Veterinary Assessment of Aerial Removal Procedures

Government of the Northwest Territories and Tłı̨chǫ Government

2020 Wolf (Dìga) Management Pilot Program

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Summary

This Report provides a summary of the gross necropsy findings from 36 wolf carcasses derived from the 2020 Wolf (Dìga) Management Pilot Program (Nishi *et al* 2020) implemented on the Bathurst and Bluenose-East caribou winter ranges. It was completed by a board-certified wildlife Pathologist at the request of the Government of the Northwest Territories (GNWT) Department of Environment and Natural Resources (ENR).

The 2020 Wolf (Dìga) Management Pilot Program supplements wolf harvest with aerial shooting when ground-based harvest does not meet removal target levels needed to support caribou recovery. All animals were shot by a single shooter with previous experience with helicopter-delivered wolf removal utilizing a shot-gun in 35/36 cases and a high-powered rifle in one instance. The humaneness of the aerial removal process was assessed based on field information that was provided by ENR staff and injuries that were observed during the necropsies. General observations on the health of the wolves are also included in the summary.

Assessment of the humaneness of animal handling, care or euthanasia methods in remote field settings is challenging as the methods used for assessment are often highly subjective and require integration of multiple factors in order to draw conclusions. The American Veterinary Medical Association assesses euthanasia methods according to the following criteria: (1) ability to induce loss of consciousness and death with a minimum of pain and distress; (2) time required to induce loss of consciousness; (3) reliability; (4) safety of personnel; (5) irreversibility; (6) compatibility with intended animal use and purpose; (7) documented emotional effect on observers or operators; (8) compatibility with subsequent evaluation, examination, or use of tissue; (9) drug availability and human abuse potential; (10) compatibility with species, age, and health status; (11) ability to maintain equipment in proper working order; (12) safety for predators or scavengers should the animal's remains be consumed; (13) legal requirements; and (14) environmental impacts of the method or disposition of the animal's remains (AVMA 2020). Euthanasia is considered to be the terminal ending of an animal's life without pain or suffering with humane killing being considered a more appropriate term for killing of otherwise healthy animals. This veterinary assessment primarily focuses on only the first criterion, with some discussion of the second criterion and consideration of criteria 12 and 14 within the recommendations. While the other criteria of humaneness are beyond the scope of this report, decision-makers are encouraged to consider them. Likewise, this report cannot assess social, cultural, ethical, and political concerns and this project is highly publicized, scrutinized, and politicized.

The methods utilized in this report to assess the humaneness according to criterion 1 of the American Veterinary Medical Association (i.e. the ability to induce loss of consciousness and death with a minimum of pain and distress) of the aerial removal technique were taken from a small number of published studies in other species, as well as consultation with Canadian wildlife welfare experts. Attempts were made to be as objective and scientifically technical as possible. Optimal humaneness is considered to be likely instantaneous loss of consciousness

that is likely to occur from a killing shot to the head or high cervical spinal cord shot and acceptable humaneness or humane killing in other references, would be a likely loss of consciousness within 180-300 seconds (Hampton et al. 2014; AIHTS 1997).

In this assessment, attempts were made to interpret humaneness from postmortem (after death) evaluation of previously frozen carcasses that had undergone multiple freeze/thaw events. Although not logistically possible in this case, the postmortem assessments are better performed on fresh carcasses. Overall, a fatal permanent wound tract or "killing shot" (i.e. the damage present in the carcass could be interpreted to determine a shot that likely killed the animal) was determined in 97% of cases (35/36 wolves examined). As an experienced single shooter was utilized for this removal effort, there were no injured animals, which is a positive and ideal result for the overall humanness of the activity. Studies from helicopter-based removal of camels in Australia found that shooter identity was the most important factor for determining animal welfare outcomes and recommended rigor in shooter selection and training for that project (Hampton et al. 2014).

