Philosophy of Science

What are the ethical implications behind population control in Zoos?

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Abstract

Historical records show a long history of animals being kept in captivity: some of the first civilizations, like Ancient Egypt and Ancient Greece, already carried out the practice of keeping animals, their reasons being mainly religious. The practice of animals being held in captivity is still practiced today, which is the main relevance of this project.

Nowadays, and arguably since the environmental movement during the 1960s and the 1970s, the main purpose is not solely the one of recreation and education, but also the conservation and preservation of species.

Parallel to the zoo's turn in purpose, other domains like management of the animals - or populations - have developed and progressed, introducing and practicing methods of population control. This project, which combines the fields of environmental biology and ethics, attempts to discuss these population control methods from an ethical point of view. As part of the research within the mentioned aspects, the project will include two cases studies on population control. These cases include the population of wolves from Mexico, and the case of Marius the giraffe in Copenhagen.
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Glossary

**Culling**: the process of removing or segregating animals from a breeding stock based on specific criteria.

**Disruptive selection**: favours both extremes over a range of phenotypes.

**Fitness**: the genetic contribution of an organism to future generations, relative to the contributions of other organisms living in the same environment with different genotypes.

**Euthanasia**: the act of putting to death painlessly or allowing to die, as animals suffering from an incurable, especially painful, disease or condition.

**Ex situ**: the process of protecting an endangered species of plant or animal outside its natural habitat.

**Genetic drift**: evolution (change in allele frequencies) owing to chance processes.

**Genetic pool**: all the alleles of all the genes of all the individuals in a population.

**Genetic variability**: the tendency of individual genetic characteristics in a population to vary from one another.

**Genotype**: the genetic constitution, latent or expressed, of an organism, in contrast with

**Inbreeding**: the breeding of a closely related individuals.

**In situ**: the process of protecting species of plants or animals within their natural habitat

**Intraspecific competition**: interaction between members of the same species where these compete for limited resources.

**Interspecific competition**: a form of competition between members of different species inhabiting the same habitat.

**Migration**: seasonal movement of animals from one region to another.

**Natural selection**: the differential reproduction of genotypes based on their genetic constitution.
**Phenotype:** the total sum of all the genes present in an individual.

**Population:** any group of individuals, usually of a single species, occupying a given area at a given time.

**Predation:** biological interaction where a predator (an organism that is hunting) feeds on its prey (the organism that is attacked).
Introduction

In Ancient Egypt, sacred animals were kept in captivity near temples for religious reasons (Loisel, 1919); in Ancient Greece animals were kept, sacrificed and offered to the gods (Moran, 1987). Animal captivity has existed for a long time and, even though the concept, purpose and form of it has changed a lot, animal captivity still exists today. The most common example of this is with zoos, but also found in animal sanctuaries and wildlife preservation programs.

Generally known for their collections of animals and recreational value, zoos also provide a platform for scientific studies and experimentations. As part of the scientific studies, a great deal of them revolves around the preservation and promotion of biodiversity. The preservation purposes of animals in zoos range from those with least concern to endangered species, as well as animals which are extinct in the wild. Due to mass destruction of wildlife habitats, zoos are found to be necessary for the conservation of some endangered species. Animal populations in the wild are rapidly decreasing to be demographically and genetically viable, where the specific species will go extinct without continuous monitoring and management (Minteer and Collins, 2013). To achieve desirable results, zoos practice artificial altering of population sizes, typically controlling the animal population size within manageable limitations. This is known as population control, not to be mistaken with conservation biology, which is the protection of species from extinction.

Population control within zoos depends on a variety of factors that influence their sizes. Generally the determinants of population control rely on food supply and habitat limitations. Unlike in the wild, zoos are not concerned with predation and competition from animals with the same resources. Certain means to population control involve the active killing/ euthanasia of animals, rather than letting them take a natural course to life extinction. Other approaches of population control involve manipulation of reproductive capabilities, translocation or culling. The methods of population control have given rise to controversial cases, on how morally and ethically correct it is to perform these procedures. Adapting to
modern zoos, which have systems and legislations placed for the rights and welfare of animals; considerable investigations into these aspects are taking precedence in society’s opinion. The situation of population control draws in other aspects of zoos and animal development, that make it a situation to be approached from different angles, where various biases are not uncommon. To be able to balance out these angles, different properties of ethics and morality will be taken into consideration and further explained throughout the project. To illustrate the aims of the project there will be research done into the historical approach of zoos and more specifically of population control. There will be relevant cases that will be evaluated on, from the variety of information researched, assisting in addressing the problems found in population control, particularly within ethics. This will be supported by the methods of population control, and comparisons of researched material concerning the legislative and welfare aspects of animals.

The conclusive aim of the project is to illustrate the development of the population control from the ethical and progressive aspects of society.

Problem Formulation

What are the ethical implications behind population control in Zoos?

Sub questions:

What are the different methods of population control?
What are the ethical aspects behind the different population control methods?
Methods

Population development and genetic variability

Ecology’s presence in the scientific community was limited until the 1960’s, during the environmental movement. The relation between populations and communities of humans and animals to nature - which was previously considered not as a science but merely as a point of view - was now the core of a theoretical and methodological framework used by, not only biologists and applied biologists, but also political circles. Population biology, a field within ecology which has developed and grown using the methodology of other fields and sciences (like mathematics or genetics), studies the size, growth, history and extinction of populations or communities of organisms (McIntosh, 1985).

The growth and size of a population are usually affected by the interactions of the population itself with the abiotic factors. These factors include temperature and precipitation - and various biological interactions, such as inter- and intra-specific competition, predation and disease. Another factor that also plays an important role is the genetic variation of the population and its individuals.

Genetic variation can be caused by mutations, natural selection/evolution, migration, genetic drift and inbreeding. The most relevant of activities on zoos would include: Inbreeding, genetic drift and migration.

It can be assumed, that the greater the genetic variability within a population, the better this will be for a population to adapt to changes within the environmental conditions (Lacy, 1997).

