia: http://www.unbc.ca/nlui/wildlife_diseases_bc

iv) Canadian Cooperative Wildlife Health Center: http://wildlife1.usask.ca/

v) Diseases You Can Get from Wildlife in British Columbia, A Field Guide for Hunters, Trappers, Anglers and Biologists: http://www.env.gov.bc.ca/wld/documents/wldhealth/diseases_from_wildlife_safetymanual.pdf

vi) The British Columbia Provincial Wildlife Health Site: http://www.env.gov.bc.ca/wld/wldhealth.html

vii) Fact sheets of common parasites and diseases of fishes and wildlife in Alberta: http://www.srd.gov.ab.ca/fw/diseases

viii) Parks Canada DNA database (maintained at the University of Alberta): https://portal.pc.gc.ca/whalecomb83f8e7c595737/whalecom0/intranet/calgary/ecosystem_services/ecosystem_conservation/DNA%20Web%20Page/index.htm

ix) Canadian Food Inspection Agency – Reportable Diseases (Spring 2007) http://www.inspection.gc.ca/english/anima/heasan/disemala/guidee.shtml

x) Public Health Agency of Canada - Infectious Diseases http://www.phac-aspc.gc.ca/id-mi/index.html

xi) Transport Canada – Infectious Substances and Guidance for TDG Classifications http://www.tc.gc.ca/CivilAviation/commerce/DangerousGoods/guidance.htm

Appendix B – Summary Tables of Potential Wildlife Diseases in the LLYK Parks

DISEASE	Adeno-Virus	Anthrax	Besnoitiosis	Chronic wasting disease (CWD)	Conjunctivitis (Pink eye)	Epizootic Hemorrhagic Disease (EDH) and Bluetongue	Giant Liver Fluke	Hydatid disease (Echinococcosis)	Leptospirosis	L
PG	27	19	23	24	25	27	29	31	32	
SPECIES		Potentially All								
Bighorn Sheep					X	X	X	X (rare)		
Mountain Goats					X					
Woodland Caribou	X		X	X Potentially						
White-tail Deer	X (& Black-tailed deer)	X		X		X	X	X	X	
Mule Deer	X	X		X		X	X	X	X	
Elk		X		X			X	X		
Moose	X	X		X			X			

Note – the tables in Appendix B are a summary, not comprehensive

Table 2 – Summary Table of Potential UNGULATE Diseases in LLYK Parks

APPENDIX B

Table 3 - Summary Table of Potential MAMMAL Diseases in LLYK Parks

DISEASE	Anthrax	Distemper	Filarial Worms	Hanta virus	Hydatid Disease (Echinococcosis)	Leptospirosis	Moose Measles	Plague	Rabies	Raccoon Roundworm	Mange	Trichinellosis	Tularemia	TB	Ticks
PG	19	26	28	30	31	32	34	37	38	39	41	43	45	44	42
SPECIES															
ALL MAMMALS	X			X				X	X	X	X			X	X
Black bear		X	X				X					X			
Grizzly bear		X	X				X					X			
Cougar	X	X					X					X			
Bobcat	X	X													
Lynx		X						X							
Wolf		X			X (Ech.)		X				X				
Coyote		X			X (Ech)		X				X				
Fox		X			X (Ech.)						X				
Raccoon	X	X				X			X	X					
Wolverine		X													
Mink	X	X						X							
Marten		X						X							
ALL Rodents				X		X		X	X						
Beaver						X									
Squirrels								X					X		
Marmot															
Mice				X											
Hare/ Rabbit													X		
Bats									X						

