Mara Cheetah Project

Kenya Wildlife Trust

2016

Progress Report

KENYA WILDLIFE TRUST

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Foreword

Message from our Ambassadors:

It was not so long ago that people talked about only 12,000 to 15,000 cheetahs remaining in the wilds of Africa. Certainly reason for concern. Yet today it is estimated that there may be as few as 7,000 cheetahs. It is always wise to be cautious about numbers and population sizes unless you have reliable data. Estimating numbers of far ranging creatures such as cheetahs or predators that rely on concealment such as leopards is particularly testing. What we can be sure of is that cheetah numbers are declining across most of their traditional range and that their natural habitat is shrinking by the day. The human population and its livestock now cover most of the habitable regions of our planet leaving little room for wild animals, particularly large predators that traditionally are seen as a threat to man and his livestock. Seen from outer space man's social conquest of the earth is all too visible. Gone are many of our priceless wild places and with them the glory of their charismatic fauna and flora. The cheetah is an iconic species with a special place in human history. Once domesticated as the hunting companion of Mughal Emperors across the Indian sub-continent, the spotted sphinx is the least aggressive and most tractable large carnivore, a hunter of breathtaking speed and the fastest land mammal on earth. The cheetah has survived concerns raised by scientist in the 1980s over its impoverished genetic diversity - cheetahs were found to be as inbred as siblings due to bottlenecks tens of thousands of years ago - and more recently due to persecution by man when cheetahs were viewed as vermin or a source of spotted skin coats for the fashion industry. So it is a cruel irony that man should once again be the cause of this extraordinary big cats demise due to the illegal trade in cheetah cubs to quench the appetite for exotic pets and status symbols in the Middle East. It is believed that 50-70% of cheetah cubs smuggled out of East Africa die in transit. The trade must stop.

There was a time when administrators of Africa's national parks and game reserves felt that scientific studies conducted in protected areas yielded little benefit to management, that it was science for science's sake. So we are proud to know that the work of the Kenya Wildlife Trust's Mara Cheetah Project is fulfilling its mandate in providing invaluable information on the Mara's cheetah population that will help the administration and local communities to make wise decisions on how best to protect these most charismatic of species. Healthy big cat populations are the heartbeat of Kenya's wildlife based tourism industry. They are the economic engine that helps to give local communities a rationale for preserving wildlife and natural habitats.

Jonathan and Angela Scott:
The Big Cat People and the Kenya Wildlife Trust Ambassadors

Executive summary

The Kenya Wildlife Trust started up the Mara Cheetah Project amidst fears that the cheetahs in the Maasai Mara were disappearing. This is not an irrational concern especially in light of recent estimates that there are less than 7,100 cheetahs left in the world and that this population is now confined to only to 9% of their historic range. In all this, the Maasai Mara is still considered to be part of one the most important cheetah populations not just in East Africa, but in the world and even this population is not without its threats.

The two biggest threats facing cheetahs are interconnected; habitat loss and human-wildlife conflict, both of which are of increasing concern in Kenya's Maasai Mara, where the human population is growing at an exponential rate of 8% per annum. Since cheetahs require extensive habitats in which to roam they are particularly sensitive to human disturbance. The ecosystem is rapidly evolving and, with its multitude of stakeholders and management practices, providing robust information and integrating this into management practices is key to ensuring a stable and healthy cheetah population.

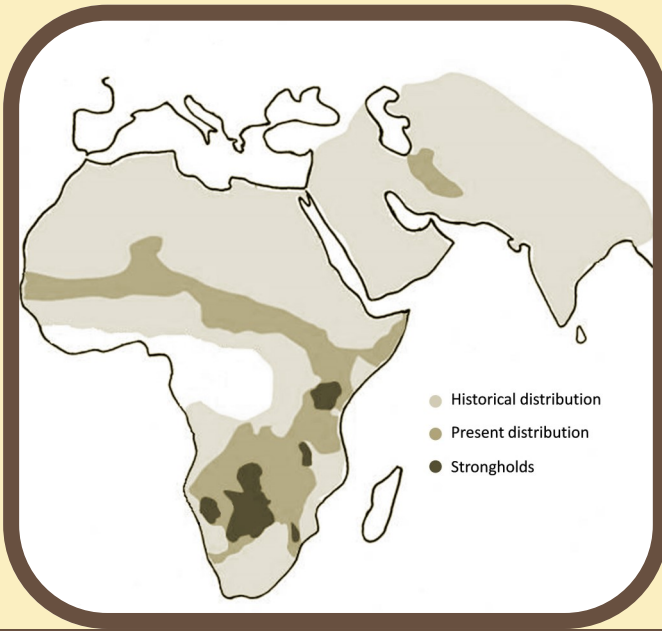
There are roughly 7,100 cheetahs left in the world

The current population is confined to only 9% of their historic range

77% of their current range lies outside formally protected areas.

Now that the project has been in existence for almost three and a half years we have entered an exciting period where we have some good data that is useful for conservation planning. This report therefore not only highlights some of our key achievements in 2016 but it also serves to give the stakeholders outputs and recommendations based on the data we have collected so far so that these can be integrated into management practices to ensure the long-term viability of cheetahs in the Maasai Mara. This provision of information is integral to our applied research and conservation approach and as such, we were honoured to be invited to County Government Spatial Planning meeting. This is an important step as habitat loss and fragmentation is one of the biggest threats that cheetahs face in the modern world.

This year we have also continued our engagement with local communities and landowners in the Mara through various events and meetings and through our outreach programmes such as our Wildlife Clubs. Engaging communities in conservation strategies is important especially as cheetahs often reside outside formally protected areas.



All in all it has been a productive year for the project and we are looking forward to 2017.

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Project overview

Background

In light of a plummeting global cheetah population (over 90% in the last century), the Mara Cheetah Project was established by the Kenya Wildlife Trust in June 2013 to secure one of the species' last remaining strongholds. The Mara Cheetah Project is the first long-term cheetah conservation research project in the Mara and its long-term goal is to ensure that the cheetah population in the Maasai Mara is stable and healthy. To achieve this, the Mara Cheetah Project is using a research-driven conservation approach through a combination of long-term population monitoring, ecological research, community-based conservation and stakeholder engagement.

Aims and objectives

1. Develop and implement robust population monitoring
2. Quantify threats to cheetahs
3. Provide information for evidence-based policy and management decisions
4. Engage with the local community to improve tolerance of cheetahs

