Northwest Territories Environment and Natural Resources	Standard Operating Procedure (SOP)	
	Capture, Handling & Release of Bears	
Wildlife Care Committee	Primary Author: Dr. Marc Cattet	Version 2 - 2011

Table of Contents

Section: **Page**

1. Purpose 2

2. Application 2

3. Background 2

4. Methods 3
4.1 Live Capture 3
4.1.1 Considerations 3
4.1.2 Techniques for Live Capture 4
4.1.2.1 Remote Drug Delivery 4
4.1.2.2 Culvert (or Barrel) Trap 10
4.1.2.3 Leg-Hold Snare 11
4.1.3 Recommendations for Approach . . . 12
4.1.4 Recommendations for Initial Handling . . 13
4.1.5 Recommendations for Monitoring of Physiological Function . . . 15
4.2 Sample Collection and Measurements . . 17
4.3 Identification, Marking and Telemetry Collars . 18
4.4 Reversal Drugs and Release of Bears . . . 19
4.5 Post-Capture Monitoring 20
4.6 Euthanasia 21
4.7 Morbidity and Mortality 21
4.8 Human Safety 22
4.9 Problem Bears 23

5. Literature Cited 24

Appendix A Drug Volume Table for Grizzly Bears . . 28

Appendix B Grizzly Bear Capture Data Form . . . 30

Appendix C Field Necropsy Data Form 32

1. Purpose

- To provide recommendations for the capture, handling, and release of bears using acceptably humane methods while maintaining minimal risk to staff and allowing appropriate research or management to be conducted.

2. Application

- This standard operating procedure (SOP) applies to employees of the Government of the Northwest Territories (GNWT) and any other personnel involved with the capture and handling of grizzly bears in the NWT.

3. Background

- Three species of bears are present in the NWT: Grizzly Bear (*Ursus arctos horribilis*), Black Bear (*Ursus americanus*) and Polar Bear (*Ursus maritimus*).

- The Committee On the Status of Endangered Wildlife In Canada (COSEWIC) has assessed the three species of bears in the NWT. The federal Species at Risk Act (SARA) has legislated COSEWICas one of its key components functioning as advisory body to the Federal government. The law gives COSEWIC the mandated responsibility for assessing the biological status on Canadian species in detail, and to provide the basis for the wildlife protection and recovery measures spelled out in the rest of the SARA.

- Species can be listed either as

  Extinct: a wildlife species that no longer exists.
  Extirpated: a wildlife species that no longer exists in the wild in Canada, but exists elsewhere.
  Endangered: a wildlife species that is facing imminent extirpation or extinction.
  Threatened: a wildlife species likely to become an endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.
  Special Concern: a wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.

- The national status of grizzly bears in Canada was assessed by COSEWIC in May 2002 (and last reviewed in November 2004) as “Special Concern”. Reasons for this designation included concern for the potential of expanding industrial, residential and recreational development into grizzly bear habitats across the country, habitat and population fragmentation occurring in the southern part of the grizzly bear’s range in

Canada, and life history characteristics that make grizzly bears sensitive to human-induced mortality.

- The national status of polar bears in Canada was assessed by COSEWIC in April 2008 as "Special Concern". Reasons for the designation included sensitivity to overharvest, which varies between the 13 subpopulations of polar bear, and availability of sea ice for hunting and denning. Without seasonal sea ice, polar bears are unable to persist. Four subpopulations are projected to decline due to climate change and unsustainable harvest. Seven subpopulations are projected to remain stable or increase. Trends could not be projected for two subpopulations.

- The national status of black bears in Canada was assessed by COSEWIC in April 1999 as "Not at Risk". Reasons for the designation included the large population of black bears that occur over a large range of habitat, and no indication of population decline.

- Because the "special concern" status of grizzly bears and polar bears has implications for research and management of this species across Canada, investigators must ensure their capture and handling protocol meets all requirements under SARA and COSEWIC, as well as the requirements of the Government of the Northwest Territories Environment and Natural Resources (GNWT-ENR), e.g., permits, sample collection, etc.

4. Methods

4.1. Live Capture

Acceptable techniques for the live capture of bears in the NWT include remote drug delivery, culvert (or barrel) trap, and leg-hold snare.

4.1.1 Considerations:

- The primary focus of all capture events **must** be on the safety of both the personnel and the bear(s).
- Investigators **must** be familiar with the advantages and drawbacks of different methods of capture.
- Capture method(s) **must** be selected to minimize trauma and stress to the animal with consideration given to the capture environment and study requirements.
- Capture techniques **must** be applied by experienced individuals only.
  Inexperienced persons with appropriate training may also apply capture techniques provided they are under the direct supervision of an experienced person. Although the distinction between "experienced" and "inexperienced" is somewhat subjective, it is the responsibility of the GNWT Wildlife Care

Committee (WCC) to seek assurance that investigators and personnel have the necessary training and experience to perform procedures required for the capture and handling of bears.

- Personnel administering drugs for capture or restraint **must** have recognized and current training in the chemical immobilization of wildlife and **must** use methods of drug delivery and drugs that are appropriate for bears.

  Current training implies that personnel have completed and passed the Canadian Association of Zoo and Wildlife Veterinarians' wildlife chemical immobilization course, or another recognized course, within the past 5 years.

- Investigators **should** avoid capturing bears, especially pregnant bears, in the period from 4 weeks prior to den entry to the time of den emergence, October to April. Investigators **should** avoid capturing lactating bears and their cubs-of-the-year.

  Bears may be particularly sensitive to capture or handling stress, and sometimes drugs, during breeding, pregnancy, early lactation (i.e., ≤ 6 months post-parturition), and in the periods immediately before and after winter dormancy (denning). Although the potential for negative effects of capture and handling during these times has not been adequately examined in bears, negative effects including increased loss of body mass, post-natal offspring mortality, and den abandonment have been demonstrated in black bears (Tietje and Ruff 1980, Samson and Huot 1995), brown bears (Petram et al. 2004), and polar bears (Ramsay and Stirling 1986, Lunn et al. 2004). Further, most of the drugs used in bears are not recommended for use in pregnant or lactating animals because they have not been adequately evaluated under these conditions (e.g., Telazol® [tiletamine HCl + zolazepam HCL] - Fort Dodge Laboratories, Inc.; Cervizine 300® [xylazine HCl] - Wildlife Pharmaceuticals, Inc.; Zalopine® [medetomidine HCl] - Orion Corporation; and Antisedan® [atipamezol HCl] – Novartis Pharmaceuticals Canada, Inc.).

- Capture efforts **must** be conducted within a pre-defined safe temperature range and procedures **must** be taken to prevent, or detect and treat, large changes in body temperature during handling or recovery.

  The likelihood of thermal stress (hyper- and hypothermia) can be high in some bears at certain times. A "safe" ambient temperature range for the capture of black bears and grizzly bears is from –20°C to +20°C and from -25ºC to +15ºC for the capture of polar bears. However, attention to ambient temperature alone will not be sufficient to prevent thermal stress, even if the ambient temperature is within the recommended range. Other factors including wind exposure, precipitation, method of capture, the physical exertion at capture and size and health status of the bear must also be considered. Prolonged helicopter pursuit of an adult bear in prime body condition can cause severe hyperthermia (body temperature > 40°C) even before the animal is safely immobilized. Similarly, a yearling bear captured by leg-hold snare and restrained for hours while exposed to inclement weather may succumb to hypothermia (body temperature < 36°C) before the trap site is even checked by the field crew. Measures that can be taken to

prevent the development of thermal stress during handling or recovery include avoiding prolonged pursuit times (>1 min of strenuous running), using reversible anesthetic drug combinations, erecting a tarp or canopy to minimize direct exposure to the sun, using natural barriers to prevent wind exposure, moving immobilized bears to protected areas and wrapping small bears (cubs) in sleeping bags or parkas.

