

COMPASSIONATE CONSERVATION: CONCEPT AND APPLICATIONS

(Conservação compassiva: conceito e aplicações)

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RESUMO: O crescimento das áreas urbanas, a falta de familiaridade das pessoas com a vida selvagem, a disseminação das cidades para regiões não exploradas e a perda de habitats naturais fazem com que animais e seres humanos vivam em grandes proximidades dentro e ao redor de áreas urbanas. Esta situação impõe muitos desafios a ambas as partes e ocasionalmente gera conflitos. Ao gerenciar situações de conflito, a abordagem tradicional considera quase exclusivamente a conservação, com pouca ou nenhuma consideração pelo bem-estar animal. Este trabalho tem por objetivo discutir o conceito de conservação compassiva e sua aplicação prática pela exposição de três questões relevantes de conservação de espécies silvestres. A abordagem de conservação compassiva une a conservação e o bem-estar animal em um esforço para tomadas de decisão mais esclarecidas e, conseqüentemente, melhoria do bem-estar animal e humano e de aspectos ambientais. Em uma revisão sobre alguns métodos de manejo da vida selvagem, as abordagens são comparadas quanto a pontos fortes e fracos em relação ao bem-estar e à conservação animal.

Palavras-chave: Animais selvagens; armadilhas de cola; bem-estar animal; bem-estar único; capivara; urso.

ABSTRACT: The growth of urban areas, the unfamiliarity of people with wildlife, the spread of cities into wilderness and the loss of natural habitats cause animals and humans to live in close proximity in and around urban areas. This situation imposes many challenges to both parties and occasionally generates conflicts. When managing conflict situations, the traditional approach considers almost exclusively conservation, with little or no regard for animal welfare. This work aimed to discuss the concept of compassionate conservation and its application in practice by addressing three relevant wildlife conservation issues. The compassionate conservation approach unites conservation and animal welfare in an effort for more enlightened decision making and, consequently, improvement in animal and human welfare and environment aspects. In an overview of some wildlife management methods, the approaches are compared regarding strengths and weaknesses on animal welfare and conservation.

Key Words: Animal welfare; bear; capybara; glue traps; one welfare; wildlife.

INTRODUCTION

Conflicts with wildlife and the necessity to solve them naturally arise from all animal species sharing the planet, with an astonishing increase in human population numbers. Hence, humans end up interfering with nature in many ways, as for example attempts of conservation. Although the aims of conservation may include relieving damages such as habitat loss, climate change and pollution, paradoxically it can result in animal suffering, as animals may be injured and killed in the process of achieving conservation objectives for the greater good of their species or another species (Ramp e Bekoff, 2015). This seems to be the dominant paradigm, where conservation goals are thought of mostly in a fashion unrelated to animal welfare issues. For example, the main environmental body in Brazilian government, Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA), is known for working to preserve biodiversity, usually in a manner that excludes animal welfare considerations. The main question, according to Ramp e Bekoff (2015), is "where the trade-offs stop and the protection of individuals begins", where is the balance between individual life quality and harming and killing in the name of conservation.

Conservation takes into account values, ethical choices and science. Considering populations as the main priority, instead of individuals, is a value that has been guiding conservation. On the other hand, it has been proposed that the consideration of individuals and their welfare may be as important as the consideration of the population and its conservation metrics (Papastavrou et al., 2017). Thus, it seems morally imperative that modern solutions are provided to ameliorate coexistence in the nature (Ramp e Bekoff, 2015) and it has been proposed that both animal welfare and

conservation aspects should be considered when making management decisions towards conservation (Papastavrou et al., 2017).

This work aimed to discuss the concept of compassionate conservation and its application in practice by addressing three relevant wildlife conservation issues.

HISTORY OF COMPASSIONATE CONSERVATION

Historically, wildlife conservation and animal welfare are seen as separate entities, with conservation viewed as scientifically and welfare as emotionally motivated (Papastavrou et al., 2017). This may be in part because of past disagreements between conservation and animal welfare scientists on the role of welfare in conservation. Moreover, conservation practice and policies are often based on economic and utilitarian values, and the denial of intrinsic value and sentience of animals also play a part in this scenario (Ramp e Bekoff, 2015).