Approach

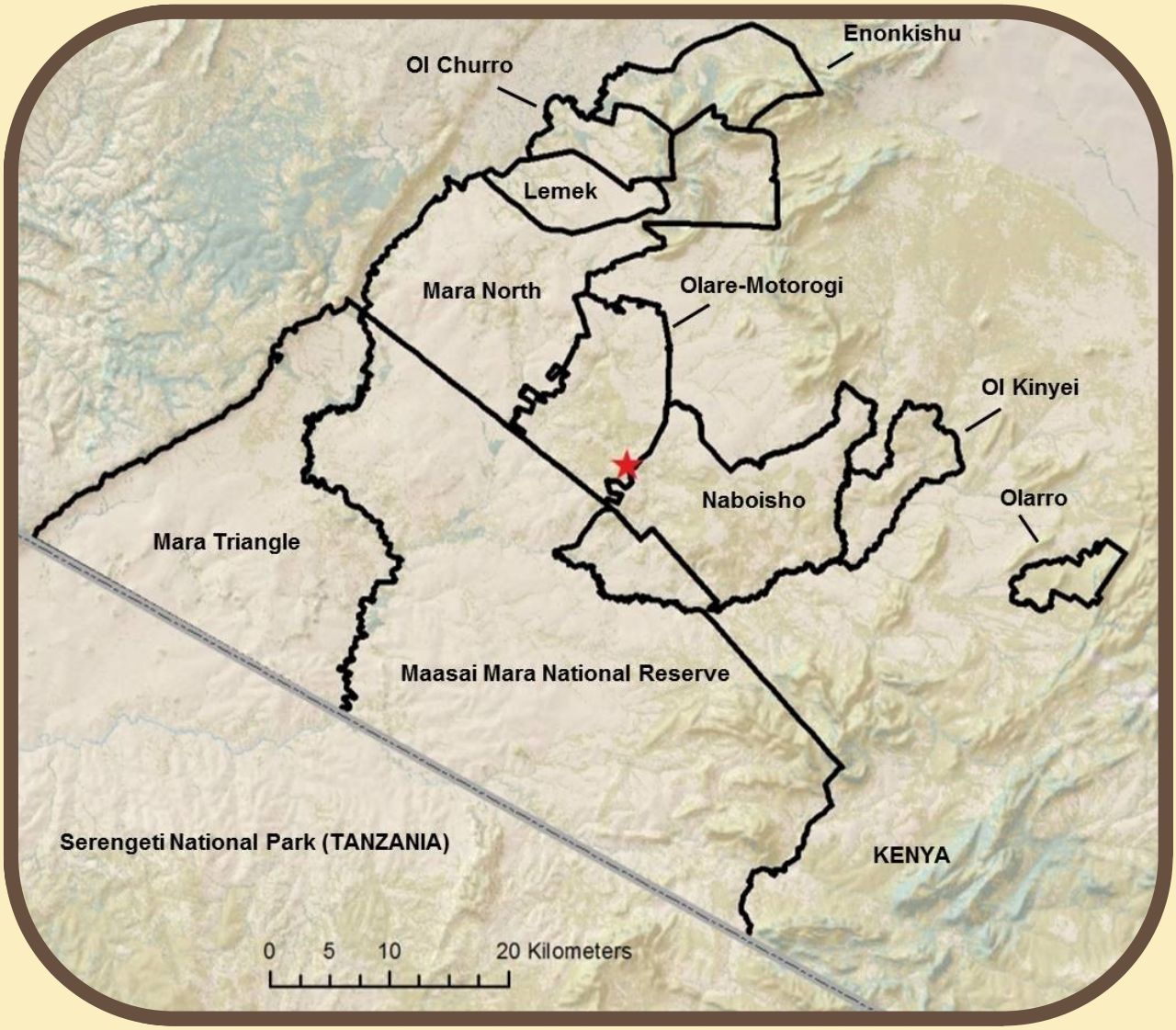
To provide key stakeholders with sound scientific recommendations that they consistently use to inform conservation strategies, and to work with community members and land owners to increase understanding and appreciation of the role of predators in the ecosystem.

Our Mission:

To enable viable predator populations within the Greater Mara Ecosystem

Where we work

The Mara Cheetah Project is based in the Maasai Mara landscape in the South-west of Kenya. The study area covers approximately 2525 km² which includes the Maasai Mara National Reserve (MMNR), which falls under the authority of the Narok County Government, and the adjacent conservancies; Mara Triangle, Mara North, Ol Chorro, Lemek, Olare-Motorogi, Naboisho and Ol Kinyei which are privately managed. To the south, the Maasai Mara borders Serengeti National Park in Tanzania, to the north and west it borders intensive agricultural land and east of the Maasai Mara is largely pastoralist settlement. The project's Community Team works with the communities around the Mara thereby almost doubling the area that the project covers.



The study area experiences a bimodal rainfall pattern, with the wet season spanning November–June and the dry season July–October. The wet season is characterised by two distinct periods; the short rains (November–December) and the long rains (March-June). The long rains attract the migrating wildebeest, zebra and Thomson's gazelle from the Serengeti. Generally the migration reaches the Northern Serengeti in July, and then spends August, September and October in the Maasai Mara before returning to Tanzania in November. Independent of the migration, substantial populations of Thomson's gazelle - cheetahs preferred prey in East Africa - are resident year round

Meet the Team

Dr. Femke Broekhuis - Project Director

Femke is the Project Director and Principle Investigator of the Mara Cheetah Project. Femke's career with cheetahs began in 2007 as part of her Masters dissertation, investigating cheetah habitat selection in the Serengeti National Park, Tanzania. From there she joined the Botswana Predator Conservation Trust (BPCT) to set up a cheetah project and begin her D.Phil research with the Wildlife Conservation Research Unit (WildCRU) at the University of Oxford. She spent four years studying cheetahs in the Okavango Delta, Botswana, investigating whether the spatio-temporal behaviour of lions and spotted hyaena influenced that of cheetahs. In June 2013 she was entrusted by the Kenya Wildlife Trust (KWT) to start up the Mara Cheetah Project.

Mr. David Thuo - Senior Research Assistant

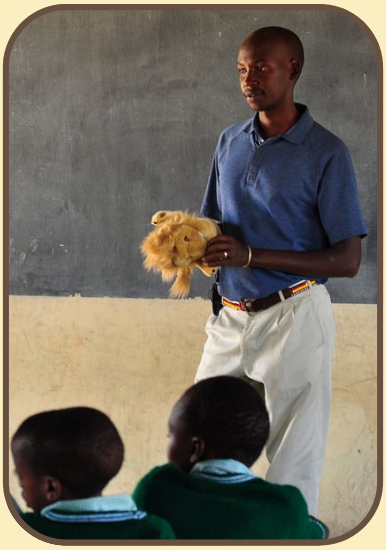
David Thuo is a Kenyan-born and based wildlife biologist. He has a B.Sc. in Wildlife Science and a M.Sc. in Animal Genetics from the University of Nairobi. His thesis, which focused on the genetic variation and population viability of Black Rhino's in Lake Nakuru National Park, has resulted in scientific publications in internationally peer-reviewed journals. He previously worked as a Research Fellow at the National Museums of Kenya's Molecular Genetics Laboratory, where he was involved in many of the routine molecular and immunological techniques. In 2017 David plans to start his PhD in genetics with Canberra University in Australia.

Mr. Symon Ole Ranah - Research Assistant

Symon was born and raised in Laikipia County, Mukogodo area. He has a Diploma in Natural Resource Management and a B.Sc. in Environmental Conservation and Natural Resources Management, both from the University of Nairobi. Before working as a senior guide at Ol-lentille Sanctuary, Symon worked for four years as a research assistant on the wild dog project in Laikipia. Symon joined the Mara Cheetah Project at the beginning of 2016 before leaving to return to Laikipia in April due to family commitments.

Mr. Michael Kaelo - Chief Community Officer

Michael was born and raised in Enkobiletai in the Maasai Mara where he grew up seeing wildlife as he grazed shoats and cattle. In 2005 Michael joined Kenyatta University for a B.Sc. in Environmental Studies and Community Development and in January 2012 Michael started his M.A. in Environmental Planning and Management at the University of Nairobi. In September 2014 Michael joined the Mara Cheetah Project and the Mara Lion Project as the Chief Community Officer. His interests are geared towards enhancing coexistence between communities, their livestock and wildlife .



Mr. Dominic Sakat - Community Liaison Officer

Dominic is the Community Liaison Officer for both the Mara Cheetah Project and the Mara Lion Project and works in the surrounding communities in an effort to reduce human-wildlife conflict. In 2007 he enrolled in the Koiyaki Guiding School, where he achieved his bronze KSPGA guiding certificate. Dominic is from the Koiyaki region of the Mara and has a keen interest in conservation. Dominic Sakat has been with the project since the beginning and he is in charge of the project's Wildlife Clubs.

Holistic Assessors

This year we employed five people from the community as the project's holistic assessors (HAs). The role of the HAs is to create awareness on improved livestock husbandry (herding and boma structure), to collect human-wildlife conflict reports and to map and monitor environmental and anthropogenic variables. In the photo from left to right: Sylvester Kipeen (HA), Dominic Sakat (Community Liaison Officer), James Saago (HA), Francis Kumum (HA), Daniel Korio (HA), James Sairowua (HA), Michael Kaelo (Chief Community Officer), Kelvin Koinet (Mara Lion Project Research Assistant).

Mr. Julius Makibior - Mechanic

Julius was born in Kakimirai, Bomet County. He is a trained automotive technician with over 20 years of experience in vehicle maintenance. He has previously worked at Transworld Safaris and Sun Africa Hotels as a workshop supervisor and head mechanic. Julius is in charge of all the project vehicles and the maintenance of the Tony Lapham Predator Hub. He is an important member of the project as he ensures that the vehicles are in tiptop condition so that the project is able to conduct its community and field work.