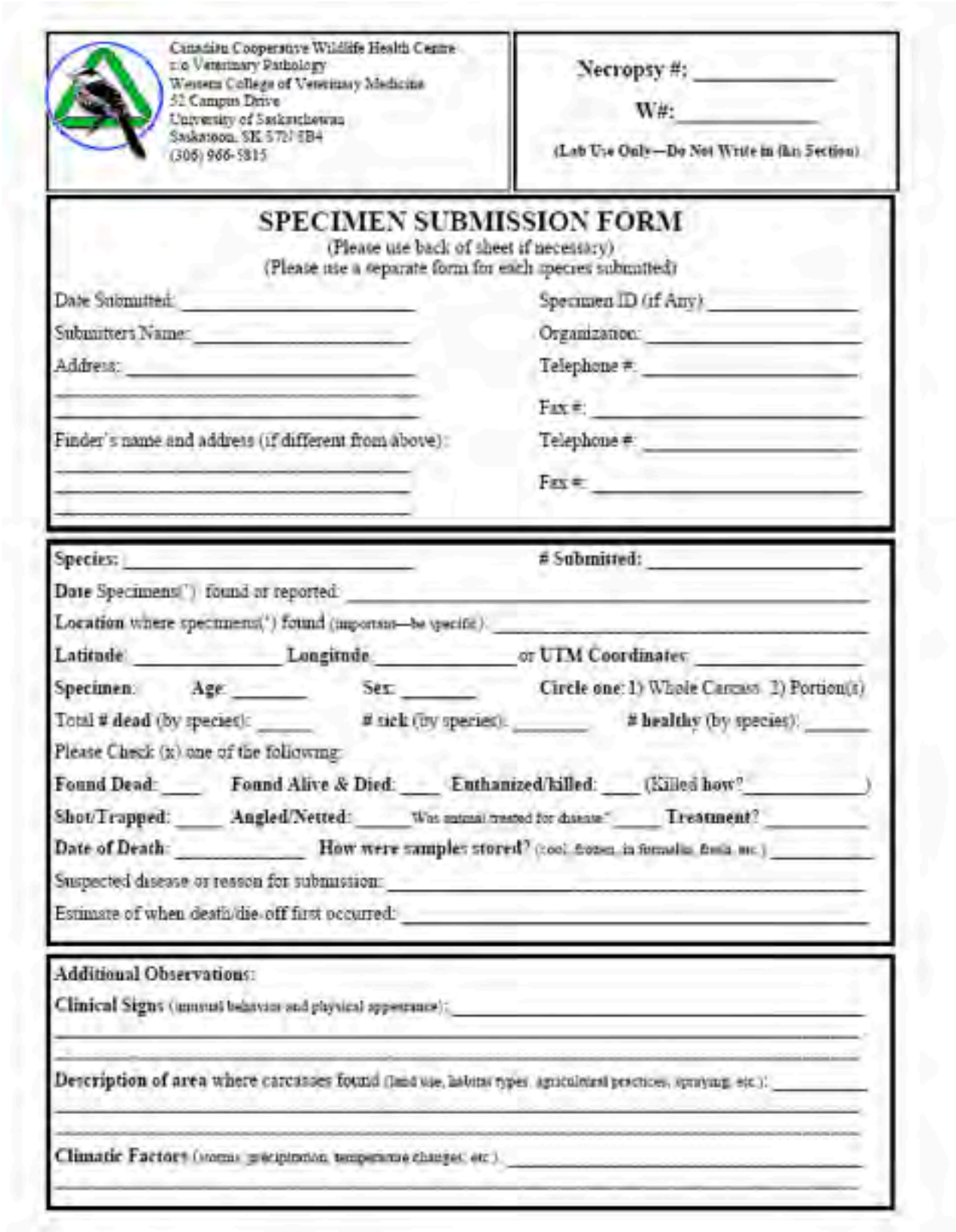
APPENDIX B

Table 4 - Summary Table of Potential AVIAN Diseases in LLYK Parks

DISEASE	Avian Flu (Avian Influenza)	Avian Pox	Avian TB	Sarcocystis	West Nile Virus
PG	20	21	44	40	46
ALL SPECIES	X	X	X		X
Crows	Low	X	X		X
Ravens	Low	X	X		X
Jays	Low	X	X		X
Magpies	Low	X	X		X
Songbirds	X	X	X	X	X
Ducks	X	X	X	X	X
Raptors	X	X			X

Appendix C – Surveillance Forms

Parks – Canadian Cooperative Wildlife Health Center Surveillance Form



Canadian Cooperative Wildlife Health Centre
c/o Veterinary Pathology
Western College of Veterinary Medicine
52 Campus Drive
University of Saskatchewan
Saskatoon, SK S7N 5B4
(306) 966-7315

Necropsy #: _____

W#: _____

(Lab Use Only—Do Not Write in this Section)