4.1.2 Techniques for Live Capture:

4.1.2.1 Remote Drug Delivery

Is: Immobilization by administration of anesthetic drugs using remote delivery systems, i.e., modified rifle, shotgun, or pistol, blowpipe, and darts that contain drug.

Is: A suitable capture technique for long-duration (>10 min) handling.

Recommendations:

- Blowpipes and CO_2- or air-powered pistols **should** be used to deliver drugs to target animals over short distances, e.g., ≤10 m.

  These types of remote drug delivery systems typically propel darts at a lower velocity than rifles or shotguns, and are less likely to cause trauma (Bush 1992, Valkenburg et al. 1999).

- For remote drug delivery over longer distances (>10 m), CO_2-powered rifles or powder-charged rifles with power adjustment capability **should** be used.

  This will reduce the potential for partial or full penetration of the skin by the dart body. Skin penetration by the dart body is unlikely to occur with lightweight 0.50-calibre (12.5 mm diameter) darts that strike the animal at a velocity <50 m/s (Cattet et al. 2006). The potential for penetration increases as projectile mass and impact velocity increase, and as the projectile diameter decreases (MacPherson 1994).

- For bears restrained by leg-hold snare or held captive in a culvert trap, drug **must** be delivered using the least traumatic method possible without compromising human safety.

  A blowpipe or pole syringe (also called a jab-stick) should be sufficient for all bears captured in culvert traps and for small bears restrained by leg-hold snare. A dart pistol, however, is preferable for larger bears captured by snare.

- Slow-injection darts **should** be used in preference to rapid-injection darts.

  Darts can be described as rapid- or slow-injection depending on the time it requires to discharge its content upon impact with the target animal. Rapid-injection darts use an explosive charge that detonates upon impact to advance the plunger and expel the drug quickly, often within a fraction of a second. Slow-injection darts use pressurized air or gas (or sometimes springs) to expel drug more slowly (1-3 seconds). The forceful injection of drug with rapid-

injection darts penetrates considerably deeper than the tip of the needle and can cause severe tissue damage (Cattet et al. 20068). Forceful repulsion of the dart during injection can cause tearing of subcutaneous tissue and partial injection of drug into the space created between muscle and skin. Further, rapid-injection darts are often fitted with large bore, end-ported, barbed needles that frequently cause contamination of the wound tract with small portions of tissue and hair, and require expansion of the wound to facilitate removal of the barb. With slow-injection darts, drug injection is less forceful and the resulting wound does not penetrate as deeply (Cattet et al. 2006). In addition, the side-ported needle typically used with this type of dart does not require a large barb to anchor it beneath the skin. However, slow-injection darts that must be pressurized prior to loading into a rifle are more prone to leaking their contents, a potential hazard that should be considered when using highly potent drugs. Slow-injection darts may also leak air after pressurization resulting in partial or no injection of drug. For these reasons, slow injection darts should only be pressurized immediately before firing.

- The dart needle **must** be long enough to ensure drug injection occurs largely into muscle, but not too long to cause injury to deeper tissues or too short to result in injection of much of the drug into the subcutaneous connective tissue and fat.

  Although a needle 2.0-3.1 cm (0.75-1.25 inches) long should be sufficient for most bears (Nielsen 1999, Reynolds et al. – unpublished report), the appropriate length should be selected based on the size and body condition (reflected by the amount of subcutaneous fat) of the bear and on the type of dart used. For example, bears in peak body condition will require a greater needle length than bears captured in spring after emerging from their den. However, needle length cannot be selected simply on the basis of estimating fat thickness at the targeted site of injection because the depth of the injection wound cavity can exceed the needle length by a significant amount, especially when using rapid-injection darts (Cattet et al. 2006). For example, a .50-calibre dart fitted with a 3.1-cm (1.25-inch) end-ported needle fired perpendicularly into the neck of a bear from a helicopter at a distance of 8-10 meters will compress the tissue at the injection site so that the needle tip will penetrate approximately 5.1 cm (2.0 inches). If a rapid-injection dart is used, its forceful expulsion of drug will penetrate another 2.5-3.5 cm (1.0-1.4 inches) beyond the tip of the needle. So, together with compression and injection, the 3.1-cm needle may cause a wound 8.6 cm (3.4 inches) deep. Using a slow-injection dart of similar volume and needle length, the injection wound would be approximately 5.1 cm (2.0 inches) deep.

- When using barbed dart needles, the position of the barb **must** be marked on the dart barrel (e.g., with a waterproof marker pen or

notched with a file) before use to ensure the dart needle can be excised from the skin with minimal trauma.

- Darts **must** be directed into large superficial, thick muscle masses with minimal fat covering to ensure good drug absorption and avoid injury to other tissues.

  The gluteal muscles (the rump) are the safest sites for injection in lean bears. However, with fat bears, it may be necessary to aim toward the larger muscles of the shoulders and neck where the covering layer of fat is markedly thinner than over the rump.

- When capturing free-ranging bears, there **must** be capability to observe and, if necessary, control animal movement following drug administration.

  Remote drug delivery is typically employed from a helicopter, but occasionally can be employed on the ground, e.g., capture of a problem bear from a motorized vehicle. In either situation, it is important to be able to observe the bear and, if necessary, control its movement away from hazardous terrain during pursuit and induction, the time that ensues between drug administration and safe immobilization of the animal.

- Remote drug delivery **should not** be attempted in areas where you are likely to lose sight of a darted bear, e.g., where tree cover is heavy.
- Remote drug delivery **should not** be attempted if the terrain is such that a partially anesthetized animal has a high probability of entering a potentially hazardous location, e.g., close to deep water, close to a cliff face. Culvert traps may be safer to use in hazardous areas when possible.
- Final, close pursuit for the purpose of delivering drug into a bear **should** be kept short (≤1 min of strenuous running), and **must** always be terminated when the target animal show signs of fatigue, e.g., panting, loss of coordination and stumbling.

  The risk of injury or death is increased greatly when animals are exhausted (Cattet et al. 2003, Kock et al. 1987, Nielsen 1999, Spraker 1993). Because adequate rest periods are not known, and are likely to be highly variable among individuals, it is preferable that any further attempt at capture of a fatigued animal is not made until the following day at earliest. A "fatigued animal" could include a bear that has been hit by one or more darts, but shows no signs of drug effect. Although such an animal may become anesthetized after the capture effort is terminated, and therefore vulnerable to thermal stress or some other physiological complication, it is more probable that continued pursuit of the darted bear would lead to serious injury or death.

- When more than one dart is required to safely immobilize a bear, adequate time **should** be given between injections to allow drug effects to occur.

In most situations, allow 10-15 minutes to elapse between the time of injection of the first dart and injection of the second dart (Kreeger et al. 2002, Reynolds et al. – unpublished report). During this time, effort should be taken to avoid unnecessary stimulation of the target animal, and allow the drug time to act. For example, when darting from a helicopter, the pilot should move the helicopter as far as possible from the animal while still allowing visual monitoring for drug effects. Alternatively, if the bear is darted while restrained by a leg-hold snare, the capture crew should move away from the immediate area and observe the bear at a distance with binoculars. If the bear continues to run at full speed despite this, it may be necessary to deliver a second dart sooner to avoid hyperthermia. If the animal shows some drug effect, but does not go down, re-administer 50% of the original dose. However, if the animal shows no drug effect within 5 minutes following the first dart, re-administer the entire original dose.