If strict criteria are used to assess for optimal humaneness (i.e. the instantaneous loss of consciousness from a shot to the head or certain portions of the neck), only 8/36 or 22.2% of animals removed would meet that criterion. However, if slightly more relaxed endpoints that are likely more comparable to ground-based shooting or traditional hunting practices with consideration for shots to the chest, are utilized as acceptable humane killing methods that are defined as likely loss of consciousness within 180-300 seconds, 35/36 or 97% of carcasses examined would meet that criterion and thus overall, the helicopter-delivered shooting of wolves in this case is considered to induce unconsciousness and death in a way that limits pain and distress (i.e. it meets criteria to be considered humane killing).

Areas of consideration to improve the robustness of welfare assessments and humaneness of helicopter-delivered shooting of wolves in future projects are discussed in the report and listed within the recommendations (e.g. utilizing video footage and dedicated personnel with stopwatches specifically documenting animal welfare endpoints). The sample size of 36 animals is low in comparison to other studies that evaluated aerial removal techniques for free-ranging or feral animals, and further investigation of additional carcasses is recommended if the technique is utilized in the future.

Additional analyses of health parameters, morphometrics, body size, and nutritional condition will take place as part of ENR North Slave region's ongoing wolf monitoring programs. The wolves included in this study will provide important data and samples to better understand the ecology of wolves in the region. Due to time constraints and logistics related to the current COVID-19 pandemic, this assessment only attempts to address humaneness through the lens of existing scientific and veterinary understanding, but the author acknowledges the long, shared history of Indigenous populations with wolves in the NWT and important social and cultural traditional ways of knowing that could and should be incorporated into future assessments and management actions.

Background and Introduction

The Tłı̨chǫ Government and the GNWT implemented a pilot program for wolf management on the Bathurst and Bluenose-East caribou winter ranges in winter 2020. The Pilot Program included aerial wolf removal in addition to ground harvest of wolves in a concerted effort to reach wolf removal targets that could support caribou recovery. This report summarizes the evaluation of the 2020 Wolf (Dìga) Management Pilot Program from the perspective of the humaneness of the aerial wolf removal components.

Financial, social, political, ethical, and moral considerations, and value judgements associated with use of lethal methods for wildlife management are beyond the scope of this report and will not be addressed, but a few references are provided for further reading (e.g. Brook et al. 2015; Dairmont et al. 2018).

Methods

Aerial removal field procedures

All wolves included in this assessment were shot from the air by one shooter with previous experience with helicopter-delivered wolf removal from either an ASB-2 or A-star helicopter with a Remington 870, 12 Gauge shotgun with an improved cylinder choke utilizing Winchester 00 Buckshot lead shot ammunition. The removals were performed on tundra landscape on the Central Barrens during the winter months of April and May 2020. On one occasion due to tree coverage, Federal Power Shock soft point 7.62 x 39 123 grain ammunition and a rifle was used at a distance of approximately 30m. All shots were made through an open rear right door of the helicopter with an estimated distance of 10-15 m to the target. The total pursuit time was calculated based upon the difference between the time when the wolf pack was identified from the helicopter (sighting time) and the time elapsed before a shot was fired.

Field sheets titled "Aerial Removal Form" were provided by ENR staff to the aerial removal crew that included a "Welfare Index" with the following criteria for time to death: 1 (immediate), 2 (0-2 minutes), 3 (2-5 minutes), 4 (5-10 minutes), and 5 > 10 minutes. The crew was also asked to record the time of targeted pursuit, the number of wolves in each pack, the number of shots, and the time to the first shot.

Carcasses were frozen at -20^{0}C and were thawed to facilitate skinning by local trappers located in Yellowknife and coordinated with the Tłı̨chǫ Government. Carcasses were often re-frozen after skinning and thawed again for postmortem assessment.

General necropsy procedures, data and sample collection

Enhanced personal protective equipment, including disposable nitrile gloves, a medical-grade surgical mask, eye protection (either safety goggles or a face shield), coveralls and a disposable apron were utilized by all staff participating in the necropsies. All participants in the necropsies had up to date rabies pre-exposure prophylaxis vaccination and the number of participants was limited to three people within the necropsy suite at a time.