SPECIMEN SUBMISSION FORM

(Please use back of sheet if necessary)
(Please use a separate form for each species submitted)

Date Submitted: _____ Specimen ID (if Any): _____

Submitters Name: _____ Organization: _____

Address: _____ Telephone #: _____

_____ Fax #: _____

Finder's name and address (if different from above): Telephone #: _____

_____ Fax #: _____

_____

_____

Species: _____ **# Submitted:** _____

Date Specimen(s) found or reported: _____

Location where specimen(s) found (important—be specific): _____

Latitude _____ **Longitude** _____ or **UTM Coordinates**: _____

Specimen: **Age**: _____ **Sex**: _____ **Circle one**: 1) Whole Carcass 2) Portion(s)

Total **# dead** (by species): _____ **# sick** (by species): _____ **# healthy** (by species): _____

Please Check (x) one of the following:

Found Dead: ____ **Found Alive & Died**: ____ **Euthanized/killed**: ____ (Killed how? _____)

Shot/Trapped: ____ **Angled/Netted**: ____ Was animal treated for disease? ____ **Treatment?** _____

Date of Death: _____ **How were samples stored?** (ice, frozen, in formalin, fresh, etc.) _____

Suspected disease or reason for submission: _____

Estimate of when death/die-off first occurred: _____

Additional Observations:

Clinical Signs (unusual behavior and physical appearance): _____

_____

_____

Description of area where carcasses found (land use, habitat types, agricultural practices, spraying, etc.): _____

_____

_____

Climatic Factors (storms, precipitation, temperature changes, etc.): _____

_____

Source: http://wildlife1.usask.ca/submission_forms/western_northern_submission_form.pdf

Appendix C – BC West Nile Virus Surveillance Forms

Parks Canada Agency – BC West Nile Virus Submission Form

FOR USE JUNE 1st to September 30th

British Columbia

West Nile Virus Bird Submission Form

This form MUST accompany EACH specimen (of the crow family only) submitted for WNV testing.

Note: Please do not submit specimens in poor condition (i.e. grossly decomposed carcasses). Bird specimen submissions with incomplete information or missing forms will NOT be tested.

Date Found/Observed: _____, 200__

Date Specimen Collected: _____, 200__

Carcass Stored: (circle) *Fresh* or *Frozen*

Species of Bird: (circle)

Crow *Raven* *Magpie*

Steller's Jay *Blue Jay*

Location where bird was found (please complete either urban OR rural location information as appropriate):	
Urban Centres	*Rural Areas*
Street Address:	Directions/Distance from Nearest Town: e.g. 40 km W of Kamloops on HWY 1
City/Town:	GPS Coordinates (Lat-Long in Deg/Min/Sec, NAD83): e.g. N51°48' 2" W120°54'35"
Postal Code:	
Local Health Area _____ (Note: mandatory – testing results will be reported by LHA)	

Finder (person that identified the bird):	**Submitter** (officer sending the bird for testing):
Name:	Name:
Telephone:	Agency:
Email:	City/Town:
	Telephone:
	Email:

Please use the back of this form for details of incident and/or other information.

Specimen submissions to:

Animal Health Centre
Corvid Surveillance Program
1767 Angus Campbell Road
Abbotsford V3G 2M3
Toll free in BC: 1-800-661-8893
Phone: 604-556-3003

Surveillance inquiries to:

BC Centre for Disease Control
Epidemiology Services
Vancouver
Phone: 604-660-6061
Internet: www.bccdc.org

Each completed form should be enclosed in its own waterproof (e.g. Ziplock®) bag and attached to the corresponding bird carcass.

