Ornithological Council Position Statement on the AVMA 2013 Guidelines on Euthanasia with regard to thoracic compression

Thoracic compression is a method of euthanasia[1] widely used by ornithologists when collecting small birds for museum specimens and tissue samples.[2] On occasion, thoracic compression is also used to euthanize some small birds that have been inadvertently injured during research manipulations and that cannot be treated with first aid or veterinary care. Ornithologists use thoracic compression because it causes loss of consciousness in a few seconds and death ensues very rapidly thereafter and because it has long been recognized, based on decades of experience, that it is humane and certainly the most humane method available in many situations.

The American Veterinary Medical Association (AVMA), which until 2013 classified thoracic compression as "conditionally acceptable" has released its updated (2013) euthanasia guidelines and has now classified this method as unacceptable.

The AVMA's revised classification of thoracic compression will have a very serious impact on ornithological research because the Public Health Service (including the National Institutes of Health), the National Science Foundation, and other federal grant-making agencies require adherence to the AVMA Guidelines on Euthanasia. To inform these grant-making agencies and the IACUCs who review research protocols that call for the use of thoracic compression, and to address concerns that have been raised and to clarify these issues, the Ornithological Council, with the assistance of numerous ornithologists who are highly experienced in the use of this method, has developed this position statement and an accompanying fact sheet.

Availability of data and publications

The AVMA admitted in a 2001 publication that it had no data upon which to determine the degree of distress and the time to loss of consciousness and death: "To date, there is a lack of research into the merits and demerits of thoracic compression."

In 2007, the AVMA guidelines stated, without qualification, that the advantages of thoracic compression are "(1) This technique is rapid. (2) It is apparently painless." For disadvantages, the 2007 guidelines stated only that, "(1) It may be considered aesthetically unpleasant by onlookers. (2) The degree of distress is unknown." The AVMA concluded at that time that thoracic compression was conditionally acceptable.

A comment submitted to the AVMA by a research veterinarian who is a member of the Association of Avian Veterinarians, the American Association of Wildlife Veterinarians, and the American Association of Zoo Veterinarians supports the conclusion that the AVMA had no data in 2013 with which to assess thoracic compression: "Based on literature search I can find no evidence for or against thoracic compression [as a form of euthanasia] in avian species." The absence of hard data that thoracic renders these small animals unconscious in a time-frame consistent with the expectations for euthanasia does not mean it doesn't occur, but rather that supporting data are simply not available.

In fact, the AVMA did have new evidence in the form of empirical data submitted by ornithologists that support the contention that this method is as rapid and humane as other methods approved by the AVMA in 2013. The ornithological community acknowledges that there are no data resulting from studies that used instrumentation (such as an EEG or visual evoked potentials) to measure brain activity to support the contention that thoracic compression is humane, or at least as humane as other methods considered by the AVMA to be acceptable or acceptable with conditions. The Ornithological Council submitted empirical observational data, but the AVMA chose to disregard those data for unstated reasons and cited no empirical evidence to the contrary. Thus, the only empirical evidence available supports the conclusion that thoracic compression is at least as humane as CO_2 , a method considered to be "acceptable with conditions" by the AVMA. That evidence comprises a consensus view of five ornithologists who have had cumulative decades of experience in the use of this method:

The consensus among the five researchers was that birds weighing less than 100 g were typically unconscious within 5 seconds after beginning thoracic compression and dead within 15-20 seconds. Birds between 100-250 g were unconscious within 10-20 seconds and verifiably dead within 20-60 seconds. More confidence was associated with the time estimates for smaller birds, and less confidence in estimates and greater variation in bird response were described for larger birds.

The Ornithological Council in late 2012 requested a research proposal from a leading research veterinarian to generate data measuring brain activity to evidence loss of consciousness to determine if these assertions are, in fact, correct. That study has not yet been conducted; we hope it will be completed by the end of 2013.

The "literature" cited by the AVMA in the 2013 Guidelines to support the change in the classification of thoracic compression is lacking in data of any kind.[3] We appreciate the concerns raised by veterinarians and have addressed them in the fact sheet that accompanies this position statement.

