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The implications of the reclassification of South African wildlife species as farm animals

The Government Gazette No. 42464 dated 17 May 2019[1] amended Table 7 of the *Animal Improvement Act (Act no. 62 of 1998)*, which lists breeds of animals, to include at least 32 new wild animal species, including 24 indigenous mammals. The list includes threatened and rare species such as cheetah, white and black rhinoceros, and suni. Some alien species such as lechwe, various deer species and rabbits are also included. The cornerstone of the original Act is 'To provide for the breeding, identification and utilisation of genetically superior animals to improve the production and performance of animals in the interest of the Republic; and to provide for matters connected therewith.'

By declaring these wild animals as landrace breeds (in Table 7 of the regulations), the Act implies that they are locally developed breeds. The Act typically provides for landrace breeds to be bred and 'genetically improved' to obtain superior domesticated animals with enhanced production and performance. Similarly, provision is made for the Breeders Association to lay claim to the breed and to establish specific breed standards for animals to be included in stud books. Animals declared as landrace breeds can also be used for genetic manipulation, embryo harvesting, in-vitro fertilisation and embryo transfers. As indigenous species of wildlife are included in the recent amendment to the Act, the amendment is flawed.

Here we point out numerous concerns in the new legislation, including the process of consultation, and argue that the law will not improve the genetics of the species mentioned but will have considerable negative genetic consequences and pose ecological and economic risks. We also suggest that this new law is in direct conflict with other biodiversity laws in South Africa.

The consultation process

This amendment was seemingly processed without any public (including industry user groups or the scientific community) participation or consultation, and without the knowledge of the national and provincial conservation organisations which, together with the Department of Environment, Forestry and Fisheries, are responsible for the protection of all wildlife/game species in South Africa.

Legislation implications

The listed species are also covered by other legislation that potentially clashes with the new legislation (Supplementary table 1). As there are spelling mistakes and scientific names are not given, there is confusion over which species are being referred to (Supplementary table 1). However, as pointed out by Ezemvelo KZN Wildlife (EKZNW)[2], the new legislation does not repeal or replace existing laws: NEM:BA (including ToPS Regulations and the Alien and Invasive Species Regulations) and KZN Nature Conservation Ordinance 15 of 1974 all still apply. However, even in KwaZulu-Natal, where there is close cooperation between game breeders and the provincial conservation organisation (EKZNW), EKZNW still has difficulty in keeping track of what happens on game farms and in enforcing legislation.[3] This new law will add to this difficulty, and will likely be less controlled in some other provinces.

What are the genetic implications?

The genetic consequences of intensive or semi-intensive breeding (farming) of wildlife species are negative, and considerable.

Genetic diversity is the fundamental basis of diversity within species and determines the underlying health and long-term survival of a population.[4] Populations with higher genetic diversity have more options (different alleles) for adapting to ever-changing environmental conditions. Genetic diversity is, therefore, essential for the evolutionary process of natural selection to occur. However, if only the so-called 'best' alleles (from a game breeders' perspective) are passed on to each successive generation, it would eventually lead to a population with reduced genetic diversity.[5] Thus, selection by itself does not maintain genetic diversity in any given population. Long-term population viability, and evolutionary potential, depend more on processes such as genetic drift and gene flow, not only selection. Genetic drift is the random change in population allele frequency. The process of genetic drift does not account for fitness or 'superiority' of an allele and will often keep alleles in a population by chance, despite heavy selection for or against that allele. However, when populations become small, genetic drift has a corrosive effect on genetic diversity, and can quickly remove alleles from a population within a few generations.[6]

The current NEM:BA ToPS Regulations *(Act 10 of 2004)* regulates breeding of the listed species to protect their gene pool for the long-term conservation of wild populations. However, intensive breeding through artificial (non-random) selection of individuals for commercially valuable traits (e.g. horn size/shape, coat colour) represents humans taking over this natural process. Such artificial selection by humans is even more powerful than natural selection in creating distinct phenotypes within very short timeframes. Although domesticated animal species have been around for thousands of years, most of our modern domestic animal breeds developed through a marked increase in intensive animal breeding within the last century or two.[7]