Animal Health Centre (Abbotsford)
Date received by AHC: _____, 200__ AHC Specimen ID: _____

Source: http://wildlife1.usask.ca/en/west_nile_virus/surveillance_forms/BC_surveillance_form.pdf

Appendix D – Sample Field Necropsy Form

SAMPLE – FIELD NECROPSY FORM

Date:_____ Occurrence Number:_____

ID Number:_____ Sex:_____

Age:_____

Location:_____

External Observations:

Nutritional Condition:

Bones and Joints:

Lungs and trachea:

Liver:

Heart:

Spleen and lymph nodes:

Gastrointestinal tract:

Kidneys and bladder:

Reproductive organs:

Other observations:

Tissues preserved in formalin (circle):

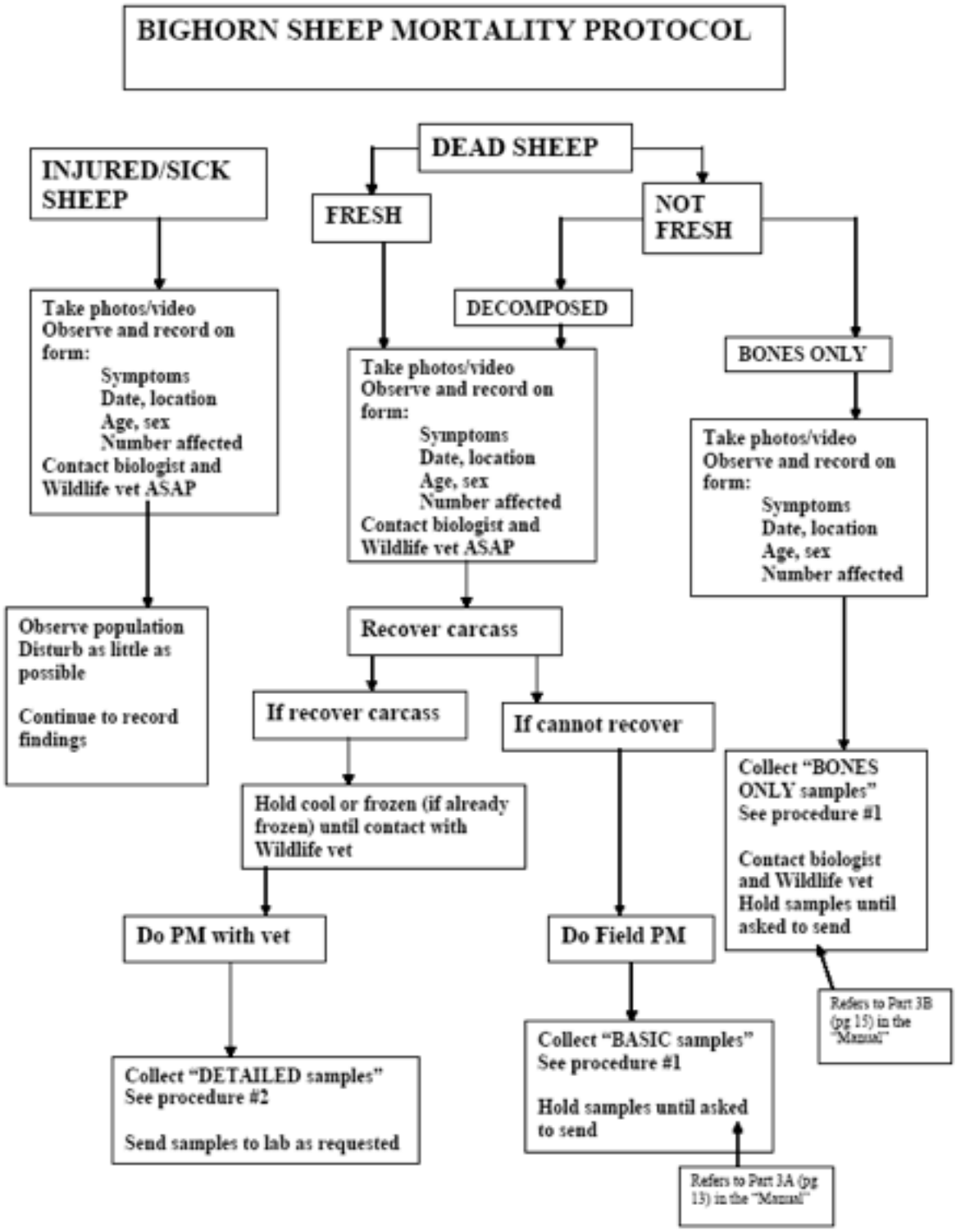
heart lung trachea esophagus thyroid adrenal rumen intestine

kidney pancreas liver spleen muscle tongue bladder

testes/uterus

Source: Grasslands National Park Bison Necropsy Form – Dr. Todd Shury, Parks Canada Agency