<u>Comparison with CO_2 and other AVMA-approved methods of euthanasia or classified by the AVMA as "humane killing"</u>

This rapidity of loss of consciousness resulting from thoracic compression compares favorably to that resulting from the use of carbon dioxide. According to the AVMA's 2013 guidelines, which classify CO_2 as acceptable with conditions:

> "time to unconsciousness with CO_2 is dependent on the displacement rate, container volume, and concentration used. In rats, unconsciousness is induced in approximately 12 to 33 seconds with 80 to 100% CO_2 and 40 to 50 seconds with 70% CO_2 (Kohler, 1998; Coenen, 1995). Similarly, a rapidly increasing concentration (flow rate > 50% of the chamber volume per minute) induces unconsciousness in only 26 to 48 seconds (Burkholder, 2010; Niel, 2006; Hackbarth, 2000; Smith, 1997; Hewett, 1993). Leake and Waters (1929) found that dogs exposed to 30% to 40% CO_2 were anesthetized in 1 to 2 minutes. For

> cats, inhalation of 60% CO_2 results in loss of consciousness within 45 seconds, and respiratory arrest within 5 minutes (Glen, 1973). For pigs, exposure to 60 to 90% CO_2 causes unconsciousness in 14 to 30 seconds (Dalmau, 2010b; Martoft, 2002; Raj, 1997, 1996) with unconsciousness occurring prior to onset of signs of excitation (Dalmau, 2010b; Forslid, 1987)."

Prior to loss of consciousness, animals exposed to CO_2 exhibit a number of reactions that indicate pain or distress. Among these, according to the AVMA, are irritation to the mucosal and ocular membranes, air hunger or gasping for air, increase in stress hormones, fear, and various aversive behaviors.[4]

Notwithstanding abundant proof that it causes pain and distress, and notwithstanding the fact that it can take far longer – depending on initial concentration and fill rate –to render an animal unconscious than does thoracic compression, CO_2 earned an "acceptable with conditions" rating, even where alternatives such as inhalants and injectable substances are readily available, as would be the case in research laboratories and clinical settings. However, where there is no evidence other than the unsupported statements of panel members and others, as contradicted by the expertise of those who actually use the method, and where alternatives are few, if any, the AVMA deemed thoracic compression unacceptable. The only reasonable conclusion is that the AVMA guidelines are, in this regard, arbitrary and inconsistent.

The same inconsistency is found in the AVMA's discussion of kill traps, some of which kill by suffocation. The AVMA states that kill traps do not meet the AVMA criteria for euthanasia but may be considered humane killing, and recognizes that they are practical and effective for "scientific animal collecting." The AVMA includes as "found to meet standards for certain species" one trap for which mean (+/- SE) estimated times to loss of consciousness and heartbeat were < or = 55 sec and 305 (+/- 8) sec, respectively after firing the trap; this study confirmed that the trap can be expected to render > or = 70% of captured fishers irreversibly unconscious in < or = 3 min ($p < 0.05$) (Proulx and Barrett 1993). The trap described in another paper cited in this context had similarly long duration: "The C120 Magnum trap, equipped with a 66 x 69 mm pan trigger, which favored double strikes in the neck and thorax regions, successfully killed nine of nine wild mink (*Mustela vison*) in simulated natural conditions. Average times to loss of consciousness and heartbeat were estimated at less than 72 (+/- 24) sec and 158 (+/- 48) sec, respectively, after firing of the trap. This study confirmed that the C120 Magnum trap can be expected to render greater than 79% of all captured mink unconscious in less than or equal to 3 min ($p <$ than 0.05)" (Proulx et al. 1990). These times – along with the reported times in other papers cited by the AVMA as reaching "the required level of efficacy" far exceed the times reported for thoracic compression, yet thoracic compression was not deemed to be a means of humane killing.

It is also interesting to note that these studies cited to support the determination on kill traps relied on observational data and not measurement of brain activity to determine loss of consciousness. These observations – loss of corneal and palpebral reflexes – were similar to the observations made by ornithologists of physiological changes in birds to determine loss of consciousness.