Natural selection acts on genetic variability reducing the influence of less fit and favoring the more fit. Fitness is represented by the number of reproducing offspring contributed to the next generation. Before an individual in a population can contribute to the
next generation, it must survive to reproduce. Survival begins at the time of fertilization and through periods of development, growth and sexual maturation (Smith, 1996). Many factors like predators, food, pathogens, competitors and weather can affect young born individuals in the population’s ability to grow, survive and reproduce (Stamps, 2007). Disruptive selection occurs in a population living in varied environments where there is a strong selection for the adaptability to a changing environmental condition (Begon, 1990). Habitat fragmentation and human exploitation of the landscape can have a major impact over populations of many species of animals which are being reduced to isolated or semi-isolated small populations. These small population carry only a sample of the whole genetic variability of the total population. These kind of situations can lead to inbreeding and genetic drift (Smith, 1996).

Inbreeding represents the mating between two closely related individuals as a result of a small gene pool (Mace, 1986). Inbreeding has been observed to cause mortality and reduced fecundity in many captive populations. Inbreeding and loss of genetic diversity may lower fitness and reduce the potential for the population to adapt (Falconer, 1981).

Zoos’ animals are protected from many of the causes of mortality that affect natural populations like predation, food stress, extremes of weather, epidemic disease, and reduced non-genetic mortality relative to natural population that could lead to an inbred population. All this conditions can cause premature death, decreased mating, fertility, fecundity, loss of vigour and reduction in growth (Lacy, 1997).

Genetic drift is a process in which allele frequencies within a population change from generation to generation. Evolution due genetic drift is not caused by environmental or other kinds of stress of individuals, and the resulting random changes can be detrimental, neutral or beneficial for the reproduce of the following generation (Hartl, 2000). The effects of genetic drift can be seen better in a small population. Whereas the effects of genetic drift on a large population are minor and are often influenced by natural selection (Charlesworth, 2009).
Case study - The Mexican grey wolf

The Mexican grey wolf (*Canis lupus baileyi*) is a case of recovery, providing a good example of the success from captive breeding and reintroduction of a specie into the nature. It also demonstrates near limitless possibilities of modern scientific techniques, resulting in outstanding specie recovery from: few individuals captured at the same time ensuring rich genetic diversity.

Since the inception of Species Survival Plan (SSP) for the Mexican wolf in late 1970’s, few individuals, consisting of four males and a pregnant female were captured in Chihuahua and Durango, Mexico. The captured wolves were translocated to zoos in the United States of America. As time passed, what developed was that only three males and a female had offspring. This was the initial start to what we know today as the McBride lineage. However, four individuals could not provide enough genetic variation for the species is long-term survival, as the population would rapidly become highly inbred.

It soon became obvious, that capturing additional wolves from nature, to increase the genetic variation, would not be a possibility. The scientists involved in the project had to search elsewhere for similar species. They ultimately succeeded in finding two small populations of Mexican wolves held in zoos in Aragon, Mexico City and Ghost Ranch, New Mexico. The wolf populations, in both zoos, showed a high level of inbreeding. The likely cause of this originated from similar captivity programs, where the females had only one male mate.

By having two different lineages, and combining them would provide essential genetic material to the Mexican wolf population. As the science of population genetics suggests, breeding even highly inbred, but unrelated animals, gives healthy offspring. The SSP had the option of enriching the McBride lineage with genes from Aragon and Ghost Ranch. The question remained “how genetically pure are the two newfound lineages?”

The wolves from Aragon and Ghost Ranch were relatively smaller compared to the McBride wolves. Old records and witness accounts about capture of wolves in 1950 rose suspicions, that newly discovered populations could be hybrids of the wolf and a dog or the
wolf and a coyote. To assess the genetic purity of animals, geneticists employed multidimensional microsatellite allele analysis, the technique also used by the crime scene investigation, to connect the suspect to a crime scene.

In order to use this method, scientists analysed the genome of given specie for specific fast changing gene sequences, microsatellites, creating a genetic library. The small variations of microsatellite genes are called alleles. The divergence is evaluated comparing sampled alleles to the genes (microsatellites) in the library. In this case, scientists identified about 20 microsatellites in coyotes, dogs, Grey wolves and Mexican wolf genomes. The result was positive, despite the wolf size, the Aragon and Ghost Ranch lineages were pure Mexican wolves.

The similar gene analysis was applied to monitor the level of inbreeding. First carried out on McBride lineage, the test showed, that another male in the originally captured pack could not breed inside the population, as the wolf turned out to relate to a lone female. This misfortune could be compensated by introducing new discovered lineages. Seven wolves from all three lineages, carefully selected and monitored, have increased the population to around 300 individuals today, which in turn has saved the species. Genetic variation rose from 83%, estimated in the McBride pack at the time of their capture, to 93% and rising. Approximately 100 wolves have been reintroduced to their natural habitat since late 1990’s.
Population Control Methods

Modern Zoos play a key role in the preservation and conservation of wildlife, as they inhabit and care for endangered species and exotic animals. Apart from research of population control and wild-to-wild translocations, zoos can contribute to metapopulation management through what was called’ integrated species conservation’ (IUCN, 2014). However, most zoos have adopted breeding programs in order to control the size of their inhabited species, as reproduction of species, if unchecked, may result to a decrease in genetic diversity and surplus animals, where the capacity of zoos may not be able to accommodate. (Cheryi et al. 1993).

The population control methods often used by most zoos are contraception, transfer and disposition and euthanasia.

**Contraception**

This is a control method that involves the use of different contraceptives in the prevention of pregnancy and conception. It is a management tool that is utilized to control the population of captive and free-ranging wildlife (Norton et al.1995)

Wildlife contraception has become an important tool for zoos and aquariums. One important application of wildlife contraception in zoos and aquariums is to reduce the production of surplus animals and for effective genetic management. Moreover, the need of contraception is an available option in fertility control and reducing the reproduction of captive population with their genes, thus resulting in the loss of important gene diversity (Seal et al. 1976). In other to prevent overpopulation in zoos, the Association of Zoo and Aquarium established a wildlife contraception centre in 1989, to give recommendations on how to minimize risks of animal discomfort in the application of contraceptive methods. However, effective contraception helps to avoid overpopulation, reduce inbreeding and modifies generational length of species. It also eliminates the disruptive procedure of removing individuals (male and female) during mating, without affecting the fertility and allows a better
utilization of housing by permitting offspring to remain in natal groups without of the risk of inbreeding and by not having to find additional space to house population not recommended to breed (Asa et al. 1996).