Mr. Billy Kaitet - Caretaker and chef

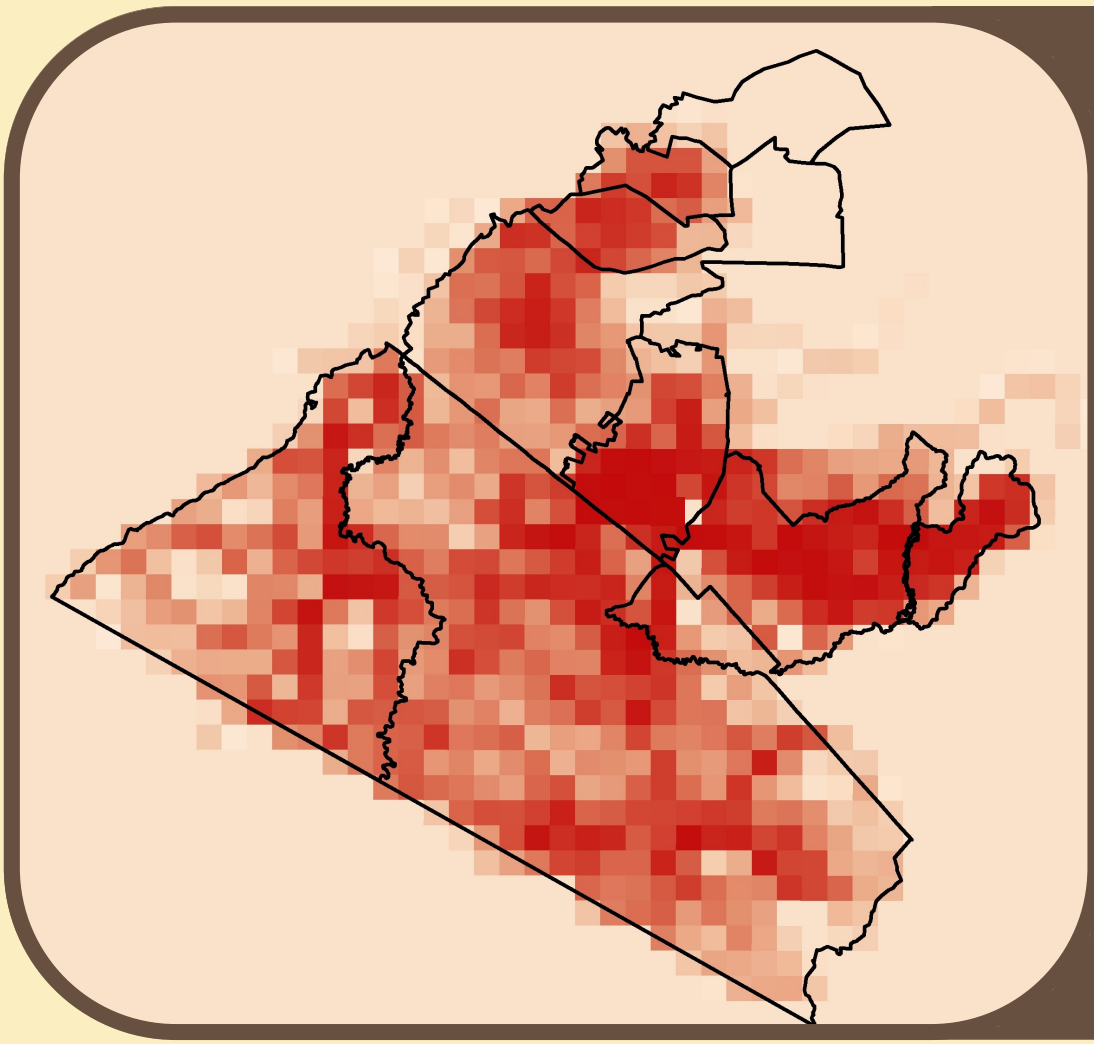
Billy was born and brought up in Naroosura in Narok County. He attended Kanunga Primary school and then Naroosura Secondary school. He trained as a room steward, laundry service and maintenance person at Crocodile Camp, Maasai Mara, where he worked from 2013 to 2015. Billy joined the project in April 2016 as a chef and caretaker. He also helps Julius in the day to day activities at Tony Lapham Predator Hub.

Research

Methods

The Mara Cheetah Project team is based in the Maasai Mara so that we can intensively monitor the cheetahs population throughout the year. We go out on a daily basis in search of cheetahs and we are often helped by reports from guides and camp managers. Whenever we sight a cheetah we take photos for identification (see page 9) and collect information on their location structure of their social groups, kills made and behaviour. With these data we can establish births and survivorship, identify important resources for cheetahs such as habitat and prey and determine their densities and distribution which helps us identify the threats that cheetahs face.

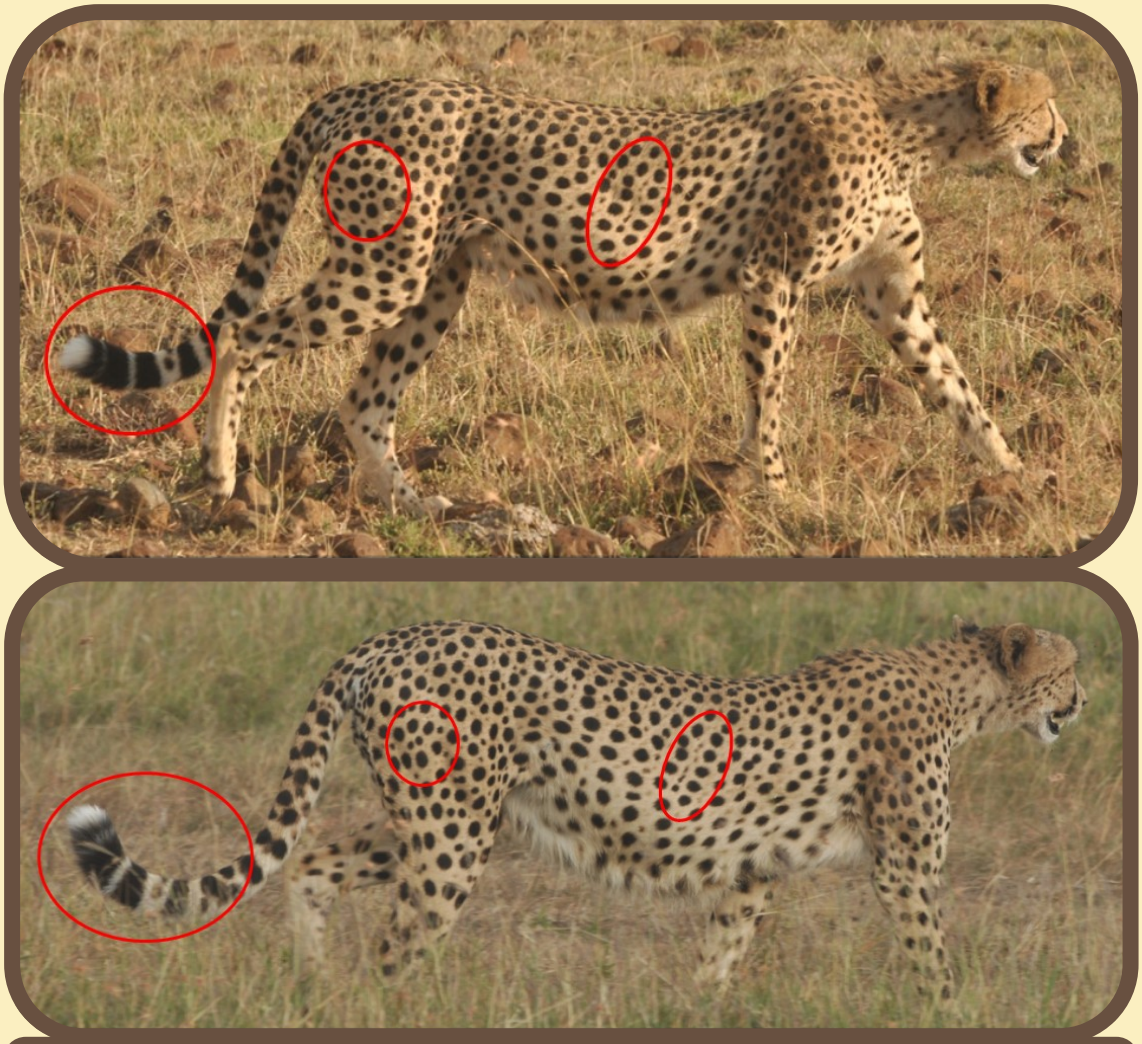
We work closely with the Mara Lion Project and all data, including sightings of other predators, livestock and vehicles are recorded using an in-house application built in Cybertracker. The application records our tracks which means that sightings can be weighted against the amount of distance or time that has been spent in an area (effort) thereby removing any bias related to effort. This allows us to calculate the abundance and distribution of these different variable which can then be used to investigate which variables have an impact on cheetah abundance and distribution.