Appendix E – Bighorn Sheep Mortality Protocol for the BC Ministry of Environment



Source: Dr. H. Schwantje, 2006, BC MWLAP

Appendix F – CCWHC Specimen Packaging/Shipping Instructions

Packaging/Shipping Instructions
for the Submission of Specimens to the CCWHC by courier/mail

Background:
While Transport Canada governs the transportation of dangerous goods, they mostly defer to international standards and regulations, especially for shipments sent via air. Those shipments being sent by air must conform to a stringent set of standards regulated by the International Air Transport Association (IATA). Under the regulations currently in place the submission of specimens for diagnostic analysis to the CCWHC do not have to be shipped as a regulated dangerous good, unless shipped with dry ice or as a known infectious substance. **However, all shipments sent via air must either be sent as a dangerous good or must conform with the current IATA exemptions i.e. "exempt animal specimen" and meet minimum packaging instructions to ensure the safe handling and viability of submitted specimens and meet the liability requirements as stipulated in the Transportation of Dangerous Goods Act and Regulations.**

Specimen Collection – Handling Instructions
Risks associated with the collection of specimens are low if reasonable sanitary precautions are taken. Persons collecting or handling animals or carcasses should avoid contact with blood or body fluids, and they are advised to avoid punctures or cuts from bills, claws, teeth or instruments during handling. Carcasses should be handled using an implement such as a small shovel or large tongs, or by hand only if disposable (vinyl, PVC, latex [if not allergic], nitrile or rubber) gloves are worn. Alternatively, carcasses may be placed in a heavy-duty puncture-resistant leak-proof plastic bag of appropriate size by inverting the bag over the gloved hand, then grasping the carcass through the bag, and wrapping the bag around the body without touching it. The bag should be thick enough to resist puncture by beaks, talons, claws, nails, etc., and of adequate size to fully contain the carcass, while permitting secure closure by knotted string, or by knotting the bag tightly on itself. It then should be placed inside a second leak-proof plastic bag, which is similarly sealed. Double-bagging prevents cross-contamination between carcasses and fluid leaks in shipping, and is required to conform with shipping regulations. Carcasses should be chilled, but not frozen, unless it will be impossible to get them to the lab within 24-36 hours (distance, weekend intervening), in which case they should be frozen. Carcasses not submitted should be double-bagged and placed in garbage destined for a landfill, or buried several feet deep where they will not be disturbed. Do not dispose of in a manner such that they could be handled again by someone. **People handling carcasses should wash their hands thoroughly with soap and water afterward.**

SOURCE: http://wildlife1.usask.ca/submission_forms/CCWHC_Packaging_&_Shipping_instructions.pdf

Appendix G - Recommended Field Equipment

Table 5 – Personal Protective Equipment Summary

• Coveralls and/or over-protective clothing. This includes shirts with long sleeves, long pants, and long socks	• Rubber boots or plastic foot protectors
• Double rubber gloves- Medical examination gloves are recommended. If latex gloves are used they should be reduced protein, powder-free gloves to reduce workers' exposure to allergy-causing proteins. Stainless steel mesh gloves can be used in addition to medical examination gloves when dealing with objects that pierce (such as needles). Cotton, leather, and other absorbent glove materials are not protective and should not be used.	• An appropriate well-fitting filter mask that covers nose and mouth and is suitable for respiratory protection against airborne bacteria and viruses • Appropriate mask types include: - NIOSH approved 100 series filters (N100, P100 and R100, formerly known as HEPA filters) - Respirator with a P100 cartridge - N95 mask Dust masks for insulating/painting DO NOT protect against airborne bacteria and viruses
• Eye goggles or a full face shield (for necropsies)	• A washable rubber apron
• Antiseptic hand wash and/or antiseptic wipes (**NOT** antibacterial or anti-microbial)	• DEET or other insect repellants - with repeated applications over time to prevent bites from insects carrying potentially serious diseases

