Canadian Council on Animal Care

guidelines on:

the care and use of wildlife

This document, the CCAC *guidelines on: the care and use of wildlife*, has been developed by the *ad hoc* subcommittee on wildlife of the Canadian Council on Animal Care (CCAC) Guidelines Committee:

Mr Peter Austin-Smith, Acadia University (Chair)
Dr Sandie Black, Calgary Zoo
Mr Daniel Bondy, Canadian Wildlife Service
Dr Nigel Caulkett, University of Saskatchewan
Dr Marco Festa-Bianchet, Université de Sherbrooke
Dr Robert Hudson, University of Alberta
Dr Donald McKay, University of Alberta
Mr Michael O'Brien, Department of Natural Resources, NS
Ms Joy Ripley, Canadian Federation of Humane Societies
Dr Helen Schwantje, Ministry of Water, Land and Air Protection, BC
Dr Todd Shury, Banff National Park/Calgary Zoo (CAZWV liaison)
Dr Gilly Griffin, Canadian Council on Animal Care

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Canadian Council on Animal Care
315–350 Albert Street
Ottawa ON CANADA
K1R 1B1

http://www.ccac.ca

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A. PREFACE

The Canadian Council on Animal Care (CCAC) is responsible for overseeing the use of animals in research, teaching and testing. Participation in the CCAC program is mandatory for academic institutions. Failure to adhere to CCAC guidelines and policies may lead to suspension of funding for research programs and/or institutions (CCAC, *Guide to the Care and Use of Experimental Animals*, vol. 1, 2nd ed., 1993; CIHR, NSERC & SSHRC, *Memorandum of Understanding on the Roles and Responsibilities in the Management of Federal Grants and Awards, Schedule 3: Ethical Review of Research Involving Animals*, 2000).

Although the care and use of wildlife is regulated through provincial, territorial and federal legislation, some agencies responsible for wildlife have adopted animal care guidelines, including those of the CCAC, and have established internal committees that oversee the care and use of wildlife for research, management and operational procedures. Many of these agencies are keenly interested in and/or are participating in the CCAC program in order to provide public accountability for their work.

In addition to the CCAC *Guide to the Care and Use of Experimental Animals*, vol. 1, 2nd ed. (1993) and vol. 2 (1984) which lay down general principles for the care and use of animals, the CCAC also publishes guidelines on issues of current and emerging concerns (http://www.ccac.ca). The CCAC *guidelines on: the care and use of wildlife* is the sixth of this series. This document replaces Chapter XXII—Wild Vertebrates in the Field and in the Laboratory, *Guide to the Care and Use of Experimental Animals*, vol. 2 (CCAC, 1984).

The refinement of animal care and use guidelines is a continuous process. The present document has drawn substantially from the work of the organizations listed in Appendix A. Permission was kindly granted to CCAC to use sections of guidelines developed by their various committees and is gratefully acknowledged. Relevant information not included in the listed guidelines is referenced separately.

The guidelines have been developed by the CCAC subcommittee on wildlife. A preliminary first draft was agreed on by the subcommittee in April 2001 and circulated to all federal and provincial/territorial wildlife directors to seek their early input. The first draft of the guidelines was circulated in August 2001 to 56 experts (including officials of the organizations listed in Appendix A) and a second draft was circulated for widespread comment in January 2002. The development of the guidelines was facilitated by workshops

held in Halifax NS, April 2001, in collaboration with the Atlantic Provinces Council on the Sciences, and in Edmonton AB, November 2001, in conjunction with the University of Alberta.

The guidelines have been organized in a format which should facilitate the preparation and review of protocols. For the most part, the sections move through the conception of the study plans, the requirement for permits, and subsequently, the conduct of the various procedures. An attempt has also been made to organize the guidelines in such a fashion that the text moves logically from the least invasive to the most invasive procedures, and through the various stages of capture, restraint, handling, translocation, release, holding, or euthanasia. A section on human safety considerations has also been added as animal care committees are responsible for ensuring that there has been institutional approval for the use of biohazardous, infectious, biological, chemical or radioactive agents (CCAC *Policy on: Terms of Reference for Animal Care Committees,* 2000) and that institutions are aware of the hazards to which their personnel may be exposed.

SUMMARY OF THE GUIDELINES LISTED IN THIS DOCUMENT

B. INTRODUCTION

Guideline 1:

The use of wildlife for research, management, teaching and testing is acceptable only if it contributes to the understanding of biological principles or to outcomes that can be expected to benefit humans, animals or ecosystems. Expert evaluation of proposals must attest to the potential value of studies involving wildlife.

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Guideline 2:

All projects involving the use of wildlife for research, management, teaching and/or testing should be described within a protocol. Protocols should be approved by an animal care committee prior to commencement of the work (references outlining the requirements: CCAC *guidelines on: animal use protocol review*, 1997; and CCAC *Policy on: Terms of Reference for Animal Care Committees*, 2000).

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Guideline 36:

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Section 2.1 Housing, p. 38.

Guideline 37:

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Guideline 38:

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Section 2.3 Social interactions, p. 39.

Guideline 39:
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Guideline 40:
Before the translocation of wildlife or release of any wild animal held or bred in captivity, the possible ramifications of such actions must be considered. Negative effects on the individual animal, the ecological conditions at the release site, and human safety must all be considered and minimized. Release should not occur if the animal is unlikely to survive due to reasons associated with its captivity, or if the existing ecological conditions at the release area could be adversely affected, including any risk of introduction of a wildlife disease new to the area.

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Guideline 42:
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I. EUTHANASIA

Guideline 43:
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J. HUMAN SAFETY CONSIDERATIONS

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Guideline 46:

The risks involved in using drugs for the capture and immobilization of wildlife must be identified and communicated to all personnel involved in the project. At least two people on the team should be trained in first aid and CPR (cardiopulmonary resuscitation), local medical authorities should be informed of the potential hazards, and an evacuation plan to medical facilities should be discussed prior to fieldwork.

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Guideline 49:

It is the responsibility of the investigator to ensure that hazardous conditions involved in field work are identified to the personnel involved. Some situations require particular experience and/or training, such as working around aircraft, diving, climbing, working at high altitude or in extreme temperature conditions, and working on ice.

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B. INTRODUCTION

These guidelines are necessarily broad and are limited to basic principles that will assist investigators, wildlife managers, and animal care committees (ACCs) in the development and review of protocols and standard operating procedures (SOPs). Additional recommendations for the various species groups of wildlife have been developed in conjunction with these more general guidelines and are published on the CCAC website (http://www.ccac.ca). These guidelines and recommendations are expected to be of use to researchers and resource managers from universities and colleges, zoological parks, research institutions, natural resource agencies, resource industries, government and/or its agencies, non-government organizations, and consultants retained by public institutions and agencies. Individuals involved with projects related to population management, animal control, and other forms of wildlife management where the welfare of animals is of concern should be encouraged to read these guidelines to assist in the preparation of SOPs or for consideration for regulatory requirements.

Studies on wildlife in the field and in captivity may include a wide range of invasiveness and involve species that vary greatly in their response to humans. The tremendous variation in animal body size, physiology and behavior needs to be taken into account to determine the most effective means of capture, restraint and handling. The controlled parameters of studying test subjects in a laboratory setting may not form a good model for conditions likely to be encountered in field studies; nevertheless, good welfare practice in the field is characterized by the same features as in laboratory-based research. When evaluating protocols for studies that are to take place in the natural habitat of the animal, ACCs should recognize that conditions may require different approaches and procedures than those dictated by a laboratory environment. ACCs should also be aware that protocols for testing devices or techniques may involve some unpredictability in order to evaluate the most humane and effective methods for subsequent use.

1. Definition of Wildlife

For the purposes of this document, wildlife refers to free ranging and captive wild vertebrates, including amphibians, reptiles, birds, and mammals (but excluding fish). This includes all introduced and indigenous species, as well as domestic animals that have become feral.

Definitions of wildlife may be restricted to game birds and mammals or expanded to include all wild organisms and their habitats. Practical considerations, however, require a definition that limits the number of species and is acceptable to a wide spectrum of wildlife professionals. The document CCAC *guidelines on: the care and use of fish in research, teaching and testing* (in preparation) is published separately. Guidelines for research on domestic commercial wildlife (for example, bison and deer) are published within the CCAC *guidelines on: the care and use of farm animals in research, teaching and testing* (in preparation). Other organizations should be consulted for guidelines on animals maintained in zoological institutions (Canadian Association of Zoos and Aquariums [CAZA]; American Zoo and Aquarium Association [AZA]), or for farmed wildlife (e.g., Canadian Agri-Food Research Council [CARC], http://www.carc-crac.ca/english/codes_of_practice).

The CCAC *guidelines on: the care and use of wildlife* extends to the consideration of free-ranging wildlife and wild-caught animals which have not been habituated to captivity. Other guidelines (both CCAC and others) should be consulted where animals are to be maintained in long-term holding.

2. Rationale for Wildlife Guidelines

Investigations involving wildlife and their habitats are of profound importance to the understanding and appreciation of our relationship with the environment (ABS & ASAB, 1997). The knowledge gained from such endeavors can be vital for the well-being of human societies, as well as for providing information for the conservation and ethical treatment of vertebrates both in the wild and in captivity. Although acquisition of scientific knowledge and understanding may justify wildlife research, often the effects of field research procedures on subject animals or their habitats cannot be predicted. Many field studies of wild vertebrates involve simple observations of the animals. Other research questions can only be answered by manipulating the animal to some degree, either in the field or in captivity (ABS & ASAB, 1997). Studies may disrupt normal animal activities, especially if capture, marking, or other more invasive procedures are used.

These guidelines aim to minimize stress to wildlife. When distressed, animals may behave abnormally and possibly be placed at greater risk due to increased susceptibility to predation or injury. Excessive stress can also reduce health, performance, immune function and reproduction.

The use of wildlife in research, as well as in teaching and testing, raises ethical questions that must be addressed prior to the initiation of the project. Adequate review of the protocol is critical to ensure that proposed field research procedures or techniques minimize changes to habitat, distortion of the behavior of animals, or other risks to the animals. Some studies may involve killing animals as part of a management program to collect biological specimens. A protocol prepared according to these guidelines should ensure that this is done in an effective, humane manner. Wildlife management studies may have alteration of habitat or behavior as a goal, or be monitoring animal response to a change in habitat. These types of studies should also balance the risks to the animals. Humane treatment of wildlife held captive requires that conditions provide the necessities of normal existence and ensures that animals can be returned to the wild, if considered appropriate. In general, treatment of the animals should ensure that there is no impairment in their abilities to resume their normal activities on release. However, in some instances modification may be necessary, for example, sterilization or contraception may be part of a special management approach to population control.

Wildlife involved in studies must be treated humanely, not only for ethical and legal reasons, but also for scientific reasons (ASB & ASAB, 1997). In general, ethically acceptable procedures should minimize interference to individual study animals, populations, and their habitats, and thereby increase the validity of the experimental data.

3. Ethics on the Use of Wildlife

Guideline 1:

The use of wildlife for research, management, teaching and testing is acceptable only if it contributes to the understanding of biological principles or to outcomes that can be expected to benefit humans, animals or ecosystems. Expert evaluation of proposals must attest to the potential value of studies involving wildlife.

The CCAC *Policy on: Ethics of Animal Investigation* (1989) applies equally to wildlife used for research, teaching and testing as it does to laboratory animals. The underlying ethical basis of CCAC guidelines and policies requires adherence to the three principles of humane experimental technique outlined by Russell & Burch (1959): Replacement, Refinement and Reduction. According to the CCAC, adherence to the Three Rs means:

- Animals may be used only if the researcher's best efforts to find a replacement by which to obtain the required information have failed. Replacement of a rare or threatened species with a more common species is more desirable in terms

of conservation impacts. However, it will not affect the welfare implications of the work, as the replacement species is likely to be closely related and of a similar sentience. It is recognized that where the aim of field studies is to understand the ecology, ecophysiology, or behavior of wildlife, replacement by a non-animal method, or even replacement of one species with a less sentient species, will likely not be an option. In addition, research involving endangered or threatened species may be necessary in support of the species conservation or the habitat.

- The most humane, least invasive techniques must be used; minimizing pain and/or distress should be a priority in consideration of options for the care and use of wildlife. The animal's physical and psychological well-being should always take precedence over considerations of cost and convenience, taking into consideration human safety. In addition, refinement should aim for the use of techniques which have less potential to impede normal behaviors.
- Investigators should use opportunities to publish refinement techniques to improve welfare outcomes for study animals.
- The fewest animals appropriate to provide valid information and statistical significance should be used. Good study design is the primary means of minimizing the number of animals required to demonstrate experimental outcomes in field studies, as in laboratory-based animal studies. However, field studies often require larger samples than laboratory studies to overcome environmental variation and intrinsic host variability that cannot be controlled in the study. Prior statistical evaluation of sample size is necessary, even when sources of variation can only be roughly estimated. Familiarity with the literature on similar studies regarding sample size and study design is equally important. Animal use can also be minimized by better sharing of data and publication of results in generally accessible formats.
- If possible, studies should be designed so that specimens are used for multiple purposes or so they can be combined with samples from additional field seasons to maximize the use of specimens. This also includes the collection of biological and genetic samples for archiving whenever possible.
- All studies must undergo an evaluation for scientific merit or potential value prior to ethical review by ACCs. Where this has not been done as a part of the application for research funding, the ACC must arrange for an independent review of scientific merit (CCAC *guidelines on: animal use protocol review*, 1997).

Formal reporting of results from wildlife studies should be encouraged (e.g., scientific paper, accessible database, formal report). Surveys or inventory-type studies where the aim is to determine the type of species present in an area, habitat use, population size, etc. can contribute to conservation science.

Investigators should take into account traditional/local knowledge and community values, and where appropriate, share knowledge and understanding of the species studied with the local community. The benefits of establishing a mutual exchange of information between scientists and holders of traditional knowledge is well recognized by the International Council for Science and the United Nations Educational, Scientific and Cultural Organization (UNESCO) (ICSU, 2002). Researchers should be aware that traditional knowledge may be considered intellectual property and must follow the same guidelines (CIHR, NSERC & SSHRC, 2000). Aboriginal views on wildlife research are discussed in Byers (1999).

3.1 Responsibilities

More detailed information is given throughout these guidelines to assist both investigators and members of ACCs to ensure that the following responsibilities are met.

3.1.1 Responsibilities of investigators

3.1.1.1 Protocols involving the use of wildlife

Guideline 2:

All projects involving the use of wildlife for research, management, teaching and/or testing should be described within a protocol. Protocols should be approved by an animal care committee prior to commencement of the work.

(references outlining the requirements: CCAC *guidelines on: animal use protocol review*, 1997; and CCAC *Policy on: Terms of Reference for Animal Care Committees*, 2000)

Investigators are responsible for obtaining approval of their studies by their home institution. They are also responsible for providing notification of the approved protocol to the local ACC in the jurisdiction where the studies are to be conducted.

A suggested format for an animal use protocol for wildlife studies is given in Appendix B. Due to unpredictable conditions in the field, ACCs should be aware that some of the procedures described within a protocol may have to be adapted depending on the prevailing conditions. Nonetheless, the protocol form developed by the local ACC should be completed fully and accurately.