It is also worth noting that the AVMA deemed decapitation to be acceptable with conditions notwithstanding the fact that a study that measured brain activity demonstrated that a pattern of brain activity ordinarily associated with alert wakefulness occurs for 8 – 29 s following decapitation (Mikeska and Klemm 1975). Though the meaning of this observation has been debated for many years, a 2010 paper published in the Journal of the American Veterinary Medical Association stated that, "viewed *in toto*, the almost inescapable conclusion is that decapitation is a painful procedure and that conscious awareness may persist for up to 29 seconds in the disembodied heads" (Bates 2010). The AVMA acknowledged in the 2013 Guidelines that the interpretation of this evidence is not yet resolved and stated that decapitation "appears" to induce rapid loss of consciousness. Despite this uncertainty and lack of consensus that the method is humane, the AVMA determined that decapitation is acceptable with conditions.

Availability of alternatives

The AVMA stated that, "The consensus of veterinarians with field biology training and expertise is that portable equipment and alternate methods are currently available to field biologists for euthanasia of wildlife under field conditions, in accordance with current standards for animal welfare."

The same can be said for the use of CO_2 in the laboratory setting, and yet the AVMA deemed CO_2 acceptable with conditions. The same could be said of kill traps. A live trap could be used and the animal euthanized with alternate methods and yet the AVMA deemed the use of kill traps to be "humane killing." The availability of more humane alternatives is not a criterion used by the AVMA with regard to methods of euthanasia other than thoracic compression.

Of greater concern, though, is a misleading statement by the AVMA about the availability of the supposed alternatives. The 2013 guidelines state that, "Anesthetics can be administered prior to application of thoracic compression. Depending on taxa, open-drop methods that do not require DEA* registration can be used."

*Drug Enforcement Agency; this registration is required for access to controlled substances such as narcotics.

It is true that certain substances such as isoflurane and sevoflurane are not regulated at the federal level, i.e., by the DEA. However, as the AVMA certainly knows, they are regulated at the state level and therefore available only to state-licensed physicians. Thus, a veterinarian must be willing to obtain it and provide it to the ornithologist for use in field research. Some states restrict the use of substances by licensees to situations where a Veterinary-Client-Patient Relationship exists. According to the AVMA, this relationship is established only when "the veterinarian has sufficient knowledge of the animal(s) to initiate at least a general or preliminary diagnosis of the medical condition of the animal(s). This means that the veterinarian has recently seen and is personally acquainted with the keeping and care of the animal(s) by virtue of an examination of the animal(s), or by medically appropriate and timely visits to the premises where the animal(s) are kept. The veterinarian is readily available, or has arranged for emergency coverage, for follow-up evaluation in the event of adverse reactions or the failure of the treatment regimen." Of course, these conditions are essentially inapplicable to most field

research or to the methods of euthanasia used in the context of field research, but as it is a legal restriction in some states, veterinarians in those states may be unwilling to provide it to field researchers.

In some states, the license restricts the use of the substance to a particular location, making it impossible to use the substance legally at a field site. In some countries, inhalants are not available to anyone but licensed physicians and veterinarians, who are not permitted to supply it to others. Some inhalants, including isoflurane, cannot be carried on aircraft or are highly restricted. Researchers who use CO_2 may face similar obstacles. Both U.S. domestic and international air transport shipping regulations consider CO_2-filled cylinders to be a dangerous good requiring specialized training, packaging, and labeling; pilots are given the discretion to refuse to allow this material on board the aircraft.

Veterinarians often refuse to give controlled substances to researchers, particularly for off-label use, due to the Animal Medicinal Drug Use Clarification Act restrictions and out of concern for potential abuse. Some IACUCs and universities will refuse to allow the use of controlled substances unless a veterinarian is present, but few veterinarians are willing and available to accompany researchers into the field on a regular basis. These substances frequently cannot be carried legally into other countries. In fact, the Food and Drug Administration now requires the use of a separate registration for each location where veterinarians store, distribute, or dispense controlled substances. The AVMA is certainly aware of this situation as it is lobbying Congress for a change in this law [https://www.avma.org/news/pressroom/pages/AVMA-Lauds-U.S.-Representatives-on-Bill-to-Amend-the-Controlled-Substances-Act.aspx].

For these reasons, the AVMA assertion that the consensus of veterinarians with field biology training and expertise that alternatives are readily available is contradicted by the facts and by AVMA's own policy and therefore lacks credibility.