Table 6 – Recommended PPE and Necropsy Equipment for the Field

• Two sharp knives	• Disposable latex or rubber gloves (double –up)	• Garbage bags
• Sharpening stone and/or steel	• Disposable Tyvek™ coveralls	• Insect Repellent
• Heavy duty pruning shears	• Plastic or rubber apron	• Digital camera
• Bone saw	• Respiratory masks suitable for protection against airborne bacteria and viruses	• CCWHC Submission sheets
• Scissors	• Eye goggles or full face shield	• CCWHC "Wildlife Disease Investigation Manual"
• Leak-proof formalin and ethyl alcohol containers (250 or 500 ml)	• Rubber boots or plastic foot protectors	• Clipboard
• 10 % buffered formalin	• Disinfectant(1% povidone iodine [Betadine™] or 4% chlorhexidine [Hibitane™])	• Pencils
• 70% Ethyl Alcohol	• Band Aids	• Waterproof Marker
• Whirl-Pak™ or Ziplock bags	• Sterile and non-sterile swabs and containers (for pink eye sampling) and cotton balls (for ticks)	• Waterproof field notebook

Appendix G – Recommended Field Equipment Continued…

Table 7 – Packing and Transport Materials

• Leak and break proof containers for primary packaging (this could be serum or vacutainer tubes, or could be a ziplock,Whirlpack or garbage bags)	• Ice coolers
• Sealing Tape or Parafilm	• Dry Ice or Ice blocks
• Absorptive packing materials (i.e. paper towels for secondary containment, packing peanuts or crumpled newspaper for shipping)	• Pail and brush
• Watertight secondary packaging (such as a ziplock or Whirlpack bag)	• Disinfectants (Borax, Sodium hyperclorite, Clorox or Lysol wipes – for disinfecting surfaces and containers)
• Outer packaging such as small, large or insulated "mailers" (available from lab supply stores) or sturdy cardboard boxes.	• 70% ethyl alcohol (for disinfecting instruments)
• Labels that meet TDG requirements and labeling tape (for samples)	• Waterproof Markers

Appendix H – Laboratory Contact Summary

NOTE, In 2007, Alberta SRD is not testing for WNV this year. Birds found in the AB Mountain Parks should be sent to the CCHWC

Laboratory	Abattoir in Banff	CCWHC in SK	CCWHC in SK	BC Ministry of Agriculture, Corvid Surveillance Program	Invermere Veterinary Hospital	British Columbia Center For Disease Control
What	Established Parks Surveillance Programs	West Nile Virus/Avian Influenza	Blood Samples/ DNA (frozen skin samples) for wildlife pops. of interest	BC- West Nile Virus in Corvids or Other Birds	Other specimens not listed (case by case basis)	Ticks that have bitten humans
When	Program dependent	Nov 01st - May 31st	Data-base maintained at U of A (see Appendix A)	In BC, June 1st – Sept 30th	Year round	Year Round
Contact Name	Jesse Whittington	Dr. Todd Shury		Animal Health Center	Dr. Mark Zehnder	General Information
Number to call before sending sample	403-762 -1402	306-966-2930		604-556-3003	1-877-342-7007	604-660-0584
Emergency (E) or Lab (L) Phone Number	(Blair Fyten) 403 -762-1438	(L) 306-966-5815		Toll-free (L) 1-800-661-9903	(E) 1-250-342-5263	(L) 604-660-5100
Shipping Address	Banff National Park Warden Office Box 900, Banff AB T1L 1K2	Canadian Cooperative Wildlife Health Center C/O Veterinary Pathology Western College of Veterinary Medicine 52 Campus Drive University of Saskatchewan Saskatoon, SK S7N 5B4		Animal Health Center, Corvid Surveillance Program 1767 Angus Campbell Road Abbotsford, BC V3G 2M3	Unit #5, Lot 13 Industrial Road #2 Box 2004 Invermere, BC V0A 1K0	BC Center for Disease Control, Vector-Borne Disease Laboratory, 655 West 12th Ave, Vancouver BC, V5Z 4R4

