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Baiting and feeding
mammalian game species:
current practices in North
America and Europe

MSc thesis

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Foreword

November 2020. I was hunting roe deer with my brother-in-law and his friend on their family's farm near the lake of Øyeren, Norway. As the hunting season was coming to an end, we decided to spend a few weekends to harvest the farm's quota of two animals. We applied a combination of stalking and driven hunts, but the deer were able to catch our scent at every turn. We would often catch a glimpse or hear the animals as they maneuvered through the forests and hills, graciously evading us at every attempt. After many failures and hours in the rain and cold, one last effort was made before I had to return for exams at the university. As the sun set, the roe deer would often graze on the pastures where sheep had been kept in the summer. This is where I decided to wait as the night closed in. I was sitting at the foot of an old hardwood tree, slightly covered by some of its lowest branches. Legal shooting hours were soon over. Being dressed for a driven hunt, I was getting cold by the lack of movement, and I lost track of time. The moment I decided to put down my rifle to get some warmth in my hands, a doe and her offspring, a young buck, came wandering silently onto the pasture just in front of me. The doe was roughly 10 meters behind the buck to the left. I had a clear shot on the buck. As I gathered my wits, the animal became aware of me, facing my location with its broadside. The perfect scenario. It looked at me for what seemed to be an eternity, as I aimed the crosshair slightly behind and below its shoulder. The sound of a single shot filled the otherwise dead-silent landscape, and the buck fell. Bright, pink blood from its nostrils. Heart or lungs. A truly beautiful animal that provided an excellent challenge, and several fine meals. However, I was suddenly struck by the feeling that I had exploited the animal's need to forage. I guess the pasture in which I decided to still-hunt would be considered "the result of normal agricultural practices" in North American hunting regulations, and as such, it would not be considered baiting. Yet, it provided me with many philosophical moments of thought, after which I have concluded that the animal was indeed granted a fair chase. I am thankful for the opportunity to write my master's thesis about something as interesting and important as these topics.

I would like to sincerely thank Andreas Zedrosser, Jon Swenson, and Michael Schneider for providing excellent guidance throughout the course of this thesis. Just as sincerely, I would like to thank every participant in the survey, for taking their valuable time in providing us with the information that made this thesis possible. The sincerest thanks to the love of my life, Marit, and our son, Einar, for keeping me motivated (and tired) all the way.

Abstract

It is commonly stated in the scientific literature that baiting and feeding are widespread wildlife management practices. However, it is difficult to determine exactly how widespread these management practices are, and what exactly falls under the definitions of baiting and feeding. Laws and regulations vary greatly between countries and are often changed or adapted within a country. The aim of this thesis is to obtain an overview on the current practices of baiting and feeding mammalian game species in North America and Europe. I reviewed the hunting regulations available online for all states, provinces and territories in the USA and Canada (i.e., North America), and sent an email questionnaire survey aimed at understanding regulations on baiting and feeding of wildlife to researchers and wildlife managers in all European countries. Current practices in North America and Europe range from general bans of all baiting and feeding, to baiting and feeding of selected species under certain circumstances, to generally allowing baiting and feeding of a wide selection of species, with a wide selection of baiting and feeding materials. Most ADs in North America and most European countries allow some hunting over bait. However, there is tremendous variation regarding both regulations and which species are allowed to be baited. Similar variation is also observed in relation to supplementary feeding, which is legal in one form or another in most ADs in North America and in most European countries. In comparison, diversionary feeding is generally not mentioned in the North American hunting regulations, while respondents from 16 European countries reported that diversionary feeding is practiced in their country. Baiting and feeding wild animals are widespread management practices, despite a considerable body of scientific evidence suggesting that the consequences remain poorly understood.

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Introduction

Practically all human activities have the potential to affect wildlife either positively or negatively (Steidl & Powell, 2006). On a global scale, biodiversity is still declining, even after considerable conservation efforts over the last century (Pascual et al., 2021). Changes in land-use, fragmentation of habitats, overharvesting, introduced or invasive species, and pollution is threatening 25% and 13% of all mammal and bird species, respectively (Tilman et al., 2017). Many animal populations suffered a decline in the wake of early industrialization (Gallo & Pejchar, 2016), but the late 19th and early 20th centuries marked a notable shift from exploitation of natural resources towards conservation, as modern wildlife management emerged (Decker et al., 2012). The unregulated harvest by early settlers and depletion of wildlife resources can be seen as the main drivers behind the North American Model of Wildlife Conservation (the North American Model, NAM) in its infancy (Heffelfinger et al., 2013; Mahoney & Jackson III, 2013). Although the validity of some of its principles has been questioned in later years, the model led to the successful conservation and management of wildlife in the U.S and Canada, where the hunter plays an important part (Mahoney & Jackson III, 2013; Organ et al., 2012). Europe has a more diverse system of species management and approaches, and this varies from country to country (Apollonio et al., 2010). However, the wildlife management and conservation initiatives in Europe have also been successful in the conservation of some species (Apollonio et al., 2010). High-density populations of especially large herbivore species are widespread today, and even considered locally overabundant in both North America and Europe (Apollonio et al., 2010; Carpio et al., 2021; Morellet et al., 2007). Through considerable conservation efforts and protective legislations, an estimated one-third of mainland Europe have one or more species of large carnivores, with stable or increasing abundance (Chapron et al., 2014).

Food provisioning of wildlife populations for various reasons, has commonly been and still is an important tool in wildlife management. People intentionally provide wildlife with food resources for management and recreational purposes around the world (Kirby et al., 2017; Murray et al., 2016), but they also provide food unintentionally, mainly in the form of garbage (Beckmann & Berger, 2003). Artificial feeding can be broadly defined as “placing natural or artificial food into the environment that supplements the food source contained naturally in the home range of a given wild species” (Dunkley & Cattet, 2003). This definition includes various types of and reasons for artificial feeding, such as 1) supplementary feeding, i.e. the provision

of food to increase physical or life-history features, such as the size of antlers and survival of young individuals in a population; 2) emergency feeding, i.e. the provision of food when natural food sources become scarce or inaccessible; 3) winter feeding, the offset of reduced availability of food due to winter conditions; and 4) intercept feeding / diversionary feeding, i.e., the provision of food in order to reduce damages to agricultural crops, livestock, or silviculture (Dunkley & Cattet, 2003). Both North America and Europe have a long history of providing supplementary food, especially for ungulates during the winter months, mainly in order to maintain viable populations of game animals for hunting, and at the same time avoid damages to crops, livestock, or forest plantations (Putman & Staines, 2004).

Baiting and feeding of wildlife are interrelated in the sense that they both involve the placement of food resources for the purpose of attracting animals. However, they are different regarding the underlying motives. A broadly accepted definition of baiting in the context of wildlife management is “the deliberate placing of natural or artificial food resources, scent lures, or decoys to attract wild animals to a certain area and retain them for a certain time” (Beringer et al., 2016; Dunkley & Cattet, 2003; Sorensen et al., 2014). Baiting is likely more limited in time, space, and volume, compared to artificial feeding. Bait is commonly used to trap furbearers (White et al., 2021), hunt big game (Cosgrove et al., 2018), view and photograph wild animals (Sorensen et al., 2014), distribute oral vaccines (Comte et al., 2013), poison introduced or invasive species (Kirkwood et al., 2014), and to capture wild animals for management or research purposes (Beringer et al., 2016; Dunkley & Cattet, 2003).

Among the ecological concerns that have been tied to both artificial feeding and baiting is the increased risk of disease transmission, by gathering animals at unnatural densities near feeding sites (Sorensen et al., 2014), intentional or unintentional increase of reproductive output and population size (Ballari et al., 2015), attracting non-target species to bait or feeding sites (Bowman et al., 2015; Candler et al., 2019), and altering migrational patterns (Jones et al., 2014). There are also concerns that wild animals may become habituated or “food-conditioned”, i.e., lose their natural wariness and associate humans with food (Woodroffe et al., 2005). This has the potential to be dangerous for humans, especially if large carnivores such as bears are involved (Kavčič et al., 2015; Steyaert et al., 2014).

Baiting and feeding remain controversial wildlife management practices (Sorensen et al., 2014). Some stakeholders consider hunting over bait to be in violation of the “principle of fair chase” by giving the hunter an advantage over the game that is perceived as unfair (DeBlaey,

2016). For example, a ballot initiative sponsored by citizens put an effective end to the use of dogs and bait for hunting of American black bears (*Ursus americanus*) in Oregon, 1994 (Boulay et al., 1999). A similar ballot initiative in Maine to end the use of dogs, traps, and bait for hunting American black bears, failed to achieve its goal in 2014 (Byrd et al., 2017). However, baiting is still considered a useful tool in some hunting regulations, such as in Pennsylvania, where other means of controlling the abundance of white-tailed deer (*Odocoileus virginianus*) has proven ineffective (PGC, 2021). Hunting of American black bears over bait is considered an effective and safe way to hunt, particularly in areas where other methods such as spot-and-stalk may not be suitable, e.g., near developed areas or in dense forests, as it grants the hunter a clear shot on a stationary target at close range (Hristienko & McDonald, 2007). In Sweden, brown bears (*U. arctos*) were hunted over bait until the year 2000, but the practice was banned in 2001, mainly due to the fear of increasing the amount of “problem bears”, and elevating the potential for encounters and thereby conflicts with humans (Zedrosser et al., 2013).

Steyaert et al. (2014) noted the lack of a consensus among researchers on whether supplementary feeding can have its desired effects. In a review of the current literature on diversionary feeding bears, Garshelis et al. (2017) reported a lack of information on the effectiveness of the method as a means of reducing conflicts with humans. The scientific literature often states that baiting and feeding of wild animals are widespread management practices (Jones et al., 2014; Putman & Staines, 2004; Sorensen et al., 2014). Since laws and regulations constantly change, it can be difficult to get an impression of just how widespread these management practices are at any given time.

The main aim of this thesis is to gather information on the practices of baiting and feeding of mammalian game species in North America and Europe. Specifically, I investigate 1a) in which administrative divisions of North America (ADs from now on) and European countries is baiting for hunting purposes allowed, 1b) which species are allowed to be baited, 1c) what is the background for either allowing or prohibiting the use of bait, and 1d) which bait materials can be used. I further investigate 2a) in which ADs or countries is supplementary feeding allowed, 2b) which species can be provided with supplementary food, and 2c) what is the background for either allowing or prohibiting supplementary feeding? Furthermore, I investigate 3a) in which ADs or countries diversionary feeding being practiced, 3b) which species can be provided diversionary food, 3c) and what are the reasons for allowing diversionary feeding?

Methods

Study areas

North America

The United States of America (USA) is the fourth largest country in the world, consisting of 50 individual states, and is characterized by its enormous natural variety (Lewis et al. (2022). Because of its size, the physical environments range from the high arctic to the subtropics, from rain forests to deserts, and from mountain peaks to prairies (Lewis et al. 2022). Although wildlife management covers a broad specter of species, the degree of attention a species receives largely depends on its legal status (e.g., game, nongame, endangered, etc.), jurisdiction (federal or state), as well as funding and relative priority (Organ et al., 2012). Canada shares 8,890 kilometers of its southern border with the USA and is the second largest country in the world (Hall et al. 2022). Vast areas of tundra, boreal forests, grasslands, and prairies characterize the country consisting of 10 provinces and 3 territories (Hall et al. 2022). The definition of wildlife, and thereby under which authority or jurisdiction it falls, depends on the part of Canada considered (Organ et al., 2012). However, large groups of species such as ungulates, waterfowl, furbearers, and birds, are considered the responsibility of professional wildlife managers everywhere in the country (Organ et al., 2012).

Authority over wildlife management in both USA and Canada is shared between their federal governments and each individual state, province or territory (Organ et al., 2012). In general, all wildlife conservation and management in North America is based upon seven key principles, which together constitute the NAM; “1) wildlife resources are a public trust, 2) markets for game are eliminated, 3) allocation of wildlife is by law, 4) wildlife can be killed only for a legitimate purpose, 5) wildlife is considered an international resource, 6) science is the proper tool to discharge wildlife policy, and 7) democracy of hunting is standard” (Organ et al., 2012). Being a foundational principle of the model, The Public Trust Doctrine aims to manage wildlife for the benefit of the common good (Hessami et al., 2021). Together with the concepts of public land (U.S) or Crown land (Canada), these concepts grant multiple groups of users access to government owned and managed lands for recreational or industrial activities (Hessami et al., 2021). Although these principles and concepts provides the foundation for how wildlife and habitats are managed, differences exist regarding funding, management practices and overall implementation of them (Organ et al., 2012). For each individual game species, the

season, bag limit, legal harvest means and methods, and areas in which seasons apply are clearly defined by laws in both the U.S and Canada (Organ et al., 2012).

Some of the most common mammalian game species in North America are American black bears, wolves, brown bears, cougars (*Puma concolor*), bobcats (*Lynx rufus*), coyotes (*Canis latrans*), moose (*Alces alces*), elk (*Cervus canadensis*), white-tailed deer, caribou / reindeer (*Rangifer tarandus*), mule deer (*Odocoileus hemionus*), and pronghorn antelope (*Antilocapra americana*), among others, as of the hunting regulations (Appendix 1).

Europe

Within its conventional borders, Europe encompasses 10 million km² of diverse climates, landforms, and geologic structures, with equally diverse cultures and countries (Windley et al. 2022). Although not applicable to all countries, the evolution of wildlife management in Europe can be seen spanning over 5 different eras; 1) prehistoric, 2) classic civilization (1000 B.C to 5000 A.D), 3) aristocratic hunting rights and exploitation of game (800 A.D to 1850), 4) conservation awareness and predator control (until 1950), and 5) the era of modern game management and nature conservation (Myrberget, 1990). Traditionally, wildlife management has been carried out by landowners or hunters, and in later years by authorities, such as the Ministry of Agriculture and Forestry or the Ministry of Environment (Myrberget, 1990). Terrain suitable for hunting is largely privately owned, but publicly available and government-owned lands are also common (Myrberget, 1990). The hunting rights generally belong to the owner (Myrberget, 1990). A common practice is that properties must be of a certain size if hunting is to take place, and the right to hunt may be leased out by the owner to individual hunters or organizations (Myrberget, 1990).