- If there is no evidence of drug effect after two darts, the immobilization effort **should** be aborted in the case of helicopter-assisted capture, or temporarily ceased with snared bears, as this strongly suggests a problem with either the drug delivery system (e.g., failed injection, needle too short) or the drug quality (e.g., inappropriate storage or formulation).

  Nevertheless, the animal should be visually monitored from a safe distance to determine the extent of drug effects. For a snared bear, it may be necessary to mix a new volume of drug or modify the delivery system before another attempt is made to anesthetize the animal. For a free-ranging bear, although there should be no further attempt at capture that day, effort should be made again over the next 24 hours to relocate the animal and assess its status.
- If a target animal is lost following darting, effort **must** be made to track the animal and assure its safety without compromising human safety.

  Capture crews may sometimes also use remote delivery of reversal drugs in situations where they are unable to safely approach or reach a drugged target animal.
- Whenever possible, effort **should** be made to find darts that miss their target.

  This is particularly important in areas frequented by humans, such as in urban settings or areas with regular human use where there is potential for someone to find a "lost" dart.
- Capture of more than one bear per capture event (e.g., adult female with dependent offspring, breeding pairs) **must** be attempted only if there are enough personnel in the capture crew to ensure that each animal can be continuously observed and its physiological function monitored closely throughout the handling period.

Otherwise, unattended bears are susceptible to physiological complications that might easily be prevented or treated if monitoring was provided. If more than one capture is planned, the second bear should not be darted until the first bear darted is immobilized and its welfare has been assured. For helicopter-assisted captures, this would require landing the helicopter and assessing the physiologic status of the first bear prior to capturing the second bear where safety of personnel allows. This approach is not recommended for polar bear family groups where the dependent offspring usually remain in close contact to their immobilized mother.

- When a breeding pair is captured, the male **should** always be immobilized first in case circumstances change and the other bear cannot be immobilized.

  Females generally leave the capture area immediately, but males may return and endanger the immobilized female or capture crew (Reynolds et al. – unpublished report).

- If capturing a family group, the adult female **should** be immobilized first, and then the young.

  Yearlings and older sub-adults should be captured using remote drug delivery, whereas cubs-of-the-year should be captured by hand, restrained, and administered drug by hand injection. An exception to this is large polar bear cubs that should be administered drug by pole syringe, blowpipe or pistol. A spotting aircraft may be required to monitor the movement of the dependent young while their mother is immobilized and assessed. If there is no intent to capture the dependent young, no attempt should be made to herd the cub(s) back to the capture site. Harassment of the offspring by aircraft decreases the probability the family will re-unite (Reynolds et al. – unpublished report). Since yearling (or older dependent) polar bears usually remain close to their mother when she is immobilized, it is necessary to dart and immobilize the offspring before it is possible to evaluate the welfare of the mother. The darting should take place from a helicopter and should take place as soon as the mother is immobilized; the goal being to immobilize the offspring as quickly and safely as possible (Holtby 2005 – unpublished report). The helicopter should approach from a high altitude (≥100m above ground level) and hover above the family group. The pilot should then descend the helicopter vertically into shooting position approximately 5-10m above the family group. If there is more than one offspring, the shooter should be prepared to dart each bear on the first approach; that is, the required number of darts should be filled with the required dose and ready to load into the delivery system. If the offspring flee during the vertical descent of the helicopter, the pilot should be prepared to herd the young back to the mother and attempt another vertical descent. If the offspring continue to run each time a vertical descent is attempted, it may be necessary to use the same approach

technique as is used for an adult (Holtby 2005 – unpublished report).

- Cargo nets alone, or ropes and hobbles, **should** not be used to sling a bear beneath a helicopter to move it over a short distance.

  When more than one bear is immobilized per capture event, it may be necessary to move animals in close proximity to each other to ensure they can be monitored closely or, in the case of breeding bears, it may be necessary to separate the animals during recovery. For movement of bears over short distances, it is recommended the bear is positioned sternally on a lightweight rigid platform (e.g., portable climbing ledge) and then lifted and carried to a more suitable location (Cattet et al. 1999). The platform can be suspended beneath a helicopter with the bear strapped directly to it or with the platform secured within a cargo net.

Specific points concerning drugs are:

- Anesthetic drug combinations that can be reversed with an antagonist drug (reversal agent) **should** be used instead of drugs that cannot be reversed.

  Reversible drug combinations provide capability to remove anesthetic effects in animals showing adverse physiological response and enable quicker recovery following handling (Cattet et al. 2005, Kreeger et al. 2002, Nielsen 1999). See Appendix A for recommended drug protocols and volumes. Although other drug protocols are described in the wildlife literature (Kreeger et al. 2002), the protocols provided in the attached table have been demonstrated to be safe and effective for the immobilization of bears (Addison and Kolenosky 1979, Arnemo et al. 2001, Cattet et al. 2003, Caulkett and Cattet 2002,Taylor et al. 1989). The dosages and corresponding volumes are intentionally provided as ranges because selection of an appropriate dosage should be based on other factors in addition to the estimated body mass, e.g., age of animal, time of year, method of capture, etc. Regarding method of capture, bears captured by remote drug delivery from a helicopter often require higher drug dosages(1.5-2.0x) than bears captured by leg-hold snare or culvert trap.

- All drug vials **must** be clearly labeled with drug name(s), concentration, and date of preparation.

  If a drug combination is prepared by adding one drug to a commercial preparation of another drug (e.g., the addition of xylazine to a vial of Telazol®), it is necessary to cover the manufacturer's label with a highly visible adhesive label to avoid confusion between drug preparations.

- Drugs **must** be protected against exposure to extreme temperatures, high humidity, or intense light.

- When not in use, drugs at field sites **should** be stored in a labeled, locked, crush-proof, leak-proof container that is lined with absorbent material.
- Darts **should** not be loaded with drug in a helicopter or motorized vehicle that is in motion.
- All used drug **must** be recorded, including amounts lost in darts that missed the target.
- Unused preloaded darts **should** be emptied at the end of each day.

  Most drug solutions are acidic and can cause corrosion of the dart components. Drug may also leak from darts with time.
- If cleaning used darts that require disassembly, the tailpiece (flight) **must** be removed first in case the drug chamber contains some drug and is still under pressure.
- Adequate steps **must** be taken to ensure that drugs used in bears do not enter the human food chain.

  Bears should be clearly marked to indicate they have received a drug and the individuals or agency performing the capture should provide contact information on the collar or ear tag (Cattet 2002). This information can be presented on collars in indelible ink or inscribed onto ear tags. Further, many of the drugs used to immobilize bears (other than Telazol) do not have established withdrawal times. Health Canada, therefore, recommends that bears immobilized with these drugs are not used for human consumption for at least one year after immobilization.

4.1.2.2 Culvert (or Barrel) Trap

Is: A technique where bait is used to attract a bear into a large culvert or barrel that is open at one end only, and often mounted on a trailer.

- The bait is attached to a trigger mechanism and, when pulled, releases a door that closes and traps the bear inside.
- This technique is often employed in areas accessible by road, such as around communities or industrial sites.
- Other species may be trapped inadvertently (e.g., wolverine, wolf, etc) since this method of capture is non-specific.

Recommendations:

- Personnel using culvert **must** be trained in their safe use, and individual traps **must** be inspected and serviced as needed before being used.
- Guillotine-type doors **should** not be used because of their high potential to cause injury.

  Instead, doors should be designed and constructed with safety mechanisms to prevent injury to body parts that fall in the path of the released door.

- Culvert traps **must** be built in such a way that bears cannot bite or hook a tooth around parts of the trap.
- Culvert traps **must** be prepared and set in well-shaded areas, and access routes **must** be clearly marked to prevent persons from inadvertently encountering a bear in the vicinity of the trap.
- Culvert traps **should** always be set with a clear line of sight to permit assessment from a safe distance.
- Active traps **must** be inspected routinely at least once daily.

  Inspections should be more frequent if traps are set in close proximity to communities or campgrounds where they may attract the attention of curious people or pets. The likelihood of injury to trapped bears may increase with the duration of captivity.
- Trapped bears **should** be anesthetized, examined, and permanently identified with a unique number or alphanumeric code by tattoo, ear tag, or transponder.
- Drugs **should** be administered to bears in culvert traps using a pole syringe (jab pole) or blowpipe.

  Dart pistols or rifles must not be used unless the dart velocity can be precisely controlled to ensure the dart impact occurs at low velocity, e.g., 20-25 m/sec required for penetration of skin by needle (MacPherson 1994).
- Bears **must** be recovered from anesthesia before translocation.

  Adequate recovery can be determined by assessing if the animal is able to stand on all four legs. This may require temporarily moving the trap or transport container to a cool, quiet area where the bear can recover with minimal stress before translocation.
- During translocation, bears **must** be protected from flying material (e.g., rocks, mud) and excessive jarring.

  This may require the construction and use of a transport container that can be secured in the back of a truck or slung beneath a helicopter. Alternatively, a culvert trap-trailer can be used provided the bear is shielded from flying debris and the trailer is fitted with strong springs and shocks.
- Bears **should** not be held captive in a culvert trap or transport container longer than 24 hours.

  Captivity is extremely stressful to most wild animals. If a bear must be held captive for a prolonged period (e.g., 6-24 hours) to permit recovery from anesthesia or to transport to a release site, it must be provided water to prevent dehydration.

4.1.2.3 Leg-Hold Snare

Is: A technique that generally involves attracting bears to a bait site at which an Aldrich leg snare is set on an approaching trail or at the bait site (i.e., cubby set, pail set, etc.).

- This technique is typically employed in heavily wooded areas where remote drug delivery by helicopter is not possible.

Recommendations:

- Snare site selection **should** always take into account human use and activities in the trapping area with the intent of minimizing human presence around the snare site.
- Access routes and snare sites **must** be clearly marked to prevent persons from inadvertently encountering a trapped bear or a bear in the vicinity of the site.
- Snares **must** be prepared and set by experienced persons only.
- A limited number of snare sites **should** be set at any one time to ensure that more bears are not captured in one day than can be effectively and safely handled.
- Snare sites **must** always be set with a clear line of sight to permit assessment from a safe distance.
- When multiple snares are set at a single location individual snare locations **should** be marked for inspection from a distance (i.e. flagging tape at tree sites) and snares **should** be set far enough apart that two captured bears cannot get entangled.
- Cable clamps **should** be used to ensure the anchor end of the snare is as short as possible
- Cub stops **should** be put on snares to avoid catching small bears or large bears by only one or two toes.
- Active snare sites **must** be inspected routinely at least once daily and, if possible, more frequently.

  The likelihood of serious injury to snared bears increases with the duration of restraint by snare. Flagging tape tied to the trap spring can simplify checking sites from the air. In addition, trap monitor transmitters may be attached to snares to assess active sites from the air. However, even with transmitters attached, it is still necessary to examine traps visually at least once daily because trap monitor transmitters may fail to perform in some cases. Deployment of electronic timers at snare sites can be used to record the duration of time that a trap has been sprung.
- Placement of the snare on a bear and the possibility of other bears in the area **must** be assessed from a distance before approaching a snared bear closely.

  Assessment of the capture area for other bears may require a helicopter where tree cover is extensive.
- Snared bears **must** be immobilized using low velocity remote drug delivery methods only, e.g., blowpipe, pistol, or rifle at low power setting.

  A pole syringe (jab-stick) may be used with small bears provided they are well restrained.

- Contingency plans and required materials (e.g., appropriate dugs) **must** be in place to deal with the accidental trapping of non-target species, e.g., wolf, black bear, moose, etc.

4.1.3 Recommendations for Approach During Live Capture:

- Bears immobilized by remote drug delivery **must** be approached quietly and slowly to assess the animal's response to noise and touch.
  Minimal stimulation of the immobilized bear is critical because peak drug effects generally occur sometime after immobilization (Caulkett et al. 1994, Plumb 2002). Excessive stimulation of a lightly anesthetized bear may be sufficient to cause a physical response, including a return to a mobile state (Nielsen 1999).
- If a helicopter is used, the pilot **must** be instructed to land a safe distance from the animal while maintaining clear view of the downed animal.
  Although the distance between helicopter and bear will be variable depending on terrain, the goal is to reduce stimulation of the immobilized animal while maintaining the safety of the capture crew. In some cases, it may be necessary to land quickly within meters of a downed bear, e.g., the bear has collapsed in water. In other cases, it may even be possible to land the helicopter during induction and observe the darted animal from a distance until it becomes immobilized (Roffe et al. 2001).
- Only two people **should** approach the immobilized bear initially. One person is responsible for assessing the animal while the other person carries a firearm and provides emergency cover for the approach person.
  The person carrying the firearm must be familiar with the "normal" behavior of a drugged bear, in particular, what movements are acceptable, e.g., slight twitching of limbs, movement of tongue, etc.
- During the approach, the helicopter **should** remain idling and other members of the handling crew **must** remain at the helicopter awaiting instruction from the approach person.
  Once the animal is determined to be safely immobilized, the approach person signals the pilot to shut down the helicopter and other members of the handling crew to approach.
- Bears captured by culvert trap or leg-hold snare **should** be approached in the same manner as bears captured by remote drug delivery.
  However, the initial approach should only be close enough to allow evaluation of the security of the restraint and the approximate size of the captured animal. If the captured bear is a dependent young animal (cub-of-year or yearling), or an adult female possibly accompanied by a consorting male, the capture crew should leave the immediate trap-site area quickly and not approach again until it is established that no free-ranging bears are in close vicinity. Assessment of the capture area for the presence of other bears may require the use of aircraft where tree cover is extensive.

4.1.4 Recommendations for Initial Handling During Live Capture:

- Noise and touching of the immobilized bear **must** be kept to a minimum at all times.
- All personnel involved with handling immobilized bears **should** wear latex gloves to protect themselves from exposure to drugs and reduce risk of disease transmission.

  Although latex gloves may be impractical some situations, such as in frigid temperatures, it is important to protect your hands with an impermeable barrier because wildlife drugs can be absorbed across the skin and, therefore, represent a serious health hazard (Cattet et al. 2005, Kreeger et al. 2002). Although disease transmission is probably more infrequent than accidental drug exposure, it is important to be aware that bears may potentially transmit some diseases (zoonoses) to humans including rabies, leptospirosis, mange, and baylisascariasis.
- All personnel involved with direct handling of bears **must** be immunized against rabies (WHO 2002)

  Rabies antibody titres should be checked every two years, and records of titre levels should be maintained (CCOHS 1998).
- The eyes of anesthetized bears **must** be lubricated and covered.