The conservationist preference for focusing on population data as opposed to individual consideration may be due to lack of exposure and understanding of the welfare of wild individuals and the difficulties intrinsic to animal welfare assessment. Even when considering wildlife welfare, some species and some issues are more noticeable, leaving other important issues unattended (Papastavrou et al., 2017).

Although there are many animal welfare assessment protocols, most of them were produced to evaluate the welfare of domestic animals, such as the Welfare Quality Assessment Protocols for farm animals (Welfare Quality Network, 2009), the Shelter Quality Welfare Assessment Protocol for dogs (Barnard et al., 2014) and the Animal Welfare Indicators Assessment Protocols for farm animals as well (Animal Welfare Indicators, 2015).

Additionally, there are approaches to assess, monitor and positively impact the welfare of captive wildlife, such as Animal Welfare Strategy of the World Association of Zoos and Aquariums (World Association of Zoos and Aquariums (WAZA), 2016). The welfare assessment of free wild animals is an ongoing construction, developed case by case, considering the many relevant specificities.

Compassionate conservation is an emergent cross-disciplinary concept that proposes that conservation ethics should consider animals as individuals, not just as members of populations of species. It means using empathy for nonhuman animals and striving to alleviate harm and suffering for them. That does not mean, however, that individual welfare supersedes species or ecosystem balance, but that the interest of individuals can no longer be ignored in conservation practice. Wildlife conservation outlines should be developed toward the management of the many lives of individuals and their social groups and not merely of the species or population. The rising view of conservation as more than prevention of population decline, extinction and reduction of biodiversity is due to the increasing recognition of the intrinsic value of sentient animals (Ramp e Bekoff, 2015).

There is additionally a more pragmatic advantage to the inclusion of animal welfare consideration in conservation efforts. While population level and ecosystem effects may take a long time to become apparent, animal welfare can be measured in the short term, enabling more targeted, continuous, early, rapid and effective measures to be taken. Thus, better outcomes can be achieved for individuals and their populations. Moreover, such measures can be better for humans, as they can be less drastic, less costly, less laborious and less interfering to human

activities (Papastavrou *et al.*, 2017). All these aspects suggest the case for compassionate conservation to be within the new concept of one welfare, which recognises the interconnections between animal welfare, human wellbeing and the environment (Pinillos *et al.*, 2016). The representation of one welfare can be seen in Figure 1, where the overlapping circles represent the new paradigm of simultaneous consideration of human welfare, animal welfare and environmental aspects (Molento, 2014). A concrete example of environmental aspects is wildlife conservation, revealing the proximity of the one welfare and the compassionate conservation concepts.

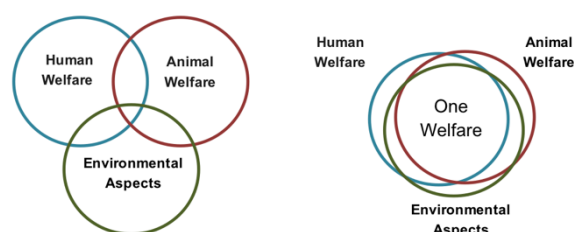


Figure 1 – Representation of one welfare concept, in which the compassionate conservation approach may be inserted; adapted from Molento (2014).

The traditional idea that conservation should only take into consideration issues that affect the whole species or population or at least a determined portion of it, is still commonly observable. The determination of a population threshold weakens the importance of individual welfare and its contribution for conservation. In opposition, some legislation for conservation are based on welfare criteria (Papastavrou *et al.*, 2017). An example is the USA Marine Mammal Protection Act which in the 1994 amendment prohibits “any act of pursuit, torment, or annoyance which has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns including, but not limited to, migration, breathing, nursing, breeding, feeding, or

sheltering". The regulation is based on individual behavioural indicators, although it was altered later towards population level (National Research Council, 2005). Such indicators display the demand for conservation to work with individuals and population alongside, and the public moral sense and concern for broader legislation that considers individual animals. Even in the presence of ample animal protection legislation, that explicitly includes wild and domestic animals such as the Environmental Act in Brazil (Brasil, 1998), governmental actions tend to weigh biodiversity conservation so highly that actions to protect individual wild animals are hardly ever taken.