Some of the most common mammalian game species in Europe are red deer (*Cervus elaphus*), roe deer (*Capreolus capreolus*), moose, reindeer, fallow deer (*Dama dama*), Alpine chamois (*Rupicapra rupicapra*), mouflon (*Ovis orientalis musimon*), and wild boar (*Sus scrofa*), among others (Apollonio et al., 2010). Large carnivores such as brown bears and gray wolves (*Canis lupus*) are hunted to a varying extent throughout their distribution, usually with strict quotas during licensed hunts or limited culls, depending on their legal status in each country (Kaczensky et al., 2012).

Data collection

North America

Every state, province, and territory's (AD) Fish and Game Department (or corresponding branch of government) releases a digital document containing information on hunting regulations prior to the hunting season each year. They are meant to grant hunters, trappers, and fishermen quick access to the most relevant laws in a clear and concise manner, as well as to keep other interested parties updated on the most recent changes in the regulations. This information is available via official websites (Appendix 1). These hunting regulations often come with a disclaimer stating that they are not legal documents, but rather interpreted summaries of each administrative division's laws, and that current statutes may be obtained via local libraries. However, they provide solid information on legal harvest means and methods for the most common game species, and as such, were used for the purposes of this thesis. I collected data on hunting regulations in Canada and the USA via downloading every AD's hunting regulation and summarizing the information related to baiting and feeding of game species. Because the regulations sometimes were quite vague in relation to feeding of wildlife, I cross-validated the information on baiting and feeding of cervids in each AD with information from a survey conducted by the Chronic Wasting Disease Alliance in the autumn of 2021 (www.CWD-info.org, accessed 05.05.2022). The state of Hawaii was excluded from this review.

In this review, I did not consider any subspecies unless the information was included in the downloaded regulations. The regulations were clear and concise for the most important big game species, such as American black bears, brown bears, white-tailed deer, elk, and gray wolves. However, the legal hunting methods for "furbearers", i.e., species that are hunted and trapped mainly for their fur, were often less obvious and required some interpretation. The term "furbearer" includes species such as coyote, bobcat (*Lynx rufus*), American badger (*Taxidea taxus*), striped skunk (*Mephitis mephitis*), northern raccoon (*Procyon lotor*), etc. depending on the AD. There are regulations specifically for furbearers in every AD, where some furbearers may only be trapped, and others can be hunted as well. Some regulations state that furbearers may be hunted over bait, whereas others fail to mention this method at all. The wild boar is an introduced and invasive species in North America. It is usually not classified as game, and its legal means of harvest are not always explained thoroughly. Therefore, and for the purpose of

this thesis, I assumed that hunting of wild boar, coyote, or furbearers over bait is legal unless specifically stated otherwise, and if the AD does not have a general ban on baiting or feeding of wildlife. As a results of this, the information presented for the coyote and wild boar should be viewed with caution, especially in the cases where these are the only species listed as hunted over bait in an AD.

Further, when baiting and feeding is legal, this generally applies to private lands, although some ADs allow it on public lands. Activities such as baiting and feeding wild animals are never legal in national parks. There are also regulations on how far away bait sites must be from infrastructure and housing. There can be restrictions on baiting and feeding the individual species in certain areas within the same AD. To further complicate the matter, each AD has its own definition of “bait” and “baited area”, i.e., an area where food has been placed to lure animals into it. These nuances were highly complex and therefore not considered during this review. However, I included relevant information in footnotes.

Europe

Because not all European countries publish their laws and regulations in English or online, a survey was conducted to gather information on the regulations and current practices in relation to baiting and feeding mammalian game species (Appendix 2). The survey was created in Google Forms and emailed to researchers and managers in each European country. The survey period lasted from the beginning of November 2021 through March 2022. Contact with the recipients was established by reaching out to relevant persons by email, asking if they would be willing to participate in a survey. The aim was to gather at least 1 response from each country. The recipients were asked a series of questions related to baiting and feeding a selection of the most common mammalian game species in Europe. I took the liberty to answer the survey on behalf of my own country, Norway, as I am familiar with the language as well as the laws and regulations.

Some recipients reported uncertainties on some of the questions asked, which may affect the validity of the information gathered. However, most recipients were researchers and managers in the fields of ecology and wildlife management, or otherwise engaged in these fields. Therefore, the results should provide a good indication as to what is legal, illegal, and what is the current practice in each country.

Analytical methods

The data gathered during this review was entirely qualitative. As such, I decided not to apply any statistical tests, as there was no hypothesis to test. To provide an overview of the current situation, the results are presented as proportional values in figures, with the possibility for readers to have easy access to the tables upon which the results were based.

North America

To estimate the proportion of a species' distribution in which it can be hunted over bait, their distribution was documented according to whether information on a given species was available in each hunting regulation, e.g., legal status, open season, no open season, and if hunting over bait is legal or not. If no information was available, I assumed the species not to be present in the AD. Local variations within ADs were not considered, as each species may very well only be present in certain areas.

Europe

Each species' distribution was documented through the IUCN Red List (www.IUCNRedlist.org, accessed on 01.06.2022) to estimate the proportion of investigated countries in which hunting a given species over bait is legal. If the respondents did not explicitly inform that a species is hunted over bait, but the species is present in the country, it was treated as if hunting it over bait is illegal. Information on legal and management status for the large carnivores was retrieved from (Kaczensky et al., 2012). Although the information in this report is highly credible, it is now 10 years old. Therefore, legal and management status, and whether brown bears and gray wolves are hunted in the respective countries, may have changed since then. Legal status for other species were not considered, as this information is not always readily available or accessible.

Due to the large amount of information gathered, it was decided to report the results from a selection of the most common species for most European countries. The complete results from

the survey, with information on all species, bait, and feed materials, will be available for download online (Appendix 7).

Results

I systematically reviewed the hunting regulations for 62 ADs in North America. In addition, the survey yielded 35 responses from 33 European countries (Russia, Karelia, included as one of them). Respondents were mainly affiliated with universities (51% of respondents), research institutes (23%) and government agencies (17%). Detailed information for each North American AD can be found in Appendix 3 (Table 2). Detailed information for each European country with relevant comments from the respondents can be found in Appendix 4, 5, and 6 (Table 3, 4, and 5).

In North America, hunting over bait was generally prohibited in 15 (24% of the ADs reviewed) and the remaining 47 (76%) allowed hunting of at least one or more species over bait (Table 2, Figure 1). Respondents from 9 European countries (27%) reported that it was not legal to use bait for the hunting of game species, and the remaining 24 (73%) allowed hunting of at least one or more species over bait (Figure 1, Table 3).

In North America, the species most commonly hunted over bait is the wild boar (16 ADs, 73% of its reviewed distribution) followed by the coyote (38 ADs, 63%), white-tailed deer (30 ADs, 52%), American black bear (18 ADs, 33%), and gray wolf (9 ADs, 45%) (Table 2, Figure 2). Alaska is the only AD in which hunting the brown bear over bait is legal, and this can be done only in specific game management units (ADF&G, 2021). Eleven ADs seem to allow hunting furbearers over bait (footnotes, Table 2). In Europe, the species most commonly hunted over bait is the wild boar; present in 32 countries, and hunting over bait is allowed in 24 of these countries (75%) (Table 3, Figure 2). The next most common species hunted over bait was the red fox (*Vulpes vulpes*) (allowed in 21 countries, 64%), golden jackal (*Canis aureus*) (11, 50%), European badger (*Meles meles*) (13 countries, 39%), red deer (12 countries, 39%), gray wolf (8, 35%), and brown bear (6, 26%) (Table 3, Figure 2).

In North America, the regulations did not mention the background for allowing hunting over bait. However, the ADs that prohibit the method typically mentioned the spread of diseases (CWD, bovine tuberculosis, etc.), and fair chase. In Europe, respondents from 6 countries (67%) reported that hunting over bait was prohibited due to the principle of fair chase, one (11%) reported that it was to minimize the spread of diseases, especially for ungulates, one

(11%) reported uncertainty on the background, and one (11%) did not report any background (see Footnotes, Table 3).

Due to the vast amount of information and specific details, it was not possible to include the bait materials used for each species in North America. However, the topic is briefly discussed in the discussion. The most frequently reported bait material in Europe across the species investigated was maize / corn (*Zea mais*), followed by roots and vegetables, cereals, scent lures, wild game carcasses, processed food for livestock, wild fish carcasses, commercial fish carcasses, artificial salt licks and livestock carcasses (Table 1).

In North America, there was no information available on feeding cervids in 5 ADs (8%) (Table 2, Figure 1). Of the remaining ADs, 12 (19%) have a prohibition against feeding cervids, 13 (21%) had certain restrictions in time or space, and in the remaining 32 (52%) feeding cervids appeared to be completely legal (Table 2, Figure 1). Supplementary feeding was reported prohibited in 9 European countries (27%) and legal in the remaining 24 (73%) (Figure 1, Table 3).

In North America, the regulations generally did not specify which species of cervids that can be provided supplementary food, with a few exceptions (see Footnotes, Table 2). Some of the regulations mentioned specific restrictions on feeding bears, cougars, coyotes, and wolves (see Footnotes, Table 2). In Europe, the species most commonly reported to be provided supplementary feed was the red deer (23 countries) and roe deer (23), followed by fallow deer (17), wild boar (16), mouflon sheep (14), moose (10), gray wolf (7), brown bear (7), chamois (6), golden jackal (5), European bison (*Bison bonasus*) (5), and wild reindeer (4) (Figure 3, Table 3).

In North America, the hunting regulations generally did not mention the background for allowing supplementary feeding. However, the ADs that have restrictions typically mention the spread of diseases. Respondents from 5 European countries (56%) reported that supplementary feeding was illegal mainly to avoid population densities above the natural carrying capacity, and respondents from 4 countries (44%) that it was to minimize the spread of diseases (Table 4). The reported legal / practical background for allowing supplementary feeding varied extensively, and ranged from old-fashioned hunting laws, helping animal populations through harsh winters, maintaining viable populations of game animals, and reducing damages to agricultural crops or trees (see Footnotes, Table 4). When asked if brown bears attended

supplementary feeding sites for other species, respondents from 15 countries (46%) reported this to occur (Figure 5).

The North American hunting regulations did not mention diversionary feeding. Respondents from 16 European countries (50%) reported that diversionary feeding was practiced in their country (Table 5). The most commonly reported species to be provided diversionary food was the wild boar and red deer (14 countries), followed by roe deer (12), moose, Northern Chamois, brown bear (4), and gray wolf (2) (Figure 4).

Respondents from 21 countries (64%) reported that bait is used to vaccinate wild animal populations against disease in their country (Figure 5), mainly the red fox against rabies and wild boar against African swine fever. Respondents from 5 countries (15%) reported that bait is used to poison problem wildlife (Figure 5). Respondents from 30 countries (91%) reported that bait is used to capture wildlife for management or research purposes, mainly for the placing of GPS collars in studies on animal movement (Figure 5). Baiting animals for wildlife viewing or photography was reported legal by respondents from 15 countries (46%) (Figure 5).

Fourteen (48%) respondents reported that baiting or feeding wild animals is considered a controversial topic in their country (Figure 5). Twelve (38%) respondents reported that they see baiting or feeding wild animals as an important tool to successfully manage, hunt, trap, photograph, or experience wildlife (Figure 5). Thirteen (39%) respondents reported recent or ongoing changes in their country regarding baiting and feeding wild animals (Figure 5).

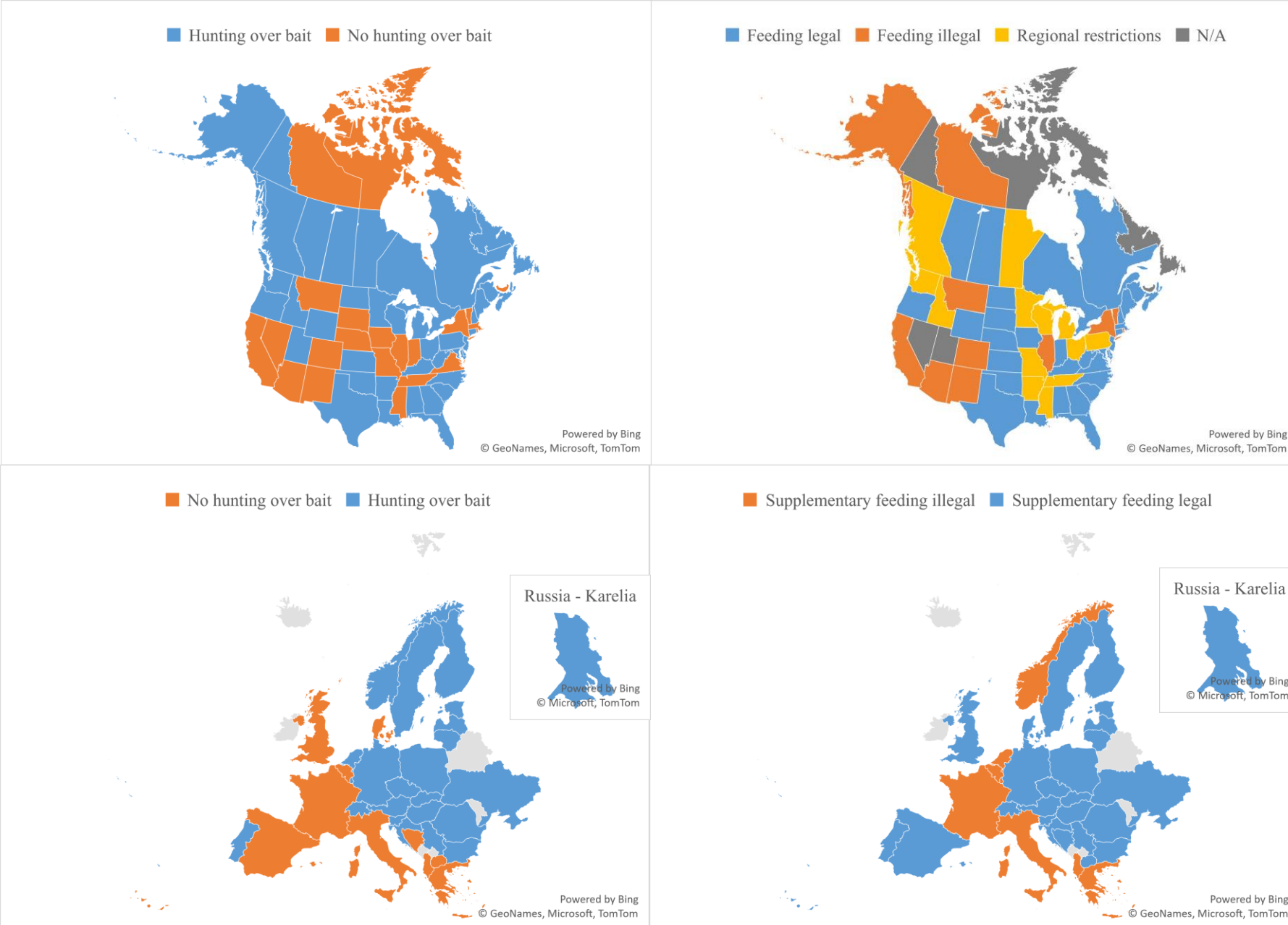


Figure 1 Results from a review of current hunting regulations in North America (USA, Canada) and a survey in Europe, illustrating where hunting over bait and supplementary feeding (cervids only for North America) is either legal or prohibited. Species investigated in North America: brown bear, American black bear, gray wolf, white-tailed deer, coyote, and wild boar. Species investigated in Europe: brown bear, gray wolf, golden jackal, wild boar, red fox, European badger, and red deer. Respondents to the survey that specified their province due to varying regulations: Austria (Carinthia / Kärnten), Belgium (Wallonia), Russia (Karelia), Slovenia (1; Dinaric Alps), Spain (Asturias and León), Switzerland (26 different Cantons, with different regulations).