This year we spent 2380 hours in the field and drove 27, 588 km in search of cheetahs and other predators. The darker the grid cell the more time that was spent there.

Cheetah sightings

Each cheetah has a unique spot pattern, similar to the human fingerprint. We use these spot patterns to identify each and every individual that we see. Below is an example of two separate sightings of the same cheetah and an illustration of the unique combinations of spots that could be used for identification.



Each cheetah has a unique spot pattern, similar to the human fingerprint, that we use for identification

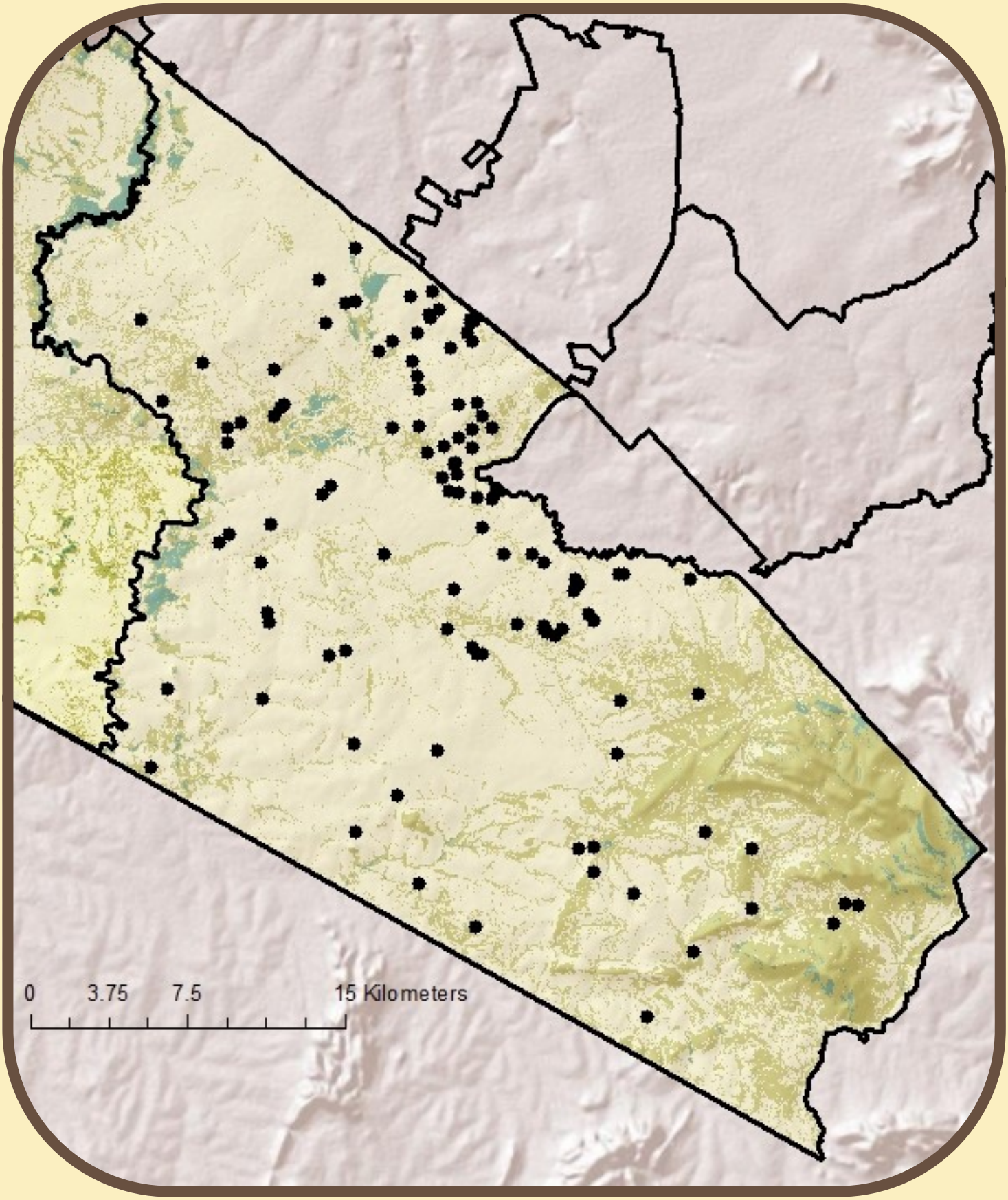
In 2016, we saw 54 different adult cheetahs (30 males and 24 females) based on 244 of our own sightings and an additional 59 sightings through various 'citizen scientists' who sent emails, uploaded sightings on our online sightings form, submitted sightings using our Spot-A-Cat Android app and through our 'Cameras for Conservation' initiative (please refer to the 2014 Annual Report for more information on our citizen science projects). This also includes individuals who we only saw once and cubs that reached adulthood and left their mothers.

The next few pages summarise the number of different adult cheetahs that were seen in the different parts of the study area over the past year. It is important to note that the cheetahs range freely across the Maasai Mara landscape and therefore some individuals were seen in several different areas.

Maasai Mara National Reserve

Sex	Cheetah name(s)	Notes	Other areas* seen in 2016
Female	Amani	Mother of Imani and Hodari, currently has 2 cubs	MNC and OMC
	Imani	Daughter of Amani	OMC
	Kisiri	Often seen in the Southern part of MMNR	
	Malaika	Mother of Bawa, Malikia and Malik	OMC
	Malkia	Daughter of Malaika who dispersed in 2016	
	Maridadi	A new individual first seen in the Sopa area	
	Miyale	Female often seen along Ol Keju Rongai	
	Musiara	Raised 3 cubs to independence at the end of 2016	MNC and OMC
	Nolari	Daughter of Narasha, Raised 1 cub in 2016	OMC
	Roza	Female often seen around Keekorok	
	Roza's daughter	Daughter of Roza who was seen pregnant in October 2016	
	Sand River female	A new individual first seen along the Sand River	
Male	Bawa	Son of Malaika. He left his mother in 2013	
	Hodari	Amani's son and Imani's brother	OMC and NAB
	Leomom	A young individual who we suspect has come from the Serengeti National Park, Tanzania	MT, OMC and NAB
	Malik	Son of Malaika who dispersed in 2016	LEM, MNC and OMC
	Miyale's sons	Miyale's two sons dispersed in June 2016	
	Oloolulo male	Used to be part of a two-male coalition until his coalition mate died in 2015	OMC
	Saitoti	Single male	
	Balloon crossing male	A new male first seen near balloon crossing before joining the 5 musketeers	OMC and NAB
	Sopa males	A two-male coalition, unlikely to be related	

* MNC = Mara North Conservancy, OMC = Olare-Motorogi Conservancy, NAB = Naboisho Conservancy, MT = Mara Triangle, LEM = Lemek Conservancy