Morphometric data including the skinned weight, contour length (tip of the nose to the base of the tail), tail length, neck girth, chest girth and rump fat were collected. Skull measurements included zygomatic width, condylobasal length, and total skull length. A premolar tooth will be extracted from the skull after further outdoor processing with fly maggots. The external and internal body condition was subjectively evaluated on a semiquantitative rank scale of 0 – 4 based upon the coverage and thickness of subcutaneous and visceral fat stores, respectively. Adequate or average body condition is generally considered to be greater than or equal to 2. An average of external and internal rank was used as an overall coarse indicator of body condition for the purpose of this report. Kidney fat indices (the ratio of the kidney weights with surrounding fat to kidney weights where the perirenal fat found surrounding the kidney has been removed) and femur lengths were not available at the time of the report.

Approximate age was recorded based upon the appearance of tooth wear according to Gipson et al. 2000, as well as additional corresponding features, such as the presence of thymic tissue and the size of the uterus if present. When present, testicular volume was recorded using a graduated cylinder to measure water displacement. Fetal weights and crown to rump length were recorded when present, as well as an estimate of the stage of pregnancy (e.g. early, mid and late term). Biological samples including tongue, hair (when present), hind limb muscle, femur, spleen, lung, feces, stomach with contents, liver, both kidneys with fat, blood-soaked Nobuto filter paper strips, and the skull were collected. In cases where there was damage to the skull, brain was collected. The Nobuto filter paper strips were left to air dry for 24 hours, placed in envelopes and stored at room temperature. Hair samples were placed in envelopes and stored at room temperature. All other samples were saved in sterile Whirl-Pak bags and stored at -20^{0}C. Any detected parasites were fixed in 95% ethanol and potential lesions were fixed in 10% neutral, buffered formalin.

All four limbs were reflected to examine associated soft tissue and underlying structures. The presence of negative pressure within the thoracic cavity was assessed via a small incision in the diaphragm after opening of the abdominal cavity. The ribs of one side were removed with strong gardening shears at the level of the spine and costochondral junctions. Estimates of the amounts of blood/fluid in the chest and abdomen were recorded utilizing standard glass beakers. The entire 'pluck' (tongue, esophagus, trachea, heart and lungs) was removed by freeing the tongue from the skeletal muscles beneath the jaw and extending an incision along the neck to the thoracic inlet and into the thoracic cavity. The lungs, heart and pericardium were examined in detail including incision and opening of the esophagus and trachea to the level of the mainstem bronchi. Abdominal organs including the liver, kidneys, adrenals, gonads (when present), stomach, small intestine, large intestine, spleen, and lymph nodes were externally examined. All uteri were removed and assessed for the presence of feti or evidence of implantation sites (i.e. placental scars). The esophagus at the level of the cardia (its entry into the stomach) and the duodenum at the level of the pylorus (origin of the small intestine from the stomach) were tied off with string in order to remove the stomach without losing content. The remaining components of the digestive tract were not opened or saved due to concerns about zoonotic tapeworms (e.g. *Echinococcus* sp.), freezer space and capacity of academic partners to perform additional analyses, but feces were saved for additional parasite or other screening.

The stomach content analysis will be included with an additional separate contractor report. Additional health determinants, such as bone marrow fat percentages, stable isotopes, serology, contaminant and pathogen testing are beyond the scope of this report, but samples were taken, labeled, and archived for potential future analyses.

Procedures specific to humaneness assessment

A detailed examination of each carcass was adapted from King et al. 2013 and Urquhart and McKenzie 2003 with bullet wounds identified based upon criteria outlined in Hollerman et al. 1990. The skull, neck, dorsum (spine), pelvis, all four limbs (when present as limbs and appendages were occasionally removed with skinning procedures), external thorax, external abdomen, and tail were evaluated for evidence of fractures, hemorrhage (free blood), bruising, and edema (accumulated fluid associated with swelling from trauma).