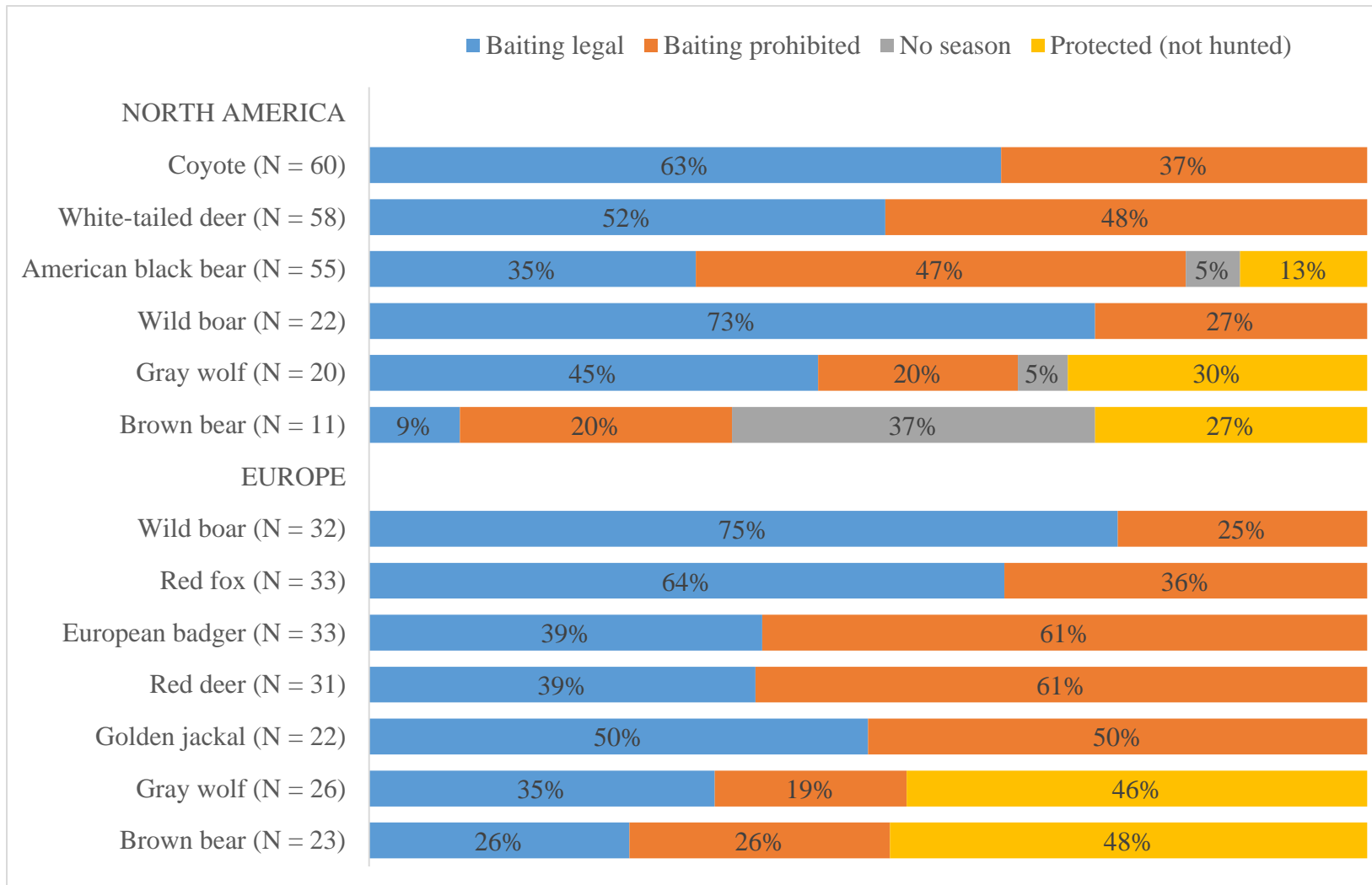


Figure 2 Results from a review of hunting regulations in North America (N) and a survey to European countries (N) on baiting and feeding mammalian game species, illustrating the proportion of the respective species' investigated distribution where hunting over bait is legal or prohibited, there is no season on the species, or the species is protected.

Table 1 Results from a survey in Europe on baiting and feeding mammalian game species, where 14 of the respondents were asked to report the species that may be hunted over bait and legal bait materials. Each number represents the number of times a species was associated with a given bait material in the survey.

Bait material	Brown bear	Gray wolf	Golden jackal	Red fox	European badger	Wild boar	Red deer	SUM
Maize	7	4	5	8	10	14	10	58
Roots / vegetables	5	4	5	7	9	14	9	53
Cereals	5	5	6	8	10	11	8	53
Scent lures	4	6	7	9	9	8	6	49
Wild game carcasses	5	8	9	10	8			40
Processed food (livestock)	3	5	5	7	7	6	4	37
Fish carcasses (wild / commercial)	5	6	6	8	7			32
Artificial salt licks						8	11	19
Livestock carcasses	3	5	4	5	2			19

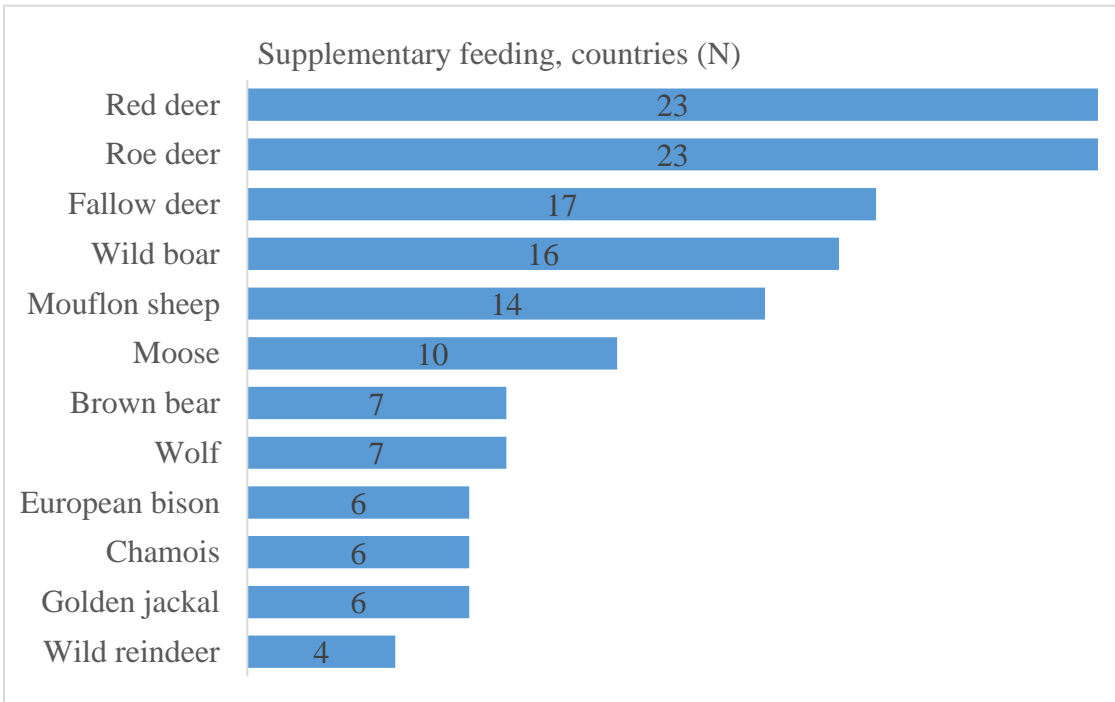


Figure 3 Results from a survey in Europe on baiting and feeding mammalian game species, where respondents were asked to report which species may be legally provided supplementary food.

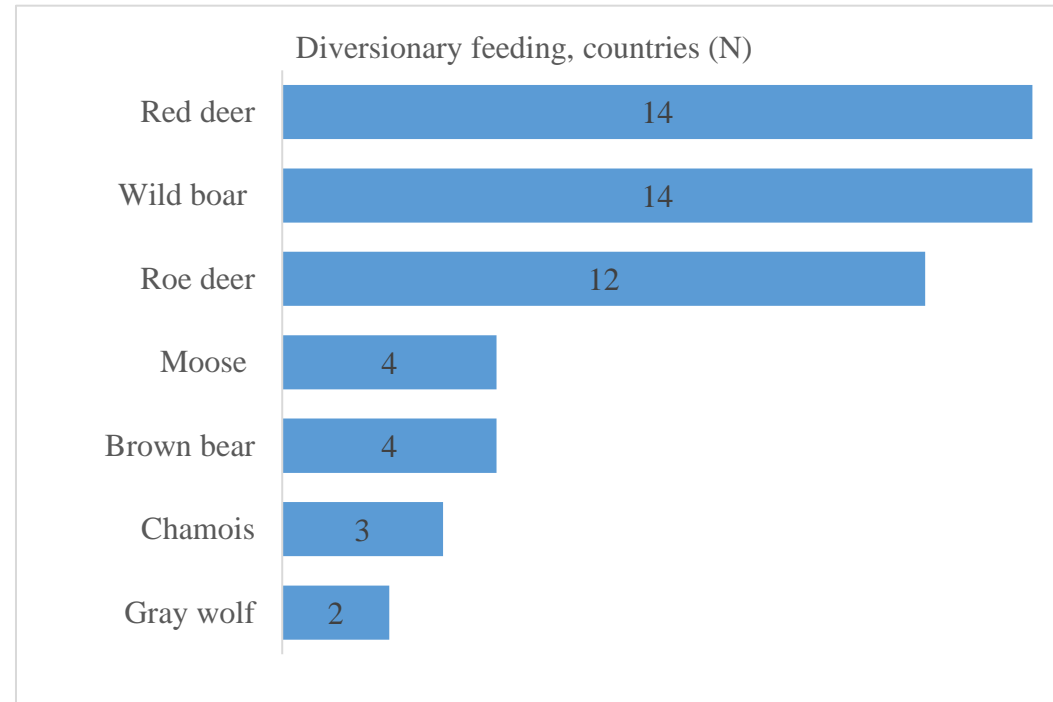


Figure 4 Results from a survey in Europe on baiting and feeding mammalian game species, where respondents were asked to report which species were provided diversionary food.

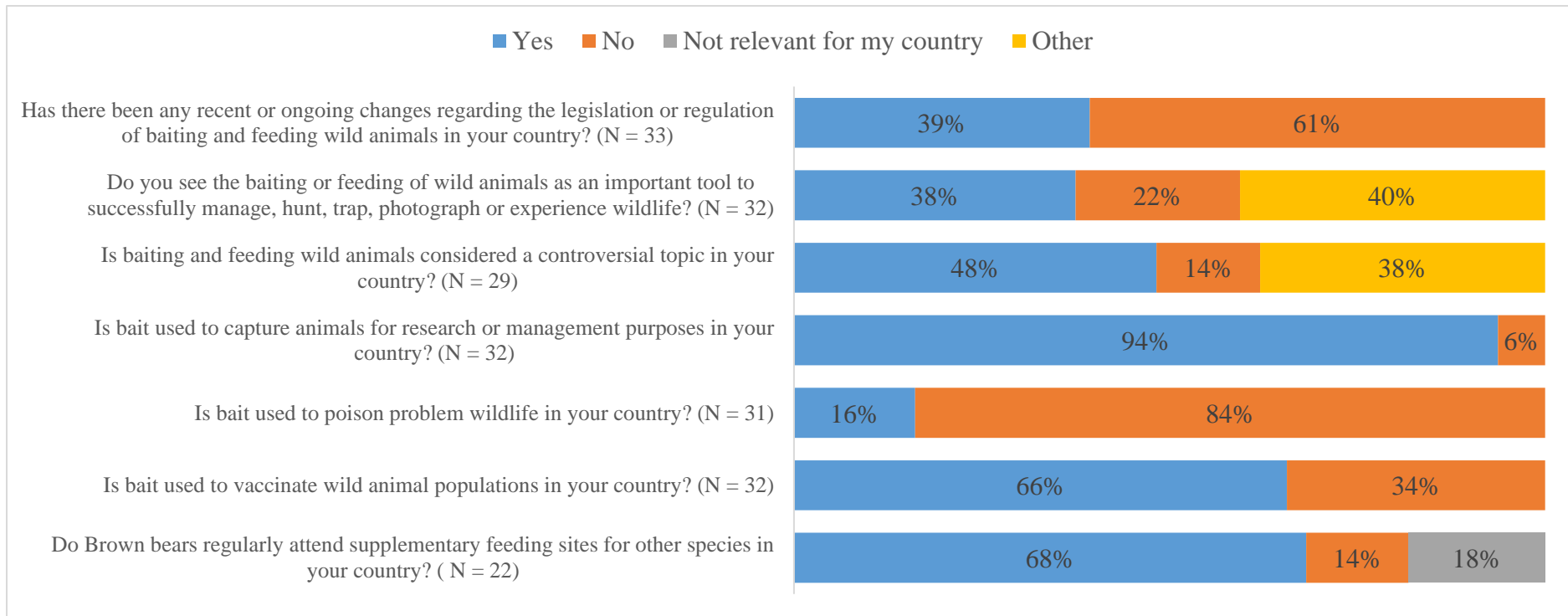


Figure 4 Results from a survey in Europe on baiting and feeding mammalian game species, where respondents were asked a series of questions related to the topic.

