Evolution of Leopards

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Abstract

Leopards have evolved and adapted several times since they first entered the world as a big cat. They have adapted to their home range shrinking, separating or becoming closer to other cat species, and even their coat patterns changing. Mothers are adapting to taking care of their cubs longer to ensure their survival. Leopards have become opportunistic hunters and have turned themselves into becoming the most elusive cat. Leopards have adapted their hunting style depending on what type of prey they are hunting and what habitat they are hunting in. Leopards have a large array of prey species and prey size. Leopards, like all animals, are being impacted by humans. Leopards will continue to adapt and evolve, the only question is how will they continue to do so.

Keywords: leopard, evolution, adaptation, *Panthera pardus*

Introduction

Leopards, *Panthera pardus*, are known as the most elusive of all the big cats (African Wildlife Foundation [AWF] 2019). They are currently listed on the International Union for Conservation of Nature (IUCN) Red List as vulnerable with a 30% global decline over three generations (Dhungana et. al, 2019). Leopards are apart of the Felidae family which began to evolve about 25 million years ago and consists of 37 extant cat species (Wild Cat Family [WCF], 2019).

Leopards are adapting and evolving to coexist with humans, and humans should work on coexisting with leopards. Leopards are one of the big cats that are incredible at adaptability since they have to adapt and evolve in many ways in order to survive and coexist with competition from lions, tigers, and humans (Panthera, 2019).

Historic Range

Leopards have the largest range of all the big cats, which also means they are the most persecuted large cat in the world (Panthera, 2019). They are found in approximately 62 countries across Africa and Eurasia (Panthera, 2019). Leopards are extinct in 13 countries and regions and possibly extinct in seven more (Panthera, 2019). Leopards have vanished from at least two-thirds of their historic range in Africa and 84% of their historic range in Eurasia (Panthera, 2019). That statistic is backed up with leopards now being found only in 25-37% of their historic range due to habitat loss, fragmentation, hunting and poaching, prey depletion and human conflict (Dhungana et. al, 2019).

Evolution

The earliest known leopards were in Africa about 3.8-3.4 million years ago, with the oldest unequivaled leopards being there 2 million years ago (Werdelin et al, 2009).
The earliest leopards were in Eurasia about one million years later (Werdelin, et. al, 2009). The panthera lineage is the oldest cat lineage and they split off from the cats last common ancestor around 10.8 million years ago (Turner, 1997). Although the evolution of leopards is somewhat of

a mystery, because the oldest Panthera fossils only go back to 3.8 million years ago, it is safe to say that they are an elusive and adaptable large cat (Werdelin at. al, 2009). They are considered conical tooth cats which differ from sabertooth cats by having a more rounded canine cross section (Werdelin at. al, 2009). They are similar to sabertooths by having a long lower canine (Werdelin at. al, 2009).

There are nine subspecies of leopards and they can live between 14 and 19 years in the wild (Panthera, 2019). Leopards are related to lions, tigers, jaguars, and snow leopards since they are all in the *Panthera* family, however the snow leopard is actually more closely related to the tiger (Turner, 1997). Some believe the leopard would be related to the cheetah but they are not related and the cheetah is not in the genus panthera like leopards, lions, and tigers are (Turner, 1997). Each leopard needs at least 40 square kilometers of land (Ghosal, 2018). Leopards have evolved to be able to adapt to most environments, both warm and cold (AWF, 2019). Leopards have also evolved to become the strongest climber of all the big cats, most likely because they have to hide their food from lions and tigers (AWF, 2019).

Adult leopards have generally have a rosette coat pattern, which is often influenced by adaptations to hunting behavior and other characteristics of the species (Werdelin, 1997). However, juvenile coat patterns are more primitive, or resembles what their ancestors coats would have looked like, to the condition of the species (Werdelin, 1997). Rosettes are considered a flecked pattern and that the most transformation of coat patterns originate from the flecked pattern which is considered primitive for the Felidae as a whole (Werdelin, 1997). The melanistic or black variant in coat patterns occur mainly in leopards but even with the black color they still have rosettes (Turner, 1997).

Leopard mothers usually have two to three cubs per litter (AWF, 2019). Leopard mothers take care of their cubs for 9 to 35 months (Balme, Robinson, Pitman, and Hunter, 2017). Evolution is beginning to show us that mothers are prolonging the care of their cubs Prolonging care may increase the fitness of current offspring, but it also reduces the mothers opportunities to have more litters over her lifetime (Balme et. al, 2017). Prolonging care can increase the survival, recruitment and future reproductive success of current offspring (Balme et. al, 2017). Prolonged care can increase the cubs survival rate which makes a huge impact on cubs since

fewer than 40% reach independence (Balem et. al, 2017). Leopard mothers are different than many species in terms of caring for their young. For example, leopard mothers will adjust their demands to be sensitive of their cubs demands by putting their cubs demands over their own, and they care for their sons longer than their daughters (Balme et. al, 2016). It is not yet fully studied, however some researchers hypothesize that mothers care for their sons longer to ensure they survive and are strong enough to claim their own territory.