The AVMA has not precluded the use of thoracic compression

After considering concerns submitted by the Ornithological Council and the American Society of Mammalogists in response to the draft version of the 2013 AVMA Guidelines on Euthanasia, the AVMA in 2011 issued a backgrounder [https://www.avma.org/KB/Resources/Backgrounders/Documents/thoracic_compression_bgnd.pdf] acknowledging that, "In the absence of empirical evidence, thoracic compression cannot be assumed to reliably produce a rapid death or one with minimal suffering, and is thus not deemed to be a method of euthanasia at this time. *However*, thoracic compression should not be prohibited where its use is necessary to minimize animal suffering or is scientifically justified (such as under the oversight of an Institutional Animal Care and Use Committee)." It is unfortunate that the AVMA does not reference its own publication in the 2013 Euthanasia Guidelines.

The IACUC may approve a "deviation" from the ILAR Guide when scientifically justified

We take this opportunity to remind IACUCs that the ILAR Guide statement with regard to euthanasia expressly includes the current edition of the AVMA Guidelines and it is a "should"

statement: “Unless a deviation is justified for scientific or medical reasons, methods should be consistent with the AVMA Guidelines on Euthanasia.” According to OLAW < http://grants.nih.gov/grants/olaw/departures.htm> a deviation from a “should” statement, if approved by the IACUC because it is scientifically justified or for a veterinary or animal welfare reasons, is a departure and must be reported to the Institutional Official but not to OLAW.

In other words, neither the Guide nor OLAW prohibits the approval by an IACUC of the use of thoracic compression, where scientifically justified.

Conclusion

Thoracic compression is humane and often the most humane alternative available for certain kinds of research and in certain situations. Notwithstanding the AVMA’s unfortunate and unsupported determination, its use should not be limited when it is the most humane alternative available (as detailed in the accompanying fact sheet) or the most practical among available humane methods.

Literature cited

Bates, G. 2010. Humane issues surrounding decapitation reconsidered. Journal of the American Veterinary Medical Association 237:1024-1026.

Mikeska J.A and W.R. Klem. 1975. EEG evaluation of humaneness of asphyxia and decapitation euthanasia of the laboratory rat. Lab Animal Science 25:175–179

Proulx, G. and M. Barrett. 1993. Evaluation of the Bionic® trap to quickly kill fisher (*Martes pennanti*) in simulated natural environments. Journal of Wildlife Diseases 29:310-316.

Proulx, G., M. Barrett, and S. Cook. 1990. The C120 Magnum with pan trigger: a humane trap for mink (*Mustela vison*). Journal of Wildlife Diseases 26:511-517.

NOTE: We do not give the full citations for the papers in material quoted from the AVMA Guidelines because we do not question the underlying sources cited by the AVMA in support of its statement. We quote the text from the AVMA guidelines to delineate the metrics upon which the AVMA classifications are based and to demonstrate that the conclusions reached are inconsistent. The full text and citations can be obtained from the AVMA Guidelines on Euthanasia.

****

[1] Euthanasia literally means “good death.” The Animal Welfare Association regulations state that, “*Euthanasia* means the humane destruction of an animal accomplished by a method that produces rapid unconsciousness and subsequent death without evidence of pain or distress, or a method that utilizes anesthesia produced by an agent that causes painless loss of consciousness and subsequent death.” However, the AVMA 2013 guidelines make a distinction based on the

purpose for ending life, regarding euthanasia as both a means to end suffering and a matter of humane technique. In wildlife research, euthanasia may be used to end suffering but some studies entail the killing of a healthy animal for research purposes, including taxonomic studies that require an intact carcass for a museum specimen and the study of wildlife disease. We disagree with the construct employed by the AVMA and assert that the Animal Welfare Act definition, which represents the legal standard, is the appropriate definition. The purpose is irrelevant both legally and biologically. It matters not to the animal why it its life is ending and the humaneness of the method does not vary based on the purpose for its use. Therefore, we use the term euthanasia to refer to ethical and humane technique without regard to the purpose.