There are two major types of contraception, which are the reversible and irreversible contraception. The reversible contraception involves the use of oral medications, including feed additives, liquid and pills that animals can consume daily. In some cases, animals are implanted with contraceptives that may last for several years. For example many Hoof stock receive vaccinations the fertilization of female eggs. This method is more beneficial because it is reversible, if future breeding is necessary. The irreversible contraception involves the use of surgical methods which are permanent. This method is considered when permanent contraception is necessary, or when a disease is diagnosed in the reproductive organ. A case of both reversible and irreversible contraception can be seen in Oakland Zoo, where all non breeding female giraffes received liquid Melengestrol acetate daily in their food. All non breeding chimpanzees receive a daily pill combination of norethindrone and estradiol. The lions are castrated when they are young as this technique is chosen to keep their hormones and characteristics.

**Transfer & Disposition of animals**

This method is used by zoos to control their animal population, as surplus animals are being transferred to other accredited facilities. The receiving institution must be conducive for the well being and welfare of the transferred animal. The problem and concern related with this method is, that animals and their progeny may be transferred to inadequate facilities that do not meet up with the standard for the survival of the animal (Xanten 2001). In order to prevent this problem, there must be an assurance of proper care and management for the animal, and this should be in the good interest of the both institutions and also the species of the animal being transferred. The zoo initiating the transfer must make sure that the receiving institution has the standard and competence in animal welfare and husbandry. The health, diet, reproductive and genetic issues of the animal must be made available at the commencement of the negotiation process. The commercialization and selling of animals to
non conducive facilities is strictly prohibited (European association of zoos and aquarium (EAZA, 2004). According to the EAZA more animals should be allowed to breed if there are facilities outside accredited zoos that are interested in obtaining surplus animals.

Scientific studies have shown that once an animal is transferred outside the control of accredited institutions, a certain percentage of control population born in zoos will endure what can only be termed substandard conditions (Goldston, 1999).

Reintroduction

Reintroduction attempts to re-establish captive-breeding populations which are endangered with extirpation or extinction through release into the wild (IUCN 2014). Reintroduction and translocation are important tools for population management. Translocation has the role in moving the wild population from one natural location to another, while reintroduction releases captive born population into their natural historical ranges (Kleiman, 1989). The new approach to conservation is increasingly replacing the captive breeding for the reintroduction of the species, which refers to the exchange of animals between *in situ* population (in the wild) and *ex situ* (in human care) (Redford et al. 2012). *In situ* conservation uses innovative proposals such as damaged ecosystems to preserve rare, endangered, and threatened species and to expand the range of options available for economic development (BGCI, 2012). *Ex situ* is the process of protecting an endangered species of animals outside of its natural habitat (Seddon, 2007).

The integration of *in situ* and *ex situ* programs open the possibility to improve the demographic stability and genetic diversity of the wild and captive populations of endangered species (Fa et al. 2011).

The IUCN reintroduction guidelines emphasize the need for assessment of the availability of suitable habitat as a key component of reintroducing planning (IUCN, 1995).
Euthanasia:

A method that is also used as a means of population control and solution for the removal of surplus animals in Zoos. This method is widely recommended for animals that are seriously or terminally ill (AVAMA, 1993). However, it is also done under other conditions, where the animal cannot further contribute to the breeding program as a result of old age, or when there is genetic overrepresentation of undesirable inherited genetic traits. Examples of this can be related to the cases of Marius the Giraffe, or the four lions that were euthanized in Copenhagen Zoo. The case of the lions revolves around the removal of one of the old lions in order to introduce a younger lion in the zoo.

This method can be deemed necessary in situations where hybrids and animals of unknown subspecies are introduced into the population, for animals which can be more dangerous than expected. Moreover, when a new home or suitable facility cannot be found for the animal transfer, and also when there is continual abnormal behavior of an animal in spite of changes in condition.

Euthanasia is often considered over contraception for the animal welfare and overpopulation as the behavioural health of the reproductive individual is is more important than the life of the offspring (Holst 1998). Although animals have a humane end to their life, euthanasia also protects the genetic diversity of endangered species and some animals that will be detrimental to species if they continue to breed.

Using this method, most zoos employ the use of lethal injection to kill animals that exceed the zoo’s carrying capacity and that do not fit into the breeding program.

Case study - Marius the giraffe

The practice of euthanasia erupted in media storms with worldwide resonance. Just as the zookeepers split about their population control choices, people around the world have a split opinion about euthanasia and its unnecessary use. Further, we introduce and reflect on the few year old and now worldwide known case about giraffe Marius, euthanized in the Copenhagen Zoo.
To illustrate the various methods explained in the project, the case of Marius the giraffe will be taken into consideration. Marius, a giraffe living in Copenhagen Zoo, was considered genetically unsuitable for breeding purposes, where the decision by zoo authorities was made, to kill him. At the time of life extinction, Marius was two years old and healthy, despite his genetic disposition. Not only did the killing of Marius cause controversy locally and internationally, but also stirred up a media issue when he was dissected in front of the public, and later fed to the lions residing in the zoo. Organisations and individuals responded differently, generating a balance of how ethical it was to proceed with the killing.

According to the rules and regulations, from Copenhagen Zoo and organisations connected to the zoo, he was deemed genetically unfit for the breeding programs. As the case became more apparent to the public, different approaches were recommended in the effort to spare the giraffe’s life. The different approaches to solving the issue, considered the following: translocation, sterilization and breeding programs (outside of the giraffe’s gene pool sector). Relocating Marius was an ongoing issue, resulting in no suitable habitat found for him. Contraceptive methods would result in Marius continuing his life, but would eventually be euthanized, as not being a desired candidate for reproduction.