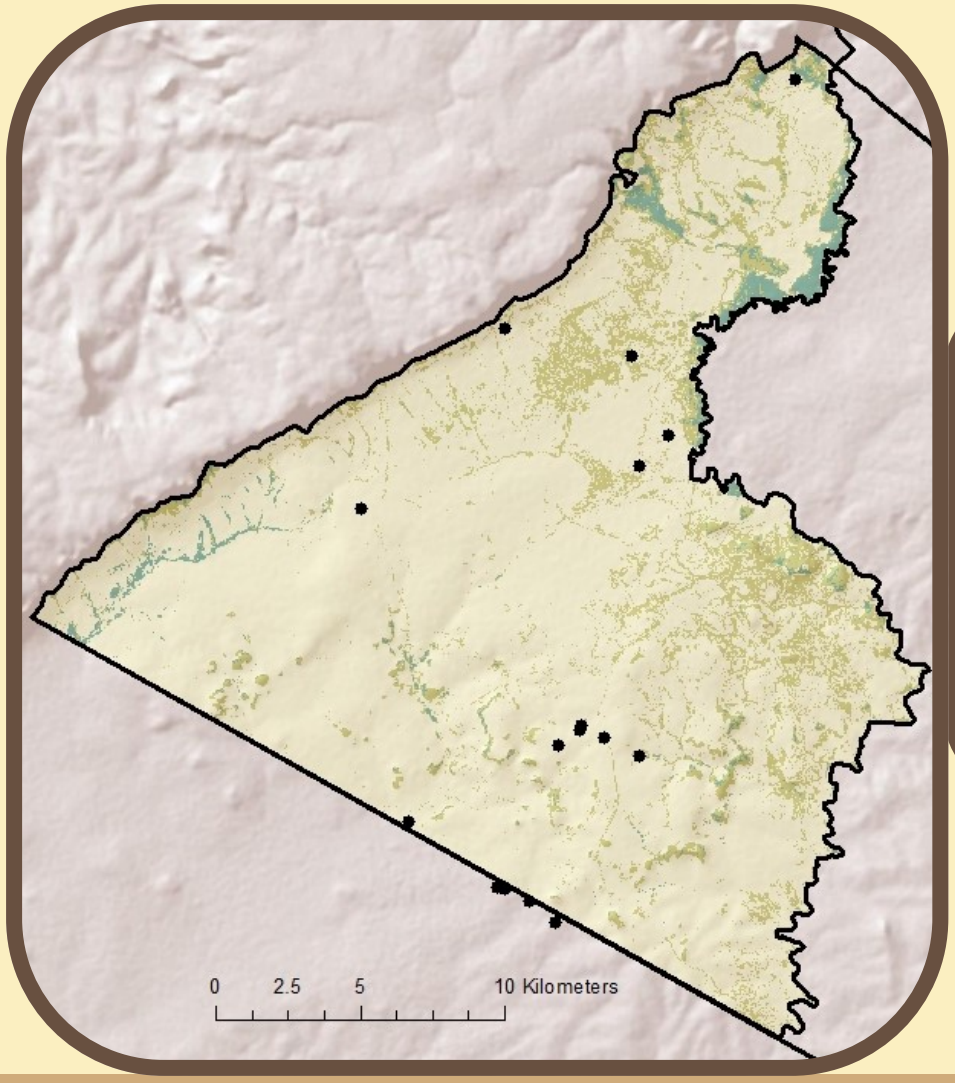


A total of 23 different adult cheetahs were seen in the Maasai Mara National Reserve in 2016

Mara Triangle

Sex	Cheetah name(s)	Notes	Other areas* seen in 2016
Female	Kakenya	Female that roams across the Triangle. She raised 4 cubs to independence in 2016	SNP
	Kakenya's daughter 1	Daughter of Kakenya	-
	Kakenya's daughter 2	Daughter of Kakenya	-
Male	Leomom	A young individual who we suspect has come from the Serengeti National Park, Tanzania	MMNR, OMC and NAB
	Triangle males	Brothers of Nabiki. Born in Naboisho Conservancy and are now often seen along the Kenya-Tanzania border	SNP
	Serena male	A new male seen along the Mara River	-
	Lemai males	A three-male coalition seen along the Kenya-Tanzania border	SNP

* SNP = Serengeti National Park (Tanzania), MMNR = Maasai Mara National Reserve, OMC = Olare-Motorogi Conservancy, NAB = Naboisho Conservancy

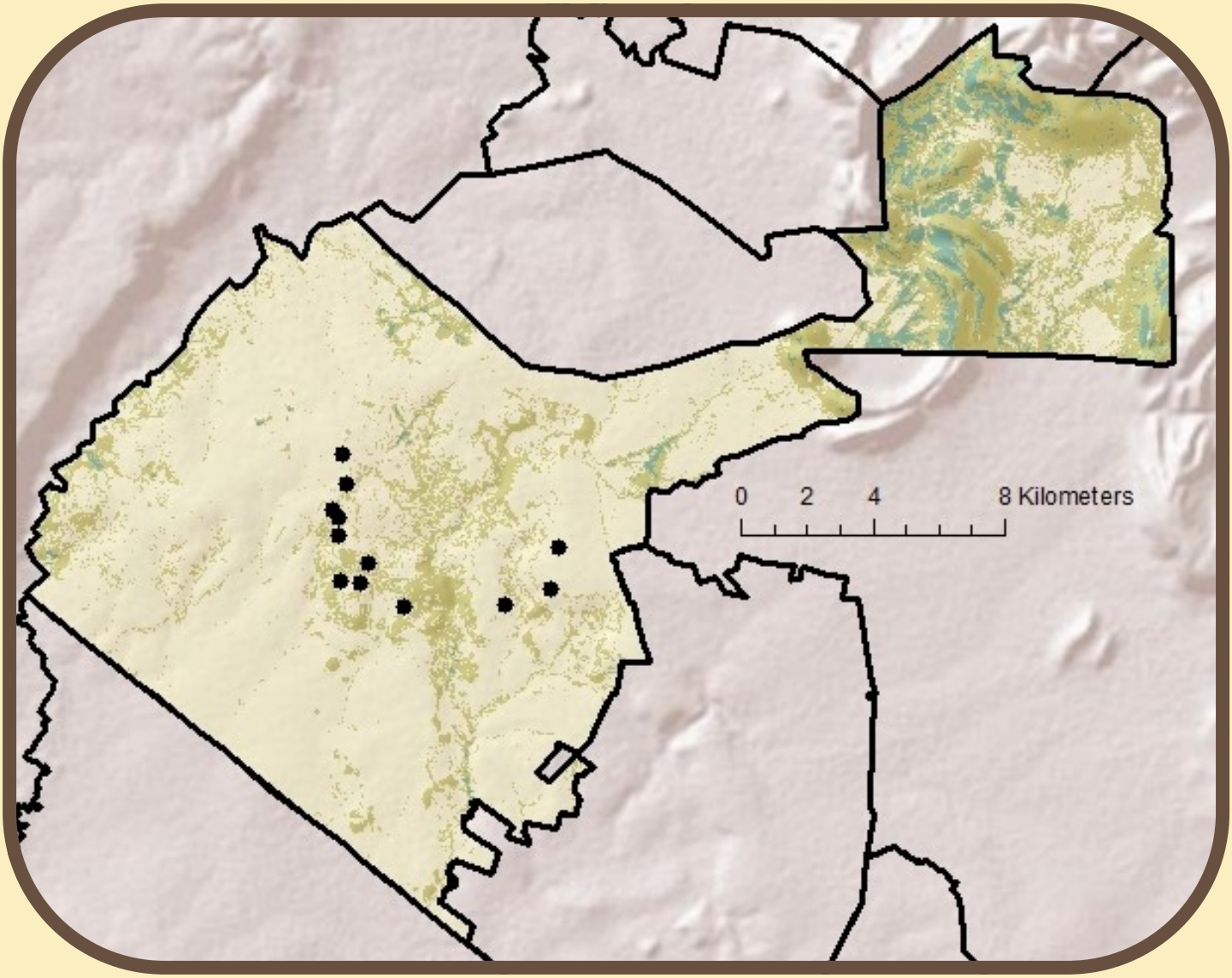


A total of 10 different adult cheetahs were seen in the Mara Triangle in 2016

Mara North Conservancy

Sex	Cheetah name(s)	Notes	Other areas* seen in 2016
Female	Amani	Mother of Imani and Hodari, currently has 2 cubs	MMNR and OMC
	Musiara	Raised 3 cubs to independence at the end of 2016	MMNR and OMC
Male	Leomom	A young individual who we suspect has come from the Serengeti National Park, Tanzania	MMNR, MT, OMC and NAB
	Malik	Son of Malaika who dispersed in 2016	MMNR, OMC and LEM

