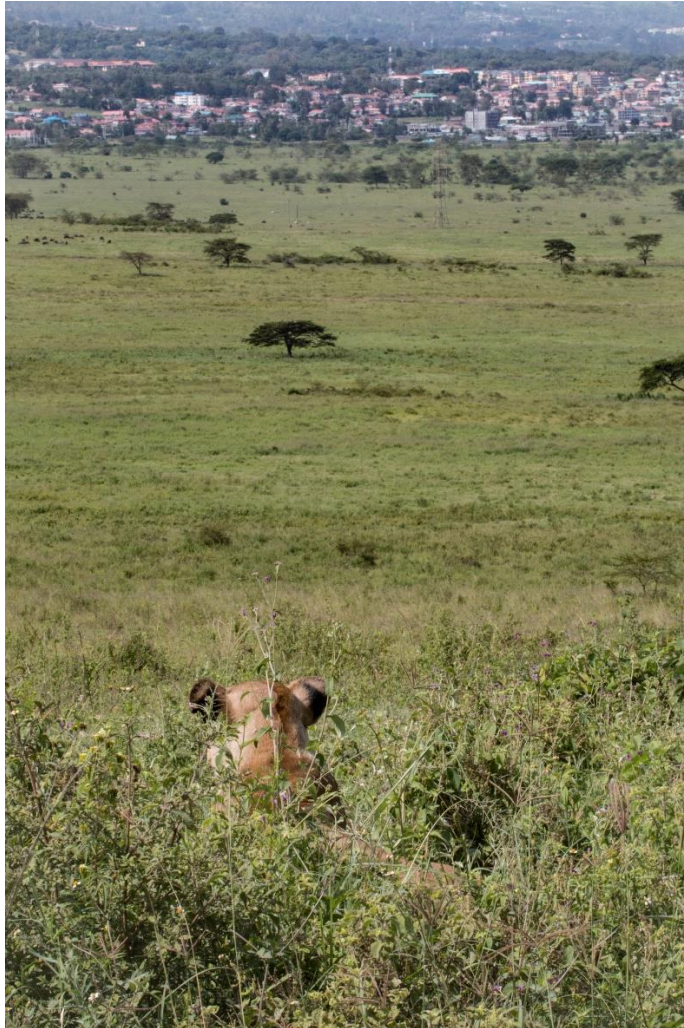




Lions and humans in Southern Kenya: conflict, coexistence and conservancies.

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Abstract

Humans and lions have shared landscapes for thousands of years. Lions have now declined in population and human-lion conflict is the most important threat to lions in Kenya. When faced with the anthropogenic pressures and disturbance, lions have been found to alter their behavior, temporally and spatially. Research supports that the availability of not only protected areas, but adjoining conservancy areas, with sufficient prey densities, are critical for the conservation of lions. Lions require space to retreat from anthropogenic pressures. When offered the space and prey required, coexistence has been proven to be possible even among pastoralists with livestock. A model for coexistence can be observed in Olkiramatian and Shampole group ranches, which employ mixed land-use management. Conservancies adjoining protected areas allow for landscape level conservation of lions.

Introduction

Humans have shared the same landscape with Africa's largest carnivore, the lion (*Panthera leo*), for thousands of years (Barnett, et al., 2014; Hunter, 2005), and in many of the rangelands of East Africa nomadic pastoralists migrate with their herds of livestock, following the seasonal rains, for food (Schuette, Creel & Christianson, 2013a). While there appears to be a decline in the tolerance of lions, and other large predators in recent years (Hazzah, Mulder, & Frank, 2009), some Maasai in southern Kenya continue to choose to coexist with lions and other wildlife (Russell, Tyrrell, & Western, 2018).

Lions have a broad habitat tolerance and are generalists that can take down almost any animal they come across, the exception being adult elephants (Bauer, Packer, Funston, Henschel, & Nowell, 2016; Hunter, 2005). The majority of their prey consists of medium to large herbivores (e.g., antelope, wildebeest and zebra), and they will also scavenge and steal from other predators, such as spotted hyenas (Bauer, et al., 2016; Hunter, 2005). Lions are currently classified by the International Union for Conservation of Nature as *vulnerable*, and their population has decreased over 40% over the past 20 years (Bauer, et al., 2016). Causes of decline include human

population growth and its associated loss of habitat, depletion of its prey base, and direct killing (Bauer, et al., 2016). In Kenya, Maasai kill lions as retaliation against human and livestock loss, to protect humans and livestock, socially as a protest, and for cultural reasons (Bauer, et al., 2016). Lions may be speared, snared, or due to their scavenging behavior, poisoned by laced carcasses (Bauer, Muller, Van Der Goes, & Sillero-Zubirir, 2017; Hunter, 2005). It is not certain how many lions are killed annually since it is usually conducted in secret (Bauer, et al., 2016).

Research of human-lion conflict in Kenya appears to fall into two categories: 1) studies of the response of lions to anthropogenic disturbance and conflict with humans, and 2) the human response to conflict with lions. Regardless of the lens that human-lion conflict is viewed and investigated, whether from the perspective of lions or that of humans, research supports the availability of conservation areas, in conjunction with protected areas, as crucial for the survival and conservation of lions.

Discussion

Lion responses to anthropogenic disturbance: land use and behavioral changes.

Studies have demonstrated that lions alter their feeding behavior and land use, become more secretive and withdraw, in response to human encroachment.

Masai Mara region. In Kenya, protected areas, such as national parks and reserves, form conservation strongholds for large carnivores. Masai Mara National Reserve (MMNR), part of the Mara-Serengeti ecosystem, is home to the highest densities of lions in Kenya (Bauer, et al., 2016) due to an abundance of prey species throughout the year (Green, Johnson-Ulrich, Couraud & Holekamp, 2018). Lions occupying areas outside of protected areas are directly threatened by increasing anthropogenic pressures (Mogensen, Ogutu, & Dabelsteen, 2011). The same growing anthropogenic pressures from outside protected area boundaries can also alter behavior of wildlife living within protected areas (Green, et al., 2018).

Mogensen, et al. (2011) studied and compared lions inhabiting MMNR and lions occupying a pastoral group ranch adjoining the reserve, and found a change in the

feeding behavior of lions. Similar to lions inhabiting the protected Serengeti (Schaller, 1972), Mogensen, et al. (2011) reported that those within MMNR guarded their prey, and consumed them hours later, usually in open grassy areas. However, those living in the ranch, outside of reserve protection, ate their kills while concealed inside bushes, and often abandoned unfinished meals due to encroaching humans and livestock, (Mogensen, et al., 2011). Lions occupying the reserve also spent more time in open habitats when compared to those lions inhabiting ranches, which spent most of their time inside bushes and woodlands. When pressures from livestock and humans were reduced, however, the ranch lions behaved similarly to those in the reserve, spending more hours in the open (Mogensen, et al., 2011).

Lions occupying different areas within MMNR were studied by Green, et al. (2018). These researchers found a decrease in lion sightings between 2004-2013 in the Talek region, which has the highest anthropogenic disturbance and encroachment pressures (Green, et al., 2018). However, since none of the lions were collared in the Green, et al. study, (2018) and the lion data was obtained solely via sightings, it is not certain whether the lions withdrew from the region, became more nocturnal and more difficult to find or due to increased opportunities for conflict with pastoralists, were killed. Both studies, however, demonstrate how lions respond to increased human-lion interaction, by altering their behavior and land-use, becoming more secretive and withdrawing in response to human encroachment.

Nairobi National Park. In 2013, the idea of using LED flashlights in a way to mimic herders at night and protect livestock from lion predation, was proposed and presented by Richard Turere, who was eleven years old at the time (Kermeliotis, 2013; Lillie, 2013). Researchers studying the effectiveness of the LED flashlight technique found there was a significant decline, a decrease of over 90%, in lion depredation of livestock in bomas, outside the Nairobi National Park, where flashlight systems were installed (Lesilau et al., 2018). Lesilau et al. (2018) also reported that after a campaign of flashlight system installations, lion attacks occurred further away from the park's boundary, inferring lions were searching for bomas without the flashlight deterrent.

system. The researchers have also observed lions adapting from nocturnal to diurnal predation events (Lesilau et al, 2018).

It appears the installation of the LED flashlight systems have affected lion behavior in two ways, with lions traveling further from the park to search for bomas without flashlights to attack livestock, as well as alter their temporal activity in response to humans attempting to deter nocturnal attacks; both behavioral changes occurred to avoid human interaction.