All puncture wounds, fractures, and other injuries were photographed and documented on a Wolf Injury Form (Appendix). The total number of puncture wounds was recorded as an indicator of the number of shots. When possible, entry wounds were distinguished from exit wounds. Any shot fragments, shrapnel or other components of shot (e.g. plastic wad) were recovered and saved. The interpreted killing shot in each case was determined based on all postmortem findings by an anatomic veterinary pathologist certified by the American College of Veterinary Pathologists with training and experience with forensic wildlife necropsies. The killing shot categories included: head (evidence of severe damage to the brain and skull), neck (severe damage to the cervical vertebrae with evidence of severing of the spinal cord), chest (presence of blood in the chest and damage to the lungs and/or heart), and unknown.

Statistical analyses were performed in R Core Team. Statistical significance was determined at α=0.05.

Results

Aerial removal field data

In the majority of instances, the total pursuit time ranged from 0-2 minutes, with one pack attempt that resulted in the removal of three wolves where the total pursuit time was 51 minutes. The 51 minutes likely includes extensive search time once the remaining pack members dispersed. Fourteen attempts at removal occurred with complete removal of the pack attempted in each case. However, as the wolves scatter quickly from the helicopter, a total of 7 wolves were documented to have escaped the removal attempts. All wolves that were shot at were recovered so it is interpreted that none of the escaped wolves were injured.

General necropsy results

A total of 36 skinned wolf carcasses were evaluated, including 21 males and 15 females. Nine females (60%) were pregnant and six (40%) females were not pregnant at the time of death. As all carcasses had already been skinned prior to presentation, assessment for lactation could not be performed, but is considered unlikely based upon the time of year that the animals were collected. One pregnant female had evidence of mammary development and near-term fetuses. A total of 35 wolves had been shot with a shotgun and one with a rifle. All animals that were shot at were determined to be killed and all carcasses were recovered from the field.

The majority (n=31; 86%) of wolves examined were determined to be in adequate body condition with average (combination of external and internal) rank scores ≥ 2.

No parasites were detected within the lungs or in the heart. A small number of nematode parasites were recovered from the esophagus, stomach, and from within the abdominal cavity from animals with punctures through the intestines (possibly *Toxocara* sp.) and were interpreted to be incidental findings. A small number of wolves had evidence of previous injuries (e.g. healed bony calluses - particularly on the ribs) and pathological processes (e.g. evidence of degenerative joint disease and marked tooth wear). These were considered to be unrelated to the aerial removal process and interpreted to be background findings in this species related to intra or interspecific aggression or other causes of blunt trauma, as well as normal age-related findings. Some wolves (n=17 or 47%) had evidence of tooth lesions where the dentin (pink layer of the tooth) was visible that could be due to freeze/thaw cycles or autolysis, but may also be related to wear or improper development of the outer (enamel) layer of the teeth suggestive of potential exposure to certain viruses, such as canine distemper virus, during tooth development (Dubielzig et al. 1981). Further investigation of the skulls and evidence of previous exposure to viruses from the blood strips (i.e. serology) would assist in understanding the significance of this finding to the overall health of the wolves examined.

Results specific to humaneness assessment

The number of shots ranged from 1-3 and the number of distinct punctures detected at necropsy ranged from 0-31. There was no significant association via Pearson's correlation between the number of shots fired and the number of punctures detected ($r^2 = 1.165$; $p = 0.5633$). based on an Analysis of Variance, there was no significant relationship between the killing shot categories (chest, head, neck or unknown) and the total volume of blood in the chest ($F = 1.607$; $p = 0.1975$). A higher amount of fluid was documented within the chest of males when compared with females (Figure 1).