* MMNR = Maasai Mara National Reserve, OMC = Olare-Motorogi Conservancy, NAB = Naboisho Conservancy, MT = Mara Triangle, LEM = Lemek Conservancy



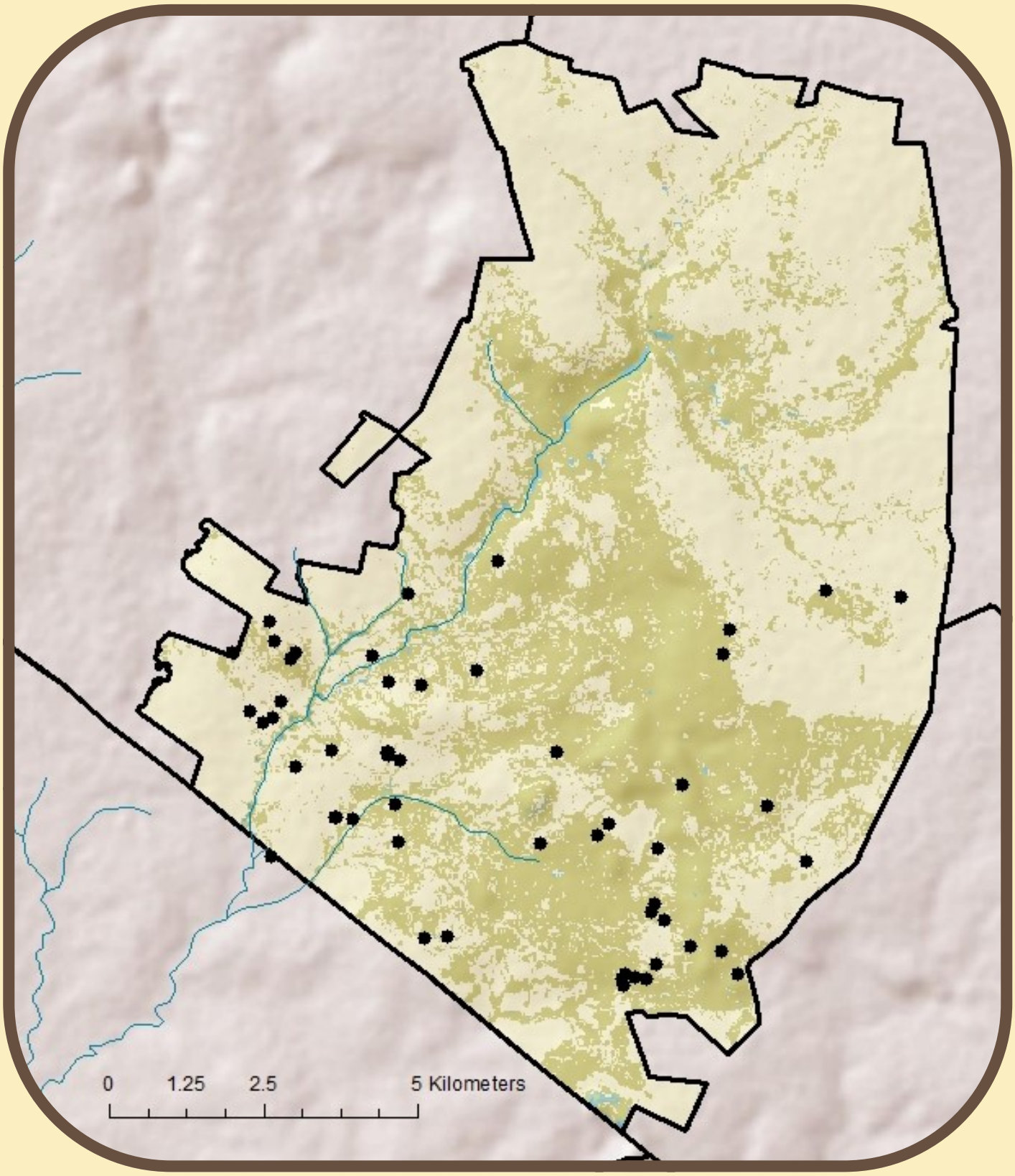
A total of 4 different adult cheetahs were seen in Mara North Conservancy in 2016

Olare-Motorogi Conservancy

Sex	Cheetah name(s)	Notes	Other areas* seen in 2016
Female	Amani	Mother of Imani and Hodari, currently has 2 cubs	MMNR and MNC
	Imani	Daughter of Amani	MMNR
	Imani's daughter	Daughter of Imani. Seen alone since splitting away from her two brothers (see Imani's subs)	MMNR and NAB
	Malaika	Mother of Bawa, Malikia and Malik	MMNR
	Musiara	Raised 3 cubs to independence at the end of 2016	MMNR and MNC
	Nabiki	Sister of the Triangle males. Died in May 2016.	NAB
	Nolari	Daughter of Narasha, Raised 1 cub in 2016	MMNR
	Malkia	Malaika's daughter	
Male	Hodari	Amani's son and Imani's brother	MMNR and NAB
	Leomom	A young individual who we suspect has come from the Serengeti National Park, Tanzania	MMNR, MT and NAB
	Malik	Son of Malaika who dispersed in 2016	MMNR, MNC and LEM
	Oloolulo male	Used to be part of a two-male coalition until his coalition mate died in 2015	MMNR
	5 Musketeers	A new 5-male coalition that appeared in December 2016	NAB
Sub-adults	Imani's subs	Seen as a sibling group before they split	MMNR, NAB, OCC and EC

* MMNR = Maasai Mara National Reserve, MNC = Mara North Conservancy, NAB = Naboisho Conservancy, MT = Mara Triangle, LEM = Lemek Conservancy, OCC = Ol Choro Conservnacy, EC = Enonkishu Conservancy

A total of 17 different adult cheetahs were seen in Olare-Motorogi Conservancy in 2016