Appendix I – Reportable and Infectious Diseases with TDG Classifications

Diseases Listed in Wildlife Manual	Diseases Listed in Handbook (High-risk or Diseases Under Surveillance)	CFIA Reportable Diseases In Manual (Spring 2007)	Public Health Agency of Canada - Infectious Diseases in Manual	Suggested Shipping TDG Classifications (Category A or B)
Anthrax	-	X	X	A, UN 2814
Avian Flu (Avian Influenza)	X	X	X	A, UN 2814
Avian Pox	-	-	-	B, UN 3373
Bacterial Pneumonia (Mannheimia haemolytica)	X	-	-	B, UN 3373
Besnoitiosis	-	-	-	B, UN 3373
Chronic Wasting Disease (CWD)	X	X	-	A, UN 2900
Conjunctivitis (Pink eye)	X	-	-	B, UN 3373
Distemper or Canine Distemper Virus (CDV)	-	-	-	A, UN 2900

Epizootic Hemorrhagic Disease (EHD)/ Bluetongue Virus (BTV) and Adeno Virus	-	X (Bluetongue)	-	A, UN 2900
Filarial Worms	-	-	-	Exempt Animal Specimen
Giant Liver Fluke	X	-	-	Exempt Animal Specimen
Hantavirus Pulmonary Symptom (HPS)	-	-	X	A, UN 2814
Hydatid Disease (Echinococcus in Canines)	-	-	-	B, UN 3373
Leptospirosis	-	-	X	A, UN 2814
Lungworm (Protostrongylus stilesi)	X	-	-	Exempt Animal Specimen
Moose Measles	-	-	-	B, UN 3373
Orf (Contagious Ecthyma) or Soremouth	X	-	-	A, UN 2814
Parvovirus	-	-	-	B, UN 3373
Plague	-	-	X	A, UN 2814
Rabies	-	X	X	A, UN 2814
Racoon Roundworm (Baylisascaris)	-	-	X	A, UN 2814
Sarcocystosis (Rice Breast Disease)	-	-	-	Exempt Animal Specimen
Sarcoptic Mange	-	-	-	B, UN 3373
Ticks and Disease	X	-	Lyme Disease and Rocky Mountain Spotted Fever	A, UN 2814
Trichinellosis	X	X	X	A, UN 2814
Tuberculosis (TB) and Avian Tuberculosis	-	-	X	A, UN 2900
Tularemia (Francisella tularensis)	-	-	X	A, UN 2814
West Nile Virus (WNV)	X	-	X	A, UN 2814

Appendix J - 2007/2008 Surveillance Programs

Surveillance Program	What Park (s)	What tissue	Species	Start date	End Date	Goal	Program Administrator(s)
Liver Flukes	Banff and Jasper	Liver	Ungulates	Spring 2006	Spring 2007	To collect liver flukes to assist in making a worldwide genetic map of giant liver flukes, Project headed out of the Slovak Republic.	Margo Pybus - Alberta SRD
Chronic Wasting Disease	Mountain Parks	Entire Head	Deer	1999	On-going	To Monitor for the spread of CWD into domestic and wild AB and BC cervid populations	Dr. Todd Shury – Parks, CCWHC, BC and AB Surveillance Programs
West Nile Virus	Mountain Parks (it is also a nationwide program)	Entire bird (only fresh samples requested)	Birds, particularly corvids (ravens, crows, magpies, jays, Clarks's nutcrackers)	2003	Continuous	To monitor for the spread of WNV and immediate action upon occurrence	Alberta Health Authority (program ceased as of 2007) British Columbia Health Authority and The CCWHC
Avian Influenza	Mountain Parks (it is also a nationwide program)	Entire bird (only fresh samples requested)	Birds (swans and waterfowl in particular)	2005	Continuous	To monitor for the spread of Avian Influenza, (particularly H5N1) and prevent a potential disease epidemic among wild bird populations and people	The CCWHC and National Heath Authorities

Bighorn sheep liver and ear tips	Mountain Parks in BC	Liver and ear tips	Bighorn sheep	??	Continuous	To collect health information (liver) and genetic information (ear tips) on BC bighorn sheep.	BC Wildlife Veterinarian Dr. Helen Schwantje
Liver Flukes – requested future project	LLYK, Jasper, Waterton, & Glacier	Liver	Ungulates	2007/08	2008/09	To collect liver flukes to assist in making a worldwide genetic map of giant liver flukes. Project headed out of the Slovak Republic.	Margo Pybus - Alberta SRD

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