Some wild species are more appealing to the public, and thus individual animals may get more attention on conservation programs, as for the great empathy of humans towards non-human primates, while other species are sometimes not even noticed. The interest on conservation of a species is influenced greatly by predominant views on its sentience and cognition, position on the phylogenetic scale and utility to human. The cultural, ethical, aesthetic and economic values considered when planning conservation and policies often result in philosophical, moral, and practical conflict (Ramp e Bekoff, 2015). An example of different values regarding species is the higher public engagement in avoiding killing of stray dogs and cats than avoiding killing of pigeons and rats. The challenge for decision makers in conservation is to establish an ideologically sound and applicable framework. If an issue is detected and intervention is required, the values of different stakeholders should be evaluated. The conservation project must be supervised with scientifically credible monitoring programs and performance indicators measured in order to adapt the project as needed. If violations towards species or welfare of individuals are

expected, clear data are needed on the minimum number of animals affected so that the goal is accomplished. Welfare rating systems can be adapted from domestic animals and livestock (Ramp e Bekoff, 2015).

It is not easy to identify direct and cumulative non-lethal welfare consequences for individual wild animals and their population, although some of them cause the animal to be unfit and less likely to survive in the wild. Moreover, there is not much data to base quantitative animal welfare metrics for free-living populations and this, according to Papastavrou et al. (2017), reinforces the notion of welfare not being a serious branch of science and not deserving attention in the development of policies and management decisions. Some studies have started to shape useful indicators, as behaviour and hormones; however, much has to be investigated, especially among different species. It may also be postulated that these challenges are expected in a relatively recent field of research, as is the case for animal welfare, and that the recognition of its importance for better conservation strategies may be a leading force to support wild animal welfare scientific advances. The practical implementation of compassionate conservation is in its early stages; however, some examples can already be mentioned as the successfully managed predation by wolves using fencing and guard animals (Fox & Bekoff, 2011) rather than shooting, trapping, and poisoning and the control of wildlife populations through vaccine-based contraception rather than human-induced mortality control (Cohn e F. Kirkpatrick, 2015). Another example is the protection of apex predators, such as dingos, to limit populations of prey and suppress smaller predators to meliorate native–non-native coexistence, instead of killing introduced species (Wallach et al., 2015).

Thus, three issues regarding animal management are discussed in order to present different situations in which the concept of compassionate conservation can be applied and perhaps improve human-wildlife coexistence.

BEAR-HUMAN INTERACTIONS

According to the British Columbia Conservation Officer Service, there have been more than 20,000 incidents between humans and wildlife in British Columbia (BC) in 2017 up to beginning of October, ranging from cougar sightings to bear attacks. Among those, more than 14,000 involved black bears, the most common type of bear in the province, 1,500 cougars and 430 grizzly bears (The Canadian Press, 2017).

The number of black-bear related calls to the BC Conservation Officer Service has nearly doubled in BC this year compared to 2016; 8,900 calls were made only from April to August. These numbers are some of the highest in 10 years, according to Frank Ritcey, provincial co-ordinator of WildSafeBC. North Vancouver had an increase to over four times the number of incidents from last year. The increased incidents of bear-human interactions has led to a corresponding increase, near-doubling, in the number of bears killed in BC. In 2015-2016, more than 700 black bears were killed across the province, 17 black bears were relocated, 151 were hazed by loud noises or pain stimulation to instil fear of humans, and 54 cubs were sent to rehabilitation facilities (Dedyna, 2016). In 2017, 496 bears have been killed, 469 black bears and 27 grizzlies, either by conservation officers or others, after confrontations with humans. According to Mike Badry, wildlife conflict manager with the Ministry of Environment of Canada, "It's much more difficult — even impossible to change that behaviour once they've learned to access human food sources" (Kearney, 2017).