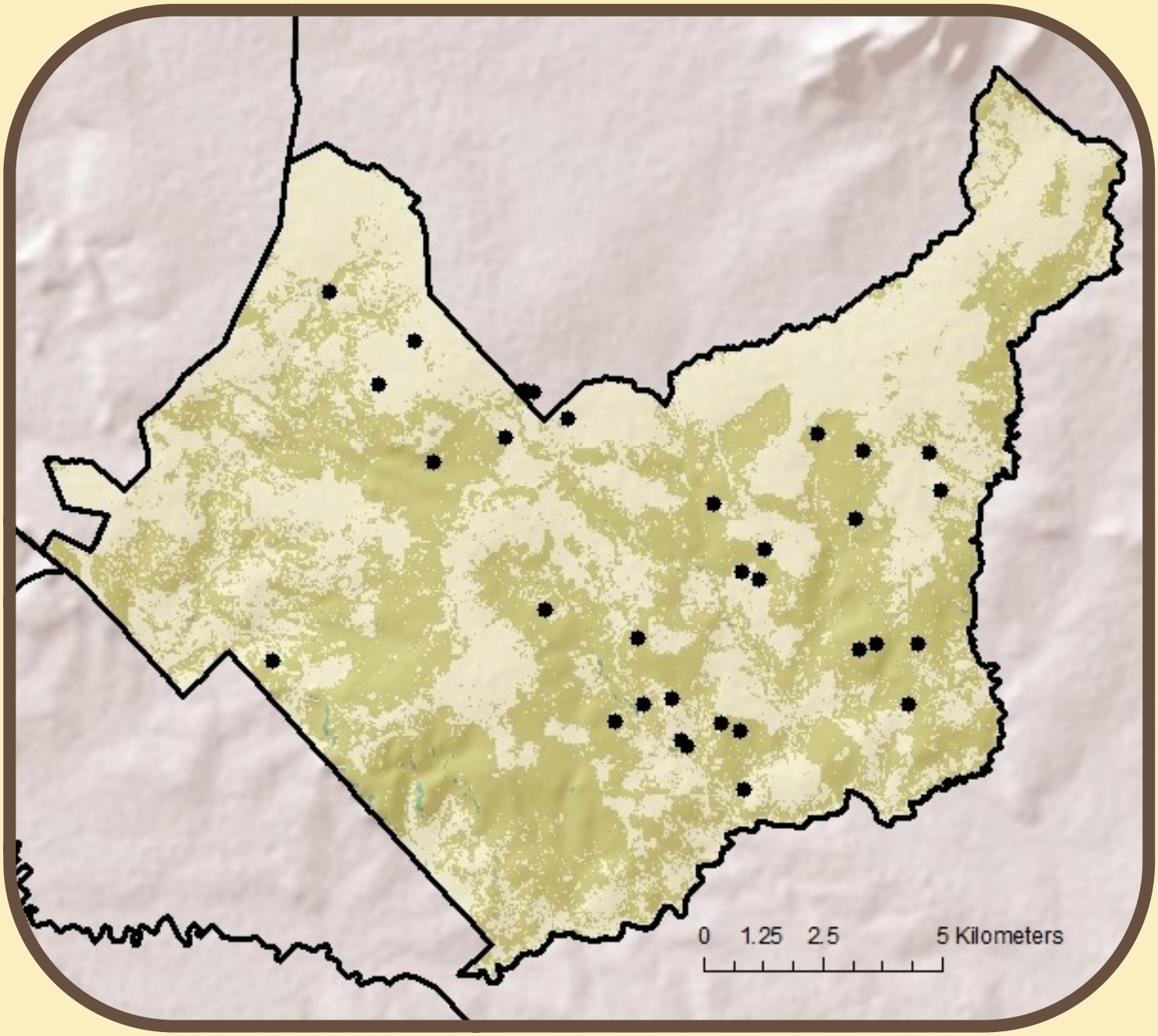

0
1.25
2.5
5 Kilometers

Naboisho Conservancy

A total of 17 different adult cheetahs were seen in Naboisho Conservancy in 2016

Sex	Cheetah name(s)	Notes	Other areas* seen in 2016
Female	Nabiki	Sister of the Triangle males. Died in May 2016.	OMC
	Naborr	Daughter of the Ol Kinyei female	OKC
	Naborr's daughter	Daughter of Naborr. Seen alone since splitting away from her two brothers (see Naborr's subs)	OKC
	Napikidongoi	Daughter of Nalang'u	OKC
	Imani's daughter	Daughter of Imani. Seen alone since splitting away from her two brothers (see Imani's subs)	MMNR and OMC
Male	Hodari	Amani's son and Imani's brother	MMNR and OMC
	Leomom	A young individual who we suspect has come from the Serengeti National Park, Tanzania	MMNR, MT and OMC
	Forester	Collared in October 2016 and is often seen near Ol Seki airstrip	OKC
	Siriwua	One of Naboisho's resident males	-
	Imani's sons	Sons of Imani who have joined forces with Nolari's son to form a 3-male coalition since splitting away from their sister (see Imani's subs)	OKC
	Nolari's son	Son of Nolari who has joined forces with Imani's two sons to form a 3-male coalition	OKC
	5 Musketeers	A new 5-male coalition that appeared in December 2016	OMC
Sub-adults	Imani's subs	Imani's two sons and daughter before they split up	MMNR, OMC, OCC and EC
	Naborr's subs	Naborr's daughter and two sons temporarily teamed up with Enkayioni	OKC
	Enkayioni	A male from Siana who temporarily teamed up with Naborr's sub-adults	Siana

* OMC = Olare-Motorogi Conservancy, OKC = Ol Kinyei Conservancy, MMNR = Maasai Mara National Reserve, MT = Mara Triangle, OCC = Ol Choro Conservancy, EC = Enonkishu Conservancy

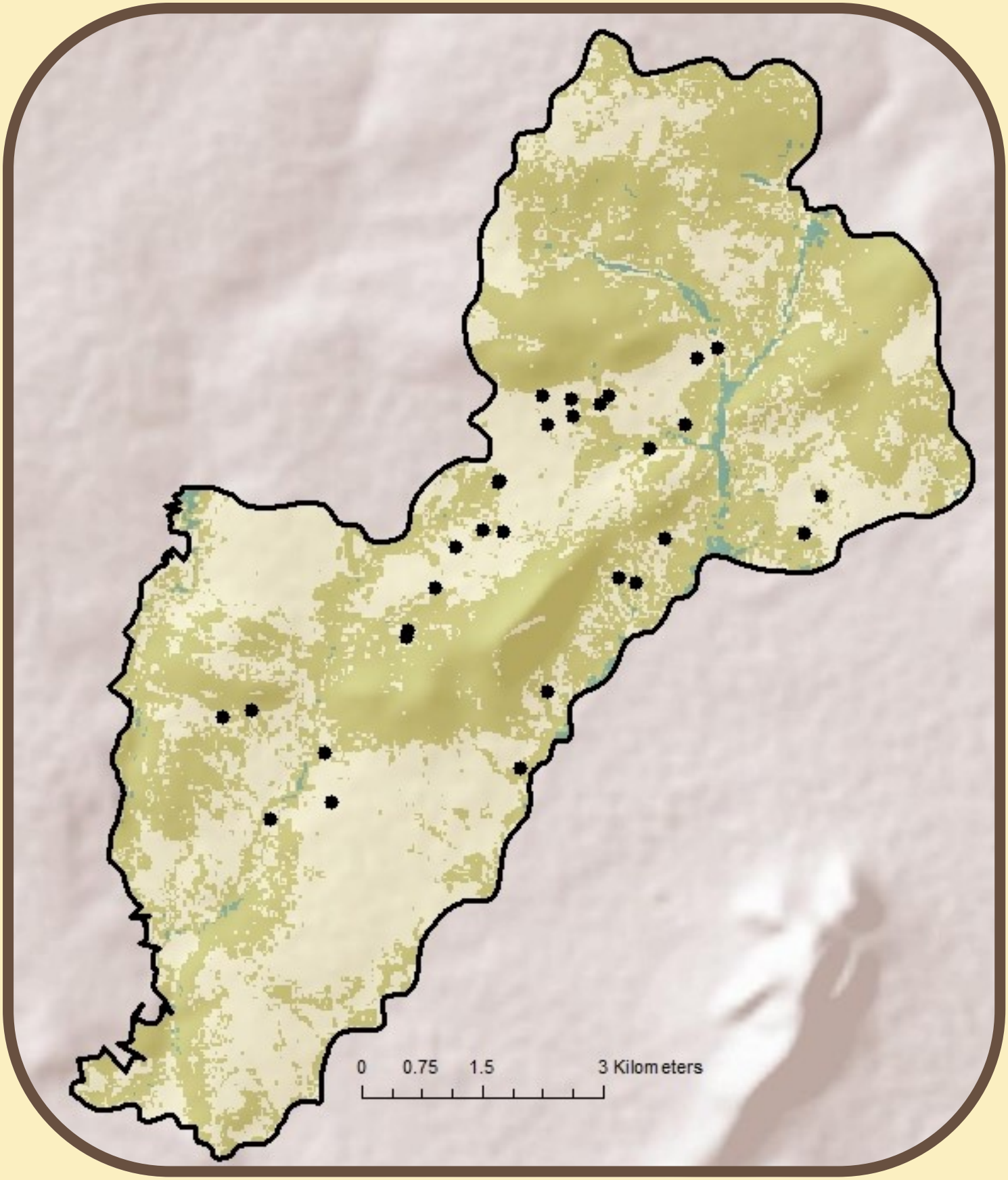

0 1.25 2.5 5 Kilometers

Ol Kinyei Conservancy

Sex	Cheetah name(s)	Notes	Other areas* seen in 2016
Female	Naborr	Daughter of the Ol Kinyei female	NAB
	Naborr's daughter	Daughter of Naborr. Seen alone since splitting away from her two brothers (see Naborr's subs)	-
	Napikidongoi	Daughter of Nalang'u	NAB
	Noosura	Female that was collared in 2015	Siana
Male	Forester	Collared in October 2016 and is often seen near Ol Seki airstrip	NAB
	Ol Kinyei male	Naborr's brother	-
	Imani's sons	Sons of Imani who have joined forces with Nolari's son to form a 3-male coalition since splitting away from their sister (see Imani's subs)	NAB
	Nolari's son	Son of Nolari who has joined forces with Imani's two sons to form a 3-male coalition	NAB
Sub-adults	Naborr's subs	Naborr's daughter and two sons temporarily teamed up with Enkayioni	NAB
	Enkayioni	A male from Siana who temporarily teamed up with Naborr's sub-adults	Siana