Discussion

The results support statements in the literature that baiting and feeding of wildlife are widespread wildlife management practices (Jones et al., 2014; Putman & Staines, 2004; Sorensen et al., 2014). Current practices in North America and Europe range from general bans of all baiting and feeding, to baiting and/or feeding of selected species under certain circumstances, to generally allowing baiting and feeding of a wide selection of species, with a wide selection of baiting/feeding materials. Most ADs in North America and most European countries allow some hunting over bait. However, there is tremendous variation regarding both regulations and which species are allowed to be baited. Similar variation is also observed in relation to supplementary feeding, which is legal in one form or another in most ADs in North America and in most European countries. In comparison, diversionary feeding is generally not mentioned in the North American hunting regulations, while respondents from 16 European countries reported that diversionary feeding is practiced in their country. Despite the differences in wildlife management and hunting practices, culture, species assembly, geography, and societal backgrounds between North American and Europe, the practices of baiting and feeding appear equally widespread on both continents.

Hunting over bait

In Canada, all 10 provinces and the Yukon Territory allow hunting of at least one species over bait. The Northwest Territories' and Nunavut's hunting regulations did not provide sufficient information for any conclusions to be drawn, however, there appears to be little tradition for hunting over bait in these territories. Canada appears to be somewhat more liberal towards the use of bait for hunting purposes compared to the U.S. In general, the regulations in relation to bating are highly nuanced in the U.S. Based on the reviewed hunting regulations, the states of Arizona, California, Colorado, Indiana, Iowa, Mississippi, Montana, Nevada, New Mexico, New York, Rhode Island, Tennessee, Vermont, and Virginia, generally prohibit hunting over bait, resembling a belt stretching from east to west (Figure 1). However, there are large regional and even local variations in relation to which species under which circumstance can be hunting over bait (see discussion below on bait hunting and feeding of different species).

In Europe, all countries allow hunting of one or more species over bait, except for Albania, Belgium, Bosnia and Herzegovina, Denmark (see Footnotes, Table 4), France, Greece, Italy, North Macedonia, Spain, and The United Kingdom (see Footnotes, Table 4). Hunting over bait generally appears to be a more common hunting practice in Northern and Eastern Europe compared to Southern and Western Europe (Figure 1).

While the results provide a general indication of the use of baiting for hunting purposes and which species are hunted over bait, it was not possible to assess the magnitude of this practice based on the method applied in this thesis. This would have required harvest records with details on hunting methods for each species in each AD or country. In addition, even if hunting a species over bait is legal, it may not necessarily be the most used hunting method. However, baiting may be a significant contributor to the overall harvest of a given species locally or regionally. For example, ~90% of American black bear hunters use bait in Minnesota, USA (Garshelis et al., 2020), and baiting is the only legal hunting method for brown bears in Croatia (Knott et al., 2014; Sahlén, 2007), while still hunting at bait sites is the most popular method for hunting the wild boar in Lower Saxony, Germany (Keuling et al., 2021). Below I discuss the circumstances under which baiting is allowed for a few selected species in both North America and Europe. Due to their importance for wildlife management and hunting, I chose to focus on the ungulate species wild boar, white-tailed deer, and red deer, as well as the carnivore species coyote, golden jackal, brown and American black bears, as well as the gray wolf.

The European wild boar is the only ungulate that occurs in large numbers and over wide areas on both continents. Wild boar populations are increasing in numbers and distribution throughout the world, mainly because of their adaptability, high reproductive output, and lack of natural predators (Massei et al., 2011). In order to reduce their numbers, agricultural damages, as well as their potential for transmission of diseases, wild boar populations have been subject to a number of control methods and management actions (Massei et al., 2011). The species occurs naturally in most parts of Europe, but is considered a non-native and invasive species in North America, where the species is increasingly causing both economic as well as ecological damages (Beasley et al., 2018; Massei et al., 2011). The wild boar was introduced to the USA in the 1600's by Europeans, but its presence in Canada is of more recent nature, as they were introduced to diversify livestock in the 1980s and 1990s (Brook & van Beest, 2014). Thirty-five US states report invasive wild boar populations as of 2016 (Beasley et al., 2018). Information on wild boars was found in the hunting regulations of 18 states in the USA, and 3 Canadian provinces. Hunting regulations for the wild boar vary greatly. For example, in the

State of Kansas, USA, the state's goal is to eradicate or reduce the current wild boar population to the lowest possible level (KDWP, 2021). Recreational hunting has been deemed ineffective at controlling wild boar numbers, and is therefore illegal (KDWP, 2021). Instead, landowners or their employees may shoot wild boar on their property on sight and without permit, while all other persons must have a permit issued by the livestock commissioner (KDWP, 2021). The State of Tennessee allows landowners to hunt wild boars year-round during daylight hours, and it is legal to trap wild boars with bait outside of the regular big game hunting season, all in order to control population numbers (TWRA, 2021). The states of Kansas and Tennessee have both banned wild boar hunting on public lands. This may be in an attempt to reduce the possibilities for recreational hunting, as it has proven inadequate in controlling wild boar numbers, and is suspected to keep stakeholders from supporting aggressive control programs (Beasley et al., 2018). The wild boar is hunted over bait in all 24 European countries that allow baiting for hunting purposes. However, independent of the use of bait, also in Europe recreational hunting has shown to be inadequate to control wild boar populations (Massei et al., 2015). As extant hunter populations grow older, and recruitment of new hunters remain low, substantial changes in hunting practices and strategies may be necessary to control wild boar numbers and their impact in the future (Massei et al., 2015). Although hunting wild boars over bait has shown to allow for a more selective harvest regime (Braga et al., 2010), it is of vital importance that the applied baiting practices do not provide enough food to stimulate population growth (Ballari et al., 2015), at least if reducing their abundance is the main management goal.

The white-tailed deer can be hunted over bait in half of the reviewed North American hunting regulations. White-tailed deer populations have increased immensely throughout their distribution, mainly due to alteration and improvement of habitats, lack of natural predators, along with conservative bag limits, short hunting seasons, and selective harvest (Rooney & Waller, 2003; Waller & Alverson, 1997). Hunting remains the primary factor limiting populations of white-tailed deer (Rooney & Waller, 2003), and with increasing densities, concerns arise regarding the effects of baiting and feeding on disease transmission (Cosgrove et al., 2018; Sorensen et al., 2014). For example, bovine tuberculosis was the primary cause for supplementary feeding being banned in large parts of Michigan, to avoid unnatural congregations of animals that could potentially hamper control efforts (Rooney & Waller, 2003). However, baiting has never been completely banned, mainly because it was feared that a ban would reduce hunter participation and harvest rates, both considered important in the effort to reduce white-tailed deer density and the number of infected animals in the state

(Rooney & Waller, 2003). The example of Michigan may very well be the case for many other states, where the ban on a hunting method may have undesirable effects on other management goals or objectives.

Respondents from 12 European countries reported that red deer can be hunted over bait. Despite the tremendous importance of red deer in European hunting traditions and culture, very little scientific literature is available from Europe on this matter.

The coyote can be hunted over bait in large parts of its distribution in North America. Coyotes are found throughout the continental USA and large parts of Canada, where they inhabit a vast variety of habitats, from grasslands and deserts, to mountains, and even urban areas (Bekoff & Gese, 2003). They are opportunistic generalist predators, and their diet can change immensely in relation to the available food (Bekoff & Gese, 2003). There exists very little scientific literature on hunting methods associated with the coyote. However, the species is generally considered a “pest species” and has been subject to a number of management methods aimed at controlling their numbers, such as intensive trapping and aerial gunning from helicopters (Mitchell et al., 2004). Coyotes have been controlled in the western U.S for over a century, mainly to reduce livestock depredation and benefit populations of game animals, as it is a notable predator on neonatal white-tailed deer (Kilgo et al., 2014). This may offer a possible explanation for the liberal hunting regulations and the common use of bait hunting often associated with the species.

Eleven European countries reported that the golden jackal can be hunted over bait (Table 4). Although no direct comparison is possible between coyotes in North America and golden jackals in Europe, they have strikingly similar ecological niches. The golden jackal is a widely distributed, medium-sized, generalist predator, capable of inhabiting a wide variety of habitats (Šálek et al., 2014). Populations of golden jackals are scattered along the Eastern Mediterranean and Black Sea, and it has recently started spreading towards western and Central Europe (Šálek et al., 2014). In 2021, the first observation of a golden jackal in Norway was made in the far-northern County of Finnmark (Henriksen, 2021). As the golden jackal’s range in Europe expands to countries where it is not considered native, challenges may arise regarding its legal status as well as the management of the species (Hatlauf et al., 2021).

Hunting Ursids over bait is generally a controversial topic (Candler et al., 2019; Glitzenstein & Fritschie, 1995; Hristienko & McDonald, 2007). Fair chase, littering, transmission of

diseases, and especially the potential to create “nuisance bears” and hazards for human safety are the main arguments used by the opponents of bait hunting (Hristienko & McDonald, 2007). On the other hand, hunter safety, consistent harvest, selectivity against females accompanied by cubs (which are commonly protected in hunting regulations), and even distribution of hunting pressure are arguments used by the proponents (Hristienko & McDonald, 2007). Sahlén (2007) has reviewed the practices of hunting Ursids over bait, and a few things have changed since 2007. The American black bear can be hunted over bait in 18 ADs, or 35% of the reviewed hunting regulations. It is hunted, but baiting is illegal in the remaining 26 ADs (47%) that have an open season on black bears. The states of Michigan and South Carolina have implemented baiting as a legal hunting method for American black bears, and a few other states now have an open season compared to the situation in 2007. The hunting regulations did not provide sufficient information on the background for prohibiting or allowing the use of bait for hunting black bears. The American black bear occurs only on the North American continent and is an important game species. In general, black bears are considered less aggressive compared to brown bears, and there are fewer human safety concerns regarding black bears (Herrero, 1972). The black bear’s nature, wide distribution, and abundance may offer some explanation to why it is hunted over bait more often than the brown bear.

Russia is home to the largest population of brown bears (130.000, estimated), followed by Alaska (~25.000 - 39.100) and Canada (~26.000), of which an estimated 15.000 reside in British Columbia (Miller et al., 2017). An estimated 17.000 brown bears reside in Europe (Kaczensky et al., 2012). Brown bears are hunted, but not over bait, in Nunavut, Northwest Territories and the Yukon Territory. There has been no open season on brown bears in Alberta since 2010 when the species was listed as threatened, with only 700 - 800 individuals left (AEP, 2022; Miller et al., 2017), or in British Columbia, where they are listed as a species of special concern (FLNRO, 2022). Alaska remains the only AD in North America that allows the hunting of brown bears over bait in some regions (ADF&G, 2021). The main reason to allow bait hunting of brown bears in Alaska is to reduce their population numbers via the liberalization of hunting regulations, included baiting, and thereby increase moose and caribou available for human harvest (Miller et al., 2017). Because of this, the State of Alaska has received considerable criticism in later years, and the question has been raised whether wildlife management in Alaska is based on science and research (Miller et al., 2017), which constitutes a key principle of wildlife management in the North American Model (Organ et al., 2012). Alaska has been recognized as the only place where reducing brown bear numbers is the main goal (Miller et

al., 2017). For Europe, Sahlén (2007) documented that brown bears can be hunted over bait in Estonia, Croatia, Russia, Slovenia, and Slovakia. According to the results, brown bears are also hunted over bait in Serbia. Bait hunting of bears was allowed in Sweden until 2001, when it was made illegal due to concerns of female with cubs (which are protected in the Swedish hunting regulation) being killed at bait sites, and due to concerns of creating problem / nuisance bears (Zedrosser et al., 2013). However, results by Zedrosser et al. (2013) suggest that these concerns are negligible, and hunting brown bears over bait is now legal in Sweden (Zedrosser et al., 2020). In general, much remains to be understood when it comes to potential consequences of hunting bears over bait. A study on the effects of harvest method on age and sex composition of harvested American black bears in Oregon from 1983 - 1994, found that hunters using hounds harvested older bears (both female and male) compared to those who baited (Kohlmann et al., 1999). Male bears harvested over bait were also younger than their female counterparts (Kohlmann et al., 1999). After the 1994 ban on the use of dogs and bait in Oregon, the overall statewide harvest was not significantly affected (Boulay et al., 1999). However, it was hypothesized that more time would be necessary to see if the ban had any effect, particularly locally, such as in western Oregon, where dense understory vegetation and local hunting traditions had made hunters rely more on dogs and bait for successful harvest (Boulay et al., 1999). Although it is difficult to directly compare hunting and harvest of American black bears to harvest of brown bears in Europe, no change in the average age or sex ratio amongst harvested animals have been found in Sweden, when comparing 4 years prior to and 4 years after the ban on baiting brown bears (Bischof et al., 2008).

In North America, gray wolves can be hunted over bait in the U.S states of Alaska, Idaho, as well as in the Canadian provinces Alberta, British Columbia, Manitoba, Ontario, Quebec, Saskatchewan, and the Yukon Territory. In Europe, respondents from Bulgaria, Croatia, Estonia, Latvia, Lithuania, Russia (Karelia), Serbia, Slovenia, Sweden, and Ukraine reported that gray wolves can be hunted over bait. It is unclear how common the use of bait hunting for wolves is in practice, as the scientific literature on hunting methods for gray wolves in both North America and Europe is very scarce. The gray wolf's legal status across Europe has been referred to as a "jurisdictional patchwork" in regard to both the Bern Convention and the EU Habitats Directive (Trouwborst & Fleurke, 2019). However, in comparison to Ursids, there seems to be little concern that baiting can result in the creation of human-habituated "problem wolves".