They are driven to urban areas by their keen sense of smell, associate human activities to food, becoming food conditioned, and may lose their natural fear of humans, getting bolder and more aggressive, becoming habituated (Metro Vancouver, 2008), although a bear can be food conditioned and not habituated, searching food around urban areas and human activities yet avoiding encountering humans (Hopkins *et al.*, 2010). Such behaviours are learned and can be developed by shortage of their natural food, as happened in spring 2017, when berry sources were insufficient; easy access to human dwellings, as facilities close to bears natural habitat and open windows and doors; and easy access to human food, as due to unsecured garbage. Garbage is the best attraction, followed by fruit and berry trees and presence of pets and pet food (Chan, 2017). Moreover, the presence of outdoor freezers, barbeques, bird feeders, compost and petroleum derived products (Metro Vancouver, 2008), agricultural and garden crops, fish from hatcheries, fruit from orchards or vineyards, honey from apiaries, hunter-killed carcasses, livestock and sanitary waste (Hopkins *et al.*, 2010) are also attractive.

Therefore, some ways of avoiding bear approach are maintaining windows and doors closed, even in the summer; storing garbage in secure buildings or bear-proof bins; putting garbage out for collection in the morning of the designated day only; keeping outdoor barbeques clean; not leaving food unattended; keeping freezers indoors; picking fruits and berries as they ripen and cleaning the floor when they fall; storing pet food indoors; not leaving bird feeders on bears' reach, hanging them higher than 3.3m and on thin wire; storing petroleum derived products in safe place and cleaning residues, as bears are drawn by its scent; avoid composting fruits and eggshells and sprinkling

compost with lime to reduce odour (Metro Vancouver, 2008), agricultural and garden crops, fish from hatcheries, fruit from orchards or vineyards, honey from apiaries, hunter-killed carcasses, livestock and sanitary waste (Hopkins et al., 2010) are also attractive. Figure 2 shows a bear feeding from human garbage stored in a bin that is not bear-proof.



Figure 2 – Bear feeding from human garbage stored in a bin that is not bear-proof (Try-city News, 2011).

The killing of animals considered dangerous raises questioning whether this is the best way for dealing with the problem. The compassionate conservation concept can help evaluate and develop other methods, thus allowing for more enlightened decisions. There seems to be room for changes in management strategies to increase animal welfare, conservation and human welfare.

CAPYBARA-HUMAN INTERACTIONS

Capybara (*Hydrochoerus hydrochaeris*) is, currently, the largest rodent alive; it may weigh slightly over 90 kg. It is a mammal of the Brazilian wild fauna, where it can be found in all states, and also occurs in other countries of Central and South America.

Green areas nearby human dwelling places, such as parks, exert an environmental, psychological and ecological function, fundamental to urban

equilibrium. They are fundamental to psychological and physical well-being of humans and they can be important reminiscent of native green area which provide habitat for many native species. That is the case for capybaras and the urban parks in the South and Southeast of Brazil (Almeida et al., 2013). Population of *Hydrochoerus hydrochaeris* is significantly higher in human altered environments due to the lack of natural predators and the availability of natural resources of shelter, food and protection, which for capybara include a source of water, as rivers, dams and lakes, shallow banks, forest shelters and a vegetation cover for foraging (Almeida, 2012).

The high prolific capacity also in urban environment, the carrying of diseases transmissible to humans and the damage to human property caused the species to be considered by some as pest. The understanding of the biology and dynamics of *Hydrochoerus hydrochaeris* is fundamental to minimize wildlife-human conflicts in urban areas and to the conservation of urban fauna (Almeida et al., 2013). Especially in the case of capybaras, the presence of the animals is also considered by many as a positive value, in terms of aesthetics and identity of the city. Curitiba, for example, houses several species of the country fauna, including capybaras. The species is considered a symbol of the city and a tourist attraction and is a subject of interest, even used as link to the public by the local government (Figure 3).