The case was reviewed and many ethical aspects were addressed. The general idea was to keep the giraffe alive and solve the problem through above-mentioned measures. On the other hand, ethical matters concerning the giraffe, from the zoo and organisations bound to it, took the approach of solving the issue best followed by their guidelines for animal welfare. The case of Marius made it aware that not only does Copenhagen Zoo perform the necessary tasks, but also considers its educational mandate. The educational aspect is not only for the public, but for veterinarians and wildlife biologists as well.

The case of Marius brought awareness to how zoos perform their tasks in accordance to professional ethics. The methods performed by zoos will encompass guidelines and rules that are ethically challenging. Each form of ethical viewpoints can be addressed in accordance with this case, ultimately illustrating the challenges of how to approach a matter delicate for some more than others.
Legislations and Regulations

Our vision is a world without animal suffering. We view ourselves as the advocate and champion of those who have no voice of their own, namely animals. The common foundation for this is the respect for all forms of life and the deep conviction that every organism has a right to be treated with consideration and to live a life with dignity that complies with its needs. Animals are sentient creatures and therefore subjectively perceive the world; we as humans bear responsibility for them. (FOUR PAWS International)

Since the first EU Directive on animal welfare adopted in 1974, which was created to protect animals at slaughter (Gavinelli and Lakestani, 2010), legislation for human action on animals had a legal basis. Animal Protection laws are periodically revised under the close supervision of animal protection organizations, such as FOUR PAWS.

Animal Protection laws are enforced by policies. Policies and directives split laws to cases and define different policies or legal acts for different situations. This huge technocratic machinery defines boundaries of legal action in for example, chicken farming or euthanasia of a pet.

The laws in a country are decided based on the constitution and the principles of democracy. It is not the case in Animal Welfare legislation. Animals do not have a voice and cannot make suggestions or comments on these laws. Metaphorically, animals are given a “voice” by animal protection organizations. Members of these organizations communicate with technocrats or lawmakers in conferences, where guidelines for laws are adjusted or redrawn.

At every revolution of a new legislative period in the EU, the biggest issues are identified by protectionist organizations and communicated to lawmakers, who afterwards propose a list of solutions or adjustments to existing ones.

Euthanasia is defined as an “act or practice of painlessly putting to death persons suffering from painful and incurable disease or incapacitating physical disorder or allowing
them to die by withholding treatment or withdrawing artificial life-support measures“ (Encyclopædia Britannica, 2014). In other words, Euthanasia is an inferred painless death, used to finish the suffering of a painful or incurable disease.

As argued by FOUR PAWS, this definition of the word Euthanasia raises an ethical question, since this practise has been used for healthy animals that were not suffering from any disease, but to control the population size in zoos. And the problem, also discussed by FOUR PAWS, is namely that population control methods, and actually zoos in general, are not regulated by any set of rules or regulations. In Europe, there are guidelines on how to carry out the decision-taking process, but it is limited to recommendations rather than rules.


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<th>2.4.4.4 Management of the collection</th>
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<td>[...] Captive breeding and population control: planning and managing according to the best available methods in the given context (e.g. contraception, temporary separation, control of hybridisation, culling and as much as possible considering for the animals’ social needs. [...]</td>
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Ethics: Modern worldview and ethics concerning animals and animal rights

The following principles of moral assessment are general on human behavior with animals and human behavior with nature. An important note: the principles of ethical justification are tentative views and tendencies, which are evolving together with human understanding of nature and humanity's impact inflicted on them. These dynamic tendencies are the mirror of the modern worldview, and each of them can provide background for different aspects and approaches for the subject of moral assessments.

This chapter includes brief descriptions of the main philosophical directions and their branches, sometimes followed by a short example; the purpose is to provide different angles and theoretical framework for subject analysis.

Utilitarianism

The founder of modern utilitarianism is Jeremy Bentham (British philosopher, 1748-1832). The best moral action, from an utilitarian perspective, is considered to be the one maximizing utility (benefit). The essence of utilitarianism is to find a practical solution on what "ought" to be done, by acting accordingly, resulting in finding the best consequences possible.

Utilitarianism is a form of consequentialism, which states that the consequences of any action can only be right or wrong and rests on even older fundamentals of Kantian ethics, founded by Immanuel Kant in 18th century. By doing what's right or wrong, good or bad, will arise from what act the person or people do, let it be during or after the act has been performed. For utilitarians, the matter focuses on how great the differences in the consequences are, which will then determine how they decide between the moral issues.

"In assessing the consequences of actions, Utilitarianism relies upon some theory of intrinsic value: something is held to be good in itself, apart from further consequences, and all other values are believed to derive their worth from their relation to this intrinsic good as
a means to an end. As a normative system providing a standard by which an individual ought to act and by which the existing practices of society, including its moral code, ought to be evaluated and improved, Utilitarianism cannot be verified or confirmed in the way in which a descriptive theory can; but it is not regarded by its exponents as simply arbitrary. Bentham believed that only in terms of a Utilitarian interpretation do words such as “ought,” “right,” and “wrong” have meaning and that whenever anyone attempts to combat the principle of utility, he does so with reasons drawn from the principle itself. Bentham and Mill both believed that human actions are motivated entirely by pleasure and pain; and Mill saw that motivation as a basis for the argument that, since happiness is the sole end of human action, the promotion of happiness is the test by which to judge all human conduct." - Henry R. West on Utilitarianism

Preference utilitarianism is a branch of the utilitarianism philosophy. Preference utilitarianism sets moral value on the fulfillment of the interests of those involved (preferences).

For example, given the preference utilitarian perspective, moral justification entailed by balanced mutual benefit, where animal interests have equal part in the moral assessment of zoos and their implications. The basis for assessment is the interests of all parties equally, i.e. humans (zoo employs, visitors etc.) and animals (treated, fed etc.).