Type of Hunter

Just like tigers and jaguars, leopards hunt solitarily in similar terrain and they all stalk and close in on their prey (Turner, 1997). Group hunting would provide no benefit due to the fact that once detected there is very little chance of the leopard capturing its prey (Hayward, 2006). Leopards are the most adaptable and widely distributed species which helps them survive anywhere from tall grasses, dense or sparse forests, or even mountain cliffs (Dhungana et. al, 2019). Leopards are opportunistic hunters which benefits them since they are spread out among several different habitats Grey, Bell, and Hill, 2017). In open habitat, leopards will hunt at night by stalking their prey and having a short sprint to catch and kill their prey (Hayward, 2006). Conversely, in rainforests leopards will hunt diurnally and ambush their prey (Hayward, 2006).

Prey

Leopards have the broadest and most diverse diet of all the large predators, having around 92 to over 100 prey species (Hayward, 2006; Panthera, 2019). Leopards need to eat between 1.6 and 4.9 kilograms of meat per day which balances out to about 40 prey items per year (Hayward, 2006). The most popular prey for leopards are impala, bushbuck, and common duiker (Hayward, 2006). Cats want to kill wild prey and avoid livestock due to human retribution (Khorozyan, Ghoddousi, Soofi, and Waltert, 2015). Leopards like to prey on species within a weight range of 10-40 kg, with their most common prey weighing around 25kg (Hayward, 2006). Some believe leopards weigh weigh between 17-65 kilograms, or 37-143 pounds, while others claim that leopards actually weigh between 20 and 90 kilograms, or 44-198 pounds

(AWF, 2019; Hayward, 2006). Although there is a disagreement in how much leopards weigh, it is agreed upon that there is a large range in weight adding to the diversity of their prey species.

Unfortunately, because leopards are opportunistic hunters, they tend to come into a lot of conflicts with humans accusing them of predating on livestock. It is important for humans to realize leopards would rather choose wild prey items rather than livestock prey. Leopards are blamed for livestock loss but studies have shown that leopards are not hunting on livestock (Grey et. al, 2017). Out of the 100 different leopard scat samples, only 0.8% had livestock as a part of their diet, even though they are being accused of taking much more livestock than that Grey et. al, 2017). In Nepal leopards do eat livestock, but it is because they are getting pushed out of their territories by tigers which increases the likelihood of them predating on livestock (Dhungana el. Al, 2019). In both Africa and Asia territories Leopards will only kill cattle when they are the top predator, meaning there are no lions or tigers in the area (Khorozyan et. al, 2015). However, leopards will kill more sheep and goats when coexisting with lions or tigers (Khorozyan, et. al, 2015). Environmental changes affect the vegetation and animals that eat it, which in turn affect the cats that prey upon those animals (Turner, 1997).

Human Impacts

Humans and large carnivores have a complex history in their relationship that spans back several thousands of years (Ghosal, 2018). Leopards face habitat loss, hunting, poaching, prey depletion, and human conflict (Dhungana et. al, 2019). Their primary threat is direct killing caused by humans (Panthera, 2019). In southern Africa 800 leopards are killed every year for their fur and there are fewer than 5,000 leopards that remain in South Africa alone (Panthera, 2019). No one knows the actual number of leopards that remain in the wild, although some people believe that since leopards have always lived in the area, humans should stop acting surprised when they see one and just accept that they are in their natural home range (Ghosal, 2018).

Leopards biggest threats are retaliatory killings for being accused of predation on livestock (Khorozyan et. al, 2015). Leopards are blamed for livestock deaths when they are not to blame because there is another cause of death, the incorrect number of livestock quoted, or

poaching and theft of livestock animals by other humans (Grey et. al, 2017). Because leopards are persistence and opportunistic hunters that leads to why they are the predator to blame (Grey et. al, 2017).

Conclusion

Leopards have evolved and adapted to several changes throughout history which helps to continue the survival of their species. Leopards continue to adapt to their shrinking home range. They continue to evolve as other animals evolve and the climate changes more quickly than before. Their coat patterns have evolved to keep them hidden from predators and prey, and it also changes from when they are cubs to when they are adults. Mothers are now evolving to taking care of their cubs longer resulting in less litters produced in their lifetime to ensure the survival of the cubs they do have (Balme et. al, 2016). Leopards have adapted in hunting style by staying hidden until ready to attack. They have also adapted and evolved to being able to carry their food up high into the trees to prevent lions and tigers from stealing their catch (AWF, 2019). Leopards are often wrongly accused of stealing livestock which leads to there being human-leopard conflict. Leopards will continue to adapt and evolve to the changes humans place on them, therefore it is crucial that humans learn to coexist with leopards before they are pushed to extinction.

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