Shompole and Olkiramatian Maasai Group Ranches: a model for coexistence

Though protected areas are important for the conservation of lions, in Kenya's southern Rift Valley exists a model of unfenced joint, mixed land-use areas which experience low amounts of conflict between lions and people (Schuette, et al., 2013a). The area is divided by the permanent Ewaso Nyiro River, and its community consists of Maasai pastoralists, in low-density, subsisting on their livestock (Schuette, et al., 2013a). The group ranches of Shompole and Olkiramatian are divided into four areas defined by their use: (1) a "community conservation area" (CCA) which is regularly not used for grazing except during daylight under conditions of drought, (2) a "buffer area" which is grazed during the dry season, (3) a "grazing area" which is used in the wet season, and (4) a permanent settlement area that is regularly used (Schuette, et al., 2013a).

Studying radio-collared lions in Shompole and Olkiramatian, Schuette, et al. (2013a) found a lion density comparable to protected areas such as MMNR and the Serengeti. The researchers also found that the lions shifted in response to movement of humans with their livestock, and used the CCA and dense habitat for cover when humans were near (Schuette, et al., 2013a). This is similar to the findings of Mogensen, et al. (2011) observing lions in the Koyaki group ranch outside of MMNR using dense bushes to conceal from humans grazing their livestock.

The ability for lions, even in high density, to move freely away from humans and still have abundant wild prey, along with a relatively low density of humans, have allowed the coexistence of lions and people with livestock in this landscape.

Another complimentary study of the same area utilized camera traps to monitor carnivore activities and dynamics (Schuette, Wagner, Wagner, & Creel, 2013b). Validating the results found with radio collared lions (Schuette, et al., 2013a), the camera traps revealed high lion occupancy in the CCA, and sufficient habitat and prey to sustain its use, as well as lions leaving the CCA when human presence increased (Schuette, et al., 2013b).

Wildlife conservancies in Kenya

A 'conservancy' is land set aside for wildlife conservation. Conservancies can be managed by a community, (such as Olkiramatian and Shampole), by a group of owners, or by an individual landowner (Kenya Wildlife Conservancy Association, 2017). They are used as buffer zones to protect wildlife outside of governmental protected areas, and through ecotourism, they can financially benefit the communities/owners of the land.

Conservancies in Masai Mara region. Blackburn, Hopcraft, Ogutu, Matthiopoulos & Frank (2016) while studying lions living north of MMNR, located livestock settlements within lion home ranges and recorded whether the settlement was a member of a conservancy. Upon comparing environmental factors and conservancy membership, the researchers found conservancy membership to be *the most* influential predictor of lion survival, stronger than livestock density, percentage of vegetation, rainfall or prey availability (Blackburn, et al., 2016). Researchers found that the avoidance of conflict with humans is more crucial to the survival of lions than any of their environmental factors (Blackburn, et al., 2016). Livestock settlements without conservancy membership were found to have a negative effect on lion survival (Blackburn, et al., 2016). Survival was highest for those lions living within the reserve or occupying the centers of conservancies (Blackburn, et al., 2016). These findings align with those of Green, et al. (2018) and Schuette, et al. (2013a) and support how crucial the availability of conservation areas are for lion conservation.

Conclusion

When faced with the anthropogenic pressures and disturbance, lions have been found to alter their behavior, temporally and spatially. Lions may make changes to their temporal behavior by becoming more nocturnal to avoid human interaction. When faced with increased human encroachment, lions become more secretive and tend to stay in bushes and thick habitat, will more readily leave prey behind, and retreat. Research supports that the availability of not only protected areas, but (surrounding) conservancy areas, with sufficient prey densities, are critical for the conservation of lions. Lions require the space to retreat from anthropogenic pressures. When offered the space and prey required, coexistence has been proven to be possible even among pastoralists with livestock. The model for coexistence can be observed in Olkiramatian and Shampole group ranches, employing mixed land-use management, or other conservancies throughout Kenya. Conservancies not only behave as “buffer zones” to diminish anthropogenic pressures, but they can also improve connectivity between protected areas. Wildlife conservation can then be viewed on a landscape level, such as the Tsavo-Amboseli ecosystem.

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