Especially due to public health reasons, capybara population management has been debated lately. Removing animals, whether by killing or translocation is not an efficient method of population control, as reminiscent population increase due to less competition and greater resources availability. Moreover, the connection of habitat fragments through water bodies allows migration of other individuals for

the area, repopulating it. Actually, the removal of capybaras from an endemic Brazilian Spotted Fever area increases the risk of transmission due to the augmentation in susceptible animals in the area and consequent amplification of *Rickettsia* in ticks (Rodrigues, 2013). This seems to be a general rule for the control of zoonotic diseases. An approach that decreases the flow rate of a population may be more adequate in general, as is the case for stray dog population management and the risk of rabies (Molento, 2014).



Figure 3 – The local government of the City of Curitiba uses the capybara as a city symbol and to improve public interest and engagement (IPCC, 2017).

Hunting as a method for population control is prohibited in Brazil. In Rodrigues (2013), through deferentectomy and tubal ligation the author achieved an annual decrease of 28% on a population of 26 individuals. Some authors suggest the sustainable exploitation of capybara products as a management option. Ferraz *et al.* (2001) states that the rational exploitation aids in conservation of the species and habitats through their appreciation, resulting from the income of meat and leather, for example. Still according to the author, for this, limits for extraction should be established from annual population monitoring, avoiding population decline but providing a level of sustainable yield close to its maximum, allowing at the same time conservation and rational use.

According to Borioni (2008), when managing capybara population measures should aim to control and prevent serious environmental imbalances protecting water bodies,

riparian forests, areas of water sources, lakes and artificial reservoirs. Moreover, manipulation of the habitat can be used, reducing the biological carrying capacity to support groups of capybara residents in a given area and changing population dynamics. Habitat management may imply restoration of riparian forest, removal of a food source or placing physical barriers, limiting access to a resource. A preliminary diagnosis of the capybaras population and the environment must be carried out by experts in the field before implementing such measures. In areas of risk for Brazilian Spotted Fever, the removal of capybaras is authorized in the case of groups that can be isolated from surrounding areas through the installation of physical barriers to prevent the re-introduction (Borioni, 2008). The real necessity of capybara population management must be monitored, as not every population poses a risk to human health or human property. It will probably be more effective to construct strategies to fight disease directly, as compared to fighting the capybaras.

GLUE TRAPS AS AN ANIMAL POPULATION MANAGEMENT METHOD AND ITS IMPACTS

Glue trap impacts on animal welfare and conservation may be discussed considering Canadian information as an example. The two most common ways of controlling animals labelled as pests are traps and poison. Glue traps are marketed worldwide as an effective, nontoxic tool to the management of these animals (Waterbury, 2007) and consist of cardboard tents, fiberboard or plastic boards coated with a very sticky and strong non-drying type of adhesive, either natural or synthetic. For attraction, the adhesive is scented or a bait is placed on it (Forrester, 2014). Animals become stuck by the feet or fur when attempting

to run across it. Once captured, the animal is usually unable to free itself and brings additional body parts into contact with the adhesive as it attempts to free itself (State of Victoria, 2005).

Glue traps themselves do not kill animals, the animals captured by the glue may take a few days to die. During this period they remain with no food and water and no ability to move, eventually dying from dehydration, starvation, exposure to weather, suffocation, predation or killing by humans. Additionally, animals can die from injuries or blood loss as they try to chew through their own limbs in an attempt to escape from the trap. Depending of conditions of the trapping, the level of pain or distress experienced by animals will vary (State of Victoria, 2005); however, suffering is likely to be severe in most cases.

The glue is sufficiently powerful to catch insects such as spiders, beetles, cockroaches and flies and mammals such as mice and rats. However, they can potentially trap non-target victims, which include any small animal, including birds, possums, bats, reptiles, amphibians, squirrels, and other wildlife, even pets and can cause trouble for children that get in contact with them as well (Forrester, 2014; State of Victoria, 2005; Waterbury, 2007). Depending of the animal's condition, euthanasia may be necessary.