In preparation of a protocol, investigators should:

- first and foremost, articulate the goal of the study from academic or practical standpoints, put the work in a broad perspective and explain how the study may contribute to the general state of knowledge and/or desired outcomes, and justify the significance of the anticipated results against the use and potential pain, distress and/or death of animals;
- ascertain the conservation status of the animal to be studied and ensure that the animals chosen are best suited to provide the information sought;
- avail themselves of relevant expertise to ensure that protocols and SOPs are comprehensive and represent best practices. Suggestions of appropriate organizations to contact are listed in Appendix C. If similar procedures will be used on several protocols, such as capture and/or marking techniques, it is recommended that the procedures be written up as SOPs. All SOPs must be approved by the ACC and reviewed regularly. Approved SOPs need only be referred to by their assigned number and title in the procedures section of the protocol form;
- describe all animal-based procedures accurately;
- alert ACCs to potential changes in the protocol, in particular where there might be better welfare outcomes. No major changes should be undertaken until review and approval by the ACC.

A **complete protocol** on any proposed studies involving the use of wildlife should be submitted for review by the local ACC at least once every four years. If the protocol is similar to a previous submission, it should include a progress report (see below under renewal form).

In the interim years, a **renewal form** is required that includes any minor changes to the original protocol, the number of animals required in the upcoming year and a progress report for the past year. The **progress report** should include a basic summary of progress to date and a list of species and numbers of each used, including animals used unintentionally (e.g., by-catch). It should also include information on all animals injured or killed unintentionally, any treatments given, the results of any postmortems performed on unplanned mortalities, and precautions or recommendations to reduce such incidences in the future. Details on the disposal of

carcasses should be included. Additionally, it is extremely useful to the local ACC to include recommendations that may improve the well-being of the animals and/or the outcome of the study (e.g., handling times, chase times, and vital signs). The progress report will be used by the ACC to report annual animal use to the CCAC and to evaluate future protocols. In particular, this exercise provides feedback to the ACC to assist in further development and understanding of good welfare practices in field-based research. The progress report is a means of educating the ACC and improving standards of future protocols.

An **addendum** to a complete protocol can be used to submit minor changes during the course of a study. These changes may include such things as personnel changes and refinement of procedures without altering the level of invasiveness. All major changes in protocol require submission of a complete new protocol.

A protocol should be reviewed and approved by the local ACC prior to the commencement of a study. Similarly, renewals and/or addendums should be reviewed and approved by the ACC before continuing with a study. In some cases (e.g., personnel changes) interim approval may be granted until the whole ACC has an opportunity to review the protocol or proposed changes (see Section 3.1.2).

In carrying out the approved protocol, investigators should:

- be responsible for adherence to the protocol, unless permission is given by an ACC to deviate from, or to amend the protocol;
- obtain all applicable permits prior to initiation of research, and understand and comply with all regulations relative to the species to be studied. When working outside of Canada, Canadian investigators are subject to the relevant legislation and regulations pertaining to animal care in the country where the study is conducted;
- avoid or minimize the intensity and duration of an animal's pain and/or distress, and ensure that an animal experiencing severe unrelievable pain and/or distress is euthanized as soon as possible;
- understand and provide the appropriate husbandry to ensure humane treatment and daily maintenance of animals used in captivity;
- understand and attempt to minimize any negative demographic and behavioral effects on the species' population;
- take precautions to minimize the capture of non-target animals, but be prepared to deal with them. In particular, plans for handling non-target species should include mechanisms to deal with unplanned captures and accidental killing. The plans should include reporting to the ACC and the relevant permit agency (if required), as well as details for handling live animals and disposing of any carcasses;
- be prepared to deal appropriately with accidental injury to animals during capture or handling;
- ensure appropriate disposition of the animals at the conclusion of the study if animals are not to be released (i.e. investigators should attempt to donate carcasses to museums, to researchers investigating contaminants in the area, or to other suitable research programs);
- for animals released back to the wild, take care to maximize each individual's ability to resume normal behavior and to minimize effects on existing populations (see IUCN/SSC *Guidelines for Re-Introductions*, 1995, http://www.iucn.org/themes/ssc/pubs/policy/reinte.htm);
- ensure that animals released do not represent a risk to the public, other animals, or the environment.

Guideline 3:

Investigators are responsible for their own conduct, as well as for the conduct of all other personnel involved in the investigators' studies.

In particular investigators should:

- ensure that all individuals involved with capture, handling, sampling, identification,

maintenance, monitoring, and/or euthanasia of animals are appropriately trained;

- ensure that all co-operators of their projects, whether volunteers, institution staff or contractors involved in any aspect of the study, comply with the procedures specified in the approved protocol;
- ensure that all personnel assisting with the project take appropriate precautions to reduce the risk of transmitting diseases to animals or humans.

3.1.2 Responsibilities of the animal care committee

Guideline 4:

The animal care committee is responsible for reviewing all studies that are conducted by principal investigators belonging to their institution or agency, regardless of whether that project will be conducted within their jurisdiction or in the jurisdiction of another animal care committee.

Responsibilities of the ACC are defined in the CCAC *Policy on: Terms of Reference for Animal Care Committees* (2000). ACCs must ensure that all protocols are properly evaluated. In reviewing a protocol involving wildlife, ACCs are responsible for ensuring that:

- all animals to be used in a study will be treated in a manner which provides for their physical and psychological well-being for the duration of the study;
- adequate physical and personnel resources will be available for the duration of the study;
- pain and/or distress concomitant to the study, in so far as can reasonably be determined, will be minimized both in intensity and duration;
- any animal experiencing severe, unrelievable pain and/or distress inflicted as a result of the study will be euthanized as soon as possible;
- the project has merit, either by evidence of peer review for scientific merit (research projects); for pedagogical merit (teaching projects); or by evidence of evaluation of the goals (e.g., responsible sustainable management, or reduction of human hazards);
- investigators have the necessary training and experience to perform the procedures described in the protocol.

When multiple research partners are involved in a project, the ACC of the principal investigator should normally take the lead in providing an ethical review of the protocol. Co-operating investigators should be responsible for provision of the reviewed protocol to their home institution, indicating that approval has already been given by the lead ACC. Any questions concerning the reviewed procedures from the home ACCs of the co-operators should be directed to the lead ACC for resolution. Home institutions or agencies should be aware of all projects being conducted by their investigators and should ensure that the procedures to be used are ethically acceptable and comply with all legislative and other applicable standards.

Where more than one ACC is involved in the review of a protocol (e.g., when research is conducted outside of the jurisdiction of the home institution), a well-defined arrangement between the ACC of the home institution and the host organization, for monitoring the proposed project and the welfare of the animals, should be agreed upon before the project begins. ACCs need to be aware of the protocols and progress of projects which are being carried out locally. The local ACC is often the point of contact for the public and should be able to answer questions concerning wildlife studies in their area.

Protocol forms for investigations at Categories A and B levels of invasiveness (see Appendix D) and minor changes submitted on an addendum may be approved on an interim basis by a subcommittee of the ACC, consisting of at least the ACC chair, a veterinarian, and a community representative. The subcommittee should consult a wildlife professional with the appropriate expertise where needed. Final approval should take place at a formal ACC meeting.

Guideline 5:

The local animal care committee should include persons with relevant expertise with wildlife in field and/or captive situations or should seek advice from independent experts who can provide an understanding of the nature and impact of the proposed field investigation.

ACCs that regularly deal with field-based projects should have two or more wildlife professionals on the committee. Committees that rarely review wildlife studies (less than five per year) may need to rely on *ad hoc* advice. However, given the wide range of species and methodologies employed, even committees most experienced with reviewing protocols involving wildlife will have to periodically seek outside reviews from other wildlife professionals or veterinarians having experience with wildlife.

ACCs that deal with applications for field-based wildlife projects, and which have insufficient expertise in the area of field-based wildlife research, should seek expert advice from experienced wildlife field researchers about the potential welfare implications of proposed techniques on the individual animals and the potential impacts on populations. It should also be noted that ACCs are in a position to pass on acquired knowledge on the welfare implications of field-based practices.

Guideline 6:

All personnel involved with the use of wildlife for research, teaching and testing must be adequately trained in the ethics of animal use and receive the necessary training and experience to perform the procedures described in the protocol.

The CCAC *guidelines on: institutional animal user training* (1999) require that animal users involved in research, teaching and testing using wild species in the field receive adequate training according to the *Recommended Syllabus for an Institutional Animal User Training Program*, Section 2, Wildlife Stream. Institutions are responsible for providing access to the necessary training programs and for providing evidence that all personnel have been adequately trained (CCAC *guidelines on: institutional animal user training* and accompanying *Recommended Syllabus for an Institutional Animal User Training Program*, 1999).

3.1.3 Role of the veterinarian

Guideline 7:

Consultation and/or participation of veterinarians having experience with wildlife should be sought in projects involving potential animal health concerns, such as translocation of animals and medical or surgical procedures. Consultation with veterinarians having experience with wildlife or experienced wildlife professionals should also be sought for immobilization activities.

Veterinary legislation of most provinces and territories requires that a veterinarian have an established "veterinarian-client relationship" before dispensing pharmaceuticals or medical advice. Researchers should be encouraged to consult with veterinarians experienced in or knowledgeable about the species in question and the logistics of field research. In general, veterinarians remain liable for the use of pharmaceuticals dispensed and for veterinary care. This means that a veterinarian should be an integral part of research where they have prescribed pharmaceuticals for the use of investigators and/or when medical or surgical procedures are involved. Pharmaceuticals used for wildlife immobilization are also available to trained wildlife professionals under special authorization from Health Canada (Woodbury, 1996).

Where there is no need for a veterinarian to prescribe pharmaceuticals and where medical or surgical procedures are not involved, consultation and/or participation of non-veterinarians with appropriate expertise in immobilization, translocation and/or disease concerns is appropriate. However, combining the expertise and experience of wildlife biologists and other wildlife professionals with that of veterinarians maximizes the likelihood of safe,

humane and efficient use of wild animals and should be encouraged whenever possible.

4. Wildlife Regulations

Anyone proposing to conduct research on, study, capture, hold or release wildlife should be familiar with, and comply with, the relevant legislation governing their use.

In most cases, licenses or permits are required to import or export wildlife or parts thereof, to capture or kill wildlife, to band or otherwise mark wildlife, and to hold in captivity or release wildlife. It is the investigator's responsibility to ensure that all licenses, permits and approvals are in place before proceeding with any wildlife project (see Appendix E for a list of regulatory agencies).

A wildlife study that involves native communities may require permission from the First Nations Government and, if it involves interviews or other surveys, requires review by the Human Ethics Review process (see Section 3. Ethics). Depending on the community, region or land claim area involved, there may be established protocols for appropriate consultation, project approval and/or community participation. There may also be regional organizations that must be consulted in addition to the local community.

4.1 International

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), in force since 1975, has 162 member countries (as of 2003), including Canada. Member countries ban commercial trade in endangered species and regulate and monitor trade in other species that might become endangered. The import or export of any animals on the CITES list requires a CITES permit from the Canadian Wildlife Service (CWS) and the appropriate import or export permit from the provincial or territorial agency responsible for wildlife. Some provincial/territorial wildlife authorities are also CITES permit-issuing authorities for that province or territory. CITES not only deals with live animals, but also with "parts and parts thereof" which includes all types of biological samples (skin, hair, bones, blood, serum, etc.).

Other listings and agreements that investigators should be aware of include: the International Union for Conservation of Nature and Natural Resources (IUCN) *Red List of Threatened Species* (http://www.redlist.org); the 1997 *Agreement on International Humane Trapping Standards between the European Community, Canada and the Russian Federation* (http://europa.eu.int/smartapi/cgi/sga_doc?smartapi!celexapi!prod!CELEXnumdoc&lg=EN&numdoc=21998A0214(02)&model=guichett); and the *Animal (mammal) traps*, Part 4 (ISO 10990-4:1999) and Part 5 (ISO 10990-5:1999) of the International Organization for Standardization (ISO) (http://www.iso.ch/iso/en/ISOOnline.frontpage). As the United States and Canada share many species and populations of species, investigators should also determine whether the species or population to be studied is on the US endangered species list (US Fish and Wildlife Service, http://endangered.fws.gov/wildlife.html). Additionally, the International Air Transport Association (IATA) elaborates regulations for appropriate containers, care and handling during transportation (IATA, 1995).

4.2 Federal

The CWS promotes the conservation of Canadian and international wildlife and biological diversity by managing migratory birds and nationally significant habitat, and by providing leadership on other issues such as recovery of endangered species. The CWS oversees the following Acts and Regulations:

- *Canada Wildlife Act* (http://laws.justice.gc.ca/en/W-9/index.html);
- *Wildlife Area Regulations* (http://laws.justice.gc.ca/en/W-9/C.R.C.-c.1609/62555.html;
- *Migratory Birds Convention Act* (http://laws.justice.gc.ca/en/M-7.01/index.html);

- *Migratory Bird Sanctuary Regulations* (http://laws.justice.gc.ca/en/M-7.01/C.R.C.-c.1036/143398.html);
- Migratory Birds Hunting Regulations (http://www.cws-scf.ec.gc.ca/publications/reg/index_e.cfm);
- *Wild Animal and Plant Protection and Regulation of International and Inter-provincial Trade Act* (WAPPRIITA) (http://lawsjustice.gc.ca/en/W-8.5/106599.html);
- *Wild Animal and Plant Trade Regulations* (http://laws.justice.gc.ca/en/W-8.5/SOR-96-263/184434.html);
- *Species at Risk Act* (http://www.speciesatrisk.gc.ca/index_e.cfm).

Other federal agencies (e.g., Fisheries and Oceans Canada) bear responsibility for marine reptiles and mammals (marine mammals regulations are listed under the *Fisheries Act*, http://laws.justice.gc.ca/en/F-14/).

The *Canada National Parks Act* provides for regulations for the protection of fauna, the taking of specimens of fauna for scientific or propagation purposes, and the destruction or removal of dangerous or superabundant fauna (*Canada National Parks Act*, 2000, http://laws.justice.gc.ca/en/n-14.01/18251.html).

WAPPRIITA is the enabling legislation for CITES in Canada. WAPPRIITA also provides the authority to protect Canadian ecosystems from the introduction of listed harmful invasive species by requiring permits and makes it an offence to transport an animal or plant from one province or territory to another or export from a province or territory without the required provincial or territorial permits.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) develops and maintains a national listing of Canadian species at risk, based on the best scientific evidence available (http://www.cosewic.gc.ca). COSEWIC consists of representatives from the wildlife departments of all 13 Canadian provincial and territorial governments; federal departments and corporations concerned with wildlife, including the Canadian Wildlife Service (which provides the secretariat), Parks Canada, Fisheries and Oceans Canada and the Canadian Museum of Nature; and three non-governmental conservation organizations. It is the responsibility of the respective provincial and territorial jurisdictions where the species occurs to take whatever actions are appropriate to address the threats and limiting factors placing a species at risk.

Many birds migrate across international borders, and hence their research use and consequent influence on survival may be of interest to several countries. The CWS regulates the hunting of migratory birds and also requires that special permits be obtained for the collection, banding and/or holding of these birds. In addition, permits are required to carry out activities such as wildlife research in National Wildlife Areas and Migratory Bird Sanctuaries.

Permits from the Canadian Food Inspection Agency (CFIA) are required for the movement of cervids within Canada under the *Health of Animals Regulations* (http://laws.justice.gc.ca/en/H-3.3/C.R.C.-c.296/131353.html) in order to prevent the spread of brucellosis, tuberculosis or chronic wasting disease. If the presence of these diseases, rabies, anthrax or foreign animal diseases are suspected in wildlife, CFIA should be contacted. Additionally, the Centre for Infectious Disease Protection and Control within the Population and Public Health Branch of Health Canada should be contacted if wildlife diseases transmissible to humans are suspected.