Some suggest moral justification to be reached over precise cost - benefit assessment (Lomborg 2012) and although sounds idealistic, this tendency still suffers heavy criticism and in some cases reveals its fundamental problems. Often utilitarianism criticized for ignoring justice and in some cases being impractical. Among most common issue is inability to measure the benefit equally and adequate.

The theory behind Utilitarianism distinguishes between what can be said in theory and that which is applied in practice. Utilitarianism does not stand as a single topic with conclusive guidelines. The term is continually being revised to the standards and the areas of interest it is applied, such as politics, economics and legislations. There are clear guidelines within each respective field the subject is applied to, which in turn raises the choice of the
individual to decide if they agree or disagree.

"These problems, however, are common to almost all normative ethical theories since most of them recognize the consequences... ... an act as being relevant ethical considerations. The central insight of Utilitarianism, that one ought to promote happiness and prevent unhappiness whenever possible, seems undeniable. The critical question, however, is whether the whole of normative ethics can be analyzed in terms of this simple formula."- Henry R. West on Utilitarianism

Environmental holism

Holistic community - term coined by American botanist and ecologist Frederic Clements in 1916. Idea of the system, where the species within the community are dependent on each other for keeping balance and shares equally important role in it (i.e. holistic community) is a fundament of ecology. References to holistic community often made to justify one or another human interaction with the nature.

Ethical assessment of human behaviour regarding environment and nature in general, from the holistic community view perspective partially justifies population control. Examples could be controlled wild animal hunting: as long numbers of population are stable, balance withheld and no harm done on the holistic community, action is, morally approved, i.e. killing the animal is the right thing to do, especially if the species are overpopulated.

This can be seen as two different characteristics debated as either humane moralism or moral humanism. This two principles are based on J. Baird Callicott in which he characterises:

"...the land ethic as maintaining that the ecological whole is the ultimate measure of moral value. Indeed, the primary human duty is protection of the biotic community or organism as a whole, even where this means considerable human sacrifice. The value of individual organisms lies in their ecological function; and so the well-being of individual organisms should be considered inasmuch as they contribute to the ecological whole. Thus the value of individuals is context dependent, relating to their function and significance in the whole. If they are vital to the ecosystem - members of what are sometimes called "keystone"
species - then they are of very high value. If they are not significant to the system, or they are very common, or their role can easily be performed by another organism, or there are too many of them, then their value is much diminished. This implies, for instance, that the value of an individual varies in relation to how many others there are, what it does, and so on....

...Thus, the value of rare/functionally vital parts/members can trump the value of common/functionally redundant parts. In the interests of biodiversity, it is more important to protect an individual of an endangered species than an individual of a common species, even if the individual of the endangered species is not sentient, and the individual of the common species is... ... Even where endangered species are not involved, if large numbers of one species (eg deer) are threatening the stability of the ecological community as a whole, then hunting may be required. This remains so even if hunting involves suffering as well as killing. The most essential species (such as the pollinating honey bee) are more important than, for instance, higher mammals which play a far less vital role in the biological community. This clearly reflects on human beings, who are not only not vital to the system, but who actually destroy it. Indeed, Callicott suggested that the more misanthropy there is in an ethical system, the more ecological it is, and that the human population should be, in total, about twice that of bears!" (Clare Palmer et al)

The Rights view

Tom Regan (American philosopher, specializes in animal rights theory. Born 1938)

The rights view in modern philosophy values individual rights. It advocates and recognizes Animal rights: animals, similar to humans, has a right to live, be free and avoid suffering, because animals are (in some cases) self-aware beings (“subject-of-life”, Regan) and should be treated with the same adequate respect as we, humans are.

From the rightist perspective, for example, interests and needs of humans does not justify human action to keep animal confined, regardless their benefit (jobs, recreation etc.),
because such an action violates animal right to be free and degrades its moral status.

There are several branches of the rights view:

**Abolitionism:** All beings, human and non-human shares the right to never be someone’s property (term abolitionism originates from the times of social movement to end slavery). Proponents: Gary Francione promoting ethical veganism\(^1\) and his concerns about “new welfarism”. Tom Regan in pursuit of moral paradigm shift, where the final goal would be ending treating animals like objects, i.e. owning and using them. “Abolitionists want empty cages, not bigger ones” (Regan).

**Deontology:** Term Deontological ethics mentioned first 1826 by Jeremy Bentham to mean, "The knowledge of what is right and proper" (“duty” ethics, Kant). In this context, action is more important than consequence.

**Sentiocentrism:** Only humans, and animals capable to feel, are sentient. Only rights and interests of sentient species considered (opposing speciesism, where distinct species are more favored).

**Animal protectionism:** Animal protectionism seeks radical change in the way humans treat animals: animal use should end entirely. This position was presented by preference utilitarian Peter Singer (Australian philosopher, Practical Ethics 1979). He argues from the interest position (not the moral rights) that animals have an interest to avoid suffering, which has to weigh equally (Bentham, i.e. preference utilitarian perspective).

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\(^1\) Term used to define individuals living lifestyle excluding any use of animals
Discussion

The purpose of this chapter is to draw connecting lines between the informative subchapters in the methods section and discuss the ethics and implications that the population control methods arise. Furthermore, the case of Marius the giraffe will be presented and discussed.

When the Babies are the Problem

The animals in zoos are sometimes allowed to mate, increasing the population of individuals in the limited space which is captivity. The management of population inside of the zoos is one of the most difficult tasks for zookeepers. They can prevent undesired pregnancy, if not - transfer surplus offspring to other facilities or reintroduce animals to their natural habitat. If transferring and reintroduction is not an option, zookeepers sometimes choose euthanasia.

The choice of the population control method in the zoos is dividing zookeepers around the globe. Different philosophical and cultural perspectives around the world influence the choice of the population control method. For example in Hinduism and Buddhism, killing even terminally ill animals is considered wrong, and complicated to legitimize. In Africa, euthanasia is accepted and widely used as a population control method. North America prefers contraception in wide range of animals as a first choice. In Europe, different countries have different approach and choices.

What is the right choice of population control? If the possibilities of transferring the surplus animals to another zoo exhausted and reintroduction to the natural habitat is out of question, it is natural, that choice of contraception was not made and only what is left, is euthanasia. However, zookeepers are fully aware that not using contraception and letting animals mate can end in killing their offspring. The following briefly described cases are a good example of the split opinions and reflects the global situation today.
**Cases and arguments:**

In **Denmark**, euthanasia is often the choice of population control method. For example, Copenhagen zoo annually performs euthanasia by lethal injection to 20 to 30 healthy exotic animals: gazelles, tigers, lions, hippopotamus and chimps².

The zookeepers in Denmark argue that the use of contraception will take away an important part of animal life, parenting. Allowing animals in captivity raise their infants mimics best their natural life cycle. Another argument is that only small part of infants (down to 20% in some cases) would survive in the nature, many would die from predators, starvation or disease. Animals in captivity does not have that natural selection, therefore euthanasia partially serves nature's purpose.

Contraception considered unnatural and it has side effects, for example, large cats as tendencies to urinal infections and tumors; elephants has difficulties with restarting reproductive cycles after contraception terminated.

Timing for euthanasia of surplus animals in Denmark picked following nature, usually by maturity of the cubs. “This is maybe more painful for us, but more natural for them”, emphasizes Dr. Holst, director of conservation for Copenhagen Zoo.

Germans, for example, do not share the same opinion. In **Germany** euthanasia is only legal, if “reasonable”, sometimes making it challenging to distinct. Few years ago in Magdeburg Zoo, zookeepers discovered that one of the tigers is a hybrid of two subspecies. The zoo decided to euthanize tiger’s three cubs just after birth as being genetically useless. Animal protection organizations disagreed with the decision to kill cubs being reasonable enough and achieved that director of the zoo and three employees got suspended their licenses.

In **North America**, contraception broadly used since its development. The choice advocated by arguments that maintaining diversity and salvation of endangered species can be achieved using contraception and without running out of space, if managed correct.

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² Bengt Holst, director of conservation for Copenhagen Zoo, interview to New York Times 2012
The birth control allows males and females being together in family groups and have their offspring “planed”. Hormones used in contraception makes animals less aggressive and easier to handle in captivity.

Given the example of Mexican wolf, nearly extinct in 1970s. Few zoos begun the breading with only seven wolfs (From 1977 to 1980, four males and a pregnant female captured in Durango and Chihuahua in Mexico to act as founders of a new "certified lineage") and bred a colony to nearly 300 individuals, saving the species. In 1998, 92 wolves were reintroduced to wilderness. Colony grew and used up the limited space allotted for the program in New Mexico and Arizona, however issue solved distributing surplus among other states.

In United States, animal breeding plans run centralized in AZA (Association of Zoos and Aquariums) Centralized planning with genetic diversity in mind believed to be the key in long-term conservation of endangered species. For example, contraception currently used for more than half of the female Western lowland gorillas enables a young female to stay in her family together with grown up siblings without a risk of inbred pregnancy.

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Euthanasia

The decision of Copenhagen Zoo to put down Marius the giraffe raised a storm of controversies around the world, even as it was surprising to many and shocking to quite a few people as to how ethical it was killing a healthy Giraffe. The death of the 18 months old Giraffe which was considered not useful for breeding because his genes has been well represented in the giraffe population across the zoos of the European association of Zoos and Aquarium (EAZA), was followed by a dissection which was used for educational purpose in front of a large crowd including children and fed his carcass to the lions which raised concerns and protest around the world.
The incident reveals an ethical dilemma that rests at the center of the zoo management and the society. The reality is that zoos are faced with the responsibility to manage their population as sustainably as possible, which include preventing inbreeding and avoiding overpopulation, as genetic diversity is important for species survival because it prevents inbreeding and preserves a broad array of traits that animals might need to survive in the wild.

Bengt Holst, the director of conservation for Copenhagen zoo explains that euthanizing the offspring of exotic animals helps the creatures to retain aspects of their natural behavior. It is the philosophy of most European Zoos to let animals breed naturally and do not rely on the use of contraceptives. According to this principle, animals give birth to their young as they would in the wild and are able to carry out normal parenting behaviors.

The African association of zoos lists euthanasia as a population management tool; however, the precepts of Hinduism and Buddhism make the killing of even terminally ill animals difficult.

The Animal rights view argues that animals have the same right like humans and they are conscious, living individuals often referred to as non human persons. They have a right to exist and to be granted the freedom from pain and disease, freedom from hunger and thirst, freedom from discomfort, freedom to express natural behaviors and freedom from fear and distress. They also believe that animals have the right to life and that humans do not have the right to take that life, exploit them for meat or milk. They believe that animals should not be viewed as property, or should be used for food, clothing, research, entertainment or as beasts of burden. They believe that animals deserve equal consideration to humans: if animals are not given equal rights, this is “anthropocentrism” which is as bad as racism, i.e. human interests has main focus. They believe that in the future, we will look back on our time and see our attitude to animals in the same way as we currently view human slavery.

In the perspective of the animal rights view, Marius the giraffe was a “non-human person”, and that it was outrageous that his life was taken. They also argue that the zoo compounded the unfairness by dissecting Marius in public even in the presence of children.
and then fed him to the lions. This showed lack of respect to Marius, and an uncaring attitude to an adorable creature.

On the other side of the spectrum, from the Animal welfare perspective, animals are conscious beings and there should be efforts should be ensure their well-being, especially when they are under the care of humans. However they do not believe that animals have the same rights as humans. They also believe that animals deserve the five freedoms, but they believe that humans have the right to decide what happens to animals, which includes taking the animal’s life in a humane manner in some circumstances. They believe that it’s acceptable to farm animals for meat and milk, as long as the animals have a life worth living while they are farmed, and as long as the animal’s death takes place in a way that is free of fear and pain. They believe that it’s acceptable to use animals for food, clothing, research, entertainment or as beasts of burden as long as the Five Freedoms are not impaired. Animal welfare people do not believe that animals have a right to life, justice or freedom. This is the most widely held view in the Western world today: that it is morally and ethically acceptable for humans to use non-human animals, provided that adverse effects on animal welfare are kept to a minimum.

In the case of Marius the giraffe from the animal welfare perspective they will argue that, Marius has been stated by the zoo as a surplus animal to its own requirement and there was no simple alternative. The option that was available which may be to transfer Marius to a non accredited facility, wildlife parks and private sanctuaries was concerned that they would lose control of the giraffe and that it might end up in an inappropriate situation which may be detrimental to the welfare of the animal. The zoo believed that quick, pain-free death was a better alternative for the giraffe than to take that risk. The zoo would say that millions of cattle, pigs and sheep are killed in the same way every day and nobody complains about them.
Translocation and disposition

An alternative to the euthanization of Marius would have been to move it to another zoo (disposition), or perhaps reintroduce it to its habitat (translocation). The option of translocation was very real in our case study, since various offers were done to the Copenhagen zoo, by the Yorkshire Wildlife Park, the Krakow Zoo (both are EAZA members), and two other non-EAZA members also expressed their interest in Marius. Still, he was euthanized and this decision was supported by the EAZA organization. Marius was considered a genetically weak giraffe, and the best solution according to Copenhagen Zoo was to euthanize it.

According to preference utilitarianism, both parties’ interests (Marius and the Copenhagen Zoo) would have to be acknowledged equally. Considering that it is humans who have to decide or assume what is best for the animals’ interests and be the animals’ voices, it becomes very tricky. How to measure how ‘good’ the consequences of Marius being disposed or reintroduced are?

One could argue that it is in Marius’ interest to stay alive, that is what all animals fight for: following its instincts of feeding himself, sleeping and reproducing. Even though he is in captivity and life would be very different for him if living in his natural habitat, he is allowed to ‘live as a giraffe’ to some extent. Moving him to another zoo might involve having to adapt to a new population structure and environment, and being translocated into the wild would mean a period of adaptation as well - that might come to be more challenging as this giraffe has been born and raised in a zoo - but he could most likely continue his way of living until a natural death. On the other side, the Copenhagen Zoo’s interest is to maintain a strong genotype among the populations - in this case, the giraffe populations - and Marius was an obstacle. His translocation or disposition would have involved economic expenses, training to achieve adaptation and a much longer procedure, and all without having a certain outcome.

But what about the animals’ rights? To live, be free and avoid suffering? The Rights view would, most likely, condemn disposing Marius. Although the right to live or to be free is not taken away by the action - complete freedom is not possessed by the captive animals in
the first place - it doesn’t give it back either. It perpetuates the captivity. Translocation into the wild, on the opposite, would give this freedom to them, though, after some necessary ‘training’. But the freedom comes with unwanted side effects, for natural habitats are unknown to animals born and raised in captivity, and furthermore, many natural habitats are being destroyed. Or in the case of giraffes, they pose other problems like the danger of being hunted by humans. And let’s remember that giraffes are in danger of extinction.

And that is one of the claimed purposes of zoos: to protect biodiversity in the animal and plant kingdom, and ensure genetically strong populations of endangered species. So the animal populations in zoos are prioritized over the individuals of these populations. And that is purely holistic: the animal’s purpose is not in itself, but in the system it is part of. When this is taken as the start point in the Marius case - considering that Marius is genetically weak and his genes are already represented in the Copenhagen Zoo population and possibly in the european populations too - he cannot be allowed to procreate.

**Contraception**

From a utilitarian point of view, and according to some zoos, the method of contraception is seen as a solution in controlling population breeding, but without conclusive data on consequences of contraception use in all species. The ethical issue becomes whether the possibility of health risks regarding the use of this method is outweighed by the benefit of not producing surplus animals.

According to the Copenhagen Zoo, the method of contraception could have adverse effects on the animals, and is against their policy on allowing the animals to breed naturally. So if one tries to identify the ethical reasoning behind their decision-taking process, it is clearly based on consequentialism-utilitarianism: the inferred death of the surplus animals is a minor cost, compared to the reduction in the quality of life for all the population through
contraceptives. The argumentation of this zoo regarding the use of euthanasia in Marius’ case is seen wrong by other zoo professionals, who believe that the birth of this giraffe could have been prevented, or that contraception could have been a better approach in preventing Marius from breeding and further spread of his genes. This in turn also raises the question of how are zoos and scientists able to determine the genetic outcome of an infant animal pre-natal. which would even lead further back in the process, by altering the mating patterns of animals.

In other countries like US and Europe most of all zoos are using the method of contraception in controlling population breeding. This raises an ethical question of the efficiency of contraceptive methods and argues on the fact that this method could be a better solution. In the case of Marius, removing him from the female giraffe during mating or sterilize his reproductive organs.

Some zoo professionals that have a more holistic point of view object that the use of contraception in the case of Marius could have been wrong. This is based on the the belief that preventing animals from mating, this method could have negative effects in the development of a natural reproductive behavior on Marius. This view holds the fact that mating has a essential importance in the well being of captive population, by preventing this experience is considered unethical in the case of Marius the giraffe.

According to the rights’ view every animal has the right to live and be free. Looking at Marius case form a ethical perspective this situation could be avoided if some measure had been take that not affect Marius and other control population. AZA has implemented a contraception center which has the role of monitoring the use of contraceptive in breeding for control population. They believe that the attitude of Copenhagen Zoo regarding the animals in general is very egoistic and free of ethics, because they treated the case of Marius without thinking of a better solution, and what could have been done without affecting the giraffe and the rest of population.
**Reintroduction**

Reintroduction is another area that can be discussed from an ethical point of view of the welfare of animals. The main priority of the zoo should be the reintroduction of endangered species back into the wild, but looking from an ethical point there are some doubts regarding the seriousness of zoos in using reintroduction, since the majority of breeding programmes concentrate on keeping population of endangered species in captivity.

From a utilitarian perspective, in the case of Marius according to some zoos, reintroduction couldn’t have been a good solution because the giraffe was born in captivity and not prepared for life in nature, and by returning him into wild could develop a stressful behaviour.

According to the right view every animal has the freedom to return into the wild and preserve their natural habitat. In their opinion in the case of Marius the giraffe reintroduction could be a risk worth it because he could have the chance to survive into wild. Other issues apart concerning Marius that would arise, would be the humane aspect. Even though the giraffe would be reintroduced back in the wild, what would be the best approach. Would the giraffe suffer more than behavioural problems, or would it in turn not be able to be part of a flock. Would there be an exhibition of outcasting the giraffe, where it would have to survive on its own in an environment foreign to it. How long would the giraffe’s survival be within and outside of a flock. These are ethical and moral issues that would be addressed and consequently resulting in a debate between the groups revolving the reintroduction of Marius.

One could opine that the existence of population control methods alone contradicts the purpose of preserving and conserving fauna (and flora) species, and categorize it as hypocritical. After all, if they are trying to preserve species, why do they limit the size of the populations in the zoos? Why do they euthanize them, or use contraception to avoid breeding? And, in the case of endangered species, are there really ‘surplus animals’ as such?

Starting with the last question, ‘surplus’ animals in captive populations of endangered
species can not be considered surplus. If the species is in danger of going extinct and there is a ‘surplus’ in a given population, why not try reintroduction? Afterall, their own natural habitats are the locations where animals, theoretically, have the highest chances of survival according to the climate and resources, among other factors. Animal species have evolved over many years and their physical, physiological and social behaviour have been developed in order to survive in their natural environment. But of course, one can not ignore the difficulty that reintroduction of a species into the wild would arise, considering that all ‘the dangers’ the species would face in their natural habitats (predations, competition for food and water, etc) are nonexistent or have been removed in zoos. This creates a situation where it is made difficult for natural selection to ‘choose’ or select the more fit genes, and thus, it is made difficult for the species to evolve. So the population control methods could be seen as a sort of selection, made by us - artificial selection perhaps.

Going back to reintroduction. If the real purpose of zoos is the preservation and conservation of species, reintroduction programmes should take place more often, and be a priority for zoos in Europe and in the rest of the world. There are zoos that have specific programmes to reintroduce a species into its habitat, but the reason why these don’t take place as often as they should might be the obvious risk of the reintroduced animal not surviving, along with the great economical expenses that are brought up with the long training, surveillance or monitoring, and care so necessary during the reintroduction period.

The only way to begin to analyse the decision-taking process of zoos is to acknowledge that they - the zoos’ (and aquaria) bodies - and probably the most of the scientific community, have a very holistic point of view. They do not see the individuals - in this case the single animals in the captive populations. Or perhaps they see them, but consider the whole species as a more important ‘being’ that needs to be saved. And so, individual animals are allowed to be sacrificed for the whole species.

The bottomline is that zoos are trying to avoid the extinction of some species, at the cost of keeping some individuals in captivity. This ‘cost’ is payed by both parties: the economical cost that supposes taking care of animals, feeding them, all the personnel, etc; and for the animals, one might argue, its rights to live or to conceive freely (among others). Are
these costs worth paying?

What about the species that are not endangered? Marius’ species is not endangered. Why are they in the zoos? While discussing our project many questions like this have crossed our ways.

Conclusion

The project provides different terms of ethics and aspects of population control in zoos, respectively. Historical and geographic incidences are determining factors on how to approach the matter of ethics in population control for animals in captivity. The project illustrates different angles on how these issues are being solved, and previously solved. With the investigation into laws and legislations, organizations and protocols, it becomes apparent the rise of a natural bias towards the topic. Already, humans are having a troublesome time figuring out clear guidelines on how to differentiate appropriate ethical domains. Subsequently, having to find ethical solutions for animals introduces another challenge.

Illustrating the cases of the wolves and Marius, give rise to two instances where various methods have been applied. Drawing in the best ethical approaches into the population control discussion, another tedious issue arises. The main focus is to keep the welfare of animals in captivity upheld. The converse to this focus is to keep the future development of the species going, with most humane procedures. The financial aspect and the rights to unnecessarily kill animals are factors that culminate to how an organisation or a zoo proceeds.

Zoos do not have perfect systems to control the population, based on ethical views. The holding capacities of zoos are determinant in how to control increasing populations. Even though the holding capacities of zoos are conclusive, it does not mean that in the wild, animals are not controlled according to nature's laws. No natural ecosystem is capable of supporting an infinite growth in population, without consequences. Nature will control populations sizes through predation, drought or starvation, where zoos use other means for control of population growth. In cases of administering euthanasia a control mean, two issues
arise, where a solution has to be found for letting the animal live and faces certain consequences, or, euthanizing the animal and disrupting the animal social behaviour. As scientist we are equipped with limited tools to find the correct answer/solution to population control in zoos. On the other hand, with the tools we are equipped with, we are able to describe and avail alternatives and furthermore illustrate any consequences that accompany these alternatives. The final decision is balanced out by the variables and factors that decide the most desired or optimal outcome, from a selection of unsatisfactory preferences, which is challenged by the social or individual influence.

Perspectives and evaluation

If more time was available for the termination of this project, we would have explored other areas such as: the destruction of natural habitats and how that is affecting specific animal and plant species. As well as a deeper investigation into methods of reintroduction, more real life examples and how that might impact the natural habitats (if these still exist); or a deeper analysis of legislations and policies on zoos around the world. Further studies within the area of ethics in zoos in general, and population control in particular, could also incorporate what future framework a zoo has for their animals. This could lead to a deeper evaluation on how to approach and tackle the situation in the most desirable manner. Subsequently, this might lead to a new area of interest which would integrate the same, if not several, ethical points of view.

The making of this project has allowed us to achieve a better understanding of what ethics is and what it can be ‘used’ for, the applicability of ethics in science and to understand and empathize from different ethical perspectives. Furthermore, the project has also shed light on the variety of ethics that can be used for such a precise instance, as well as for several areas. By researching the different aspects and angles in ethics, it becomes aware the limitations applied to each point view, from mostly being able to only use the terminology theoretically.
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