Wildlife can be attracted to the trap by the scent or the bait or even by captured insects, rodents and small birds (Figure 4). When glue traps are used outside, the hazard seems higher (Waterbury, 2007). The menace these types of trap impose has already been perceived by many animal protection institutions such as Wildlife Rescue Association of British Columbia, Toronto Wildlife Centre, Animal Welfare Institute, The British Columbia Society for the Prevention of Cruelty to Animals, Humane Society International and People for the Ethical Treatment of

Animals. Some institutions even posted instructions for safe removal of wildlife from glue traps and others work for the ban of such traps around the world.

Awareness, especially of consumers, is a first step toward minimizing the impact of glue traps on wildlife (Waterbury, 2007). Additionally, the search for more humane animal control options is necessary, as the currently available options present conservation and severe welfare challenges. The advertisement of glue traps does not transmit the conditions of the death the trapped animals suffer. The manufacturers advertise and the packages picture them as convenient, using discreet words as "capture," "hold" or "secure". There are some types of glue traps that are "no see", which unable visualization of the dead animal. Therefore, the consumer cannot see the conditions of the animal's death and cannot even see which animal is trapped (Waterbury, 2007).



Figure 4 – Northwestern crow captured in a glue trap when attracted by a previous captured mouse; chinchilla powder is being used to remove the animal from the trap.

Glue traps are not to be used, with some exemptions, because they capture yet do not kill animals, causing animal suffering. Thus, the method is prohibited unless exemption is granted by the BCSPCA AnimalKind™ Accreditation Program or the building is a food-handling facility that must comply with

Health Canada and Canadian Food Inspection Agency regulations. The traps are for indoor use only, must be monitored continuously by a physically present technician, which must have available a killing method for the captured rats and mice. Rats and mice caught must be killed immediately upon detection using a method with a quick time to irreversible unconsciousness or time to death, for instance sufficient impact on the head or neck (State of Victoria, 2005). Non-target animals trapped must be transported to a professional wildlife rehabilitation centre or veterinarian for care. However, to avoid capturing non-target animals, glue traps must be enclosed in boxes or placed in an area that those animals cannot access.

Although generally considered non-toxic to humans, glue traps can affect children that have contact with it. According to the study of Forrester (2014), children under three years old appear to be in greater risk, corresponding to 77.7% of the 431 cases in Texas between 2000-2013. The exposures occurred mainly through dermal contact solely (45.2%) and ingestion solely (39.2%); however, combinations of dermal contact, ingestion and eye contact were also reported. The majority of exposures (91.6%) took place at the children's own residences. In the study, even though no death was reported, some adverse clinical effects were reported as erythema, vomiting, diarrhoea and dermal pain. Individually, there were cases of bullae, nausea, fever, ocular irritation, red eye, and bleeding (Forrester, 2014).

Considering the interests of key stakeholders as animal welfare organisations, glue trap suppliers, glue trap users, agricultural and food industry and food regulators, the State of Victoria, Australia, Department of Primary Industries 2005 determined the

prohibition of glue trapping since the benefits with reduction of pain and suffering to animals are considered to outweigh the costs to suppliers and users of glue traps. It deliberated that glue traps cause an unacceptable level of injury, suffering and distress, similar to serrated steel jawed leghold traps and that all other available methods of rodent control, except for ingested poisons and possibly metal toothed rodent traps, are more humane than glue traps. The use of glue traps on wildlife was already prohibited in 1975, unless exemption granted.

WILDLIFE MANAGEMENT

Most nuisance wildlife problems occur in and around urban environments due to the increasing numbers of people, who are often unfamiliar with wildlife, and the large number of wild animals displaced by urban spread (Clark, 1994). Some issues are due to the lack of knowledge of animal biology and behavior or to questionable information about the real risks of living with wildlife in urban areas, such as the risk of diseases transmission by capybaras or the risk of attacks by frugivorous bats. Sharing the environment can cause problems for both parties, for example, transmission of diseases to humans or damage from noise pollution, electric shocks or vehicle collisions to animals (Vilela *et al.*, 2016).