At least one presumed fatal wound tract (i.e. killing shot) could be determined in 35/36 (97%) of cases. In four cases, two fatal wound tracts were observed with the primary tract interpreted as that to have caused unconsciousness the fastest (for example impact to the head or neck was interpreted to have caused unconsciousness more quickly than a chest or heart injury). The majority of animals (n=21 or 58.3%) had chest wounds, followed by neck (n=12 or 33.3%) and head injuries (n=2 or 5.6%). Of the chest injuries, a puncture wound in the heart was detected in 12/21 (57%) cases, while only lung injuries were detected in 9/21 (43%) cases. Of the neck injuries, six wolves had fractures and severance of the spinal cord at the level of cervical (neck) vertebrae 1 to 3 (C1-C3), four had fatal injuries at (C4-C6) and two animals had neck injuries with severing of the spinal cord at the last cervical vertebra (C7) and the first thoracic vertebra (T1). The head injuries primarily involved the parietal (top) bones of the skull, as well as the lower jaw. One animal with an unclear fatal wound tract had damage to the temporomandibular (jaw) joint, temporal (side) bone of the skull, lower jaw, and the sagittal crest (middle of the top of the skull), without damage to the brain case, heart or lungs. As these injuries could be interpreted as being non-terminal, it is possible that the cause of death in this animal was severe concussive injury to the head and brain related to the force of a shot without damage to the braincase. Twenty-five (69.4%) of the wolves examined had at least 1 thoracic rib fracture, with some wolves having up to ten broken ribs. Two wolves (5.6%) had broken pelvises with fractures of the lumbar spinal cord. Twenty-one (58.3%) animals had at least one limb bone fractured or disarticulated (having a higher degree of joint mobility than normal). Affected bones included the humerus, radius, ulna, femur, tibia, and scapula). Ten (27.8%) of the wolves examined had evidence of shots to the abdomen with gastrointestinal content admixed with nematode parasites thought to have originated from the gastrointestinal tract and extensive damage to the abdomen, and six (16.7%) animals had damage to their tails. The results of the presumed fatal permanent wound tracts are summarized in Table 1.

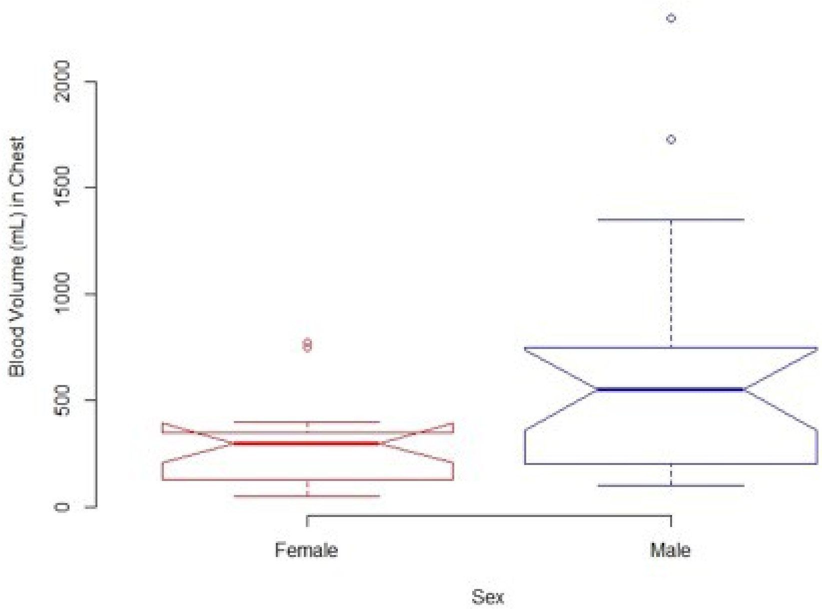

Figure 1. Amount of blood in the chest in milliliters (mL) of 36 wolves killed by shotgun via helicopter. This amount was greater in males (n=21) than in females (n=15).

Table 1. Breakdown of presumed fatal permanent wound tracts (or killing shots) of 36 wolves killed by shotgun via helicopter by anatomic location. C refers to the cervical vertebrae and the number indicates the specific cervical or neck vertebra(e) surrounding the area of spinal cord damage.