The major difficulty with artificial selection is its focus on obtaining a desired or genetically superior phenotype, but without the built-in safety net of natural processes, which allow genetic drift and gene flow to maintain population genetic diversity in the background. Intensive and semi-intensive breeding invariably leads to small isolated (closed) populations because it is the quickest way to produce a desired phenotype. These populations lose genetic diversity through artificial selection for the so-called superior traits, as well as through genetic drift (a consequence of small populations) and lack of gene flow (a consequence of isolation).

The full negative impact of reduced population genetic diversity then becomes clear as most individuals in the population become so closely related that they all possess the same lethal or deleterious allele copies for the same genes. This then increases the chance that an individual will receive harmful copies of a gene from both parents in a phenomenon known as inbreeding depression.[8] In the wild, natural selection purifies or purges populations of these harmful alleles on the rare occasion when a homozygote emerges. The domestication of traditional farm animals was, therefore, necessarily a lengthy process because it had to allow time for natural selection to purge populations of harmful alleles before they became a burden (load) to the population. However, modern-day breeding practices require the establishment of the desired phenotype as quickly as possible. In these populations, lethal homozygotes increase and, with the population usually being small, will soon be unable to bear the accumulated genetic load of all the 'bad genes'.[9]

Finally, intensive and semi-intensive breeding often leads to hybridisation because individuals from other parts of the species range (other subspecies), or other closely related species, are also present on the same land. This is a common occurrence in South Africa. Although hybridisation is the opposite of low genetic diversity and inbreeding, as it leads to increased genetic diversity, its negative consequences for long-term population survival should not be understated.[10] Attempting to increase population genetic diversity on wildlife reserves in this way is unethical for the following reasons. Populations of wide-ranging species are often adapted to local conditions, especially if local conditions can be markedly different from the rest of the species' range, as is the case in temperate South Africa relative to the rest of tropical Africa. While managed gene flow may be required, and even essential, to maintain long-term genetic diversity of many wild large mammals, gene flow between evolutionary divergent populations can disrupt local adaptability and lead to the loss of unique alleles in receiving populations. It is, therefore, disingenuous to claim that genetic diversity of intensively managed populations can be maintained through translocations if, in reality, the translocations are undermining locally evolved adaptive traits. Hybridisation between species, or very distantly related subspecies, compounds this effect even more because the hybrid will not be adapted to either parental environment, which leads to reduced fitness and survival.[11]

What are the ecological and industry considerations?

Extralimital or exotic species can have benefits such as ecotourism.[12] However, the ecological implications of moving some of these species are potentially large. For instance, rabbits can cause massive environmental impacts.[13] Due to the lack of transparency and details, we do not know how these species will be managed and, therefore, what the ecological implications will be. A logical endpoint of this legislation is that we will have two populations of each species: one wild and one domesticated. We suggest that maintaining this distinction will be expensive, if it is actually possible. Thus, domesticated varieties of wildlife will represent a novel, genetic pollution threat to South Africa's indigenous wildlife that will be virtually impossible to prevent or reverse.[14]

In conclusion

We provide concerns and threats which arise from the amended Table 7 of the *Animal Improvement Act* (*Act no. 62 of 1998*). Most importantly, we point out that the main aim of the law, which is 'To provide for the breeding, identification and utilisation of genetically superior animals to improve the production and performance of animals in the interest of the Republic…' is fundamentally flawed when applied to wild animals on this amended table. The genetic consequences of the law are likely to be severe for some of the listed species. We, therefore, believe the process and reasons given for the addition of indigenous wild game species as landraces is a risk to South Africa's biodiversity heritage, as enshrined in the Constitution.

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