4.3 Provincial / territorial

All provinces and territories in Canada have legislation governing the use of wildlife. Therefore, it is imperative that investigators consult with the appropriate provincial or territorial agency when planning a project involving wildlife (see Appendix E). Licenses or permits are required for the killing, capture, holding, marking, transport, trade, and sometimes release of most wildlife. This includes wildlife held for research, teaching, management, interpretive purposes, rehabilitation, and may include farming. Provincial

regulations also exist for the types of traps permitted and for the use of firearms or other weapons in specific areas. Additionally, permits are required for the movement of wildlife, or parts thereof, across borders, and such movement may necessitate obtaining permits in more than one province/territory.

Provinces and territories may have endangered species legislation and listings and associated permit requirements. Such legislation and listings may also be applied to species for which the normal management responsibility lies with another agency (e.g., migratory birds, and marine reptiles or mammals). Investigators should note that most terrestrial species (mammals, amphibians and reptiles) and several species of birds (raptors, corvids and resident non-migratory species) fall solely within provincial/territorial jurisdiction.

Permits may also be needed to conduct wildlife research in provincial/territorial wildlife areas, refuges, game sanctuaries, ecological reserves, wilderness areas, parks, or other specially designated lands. Additionally, permits may also be required for active habitat manipulation or other activities on any provincial/territorial land holding.

4.4 Municipal

Many municipal governments have regulations governing the holding or use of wildlife within municipal boundaries. There are usually restrictions on the use of firearms and other weapons. There may be regulations relating to the use of traps or other tools and vehicles. Investigators must consult the appropriate municipal by-laws.

4.5 Private property

Although wildlife is a public resource, wild animals may occupy private and communal lands and certain rights of access are extended to lease holders. Therefore permission should be obtained from the owner to access private property regardless of the permits held. In some cases, on undeveloped lands and/or in remote areas, it may be difficult to locate the owners for permission. In these situations, local provincial/territorial wildlife personnel should be consulted for advice. It is also prudent to inform local residents or interest groups (e.g., local fish and game organizations) of any studies being conducted, whether on private or public land. In addition, government agencies likely to receive calls from the public should be notified prior to the activity (e.g., provincial/territorial and local conservation officers, the Coast Guard, Harbor Commission, CWS, RCMP or local police).

4.6 Professional associations

Many professional associations have produced guidelines for the capture, handling and care of wildlife (see Appendix A). In addition, some scientific journals have developed guidelines that must be followed in order to have work published in their journals. For Canadian researchers, many journals specifically ask for demonstration of ACC review and approval before reviewing a paper that involves animals.

C. FIELD STUDIES — GENERAL CONSIDERATIONS

Projects involving aspects of wildlife ecology, management and/or behavior typically deal with free ranging animals in natural habitats. These projects may address such questions as habitat selection, foraging behavior, social organization, communication, effects of various management regimes, and interspecies relationships, and provide information for population management and the impact of development projects on wildlife.

Some projects may require baiting, capture, marking or additional procedures, usually in combination. Those projects involving manipulation of one or more variables of the study animal and its environment, or actual physical handling, are more intrusive. As such, ensuring that these procedures are carried out in a humane manner is an ethical concern. Understanding the nature of the procedures and potential impacts is also important to the interpretation and integrity of research results.

To understand and potentially reduce the impact of observational and experimental procedures, investigators should conduct appropriate pilot studies whenever possible, particularly to evaluate a new technique or a proven technique being used in a novel manner.

It is essential for personnel involved in a study to be assessed by qualified persons as being adequately trained and/or experienced in the procedures listed on the protocol before the study begins (see also Section B.3.1.1).

A list of examples of procedures and their relative level of invasiveness has been provided in Appendix D in order to assist ACCs to assign the study to one of the CCAC Categories of Invasiveness (A-E).

Guideline 8:

Procedures likely to have lasting negative effects on a population or to affect the existence of a population should not be undertaken, except under extraordinary circumstances. When such impacts are likely, the investigator must demonstrate, through the concurrence of recognized experts, that the procedure is necessary.

For the most part, procedures should not have a detrimental impact on populations. However, some types of research may have population control, or even extirpation, as its goal. For example, habitat improvement for rare birds may involve elimination or control of introduced or over abundant predators (e.g., rats on islands), or management of urban deer or raccoons may involve sterilization or culling of populations.

Investigators must be knowledgeable about the population status of a species to be studied and should consider the use of a species less sensitive to population effects where possible. Sometimes, however, population status assessment is the goal of the study. Field work done on species outside of Canada should involve a local partner, in particular one with knowledge of local wildlife populations.

Unless the design of a study entails manipulation of local populations (e.g., studies designed to lower density, alter sex ratio, or to study certain aspects of physiology or behavior), permanent removal of animals for experimental purposes may be permitted only if there are no lasting negative effects on the population. Other practical alternative methods of achieving the study objectives should be considered and engaged (e.g., obtaining specimens from animals collected for other purposes, such as hunting).

Investigators should take into account the social structure and social behavior of the species in question. The most obvious example is the dependence of young on maternal care. For species with complex social organization, the removal of a critical member could impair the well-being of the remaining group members. These precautions may apply to the temporary removal of animals.

When conducting the temporary removal of animals, the animals should not be relocated but reintroduced as close to the original capture site as possible so as to permit the captured animal to rejoin its social group or to occupy the territory with which it is familiar. Animals that are relocated into unfamiliar areas may be driven away by territorial animals, predated, or may die from lack of shelter or starvation. Even when released at the original capture site after a temporary absence, some of these problems can occur, depending on the length of absence.

1. Observational Projects

Guideline 9:

Observational activities should minimize disturbance that can lead to abandonment of territories or home ranges, pre-emption of feeding, disruption of social structures, and alteration of predator-prey relationships.

Observational activities may lead to disruption of normal animal activities, whether as part of the study procedure or incidental to it. For example, access to or through sensitive areas (e.g., breeding sites) is disruptive and therefore requires ACC review and approval (see Appendix D).

Aircraft or ground surveys should be conducted in such a manner that disturbance to the animals is minimized. Reaction to aircraft and vehicles (e.g., snow machines or ATVs [all-terrain vehicles]) may be extreme and may depend upon the characteristics of the motorized vehicles themselves, as well as on the animal, season, distance, terrain and other factors. The investigator should refer to the most recent literature for survey techniques recommended for each species or to people most experienced with the species and technique to be used.

Disturbance of breeding individuals is a significant concern. The impact of observers, the number and length of visits, and other forms of disturbance should be minimized. In addition, reducing the impact on dependent offspring, pair bonds, and breeding behavior should be considered in the timing and locations of the research.

2. Projects Involving Manipulation of Wildlife

Guideline 10:

Field research involving manipulation of wildlife for experimental studies requires that investigators use the least invasive practical procedures required to achieve the study objectives, considering the biology and behavior of the species of interest. Every effort must be made to minimize distress and ensure the post-handling survival of the animals by selecting the most appropriate method(s) of capture and handling for that species.

2.1 Indirect manipulation

Experimental manipulation of animals in the field (e.g., artificial or actual predators, competitive interaction field experiments, food supplement experiments, acoustical experiments, and aversive conditioning) may expose animals to physical injury, disrupt normal social interactions, or impose other forms of distress. Well-defined endpoints should be agreed upon prior to commencement of a study (CCAC *guidelines on: choosing an appropriate endpoint in experiments using animals for research, teaching and testing*, 1998). Whenever possible, studies of natural encounters or the use of models should replace staged aggressive or predatory encounters. Also, investigators should monitor the study continuously with the intent to stop the interactions at predetermined levels (ABS & ASAB, 1997). Provision of protective barriers and escape routes to reduce injuries should be included in the study design.

2.2 Projects involving direct handling of wildlife

Once the decision has been made to handle wild animals, maximizing the information obtained and reducing the impact on the individuals is an ethical imperative (Karesh, 1996). Nevertheless, there are some situations (e.g., re-establishment of stable groupings) where reduction of stress and impact on a group of animals may necessitate imposing stress on a particular individual.

Stress is the result of an animal's interaction with its environment that serves to protect it during adverse conditions. A state of excessive stress (distress) will occur if the animal has to devote substantial effort or resources to the adaptive response to challenges emanating from the environmental situation or if the animal is unable to make the necessary adaptations.

Potential causes of distress in capture and handling situations are numerous. Excessive running, struggling and exertion may lead to physiological changes, which may have fatal consequences either immediately or at a later time (Jenkins & Kruger, 1973). These include hyperthermia, hypothermia, capture myopathy, abortion in pregnant animals and shock.

Any procedures with the potential to cause distress should be well controlled or, if possible, avoided. Maximum chase time and signs of animal distress should be agreed upon prior to the initiation of studies requiring chases for capture. Physiologic stress caused by temperature extremes (hot or cold) should be minimized by selecting daily and seasonal times best suited for the work, and utilizing methods to warm or cool animals as needed. Distress may also be induced by lack of water or nutrition. Frequent monitoring and the provision of water and high quality food for animals held in captivity may be required.

Pre-existing stressors such as pregnancy, lactation, lack of adequate food and/or water, social stress, and environmental factors such as temperature extremes may decrease an individual animal's ability to deal with the intense and sometimes prolonged distress of a capture event. Therefore, animals already compromised by such stressors are likely to be poor candidates for handling or immobilization, and if possible, their handling should be avoided. There is considerable variability among species regarding their ability to compensate for stressful conditions. It is imperative that the investigator be aware of the specific sensitivities of his/her species of interest and of any non-target species that are likely to be caught.

During any handling procedure, noise and touching or movement of the animal should be minimized. For example, using ear plugs, covering an animal's eyes, or placing it in a darkened environment may help reduce stimuli and prevent arousal. For certain animals, restraining the legs and/or muzzling the mouth will decrease the risk of injury to both the animal and personnel. Handling times should always be kept to a minimum.

Sufficient personnel must be on hand to deal with all reasonable eventualities, e.g., larger than expected number of animals in nets and traps. If insufficient personnel are available, excess animals captured must be released as soon as possible and the operation reduced in scale or stopped.

Guideline 11:

Those conducting field studies should anticipate and be prepared to deal with the range of conditions that may cause undue stress and/or injury to the animal.

Investigators should be prepared to stop activities when they are considered to cause unacceptable stress or likely to cause injury, e.g., during extremes of weather (including temperature extremes) or in the presence of predators.

Investigators should be prepared to recognize and treat animals injured as a result of their actions.

Guideline 12:

The investigator must be prepared to euthanize any animal in the field that is suffering unrelievable pain and/or distress as a result of the capture or handling procedures, or the experimental intervention.

See Section I. Euthanasia.

3. Morbidity and Mortality in the Field

Guideline 13:

When morbidity is observed during or following handling or manipulation, it should be addressed and then documented and investigated. Any mortalities should receive a thorough postmortem to determine cause of death.

Basic veterinary first aid and the appropriate medications should be available during all procedures relating to the handling of wildlife. An individual with the appropriate training and direct experience with the species of interest, or related species, should be on site for all animal first aid, medical or surgical procedures, physical and chemical restraint and anesthesia. Investigators should establish a link with a veterinarian with expertise in wildlife in the planning phase of the project and ensure that they can contact the veterinarian during the field season for additional advice.

If animals are to be medicated for any pre-existing health problems or prophylactically, a veterinarian experienced with the species of interest, or related species, should be consulted in the planning phase of the project.

Arrangements for postmortems to be carried out in veterinary pathology facilities should be made in advance of the beginning of field-work so that the pathologist can explain how the carcass and tissues should be handled and preserved, as well as to minimize the time required to make arrangements for the examination. Ideally, postmortems should be conducted by veterinary pathologists in laboratories, by veterinarians, or remotely by personnel in direct consultation with animal disease specialists who can then receive specimens for further evaluation. When it is not possible for carcasses to be retrieved from the field, it is helpful for someone on the research team to have had prior training in postmortem techniques. A gross postmortem or photographs of lesions may be adequate for diagnosis of the cause of death. However, samples of the carcass may be required for further work-up or genetic archiving. It is necessary that the personnel conducting postmortems understand proper sample collection and preservation techniques to maximize the opportunity for the recovery of disease agents and causes of death and for genetic archiving. A pathologist or veterinarian can then make the diagnosis with the greatest degree of accuracy. Field postmortem techniques are well described for some species (e.g., National Wildlife Health Laboratory, *General Field Procedures and Diseases of Migratory Birds*, 1987; Canadian Cooperative Wildlife Health Centre & Office International des Épizooties, *Wildlife Disease Investigation Manual*, 1990; and Munson, *Necropsy Procedures for Wild Animals*, 1999).

D. COLLECTING VERTEBRATES

1. Killed Specimens

Investigators should attempt to obtain dead specimens from other sources (e.g., road kills and hunter kills) whenever possible.

Provincial/territorial regulations concerning traps and their use should be consulted for local requirements.

Guideline 14:

Killing methods for collection of wildlife should be species-specific and humane. Investigators should be trained in the proposed collecting method(s) to ensure effective humane kills.

Some types of studies require the killing of specimens for study collections. It is important that such collections further our understanding of these animals. Collection of specimens to be used only to demonstrate specimen preparation should be discouraged. Whenever possible, this should be done using laboratory or domesticated species that have been euthanized for other purposes. All reasonable efforts should be made to acquire as much information as possible from each collected animal.

The collection method chosen will depend upon circumstances (e.g., the species, season, and purpose for which the specimen will be used); however, the most efficient and humane method that will serve the study collection purposes should be used. The collection method should not compromise the quality of the biological samples to be collected.

Testing and certification of traps for mammal species in accordance with standards set out in the *Agreement on International Humane Trapping Standards* (AIHTS) (European Community, Government of Canada & Government of the Russian Federation, 1997) is currently on-going but incomplete in Canada. Full implementation of AIHTS is expected in 2007. As far as possible, traps that are certified as having met the standards specified in AIHTS should be used. For information on traps that have been tested and certified for various species, consult provincial/territorial wildlife management authorities (see Appendix E) or the Fur Institute of Canada (2002). Except with special authorization from provincial or territorial authorities, only traps permitted by provincial/territorial regulations for various species may be used. Traps for species not covered by provincial/territorial trap regulations should be the most humane and effective available, based on references to published literature and/or persons experienced in animal capture.

All traps should be deployed and operated according to instructions, monitored for performance, and adjusted to ensure effective and humane kills.

Kill traps should be checked regularly to comply with provincial/territorial regulations and to prevent specimen loss due to scavengers or spoilage.

Shooting may be the most efficient or only practical means of collecting some species. Firearms and ammunition appropriate for the species to be collected should be used. Situations that may lead to a high risk of losing the carcass (e.g., aquatic or marine mammals in open water) should be avoided. An experienced marksperson should be used. The investigator must be prepared to retrieve and kill wounded animals quickly (see Section I. Euthanasia).

2. Live Capture

Guideline 15:

Before initiating field projects involving capture, investigators must be familiar with the study species and its response to disturbance, as well as its sensitivity to capture and restraint. In addition, investigators should be familiar with the advantages and drawbacks of available methods of live capture, particularly those that have been used with the study species.

Investigators should review the various traps and trapping techniques to ensure that the

type used is effective and suited to the species and situation, will minimize distress and injury to the study animals, and will minimize capture of non-target species. In addition, the investigator should be trained in the correct use of the selected method or technique and should be able to ensure the prompt release of any non-target animal that may be accidentally captured. Restraining (live holding) traps for certain mammal species are also subject to the AIHTS and provincial/territorial regulations.

Live captures must be planned to keep captive animals alive, uninjured, and where necessary, provided with food and water prior to processing and release. Trapping methods must also be selected based on the geographic region and the climatic conditions. Where possible, trapping must be avoided when weather conditions threaten the survival or well-being of trapped animals, unless steps can be taken to mitigate these risks. Investigators should make every effort to avoid trap deaths from factors such as exposure, shock, capture myopathy, and predation. In some areas, the provision of shelter is required.