<table>
<tr><th colspan="2">Chest</th><th>Head</th><th>Neck</th><th>Unknown</th><th>Total</th></tr>
<tr><td>lung
9 (43%)</td><td>heart
12
(57%)</td><td rowspan="2">2 (5.6%)</td><td>C1-C3 (6); C4-C6(4); C7-T1 (2)</td><td rowspan="2">1 (2.8%)</td><td rowspan="2">36</td></tr>
<tr><td colspan="2">Total chest: 21 (58.3%)</td><td>Total neck: 12 (33.3%)</td></tr>
</table>

Discussion

This report primarily focuses on the postmortem assessment of injuries and permanent wound tracts (i.e. the shot that likely killed the animal). Additional analyses of antemortem (i.e. before death) endpoints, such as the time to unconsciousness from video recordings would have provided valuable information for a more holistic approach to assessment of humaneness. Information on whether the shots fired hit the animal or were missed was not included within the assessment. A welfare index was not available in five cases and was recorded as categorical data in the others as opposed to a continuous variable solicited from a time-recording device. The elapsed time between shots was often recorded as zero, but is subject to speculation on human errors in recording as two or three shots were fired. It is likely that the crew that is focused on removal of wolves will have other focus and responsibilities that could impact accurate documentation of shots and time to unconsciousness or death. The presence of an additional observer who focuses entirely on recording and documenting the times of shots with a dedicated stop watch and/or access to video recordings would increase the robustness and oversight of the procedure, as has been done for the commercial seal hunt in Canada (Daoust et al. 2002).

In general, a shot to the head and upper cervical (neck) spinal cord (C1-C3) is considered to produce immediate unconsciousness and death. Injuries to the mid (C4-C6) or lower cervical spinal cord and cranial thorax (C7-T1), as well as the chest, may not produce immediate unconsciousness (Carbone et al. 2012). By those criteria, only 8/36 wolves or 22.2% would meet the highest level of "humaneness" utilized for recommended euthanasia techniques. However, shots to the chest and neck that can result in a time to unconsciousness of less than 180-300 seconds are generally accepted as "humane killing" when considering other forms of ground-based shooting or hunting (Hampton et al. 2014) and considering other methods of hunting that can have variability with up to 50% of animals not being killed instantly (Kestin 1995; Gregory 2005). In this analysis 35/36 or 97.2% of wolves met an "acceptable humaneness" criterion. However, it is likely that wolves shot in the chest without puncture of the heart may have had a more prolonged time to death than wolves shot in the chest with puncture of the heart, but this warrants further investigation. Attempts were made to investigate a potential relationship between the amount of blood/thoracic fluid within the chest and an approximate welfare index, the number of shots, and the number of punctures, but no significant statistical relationships were found. The hypothesis would be that the longer the time interval to death, the more blood may be present in the chest, which theoretically could provide a quantitative measure that could be utilized within an overall interpretation of humaneness. However, there are likely multiple factors resulting in variability in the volume of thoracic fluid recorded from the chest including sex, body size, and multiple freeze/thaw cycles. Males were found to have more fluid in their chest at necropsy than females, but the significance and cause of that finding are not known.

The majority (n = 35 or 97.2%) of wolves were shot with buckshot from a shotgun and multiple punctures were common with some instances where large wounds were present. Attempts at determining exit vs entry wounds were made, but were complicated by the presence of multiple punctures with shotgun injuries. All wolves that were shot had fatal injuries and were recovered from the field. Extensive non-fatal injuries, including rib, pelvic, and limb fractures, as well as abdominal damage, were also documented. In general, a wounding rate of 0% is considered ideal with rates of 0.4% reported in aerial removals of camels in Australia (Hampton et al. 2014), and 'crippling rates' of 18-50% in waterfowl and game bird hunting (Noer et al. 2007; Schultz et al. 2013).