Although this study aimed to gather information on the background for allowing or prohibiting hunting of a given species over bait, it remains difficult to draw conclusions based on the results. The principle of fair chase and spread of diseases is sometimes mentioned in North American hunting regulations as well as by some European respondents. However, the general impression is that bait is commonly used to increase the chances of successful harvest by hunters (Dunkley & Cattet, 2003; Sorensen et al., 2014), and despite several potential risks associated with the method, this is probably the main reason for allowing the baiting in most cases.

In general, there is an extremely wide variation in the bait materials that can legally be used. Typically, the amount of bait is restricted rather than any specific bait materials. Many North American ADs do, however, promote the use of natural and non-processed baits, with the exception of natural scent lures containing urine or biological matter, which are typically banned in areas where CWD has been detected, e.g., Arkansas (AGFC, 2021). Despite the recently discovered prevalence of CWD in white-tailed deer, the State of Arkansas still allows hunting over bait in areas where CWD has yet to be detected (AGFC, 2021). For American black bears, some states have banned the use of specific materials, such as New Hampshire's ban on chocolate or any cocoa derivative, which contain theobromine that can be toxic to bears and other wild animals (NHF&G, 2021). In Idaho, it is illegal to use any parts of animals or fish classified as game to hunt bears, and no salt (liquid or solid) can be used as bait for ungulates (IDFG, 2021). If any mammal carcass is to be used as bait in Idaho, the skin must be removed (IDFG, 2021). These are just a few examples of the complexity found in the regulations.

The information gathered on baiting materials in Europe show in general that slaughter remains and carcasses of wild game, and sometimes of livestock, are commonly used for the hunting of carnivores. Respondents from Bulgaria, Russia, Serbia, Sweden, and Ukraine reported that livestock carcasses can be used as bait material for hunting purposes. However, Bulgaria and Sweden are members of the European Union. This makes them subject to the EU sanitary policies implemented in 2001 after the outbreak of bovine spongiform encephalopathy (BSE, i.e., "mad cow disease") in livestock. As a precautionary measure, all carcasses had to be collected and destroyed at authorized plants (Margalida et al., 2017). Regulations have been implemented to benefit scavenger communities of conservational importance, by allowing farmers to place livestock carcasses in specific areas (Margalida et al., 2017). Perhaps these countries have similar regulations as Norway. In Norway, hunters can use slaughter remains

from animals that were meant for human consumption as bait, provided that they were slaughtered in a professional butchery (Mattilsynet, 2022). It is not legal to use livestock that died of natural causes or disease as bait, as these must be delivered to approved processing plants (Mattilsynet, 2022). Slaughter remains from wild game can be used as bait in the same area that is considered their natural habitat (Mattilsynet, 2022). To avoid further spread of CWD, slaughter remains, or carcasses of wild ungulates must be tested negative for CWD before they can be used as bait (Mattilsynet, 2022). To prevent the spread of African swine fever, no wild boar or domestic pig can be used as bait (Mattilsynet, 2022).

For ungulates, salt licks, corn, and grains are generally used as bait. Perhaps most interesting was the fact that 4 respondents mentioned corn and vegetables in relation to the hunting of wolves. However, this was probably done by the respondents to illustrate a point, when there are no specific materials mentioned in the legislation, or when no regulations exist at all. The widespread use of corn is interesting in itself, as corn and grains are susceptible to fungi, both prior to and post-harvest (Murray et al., 2016). Regular feed, but particularly moldy feed, can contain high levels of mycotoxins such as aflatoxin, which are byproducts of the fungi's metabolic activity (Murray et al., 2016). These mycotoxins can potentially be lethal, depending on the animal, and the amount that is consumed (Murray et al., 2016).

Baiting is most often associated with hunting; however, it is used in a variety of different ways. Most European respondents reported that baiting can be used for scientific experiments or other management purposes in their country, and that it has also been used to vaccinate wild animal populations against disease. Oral vaccination of foxes against rabies has successfully eradicated the disease in most of Western and Central Europe, where baits containing the vaccine typically has been delivered using airplanes (Tizzani et al., 2020). Bait is commonly used to increase the success in detecting a species in camera trap studies (Ferreira-Rodríguez & Pombal, 2019). Further, respondents from 15 countries reported that baiting for wildlife viewing or photography is legal. For example, baiting of brown bears is common practice in parts of Finland, and has considerable effects on bear behavior (Kojola & Heikkinen, 2012). Although bait can be used to enhance the possibilities for viewing opportunities for wild animals, some photography organizations do not approve the use of bait when taking pictures, and images may be rejected on the background of this (Pitts, 2018).

Supplementary feeding

In North America, the U.S states of Alaska, Arizona, California, Colorado, Illinois, Maine, Montana, New Mexico, New York, Rhode Island, Vermont, as well as the Canadian territories of Northwest Territories, and Yukon, prohibit the feeding of Cervids, or wild animals in general. In the rest of North America, feeding Cervids is either completely legal, or certain restrictions exist, usually as a means of stopping the spread of diseases. No geographical patterns seem to exist within North America in relation to allowing or prohibiting supplementary feeding, and it appears to be up to each individual AD to implement such regulations as they see fit.

In Europe, supplementary feeding of Cervids was reported legal in all countries, with the exceptions of Albania, Belgium, France, Greece, Luxembourg, and Norway. Supplementary feeding of ungulates has been made illegal in Norway in 2016, when CWD was detected in wild reindeer to avoid potential spread to other ungulates (Mysterud et al., 2019).

The North American hunting regulations generally do not specify which species of Cervids may or may not be provided supplementary food, with a few exceptions (see Footnotes, Table 2). In general, the regulations refer to “deer”, e.g., it is illegal / legal to bait and feed deer, without necessarily specifying the exact species. This is likely because it is difficult to specifically feed one deer species while excluding another deer species from the same feed / feeding station. Some ADs specify that feeding predators is illegal (see Footnotes, Table 2), which leaves questions about what is legal in the ADs that do not mention any such restrictions. The results from Europe show that all species investigated have access to supplementary food to varying extent across the continent. In accordance with the literature, the red and roe deer is provided supplementary food across large parts of Europe, mainly due to their wide distribution and importance as game species (Putman & Staines, 2004). This is also the case for the wild boar. Supplementary feeding of large carnivores appears to be very limited in extent.

The North American hunting regulations generally do not provide sufficient information on the background for allowing supplementary feeding. However, the ADs that prohibit supplementary feeding, or where certain restrictions exist, typically mention the spread of diseases and the avoidance of human-wildlife conflicts as reasons for not allowing supplementary feeding. In Europe, the most commonly reported reason for prohibiting supplementary feeding is to avoid population densities above the natural carrying capacity, and to minimize the spread of diseases. The reported reasons to allow supplementary feeding were

to increase overwinter survival, maintain viable populations of game animals, and reduce damages to crops and forestry. These are also commonly mentioned motivations for supplementary feeding found in the literature (Felton et al., 2017; Putman & Staines, 2004), as well as common arguments concerning its regulation (Cosgrove et al., 2018; Sorensen et al., 2014).

Milner et al. (2014) reviewed the scientific literature for intended and unintended effects of supplementary feeding of ungulates. Of the intended effects, 4 of 7 studies showed an increased survival rate, 5 of 8 showed an increase in reproductive rate, 5 of 7 showed reduced winter mass loss or improved winter condition, 4 of 6 showed increased population size or density, and 8 of 8 showed a concentration of activity around feeding sites (Milner et al., 2014). However, only 1 of 4 studies showed an increase in hunting success, and 2 of 5 studies showed increased antler growth, and supplementary feeding through the winter did not increase carcass weights the following autumn (Milner et al., 2014). The unintended effects are in general less studied, but 4 of 5 studies showed an increase in aggression between individuals near feeding stations, 4 of 4 showed an increase in local browsing pressure, 3 of 3 showed a change in the composition of local plant species, 4 of 4 showed a decline in shrubs and woody vegetation cover, and 6 of 7 showed an impact on non-target species (Milner et al., 2014). Although Milner et al. (2014) warned about drawing any conclusions based on the small sample sizes, the information suggests that in most cases such unintended effects do occur. Murray et al. (2016) reviewed 115 studies that evaluated wildlife health in relation to supplementary feeding. Although supplementary feeding can increase the rate of survival and reproduction within a population, it is often associated with a higher level of stress and susceptibility to pathogens through increased contact rates and competition (Murray et al., 2016). Supplementary feeding programs for the conservation of small or declining animal populations proved to have the most beneficial effects on animal health, most likely because they were conducted by professionals, and gathered over-abundant species to a lesser degree than traditional game feeding (Murray et al., 2016). It is possible for a feeding program to be tailored with a species' biology in mind, by meeting its nutritional needs at the time, taking into account its behavior, and avoiding unnatural concentrations of animals on the landscape (Murray et al., 2016).

It makes intuitive sense to avoid unnatural congregations of animals, especially when the goal is to limit the spread of infectious diseases (Sorensen et al., 2014). However, complete bans on baiting and feeding practices may be hard to implement, due to a lack of compliance and the fact that it can be problematic to persecute violators (Cosgrove et al., 2018). Special

concerns have been raised regarding the regulation of baiting and feeding in the wake of CWDs emergence in North American ungulates (Sorensen et al., 2014), and the risk of bovine tuberculosis spreading to livestock (Cosgrove et al., 2018). In 2016, CWD was discovered in a wild reindeer population in Norway, and later in moose and red deer (Vikøren et al., 2019). A survey to municipal wildlife managers in Norway revealed extensive supplementary feeding of ungulates, even after the nationwide ban in 2016 (Mysterud et al., 2019). Mysterud et al. (2019) recommended stronger enforcement of such bans in areas where CWD was detected, rather than little to no enforcement on a nationwide level. This approach is also evident in North America, where some states implement area-specific baiting and feeding regulations and CWD-management zones, rather than complete bans. If this is the best or most effective way to limit the spread of CWD and other diseases remains unknown, as it has yet to be documented (Mysterud et al., 2019). Artificial feeding and the use of salt licks that aggregates hosts on the landscape is likely to be banned by the governments where CWD is detected (Mysterud & Edmunds, 2019).

Diversionsary feeding

No information on the practices of diversionsary feeding was found in the North American hunting regulations. However, it is considered a common management practice in both North America and Europe (Arnold et al., 2018), and respondents from 16 European countries reported that diversionsary feeding was practiced in their country. In Europe, the most common species reported to be provided diversionsary feed is the red deer, roe deer, and wild boar. Diversionsary feeding of moose and northern chamois is less common, probably due to the more limited distribution of these species. Only a handful of European countries reported the use of diversionsary feeding of brown bears and gray wolves. Supplementary feeding (or diversionsary, often used interchangeably) with livestock carrion did not reduce brown bear depredation on sheep in Slovenia, when comparing five years prior to, and five years after the ban on the use of livestock carcasses by the country's adoption of EU regulations in 2004 (Kavčič et al., 2013). Neither did depredation increase because of this ban. Kavčič et al. (2013) found no evidence of brown bears favoring carrion feeding sites over feeding sites with corn. Steyaert et al. (2014) did not discover a connection between supplementary feeding and "nuisance" behavior in brown bears, and neither did it prove an efficient tool for keeping brown bears away from people. Variation on the individual level within the bear populations was the most important

factor explaining why some brown bears selected more strongly towards feeding sites, whereas others did not (Steyaert et al., 2014).

Kubasiewicz et al. (2016) reviewed 21 papers that quantified the effects of diversionary feeding. In this review, 10 of 15 experiments to protect crops by providing diversionary feed were considered successful, while only one of three experiments using diversionary feeding to reduce risks for human safety, and two of three to reduce predation on vulnerable or game species were considered successful (Kubasiewicz et al., 2016). The effects of diversionary feeding are often measured in three stages; 1) the uptake of diversionary food by the species in question, 2) the direct impact of this feeding on the problem, e.g., a reduction in depredation, damage to crops or silviculture, and 3) the outcome, i.e., the overall benefit in relation to the current management objective, e.g., increased crop yield (Kubasiewicz et al., 2016). It is important that the diversionary food provided is considered more “nutritionally appealing” than the crops or silviculture one aims to protect, and that the population is experiencing natural food limitations (Kubasiewicz et al., 2016). When used to reduce predation, species with a generalist diet are more likely to switch towards the offered diversionary food when natural food is limited (Kubasiewicz et al., 2016). There are several factors which may affect the results of this management practice, and its success can vary between different locations and time of year, and whether it is deemed successful can vary depending on the objectives of stakeholders (Kubasiewicz et al., 2016). In a review of five case studies from North America and Europe on diversionary feeding of bears, Garshelis et al. (2017) concluded that it can be an effective management measure when 1) food demand is not met by naturally available food, 2) when the provisioned food easily accessible outside the conflict area, 3) when the provisioned food is attractive, and 4) when bears do not associate humans with the food provided. They recommended that diversionary feeding of bears should be a well-organized effort by professionals, that it should be conducted as an experiment, and that the correct variables are measured, making it possible to assess whether the diversionary feeding can be deemed a success or not (Garshelis et al., 2017).

Conclusions

In conclusion, baiting and feeding of wildlife are matters that operate on many different levels, ranging from the environmental and ecological, to the social, political, and even the economical (Dunkley & Cattet, 2003; Sahlén, 2007). The underlying motives for baiting and feeding differ, but their effects on the environment are often considered together, as they both

involve offering natural or artificial food for wild animals at specific locations (Dunkley & Cattet, 2003). Whether it is a bait pile or supplementary feeding site, it represents an anthropogenic resource pulse in the environment (Candler et al., 2019). In Europe, baiting and feeding can often occur simultaneously, for several purposes (Kavčič et al., 2015). When it comes to prohibiting hunting over bait, a few North American hunting regulations and European countries point towards the principle of fair chase and the spread of diseases. Apart from that, it is hard to tell what these ADs and countries have in common. Such a wide selection of species is hunted over bait on both continents, each with its own biology, behavior, distribution, local abundance, and hunting regulations, that it makes general conclusions difficult. Whether the reasoning behind allowing or prohibiting hunting over bait is rooted in science, politics, or cultural differences, is often hard to assess and not always obvious. A number of elements affect the way hunting is structured in a given jurisdiction, including demographics, geography, local traditions, and politics (Hristienko & McDonald, 2007). A tremendous variation in the application of baiting as a hunting method is obvious in the results, and the nuances are far too great to be discussed individually. On the matter of fair chase, Dunkley and Cattet (2003) stated that philosophical differences render science unable to determine whether hunting over bait is ethical. I believe this to be true. It is up to each hunter, manager, scientist, or member of the public to decide whether hunting over bait is ethical. However, the potential impact on the environment associated with these practices, if not properly regulated or conducted, should not be disregarded regardless of background or profession. Feed and bait sites are known to attract a wide specter of non-target species (Bowman et al., 2015; Fležar et al., 2019), they may increase local browsing pressure on the vegetation (Cooper et al., 2006), alter migratory patterns (Jones et al., 2014), and even increase the predation on ground-nesting birds in the vicinity of bait or feeding sites (Selva et al., 2014). For example, respondents from 15 European countries reported that brown bears attended supplementary feeding sites intended for other species (mainly ungulates). Because of these effects, scientists and managers commonly advocate stricter regulations of baiting and feeding of wildlife.