When not in use, traps must be closed, deactivated or removed, and mist nets should be closed and furled to avoid unintentional captures.

The removal of animals with dependent young from the wild should be avoided. Capture and handling of these animals must be carried out with particular care to avoid abandonment. The timing of births can be widely variable. Local expertise (e.g., biologists, trappers and/or wildlife rehabilitators) can be a good source of information about the variances at any particular time.

Decoys can be useful in capturing some species. As far as possible, dummy lures should be used (McCloskey & Dewey, 1999). Where living lures must be used, investigators are responsible for the well-being of all of the animals, both lure and target. Therefore, care must be taken to minimize the level of distress of the lure species (Bloom, 1987; Bookhout, 1996).

Investigators should monitor and record the effects of capture on both study animals and non-target species. This also applies to the protection of lure animals in live traps used to attract predator species.

Investigators should ensure that special considerations have been reviewed for the live capture of animals dangerous to humans. Depending upon species and location, or when trapping gear that is potentially dangerous to humans or their pets is deployed, the public may have to be warned to avoid study areas (e.g., warning signs should be posted around the study site). Some provincial/territorial jurisdictions may have regulations or restrictions governing placement and use of certain devices. Investigators should be aware of relevant regulations and consult local authorities regarding the need for posting of warning signs, public information efforts, etc.

2.1 Trap monitoring frequency

Guideline 16:

Investigators must check restraining traps and nets frequently to avoid injury or death to captured animals.

Depending on the protocol and species involved, traps and nets must be checked as often as possible, with the frequency depending upon the species, trap or net type, weather, location, study objectives, and applicable provincial/territorial regulations. Many animals are sensitive to exposure to heat, cold, dehydration and energy deprivation. As well, long periods spent in traps or nets during the reproductive season should be avoided to reduce the possibility of affecting dependent young and breeding behavior.

Animals caught in live holding traps will sometimes fight the trap and may become injured. The occurrence and severity of this will vary with individuals, species, trapping devices and the trapping situation. Investigators should be aware of the specific sensitivities and requirements of the species they are dealing with and make provisions to accommodate these (e.g., providing shelter, shade, etc.; see the CCAC species-specific recommendations, http://www.ccac.ca).

Radio telemetry can be used to monitor trap sites; however, it should not replace frequent on-site monitoring.

E. RESTRAINT

The well-being of the animals under study is of paramount importance. Improper restraint, especially of distressed animals, may lead to major and potentially fatal physiological disturbances. In addition, the capture of some species of animals may alter their behavior or predispose them to predation.

The decision to use physical or chemical restraint should be undertaken through consultation with knowledgeable individuals. This should be based upon the length of the procedure, the invasiveness of the procedure, the need for analgesia, the degree of stress involved in the capture and restraint of a particular species, and the safety of the investigator. Predictable chemical restraint protocols with good analgesia and antagonists exist for some species, but not others. For many species, effective physical restraint (e.g., net gun capture) can be accomplished faster with fewer complications.

Investigators should be competent in the restraint techniques to be used and should not allow unsupervised or inexperienced persons to handle any species until adequately trained to restrain, manipulate and release the animals properly. The investigator should consult the current literature and seek the advice of experienced professionals before handling an unfamiliar species.

Chemical or physical restraint of wildlife may cause various forms of social disruption which should be considered in the planning process of the project. Social disruption is more detrimental at certain times of the year, especially during breeding. Pregnancy status of female animals should be taken into consideration and physical or chemical restraint of pregnant females avoided, particularly during the last trimester of pregnancy, due to the potential risks to the health of the female and fetus. Generally, chemical restraint of animals with dependent young should be avoided as there is increased risk of abandonment.

The following are basic restraint principles. For more detailed advice, particularly species-specific information, consult the CCAC species-specific recommendations, http://www.ccac.ca, and the guidelines listed in Appendix A.

1. Physical Restraint and Handling

Guideline 17:

Effective methods of physical restraint that minimize the possibility of physical injury and physiological and psychological stress should be chosen within the limits of human safety. The least amount of restraint and the shortest possible time necessary for the procedures being undertaken should be used. Personnel handling animals should be thoroughly trained in the planned procedures as well as in alternative methods of restraint that may be required.

Physical restraint should be performed only by individuals who are familiar with the normal behavior of the species being restrained.

Investigators should endeavor to keep the length of the procedure(s) to a minimum. Prolonged stressful restraint is not acceptable. Investigators should also minimize sensory stimuli by handling animals quietly, with a minimum of personnel, and without sudden movement. Placing blindfolds and earplugs on animals and/or working in darkened environments may reduce stress.

Supplemental chemical restraint may be necessary to prevent injury to an animal and/or to personnel (see Section J.). Additionally, restraining devices (e.g., hobbles, nets and bags) may be required to avoid injury to the animal or to the researcher. Investigators should be familiar with the appropriateness of such devices for the study species.

On-site weather and other environmental conditions, as well as species-specific factors, will influence the outcome of the restraint procedures, and should be considered when planning such activities. Investigators should be aware that seasonal changes in behavior might influence the ease with which many animals may be captured and restrained.

2. Chemical Restraint and Anesthesia

The principal goals of chemical restraint and anesthesia are: to render the animal unconscious or deeply sedated, with a minimum amount of stress and no injury to the animal; to provide adequate intra-operative and post-operative pain control when painful procedures are performed; and to ensure safe and rapid recovery. Wild animals are frequently anesthetized in hazardous environments. Capture equipment has the potential to induce severe injury to the target animal or personnel working with the animal. Drugs used for wildlife anesthesia have the potential to produce adverse effects in the animal and in members of the capture team. The risk of significant morbidity and mortality is often high. Every possible step should be taken to decrease these risks. The following sections outline guidelines that should be followed to decrease stress and morbidity or mortality during chemical restraint and anesthesia. Additional useful information is found in the Canadian Association of Zoo and Wildlife Veterinarians (CAZWV) course manual for the *Chemical Immobilization of Wildlife* (Woodbury, 1996). For guidelines on the use of analgesics, see Section G. Medical / Surgical Procedures.

2.1 Training

Guideline 18:

Personnel performing chemical restraint and anesthesia on wildlife should receive recognized and current training, and should use techniques and drugs that are appropriate for the species with which they are working.

Anesthesia of free ranging wildlife can be complicated and can result in significant morbidity and mortality. Additionally, anesthetic protocols and complications vary considerably between species. Personnel performing anesthesia on wildlife should, therefore, receive appropriate training in anesthesia and be familiar both with the target species and with the best techniques available.

At a minimum, personnel involved in chemical restraint of wildlife should have successfully completed a recent (within the past five years) and recognized course in the chemical immobilization of wildlife or an acceptable combination of initial training (recognized course), refresher training, continuing education, and regular hands-on practice or actual participation in wildlife chemical immobilization events. Personnel should gain experience with the process and target species before attempting the process themselves. It is recommended that the current literature should be reviewed and that a consultation process should take place with personnel that are familiar with the particular species (e.g., wildlife biologists, wildlife management personnel, and veterinarians with wildlife experience).

2.2 Pharmacological considerations

Guideline 19:

Drugs used for wildlife capture should, whenever possible, have the following properties: provide anesthesia; be stable in solution; be effective in small volumes; produce minimal deleterious physiological or toxicological effects; result in rapid onset of anesthesia; and be reversible.

While it is recognized that there is no perfect drug to be used in capturing wildlife, researchers should strive to meet the objectives of this guideline as closely as practical.

Chemical restraint as the primary capture method should be performed with drugs that provide adequate anesthesia. The drug should render the animal unconscious and make it unaware of manipulations that are being performed during immobilization.

All drugs should be stored and transported in the field appropriately (i.e. under aseptic conditions and correct temperature, humidity and light requirements). An extreme range of ambient temperatures may be encountered in the field. Drugs should be stable over a large range of temperatures to facilitate precise delivery of a given drug dosage. Many of the commonly used drugs are water-based solutions and therefore subject to freezing in extreme cold temperatures. Drugs must be properly disposed of when outdated.

Drugs used for wildlife immobilization should be potent, allowing for the use of small volumes. The use of smaller drug volumes and small darts facilitates accurate remote delivery of drugs and minimizes tissue trauma.

Drugs used for wildlife immobilization should have a high therapeutic index and minimal toxic side effects to decrease the risk of morbidity or mortality.

Induction of anesthesia is a particularly hazardous time for wildlife and capture personnel, and should therefore be as rapid as possible. If prolonged, there may be increased risk of injury to the animal and capture personnel, as well as increased risk of losing the animal if it is free ranging and cannot be readily tracked. The drug dose should be calculated to deliver an adequate volume in a single dose to ensure effective, rapid immobilization within the maximum safe dosage margins for the drug in question.

Since wild animals must often be allowed to recover in the field, the administration of a reversal agent is useful to decrease recovery times and to enable the animal to defend itself or escape predators more readily. These drugs also antagonize the side effects of anesthetic agents and facilitate rapid recovery in emergency situations.

2.3 Muscle relaxants

Guideline 20:

Depolarizing muscle relaxants (e.g., succinylcholine chloride) produce paralysis without anesthesia and must not be used without an anesthetic agent.

In the past, muscle relaxants have been used as the sole agent for wildlife capture. Because they do not produce anesthesia and the animal is fully aware of its surroundings, they are extremely stressful and inhumane. Muscle relaxants are titrated to produce paralysis of the limbs, but are not selective for the muscles of locomotion, and thus produce varying degrees of paralysis of the respiratory muscles, resulting in depression of the respiration system, potential suffocation, and often death (Delvaux *et al*., 1999; Jolicoeur & Beaumont, 1986; Kreeger, 1996). Therefore, they must not be used without an anesthetic agent.

2.4 Drug delivery

Guideline 21:

Remote drug delivery systems for administering anesthetic agents to free ranging wildlife must be appropriate for the size of the animal and the volume of drug to be administered.

Many equipment systems are available for the remote injection of drugs, including high velocity dart rifles, low velocity systems and pole syringes. It is important to choose a system that will deliver the required volume of drug with the least amount of physical trauma to the animal (Bush, 1992; Kreeger, 1996).

Hitting a proper injection site is critical when remotely injecting immobilizing drugs in wildlife species. A large skeletal muscle mass is usually the most desirable target to achieve an intramuscular injection. Regular practice sessions with remote drug delivery systems and knowledge of animal anatomy are necessary to be able to consistently hit the appropriate anatomical site. Factors such as season, age and body condition of the animal should all be considered before immobilization as they can radically alter the target site and the dose required. Additionally, an appropriate needle length should be chosen for the size, age and body condition of the target animal to allow effective injection and reduce the risk of laceration and trauma.

High velocity dart rifles are capable of killing most mammalian species and should only be used by experienced personnel. They are generally much less accurate than traditional firearms. Most accidental animal deaths involving these firearms have resulted from using excessive velocity to propel the dart and/or missing the target area, causing penetration of a vital organ or body cavity, and/or broken bones.

Low velocity systems, including CO_2 powered pistols and low velocity dart guns, cause less trauma than high velocity dart guns because the projectile travels at a much lower speed. Low velocity systems, however, have limited use for most free ranging animals because they have a short range and are limited to smaller drug volumes.

Slow-injection darts, pressurized with air or gas, cause less tissue damage when injecting than rapid-injection darts which contain an explosive charge.

Pole syringes are useful for trapped or restrained animals. They are capable of delivering larger volumes of drug than some of the low-velocity systems and create less trauma than high-velocity systems due to the slow speed of injection. However, pole syringes can result in lacerations or needles can break off, especially when used with needles that are too long or when administering large volumes. Placement of the syringe needs to be accurate as pole syringes may harm the animal if incorrectly placed.

2.5 Anesthesia under field conditions

Guideline 22:

Efforts must be made to minimize the risks associated with chemical restraint. The animal's welfare must be the primary consideration, taking into account human safety.

Anesthesia of free ranging wildlife can be particularly challenging. Prior to administering anesthetic agents, many factors need to be considered with regard to their potential risk to anesthetized animals in the field. These include terrain, ambient temperature, visibility, weather, season, age and sex, as well as the possibility of pregnancy or accompanying infant animals, the proximity of predators, and the metabolic state of the animal.

During the induction period of anesthesia, animals are not fully aware or fully ambulatory and may not avoid hazards such as cliffs, water bodies, ice, steep slopes, roads and fences. Investigators must be aware of such changes of behavior and avoid operations near such hazards. In addition, investigators must agree on acceptable chase times with maximum and minimum ambient temperatures for capture sessions. These should be set prior to the project, and chase times should be minimized.

Anesthetized animals may remain under the influence of anesthetic agents for several hours or days following immobilization and are often at risk of injury and death from predators or conspecifics. Steps must be taken to reduce these risks by using anesthetic agents that can be reversed, if available, and by protecting the animals while they recover.

2.6 Monitoring and supportive care

Guideline 23:

Appropriate supportive care and regular monitoring must be provided to minimize the risk of morbidity or mortality.

General anesthesia subjects the animal to potentially life-threatening complications. Anesthetized animals require close monitoring of their cardiovascular, respiratory and thermoregulatory systems. Personnel working with anesthetized animals must be trained to recognize potential complications and deal with them. Ideally, these systems should be monitored continuously; if this is not feasible, close monitoring should be performed every

5 to 10 minutes. The depth of anesthesia should also be closely monitored to detect sudden changes that may indicate distress of the animal or a hazard for personnel. The type of supportive care required varies considerably between species, and therefore, personnel must be aware of the appropriate care for the target species. Investigators should keep the amount of talking and noise to a minimum. Helicopters and other motorized equipment should be turned off or moved away from the handling area. It is advisable to have one worker whose sole job is to monitor the physiological status of the immobilized animal throughout the handling procedure.

Dependable, lightweight, highly portable equipment to assist in monitoring anesthesia is becoming increasingly available (e.g., pulse oximeters, digital thermometers, and oscillometric blood pressure monitors). Personnel conducting field anesthesia should become proficient in the use of the appropriate aids and make this equipment available in the field. Animals showing signs of hypoxia should be treated with supplementary oxygen and investigators should be prepared to administer oxygen in the field. Compressed medical grade oxygen is easily transported in D-size cylinders under most field conditions (Read *et al*., 2001) but is classified as a hazardous material and may be subject to transport regulations. Portable self-inflating resuscitation apparatus (ambu bags) can be useful in smaller species as they are very portable and provide ventilatory support.

Ideally, anesthetized animals that have lost the reflex to swallow should be intubated. Since this is difficult for many species in field situations, it is recommended that the head and neck be extended, and that handling personnel have the necessary training to recognize and treat airway obstruction. Monogastrics should be positioned in lateral or sternal recumbency on a soft, even surface with the head and neck extended; ruminants should be positioned in sternal recumbency on a soft, even surface with the head and neck extended. If, for any reason, sternal recumbency cannot be maintained with ruminants, the animals may be maintained in lateral recumbency if carefully monitored for rumenal tympany and regurgitation.

Dissociative anesthetics are frequently used for wildlife anesthesia and may eliminate the palpebral or blink reflex. Eye lubrication is therefore required to decrease the risk of corneal ulceration or trauma. The eyes and eyelids should also be protected by blindfolding.

Drugs used for wildlife immobilization often impair thermoregulation, making the animals susceptible to hypo- or hyperthermia. This risk is further increased by the field conditions under which wildlife immobilization is frequently performed. Personnel using immobilizing drugs should be able to recognize these complications and know how to prevent or treat them. Because there is a high degree of variability between species, wildlife handlers should know the range of normal body temperature for the target species, and should monitor the temperature frequently throughout anesthesia.

2.7 Drug residue

Guideline 24:

Adequate steps must be taken to ensure that drugs used in procedures on wildlife do not enter the food chain.