[2] The purposes for scientific collecting often involve very different concerns than those resulting from the need to euthanize an animal at the end of an experimental procedure. Birds are collected for specific purposes. They will become museum specimens (skins, fluid preserved, whole specimens, skeletons, or some combination of these) and are stored in research and teaching collections. Tissue samples are used for stable isotope analysis, disease screening, contaminant assessment, and genetic analysis. A given specimen or sample may be used decades or centuries after the specimen is collected; it is not possible to know all the analyses to which a sample may be eventually subjected. The goal is to maximize the usefulness of every bird collected. Compromising the physical integrity of the specimens is not acceptable. Therefore, chemical methods of killing are considered unacceptable unless it can be shown that an agent will not compromise or bias potential tissue analysis. Cervical dislocation cannot be used on very small birds because of the risk of decapitation, which will destroy the value of the specimen.

[3] The "literature" cited by the AVMA consists of:

- a letter to the Journal of the American Veterinary Medical Association by John Ludders, describing the physiological mechanism of thoracic compression, as described by the AVMA in its 2007 guidelines, and states that the method constitutes suffocation. Dr. Ludders fails to note that suffocation is also the mechanism of CO2. [AVMA Guidelines citation 413]

- a letter from the Association of Avian Veterinarians (AAV) stating that thoracic compression entails suffocation, but failing to recognize that this is also true with the use of CO_2. The letter offers no data or other evidence. It simply states an objection and proffers that a barbiturate overdose would be the preferred method, or failing that, cervical dislocation. It does not acknowledge that controlled substances are rarely available to field biologists; that cervical dislocation distorts the spine and often, especially with small animals, results in the separation of the head from the body of the animal and is simply inappropriate for the collection of specimens. [AMVA Guidelines citation 414]

- the euthanasia standards of the National Wildlife Rehabilitators Association (Miller 2000) which provide no evidence whatsoever to support the conclusion that thoracic compression is inhumane; the two pages about euthanasia consist of little more than two lists of methods. Further, these standards pertain to the practice of veterinary medicine in a clinic setting; that the animals treated happen to be wildlife does not make these

standards relevant to field biology which takes place in different and uncontrolled conditions and where veterinarians and controlled substances or other pharmaceutical agents are rarely available.

- a paper by Dr. Susan Orosz. [AVMA Guidelines citation 416]

  The entire text reads as follows:

  "Thoracic compression has been used historically for birds in the field (Gaunt, 1999) but this method of euthanasia is not recommended due to concerns about the efficacy, prolonged duration of the procedure, the potential for distress of the bird, and the perception of pain."

  The paper gives not one reference; not one scrap of data. It is a mystery how Dr. Orosz knew anything about the duration of the procedure or its efficacy given the statement by the AVMA about the absence of data. It seems unlikely that Dr. Orosz has had any experience with ornithological research in the field. Her credentials, though admirable, indicate no relevant experience. Dr. Orosz then recommends CO_2 or isoflurane and says that if not practical, use barbituates. However, she admits, "The availability of controlled drugs is often limited for personnel performing avian euthanasia under field and some other circumstances, and this can limit the use of this method." She also neglected to recognize the prolonged duration of the procedure, the potential for distress, and the perception of pain resulting from the use of CO_2.

[4] Quoted directly and in entirety from the draft AVMA guidelines:

> Carbon dioxide may cause pain due to the formation of carbonic acid when it contacts moisture on the respiratory and ocular membranes. In humans, rats and cats most nociceptors begin to respond at CO2 concentrations of approximately 40% (Chen, 1995; Peppel, 1993; Thurauf, 1993; Anton, 1991). Humans report discomfort begins at 30 to 50% CO2, and intensifies to overt pain with higher concentrations (Feng, 2003; Thurauf, 2002; Danneman, 1997).
>
> Inhaled irritants are known to induce a reflex apnea and heart rate reduction, and these responses are thought to reduce transfer of harmful substances into the body (Widdicombe, 1986). In rats, 100% CO2 elicits apnea and bradycardia, but CO at concentrations of 10, 25 and 50% do not (Yavari, 1996), suggesting gradual displacement methods are less likely to produce pain prior to unconsciousness in rodents.
>
> Carbon dioxide has a key role as a respiratory stimulant, and elevated concentrations are known to cause profound effects on the respiratory, cardiovascular and sympathetic nervous systems (Moosavi, 2003; Millar, 1960; Nahas, 1960). In humans, air hunger begins at concentrations as low as 8% and this sensation intensifies with higher concentrations, becoming severe at approximately 15%. (Liotti, 2001; Dripps, 1947; Hill, 1908). With mild increases

in inspired CO2, increased ventilation results in a reduction or elimination of air hunger, but there are limits to this compensatory mechanism such that air hunger may reoccur during spontaneous breathing with moderate hypercarbia and hypoxemia (Banzett, 1996; Shea, 1996; Fowler, 1954). Adding O2 to CO2 may or may not preclude signs of distress (Kirkden, 2008; Danneman, 1997; Coenen, 1995; Hewett, 1993). Supplemental O_2 will, however, prolong time to hypoxemic death and may delay onset of unconsciousness.

Although CO2 exposure has the potential to produce a stress response, interpretation of the subjective experiences of animals is complicated. Borovsky (1998) found an increase in norepinephrine in rats following 30 seconds of exposure to 100% CO2. Similarly, Reed (2009) exposed rats to 20 to 25 seconds of CO, which was sufficient to render them recumbent, unconscious, and unresponsive, and observed 10-fold increases in vasopressin and oxytocin concentrations. Indirect measures of sympathetic nervous system activation, such as elevated heart rate and blood pressure, have been complicated by the rapid depressant effects of CO2 exposure. Activation of the hypothalamic pituitary axis has also been examined during CO2 exposure. Prolonged exposure to low concentrations of CO2 (6 to 10%) has been found to increase corticosterone in rats (Raff, 1988; Marotta, 1976) and cortisol in dogs (Raff, 1983).

In humans, a single breath of 35% CO2 was found to result in elevated cortisol concentrations and exposure was associated with an increase in fear (Argyropoulos, 2002). It has been suggested that responses to systemic stressors associated with immediate survival, such as hypoxia and hypercapnia, are likely directly relayed from brainstem nuclei and are not associated with higher order CNS processing and conscious experience (Herman, 1997). In fact, Kc et al. (2002) found that hypothalamic vasopressin-containing neurons are similarly activated in response to CO2 exposure in both awake and anesthetized rats. As stated previously, assessment of the animal's response to inhaled agents, such as CO2, is complicated by continued exposure during the period between loss of consciousness and death.

Distress during CO exposure has also been examined using behavioral assessment and aversion testing. Variability in behavioral responses to CO2 has been reported for rats and mice (Burkholder, 2010; Niel, 2006; Hackbarth, 2000; Smith, 1997; Coenen, 1995; Blackshaw, 1988; Britt, 1987; Hornett, 1984), pigs (Jorgman, 2000; Raj, 1996; Raj, 1995; Troeger, 1991; Dodman, 1977), ducks (Gerritzen, 2006) and poultry (Gerritzen, 2007; McKeegan, 2007; McKeegan, 2006; Abeyesinghe, 2000; Gerritzen, 2000; Lambooij, 1999; Raj, 1996). While signs of distress have been reported as occurring in animals in some studies, other researchers have not consistently observed these effects. This may be due to variations in methods of gas exposure and types of behaviors assessed, as well as strain variability.

Using preference and approach-avoidance testing, rats and mice show aversion to CO2 concentrations sufficient to induce unconsciousness (Leach, 2002a, 2002b), and are willing to forgo a palatable food reward to avoid exposure to CO2 concentrations of approximately 15% and higher (Makowska, 2009; Niel, 2007) after up to 24 hours of food deprivation (Kirkden, 2008). Mink will avoid a chamber containing a desirable novel object when it contains 100% CO2 (Cooper, 1998). In contrast to other species, a large proportion of chickens and turkeys will enter a chamber containing moderate concentrations of CO (60%) to gain access to food or social contact (Webster, 2004; Gerritzen, 2000; Raj, 1996). However, following incapacitation and prior to loss of consciousness, birds in these studies show behaviors that may be indicative of distress such as open-beak breathing and head-shaking. Regardless, it appears that birds are more willing than rodents and mink to tolerate CO2 at concentrations that are sufficient to induce loss of posture, and that loss of consciousness follows shortly afterwards.