The main aim of this thesis was to gather information on the practices of baiting and feeding mammalian game species in North America and Europe. Although it is almost impossible to cover every detail for each species of concern, the result of this study provides a good foundation for further discussion. Baiting and feeding wild animals remain widespread management practices, despite a considerable body of scientific evidence suggesting that the

consequences remain poorly understood. The practices of baiting and feeding continues to affect the environment as well as wildlife and humans, whether they are aware of it or not.

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Appendix

1. Sources, North America

State, province, or territorial agency	Abbreviation	URL
Alabama Department of Conservation and Natural Resources	ADCNR	https://www.outdooralabama.com
Alaska Department of Fish and Game	ADF&G	https://www.adfg.alaska.gov
Arizona Game and Fish Department	AZGFD	https://www.azgfd.com
Arkansas Game & Fish Commission	AGFC	https://www.agfc.com/en/
California Department of Fish & Wildlife	CDFW	https://wildlife.ca.gov
Colorado Parks & Wildlife	CPW	https://cpw.state.co.us
Connecticut Department of Energy & Environmental Protection	CTDEEP	https://portal.ct.gov/DEEP
Delaware Department of Natural Resources and Environmental Control	DNREC	https://dnrec.alpha.delaware.gov
Florida Fish and Wildlife Conservation Commission	FWC	https://myfwc.com
Georgia Department of Natural Resources	GDNR	https://georgiawildlife.com
Idaho Fish & Game	IDFG	https://idfg.idaho.gov
Illinois Department of Natural Resources	IDNR	https://www2.illinois.gov/dnr/Pages/default.aspx
Indiana Department of Natural Resources	IDNR	https://www.in.gov/dnr/
Iowa Department of Natural Resources	IDNR	https://www.iowadnr.gov
Kansas Department of Wildlife and Parks	KDWP	https://ksoutdoors.com
Kentucky Department of Fish & Wildlife Resources	KDFWR	https://fw.ky.gov/Pages/default.aspx
Louisiana Department of Wildlife & Fisheries	LDWF	https://www.wlf.louisiana.gov
Maine Department of Inland Fisheries and Wildlife	MDIFW	https://www.maine.gov/ifw/
Maryland Department of Natural Resources	MDNR	https://dnr.maryland.gov/Pages/default.aspx
Massachusetts Division of Fisheries and Wildlife	MDFW	https://www.mass.gov/orgs/division-of-fisheries-and-wildlife
Michigan Department of Natural Resources	MDNR	https://www.michigan.gov/dnr/
Minnesota Department of Natural Resources	MDNR	https://www.dnr.state.mn.us
Mississippi Department of Wildlife, Fisheries and Parks	MDFWP	https://www.mdwfp.com
Missouri Department of Conservation	MDC	https://mdc.mo.gov
Montana Fish Wildlife & Parks	MFWP	https://fwp.mt.gov
Nebraska Game and Parks Commission	NGPC	http://outdoornebraska.gov
Nevada Department of Wildlife	NDOW	https://www.ndow.org
New Hampshire Fish and Game Department	NHF&G	https://www.wildlife.state.nh.us
New Jersey Department of Environmental Protection	NJDEP	https://www.nj.gov/dep/
New Mexico Department of Game & Fish	NMDGF	https://www.wildlife.state.nm.us
New York State Department of Environmental Conservation	NYSDEC	https://www.dec.ny.gov
North Carolina Wildlife Resources Commission	NCWRC	https://www.ncwildlife.org
North Dakota Game and Fish	NDGFD	https://gf.nd.gov
Ohio Department of Natural Resources	ODNR	https://ohiodnr.gov
Oklahoma Department of Wildlife Conservation	ODWC	https://www.wildlifedepartment.com
Oregon Department of Fish and Wildlife	ODFW	https://www.dfw.state.or.us
Pennsylvania Game Commission	PGC	https://www.pgc.pa.gov/Pages/default.aspx

Rhode Island Department of Fish & Wildlife	RIDFW	https://www.dem.ri.gov
South Carolina Department of Natural Resources	SCDNR	https://www.dnr.sc.gov
South Dakota Game, Fish & Parks	SDGFP	https://gfp.sd.gov
Tennessee Wildlife Resources Agency	TWRA	https://www.tn.gov/twra.html
Texas Parks & Wildlife	TPWD	https://tpwd.texas.gov
Utah Division of Wildlife Resources	UDWR	https://wildlife.utah.gov/
Vermont Fish & Wildlife Department	VFWD	https://vtfishandwildlife.com
Virginia Department of Wildlife Resources	VDWR	https://dwr.virginia.gov
Washington Department of Fish and Wildlife	WDFW	https://wdfw.wa.gov
West Virginia Department of Natural Resources	WVDNR	https://wvdnr.gov
Wisconsin Department of Natural Resources	WDNR	https://dnr.wisconsin.gov
Wyoming Game and Fish Commission	WGFC	https://wgfd.wyo.gov
Alberta Environment and Parks	AEP	https://www.alberta.ca/environment-and-parks.aspx
British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development	FLNRORD	https://www2.gov.bc.ca/gov/content/home
Manitoba Agriculture and Resource Development	MARD	https://www.gov.mb.ca/iem/
New Brunswick Department of Natural Resources and Energy Development	NBDNRED	https://www2.gnb.ca/content/gnb/en.html
Newfoundland and Labrador Department of Fisheries Forestry and Agriculture	NLDFFA	https://www.gov.nl.ca/ffa/
Northwest Territories Department of Environment and Natural Resources	NTDENR	https://www.enr.gov.nt.ca/en
Nova Scotia Department of Natural Resources and Renewables	NSDNR	https://novascotia.ca/natr/
Nunavut Department of Environment	NDE	https://www.gov.nu.ca
Ontario Fish and Wildlife	OFW	https://www.huntandfishontario.com
Prince Edward Island Forests, Fish and Wildlife Division	PEIFFWD	https://www.princeedwardisland.ca/en
Quebec Department of Forests, Wildlife and Parks	WDFWP	https://www.quebec.ca
Saskatchewan Fish Wildlife and Lands Branch	SFWLB	https://www.saskatchewan.ca/residents/parks-culture-heritage-and-sport/hunting-trapping-and-angling/hunting
Yukon Department of Environment	YDE	https://yukon.ca/en/department-environment

2. Survey, Europe

1. What is your country of residency?
2. Province? If this is relevant for wildlife management in your country, specify by pressing “Other”.
3. Which of the following best describes your current occupation? Multiple answers possible, select “other” to specify.
 - a. Government agency
 - b. Research institute
 - c. University
 - d. Non-governmental organization (NGO)
 - e. Hunting-oriented NGO
 - f. Conservation-oriented NGO
 - g. Private consultancy
 - h. Other
4. Baiting for the purpose of hunting. By this, we mean actively hunting over a bait placed with the intention of attracting game species. Is it legal to bait mammalian game species for the purpose of hunting in your country?
5. If yes: Which of the following mammalian game species can legally be baited for the purpose of hunting, and what kind of bait can be used? Multiple answers possible.
 - a. Species: brown bear, grey wolf, wolverine, Eurasian lynx, golden jackal, red fox, European badger, Eurasian wild boar, moose, reed deer, roe deer, chamois, fallow deer, mouflon sheep
 - b. Bait materials: not legal to use bait, not relevant for my country, wild game carcasses / slaughter remains, wild fish carcasses / slaughter remains, livestock carcasses / slaughter remains, commercially produced fish carcasses / slaughter remains, scent lures

(commercial / homemade), processed food for livestock / pets, roots / vegetables, cereals, maize (corn), commercially processed food for human consumption (e.g., doughnuts, cookies), artificial salt licks

- c. If a certain species or bait material is not mentioned above, you may specify here
6. If no: What is the legal / practical background for NOT allowing the use of bait to attract and hunt mammalian game species? Multiple answers possible, select “other” to specify.
 - a. To avoid habituating wild animals to people
 - b. To avoid nuisance animals in the vicinity of people
 - c. To minimize the spread of diseases
 - d. Fair chase principle, i.e., to not give hunters an advantage perceived as unfair
 - e. Other
 7. If only for a few specific species: Please write briefly which species may be hunted legally over bait, the bait material used, and under which circumstances.
 8. Baiting for the purpose of trapping: By this, we mean traditional trapping for furs, and not for wildlife management or pest control. Is it legal to bait animals for the purpose of trapping in your country?
 9. If yes: Which species can legally be baited for the purpose of trapping, and what kind of bait can be used? (Multiple answers possible).
 - a. Species: brown bear, wolf, wolverine, Eurasian lynx, golden jackal, red fox, European badger, European pine marten, stone marten, European polecat, mink, stoat, least weasel
 - b. Bait materials: not legal to use bait, trapping is illegal, not relevant for my country, wild game carcasses / slaughter remains, wild fish carcasses / slaughter remains, livestock carcasses / slaughter remains, commercially produced fish carcasses / slaughter remains, scent lures (commercial / homemade), processed food for livestock / pets, roots / vegetables, cereals, maize (corn), commercially processed food for human consumption (e.g., doughnuts, cookies)
 - c. If a certain species or bait material is not mentioned above, you may specify here

10. If no: What is the legal / practical background for NOT allowing the use of bait for trapping?
11. If only for a few specific species: Please write briefly which species it is legal to trap, the bait material used, and under which circumstances.
12. Baiting for wildlife viewing / photography: By this, we mean the use of bait to experience or take pictures of wildlife, but not disturb them in any manner. Is it legal to bait animals for wildlife photography / viewing?
13. If yes: What kind of bait material are you allowed to use for wildlife photography / viewing? (Multiple answers possible)
 - a. Bait materials: wild game carcasses / slaughter remains, wild fish carcasses / slaughter remains, livestock carcasses / slaughter remains, commercially produced fish carcasses / slaughter remains, scent lures (commercial / homemade), processed food for livestock / pets, roots / vegetables, cereals, maize (corn), commercially processed food for human consumption (e.g., doughnuts, cookies)
 - b. Are there any species it is illegal to attract by the use of bait for wildlife viewing / photography?
14. If no: What is the legal / practical background for NOT allowing the use of bait for wildlife photography / viewing?
15. Bait as a management and research tool: The use of bait can be a valuable tool in order to achieve certain management or research goals.
 - a. Is bait used to vaccinate wild animal populations against disease in your country?
 - b. Is bait used to poison problem (introduced / invasive) wildlife in your country?
 - c. Is bait used to capture wildlife for management or research purposes in your country?
16. Supplementary feeding is the general provisioning of food for game species to enhance the features of individuals or populations, e.g., the size of antlers, the survival of young individuals, or general population density. Is supplementary feeding of game animals legal in your country?
17. If yes: For which species is supplementary feeding allowed in your country? (Multiple answers possible)
 - a. Species: brown bear, wolf, golden jackal, wild boar, roe deer, red deer, moose, wild reindeer, European bison, chamois, fallow deer, mouflon sheep

- b. What is the legal / practical background for allowing supplementary feeding of game animals in your country?
 - c. Do brown bears regularly attend supplementary feeding sites for other species in your country?
18. If no: What is the legal / practical background for prohibiting supplementary feeding of game animals? (Multiple answers possible)
- a. To avoid habituating wild animals to people
 - b. To avoid nuisance animals in the vicinity of people
 - c. To minimize the spread of diseases
 - d. To not contribute to population densities above the natural carrying capacity
19. In wildlife management, diversionary feeding (or intercept feeding) involves the placing of food to draw animals away from problematic activities or locations. Is diversionary feeding being practiced in your country?
20. If yes: Are any of the following species provided diversionary food to avoid damages to agricultural crops, silviculture, livestock, or to keep them away from roads and populated areas? If so, what material is commonly used?
- a. Species: brown bear, wolf, wolverine, Eurasian lynx, moose, wild boar, red deer, roe deer, chamois.
 - b. Bait materials: wild game carcasses / slaughter remains, wild fish carcasses / slaughter remains, livestock carcasses / slaughter remains, commercially produced fish carcasses / slaughter remains, scent lures (commercial / homemade), processed food for livestock / pets, roots / vegetables, cereals, maize (corn), commercially processed food for human consumption (e.g., doughnuts, cookies), artificial salt licks
 - c. If a certain species or bait material is not mentioned above, you may specify here.
21. Is baiting or feeding wild animals considered a controversial topic in your country? Select “Other” to elaborate.
22. Has there been any recent or ongoing changes regarding the legislation or regulation of baiting and feeding wild animals in your country?
23. Do you see the baiting or feeding of wild animals as an important tool to successfully manage, hunt, trap, photograph or experience wildlife? Select “Other” to elaborate.
24. Is there anything you would like us to know that was not included or available in the survey?

25. In case you are interested in this study, please leave your email address below and we provide you with a summary of our results at the end of the study.

3. Table, results from North America

Table 2 States, provinces, and territories in North America (U.S.A and Canada) where hunting brown bear, black bear, gray wolf, coyote, wild boar, and white-tailed deer over bait is either legal (+) or prohibited (-) and feeding cervids is legal or prohibited (+ / -). (P) indicates protection under state or federal law and (N) that there currently is no open season on that species. Based on a review of current hunting regulations (Appendix 1). Information on baiting and feeding cervids, and prevalence of CWD retrieved from (www.CWD-alliance.org, accessed on 05.05.2022). ADs in which CWD has been documented in wild cervids indicated by orange. Administrative divisions with a general baiting and / or feeding ban is highlighted in gray.