  Apply a non-medicated eye lubricant (e.g., methylcellulose) to the cornea to prevent drying and apply a blindfold to protect the eyes and prevent any visual stimulation.
- The dart(s) **must** be removed from anesthetized bears at the onset of handling.

  If using darts that require some assembly (e.g., Cap-Chur darts, blow darts), slowly unscrew the tailpiece to vent the rear chamber before removing the dart. This will eliminate any possibility of drug spraying from the dart during removal if the needle port was occluded by tissue during injection. In most cases, treatment of the dart wound should require no more than wiping away excess blood, removing imbedded hair, clipping surrounding hair, and flushing the area with liberal amounts of sterile water to clean the wound. Antiseptic ointments, such as Hibitane® Veterinary Ointment, may also be applied although the effectiveness of these preparations in preventing infection in wild animals is unknown. Only a qualified veterinarian should treat more serious dart wounds, e.g., wounds that require sutures, restoration of intra-thoracic pressure, excision of darts that have fully penetrated the skin, etc.
- Anesthetized bears **must** be positioned so the animal's breathing is not impinged, i.e., keep neck straight and ensure nostrils and mouth are not blocked.

  Position the anesthetized bear ventrally (sternally) recumbent with its head held higher than its thorax and its nose pointing down to avoid aspiration of fluids. Ensure the ground under the bear is flat with no protruding surfaces, e.g., rocks. Should the animal need to be rolled, it is preferable to roll across the sternum as opposed to across the back. When rolling, two or more persons must work together to ensure the head and tail ends of the bear are rolled in parallel to avoid twisting the animal along its spinal axis.

Anesthetized bears should never be moved (rolled or picked up) by grasping or pulling their skin and hair.

- The physiologic response to chemical immobilization (anesthesia) **must** be assessed, and the assessment **should** include the following measures:
  - Reflex activity (e.g., palpebral, ear twitch, and tongue withdrawal reflexes): the presence and strength of reflexes is used to evaluate the level of immobilization (deep vs. light) and need for additional drug or reversal.
  - Respiratory function: evaluated by respiratory rate, depth, and sound. Although respiratory rate is affected by many factors (age, activity, drugs, etc.), it should remain ≥6 breaths per minute in an anesthetized bear. Each breath should be quiet and characterized by full expansion and relaxation of the rib cage. If the respiratory rate is less than 6 breaths per minute, artificial ventilation (chest compressions, ventilation via endotracheal tube and resuscitation bag) and administration of a reversal drug may be required, if other signs point toward respiratory depression, i.e., blue or gray mucous membranes, oxygen saturation trend is continually downwards.
  - Cardiovascular function: evaluated by pulse or heart rate, mucous membrane color, and capillary refill time. Although pulse or heart rate is affected by many factors (age, activity, drugs, etc.), it should remain between 50 and 130 beats per minute in an anesthetized bear. In addition, mucous membranes (i.e., gums, anus, vulva) should be pink and the capillary refill time should be <3 seconds. If the pulse or heart rate increases or decreases outside of the recommended range, respiratory function should be re-assessed immediately and corrected, if necessary. Reversal drug should also be available to administer, but should not be given unless other signs point toward cardiovascular distress or collapse, i.e., blue or gray mucous membranes, prolonged capillary refill time (>2 seconds), dilated pupils.
  - Body temperature: evaluated rectally using an electronic digital thermometer. A spare thermometer should always be carried in case the active thermometer malfunctions. The rectal temperature should range between 36°C and 40°C. Administration of a reversal drug is the most effective treatment if hyperthermia (>40°C) develops, because it enables the bear to use its normal cooling mechanisms, e.g., panting. Other cooling methods, including dousing with cold water and cold water enemas, may or may not be effective depending on the size of the bear, the thickness of its hair coat (and subcutaneous fat stores), and the rate of temperature increase. Hypothermia (<36°C) may also develop in some bears, especially in cubs that are captured under cold ambient conditions. Treatment should be directed toward active warming of the animal

first (heating pads, place in sleeping bag, drying wet hair coat), and not administering a reversal drug until the body temperature has returned to within the recommended range.

4.1.5 Recommendations for Monitoring of Physiological Function During Live Capture:

- The physiologic response to anesthesia **must** be monitored throughout handling until the bear is administered the reversal (antagonist) drug, or left to recover (if using Telazol® or Zoletil® alone). Assessments **should** be made and recorded every 10-15 minutes.

  Attention to physiologic function can provide advanced warning of developing complications (e.g., hyperthermia) and provide opportunity for preventative measures. Further, detailed records of physiologic function are an invaluable aid for investigation of any post-handling mortality.
- Handheld blood monitors, e.g., iStat machines, can be used to monitor blood values to determine which bears may need increased monitoring immediately following recovery.
- A pulse oximeter **should** be included as a standard component of the capture equipment.

  It provides a useful means of evaluating respiratory and cardiovascular functions by measuring the hemoglobin oxygen saturation (in %) of blood and the pulse rate (Allen 1992, Cattet et al. 2005, Kreeger et al. 2002, Reynolds et al. – unpublished report). Small, battery-powered, portable pulse oximeters are available commercially for use in the field. The recorded oxygen saturation values are often inaccurate for various reasons including calibration of the instrument for use in domestic species, decreased blood perfusion of peripheral tissues, variation in skin color, and variation in probe placement (Cattet et al. 1999, Hendricks and King 1994). However, monitoring for trends in oxygen saturation is valuable; if readings steadily decrease, it is likely the animal is in some sort of physiological crisis. When using a pulse oximeter, the probe should be applied at a consistent location (e.g., the tongue) and left in place until a stable signal is obtained before recording the oxygen saturation and pulse values. Concurrent evaluation of mucous membrane color will enable detection of hypoxemia, i.e., oxygen saturation is <85%, pulse rate increasing, and mucous membranes are becoming blue. Hypoxemia refers to low oxygenation of blood and, if prolonged, eventually leads to hypoxia, which is the diminished availability of oxygen in body tissues. Although the most obvious cause of hypoxemia is respiratory depression, it probably arises more frequently in captured wildlife as a consequence of elevated body temperature where the oxygen demand of body tissues exceeds the supply (Caulkett and Haigh 2004).
- Supplementary oxygen **should** be available to treat hypoxemia and prevent hypoxia.

  Oxygen therapy is the most effective treatment for hypoxemia (Read et al. 2001). Supplementary oxygen can be carried readily in the field in pressurized "D" cylinders (weigh approximately 6 kg when full and are safe to

carry aboard a helicopter) and administered to animals by use of a mini-regulator and nasal cannula. A flow rate of 5-10 liters per minute is required for most bears and the efficacy of treatment should be monitored with a pulse oximeter (Caulkett and Cattet 2002). The availability of medical grade oxygen provides an invaluable aid to assisting field anesthesia of bears, especially when used in conjunction with a pulse oximeter (Cattet et al. 2003, Reynolds et al. unpublished report). This equipment is available from most ambulance supply companies and is recommended as a standard component of the capture equipment. This equipment is also useful for supportive care of field personnel following significant drug exposure.

- All capture data, including drug doses and measures of physiological function, **must** be recorded on data forms at the time of capture and handling. Additional data recorded should include time of darting, number of darts used, start and end times of procedure, time bear spent in sternal recumbancy and body condition score.

  These data are invaluable in investigating health complications or the death of a bear during or following handling. A template for a capture data form is provided in Appendix B.

4.2 Sample Collection and Measurements

Recommendations:

- All handling, including sample collection and measurements, **must** be completed quickly and quietly with the objective of minimizing the handling time, and releasing the animal as soon as possible.
- Samples and measurements **must** be consistent with the experimental design and details provided in the animal handling protocol.
- Extraction of a premolar for the purpose of aging **must** only be done if 'age in years' is data critical to the study objectives.

  Otherwise, age or age class should be estimated based on body size and appearance.
- Local or regional anesthesia **should** be provided to manage pain resulting from premolar extraction. However, investigators **must** receive training by a licensed veterinarian before applying either of these procedures.

  Extraction of a tooth produces strong, long-lasting, painful stimuli associated with tearing of the periodontal ligament and sensory nerve supply. Where premolar extraction is justified, local or regional anesthesia should be provided to manage pain during the procedure and in the hours following handling (Holstrom et al. 2004). Although different local anesthetics are available, 0.5% bupivacaine is recommended for the long duration of analgesia it provides, i.e., 6-10 hours. Local anesthesia is accomplished by injecting anesthetic (e.g., 1 ml of bupivacaine) into the periodontal space and gingiva surrounding the premolar approximately 10 minutes prior to extraction. Regional anesthesia is accomplished by using either an infraorbital nerve block for an upper premolar, or a mental nerve block for a

lower premolar, approximately 10 minutes prior to extraction. Of the two techniques, regional anesthesia is technically more difficult but provides more complete pain relief. Both techniques require prior instruction and training by a licensed veterinarian, but can be perfected easily with practice.

- Local anesthesia **should** be considered for other sampling procedures (aside premolar extraction) that are likely to elicit pain, e.g., tissue biopsy.

  Local (or regional) anesthesia is generally not required for most routine sampling procedures (blood collection, ear punch, skin/fat biopsy) because the pain elicited by these procedures is of short duration (when compared to tooth extraction) and adequately controlled by the immobilizing drug. However, where zolazepam-tiletamine (Telazol® or Zoletil®) is used alone as the immobilizing drug, local anesthesia may be required because of the poor analgesic effect of this drug (Caulkett et al. 1999). In such case, infiltration of the biopsy/punch site with 2-3 ml of lidocaine (with 2% epinephrine) approximately 5 minutes before tissue collection will provide sufficient pain control and minimize bleeding.

- Least invasive procedures **must** be used for genetic (DNA) sampling, e.g., hair follicle extraction, oral swab.

  Tissue biopsy for DNA analysis is unacceptable unless the biopsy samples are also required for other analyses, e.g., contaminants, stress indicators.

- If an ear tag is applied, the hole **should** be made with a sterile biopsy punch (6 mm diameter) and the tissue plug **should** be preserved for any analyses that require tissue samples.

  The ear tag stud is manually directed through the biopsy hole prior to securing the tag with the applicator.

- Sampling of blood and tissue **should** be performed only after appropriate training and adequate experience. Proper collection and handling and preservation protocols **must** be followed in order to obtain useful field data.

- If the handling protocol requires weighing captured animals, the weighing **must** be done in the least stressful manner possible.

  Bears should not be suspended in a cargo net, or by "cuffs" attached to their four limbs, because of the potential for adverse health effects, e.g., hypertension, regurgitation and aspiration (Cattet et al. 1999, Kreeger et al. 2002). Instead, bears should be weighed by first positioning them sternally on a lightweight rigid platform (e.g., portable climbing ledges weigh 4-6 kg) and then suspending the platform from a pole, bipod, or tripod. If required, a portable climbing ledge can also be suspended safely beneath a helicopter for the purpose of moving a bear a short distance to safer terrain.

- At some point during handling, the anesthetized bear **must** be checked for wounds, injuries, and general condition and this information **must** be recorded on the field data sheet.

  This should include a thorough examination for injuries caused by the capture procedure. For example, wounds to claws and teeth are common in some type of culvert traps with extensive mesh, while edema (swelling), cuts, abrasions and fractures may occur with leg-hold snares.

- Antibiotics **must** not be administered routinely to captured bears.
- Antibiotics **should** only be administered under the advice or direct supervision of a veterinarian.

  The effectiveness of these drugs in free-ranging wildlife is often unproven and largely unknown (Pietsch et al. 1999). In addition, antibiotic residues (metabolites) often remain in tissues for long periods of time posing a public health risk to persons consuming bear meat (Cattet 2002).

4.3 Identification, Marking and Telemetry Collars

Recommendations:

- Investigators **must** aim to minimize any adverse effects of identification or marking procedures on the physiology, or behavior of individual study animals.
- Primary consideration **must** be given to identification or marking techniques that are not invasive, do not require recapture for identification, will remain visible for the duration of the study, and will not compromise the animal's welfare.

  Ideally, techniques used should comply with the following criteria:
  - *Should be quick and easy to apply;*
  - *Should be readily visible and distinguishable;*
  - *Should be persistent, remaining for the duration of the research;*
  - *Must not cause long-term adverse health effects;*
  - *Must be recorded accurately on field data sheets; and*
  - *Must allow for seasonal changes in size and growth.*
- Tattoo dyes **must** be cleaned well (e.g., rinsed in isopropyl alcohol) between uses to prevent transmission of disease between bears.

  Tattooing is a common method of permanent identification in bears, although the legibility of tattoos is variable over long periods. Tattoos are applied either to the inside of the lip or to the inside of the thigh at the groin where hair cover is sparse.
- Telemetry collars **should** be as light in weight as possible (<3% of body mass) and **should** be selected for long duration battery life and remote drop capability to minimize re-capturing of collared bears. All collars **should** incorporate connecting material that will eventually rot off, allowing the collar to drop from the animal.

  Collars with self-removing or breakaway devices should also incorporate "rot off" material, in case the devices fail to function (Garshelis and McLaughlin 1998).Further, investigators should consider using expandable collars on juvenile bears (Strathearn et al. 1984, Vashon et al. 2003).
- The shape and flexibility of the collar **must** be selected to avoid causing debilitating injuries to study animals (Krausman et al. 2004).
- Collars **must** be fitted tightly enough that they are not easily shed, but loose enough to allow for weight gain without impeding normal neck movement or causing abrasion.

The best fit is usually achieved when the collar is as tight as possible, but still able to be pulled over the head (Reynolds et al. – unpublished report). A collar that is snug but not too tight at the width of the zygomatic arch (i.e., finger's width between the collar and zygomatic arch on either side) will generally ensure that the collar will be loose enough to accommodate the seasonal increase in body mass. If bears are fitted with collars when they are in poor condition (e.g., in a year following a food-failure year), investigators should ensure there is enough space between the collar and the neck to accommodate a large gain in body mass in a good food year. Further, male polar bears and some male grizzly bears cannot be fitted with telemetry collars due to the width of their neck in relation to their skull. However, ear tag transmitters can be applied to these animals instead.

- Conventional VHF collars **should** not be deployed unless funds have been procured to monitor the collars for the length or majority of the battery life.

  Conventional VHF collars should not be fitted on bears if funding is not sufficient to ensure that radio locations will be recorded at a rate (i.e., number of locations per unit time) that will adequately meet the study objectives.

- If ear tag transmitters must be used to meet the study objectives, the transmitter weight **should** be as light as possible (<30 g) and only one transmitter should be applied per bear.

  Larger ear tag transmitters are likely to cause chronic irritation and abrasion of the "tagged ear". Ear tag transmitters should not be applied to both ears of a bear for the purpose of attempting to ensure the transmission life is of adequate length. Instead, investigators should purchase high quality transmitters and perform controlled outdoor testing prior to deploying the transmitters on bear.

- The use of radio transmitters implanted beneath the skin or in abdominal cavity should be avoided because of invasiveness of their application, the lack of information on their long-term health effects, and their poor performance relative to radio transmitters that are applied externally. However, if the use of "implant" transmitters is justifiable, the implant procedure should be conducted by a veterinarian using proper surgical technique.

  To date, the routine use of "implant" transmitters in bears has been hampered by poor performance including reduced signal transmission range (Koehler et al. 2001) and short transmission life (Amstrup et al. 2001).

4.4 Reversal Drugs and Release of Bears

Recommendations:

- Reversal (or antagonist) drugs **must** not be administered until all equipment has been repacked and removed, and all personnel except the

person administering the drug and person providing firearm cover have cleared the area.

- Once the reversal drug is administered, the persons remaining at the bear **must** retreat to a safe location to monitor the recovery.

  Every effort should be made to observe the animal until it is ambulatory and coordinated in its movements.

- Bears captured by snare **should** be observed from a safe distance until they recover and move away from the site. Other bears approaching the recovering bear and snare site **should** be chased off using noise, unless they are other members of a family group.
- When using non-reversible drug combinations, every effort **should** be made to observe the recovering bear until it is ambulatory and coordinated in its movements.
- Where a bear has been captured by leg-hold snare, all other active snares in the area **should** be removed before the anesthetized bear is administered reversal drug or left to recover. If snares cannot be removed, they **must** be de-activated by closing all snare loops.
- When non-anesthetized bears are released from culvert traps, the release **must** be triggered remotely or from inside a vehicle.

  Persons must not open the trap door while standing upon the trap.

- Helicopters should not leave until the bear is standing properly.

4.5. Post-Capture Monitoring

Recommendations:

- Bear fitted with radio collars **should** be observed visually at least once within the three days immediately following capture and handling, and ideally within 24 hours of release.

  This is especially important if the bear showed any adverse or unusual response to capture and handling, e.g., hyper- or hypothermia, significant physical injury. Although animals sometimes die during capture and handling, death may also be delayed occurring within hours to days following capture (Spraker 1993, Fowler 1995). If an animal dies following capture, the opportunity to determine cause of death is important for two reasons (Nielsen 1999). First, if the animal died as a direct result of the procedures used during capture and handling, then a detailed necropsy should be followed by a review of the capture event and, if required, a revision of the methodology used. Second, if the animal died as a result of a pre-existing illness or disease exacerbated by the stress of capture and handling, then the detailed necropsy will help to assure continued confidence in the capture methodology used and may also provide new information regarding the health of the species.

- Ideally, bears **should** be visualized from high altitude to minimize stress associated with the noise and proximity of the aircraft. However, sighting a bear where tree cover is extensive may be difficult, if not impossible. In

such case, movement of the animal **should** be confirmed by detecting change in its radiolocations.

Although most telemetric devices are equipped with motion-sensitive mortality sensors, these alone are not adequate for confirming movement of the released bear and should not be used as a substitute for visual observation or radiolocation in the immediate period following capture. Activation of the sensor may not always occur within the programmed time because of intermittent movement of the collar following death caused by animals feeding on the carcass. Detailed examination of a carcass that has been scavenged extensively is unlikely to provide any insight into the cause of death.

- Researchers should monitor bear movements 3 months post capture.

  This will allow researchers to gather information about behavior and movements of bears after anesthesia. Further, it may determine if there is increased movement of bears into urban areas, due to adverse effects of capture.

4.6 Euthanasia

Recommendations:

- The investigator **must** be prepared to humanely kill any animal in the field that is suffering intolerable pain, irreversible injury, or distress as a result of capture or handling procedures, or experimental intervention.

  Personnel should know how to perform the procedure, if required, and should have the appropriate equipment available at all times during capture operations.
- A detailed report of the euthanasia **must** be written and every effort **must** be made to salvage the hide, skull, and other parts legally required, and submit these with the report to a wildlife officer as soon as possible.
- Acceptable methods of killing bears are as follows:

  a) Gunshot
  - A shot to the brainstem of an animal produces a quick and humane death, but is best attempted when the animal is immobilized by injury or drug.
  - In free-ranging situations, or where the intact brain is required for laboratory testing (e.g., rabies), gunshot to the heart and lung area may be more appropriate.

  b) Exsanguination (bleeding)
  - This method is considered humane if performed on a deeply anesthetized animal.
  - The technique requires bleeding the anesthetized bear by slicing deeply across the throat to sever the carotid arteries.

  c) Intravenous injection of concentrated potassium chloride

- Concentrated potassium chloride injected as a bolus intravenously is considered an acceptable form of euthanasia in a deeply anesthetized bear.
- This technique should not be attempted by individuals unless they have significant experience in giving intravenous injections in bears.

4.7. Morbidity and Mortality

Recommendations:

- Any injury, disease, or abnormality observed during or following capture or handling **must** be documented and reported to the GNWT-ENR Wildlife Veterinarian as soon as possible. An investigation **should** be conducted wherever possible.

  Investigation may include collection of samples (blood, feces, etc.) for submission to a veterinary diagnostic laboratory for further evaluation, e.g., serum biochemistry, parasite identification. Ideally, the written report should include digital images.
- Dead bears **must** receive a detailed necropsy to determine the cause of death and be reported to the GNWT-ENR wildlife veterinarian as soon as possible.

  If the necropsy is performed in the field, appropriate tissue samples should be collected and frozen or fixed in 10% buffered formalin for submission to a veterinary pathology facility. Appropriate tissue samples should include brain, lung, heart, liver, kidney, spleen, lymph nodes, and muscle. Investigators should refer to a wildlife necropsy manual for details regarding required equipment, techniques, and sampling procedures (see for example, Munson 1999). A template for a field necropsy data form is provided in Appendix C. Documentation should also include a detailed history and digital images of the field necropsy to assist the veterinary pathologist diagnosing the cause of death. Alternatively, under some circumstances, it may be better to arrange shipment of the entire carcass to a veterinary pathology facility for detailed necropsy.
- A detailed report of the death **must** be written and every effort **must** be made to salvage the hide, skull, and other parts legally required, and submit these with the report to a conservation officer as soon as possible

4.8. Human Safety

Recommendations:

- Appropriate handling and restraint techniques **must** be used for bears, and personnel **must** have appropriate training and experience in their use to avoid injury.

  Bears are capable of inflicting serious injury and transmitting disease to persons handling them.

- The risks involved in using drugs for the capture and immobilization of bear **must** be identified and communicated to all personnel involved in the project (including the helicopter pilot).
- The investigator **must** ensure that an emergency action plan is in place.
  The emergency action plan provides step-by-step details on what to do in the event of an accident or emergency (e.g., human drug exposure, downed aircraft) and, if well designed and implemented, can reduce the severity of emergencies and save lives.
- At least two people on the handling team **must** be trained in first aid and cardiopulmonary resuscitation (CPR), local medical authorities **should** be informed of the potential hazards (accidental drug injection, animal bite), and an evacuation plan to medical facilities **must** be discussed prior to fieldwork.
- Personnel handling drugs **must** have current training (within 5 years) in the chemical immobilization of wildlife and inform other members of the team of the risks of human exposure and procedures for addressing drug exposure.
- When contracting helicopter services, project leaders **should** be able to insist on only using the most experienced pilots.
  An experienced pilot is not only essential for the safety of the capture crew, but also to ensure that captures can be performed quickly and efficiently.
- Helicopter pilots assisting with wildlife capture operations **must** have demonstrated skills in their ability to pursue target animals and, when required, control animal movements in a gradual manner that imposes as little stress as possible on the target animal.
- The investigator **must** ensure that potentially hazardous conditions involved in fieldwork are identified to the personnel involved.
  Some situations may require particular experience or training, such as working around aircraft or firearms, or in extreme cold temperatures.
- Helicopter egress training **should** be encouraged for all capture crew participants. The use of appropriate safety clothing (i.e. Nomax coveralls, flight helmet) **should** be used.
- Personnel involved in capture and restraint **must** have current training and proficiency in the use of pertinent equipment, e.g., firearms, dart rifles, etc.
- Personnel carrying firearms **must** have the legal authorization to use a firearm, e.g., an *Authorization to Carry a Restricted Weapon* is required by a person carrying a handgun.
- Following completion of a training course, inexperienced personnel **should** develop and refine their skills by working with a mentor.
  Although training courses can provide basic safety information, they cannot provide the breadth of knowledge acquired through field experience.

4.9 Problem Bears

- Bears are typically regarded as problem wildlife when their activities threaten human lives or property. In contrast to research and other management activities, the capture and handling of problem bears is often an emergency situation where control of the problem animal must be achieved as quickly as possible. In such cases, animal safety may need to be compromised to some extent (e.g., capture at sensitive times such as immediately prior to den entry, capture at high ambient temperature, prolonged chase, etc.), especially when human life is threatened. In some circumstances, it may be more acceptable to humanely kill a problem bear than to attempt a difficult capture where the probability of injury and excessive stress is high.

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Appendix A – Drug Volume Table for Capture and Reversal of Bears

	Xylazine (mg/kg) : ketamine (mg/kg) and yohimbine (µg/kg) or atipamezole (µg/kg)	**Xylazine (mg/kg) : Telazol® (mg/kg) and yohimbine (µg/kg) or atipamezole (µg/kg)**	**Medetomidine (µg/kg) : Telazol® (mg/kg) and atipamezole (µg/kg)**	**Telazol® (mg/kg)**
Black bear	2 : 5 **and** 200 or 200	2 : 3 **and** 200 or 200	50 : 1.8 **and** 200	4 - 6
Grizzly (brown) bear	Not recommended	3 : 4.5 **and** 200 or 200	125 : 2.5 **and** 500	8 - 10
Polar bear	Not recommended	3 : 4.5 **and** 200 or 200	75 : 2.2 **and** 300	6 - 8

Appendix B – Example Bear Capture Data Form

PERSONNEL: _____

DATE: (dd-mm-yy, i.e. 18-Apr-05) _____

ANIMAL DATA:

Species: ☐ Grizzly ☐ Black ☐ Polar **Recapture?** ☐ Yes ☐ No **Relocated?** ☐ Yes ☐ No **Location:** **UTM:**	**Sex:** ☐ M ☐ F ☐ Unk. **Age class:** ☐ Cub of year ☐ Yearling ☐ Sub-adult ☐ Adult **Lactating?** ☐ Yes ☐ No	**GNWT Bear ID** _____ **Other ID** _____ **Family group or other bears at site:**

ID #	Sex	Age class

CAPTURE INFORMATION:

Capture Method: ☐ Heli Dart ☐ Culvert Trap ☐ Snare: _____ (snare site name)	**Delivery System:** ☐ pole syringe ☐ blowpipe ☐ pistol ☐ rifle	**Dart System:** ☐ low velocity ☐ high velocity ☐ slow injection ☐ rapid injection

LOCATION DATA:

General:		
Please use Datum NAD83 →	UTM east:	UTM north:

MARKINGS: ***Circle Y / N choices***

Collar: brand:	freq:	rotoff? [Y / N]	**Ear Trans:** freq.	Initial. Time:
Drop-off: brand:	#days:	RC? [Y / N]	Serial#:	Initial. time (ATS only):
Transponder: [Y / N]	If yes, brand: _____		ID#: _____	Implant location: _____
Tattoo #	**Inside of thigh:** left or right		**Quality & loc. of previous tattoo(s):**	

DRUG INFORMATION:

	Inject #1	Inject #2	Inject #3	Inject #4	Reversal
Drug					
Amount (mg)					
Volume (cc)					
Time					
Inj. site / Miss					

VITAL STATISTICS:

Time	Pulse	Resp	Temp°C	SpO_2 (O_2 flow)

Induction Sequence (record approx. times)

Staggering	Rump down	Head down	Immobilized

Recovery Sequence (record approx. times)

Head up	Standing	Staggering	Running

Continued on next page

BODY MEASUREMENTS: ***Indicate the units used, if different***

Weight: _____lb or kg

Estimate or Actual

Straight-line length (nose to tip of tail) _____cm
Zoological length (body contours) _____cm
Chest girth (behind shoulders) _____cm

Testicle size:
Left (L) _____cm (W) _____cm
Right (L) _____cm (W) _____cm

SAMPLES COLLECTED:

Tooth (*circle*): LLPm1 LRPm1 ULPm1 URPm1 **Blood:** ☐ red ☐ purple	☐ Ear plug ☐ Hair ☐ Feces ☐ Claw tip

CHECK LIST:

- ☐ Dart recovered
- ☐ Hibitane
- ☐ Eye ointment
- ☐ Transmitter magnets off

RECORDED:

- ☐ Collar/Ear Tag freq.
- ☐ Transponder #
- ☐ Tattoo # & location
- ☐ Body measurements
- ☐ Animal data
- ☐ Capture data
- ☐ Location data
- ☐ Body weight
- ☐ Testical size

COMMENTS: _____
_____
_____
_____

Appendix C – Example Field Necropsy Data Form

GENERAL INFORMATION:

Date:	**Location:**	**Personnel:**
Species:	**Sex:** ☐ M ☐ F ☐ Unk.	**Age Class:** ☐ Young of year ☐ Subadult ☐ Adult
Euthanasia: ☐ Yes ☐ No If yes, method of euthanasia: _____		

CARCASS INFORMATION:

State of preservation: ☐ fresh ☐ frozen ☐ decomposed ☐ whole carcass ☐ partial carcass	
Nutritional condition:	**Pregnant:** ☐ yes ☐ no

NECROPSY OBSERVATIONS:

External assessment:

Location	Description	Photos [Y / N]
Skin		
Orifices (mouth, ears, etc.)		
Other (eyes, limbs, etc.)		

Internal assessment:

Location	Description	Photo [Y / N]
Muscle		
Bones and joints		
Lungs and trachea		
Liver		
Heart		
Spleen and lymph nodes		
Stomach(s)		
Intestines		
Urinary		
Reproductive system		
Brain		
Other observations		

TISSUE COLLECTION:

	Muscle	Lung	Liver	Heart	Stomach	Intestine	Kidney	Brain	Other
Formalin?									
Frozen?									

Specimens collected for other tests: _____