Human-wildlife conflicts are frequently addressed by excluding, relocating or lethally controlling animals with the goal of preserving public health and safety, protecting property, or conserving other valued wildlife. As concerns for public safety and property protection drive most wildlife control practices, concerns for animal welfare are often neglected (Dubois *et al.*, 2015). In addition, many jurisdictions have limited surveillance of wildlife control measures, including those used by commercial pest control businesses and

by the general public, even though methods available to the public should cause the least suffering, as are used without specialized training (Dubois et al., 2017). The commerce of these methods is an important control point; however, there seems to be little effort in this kind of regulation, both in South and North America. Mason et al. (2003) state that there is little concern for welfare in wildlife control as some of the least humane methods can be used by members of the general public, and are used as a first measure rather than as a last resort. Many invertebrate and adaptable vertebrates such as coyotes (*Canis latrans*), ground squirrels (e.g. *Spermophilus californicus*) and red-billed quelea (*Quelea quelea*) resist control measures; on the other hand, other species do not adapt well to the pressure of the measures and may have become seriously endangered as a result (Woodroffe et al., 2005).

Dubois et al. (2017) published the first international principles for ethical decision making in wildlife control which proposes a seven-step process for managing human–wildlife conflict. The steps are (1) Modify human practices that cause conflict when possible, develop culture of coexistence. (2) Justify the need for control. (3) Have measurable outcome-based objectives that are clear, achievable, monitored, and adaptive. (4) Cause the least harm to animals, both direct harm and indirect effects, to the least number of animals. (5) Consider community values and priorities in addition to scientific and practical information (6) Be integrated into long-term systematic management. (7) Base control on specifics of the situation rather than negative labels applied to the target species. In this approach all relevant concerns, for instance necessity, benefits, feasibility, costs to people and animals, are taken into account. The seven principles method is a

consequentialist approach to ethics as it weights different outcomes.

Pehling e Barnes (2012) consider many items when discussing the management of vertebrate animals similarly to the international principles for ethical decision making in wildlife control by Dubois et al (2017); however, welfare issues are not amongst them. The authors mainly considers the need of control, the species and its aesthetic or recreational value for the community, the costs and benefits and the effects the control program would have on non-target animals and the environment. The management method aims to eliminate or repel the unwanted animals or change their negative habits not endangering humans, non-target animals or the environment. If alternatives methods cannot be enforced as habitat manipulation, the control may involve killing. This is an example of old fashioned guidelines for decision-making, which do not consider compassionate conservation principles.

Fraser (2012) suggests a practical animal ethics philosophy which policy makers can use in complex real-life situations. The author classifies four main ways in which human activities affect animals: (1) keeping animals, (2) intentional harm, (3) direct but unintentional harm, and (4) indirect harm by altering life-sustaining processes and balances of nature. Such effects raise different ethical issues such as suffering, injury and deprivation, regarding animal welfare, and decline of populations, disruption of ecological systems and extinction of species, regarding conservation, apart from death. The moral evaluation and decision-making should also consider the number of animals affected, the duration of the effects, the probability of irreversible effects, and the degree of control over the effects.

It is relevant that the animal control operator, apart from being familiar with

the biological aspects of wildlife control, performs an integrated management and utilizes ecologically responsible techniques, aiming for customer education. Additionally, realistic expectations of the results are essential, and these necessarily involve a deep level of knowledge in terms of population size and dynamics as well as detailed planning including estimated results according to the intervention proposed (Clark, 1994). Information on population size, demography, ecology, behavior and reproductive capacity is necessary to predict the likelihood of success of the intervention. If other aspects of the problem, apart from the animal presence itself, as habitat conditions, human behaviour and food availability are not addressed, the issue may not be solved or an even worse scenario may arise, as a boomerang effect. Regarding food-conditioned animals, altering human behavior is the first step, although wildlife control may also be needed in the short term for animals already conditioned (Dubois *et al.*, 2017). Moreover, for effective wildlife management, partnership between government agencies, urban wildlife management institutions and society is fundamental for integrated control techniques, coupled to community education (Clark, 1994).

Management strategies that aim to prevent or deter individual animals from becoming involved in incidents, called proactive management, are composed of relevant measures as management of edible waste, food storage regulation, exclusion for instance with fencing, public education and restricting human access to the species management areas (Hopkins *et al.*, 2010). Management of individual animals, called reactive management, is required when they are involved in incidents or to reduce the local population (Hopkins *et al.*, 2010). A dynamic management strategy called adaptive management, which combines both proactive and reactive methods and

adjusts according to new information from outcomes and research, seems to be the most effective human-wild animal management strategy because management methods adapts to previous successes, failures and research findings (Hopkins *et al.*, 2010).

Although exclusion and short-distance relocation may cause mild and short-term negative effects, relocation is a controversial measure. It can result in severe welfare problems, stress, high injury and mortality rates among relocated animals due to unfamiliarity with food and water sources, shelter sites, territorial disputes and failure to obtain safety and territory in the new environment (Dubois *et al.*, 2017). Other level of consequences is the effect the translocated animal may have on those animals living in the destiny location. On the other hand, relocation and release on site are more suitable when there are no practical and human ways of killing available. Release on site may be a requirement for some species at different locations; however, even though animals released after exclusion or habitat modification do not suffer relocation stress, they may cause additional damage trying to return to food supply (Clark, 1994).

Translocation and relocation may not be a permanent solution as the animals may return, however they can be successful especially if the new location has abundance of natural foods (Hopkins *et al.*, 2010). It is necessary to consider that territorial animals removed from an area are likely to be replaced by incoming conspecifics, if no changes are made in the area (Baker *et al.*, 2016).

Aversive conditioning and hazing are two non-lethal management methods. The major difference between them being that conditioning must be applied consistently over time, while hazing is usually only periodically applied, providing a negative stimulus to punctual unwanted behaviour situations.

Hazing methods include a range of aversive activities including human dominance (Brabyn et al., 2005). Aversive conditioning is an operant technique which uses a negative stimulus to cause pain, avoidance or irritation in an animal engaged in an unwanted behaviour. For aversive conditioning of bears, for example, some stimuli that were tested include illness-inducing chemicals in food; electrification of human food; electric-shock collars; firearm that shoot painful but nonlethal projectiles such as rubber or plastic slugs (Mazur, 2010); trapping, associated or not with "hard release", such as pain stimuli from beanbag rounds and rubber bullets (Brabyn et al., 2005) or other aversive stimuli as dogs and noisemakers; pepper spray. None of those methods has proven to be effective in all cases, although they are capable of reducing the behaviour or extinguishing it in some animals. Aversive conditioning and hazing actions are intrinsically problematic both from an animal welfare and an animal ethics point of view. Additionally, lethal removal, aversive conditioning and hazing are not effective management strategies if human food or other attractants remain available and accessible.

Though lethal wildlife management methods may appear worse in welfare terms, some researchers propose that non-lethal methods are not always less damaging (Dubois et al., 2017). Baker et al. (2016) developed an assessment model to differentiate and rank the impacts of different wildlife management interventions for decision-making purposes. The model ranked interventions from least to most impact, which, for rabbits were fencing, head shot and chest shot and for crows were shooting, scaring and live trapping with cervical dislocation. The model determined least impact on managing molehills and tunnels for moles. Both

spring trapping and live trapping followed by translocation, scored greater impacts. As methods may not be standardized, more research is needed on objective welfare assessments.

CONCLUSION

The scientific knowledge as well as increased public perception of animal sentience call for a new approach on conservation measures. Compassionate conservation, meaning that animal welfare considerations are included in conservation efforts, seems to favour decision making regarding animal population management that is made on specifics of the situation, in a more cost-effective manner, considering all existing options and developing new approaches. Wild animal-human conflict management best practices rely on adaptive strategies. Independently of the primary motivation for conservation, it may be improved by considering both population and individual as interconnected and interdependent aspects.

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