North America	Feeding (cervids)	Brown bear	American black bear	Gray wolf	Coyote	Wild boar	White-tailed deer
Alabama	+		N		-	+	+
Alaska ¹	-	+	+	+	-		-
Arizona ²	-		-		-		-
Arkansas ³	+		+		+		+
California ⁴	-		-	P	-		-
Colorado ⁵	-		-		-		-
Connecticut	+		P		-		+
Delaware	+				-		+
Florida ⁶	+		P		+	+	+

¹ Alaska: wolverines (*Gulo gulo*) and foxes (unspecified species) may be hunted over bait. Illegal to feed wildlife in general, with the exceptions for baited species.

² Arizona: General baiting and feeding ban.

³ Arkansas: elk (*Cervus canadensis*) and furbearers (gray fox (*Urocyon cinereoargenteus*), red fox, opossum, raccoon, striped skunk, bobcat, coyote) may be hunted over bait. Unlawful to feed wildlife within the CWD management zone, with the exceptions for baited species.

⁴ California: General baiting and feeding ban.

⁵ Colorado: General baiting and feeding ban.

⁶ Florida: Non-migratory game can be hunted near year-round game-feeding stations if the feeding has been maintained for at least six months prior to the taking of game. Placing feed or garbage that may attract black bears, foxes, coyotes, or raccoons is prohibited after receiving written notification from the FWC.

North America	Feeding (cervids)	Brown bear	American black bear	Gray wolf	Coyote	Wild boar	White-tailed deer
Georgia	+		-		-	+	+
Idaho	+	N	+	+	+		-
Illinois	-		P		+		-
Indiana ⁷	+				-		-
Iowa ⁸	+				-		-
Kansas ⁹	+				+	N	+
Kentucky ¹⁰	+		-		+		+
Louisiana	+		P		+	+	+
Maine ¹¹	-		+		+		-
Maryland ¹²	+		-		+		+
Massachusetts ¹³	+		-		+		-
Michigan ¹⁴	+		+	P	+	+	+
Minnesota ¹⁵	+		+	N	+		-

⁷ Indiana: vague regulations in general.

⁸ Iowa: vague regulations in general.

⁹ Kansas: it is legal to bait deer, turkey (*Meleagris gallopavo*) and non-migratory game animals on private land. Assumed legal for furbearers (American badger (*Taxidea taxus*), bobcat, gray fox, red fox, swift fox (*Vulpes velox*), opossum, raccoon, striped skunk) and coyotes. Feeding discouraged by the KDWP due to CWD. Sport hunting of wild boars is illegal.

¹⁰ Kentucky: elks may be hunted over bait outside the “elk zone”. Illegal to feed bears.

¹¹ Maine: baiting and feeding deer and moose (*Alces alces*) is prohibited from September 1st to December 15th, which covers the hunting seasons for both species.

¹² Maryland: no restrictions to be found on hunting furbearers (coyote, gray fox, opossum, raccoon, red fox, skunk) over bait.

¹³ Massachusetts: bobcats, red foxes and crows (unspecified species) may be hunted over bait.

¹⁴ Michigan: furbearers (bobcat, coyote, red and gray fox, raccoon) may be hunted over bait.

¹⁵ Minnesota: Deer baiting and feeding ban in some counties.

North America	Feeding (cervids)	Brown bear	American black bear	Gray wolf	Coyote	Wild boar	White-tailed deer
Mississippi ¹⁶	+		-		-	-	-
Missouri ¹⁷	+		-		+	+	-
Montana ¹⁸	-	P	-	-	-		-
Nebraska	+				+		-
Nevada ¹⁹	NA		-		-		
New Hampshire ²⁰	+		+		+		+
New Jersey	+		N		-		+
New Mexico ²¹	-		-	P	-	-	-
New York ²²	-		-		-		-
North Carolina	+		-	P	+	+	+
North Dakota ²³	+		N	N	+		+
Ohio ²⁴	+		P		+	+	+
Oklahoma ²⁵	+		-		+	+	+

¹⁶ Mississippi: Feeding of wildlife is banned within any CWD Management Zone.

¹⁷ Missouri: Baiting is not legal for black bears, deer, elk, migratory birds, and turkeys. Regulations do not mention other species.

¹⁸ Montana: General baiting and feeding ban.

¹⁹ Nevada: General baiting ban.

²⁰ New Hampshire: Coyotes may be hunted over bait. Vague regulations for other furbearers.

²¹ New Mexico: General baiting and feeding ban.

²² New York: General baiting and feeding ban.

²³ North Dakota: Regulations only mention trapping for furbearers, not hunting.

²⁴ Ohio: Regulations only mention trapping for furbearers, not hunting. Baiting and feeding deer prohibited within the Disease Surveillance Area.

²⁵ Oklahoma: Baiting is illegal on public lands but appears to be legal on private lands. No specific species mentioned.

North America	Feeding (cervids)	Brown bear	American black bear	Gray wolf	Coyote	Wild boar	White-tailed deer
Oregon	+		-	P	+	+	+
Pennsylvania ²⁶	+		-		+	+	+
Rhode Island ²⁷	-				-		-
South Carolina	+		+		+	+	+
South Dakota ²⁸	+		P	-	+		-
Tennessee ²⁹	+		-		-	-	-
Texas	+		P		+	+	+
Utah	NA		+		+		-
Vermont ³⁰	-		-		-		-
Virginia ³¹	+		-		-	-	-
Washington	+	P	-	P	+		+
West Virginia	+		-		-	-	+
Wisconsin	+		+	-	+		+
Wyoming	+	P	+	-	+		-

²⁶ Pennsylvania: Baiting is broadly prohibited but allowed conditionally where other methods of controlling deer has proven ineffective. Feeding deer is illegal within CWD-positive areas. It is illegal to intentionally feed bears and elk.

²⁷ Rhode Island: General baiting and feeding ban.

²⁸ South Dakota: No restrictions to be found on hunting furbearers over bait.

²⁹ Tennessee: General baiting ban.

³⁰ Vermont: General baiting and feeding ban.

³¹ Virginia: Illegal to feed bears, year-round and statewide.

North America	Feeding (cervids)	Brown bear	American black bear	Gray wolf	Coyote	Wild boar	White-tailed deer
Alberta ³²	+	N	+	+	+		-
British Columbia ³³	+	N	-	+	+	+	+
Manitoba ³⁴	+	N	+	+	+	+	-
New Brunswick ³⁵	+		+		+		+
Newfoundland & Labrador	NA		+				
Northwest Territories	-	-	-	-	-		-
Nova Scotia	+		+		+		+
Nunavut	NA	-	-				
Ontario ³⁶	+		+	+	+		+
Prince Edward Island	NA				+		
Quebec	+		+	+	+		+
Saskatchewan	+		+	+	+	+	+
Yukon	-	-	-	+	+		-

³² Alberta: Illegal to feed black bears, grizzly bears, cougars, wolves, and coyotes, except for baited species.

³³ British Columbia: cougars may be hunted over bait. Illegal to feed cougar, coyote, wolf, and bear, with the exception of baiting. It is illegal to feed or bait ungulates in the Kootenay Region.

³⁴ Manitoba: Feeding wildlife is discouraged. Illegal to feed or place attractants for white-tailed deer and moose in specific areas. Baiting cervids is illegal for the purpose of hunting.

³⁵ New Brunswick: Feeding white-tailed deer is discouraged by the NBDNRE.

³⁶ Ontario: Feeding deer and elk is discouraged by the OFW due to the increased potential to spread disease.

4. Table, results from Europe, baiting

Table 3 Results from the answers to a survey in Europe on baiting and feeding mammalian game species, where hunting brown bear, gray wolf, golden jackal, wild boar, red fox, European badger, and red deer over bait was reported either legal (+) or illegal (-) by respondents. Croatia and Slovenia's responses are numbered, indicating two different responses from the countries. Distribution for each species is illustrated with color (green – extant, resident, yellow – presence uncertain, orange – extinct, and white – not present) based on the IUCN Red List (www.IUCNRedlist.org, accessed on 01.06.2022). Legal and management status for brown bear and wolf acquired from (Kaczensky et al., 2012), where P indicates protected and H indicates hunting to varying extent. Comments from respondents are included in footnotes.

Europe	Is it legal to bait for the purpose of hunting in your country?	Brown bear	Gray wolf	Golden jackal	Wild boar	Red fox	European badger	Red deer
Albania ³⁷	No	P	P					
Austria, Carinthia ³⁸	Yes	N	P		+	+	+	
Belgium, Wallonia	No							
Bosnia & Herzegovina ³⁹	No							
Bulgaria	Yes	P-	H+	+	+	+	+	+
Croatia (1)	Yes	P, H+	P, H+	+	+	+	+	+
Croatia (2)	Yes	P, H+	P, H		+			
Czech Republic	Yes	-	P-	-	+	+	+	+

³⁷ Albania: Fair chase principle.

³⁸ Austria, Carinthia: Note that hunting and baiting regulations slightly differ between the provinces, but overall, the differences are not that big. In general, baiting is allowed for carnivores (other than bear, wolf, lynx) and wild boar. There are no specific regulations in relation to what materials can be used, other than those materials used to legally feed red deer during winter (for example, commercial livestock/wildlife pellets) cannot be used for attracting wild boar in areas with red deer.

³⁹ Bosnia & Herzegovina: There are 2 entities and one district in Bosnia and Herzegovina, each with its own set of laws. The background for prohibiting baiting is not specified in any of the hunting and nature protection laws. Probably fair chase principle.

Europe	Is it legal to bait for the purpose of hunting in your country?	Brown bear	Gray wolf	Golden jackal	Wild boar	Red fox	European badger	Red deer
Denmark ⁴⁰	No					+		
Estonia	Yes	H+	H+	+	+	+	+	+
Finland	Yes	H-	P		+	+	+	
France ⁴¹	No	P	P					
Germany ⁴²	Yes		P		+	+		
Greece ⁴³	No	P	P, H					
Hungary ⁴⁴	Yes			+	+	+		
Italy ⁴⁵	No	P	P					
Latvia	Yes	P	P, H+	+	+	+	+	+
Lithuania	Yes		P, H+	+	+	+	+	+
Luxembourg ⁴⁶	Yes				+			+
Netherlands ⁴⁷	Yes				+	+		+

⁴⁰ Denmark: Fair chase principle. The following species can be trapped (or shot at baiting sites) as pest control (not hunting): raccoon dog, red fox, stone marten, polecat.

⁴¹ France: To minimize the spread of diseases, to avoid increasing density locally (especially for ungulate species).

⁴² Germany: Wild boar; amount of food that can be used for bait is limited, with exact amounts depending on the state. Red foxes, waterfowl and certain other birds can also be baited (the latter two only via visual cues).

⁴³ Greece: Respondent not certain on the legal / practical background.

⁴⁴ Hungary: Wild boar (luring) and medium sized predators (baiting) - e.g., red fox, golden jackal.

⁴⁵ Italy: Fair chase principle.

⁴⁶ Luxembourg: This is the subject of an entire regulation: <https://legilux.public.lu/eli/etat/leg/rgd/2012/10/09/n1/jo>. Species: Cervus elaphus and Sus scrofa as native species, Dama dama and Ovis ammon as invasive / alien species.

⁴⁷ Netherlands: Species: wild boar, roe deer, red deer, fallow deer. Fox bait: organic bait, lure odors, non-organic (but manufactured so there is no risk on transferring diseases).

Europe	Is it legal to bait for the purpose of hunting in your country?	Brown bear	Gray wolf	Golden jackal	Wild boar	Red fox	European badger	Red deer
North Macedonia ⁴⁸	No							
Norway ⁴⁹	Yes	P, H-	P, H		+	+	+	
Poland	Yes	P	P		+	+	+	
Portugal ⁵⁰	Yes		P		+			
Romania ⁵¹	Yes	P, H	P	+	+	+		
Russia	Yes	+	+		+	+		
Serbia	Yes	P+	P, H+	+	+	+		+
Slovakia ⁵²	Yes		P, H		+			
Slovenia (1), Dinaric Alps	Yes	P+	P+	+	+	+	+	+
Slovenia (2)	Yes	P+	P	+	+	+	+	+
Spain, Asturias and León ⁵³	No	P	P, H					
Sweden	Yes	P, H+	P, H+	+	+	+	+	+

⁴⁸ North Macedonia: Fair chase principle. The Law on Hunting just states that it is forbidden without a specific reason, but I assume it is because of fairness.

⁴⁹ Norway: As of the current legislation, the county governor can allow the placing of a bait during licensed hunts on brown bears. However, no evidence of this actually being practiced can be found.

⁵⁰ Portugal: Wild boar, baited with corn.

⁵¹ Romania: Wild boar, African swine fever, 5 kg. corn per baiting site. Golden jackals and foxes are hunted with carcasses or leftovers.

⁵² Slovakia: Wild boar with corn. Should be placed in feeding device so that other species (like deer and bear) cannot feed from it. Not allowed during emergency periods (harsh winters). Carnivores: large carnivores and wild cat are under all year protected, meat baiting under special requirements Birds: meat baiting only genus Corvus.

⁵³ Spain, Asturias and León: Until recently, it was used to lure wolves in some areas. Very recent regulation makes it illegally, though.

Europe	Is it legal to bait for the purpose of hunting in your country?	Brown bear	Gray wolf	Golden jackal	Wild boar	Red fox	European badger	Red deer
Switzerland ⁵⁴	Yes	P	P		+	+		
Ukraine	Yes	-	+	+	+	+	+	+
United Kingdom ⁵⁵	See footnote				+			

⁵⁴ Switzerland: Martin Baumann, personal communication. 26 Cantons with different legislations. The main practices consist of hunting red foxes (slaughter remains) and wild boar (tar) on the bait. No other means of baiting wildlife is known.

⁵⁵ United Kingdom: Rory Putman, personal communication. England / Wales and Scotland has different legislations. Baiting (feeding in order to lure animals into an area for capture or shooting) is not legal in any part of the UK, as it is considered “entrapment”, which is illegal. However, it is legal (and quite common) in Scotland to provide food for wild boar to lure them into areas where hunters may shoot from a high seat.

5. Table, results from Europe, supplementary feeding

Table 4 Results from the answers to a survey in Europe on baiting and feeding mammalian game species, where respondents were asked to report which species that could legally be provided supplementary food. Croatia and Slovenia's responses are numbered, indicating two different responses from the countries. Distribution for each species is illustrated with color (green – extant and resident, yellow – presence uncertain, orange – extinct, and white – not present) based on the IUCN Red List (www.IUCNRedlist.org, accessed on 01.06.2022). Legal and management status for brown bear and wolf acquired from (Kaczensky et al., 2012), where P indicates protected and H indicates hunting to varying extent. Comments from the respondents are included in the footnotes.