Variability in shooters' skill in addition to environmental or wolf behavioural factors could result in non- fatal injuries as has been demonstrated in aerial removal programs for other species (Hampton et al. 2014). All wolves that were shot at were recovered in this case, making the use of lead shot less of a concern, but consideration for minimizing non-target exposure of scavengers to lead through the use of non-toxic ammunition should be included within standard operating procedures in the event that not all carcasses could be recovered and to account for stray ammunition. Specifications for use of non-toxic shot, as well as requirements for training and certification of staff and pilots to participate in aerial removals, are incorporated into United States Department of Agriculture (USDA) feral swine control programs (USDA 2012).

Multiple freeze/thaw cycles and prolonged periods without refrigeration likely contributed to autolysis and the presence of additional red-tinged fluid within body cavities and likely obscured subtle lesions. The sample size was low (n = 36) compared with similar analyses that examined 700 – 900 animals (Urquhart and McKendrick 2003; Hampton et al. 2014) and included less extensive antemortem animal welfare outcomes than were documented in other studies (Hampton et al. 2014).

Although published protocols and welfare assessments for lethal removal of wolves or related carnivores were not available in the peer-reviewed scientific literature, guidelines on euthanasia and humane killing of wild animals exist through the Canadian Council on Animal Care (www.ccac.ca/Documents/Standards/Guidelines/Wildlife.pdf) and the American Veterinary Medical Association (https://certifiedhumane.org/wp-content/uploads/2020-Euthanasia-Final-1-17-20.pdf). Although a gunshot to the head is often considered to be preferred for euthanasia or "good death" in many instances in veterinary medicine, a gunshot to the neck or chest can be considered humane killing and can be accepted as a method of dispatch in certain circumstances. There is also consideration by certain welfare experts that the logistics associated with shooting from a moving vehicle, such as a helicopter, may warrant a larger target than the head in order to avoid wounding and injuries (Hampton et al. 2014). The cited assessment from Australia leaned heavily on shooter training and experience being the most important for animal welfare outcomes in that particular study on aerial removal techniques. Consideration of cover was also mentioned in the Hampton et al. 2014 study, with the presence of woodland vegetation being associated with less desirable animal welfare outcomes. Consideration of terrain should be included within criteria of the shooter and pilot for when targeted wolf removal is initiated.

Given the animal welfare findings included within this veterinary assessment and comparison to similar evaluations and assessments, a number of recommendations are outlined as considerations for future aerial wolf removal programs within the Northwest Territories, including:

- Ensure aerial removal crews document accurate time to unconsciousness of all wolf kills. Consider the application of video recording as a complementary technique for this documentation.

- Ensure wolf carcass integrity by taking steps to minimize or eliminate freeze / thaw cycles during storage, and prior to, during and after skinning.
- Continue collection and archiving of scientific information and biological samples from all wolf carcasses to contribute to broader wolf sample programs in the NWT.
- Collaboratively develop standard operating procedures and guidelines for all aspects of aerial removal of wolves with input from experts in the field.
- Submit the Aerial Wolf Removal Procedures for review and approval to the NWT Wildlife Care Committee and allow for periodic audit by external experts.

As stated in the introduction, consideration of ethics, moral standards, and value judgements associated with use of lethal methods for wildlife management, including aerial removals via helicopter, are considered beyond the scope of this report.

Overall, the conclusion of this veterinary assessment on the humanness of the aerial wolf removal procedures utilized by the GNWT would meet criteria consistent with humane killing. To ensure any future aerial wolf removal programs are consistently conducted in a manner to maximize humaneness outcomes, further investigation and oversight of the procedures are recommended focused on scientific evaluation, collection and archiving of samples, and development of standardized protocols and procedures.

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Appendix

Wolf Injury Form

Location	Hemorrhage	Bruising	Fractures	Puncture wounds (exit = ex; entry = en)	Other
Head					
Neck					
L shoulder					
R shoulder					
L forelimb					
R forelimb					
L Flank (external)					
R Flank (external)					
Chest/Thorax (internal)					
Abdomen (internal)					
L hindlimb					
R hindlimb					
Tail					

Wolf Injury Documentation

NSR number ______________

Volume of blood in chest:

Volume of blood in abdomen:

Total number of bullet holes:

Likely killing shot/injury: