



Kwando Carnivore Project

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Human-Lion Conflict Mitigation in the Zambezi Region, Namibia

Report June 2020



Dispersing males from the Mudumu River Pride, Mudumu NP

Photo: Dan Stephens

Lise Hanssen¹, Lusicious Kukuwe¹, Coster Sililo¹,

Conservancies in alphabetical order: Balyerwa, Bumunu, Dzoti, Kabulabula, Kasika, Kwandu, Lusese, Mashi, Nakabolelwa, Sangwali, Sobbe and Wuparo.

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The Mudumu Landscape

Background

The Mudumu Complexes in the Zambezi Region are made up of protected areas, conservancies and community forests and lie adjacent to the Kwando River in the eastern part of the region. This area lies at the heart of the Kavango-Zambezi Transfrontier Conservation Area (KAZA), within the Kwando Wildlife Dispersal Area (WDA), and is one of six WDAs identified as imperative for wildlife connectivity within KAZA. The Kwando WDA is an important area for transboundary movement of many wildlife species including all of the larger carnivores, and is pivotal to the success of KAZA as a wildlife landscape, and an especially important area of connectivity of lions between Angola, Botswana and Zambia.

During 2012 and 2013, predation on cattle by lions in the conservancies of the Mudumu South Complex increased dramatically, seemingly in response to lion populations in Nkasa Rupara and Mudumu National Parks reaching their ecological thresholds. In 2012/13 a total of 135 cattle were reported killed by lions, followed by 61 in 2014. In response 17 lions were killed in retaliation in late 2012/2013. One pride was particularly heavily culled, the Lupala Pride, which was 15 individuals strong in early 2012, and by the end of 2013 had been reduced to 3 individuals. By the end of 2014, only a single adult female remained of this pride leaving a vacant territory, severely impacting tourism activities in the area and causing friction between stakeholders. Several additional lions were killed in response to this conflict in 2014.

A comprehensive human-lion conflict mitigation project was initiated in the Mudumu-South Complex of Namibia in 2013/14. The project was expanded to include the Mudumu North Complex during 2016 focusing on two conservancies (Mashi and Sobbe) adjacent to the north of Mudumu National Park. During 2017, the conservancies along the eastern floodplain of the Chobe River were also included as 17 lions originating from Chobe National Park in Botswana were killed there in that year. The key focus of the program to date has included the building of 130 lion-proof kraals in the Mudumu Complexes and 40 lion-proof kraals along the eastern floodplain, supporting conservancy game guards in dealing with conflict situations and extensive engagement with communities. More recently we have successfully used mobile kraals to protect grazing cattle on fields and have partnered with Namibian NGOs who are piloting rangeland conservation and conservation agriculture in a number of conservancies in the Mudumu Landscape.

This has resulted in an overall reduction of approximately 90% in the annual number of cattle killed by lions in the Mudumu Landscape. Retaliatory killing has dramatically declined where 20 lions were killed in 2013/14, no lions were killed in 2015 and 2016, two lions were killed during 2017, one lion was killed in 2018 and no lions were killed during 2019. The lion population in the surrounding parks has recovered and surpassed pre-2013 levels with the formation of two small prides in addition to the main pride in Mudumu National Park, one large and two small prides in Nkasa Rupara National Park and two prides in the Kwando Core Area of Bwabwata National Park. A number of male lions have dispersed through the Kwando WDA/Mudumu Landscape and lions are once again an important tourism attraction for the parks as well as



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contributing to community benefits within some conservancies. The Mudumu North Complex focal area has expanded to include Kwandu and Mayuni Conservancies to further facilitate connectivity for lions between the Mudumu Landscape and Sioma Ngwezi National Park in Zambia and Luengue-Luiana National Park in Angola to the north. The Mudumu South Complex focal area has once again included Bamunu Conservancy.

Lions are now approaching ecological capacity within the Kwando WDA and connectivity within the Mudumu Complex mosaic landscape has improved with no mortality of dispersal aged male lions during 2019. This lion recovery has resulted in new challenges such as emerging hotspots of conflict where human settlement coincides with lion dispersal corridors and a slight increase in attacks on grazing cattle that are left unattended by herders. Thus our conflict mitigation program needs to continue monitoring and responding to these population increases along with conflict by implementing new mitigation techniques.

Cattle predation statistics in the Mudumu South Complex (MSC) in the last year

Data on lion-livestock conflict incidents from conservancy event books are now collected twice a year in order to identify hotspots of conflict and respond to in a shorter time frame. Overall there has been a steady decline in the number of livestock killed by lions in the MSC from 2012/2013 before intervention until 2020. Thirty four cattle were killed in the Balyerwa, Dzoti and Wuparo Conservancies MSC during 2019, which is a decline of 80% since 2012/2013 when cattle killing rose sharply. Of these only five were killed in traditional kraals, while 29 were killed while grazing. The number of cattle killed by lions in the MSC has remained reasonably constant over the past two years, despite the increase in lion numbers in Nkasa Rupara National Park. An intense drought was also experienced during 2019 resulting in cattle being left outside kraals at night more often so that they do not have to be herded back from grazing areas.

At least eight of the cattle killed in Dzoti Conservancy (Figure 1) was due to a single male lion whose pride (Nkasa Pride) was taken over by two male lions from the Lupala Pride. His GPS collar stopped working prematurely so we were unable to monitor his movements, but his spoor was identified at the carcasses and this was confirmed by photos taken by camera trap. The killing of cattle stopped after October when he moved out of the area, whereafter there were no more cattle losses in Dzoti in 2019. Additionally, three cattle were killed in two traditional kraals in Bamumu Conservancy during 2019.

Three grazing cattle that were killed by lions in Balyerwa Conservancy belonged to a single farmer who has already had his kraals upgraded to lion-proof. There is little doubt that kraal improvements in areas of conflict as well as in “hotspots” of intense conflict is a big contributor to the overall decline in lion attacks on cattle. Lion attacks on cattle that are housed in traditional kraals now make up a small percentage of the overall number of cattle killed by lions in the MSC.



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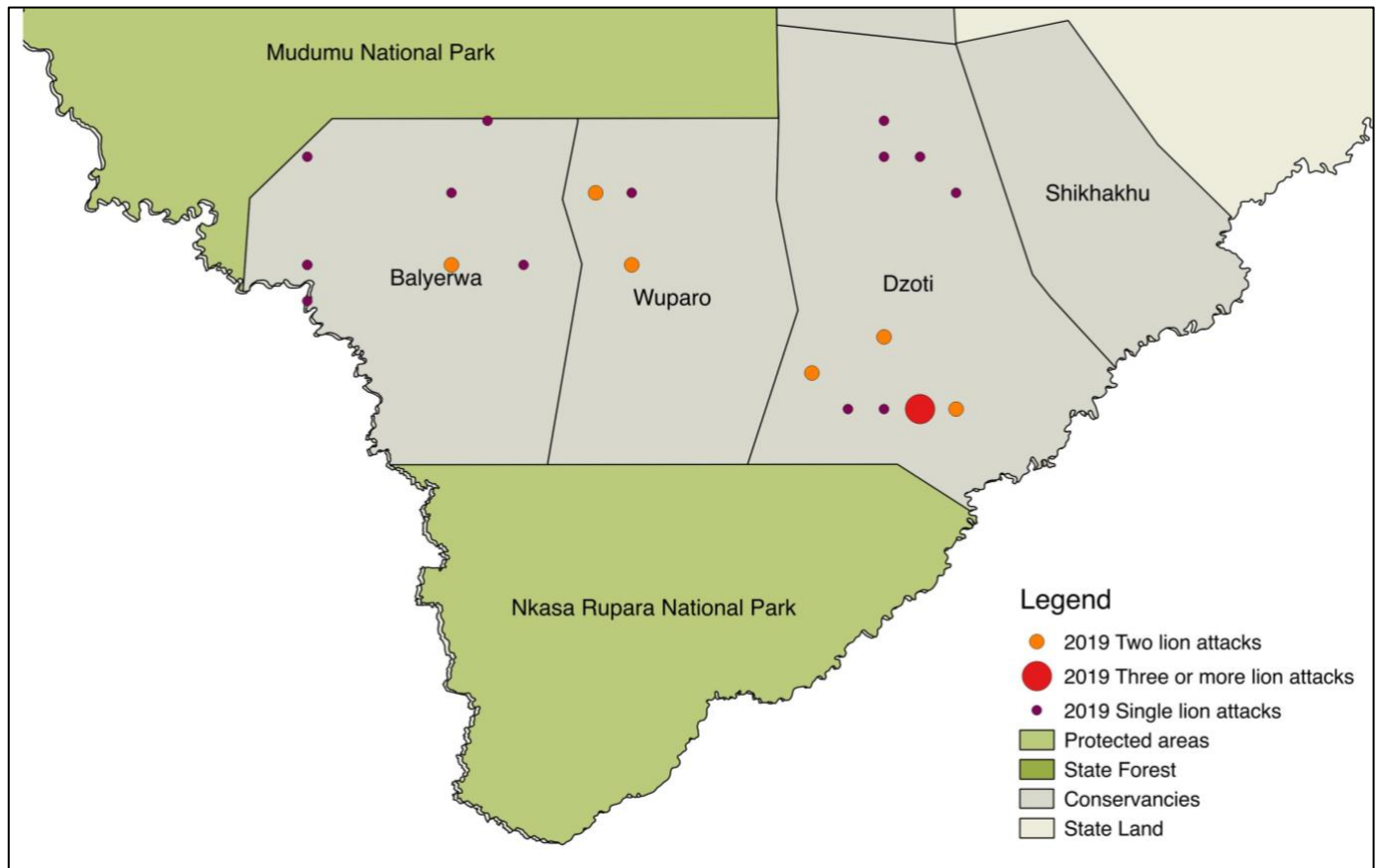


Figure 1: Lion attacks on cattle in the Mudumu South Complex during 2019

Although the number of cattle killed by lions in the MSC represent only 0.3% of the 14,572 cattle (Diaz Silubanga *pers. comm.*) in the Mudumu South conservancies (Balyerwa, Bamunu, Dzoti and Wuparo), these losses were born by 29 families out of the 5947 residents. The area of the MSC Conservancies is 1214 km² although Bamunu Conservancy is not contiguous with the other three conservancies. The numbers of cattle killed by lions per year and per conservancy in the Mudumu South Complex are presented in Table 1.

From the data it is clear that irrespective of the decline in predation levels and the building of the lion-proof kraals, that nevertheless the majority (80%, n = 309) of cows over the seven year period were actually killed while grazing **unattended** (no herders were present in the day or the cattle were not kraaled at night) (Figure 2). However, the declining number of cattle killed annually since the project was initiated during 2014 suggests that the high numbers of lion-proof kraals in hotspots and problem areas makes the conservancies less attractive area for lions to hunt for food. To date not a single cow has been killed by lions inside a lion-proof kraal in the MSC.

Although predation rates are as low as on record these losses are, however, significant to these families and could mostly be avoided if we could institute day time herding and night time kraalings as standard 'traditional' practice.



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Table 1. Cattle losses to lions per conservancy in the Mudumu South Complex from 2013 to 2019 (Event Book data from Balyerwa, Dzoti and Wuparo Conservancies).

Conservancy	Balyerwa	Dzoti	Wuparo	Total (%)
No of cattle killed in 2013:				
While kraaled	21	17	15	53 (39%)
While grazing	31	31	20	82 (61%)
No of cattle killed in 2014:				
While kraaled	0	5	3	8 (13%)
While grazing	22	23	8	53 (87%)
No of cattle killed in 2015:				
While kraaled	0	4	2	6 (20%)
While grazing	14	8	2	24 (80%)
No of cattle killed in 2016:				
While kraaled	1	3	0	4 (10%)
While grazing	19	17	1	37 (90%)
No of cattle killed in 2017:				
While kraaled	14	9	6	29 (35%)
While grazing	27	21	4	52(64%)
No of cattle killed in 2018:				
While kraaled	2	0	0	2 (6%)
While grazing	8	22	2	32(94%)
No of cattle killed in 2019:				
While kraaled	0	1	4	5 (14%)
While grazing	15	13	1	29(86%)
Total	174	174	68	416



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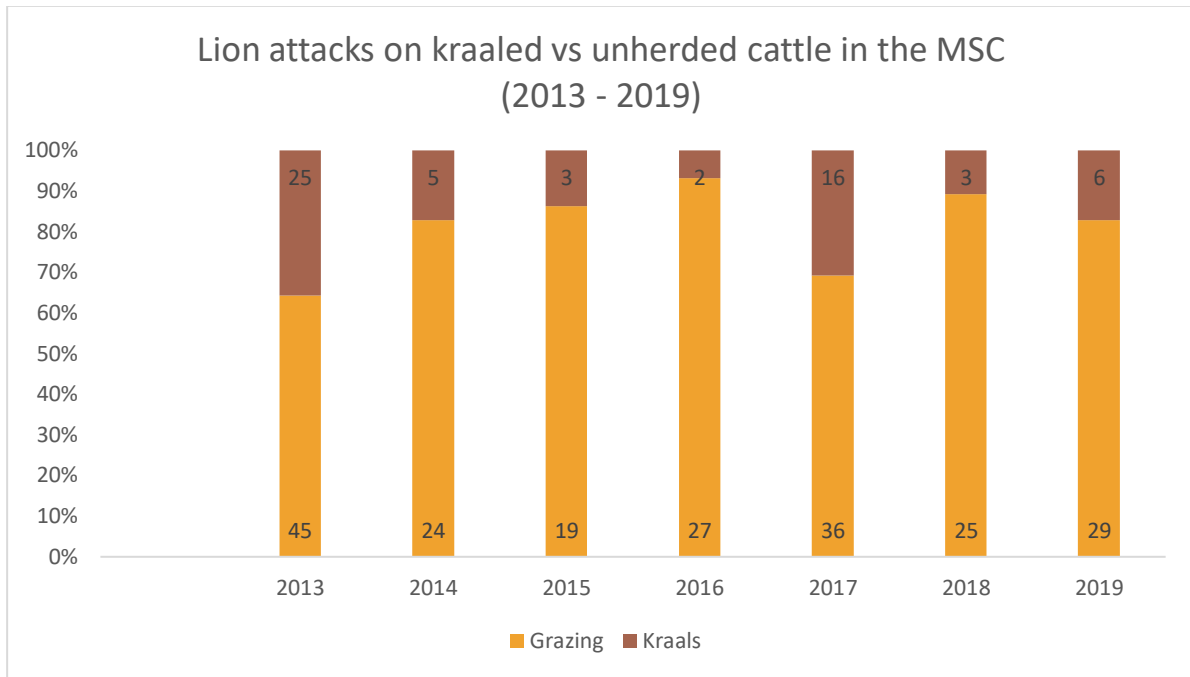


Figure 2: Illustrates the shift in cattle depredation. During 2012/2013 cattle depredation that took place in kraals made up almost half of all cattle depredation. Over the past seven years as the number of lion-proof kraals have increased, this has shifted to approximately 5%. This strongly suggests that lion-proof kraals have played a significant role in reducing livestock depredation in MSC.

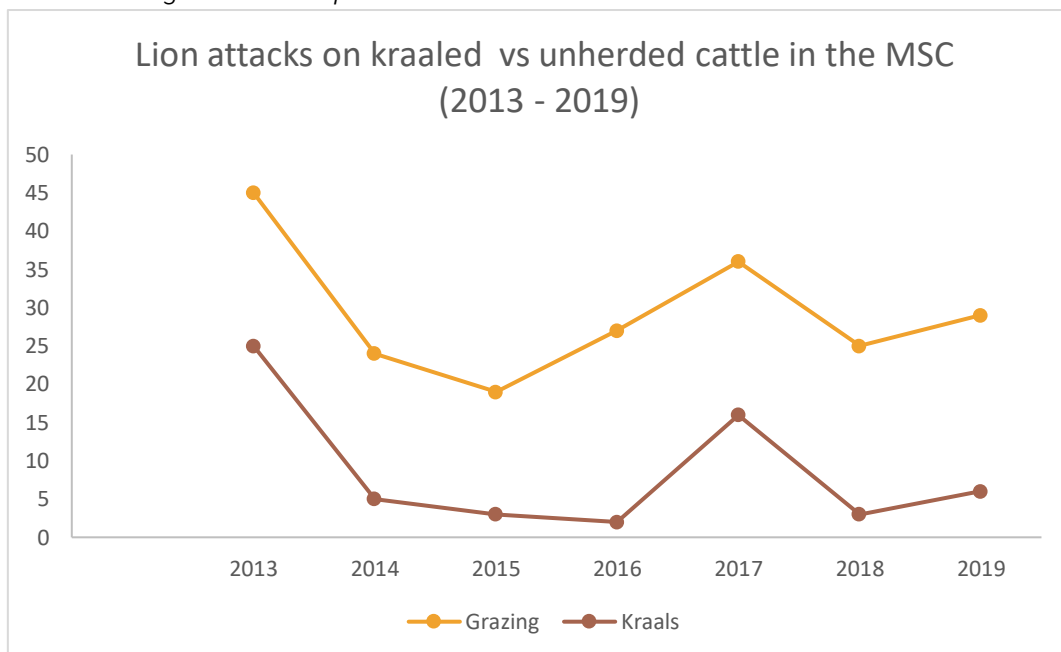


Figure 3: Percentage of cattle killed by lions while grazing vs in traditional kraals in the Mudumu South Complex from 2012 to 2019.



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In figure 3 the peak of lion attacks on cattle during 2013 represents the height of lion depredation on cattle before the project was initiated. The secondary peak during 2017 represents a period when good rains followed a drought resulting in sudden dispersal of prey species combined with dispersal of young adult male lions. Livestock attacks by lions increase when prey disperses and dispersal age lions tend to kill more livestock before settling down

Seasonality of conflict

Seasonality of conflict with lions during 2019 followed the same pattern as all previous years (Figure 4) with a peak of conflict during the height of the wet season and the again in June/July. When all the data from 2013 to 2018 are compiled (Figure 5), it is clear that predation on grazing unprotected cattle occurs throughout the year. There are, however, two clear periods of greater activity for both grazing and kraaled cattle (Figure 5 and 6). There is an increase during the late wet season from January to April, which is likely partly due to prey dispersing with the height of the rains resulting in the lions having to work harder for food. The mid-year and late dry season spikes are likely due to farming activities.

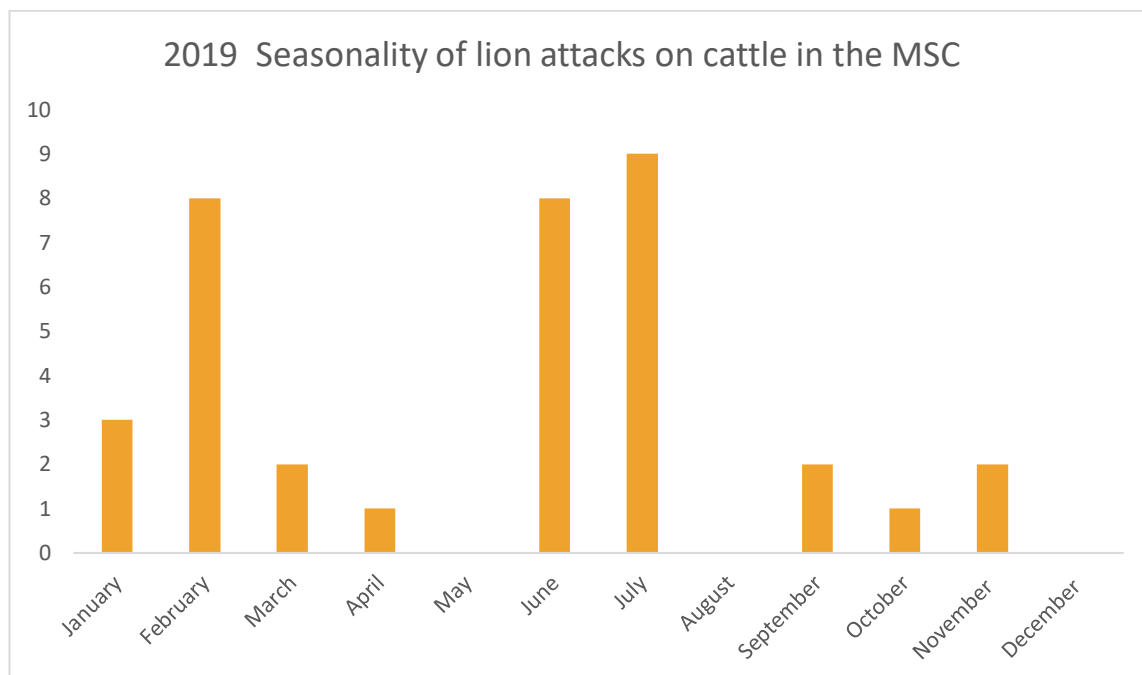


Figure 4: Seasonality in livestock depredation by lions during 2019 showing peaks of conflict during the height of the wet season and in the middle of the year.



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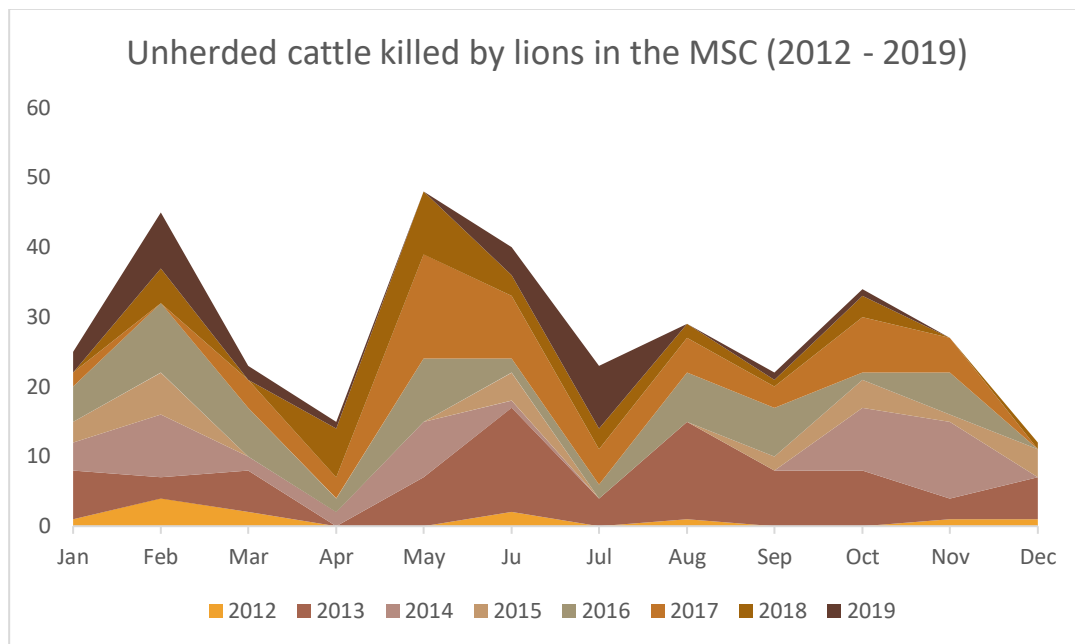


Figure 5: Seasonality of lion predation on unprotected grazing cattle in the Mudumu South Complex, Zambezi Region, from 2012 to 2019 showing spikes in predation in the late wet season and in the middle of the year.

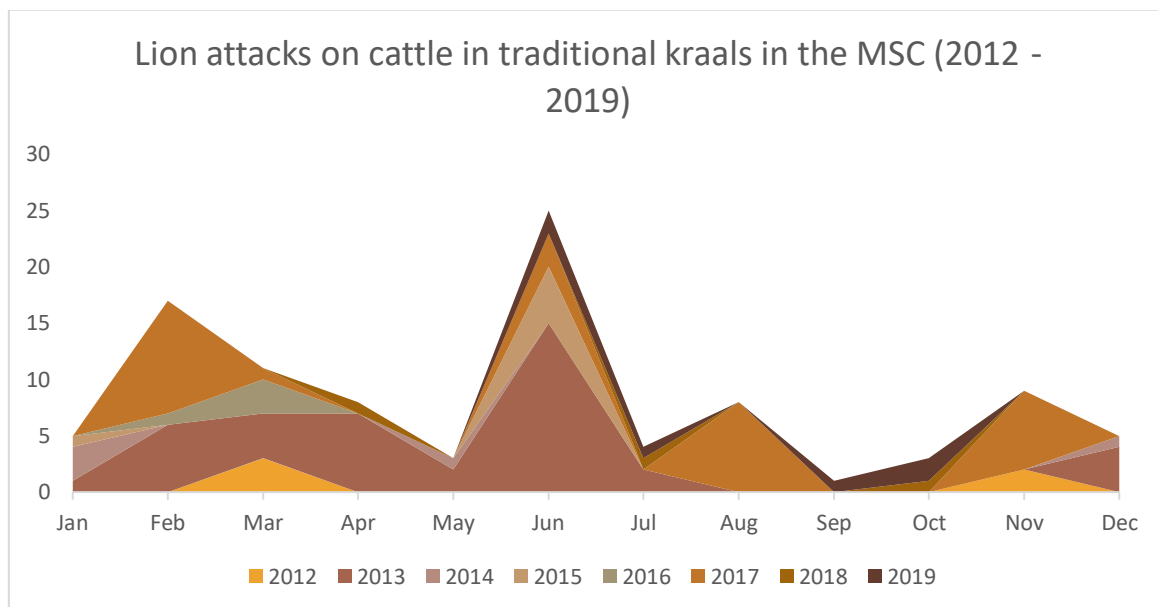


Figure 6: Seasonality of lion predation on kraaled cattle in the Mudumu South Complex, Zambezi Region, from 2012 to 2019 clearly showing that predation on cattle by lions increases dramatically when extended drought is followed by good rains. This was the case when the 2015/2016 El Nino conditions were followed by good rains during the 2016/2017 wet season. There is a marked increase in attacks on livestock during the height of the wet season and in the middle of the year.



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Cattle predation statistics in the Mudumu North Complex (MNC)

The number of cattle killed by lions in the MNC has stayed relatively constant over the past two years. By far the majority of cattle (94%, n = 25) were killed while left unattended. Seven cattle were killed inside traditional kraals that need to be upgraded to lion-proof during 2020. Overall losses of cattle to lions are low in the MNC, but could be dramatically reduced if grazing cattle were herded. Lion-proof kraals have made a significant impact on lion attacks, where attacks on kraaled cattle used to make up almost 50% of attacks, they now make up less than 10%.

Kwandu and Mayuni Conservancy are now included in the MNC focus area although neither lost cattle to lions during 2019. These two conservancies are furthest away from the Mudumu NP which is likely to buffer them from losing cattle to resident lions (Figure 7). However, both conservancies lost cattle to lions in years when male lions dispersed from the protected areas of the Zambezi Region as well as Sioma Ngwezi NP in Zambia.

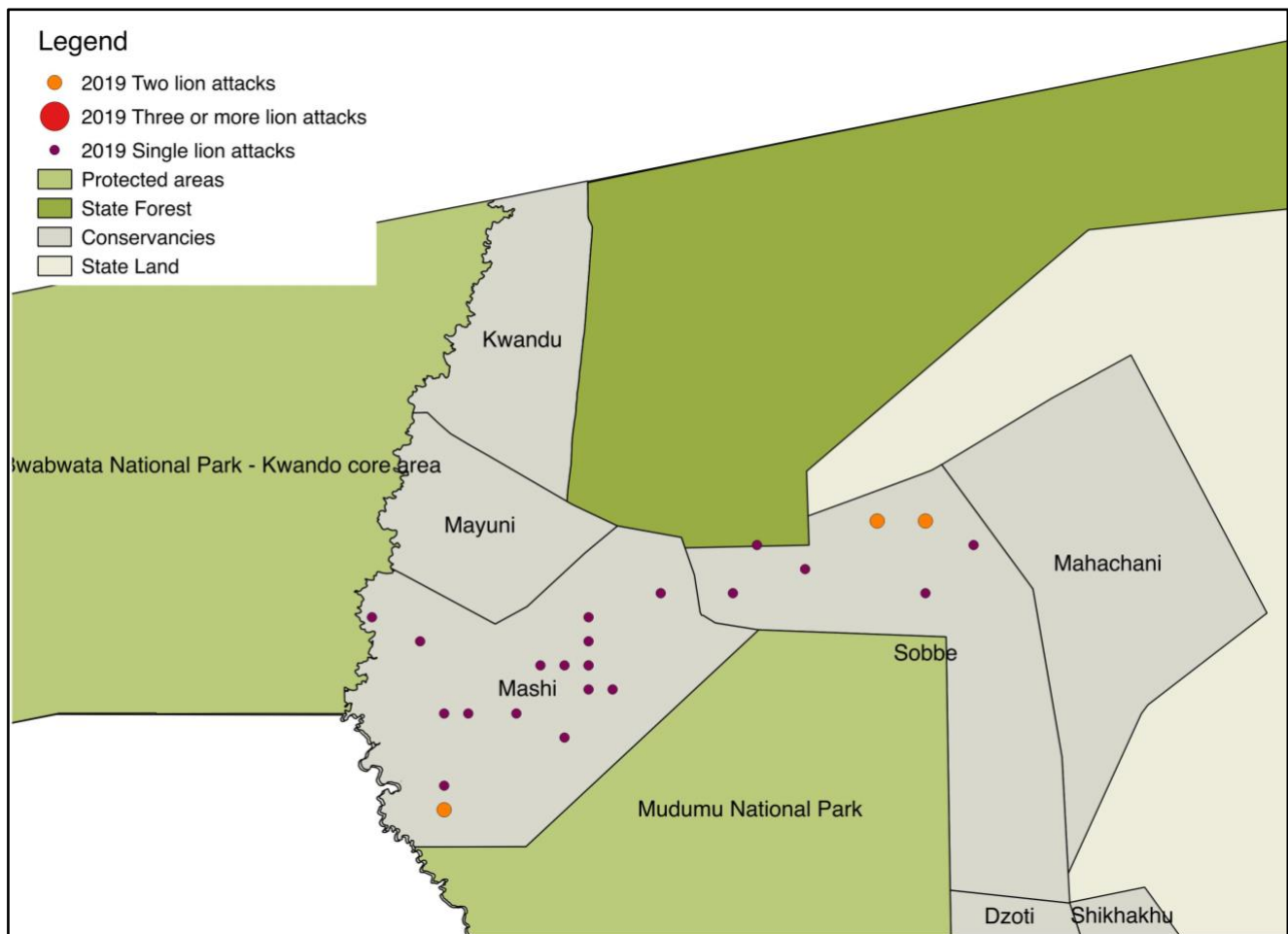


Figure 7: Lion attacks on cattle in the Mudumu North Complex during 2019



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The number of cattle killed by lions represent only 0.3% of the 10,031 cattle in the MNC (Diaz Silubanga, *pers. comm.*). However these losses were born by 26 individuals who make up 0.2% of the 9986 people residents of the MNC. The MNC covers an area of 1042 km². The numbers of cattle killed by lions per year in the Sobbe and Mashi Conservancies are presented in Table 2.

Table 2. Cattle losses to lions in Sobbe and Mashi Conservancies in the Mudumu North Complex from 2015 to 2019 (Event Book data).

Conservancy	Mashi	Sobbe	Total (%)
No of cattle killed in 2015:			
While kraaled	5	2	7 (41%)
While grazing	7	3	10 (59%)
No of cattle killed in 2016:			
While kraaled	0	1	1 (3%)
While grazing	18	10	28 (97%)
No of cattle killed in 2017:			
While kraaled	1	3	4 (30%)
While grazing	3	6	9 (70%)
No of cattle killed in 2018:			
While kraaled	1	1	2 (6%)
While grazing	3	19	22(94%)
No of cattle killed in 2019:			
While kraaled	5	2	7 (6%)
While grazing	17	8	25(94%)
Total	60	55	115

Figure 8 illustrate the shift in cattle depredation in MNC. During 2015 cattle predation that took place in traditional kraals made up almost half of all cattle predation. During 2016, nine lion-proof kraals were constructed followed by a further twenty during 2017 and 2018. This strongly suggests that lion-proof kraals



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have made an impact on lion depredation as now almost all lion attacks on cattle taking place while they are grazing without protection.

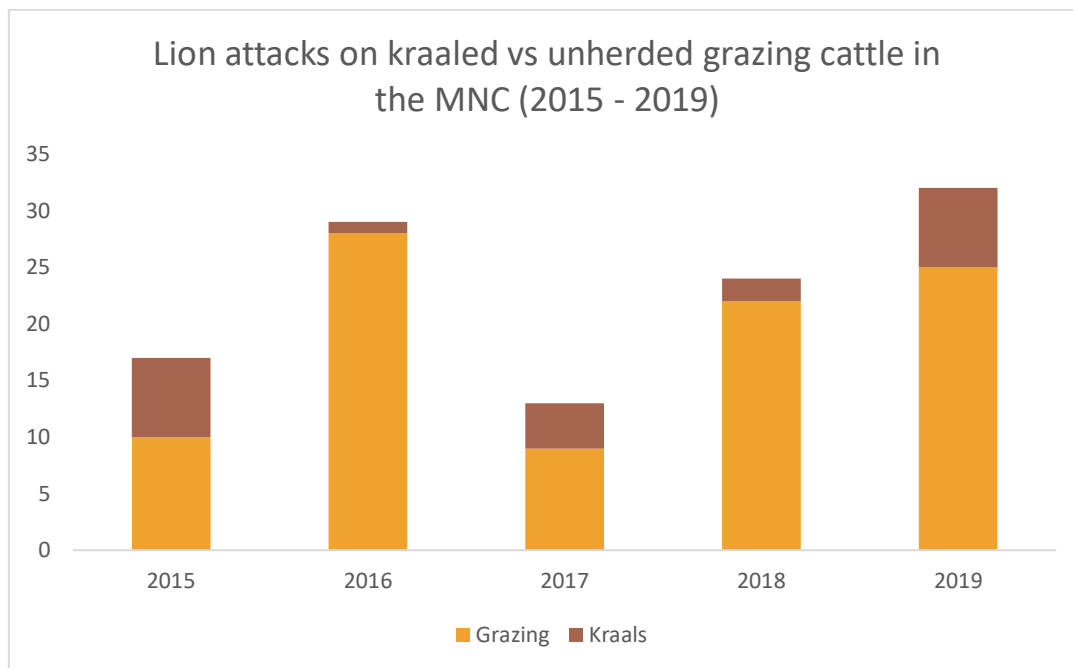


Figure 8: Lion attacks on cattle have shifted to mostly grazing cattle with cattle in traditional kraals only making up 5% of losses. Losses of livestock to lions in the MNC would be markedly reduced if cattle were kraaled at night time or even guarded by herders while out grazing.

Seasonality of conflict

Seasonality of lion attacks on cattle in the MNC is less defined (Figure 9) with dispersing and resident lions from Mudumu NP tending to kill cattle that graze in close proximity to the park throughout the year over the sampling period (Figure 10). Intense upgrading of kraals adjacent to the Sobbe Corridor alleviated a conflict hotspot that had developed there. The Sobbe and Mashi Conservancies are important for the persistence of the Mudumu lion prides that spent some of their time in uninhabited areas of these conservancies. Their increased presence in these conservancies is largely due to a number of artificial waterpoints that have been established close to the park boundary. These waterpoints are a positive contribution to wildlife in the Mudumu Landscape, but extra vigilance and mitigation are required to protect livestock from the increased presence of lions and other predators.



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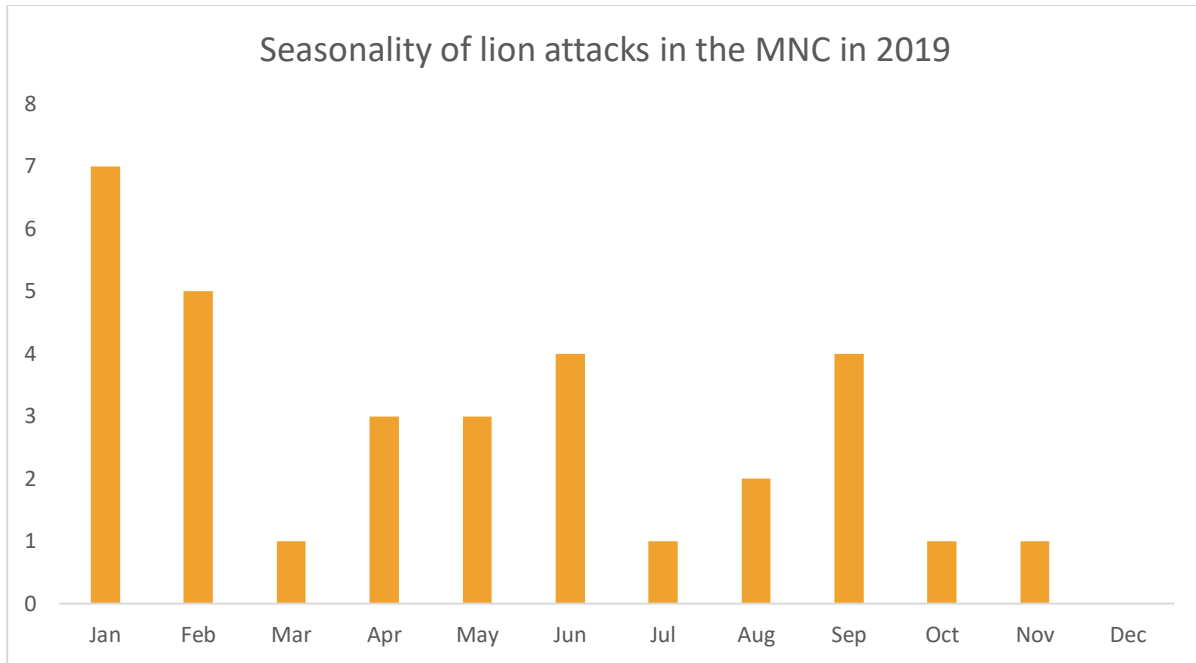


Figure 9: Attacks on livestock occur throughout the year in the MNC with only a slight peak in the height of the wet season.

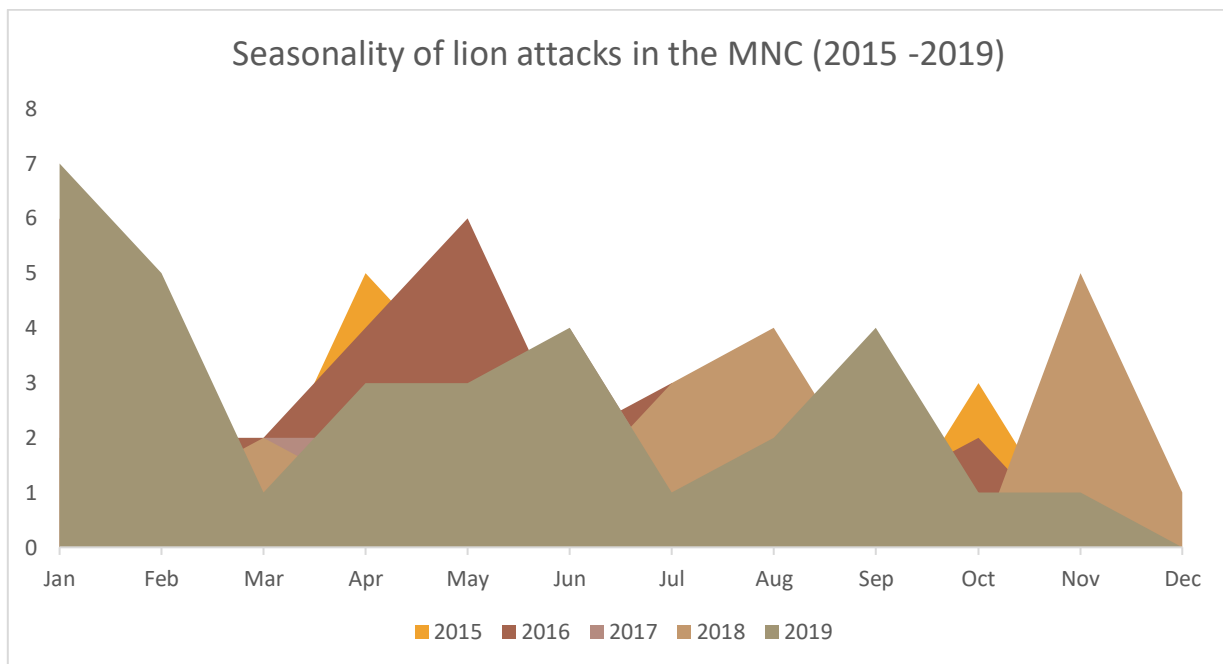


Figure 10: There is less seasonality in lion attacks on livestock in the MNC as unherded grazing livestock close to the proximity of Mudumu NP provide year round feeding opportunities to resident Mudumu lions.



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It is clear that for further improvement in livestock management and prevention of lion attacks on cattle in the Mudumu Complex landscape, conflict mitigation focus has to shift to the protection of unattended cattle and to understanding the inadequate herding of cattle. Attacks on grazing cattle now make up 95% of overall losses of livestock to lions, however, lion attacks on cattle have declined by over 80% since the inception of the project in 2014, which in turn has led to far greater tolerance of lions in general.

Of importance is that the wet and dry season patterns of cattle predation also correspond to certain agricultural practices. Farmers will need to consider the following as simple ways to mitigate a significant amount of the threat that lions pose to their livestock:

1. The sharp spike in May/June (dry season) and smaller spike in August would seem to be in response to cattle being left out at night unattended in order to graze on the remaining maize and mahango plants after the crops have been harvested during May (maize) and July (Mahango). This is done to help fatten the cattle before the winter months but is clearly a cause of much of the cattle depredation by lions. The practice is also destructive for the soil as it is left exposed to the harsh sun of the late dry season.
2. The increase in predation over October and November (hot dry season) could be in response to farmers and herders focusing their efforts on ploughing of fields in readiness for planting crops during the early wet season resulting in cattle not being attended to as regularly as they would usually be. Plough oxen are left unprotected in close proximity of fields during ploughing periods rather than herding them back to kraals every day. The late dry season is also a time where grass is minimal and cattle lose condition. Farmers leave cattle out at night in order to graze for longer periods of time.
3. Often cattle are left to roam for long periods of time unherded during the wet season to make the most of the green forage increasing their chances of encountering lions and hyaenas.
4. Cattle are left out of kraals in the late wet season when the dung build-up inside the kraals become very wet from prolonged wet conditions causing ill health in cattle.

Lion statistics from the Mudumu Complexes (2013 – 2019)

- The Lupala Pride (17 lions) that was killed during 2013 and early 2014 was replaced in early 2014 by the Mparamure Pride (8 lions in total).
- Four young adults of the Mparamure Pride dispersed during 2017 of which one (collared) is confirmed dead. Three young adult males (one collared) dispersed to Botswana and have since settled in the marshland between Namibia and Botswana.
- One adult female from the Mparamure pride disappeared followed by the two adult males. These adult males recently returned to the park seemingly from Botswana.
- The single surviving female of the Lupala pride was shot inside a kraal in February 2017. She had killed nine calves in one incident.



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- In late 2015 the small Liadura Pride (three lionesses) moved into the area seemingly from Botswana. They disappeared in 2016, but returned in October 2017 accompanied by three small cubs, along with the original adult males from the Mparamure pride.
- During 2016, three young adult male lions from the Horseshoe Pride moved north into Luengue-Luiana National Park in Angola. They move between Angola and Namibia. Two of the Angola Males have been radio-collared.
- In 2016 the Horseshoe Pride males moved south into Botswana and took over the Kwando Lagoon pride. They move between the Kwando Lagoon and the Horseshoe prides.
- The entire Horseshoe pride moved to Botswana during 2017 and were known within Botswana as the Northern Pride.
- The Horseshoe Pride successfully raised the fourth litter of cubs in 2017. The litter of two males and one female were 15 months old and living with their mother in the extreme south of Bwabwata NP adjacent to the Botswana border. This family walked south and were killed at a settlement in NG13. This incident was followed up by Botswana colleagues who found two lion carcasses.
- Fourteen Horseshoe lions have dispersed since 2010.
- Ten Mudumu lions have reached dispersal age since 2012.
- One young adult female from Mudumu was shot in Balyerwa conservancy during February 2017 in the act of killing a cow.
- Despite visible presence of lions in the conservancies no dispersal-aged lions were killed in the Mudumu Complexes during 2017, 2018 and 2019.
- The Mukwanyati males (two) who originally dispersed from the Horse Shoe Pride walked south into Botswana and were killed in NG13. This incident was followed up by Botswana colleagues who found the collar.
- In 2018 a young adult male lion successfully dispersed from the Mudumu pride and is now part of a small pride in the Okavango Delta of Botswana.
- A small lion pride with only one adult female and two cubs emerged in Mudumu NP. During December of 2018, the mother was killed by a speeding vehicle leaving the two cubs alone. The male cub was collared and they are successfully hunting and in good condition and spending most of their time within the park boundaries. On two occasions they visited a village during the night, but the collar stopped working prematurely and we lost track of them.
- A northern pride has formed in Mudumu made up of two adult females. The Mamili boys who originally dispersed from Nkasa Rupara NP have taken over this pride as well as the main Mudumu pride to the east of Mudumu NP.
- In November 2018, a female lion with four 7 month old cubs was collared in the Kwando Core Area. The Angola Boys are the fathers of the cubs.



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- In December 2018, the old Horse Shoe pride female that moved to Botswana with her sisters returned to the Kwando Core Area where she has three 15 month old cubs also fathered by the Angola Boys.
- The two sons of the Horse Shoe female dispersed to Angola in April 2020.
- A third lioness with three large cubs fathered by the Angola Boys settled in the Kwando Core Area.
- The male sons of this lioness dispersed in early 2020 towards Chetto. They travelled south into Botswana and then moved east back to the Kwando River.
- An unknown adult male lion was collared in northern Kwando Core Area in May 2020.
- There are between 15 and 20 lions in the Kwando Core Area of Bwabwata National Park.
- The Lupala Pride males took over the Nkasa pride in Nkasa Rupara NP.
- The Nkasa pride male moved to Botswana and has returned to Nkasa Rupara NP where he is currently on Lupala Island.
- In January 2019, a pride of eight lions moved into Nkasa Rupara NP from Botswana. They have taken up residence in the very south of the Island and have been called the Jackalberry Pride.

The Chobe River Floodplain

Background

The woodlands and floodplains adjacent to the Chobe River are important for the dispersal of lions to and from Chobe National Park in Botswana and for the potential colonisation of the Simalahaa area by lions in Zambia. The Chobe/east Zambezi/Simalahaa area has been identified as an important area of connectivity for lion dispersal, but the area adjacent to the Chobe floodplain and the Zambezi River are heavily settled with large herds of cattle. This has resulted in increasing levels of livestock depredation by lions from Botswana's Chobe National Park that share the floodplain with many ungulate species as well as Namibian and Botswana cattle. There are no resident lions in the Chobe conservancies of Namibia, however, lions do spend limited time on the Namibian side of the river. Conflicting land use results in retaliatory killing in Namibia of valuable tourism lions from Botswana. Lions are becoming increasingly important for tourism on the Namibian side of the river as the number of tourism lodges increase.

In the late dry season, the Chobe River near the Ngoma area (the official border post between Namibia and Botswana) sometimes dries up completely, apart from small stagnant pools, allowing easy opportunity for lions to access the whole floodplain. Herds of cattle are often left unattended on open floodplains in dry years as forage becomes scarce in woodland areas. Occasionally the cattle cross into Chobe National Park itself or lodge areas on the Botswana side making them even more vulnerable to predation by lions. Without a flowing river there is no barrier preventing Chobe lions attacking cattle in Namibia.



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Poor quality kraals in close proximity to park lions in Botswana are where 84% (n = 227 in 120 lion attacks) of lion attacks on cattle took place from 2015 to 2018. As the habitat in many areas is largely floodplain, there is little material that can be harvested for robust kraal construction so the existing cattle kraals are largely ineffective in protecting livestock. Interacting with livestock owners has provided insight into their agricultural practices, which are adapted to annual and highly variable flooding of the ecosystem. As their cattle have to be moved away during times of flood, the kraals that exist are generally of poor quality and often fall into disrepair during this time. Inadequate kraal quality, lack of herding and annually increasing human settlement and cattle numbers resulted in the high numbers of cattle killed. In retaliation, between 35 and 40 lions originating from Chobe NP were killed during the same period of time.

In deciding what to do we focused on intensive discussions with the affected communities and the participatory construction of lion-proof kraals in five conservancies. Evidence suggests that there are very specific hotspots in three of the five conservancies where conflict reoccurs annually. Focusing on upgrading as many kraals to lion-proof as possible in these hotspots first will make a significant impact on mitigating human-lion conflict in the Chobe conservancies. The key focus of our intervention since 2017 has thus been to engage with the communities along the Chobe floodplain and build forty lion-proof kraals as the first step in mitigating the human-lion conflict.

Cattle predation statistics along the Chobe floodplain

The number of cattle killed by lions along the Chobe floodplain declined from 62 cattle in 2018 to 18 cattle during 2019 despite the drought, which would usually result in higher cattle mortality to lions. This translates as an 80% decline in cattle killed by lions since 2016 when the largest cattle losses to lions occurred during the five years of data (35%, n = 81). It is unclear whether this decline in lion attacks is as a result of intervention, however, the change in lion attacks on kraaled cattle as opposed to grazing lion attacks appears to be as a result of upgrading kraals to lion-proof. Lion attacks on kraaled cattle made up 80% to 100% of cattle losses from 2015 to 2017. After the first twenty lion-proof kraals were built in 2017, attacks on kraaled cattle in 2018 made up 70% of cattle losses. During 2019, the attacks on kraaled cattle made up 28% of lion attacks with 72% of lion attacks focused on grazing cattle. This shift is likely due to intervention focusing on hotspots of conflict. For the first time in five years, Kasika and Lusese Conservancies lost no cattle to lions and Kabulabula and Nakabolelwa Conservancies lost two cattle each to lions.

An area is considered a hotspot if two or more incidents of lion depredation on cattle occur within a grid cell within one year, and are mostly related to the number of cattle in the landscape as well as herding practices where many cattle spend time in a particular conservancy to take advantage of grazing opportunities (see Figure 11). Three hotspots consistently occurred in eastern Salambala, Nakabolelwa and Kabulabula Conservancies until 2019, when only the hotspot in eastern Salambala persists (Figure 11). In Salambala

alone there are about 20,000 cattle resulting in it being one of the key conflict hotspots. Losses of grazing and kraaled cattle in the five conservancies in our focal area are presented below in Table 3.

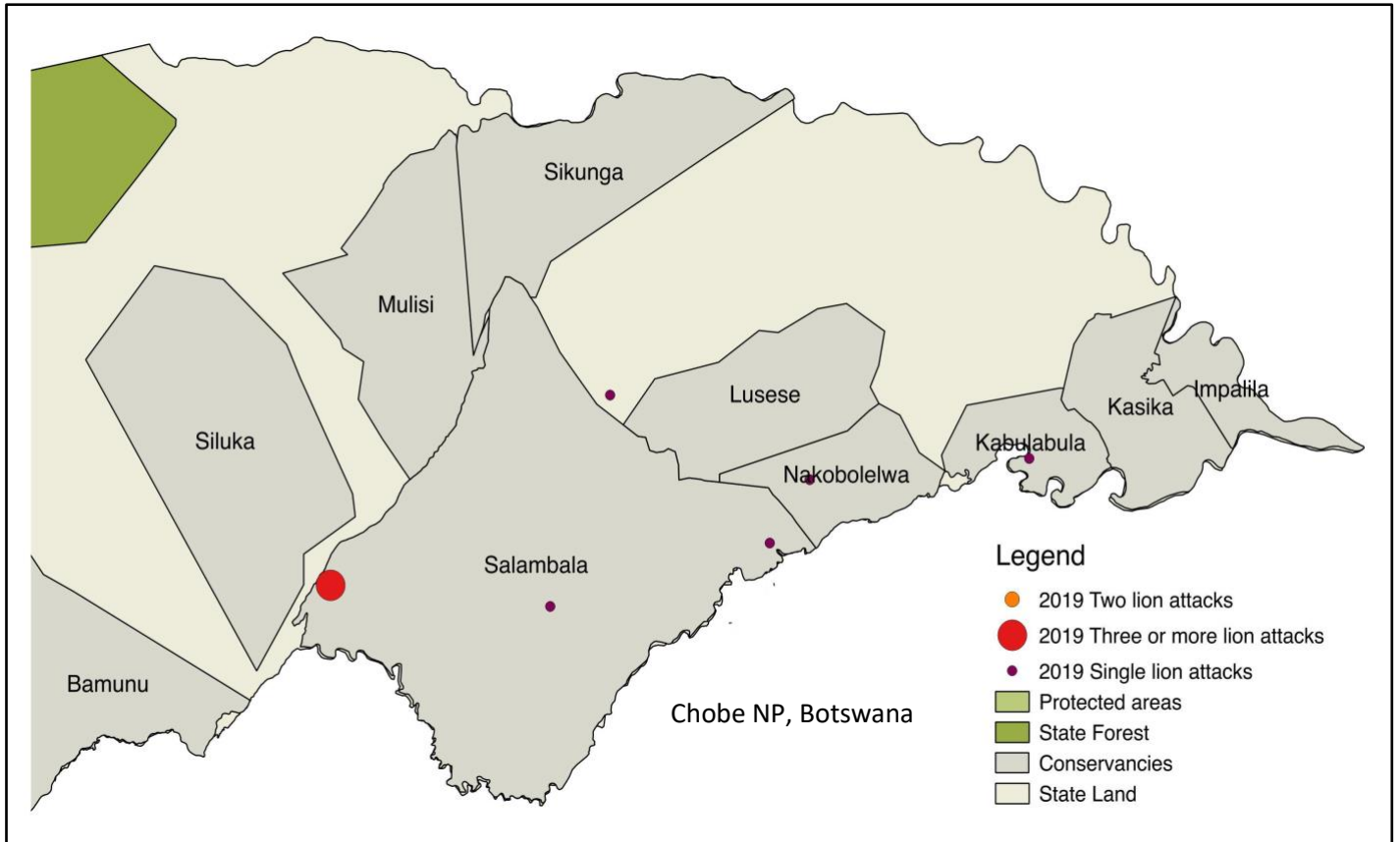


Figure 11: Lion attacks on cattle along the Chobe River floodplain during 2018. Four hotspots emerged in Kabulabula and Nakobolelwa Conservancies and on the boundary between Salambala and Nakobolelwa conservancies.

Lion group sizes range from 1 to 24 that have been involved in cattle killing. An entire pride of 13 lions was involved in one incident in Salambala Conservancy during 2019. This suggests that the landscape is shared by wildlife and cattle where grazing cattle will be taken as prey in addition to zebra and buffalo rather than habitual stock raiding lions targeting livestock. Lions and grazing cattle often encounter each other and many kraals are within line of sight of the Chobe NP in Botswana. Cattle movement, grazing and kraaling is synchronised to the flooding of the Chobe River with most lion attacks actually of kraaled cattle up until 2019 when it started to swing towards grazing cattle as the cattle kraals were steadily improving (Figure 12). The high numbers of kraal attacks suggest that conflict with lions would be mitigated over time as kraals are upgraded to lion-proof (see Figure 13), but will need to be augmented with improved herding practices going forward.



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Table 3. Cattle losses to lions in five Chobe floodplain conservancies from 2015 to 2019 (Event Book data from Kabulabula, Kasika, Lusese, Nakabolelwa and Salambala Conservancies).

Conservancy	Kabulabula	Kasika	Lusese	Nakabolelwa	Salambala	
No of cattle killed in 2015:						
While kraaled	0	0	3	14	17	34 (97%)
While grazing	0	0	0	1	0	1 (3%)
No of cattle killed in 2016:						
While kraaled	28	2	8	15	10	63 (78%)
While grazing	17	0	0	1	0	18 (22%)
No of cattle killed in 2017:						
While kraaled	4	1	4	12	28	49(100%)
While grazing	0	0	0	0	0	0 (0%)
No of cattle killed in 2018:						
While kraaled	0	0	0	45	0	45 (73%)
While grazing	1	4	5	7	0	17 (27%)
No of cattle killed in 2019:						
While kraaled	2	0	0	0	3	5 (28%)
While grazing	0	0	0	2	11	13 (72%)
Total	52	7	20	97	69	245

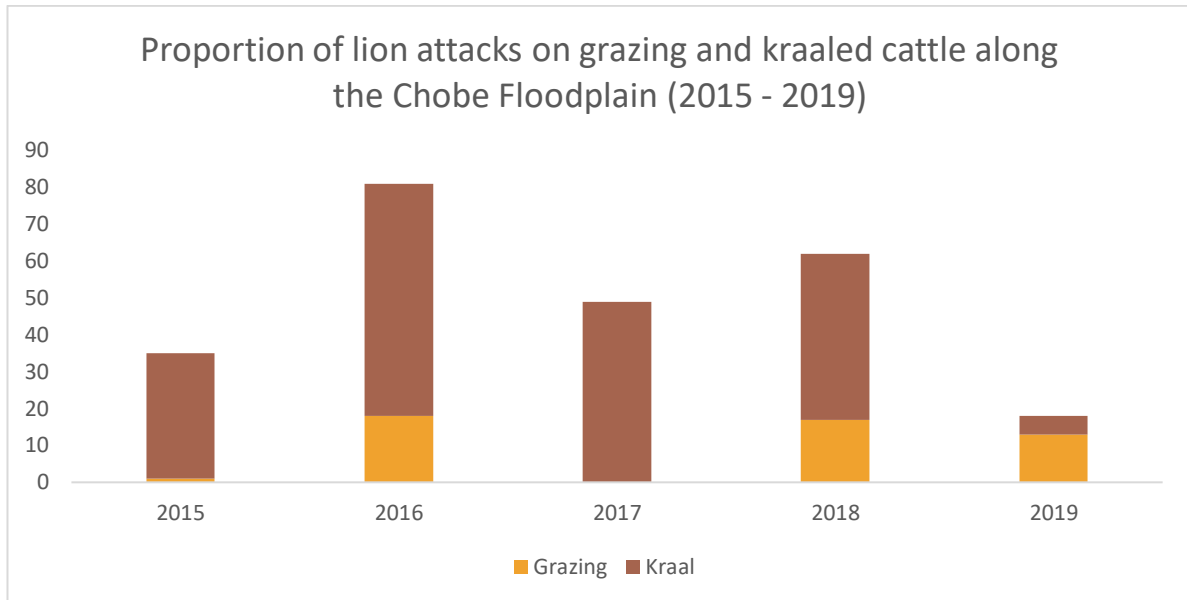


Figure 12: Numbers of cattle killed by lions while grazing compared to those killed in traditional kraals in the Chobe Floodplain conservancies from 2015 to 2019.



Figure 13: Cattle kraals are often temporary structures due to the changing environmental conditions such as flooding when cattle have to be moved to high ground.



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Although Kasika Conservancy had only one incident of lion attack in 2018 where 4 cattle were killed, seven lions were killed over two days in retaliation and four lions were killed in retaliation for the loss of one cow in Kabulabula Conservancy during January 2020. These incidents require further investigation in order to establish whether retaliation for losses of livestock is the primary driver for the killing of lions. Cattle losses to lions represents only 0.05% of the 40,000 head of cattle (Diaz Silubanga, 2018) in the five conservancies of our focus area along the Chobe. These losses were borne by 9 families of the 12,728 people that resident in these conservancies. The area where these lion attacks take place falls over 1487 km².

The monetary value of the cattle killed by lions during 2019 was approximately N\$100,000 but it is not possible to quantify the anger and vulnerability felt by communities along the Chobe River. The loss of even one pride of lions translates into hundreds of thousands of dollars to the wildlife-based tourism enterprises in the Chobe National Park of Botswana. These opposing perspectives are clearly divisive and a source of resentment between the respective parties. It is vital that lion conservation at a trans-boundary, landscape level is adopted that is inclusive of everyone's needs if Chobe lions are to survive as a viable tourism and ecological entity in the immediate area along the Chobe River.

Seasonality of lion attacks on cattle

Lion depredation on cattle is strongly seasonal with a clear peak in January/February just before the Chobe River floods in March. Lion attacks increase again once the river subsides in July (Figure 13). The period from March to July when almost no cattle are killed corresponds with the flood levels of the Chobe River. The flooded Chobe River creates a barrier to opportunistic cattle depredation by lions from Botswana. Zebra and buffalo are important prey species for lions and graze on the floodplain from July to November disperse with the onset of the rains.

Conflict declines dramatically from March until June when the Chobe River is in peak flood. This suggests that the river creates a barrier to prides of lions from the Chobe NP who would usually spend time on the floodplain and would opportunistically kill cattle. Lion attacks increase as soon as the river level subsides in July. There is a sharp spike in November which is likely due to sudden prey dispersal with the onset of the rains. During 2019, the Chobe River did not flood due to poor rains resulting in lion attacks throughout the flooding season.



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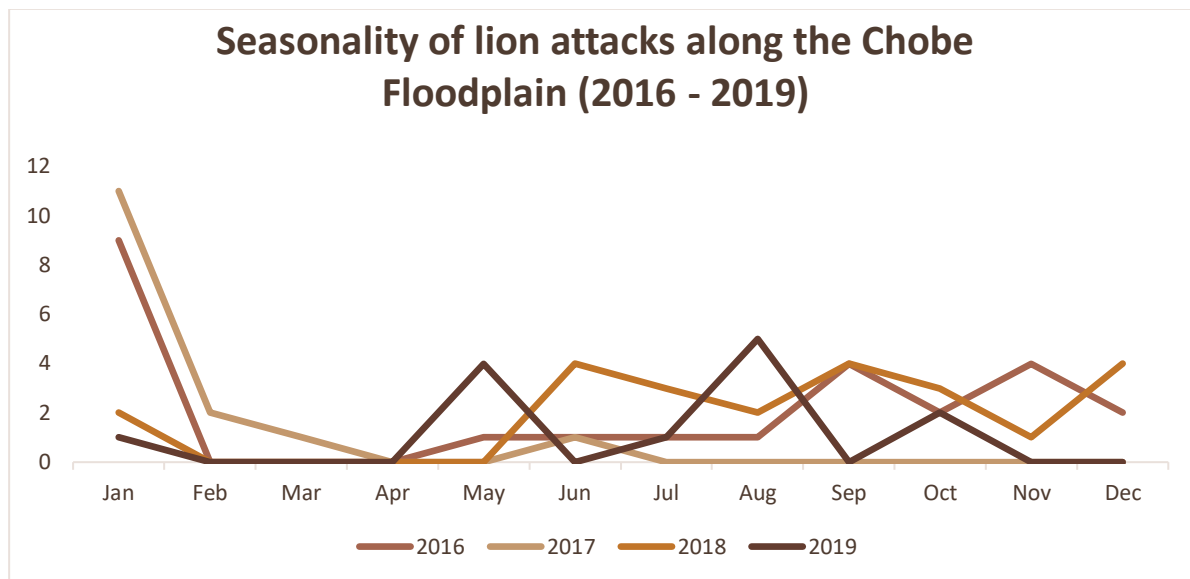


Figure 13. Lion attacks on cattle along the Chobe River floodplain from 2016 to 2019.

Next steps for 2020 - 2021

1. Build additional lion-proof kraals in conflict hotspots along the Chobe Floodplain and in the Mudumu Landscape.
2. Assess the need for human-lion conflict mitigation in the Kavango East and northern Otjozondjupa Regions as lions are unable to recover in western Bwabwata and Khaudum NPs.
3. Collaborate across the Khaudum/Ngamiland transboundary landscape with Botswana in potentially upgrading cattle kraals to lion-proof.
4. Work with Chobe Floodplain conservancies, IRDNC and WWF in Namibia to pilot “Lion Guards” to protect cattle and chase lions back to Chobe NP.
5. Collaborate with IRDNC and NNF in rangeland management and conservation agriculture in the Mudumu Landscape where practices protect cattle from lions.



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Conservation Partners in this project (in alphabetical order)

- Conservancies: Balyerwa, Bamunu, Dzoti, Kasika, Kwandu, Lusese, Kabulabula, Mashi, Mayuni, Nakabolelwa, Salambala, Sobbeb and Wuparo.
- Integrated Rural Development and Nature Conservation (IRDNC)
- KAZA Carnivore Coalition
- Ministry of Environment, Forestry and Tourism: Directorate of Parks and Wildlife/ Regional Services; Directorate of Scientific Services; Directorate of Wildlife Protection Services.
- Namibia Association of Conservancy Support Organisations
- Namibia Chamber of Environment
- Namibia Nature Foundation
- National Geographic: Big Cat Initiative (BCI)
- Oak Foundation
- Panthera
- Predator Conservation Trust in the UK
- Tosco Trust
- Wildlife Conservation Network's Lion Recovery Fund
- WWF Germany
- WWF in Namibia

References

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