Europe	Supplementary feeding legal?	Brown bear	Gray wolf	Golden jackal	Wild boar	Red deer	Roe deer	Moose	Fallow deer	Mouflon	Northern Chamois
Albania ⁵⁶	No	P	P								
Austria, Carinthia ⁵⁷	Yes	N	P			+	+				
Belgium, Wallonia ⁵⁸	No										
Bosnia & Herzegovina ⁵⁹	Yes	+	+	+	+	+	+		+	+	+
Bulgaria ⁶⁰	Yes	P	H		+	+	+		+	+	
Croatia (1) ⁶¹	Yes	P, H	P, H		+	+	+		+	+	+

⁵⁶ Albania: The law is not clear / specific on the stand for supplementary feeding.

⁵⁷ Austria, Carinthia: To help high density deer populations survive times with low natural food supply and at the same time to avoid damages to forestry.

⁵⁸ Belgium: To not contribute to population densities above the natural carrying capacity.

⁵⁹ Bosnia and Herzegovina: All listed animals, except for Moose, Wild Reindeer and European Bison, are game animals, and the law states that "profit raised from use of the hunting ground by the hunting organization that is in charge of the hunting ground is to be used for "development of the hunting", which also (aside from other measures) includes the provision of supplementary food. However, "allowed" and "forbidden" foods are not specified. In most cases, feeding makes sure that the animals survive the severe weather conditions.

⁶⁰ Bulgaria: It is regulated by the Hunting Law. Each hunting unit is required to provide supplementary feeding on their grounds. The season is not regulated, in some areas supplementary feeding is all year round

⁶¹ Croatia (1): Hunting law.

Europe	Supplementary feeding legal?	Brown bear	Gray wolf	Golden jackal	Wild boar	Red deer	Roe deer	Moose	Fallow deer	Mouflon	Northern Chamois
Croatia (2) ⁶²	Yes	P, H+	P, H		+	+	+				
Czech Republic ⁶³	Yes		P		+	+	+	+	+	+	+
Denmark ⁶⁴	Yes					+	+				
Estonia ⁶⁵	Yes	H+	H+	+		+	+	+			
Finland ⁶⁶	Yes	H+	P+	+	+		+	+	+		
France ⁶⁷	No	P	P								
Germany ⁶⁸	Yes		P			+	+		+	+	
Greece ⁶⁹	No	P	P, H								
Hungary ⁷⁰	Yes				+	+	+		+	+	

⁶² Croatia (2): "Helping wildlife", like in winter.

⁶³ Czech Republic: It could be realized only by the owner of hunting ground.

⁶⁴ Denmark: Pheasants, ducks etc. In the legal framework, supplementary feeding is generally allowed with no specific species mentioned. For ungulates feeding is extensively used to attract the animals to specific properties so that they are harvested by the neighbors. There is also a widespread illegal practice of placing food (oops I lost a bunch of carrots..!) near shooting towers.

⁶⁵ Estonia: Remnant of former practice when it was an integral part of game management. Nowadays it is not common practice anymore but still legal, except for wild boar due to spread of African Swine Fever. Wild boar baiting is allowed in limited amounts and places.

⁶⁶ Finland: Wild reindeer and white-tailed deer. Hunters want to have higher winter survival and productivity in deer (and mountain hare too), large carnivore feeding for viewing and photographing was started up in early 1990s, and still there exists very little restrictive legislation. Small and mid-size carnivores are fed to ease legal control; higher survival of game birds (waterfowl, grouse) as an important motivation.

⁶⁷ France: To not contribute to population densities above the natural carrying capacity.

⁶⁸ Germany: Sika deer. Winter harshness; to avoid suffering of animals in times of food shortage.

⁶⁹ Greece: Respondent not certain on the legal / practical background.

⁷⁰ Hungary: Brown hare, ring-necked pheasant, grey partridge. Act on the conservation and management of game, and hunting ("Hunting law" of 1996) and the related ministerial decrees.

Europe	Supplementary feeding legal?	Brown bear	Gray wolf	Golden jackal	Wild boar	Red deer	Roe deer	Moose	Fallow deer	Mouflon	Northern Chamois
Italy ⁷¹	No	P	P								
Latvia ⁷²	Yes	P	P, H		+	+	+	+			
Lithuania ⁷³	Yes		P, H+	+	+	+	+	+	+	+	
Luxembourg ⁷⁴	No										
Netherlands ⁷⁵	No										
North Macedonia ⁷⁶	Yes				+	+	+	+	+	+	+
Norway ⁷⁷	No	P, H	P, H								
Poland ⁷⁸	Yes	P	P		+	+	+	+	+	+	
Portugal	Yes		P		+	+	+			+	
Romania ⁷⁹	Yes	P	P			+	+		+		+

⁷¹ Italy: To not contribute to population densities above the natural carrying capacity.

⁷² Latvia: Generally, there is no ban to feed any species, except within protected areas. Believe of game keepers.

⁷³ Lithuania: There is no specification in the Hunting Rules which species may be fed, so I ticked off all the present ones. The amount of food and the distribution of feeding stations is regulated. Also, it is stated in the Hunting Rules that supplementary feeding is allowed to (1) help wildlife to survive during the periods with adverse conditions for natural feeding and to (2) draw away from agricultural zones to reduce damages.

⁷⁴ Luxembourg: To avoid habituating wild animals to people, to avoid nuisance animals in the vicinity of people, to minimize the spread of diseases, to not contribute to population densities above the natural carrying capacity.

⁷⁵ Netherlands: To not contribute to population densities above the natural carrying capacity.

⁷⁶ North Macedonia: It is up to the hunting concessionaires to provide this on their own will. But almost all concessionaires do this regularly.

⁷⁷ Norway: To minimize the spread of diseases. All feeding of ungulates (including salt licks) has been illegal since 2016 to stop CWD from spreading between the different species of ungulates (Reindeer, roe deer, red deer, moose and fallow deer).

⁷⁸ Poland: European bison. Not specified clearly in legislation. Popular meaning is support of animals during harsh winters and reduction of crop depredation

⁷⁹ Romania: European bison. Contractual obligations to feed these species during winter.

Europe	Supplementary feeding legal?	Brown bear	Gray wolf	Golden jackal	Wild boar	Red deer	Roe deer	Moose	Fallow deer	Mouflon	Northern Chamois
Russia, Karelia ⁸⁰	Yes	+	+		+		+	+			
Serbia ⁸¹	Yes	P+	P, H+	+	+	+	+		+	+	+
Slovakia ⁸²	Yes		P, H		+	+	+		+	+	
Slovenia (1), Dinaric Alps ⁸³	Yes	P	P			+	+		+	+	
Slovenia (2) ⁸⁴	Yes	P	P			+			+	+	
Spain, Asturias, and León ⁸⁵	Yes	P	P, H			+			+		
Sweden ⁸⁶	Yes	P, H+	P, H+	+	+	+	+	+	+	+	
Switzerland ⁸⁷	Yes	P	P			+	+				
Ukraine ⁸⁸	Yes				+	+	+	+			

⁸⁰ Russia, Karelia: Wild reindeer. Hunting law. It is old traditional way to increase reaches and state of Game animals. Frankly, no one feeds bears and wolves just like that, but hunting does not always happen and sometimes animals are simply fed. For example, in oat fields specially sown to attract bears.

⁸¹ Serbia: To increase trophy values and reduce damages.

⁸² Slovakia: Hunting law allows feeding during emergency periods (harsh winters).

⁸³ Slovenia (1), Dinaric Alps: Hunting management law.

⁸⁴ Slovenia (2): Allowed in certain areas for certain species with limited amount of food on designated locations, approved by authorities.

⁸⁵ Spain, Asturias and León: I am not sure about the legal background, but they do it in private lands.

⁸⁶ Sweden: Feeding is allowed, but the County Administrative Boards can decide on limited regulations for feeding deer, moose, roe deer, mouflon and wild boars (cloven-hoofed animals).

⁸⁷ Switzerland: Martin Baumann, personal communication. Feeding of wildlife for hunting purposes is not regulated in the territory open to hunting. There were plans, to forbid this on a federal level, but the corresponding change of the federal hunting law was rejected in a peoples vote in 2021. Yet, within federal game and bird protection areas (where hunting is forbidden), the feeding of wildlife (food, salt) is prohibited, even if no hunting takes place there. Feeding of wildlife for hunting purposes is in most cases not regulated. Several Cantons started to forbid the feeding of Ruminants (mainly Red Deer, Roe Deer) on their territory.

⁸⁸ Ukraine: European bison. Supplementary feeding supports game animals valued by hunters during winter. More game animals mean greater profits from hunting.

Europe	Supplementary feeding legal?	Brown bear	Gray wolf	Golden jackal	Wild boar	Red deer	Roe deer	Moose	Fallow deer	Mouflon	Northern Chamois
United Kingdom ⁸⁹	Yes					+					

⁸⁹ United Kingdom: Rory Putman, personal communication. The information from Apollonio, M., Andersen, R., & Putman, R. (2010). *European ungulates and their management in the 21st century*. Cambridge University Press.) is up to date, as there has been no changes in the legislature since then. Supplementary feeding is not regulated, and the decision to feed lies with the individual landowner. Feeding is not common in England or the Lowlands of Scotland. However, it is more common for red deer in upland areas, i.e., Northern Scotland.

6. Table, results from Europe, diversionary feeding

Table 5 Results from the answers to a survey in Europe on baiting and feeding mammalian game species, where respondents were asked to report which species that were provided diversionary food. Croatia and Slovenia's responses are numbered, indicating two different responses from the countries. Distribution for each species is illustrated with color (green – extant and resident, yellow – presence uncertain, orange – extinct, and white – not present) based on the IUCN Red List (www.IUCNRedlist.org, accessed on 01.06.2022). Legal and management status for brown bear and wolf acquired from (Kaczensky et al., 2012), where P indicates protected and H indicates hunting to varying extent. Comments from the respondents are included in the footnotes.

Europe	Diversionary feeding practiced?	Brown bear	Gray wolf	Golden jackal	Wild boar	Red deer	Roe deer	Moose	Fallow deer	Mouflon	Northern Chamois
Albania	No	P	P								
Austria, Carinthia	No	N	P								
Belgium, Wallonia ⁹⁰	Yes				+	+	+				
Bosnia & Herzegovina	No										
Bulgaria ⁹¹	Yes	P+	H+		+	+	+				+
Croatia (1)	Yes	P, H+	P, H		+	+	+				
Croatia (2)	Yes	P, H+	P, H		+	+	+				
Czech Republic	Yes	-	P-		+	+	+	+			+
Denmark ⁹²	Yes		+		-	+	+				

⁹⁰ Belgium, Wallonia: Red and roe deer can only be fed with hay. The aim is to limit damages to tree plantations. Wild boar can only be fed with cereals (excluding maize) and peas, with the aim to limit damages to crops.

⁹¹ Bulgaria: For the ungulates, the so called “game fields” are seeded where ungulates can graze within the forests. For the bear, fruit trees are planted to attract bears away from the villages.

⁹² Denmark: Gray wolf with scent lures.

Europe	Diversionsary feeding practiced?	Brown bear	Gray wolf	Golden jackal	Wild boar	Red deer	Roe deer	Moose	Fallow deer	Mouflon	Northern Chamois
Estonia	No	H	H								
Finland	No	H	P								
France	Yes	P-	P-		+	+					
Germany ⁹³	Yes	-	P-		+	-	-				-
Greece	No	P	P, H								
Hungary ⁹⁴	Yes				+	+	+				
Italy	Yes	P+	P-		-	+	+				-
Latvia ⁹⁵	Yes	P	P, H		+	+	+	+			
Lithuania ⁹⁶	Yes		P, H		+	+	+	+			
Luxembourg	No										
Netherlands	No										
North Macedonia	No										
Norway	No	P, H	P, H								
Poland	Yes	P	P		+						

⁹³ Germany: Diversionsary feeding of wild boars can also use acorns, beechnuts etc.

⁹⁴ Hungary: Side products of fruit processing.

⁹⁵ Latvia: Branches of trees after forest cutting.

⁹⁶ Lithuania: Diversionsary food is mainly used to draw ungulates away from agricultural crops. But it is usually difficult to separate between supplementary feeding and diversionsary feeding, and there are no separate rules for that. Therefore, I ticked all the allowed material - the same as in the supplementary feeding part. As far as I know there is no practice to diversionsary feed carnivores, therefore I checked no boxes for those that are present in Lithuania.

Europe	Diversiory feeding practiced?	Brown bear	Gray wolf	Golden jackal	Wild boar	Red deer	Roe deer	Moose	Fallow deer	Mouflon	Northern Chamois
Portugal	No		P								
Romania	Yes	P-	P-		+	+	+				
Russia, Karelia	No										
Serbia	Yes	P	P, H		+	+	+				+
Slovakia	Yes		P, H								
Slovenia (1), Dinaric Alps ⁹⁷	Yes	P+	P		+	+	+				+
Slovenia (2)	Yes	P+	P				-				-
Spain, Asturias, and León	No	P	P, H								
Sweden ⁹⁸	Yes	P, H	P, H		+	+		+			
Switzerland ⁹⁹	See footnote	P	P								
Ukraine	No										

⁹⁷ Slovenia (1), Dinaric Alps: Also, hay may be used for deer, but this is often used simultaneously for the purpose of supplemental feeding.

⁹⁸ Sweden: Common for large grazing birds (geese, crane and swans).

⁹⁹ Switzerland: Divisionary feeding of wildlife is not regulated. Yet, within federal game and bird reserves, the divisionary of wildlife (food, salt) is forbidden even if no hunting takes place there. Some Cantons forbid the divisionary feeding of wild boar.

7. Complete results from the survey

The Microsoft Excel document containing all the information gathered in the survey is available for download via the following link:

https://docs.google.com/spreadsheets/d/1PN1qmUBvkt5_xTRvVO76qoQdKIK3kwV7/edit?usp=sharing&oid=103941929449119072972&rtpof=true&sd=true

The Excel document is password protected. E-mail me at www.torhol3@gmail.com for access.