Drugs used for wildlife have the potential to have adverse effects in humans and other animals if the subject is consumed soon after anesthesia. Animals should be clearly marked to indicate that they have received a drug and the individuals or agency performing the capture should include contact information on the tag. Personnel administering these drugs should be aware of approximate withdrawal times for the target species. The Veterinary Drugs Directorate at Health Canada or drug manufacturers and/or distributors should be able to provide information for some drugs regarding the length of time during which an animal should not be consumed after receiving the drug (withdrawal time) and

may have specific requirements for animals administered drugs under their authority. It should be noted, however, that many of the pharmaceuticals used in wildlife are "off label" uses, in which case the drug residues and long-term effects have not been determined for these species. Information on withdrawal times for some drugs commonly used for wildlife is given by Craigmill *et al*. (1997) and the Western Wildlife Health Committee (2000); and is available to veterinarians through Canada's gFARAD (global food animal residue avoidance databank) by phone 1-866-243-2723. However, these withdrawal times should be used at the discretion of veterinary authorities in each region.

Chemical restraint should not be performed close to the hunting season for the target species unless appropriate notification has been given. Additionally, consumers of wild meat (e.g., First Nations groups, regional hunter groups and trappers associations, etc.) should be notified prior to wildlife capture and fully informed about any potential risks from consumption of the meat.

F. MARKING

1. General

When choosing a marking technique, primary consideration should be given to methodologies that are not invasive, do not require recapture for identification, and will remain visible for the duration of the study. Where possible, investigators are encouraged to use unique natural features as marks to identify individuals, rather than removing or damaging tissues or attaching auxiliary markers.

Guideline 25:

Investigators must aim to minimize any adverse effects of marking procedures on the behavior, physiology or survival of individual study animals.

Guideline criteria for marking:

- marking should be quick and easy to apply;
- marking code (numbers or colors) should be readily visible and distinguishable;
- markings should persist on animals until all research objectives are fulfilled;
- animals should experience no long-term adverse effects on health, behavior, longevity, or social life;
- accurate records of the marking procedure should be kept;
- marking must comply with federal, provincial/territorial, and other agency regulations;
- marking must allow for seasonal changes and growth of juvenile animals.

While some of the effects of marking may not be known, researchers should strive to comply with the above criteria as much as possible.

Where feasible and practical, investigators should include an investigation of the effects of marking in their study objectives. In most cases, these effects are unknown, partly because of the unavailability of controls; however, in some cases, the opportunity exists to compare the impact of different types of markings. New marking methods should be tried on captive animals first, if feasible.

In choosing an acceptable marking technique, the investigator should consider the nature and duration of restraint, the amount of tissue removed or damaged, whether or not pain is momentary or prolonged, and whether the risk of infection is minimal. The legibility and permanence of the mark should be weighed against subsequent need for recapture.

Techniques for marking animals have been reviewed in many publications which should be consulted for specific methodologies. The following guidelines summarize the most common animal marking techniques and their potential problems.

2. Banding and Tagging

Guideline 26:

Investigators should weigh the research needs for greater visibility and individual recognition against the potential risks of injury that come with the use of specific marking techniques such as banding and tagging, and should minimize the risks associated with the chosen technique.

The risk of injury for each type of marker is dependent upon the species; and therefore, researchers should be aware of problems and new developments associated with the use of each type on the species of interest. Investigators should be encouraged to publish results of studies showing the effectiveness of the marker type or design, including any negative impacts on the study species, so that this can be taken into account by other investigators. This is particularly true of novel experimental marking techniques.

The size, shape and placement of tags should allow normal behavior in the animal that is marked. Bands and tags that project from the body may impair physical activities or cause entanglement in undergrowth or aquatic cover. In addition, projecting markers may be torn as a result of the animal's movements. Brightly colored tags may compromise an animal's camouflage or possibly act as predator attractants.

Because of the high visibility of bands and tags, investigators making use of them must also be prepared to address questions and concerns from the public.

Tattooing and Passive Integrated Transponder (PIT) tags have been used successfully on many animals, primarily mammals, but also on birds, amphibians and reptiles (e.g., Williams *et al*., 1997; Nietfeld *et al*., 1996). One limitation of tattoos and dye marks is that they might be misread due to loss of legibility.

3. Tissue Marking (Invasive)

Guideline 27:

Marking techniques which cause significant tissue injury, such as branding and toe, ear and tail clipping, should only be used if evidence is provided to an animal care committee indicating that alternative methods cannot achieve desired results.

Branding causes pain and serious tissue damage. Therefore, it should only be used in exceptional circumstances. There is currently insufficient data to determine whether freeze branding is preferable to hot branding (Schwarkopf-Genswein & Stookey, 1997; Pierre Yves Daoust, pers. comm., 2002). If branding is the most appropriate option (e.g., for long-term studies), the operation should be conducted only by experienced personnel and every effort must be made to minimize the animal's pain and discomfort (e.g., provision of analgesia with or without anesthesia).

Removal or damage to tissue by toe, ear and tail clipping should be used only when no alternative marking methods are available. When used, tissue removal should not impair normal activities and survival of the marked animal. Toe clipping must not be used for animals that burrow, climb, or otherwise use toes with specialized functions. If no alternative methods to toe clipping are available, then toe removal combinations should be tested on captive animals to determine if impairment will occur. Only the most distal phalanx should be cut. New technologies available give reason to question the continued use of these methods, except when tissue samples are required.

Researchers should ensure that the marking process does not cause unnecessary tissue damage, pain, and/or severe blood loss. Adequate pain control is necessary when undertaking such procedures. Certain techniques can lead to infection if not carried out under aseptic conditions.

4. Radio Transmitters

Radio telemetry packages have become increasingly popular for remotely monitoring the physiology, behavior, habitat use, survival, and movements of animals. In recent years, these devices have become lighter with longer battery life and are increasingly more reliable. Therefore, in some instances fewer animals are required to be captured and handled to acquire the needed data for meeting study goals.

Transmitters are becoming preferred to other forms of marking to follow the movements of animals. Effects on energetics, survival, reproductive success and behavior should be considered in protocol development. This is especially important for birds and marine mammals.

Guideline 28:

Telemetry devices should be as light in weight as possible. Transmitters should weigh less than 5% of the body mass of the animal. When available and feasible, lighter transmitter devices should be selected. Investigators should make every effort to use external transmitter devices that will break away at the end of the useful life of the transmitter.

In the past, it was generally accepted that transmitters should weigh less than 5% of the body mass of the animal. With better technology, it may be appropriate to further reduce the 5% rule. In addition to mass, however, the design, fit and materials of the radio transmitter should also be considered to ensure there is no unacceptable hair loss or skin damage to the animal. As well, in calculating the allowable mass of a transmitter, the investigator should take into account the mass of other tracking materials being used at the same time (e.g., wing bands, tags, and adhesives) (Barclay & Bell, 1988). Final mass of the transmitter package will be a compromise between total mass and inclusion of such desirable features as longer battery life, mortality sensors, drop off devices, GPS devices, etc.

If transmitters are surgically implanted, the procedures should use recognized veterinary techniques (see Section G. Medical / Surgical Procedures).

Ideally, external transmitters should be removed once an experiment or study is completed, but this is frequently not possible or presents too much risk to the animal. Attachment designs that will quickly and completely "self-remove" within a pre-planned time period or when remotely triggered should be considered. It should be noted that implanted and sometimes externally attached transmitters can be ingested by predators.

In order to use radio transmitters, a permit or license may be required from Industry Canada, depending on the frequency used. The appropriate spectrum office of Industry Canada should be contacted regarding the licensing process. Industry Canada's *Radiocommunication Information Circular 66* document (RIC-66) should be consulted for contact information of regional and district offices (http://strategis.ic.gc.ca/SSG/1/sf01742e.html).

Some newer telemetry systems, referred to as harmonic radar, use a microwave pulse detector (the tag) that emits a VHF signal only when it detects a specific microwave pulse from a radar transmitter. As power consumption of the tag is very low in "listening mode", the 1g unit should operate for up to one year or more.

A wide variety of attachment methods for transmitters exist and these are reported in the literature. It is important that investigators who intend to utilize telemetry investigate those sources relevant to their study species. A review of the pertinent literature will help to identify any potential adverse effects that transmitters may have upon the behavior, survival and well-being of their study animals. It is strongly recommended that prior to being used in the field, new attachment techniques are evaluated on captive individuals of the same or similar species.

G. MEDICAL / SURGICAL PROCEDURES

It may be necessary to perform medical and surgical procedures on study animals, either as part of an experimental protocol, for prophylactic treatment, or to provide care to animals inadvertently injured during the capture and handling phase of a study. Some procedures may be considered minor, while other procedures may require chemical restraint for the safety of the animal and/or handlers, or complete general anesthesia for painful or invasive procedures. Investigators may be the most knowledgeable persons regarding the handling of the animals for minor conditions.

The advice and/or direct assistance of a veterinarian should be requested during the planning stage of a study for the administration of antibiotics or other pharmaceuticals used, and for the more involved procedures, particularly with a species or procedures new to the investigator. Depending upon the jurisdiction, laws or policies may require that some procedures only be undertaken by a veterinarian. If any problems are encountered during recommended procedures, the investigator should consult with a veterinarian having experience with wildlife.

1. Use of Analgesics

Guideline 29:

Appropriate analgesics must be used when any procedure is performed that may produce significant intra-operative and/or post-operative pain.

Acute pain triggers catecholamine (epinephrine, norepinephrine) release, resulting in immediate multiple changes in physiology and organ function. The responses to chronic pain can result in decreased healing, decreased resistance to disease, and malnutrition. Loss of function due to pain may make the animal more susceptible to predation.

Wildlife research may involve invasive procedures such as laparotomy, biopsy, or tooth extraction, and measures must be taken to control pain during and after any of these procedures.

A variety of techniques may be available to provide analgesia for wildlife, including local anesthesia, narcotics, anti-inflammatory drugs, or a combination of these. Current literature and experts should be consulted to make an appropriate choice. It is recommended that analgesics be administered prior to surgical manipulations in order to optimize analgesic activity. It should be remembered that duration and action of analgesics vary between species.

The use of opiates, such as morphine, and opioids, such as fentanyl, buprenorphine and butorphanol, may cause side effects and should only be administered following careful consideration and consultation with a veterinarian having experience with wildlife. These drugs are classified as narcotics and are therefore included in the *Controlled Drugs and Substances Act* (Health Canada, 1996, http://laws.justice.gc.ca/en/C-38.8/35884.html). An individual wishing to use these drugs must have appropriate training and make a written request directly, or through a veterinarian, to the Drug Strategy and Controlled Substances Programme at Health Canada for every project they undertake. Once obtained, these drugs may only be used by the individual who acquired them, and the regulations for record keeping, storage and disposal of the drugs, as specified in the Act, must be followed.

The use of analgesics post-surgery must be critically evaluated, taking into account the characteristics of the species. Re-restraining animals held in short-term captivity following surgery to deliver an analgesic may cause more stress to an animal than leaving it alone.

Local anesthetics can be useful for intra-operative and post-operative analgesia of wildlife, but consideration must be given to route of administration, duration of action, and toxicity. While local anesthetics can be administered by a variety of routes, local infiltration of the surgical site is the simplest method and

is recommended for personnel that do not have advanced training. Duration of action often dictates the choice of local anesthetic agent.

2. Minor Procedures

Investigators must minimize stress and pain caused by sampling, physical measurements and aging techniques and ensure that they have no long lasting effects on the animal.

2.1 Tissue / blood samples

Guideline 30:

Sampling of blood and tissue, including tooth extraction, should be performed only after appropriate training and adequate experience. Procedures and protocols must be chosen that avoid or minimize pain and distress.

The advice of a veterinarian can be helpful in deciding on, and training in, proper blood and tissue sampling methods. The need for an anesthetic depends upon the restraining method, the species, the physical condition of the individual animal, and the tissue and/or volume of blood required. As a general rule, the volume of blood collected should be no more than 10% of the total blood volume of the animal (blood volume is approximately 100ml/kg body weight).

When appropriate, blood and other biological samples can be collected during the handling of animals in order to maximize data collection. The samples may be analyzed immediately or archived for later use. Proper collection and specimen handling and preservation protocols should be followed in order to obtain useful field data. Opportunities for tissue sampling include hair, fecal samples, skin plugs from ear tagging, claw tips, blood samples, etc. Opportunistic non-essential sampling activity should be balanced against additional restraint time required.

Tissue sampling should use procedures that minimize stress and pain while obtaining adequate samples for study purposes. Remote tissue sampling methods such as biopsy darts and remote hair sampling are options for genetic sampling of free ranging species and for the collection of samples for contaminant analysis. Darting should be done by individuals experienced with the use of remote sampling systems to ensure that sampling is done safely with as little stress to the animals as possible.

2.2 Physiological measurements

Investigators should be prepared to minimize stress and pain to captured animals as a result of procedures to take physiological measurements. See Section E. Restraint for more information on handling procedures.

2.3 Isotopes

Guideline 31:

Investigators planning to use radioisotopes must be trained in the use of such tracers, ensure that all appropriate permits have been acquired, and ensure that disposal of waste material follows the procedures specified in the permit.

Special training and precautions are required of researchers planning to use radioactive isotopes or tracer techniques in order to protect the health and safety of the researcher, staff, and the public. For any work involving radioactive isotopes in Canada, investigators are required to be licensed by the Canadian Nuclear Safety Commission (CNSC) (http://www.nuclearsafety.gc.ca/eng/licensees/). The specifics of the licensing requirements will depend on the type, activity and use of the isotope.

The advantages and disadvantages of using strong gamma emitters must be weighed in terms of possible deleterious effects on the animal and potential hazards to the public who might ingest isotope labeled game animals.

Labeling compounds have been used to mark several species of animals. Stable isotopes of elements such as carbon, hydrogen, nitrogen, and iodine are gaining use in wildlife studies of diet, energetics, and water dynamics. They

do not pose the health and environmental risks of radioactive isotopes.

3. Major Procedures

Guideline 32:

Surgical interventions, including laparotomies, radio transmitter implants, surgical sterilizations, and other invasive procedures that expose the abdominal cavity or other deep tissues, should only be done by a veterinarian or under a veterinarian's supervision.

As previously outlined, investigators should have an established link with a veterinarian prior to the commencement of a project with invasive procedures. One of the aspects of the planning phase should be to establish who will perform any surgical procedures on the animal. If the veterinarian is not to carry out the procedures, then he or she should: be apprised of the procedures to be carried out; ensure that the personnel to be performing the procedures are well-trained and have adequate supervision; and be available to answer any questions if problems arise.

3.1 Invasive procedures

Cardiac puncture is not generally permitted except in terminal collection procedures and must be performed under general anesthesia. For additional information, see the CCAC species-specific recommendations, http://www.ccac.ca (in particular for use in amphibian species).

Invasive procedures require the use of recognized veterinary procedures, including asepsis, anesthesia, analgesia, appropriate surgical techniques, and patient monitoring.

The advice of a veterinarian must be sought prior to the administration of antibiotics or other pharmaceuticals used during invasive procedures.

Animals should be observed during recovery from anesthesia whenever possible, and not be released from traps and enclosures until fully recovered.

H. MOVING AND HOLDING WILDLIFE

1. Transportation

Guideline 33:

Investigators should ensure that the care, caging, and mode of transportation are suitable for the species, and that the animal will be transported in a manner that minimizes stress and avoids injury.

Transporting animals over long distances by road, rail or air requires planning and special procedures that will ensure they receive humane treatment and care for the duration of the journey.

The species involved, the method of transportation, and the length of time of the journey are important factors in determining the type of care and conditions of containment required to transport the animal in a safe and humane manner. Individuals involved in transporting the animal should be knowledgeable regarding the appropriate procedures to be used for caging, and must ensure that adequate food, water and bedding are available during travel. Veterinary assistance may be required to prescribe and/or administer tranquilizers to the animal if the transportation process is anticipated to be highly stressful.

The transportation process should be as brief as possible. For some species, periodic rest periods may be required to allow the animals to feed undisturbed. Other species should be shipped only when they are normally inactive.

Before planning to ship wild vertebrates by air, investigators must consult the most recent edition of the International Air Transport Association (IATA) *Handbook on Live Animal Regulations* for information on species-appropriate containers, care and handling. The airline should also be contacted for further advice. Additionally, the IATA document is a good resource when preparing ground shipments.

To avoid delays, all permits, health certificates and other documents should be completed prior to shipping. The trip should be scheduled to minimize the number of transfers and delays, and to ensure that a person competent to provide appropriate care is available to meet the shipment upon its arrival. Multiday shipping may require a qualified person to accompany the shipment or appropriate alternative measures. Any required clearance of animals by animal health and customs inspectors should be arranged prior to shipment to avoid unnecessary delays.

Contingency plans must be in place to deal with emergencies such as breakdowns, collisions, or extreme weather.

Animals that have received general anesthesia should be fully recovered prior to transport.

2. Husbandry

Husbandry describes the care given to animals held in short- or long-term captivity. Animals may be held either before or after transport to a new location for required disease testing or for acclimation.

Guideline 34:

The investigator is required to research and understand the habits and behaviors of any species to be held captive. This knowledge may assist in avoiding problems associated with captivity.

The biological needs of each wild species and the nature of individual projects vary widely, and therefore, only general recommendations can be made on the housing and care of wildlife in either short- or long-term captivity for research, teaching or testing purposes. The literature contains many reviews and documentation of species successfully kept in captive environments. It may be necessary, especially

when dealing with unfamiliar species, to test and compare several methods of housing to find one that is most appropriate for the needs of the animals and the purposes of the study.

2.1 Housing

Guideline 35:

Animals held for a few hours or for transportation over short distances must be placed in appropriate holding cages and provided with bedding and adequate sources of suitable food and water.

The most appropriate housing conditions for wildlife can be markedly different from those recommended for similar domestic or laboratory animals. However, methods and types of housing, caging, feeding, and cleaning for common laboratory species and domestic animals may be applied in a general sense to wildlife. Reference to domestic livestock and exotic animal husbandry documents may be of use for many animal groups.

Holding cages should be protected from direct sunlight, wind and precipitation, and kept at a temperature appropriate to the species. Care should be taken to minimize psychological stress by shielding cages from excessive light, noise and human activities. Holding cages should have an enclosed area or denning box into which the animal can escape from view. Live trap type caging may be suitable for short-term holding if it provides adequate space and ventilation; but it is only suitable for up to a couple of hours as the animal cannot hide and the lack of mobility increases its stress level and compromises its circulation.

Animals should be regularly monitored, but with as little disturbance as possible.

Guideline 36:

The long-term captive environment of wildlife should provide for their behavioral, physical and nutritional needs, while providing enrichment opportunities for physical and psychological stimulation.

Long-term housing should attempt to duplicate all aspects of the species' natural conditions, or replace these with artificial elements or conditions of comparable value to ensure the survival and well-being of each individual. While in captivity, wild animals must be maintained under conditions that meet their needs for food, moisture, nesting, space and microclimate.

Of particular importance is the maintenance of environmental humidity and temperature within the animal's thermoneutral zone to minimize energy demands. Animals that are hibernating require special housing to maintain and monitor ambient temperatures and humidity at the optimum level for each species.

Wild species kept in captivity for more than a few days will have additional requirements for enrichment to accommodate features of their ecology, morphology, physiology, biology, and behavior. These may include feeding strategies, visual barriers, refuges, natural materials, perches, dust and water baths, and opportunities and space for exercise and play. Animals which are not provided with these features may develop signs of acute and chronic stress, including poor health and abnormal behaviors.

Wild animals maintained in captivity should be provided with a preventive health care program. This program should serve to assess the need for the following types of procedures: 1) health monitoring (e.g., visual and physical exams, blood sampling and testing, bacterial and viral cultures, and serology or molecular diagnostics for diseases of concern); 2) vaccinations; 3) monitoring and treatment for internal and external parasites; and 4) dental and foot care.

Ease of restraint and maintenance should not be the only determinants of housing conditions. The suitability of housing may be judged by monitoring a number of biological indices over time, such as changes in general health, appetite, growth and weight, survival rates, breeding success, activity types and levels, general behavior, and appearance of skin, pelage or plumage (reference manuals: Kleiman *et al.*, *Wild Mammals in Captivity: Principles and Techniques*, 1997; Fowler & Miller, *Zoo and Wild*

Animal Medicine: Current Therapy, 4th ed., 1999; CCAC *guidelines on: the care and maintenance of marine mammals*, in preparation; CCAC, *Guide to the Care and Use of Experimental Animals*, vol. 2, 1984 and subsequent versions).

2.2 Nutrition

Guideline 37:

Diet and feeding schedules should reflect the animal's normal foods and feeding behavior.

In addition to attempting to duplicate critical aspects of a species' natural environment, it is also critical, for both normal health and behavior, to ensure that the animals' nutrient requirements are met and that the animals are kept in body condition appropriate for age, gender and season. Where possible, it is advantageous to supplement standard dietary requirements with a variety of natural feeds.

Providing food *ad libitum* may be a problem for some species. Dietary changes should be made gradually; overfeeding may be a concern.

Personnel responsible for the care of wild animals must be familiar with the normal appearance and behavior of those animals in order to recognize nutritional deficiencies when they occur.

2.3 Social interactions

Guideline 38:

Social relationships and social behavior of captive wildlife must be taken into consideration.

For some species, group housing is necessary, but for others, it will increase stress and risk of injuries. Consideration should therefore be given to the appropriateness of visual, auditory, olfactory and tactile contact among animals.

2.4 Hygiene

Guideline 39:

Husbandry routines should be designed to minimize disturbance to the animals while maintaining adequate hygiene levels.

The frequency of cage or pen cleaning should represent a compromise between the level of cleanliness necessary to prevent disease and the amount of stress imposed by frequent disturbance, handling and exposure to unfamiliar surroundings and bedding (ABS & ASAB, 1997). An understanding of the normal ecology, morphology, physiology, biology, and behavior for each specific wildlife species will assist the researcher in providing optimum care and housing.

3. Translocation and Release

Translocation involves capture, transportation and release. Captive holding before and/or after transport may also be considered necessary for health testing, quarantine, habituation to new environments, or other reasons. Capture is discussed in Section D.2. The other phases of translocation have been covered in the preceding sections dealing with transportation and husbandry.

3.1 General considerations

Guideline 40:

Before the translocation of wildlife or release of any wild animal held or bred in captivity, the possible ramifications of such actions must be considered. Negative effects on the individual animal, the ecological conditions at the release site, and human safety must all be considered and minimized. Release should not occur if the animal is unlikely to survive due to reasons associated with its captivity, or if the existing ecological conditions at the release area could be adversely affected, including any risk of introduction of a wildlife disease new to the area.

The translocation and release of animals are common tools of wildlife management. They are used to: repopulate original ranges; augment or consolidate remnant populations; control local overabundance; remove problem animals; rehabilitate injured animals; and better understand animal health. Despite their

many uses, these procedures bring inevitable risks associated with diseases, genetic and ecological integrity, and have the potential to compromise animal welfare.

The translocation of wildlife from one location to another, as well as the movement of animals from captive situations (rehabilitated, captive bred and long-term holding) for release, may be considered as routine procedures. Such projects, however, should be carefully planned to enhance the probability of subsequent survival and eventual reproduction of released animals. A multidisciplinary approach to planning may be required, involving government and non-government agencies with resource management, veterinary, husbandry and academic expertise.

To be worthwhile, a release should contribute something to the well-being of the released animal and/or the species as a whole. The welfare of the animals to be released should be of paramount importance through all stages of a project. For group re-introductions or translocations, prior feasibility studies and a formal analysis of the risks should be undertaken. This should include biological and ecological investigations of the habitat, existing animals at the site and any animals to be released (Population and Habitat Viability Analysis). See the IUCN *Position Statement on Translocation of Living Organisms* (1987), http://www.iucn.org/themes/ssc/pubs/policy/transe.htm, and the IUCN/SSC *Guidelines for Re-Introductions* (1995), http://www.iucn.org/themes/ssc/pubs/policy/reinte.htm, for additional useful information.

Further information is available from the Office International des Épizooties through the Canadian Cooperative Wildlife Health Centre (CCWHC) website at http://wildlife.usask.ca/bookhtml/RiskAnalysis/RSKGUID1.htm.

Federal and/or provincial/territorial wildlife agencies must be contacted for consultation and authorization at the earliest stages of planning for a proposed release of non-indigenous animals into the wild. All applicable local, provincial/terrirorial and federal legislation should be followed, and necessary permits obtained before release.

Where possible, for captured animals not involved in a translocation or re-introduction project, release should occur as soon as possible after processing and at the site of the original capture. For captive-bred animals, or for reasons of conservation, other ecologically appropriate sites may be selected in consultation with and approval by the appropriate government natural resource management authority. Permits may be required for the release of any wildlife which has been held or bred in captivity, whether indigenous or non-indigenous.

If animals bred or held in captivity are to be released, they should be assessed for normal behavior and their ability to survive in the wild. Investigators should thoroughly review research into "hard" release (immediate) versus "soft" release (holding for a period of time at the release site). Potentially dangerous animals should not be so accustomed to human presence that they pose a potential threat to local inhabitants.

3.2 Medical considerations

Guideline 41:

Appropriate measures should be taken to ensure the health of animals throughout all stages of any translocation or release program. Prior to release, screening of wildlife for known infectious agents, parasites and possible undesirable genetic traits should be carried out.

The principal risks to be considered in translocation and release include:

- The animals may carry new diseases or parasites into the destination ecosystem that cause harm to the destination ecosystem, or animals being moved may encounter new diseases in the destination ecosystem and be harmed by these new diseases (CCWHC, n.d.).
- The animals may not represent the same race or subspecies as those at the release site, or may introduce undesirable genetic traits if interbreeding occurs.

- The animals may not find all the basic physical and nutritional conditions required, or may encounter unfamiliar mortality factors (i.e. novel predators) that prevent long-term survival in the environment into which they have been translocated.

Before release, a quarantine and observation period can help to rule out many health concerns. The time frame selected (generally 15 to 60 days) should reflect the incubation period of known diseases, particularly those for which no reliable screening test exists. During this quarantine period, appropriate tests should be carried out (e.g., serology, viral and bacterial cultures, and external and internal parasite screens). Archiving of tissue and serological samples for possible future reference should be encouraged wherever possible.

Species-appropriate vaccinations and treatments to control parasites may be desirable prior to release, if such treatments will not interfere with post-release health monitoring (e.g., serology). If used, vaccinations should be appropriate for the species and timed to allow appropriate immunity to develop before release.

Post-release monitoring is an important component of release programs. This monitoring can include radio tracking of selected individuals, thorough postmortem and investigation in cases of natural post-release deaths, demographic studies of released stock, and disease monitoring through serology of recaptured individuals. Knowledge of the age-specific natural recruitment rates can help to assess the success of re-introduction efforts. Care should be taken so that post-release monitoring does not impair the success of the re-introduced species.

3.3 Environmental considerations

Guideline 42:

Investigators should assess the habitat at the proposed release site, not only for its ability to provide the species requirements for survival and reproduction, but also to ensure that no impairment to the ecological integrity of the site will occur as a result of the release.

Investigators planning to release animals in a geographic area should be confident that ecosystem integrity will not be compromised by the release. They should attempt to determine the effects of the proposed release on resident populations, including competitive interactions and risks for other species.

Local and seasonal conditions should be conducive to survival at the time of release. The physiology and behavior of the species should be understood and considered. For example: diurnal animals should be released early in the day; seasonal times should correspond to times when food sources are abundant; there should be suitable cover for prey species; weather extremes should be avoided; and consideration should be given to normal seasonal times of dispersal for that species.

I. EUTHANASIA

Guideline 43:

Planning for field procedures on wildlife should include contingency plans for euthanasia. Information on techniques appropriate for the species of concern should be researched and the necessary materials and equipment should be obtained and prepared. Consideration should also be given to techniques that least interfere with the conduct of post-mortems or postmortem analysis.

The following recommendations for euthanasia are based on the *2000 Report of the AVMA Panel on Euthanasia* (AVMA, 2000). Many recommended means of euthanasia for captive animals are not feasible in the field; however, the challenges presented by field conditions do not lessen the ethical obligation of the responsible individual to reduce pain and distress to the greatest extent possible during euthanasia. More details relevant to the individual species are provided in the CCAC species-specific recommendations (http://www.ccac.ca).

One of the most important criteria of acceptance of a euthanasia method as humane is that it have an initial depressive action on the central nervous system to ensure immediate insensitivity to pain; this must be followed by cardiac and respiratory arrest. For this reason, pharmaceutical methods are often advised; however, the use of pharmaceuticals requires proper disposal of the contaminated carcass.

1. Pharmaceutical Methods

Non-inhalant Pharmaceutical Agents: These agents should be administered intravenously, with added sedation as needed to decrease fear and distress in the animal. Intraperitoneal injection of non-irritating solutions is acceptable if intravenous injection is impractical or impossible. Intracardiac injection is only acceptable in fully anesthetized or comatose animals. Other sites of injection (intramuscular, subcutaneous, intrathoracic, intrapulmonary, intrathecal, etc.) are not considered acceptable routes of administration for injectable euthanasia solutions.

- **Barbiturates** depress the central nervous system, starting with unconsciousness and progressing to apnea and cardiac arrest. Sodium pentobarbital is the most commonly used agent. The effects are rapid and smooth, and the solution is inexpensive. Disadvantages include: a) intravenous injection is required for best results; b) it is a controlled substance, and therefore must be carefully accounted for and used under the supervision of a veterinarian; and c) there are potentially fatal toxic effects to scavenging animals consuming carcasses.
- **T-61** is a non-controlled mixture of three drugs. It must be used intravenously and typically does not provide as smooth a death as barbiturates (Close *et al.,* 1996 & 1997; Hellebrekers *et al.,* 1990).

Volatile Anesthetics: These anesthetics (e.g., halothane and isoflurane) are useful agents for euthanasia of small species as intravenous injection is difficult. Because the liquid state of most inhalant anesthetics is irritating, animals should only be exposed to vapors. Ether and nitrous oxide are combustible and/or explosive and have potential for human toxicity and abuse, and therefore are not recommended as volatile agents for use in euthanizing wildlife. Volatile anesthetics are unsuitable for animals that have the ability to hold their breath for long periods of time (especially reptiles and diving mammals). Personnel safety must be considered in order to avoid exposure to the vapours.

2. Inhalant Gases

Euthanasia with inhaled gases is slow due to the requirement for any gas being inhaled to reach a certain concentration in the lungs before taking effect. A closed chamber to hold the gas is needed and personnel safety must

be considered in order to avoid exposure to the toxic gas.

- **Carbon Monoxide (CO)** can only be delivered reliably, in concentrations high enough to be effective, through CO gas cylinders. Vehicle exhaust is not an acceptable source. Under the effects of CO, animals do not appear in distress as CO induces unconsciousness without pain or discomfort. CO may be explosive at levels exceeding 10%.
- **Carbon Dioxide (CO_2)** is non-explosive and inexpensive. It can be obtained in pressurized cylinders. It may be distressing to the animal in higher concentration, and is unsuitable for animals that hold their breath (e.g., diving or burrowing birds and mammals) or do not breathe at a very high frequency (e.g., amphibians and reptiles).

3. Physical Methods

These techniques, when properly applied, kill rapidly and cause minimal stress. They may offer a practical solution for field euthanasia of various sized animals and prevent pharmaceuticals from entering the food chain.

Gunshot: While a shot to the brain of an animal produces a quick and humane death (Longair *et al.*, 1991), it is best attempted when the animal is immobilized by injury or physical restraint. In free ranging situations, a successful shot to the brain may be difficult to achieve and can result in accidental injury to the animal. Under these conditions, a shot to the heart and lung area may be more appropriate and is recommended in hunter education programs conducted by provincial and territorial agencies. Although death from this shot is not as quick, it is much more certain under free ranging conditions. In some cases, a gun shot to the brain may prevent proper postmortem analysis. This is particularly important if animals are to be tested for rabies.

Penetrating Captive Bolt: This method requires that animals be well restrained in order to properly place the captive bolt. Non-penetrating captive bolts are not recommended as a means of euthanasia as they may cause unconsciousness without killing the animal.

Cervical Dislocation: This method is used for mice, rats and bats (<200g), and other selected small mammals (small rodents <200g and lagomorphs <1kg), as well as birds (<2kg). The technique involves stretching the neck to cause separation of the cervical vertebrae from the skull and can only be used on small animals. For immature rabbits (<1kg), the neck is stretched, hyperextended and dorsally twisted to separate the first cervical vertebra from the skull.

Decapitation: This technique is acceptable for very small species, but requires appropriate specialized equipment not likely to be carried in the field.

Exsanguination: This can be a practical method of euthanasia in the field when performed on an anesthetized animal.

4. Unacceptable Methods of Euthanasia

When properly carried out, stunning and pithing will produce rapid unconsciousness, but not death, and should only be used in combination with other techniques such as exsanguination. Likewise, physical methods such as freezing and drowning are unacceptable unless used in combination with anesthesia to ensure that the animal is deeply anesthetized at the time of euthanasia.

Unacceptable injectable agents for euthanasia include caffeine, strychnine, any neuromuscular blocking agents, nicotine, and magnesium salts. Injectable potassium chloride is acceptable if the animal is under general anesthesia, and may reduce the risk of toxicosis for predators and scavengers in situations where carcasses of euthanized animals may be consumed. Chloral hydrate may be considered for intravenous euthanasia of sedated hoofed animals, but is not acceptable for carnivores or small mammals. Injection of an air embolus is unacceptable.

Unacceptable sources of gas include the reaction of sodium formate and sulfuric acid, and vehicle exhaust to produce CO, and fire extinguishers and chemical means (e.g., Alka Seltzer® tablets) to produce CO_2.

5. Disposal of Euthanized Animals

Guideline 44:

Any animal euthanized in the field which may contain residues of toxic euthanasia chemicals should be disposed of in such a manner that it does not enter the food chain.

Acceptable disposal methods include incineration or liming the carcass and burying in a deep hole. Prior to disposal of the carcass in the field, investigators should also determine the suitability of euthanized animals for preparation and use as study or teaching specimens with accompanying relevant information.

J. HUMAN SAFETY CONSIDERATIONS

Guideline 45:

Many species of wildlife are capable of inflicting serious injury or transmitting disease to persons handling them. Appropriate handling and restraint techniques should be used, and training in how to apply them should be provided to avoid injury to both animals and humans.

Investigators are responsible under occupational health and safety legislation for their own health and safety as well as that of their coworkers in the field. Investigators must ensure that the hazards to human health and safety when working with wild animals are clearly identified and communicated to the project personnel, and that training, written procedures and any necessary protective clothing and equipment are provided to ensure that personnel are protected against possible injury or exposure to potentially dangerous wild animals or their fluids and waste.

Personnel should work in teams of at least two people in the field, especially when involved in physical or chemical restraint and handling of animals or other high risk situations. Appropriate physical and/or chemical restraint may be necessary to prevent injury to an animal and/or personnel.

Investigators should maintain a record of any injuries incurred while handling wildlife in the field or in a holding facility. Applicable local regulations regarding the documentation and reporting of workplace injuries should be consulted.

A record must be kept of all training given to staff with the date of the training and signature of the staff member.

1. Drug Hazards

Guideline 46:

The risks involved in using drugs for the capture and immobilization of wildlife must be identified and communicated to all personnel involved in the project. At least two people on the team should be trained in first aid and CPR (cardiopulmonary resuscitation), local medical authorities should be informed of the potential hazards, and an evacuation plan to medical facilities should be discussed prior to fieldwork.

Guideline 47:

Personnel using drugs for wildlife should have current training and inform other members of the team of the risks of human exposure. There should be adequate quantities of applicable reversal drugs on hand in the field if these exist.

Anesthesia of free ranging wildlife may place personnel at risk of injury. Injury can occur from animal attacks, capture equipment, or exposure to potent drugs. Every possible effort must be made to minimize the probability of human injury when undertaking chemical restraint and anesthesia of wildlife.

It is the responsibility of the investigator to ensure that personnel have knowledge of current procedures with the subject species and thorough knowledge of the emergency care of personnel exposed to the pharmaceuticals involved. Training for those authorized to use immobilization drugs must include first aid and emergency procedures relevant to the region. Members of the field team must be familiar with and competent in such first aid procedures as may be required in an accidental exposure emergency.

Because smaller volumes of drugs are more easily delivered via remote drug delivery systems, most drugs used for wildlife anesthesia are extremely potent and pose significant hazards to the people using them. This is especially true for the potent opioid drugs such as carfentanil, A3080, etorphine, and the potent alpha-2 agonist, medetomidine (Sawyer & Hoogstraten, 1980; Petrini & Keyler, 1993).

Guideline 48:

Every reasonable attempt should be made to recover any darts that miss the target animal and contain chemicals which could pose a public health risk.

2. Hazardous Physical or Environmental Situations

Guideline 49:

It is the responsibility of the investigator to ensure that hazardous conditions involved in field work are identified to the personnel involved. Some situations require particular experience and/or training, such as working around aircraft, diving, climbing, working at high altitude or in extreme temperature conditions, and working on ice.

When working in such locations, the investigator must ensure that the hazards involved are clearly described to field staff and that appropriate training and protective equipment and clothing are provided. The investigator is responsible for ensuring that field staff are competent to work under difficult conditions.

3. Equipment Hazards

Guideline 50:

Personnel involved in wildlife restraint should have current training in the use of pertinent equipment (e.g., ATVs [all terrain vehicles], boats, firearms, drugs, dart rifles, pistols, and jabsticks).

4. Emergency Preparedness

Guideline 51:

The investigator is responsible for ensuring that an emergency plan is in place.

An emergency plan appropriate for the intended study must be developed involving collaboration with local emergency personnel where necessary. This may include: making plans for evacuation; informing local medical authorities of the project and possible safety issues; and putting a checkup and/or response system in place.

A procedure for accessing emergency medical services must be developed.

Materials and equipment, such as helmets, face masks/protectors, gloves, firearms, or respirators, should be supplied to facilitate the safe conduct of projects. Field personnel should also be provided with appropriate and effective means of communication with each other and with emergency personnel.

5. Biohazards

Guideline 52:

The investigator must ensure that all potentially hazardous biological or zoonotic agents which may be encountered in the field situation or that are particular to the species under study are identified for field staff before field work is started, and that the necessary training and preventive medical care is obtained.

The investigator is responsible for identification of any specific biohazards or zoonotic agents which may reasonably be expected to be encountered in the field. Field staff must be informed about the possible routes of disease transmission and exposure, and trained in the use of protective equipment, medical interventions and safety procedures which are to be used to manage the hazard.

In the interest of human health and safety, it is important that all wildlife that die from unknown causes in the field or in holding facilities undergo a thorough postmortem to determine the cause of death. Depending on the postmortem results, it may be necessary to obtain medical assistance to protect personnel from diseases and parasites. Investigators should familiarize themselves with the known biohazards specific to the species under study.

All individuals involved in wildlife projects should have medical checkups and be given access to any recommended vaccinations. Where exposure to infectious agents can reasonably be expected (e.g., field work with bats), all field staff must be provided with immunization or prophylactic drugs, if available and appropriate.

Investigators who become ill should seek immediate medical assistance and advise their physician of their possible exposure to potentially hazardous animals, diseases and environmental conditions.

The investigator must ensure that safety procedures are established for the conduct of postmortems in the field and that appropriate protective equipment (e.g., gloves, aprons, eye protection and respiratory protection) is provided. The investigator is responsible for ensuring that all personnel are trained in the postmortem techniques appropriate for the species.

Where an animal that can reasonably be expected to be infectious is to be trapped or handled, the investigator must provide hazard information, safety equipment, and training to minimize the potential of transmission of the infectious agent. If wild animals potentially infected with an infectious agent or identified as potentially carrying a zoonotic agent are to be brought back to the laboratory or confined in proximity to personnel, the investigator must ensure that the animals are housed according to the requirements of the *Containment Standards for Veterinary Facilities* (CFIA, 1996) and the *Guide to the Care and Use of Experimental Animals*, vol. 1, 2nd ed. (CCAC, 1993).

All potential accidents or exposures, or suspected exposures, to infectious biological agents must be reported immediately to the nearest medical authorities as described in the emergency plan. The investigator must be notified and a record of the accident or injury kept. Any unexpected illness must also be reported immediately in a similar manner.

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L. GLOSSARY

Analgesia—loss of sensitivity to pain

Anesthesia—loss of sensation with or without loss of consciousness

Antagonizing agent—an antagonizing agent or antagonist is a drug that will bind to a specific receptor and antagonize the clinical effects of the "agonist" drug, e.g., atipamezole is an alpha-2 antagonist drug that "reverses" the sedation induced by medetomidine

Apnea—absence of spontaneous breathing

Asepsis—absence of living germs, free from septic or poisonous putrefactive products

Biopsy—the surgical removal of a cell or sample of tissue for diagnostic purposes

Capture myopathy—muscle damage resulting from anaerobic muscle function; predisposition may be due to improper capture procedures

Cardiac puncture—penetration of the heart, usually for removal of a blood sample

Catecholamines—a type of biogenic amine; includes epinephrine, norepinephrine and dopamine

Culling—selective killing to reduce a population

Depolarizing agent—a muscle relaxing agent (drug) that produces a depolarization (contraction) of the muscles before it produces muscle relaxation; succinylcholine is an example of a depolarizing agent

Dissociative agent—a drug that will produce dissociative anesthesia; this type of anesthesia is characterized by a cataleptoid state in which the eyes remain open, and purposeful or reflexive muscle movements may occur

Distress—a state of excessive stress which will occur if an animal has to devote substantial effort or resources to the adaptive response to challenges emanating from the environmental situation, or if the animal is unable to make the necessary adaptations

Ecological—having to do with relations among living organisms and between living organisms and their environment

Ecosystem—a complex of the plant and animal communities within an area, along with the non-living components of the environment and the interactions among these

Enrichment—the improvement of an animal's living conditions that contributes to the behavioural and psychological well-being of the animal

Euthanasia—literally, a good death—rapid loss of consciousness and death, with no pain or distress accompanying the procedure

Exsanguination—a procedure causing extensive loss of blood due to internal or external hemorrhage

Extirpation—elimination of unwanted species

Food chain—a sequence of organisms, each of which uses the next lower member of the sequence as a food source

GPS (Global Positioning System) devices—equipment that uses satellites to determine a location on earth

Humane—conditions which promote physical and behavioral well-being of animals; in the case of euthanasia, humane methods are those which are painless, minimize fear and anxiety, and are reliable, reproducible, irreversible, simple, safe and rapid

Hyperthermia—higher than normal body temperature

Hypothermia—lower than normal body temperature

Hypoxia—reduced oxygen in air and/or blood and tissues

Immobilization—a procedure causing loss of the ability to make coordinated, purposeful movements

Indigenous—originating from a particular area; native

Intraoperative—occurring during an operation

Laparotomy—abdominal incision to access the peritoneal cavity

Lateral recumbency—lying down on the side

Monogastric—having a single stomach

Morbidity—diseased state

Mortality—loss of life; death

Pain—an unpleasant sensory and emotional experience associated with actual or potential damage, or described in terms of such damage (International Association for the Study of Pain®, http://www.iasp-pain.org/terms-p.html)

Palpebral—pertaining to the eyelid

Postmortem—an examination of the body made after the death of the animal; an autopsy

Postoperative—occurring after a surgical operation

Prophylactic—preventing a disease or the process leading to a disease

Protocol—a written description of a study or activity that includes details of the goals, the use of animals, the procedures that are to be followed and the personnel involved; the purpose of the protocol is to ensure the quality and integrity of the study or activity

Quarantine—the segregation or isolation of animals from all others to prevent the spread of disease

Radioisotopes—radioactive atoms that decay into more stable atoms by releasing energy in the form of radiation

Radio transmitter—a piece of telemetry equipment that emits a signal (usually a 'beep') on a particular radio frequency

Regurgitation—passive return of food or fluid to the mouth from the stomach

Reversal agent—drug that will "reverse" the effects of another drug or drug combination; reversal agents may specifically "antagonize" the pharmacological effects of another agent at the receptor level, or they may act non-specifically to reverse the clinical effects, e.g., doxapram induces CNS stimulation that can result in more rapid arousal

Rumenal tympany—bloat; an abnormal collection of gas in the rumen

Ruminants—polygastric animals having usually four digestive compartments

SOP—Standard Operating Procedure; written documents specifying procedures for routine activities that must be followed to ensure the quality and integrity of the study

Sternal recumbency—lying down on the chest

Telemetry—the use of devices to transmit information via radio to a distant station where it is recorded; commonly used in wildlife studies to monitor animals in order to answer questions about their physiology, behavior, habitat use, survival and movements

Therapeutic index—the ratio of dosage which kills 50% of animals (LD_{50}) to dosage which is effective in 50% of the animals (ED_{50}) used in qualitative comparison of drugs

Thermoregulatory—able to regulate heat

Translocation—the movement of animals from one site to another

Withdrawal time—the length of time between when an animal is given a drug and when that animal could be safely consumed by a human

Zoonotic—relating to the transmission of a disease from a non-human species to humans

M. ABBREVIATIONS

ABS—Animal Behavior Society

ACC—Animal Care Committee

AIHTS—Agreement on International Humane Trapping Standards

ASAB—Association for the Study of Animal Behaviour

ASIH—American Society of Ichthyologists and Herpetologists

ASM—American Society of Mammalogists

AVMA—American Veterinary Medical Association

AZA—American Zoo and Aquarium Association

CARC—Canadian Agri-Food Research Council

CAZA—Canadian Association of Zoos and Aquariums

CAZWV—Canadian Association of Zoo and Wildlife Veterinarians

CCWHC—Canadian Cooperative Wildlife Health Centre

CFIA—Canadian Food Inspection Agency

CITES—Convention on International Trade in Endangered Species of Wild Fauna and Flora

COSEWIC—Committee on the Status of Endangered Wildlife in Canada

CWS—Canadian Wildlife Service

IATA—International Air Transport Association

ICSU—International Council for Science

ISO—International Organization for Standardization

IUCN—International Union for Conservation of Nature and Natural Resources

OC—Ornithological Council

SOP—Standard Operating Procedure

UNESCO—United Nations Educational, Scientific and Cultural Organization

APPENDIX A
RELEVANT GUIDELINES

American Society of Ichthyologists and Herpetologists, The Herpetologists League & the Society for the Study of Amphibians and Reptiles (1987) *Guidelines for the Use of Live Amphibians and Reptiles in Field Research*. Electronic document, http://www.asih.org/pubs/herpcoll.html

American Society of Mammologists (1998) *Guidelines for the Capture, Handling, and Care of Mammals.* Prepared by the Animal Care and Use Committee of the American Society of Mammalogists. Electronic document, http://www.mammalsociety.org/committees/index.asp

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APPENDIX B

SUGGESTED FORMAT FOR AN ANIMAL USE PROTOCOL FOR WILDLIFE IN RESEARCH, TEACHING OR TESTING

Office Use

Protocol No. _____

Category of Invasiveness _____

Start Date _____

End Date _____

1. Administrative Information

a) Name and title of principal investigator

_____

b) Address for correspondence (include phone, fax and email)

_____

c) Title of project/number and title of course

_____

d) Type of project:

❑ Research ❑ Teaching ❑ Testing ❑ Management

e) ❑ New ❑ Renewal of protocol no. _____

f) Expected date of: commencement _____ conclusion _____

g) Location:
Where will the study take place? (Name the closest town and whether the study will occur in the field or laboratory)

_____

h) Permits:

Permits applied for	Permits obtained (Y/N)	Permit number

* Please provide photocopies of both sides of relevant licenses.

i) Emergency Contact:

Name: _____

Work phone number: _____

Home phone number: _____

Declaration

All animals used in this research project will be cared for in accordance with the policies and guidelines of the Canadian Council on Animal Care (http://www.ccac.ca) and the requirements of the relevant international, federal, provincial/territorial and municipal legislations.

_____ _____

Signature, Principal Investigator/Course Director Date

2. Source of Funding

a) Funding Agency(ies): _____

b) ❑ Grant approved, agency file number: _____
❑ Grant under review

c) Scientific Merit Review:
Approval of pedagogical merit or evaluation of goals by a peer review process?

❑ Yes ❑ No

3. Description of Use

a) Purpose of Animal Use (PAU):
Circle the number (1-6) below that best describes the purpose of animal use.

1. Studies of a fundamental nature in sciences relating to essential structure or function (e.g., biology, psychology, biochemistry, pharmacology, physiology, etc.).
2. Studies for medical purposes, including veterinary medicine, that relate to human or animal disease or disorders.
3. Studies for regulatory testing of products for the protection of humans, animals, or the environment.
4. Studies for the development of products or appliances for human or veterinary medicine.
5. Education and training of individuals in post-secondary institutions or facilities.
6. Other: _____

b) Lay Summary:
Describe in terms understandable to the non-scientist how the proposed use of animals will contribute to the advancement of science, or to outcomes that can reasonably be expected to benefit humans, animals or the environment.

c) Why is it necessary to use live animals, and what consideration has been given to the use of alternative methods which do not involve the use of animals?

d) Provide rationale for the choice of species.

e) What precautions will be taken to avoid capturing vulnerable animals and what action will be taken if these animals are captured?

f) Protocol description summary (40-100 words) listing all procedures to be done on the animals with a brief rationale for the overall protocol. This summary will be used for reporting to the CCAC.

g) Animals to be used:

Animal	Location	# Required at time	Annual total	Housing

* Provide justification for numbers of animals to be used.

h) Agents to be administered:
Indicate all agents to be administered in the research protocol for each species.

Species	Agent	Purpose	Route	Dosage	Frequency

i) Samples to be taken:
Indicate all samples to be taken for each species.

Species	Type of Sample	Site	Amount	Procedure	Frequency

j) Details of procedures to be performed on animals:

Descriptions must be sufficiently detailed to permit assessment of compliance with CCAC guidelines. Use terminology understandable to ACC members with widely different backgrounds (including non-scientists). Indicate which members of the team will be carrying out which procedures. For killed specimens, describe the method to be used to kill the animal. For complex projects with many procedures or those with routine procedures, it is easier to develop standard operating procedures (SOPs) in consultation with the ACC. These can be attached to the application and referred to from this section.

i) Describe all procedures and manipulations performed on live animals for each species. If multiple procedures are to be performed, flow diagrams may be useful, particularly if the protocol involves short-term holding and subsequent release.

ii) For studies involving capture and restraint, detail the type of restraint chosen, state the time and frequency for checking traps, provide details of physical restraint, chase times (taking into consideration possible environmental conditions), provide details of immobilization agent used for chemical restraint, describe all manipulations and precautions taken to protect the animal and investigator.

iii) Provide details of marking, including potential long-term effects.

iv) Will any radio tracking collars or other tracking equipment be used? If so, detail the equipment to be used, the method of attachment, the weight of the equipment, and the impact on the animal. Also, detail how the equipment will be retrieved.

v) Provide details of any surgical and medical procedures. Indicate where and under what conditions it will be performed, as well as by whom. Provide the name of the veterinarian where consultation is necessary.

vi) Provide details for monitoring the animals (during capture, handling and post-release), including personnel and qualifications.

vii) Housing:
Provide justification for any housing of the animals. Include details of pens, enclosures, duration and nutrition.

4. Pain and Distress

a) Is any pain and/or distress likely to be associated with the procedures or manipulations?

❑ Yes ❑ No

If Yes, please describe how it will be alleviated or minimized.

b) If animals encounter unanticipated pain and/or distress, what criteria will be used to terminate the procedure/study and possibly euthanize the animal(s)?

c) Indicate the category of invasiveness which best describes the protocol:

❑ A Methods used on most invertebrates or on live isolates

❑ B Methods used which cause little or no discomfort or stress

❑ C Methods which cause minor stress or pain of short duration

❑ D Methods which cause moderate to severe distress or discomfort

❑ E Procedures which cause severe pain near, at, or above the pain tolerance threshold of unanesthetized conscious animals

5. Methods of Euthanasia

Provide details of method of euthanasia:

i) for species of interest, where necessary upon termination of the study;

ii) for species of interest, where necessary due to unanticipated pain and/or distress;

iii) for by-catch species, where necessary due to unanticipated pain and/or distress.

6. Disposition

Provide details of intended fate of the animals used in the study. For any voucher specimens, justify the taking and number of specimens or by-catch and where they are to be kept.

7. Possible Hazards to Staff

List potential biohazards, chemical hazards, etc.

8. Qualifications and Experience

List names, positions and relevant training and experience of all individuals who will be working directly with the animals. Each individual must initial this form, indicating that they have read the entire application form, before submission.

I hereby certify that the above personnel is(are) qualified to conduct the procedures described and that they have read and initialed this application in person.

Signature (principal investigator/team leader)

APPENDIX C
USEFUL CONTACTS

American Society of Ichthyologists and Herpetologists (ASIH)
(http://www.asih.org)

American Society of Mammalogists (ASM)
(http://www.mammalsociety.org)

Animal Behavior Society (ABS)
(http://www.animalbehavior.org)

Association for the Study of Animal Behaviour (ASAB)
(http://www.societies.ncl.ac.uk/asab)

Canadian Amphibian and Reptile Conservation Network
(http://www.carcnet.ca)

Canadian Association of Zoo and Wildlife Veterinarians

Canadian Federation of Humane Societies
(http://www.cfhs.ca)

Committee on the Status of Endangered Wildlife in Canada (COSEWIC)
(http://www.cosewic.gc.ca)

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
(http://www.cites.org)

International Organization for Standardization (ISO)
(http://www.iso.ch/iso/en/CatalogueListPage.CatalogueList)

Ornithological Council
(http://www.nmnh.si.edu/BIRDNET)

The Wildlife Society
(http://www.wildlife.org)

APPENDIX D

CCAC CATEGORIES OF INVASIVENESS FOR WILDLIFE STUDIES

Category of Invasiveness A

Methods used on most invertebrates or on live isolates

Possible examples:

the use of tissue culture and tissues obtained at necropsy; the use of eggs, protozoa or other single-celled organisms; experiments involving containment, incision or other invasive procedures on metazoa; and studies in which the animals are observed without any disturbance to them.

Category of Invasiveness B

Methods used which cause little or no discomfort or stress

Possible examples:

observational studies in which there is some disturbance to the animals but not to the point that the same individuals are repeatedly observed so as to habituate or otherwise modify their behavior; census or other surveys which disturb animals but which do not involve capture or marking individuals; non-invasive studies on animals that have been habituated to captivity; short periods of food and/or water deprivation equivalent to periods of abstinence in nature.

Category of Invasiveness C

Methods which cause minor stress or pain of short duration

Possible examples:

capture, using methods with little or no potential to cause injury and marking of animals for immediate release; long-term observational studies on free ranging animals where the behavior of individuals may be altered by repeated contact; brief restraint for blood or tissue sampling; short periods of restraint beyond that for simple observation or examination, but consistent with minimal distress; short periods of food and/or water deprivation which exceed periods of abstinence in nature; exposure to non-lethal levels of drugs or chemicals; low velocity darting and slow-injection darts with immobilization chemicals. Such procedures should not cause significant changes in the animal's appearance, in physiological parameters (such as respiratory or cardiac rate, or fecal or urinary output), in social responses or inability to survive.

Note: During or after Category C studies, animals must not show self-mutilation, anorexia, dehydration, hyperactivity, increased recumbency or dormancy, increased vocalization, aggressive-defensive behavior, or demonstrate social withdrawal and self-isolation.

Category of Invasiveness D

Methods which cause moderate to severe distress or discomfort

Possible examples:

capture, using methods that have the potential to cause injury (e.g., high velocity darting and rapid-injection darts with immobilization chemicals, net gunning, etc.); maintenance of wild caught animals in captivity; translocation of wildlife to new habitats; major surgical procedures conducted under general anesthesia, with subsequent recovery; prolonged (several hours or more) periods of physical restraint; induction of behavioral stresses such as maternal deprivation, aggression, predator-prey interactions; procedures which cause severe, persistent or irreversible disruption of sensorimotor organization.

Other examples in captive animals include: induction of anatomical and physiological abnormalities that will result in pain or

distress; the exposure of an animal to noxious stimuli from which escape is impossible; the production of radiation sickness; exposure to drugs or chemicals at levels that impair physiological systems **(N.B. Experiments described in this paragraph would be Category E if performed on wildlife immediately prior to release).**

Note: Procedures used in Category D studies should not cause prolonged or severe clinical distress as may be exhibited by a wide range of clinical signs, such as marked abnormalities in behavioral patterns or attitudes, the absence of grooming, dehydration, abnormal vocalization, prolonged anorexia, circulatory collapse, extreme lethargy or disinclination to move, and clinical signs of severe or advanced local or systemic infection, etc.

Category of Invasiveness E

Procedures which cause severe pain near, at, or above the pain tolerance threshold of unanesthetized, conscious animals

This Category of Invasiveness is not necessarily confined to surgical procedures, but may include exposure to noxious stimuli or agents whose effects are unknown; exposure to drugs or chemicals at levels that (may) markedly impair physiological systems and which cause death, severe pain, or extreme distress; behavioral studies about which the effects of the degree of distress are not known; environmental deprivation that has the potential to seriously jeopardize an animal's well-being; use of muscle relaxants or paralytic drugs without anesthetics; burn or trauma infliction on unanesthetized animals; a euthanasia method not approved by the CCAC; any procedures (e.g., the injection of noxious agents or the induction of severe stress or shock) that will result in pain which approaches the pain tolerance threshold and cannot be relieved by analgesia (e.g., removal of teeth without analgesia, or when toxicity testing and experimentally-induced infectious disease studies have death as the endpoint); capture methods with a high potential of causing severe injury that could result in severe chronic pain and/or death (e.g., leghold traps)

APPENDIX E

LISTING OF REGULATORY AGENCIES AND RELEVANT LEGISLATION

FEDERAL

Canadian Wildlife Service

http://www.cws-scf.ec.gc.ca/index_e.cfm

- Canada Wildlife Act
  http://laws.justice.gc.ca/en/W-9/index.html
- Wildlife Area Regulations
  http://laws.justice.gc.ca/en/W-9/C.R.C.-c.1609/62555.html
- Migratory Birds Convention Act
  http://laws.justice.gc.ca/en/M-7.01/index.html
- Migratory Bird Sanctuary Regulations
  http://laws.justice.gc.ca/en/M-7.01/C.R.C.-c.1036/143398.html
- Migratory Birds Hunting Regulations
  http://www.cws-scf.ec.gc.ca/publications/reg/index_e.cfm
- Wild Animal and Plant Protection and Regulation of International and Interprovincial Trade Act (WAPPRIITA)
  http://laws.justice.gc.ca/en/W-8.5/106599.html
- Wild Animal and Plant Trade Regulations
  http://laws.justice.gc.ca/en/W-8.5/SOR-96-263/184434.html
- Species at Risk Act
  http://www.speciesatrisk.gc.ca/index_e.cfm

Fisheries and Oceans Canada

- Fisheries Act (Marine Mammal Regulations)
  http://laws.justice.gc.ca/en/F-14/SOR-93-56/119433.html

Parks Canada

- Canada National Parks Act
  http://laws.justice.gc.ca/en/N-14.01/18251.html

PROVINCIAL

Alberta

Alberta Sustainable Resource Development, Fish and Wildlife Division

http://www3.gov.ab.ca/srd/fishwl.html

- Wildlife Act

British Columbia

Ministry of Water, Land and Air Protection, Biodiversity Branch

http://www.gov.bc.ca/wlap

- Wildlife Act

Manitoba

Manitoba Conservation, Wildlife and Ecosystem Protection Branch

http://www.gov.mb.ca/natres/wildlife/index.html

- Wildlife Act
- Endangered Species Act

New Brunswick

Department of Natural Resources and Energy, Fish and Wildlife Branch

http://www.gnb.ca/0078/fw/index_fw.asp

- Fish and Wildlife Act
- Endangered Species Act

Newfoundland and Labrador

Department of Tourism, Culture and Recreation, Inland Fish and Wildlife

http://www.gov.nf.ca/tcr/wildlife/default.htm

- Wildlife Act
- Endangered Species Act

Northwest Territories

Department of Resources, Wildlife and Economic Development

http://www.nwtwildlife.rwed.gov.nt.ca

- NWT Wildlife Act

Nova Scotia

Department of Natural Resources, Wildlife Division

http://www.gov.ns.ca/natr/wildlife/index.htm

- Wildlife Act
- Endangered Species Act
- Circus Standards

Nunavut

Department of Sustainable Development, Wildlife Division

http://www.gov.nu.ca/sd.htm

- Wildlife Act

Ontario

Ontario Ministry of Natural Resources, Natural Resource Management Division, Fish and Wildlife Branch

http://www.mnr.gov.on.ca

- Fish and Wildlife Conservation Act
- Endangered Species Act

Prince Edward Island

Department of Fisheries, Aquaculture and Environment, Fish and Wildlife Division

http://www.gov.pe.ca/fae/faw-info/index.php3

- Wildlife Conservation Act
- Animal Health and Protection Act

Québec

Société de la faune et des parcs du Québec

http://www.fapaq.gouv.qc.ca/fr/organisa/la_societe.htm

Ministère de l'Environnement

http://www.menv.gouv.qc.ca

- Loi sur la conservation et la mise en valeur de la faune
- Règlement sur les animaux en captivité
- Loi sur les espèces menacées ou vulnérables
- Loi sur les droits de chasse et de pêche dans les territoires de la Baie James et du Nouveau Québec
- Loi sur les parcs
- Loi sur les réserves écologiques
- Loi sur les forêts

Saskatchewan

Department of Environment, Programs Division, Fish and Wildlife Branch

http://www.serm.gov.sk.ca

- Wildlife Act

Yukon

Department of Environment, Fish and Wildlife Branch

http://www.environmentyukon.gov.yk.ca

- Wildlife Act
- The Yukon Animal Health Act
- The Yukon Game Farm Regulations
- The Yukon Animal Protection Act