* NAB = Naboisho Conservancy

A total of 9 different adult cheetahs were seen in Ol Kinyei Conservancy in 2016

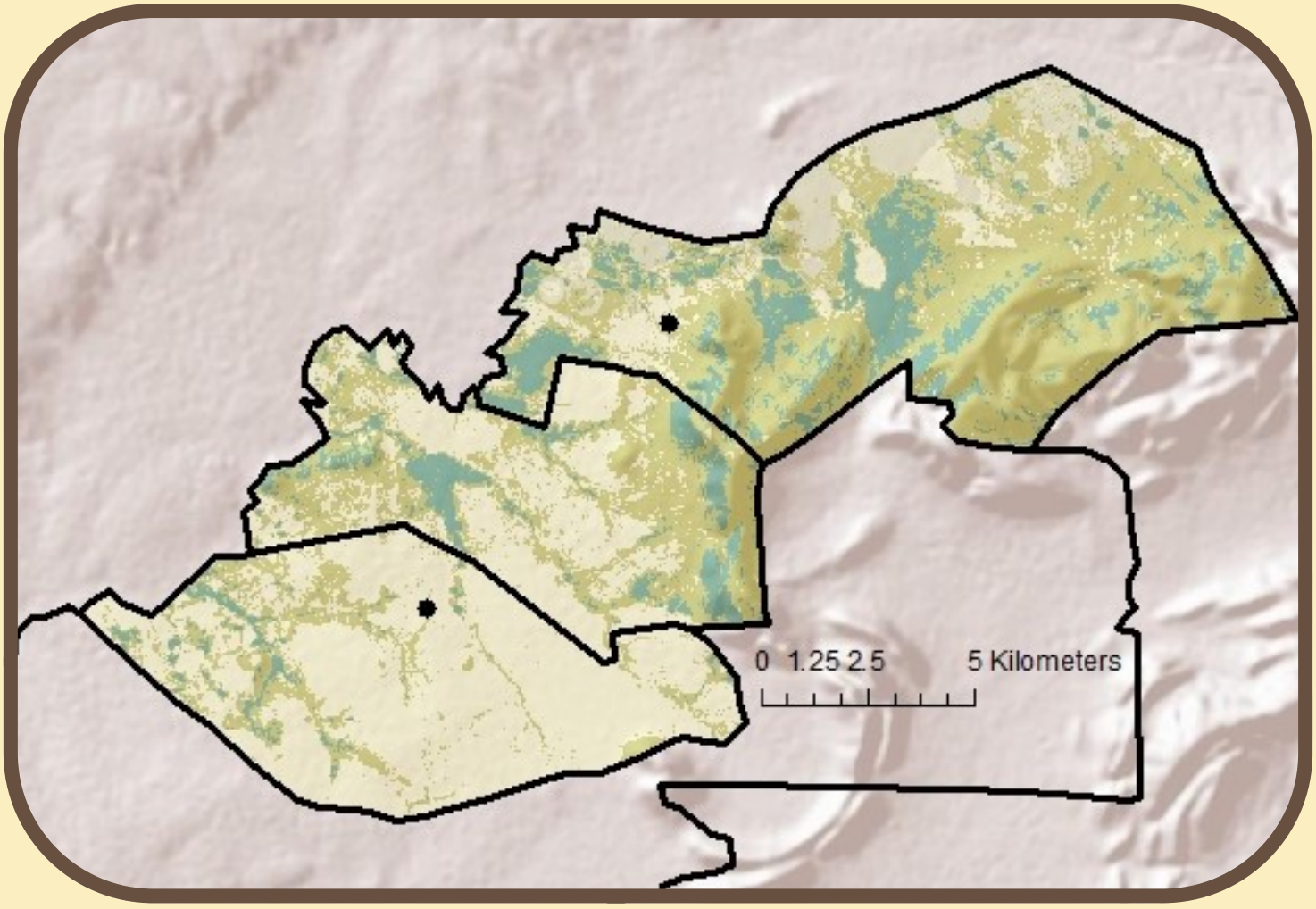

0 0.75 1.5 3 Kilometers

Remaining Conservancies

A total of 1 adult and 3 sub-adult cheetahs were seen in Lemek, Ol Choro and Enonkishu Conservancies in 2016

Sex	Cheetah name(s)	Notes	Other areas* seen in 2016
Male	Malik	Son of Malaika who dispersed in 2016	MMNR, OMC and MNC
Sub-adults	Imani's subs	Seen as a sibling group before they split	MMNR, OMC, and NAB

* MMNR = Maasai Mara National Reserve, MNC = Mara North Conservancy, OMC = Olare-Motorogi Conservancy, NAB = Naboisho Conservancy



Cheetah numbers

Understanding variations in densities across both space and time is key for conservation and management. For density estimates to be accurate, data need to be collected over a timeframe that is long enough so that a representative sample is collected but short enough to remove any problems related to increase or decrease of the population through birth/death or immigration/ emigration.

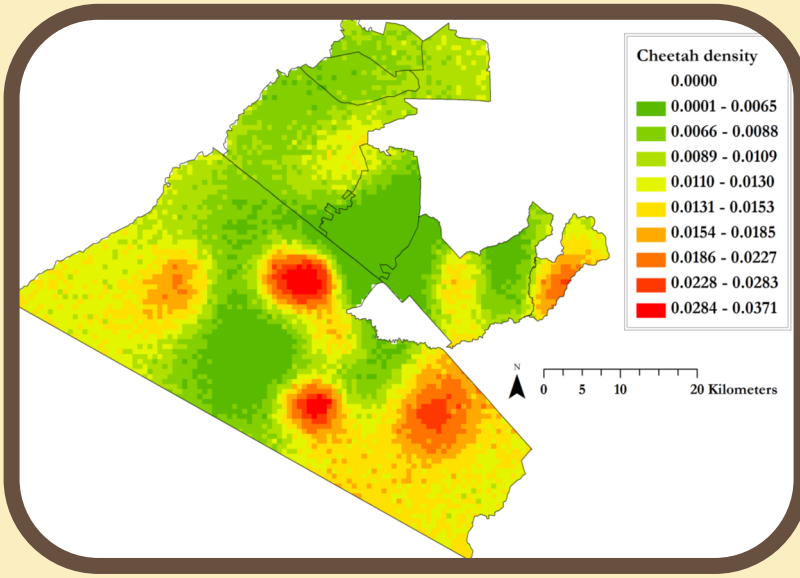
There are 1.27 adult cheetahs/100km² in the study area (roughly 31 adults). These figures are higher than many places in Africa.

To estimate the number of cheetahs in the Maasai Mara we used data collected during a survey carried out in August-October 2014. These data were analysed within a Spatially Explicit Capture Recapture framework which is an accurate method as it:

1. can distinguish visiting animals from those that reside permanently within the surveyed area, avoiding potential overestimation of numbers. This can be compared to counting the population of Nairobi's CBD in the daytime, which would give a vastly inflated figure because of the influx of commuters from neighbouring areas.

2. accounts for the probability that a cheetah is seen, thereby addressing the potential problem that not every single individual in a population is likely to be seen during the survey as this would underestimate the number.

Based on this, we estimate that there is a density of 1.27 adult cheetah in the Maasai Mara, which is high compared to the current estimates of other areas in Africa. In addition, because the analysis was spatially explicit, we were able to create a map (see below) of high (red) and low (green) density areas. The map shows that there are areas with high cheetahs densities in the Maasai Mara National Reserve and in some of the conservancies. It has been found that during the migration (when the data for this study were collected) cheetahs are more likely to be found in the Maasai Mara National Reserve compared to the conservancies (see page 30). These high density areas, or 'hotspots' are therefore likely to change over time.



These 'hotspots' will give an insight into the environmental and anthropogenic variables that influence cheetah density and distribution.

Births and survival

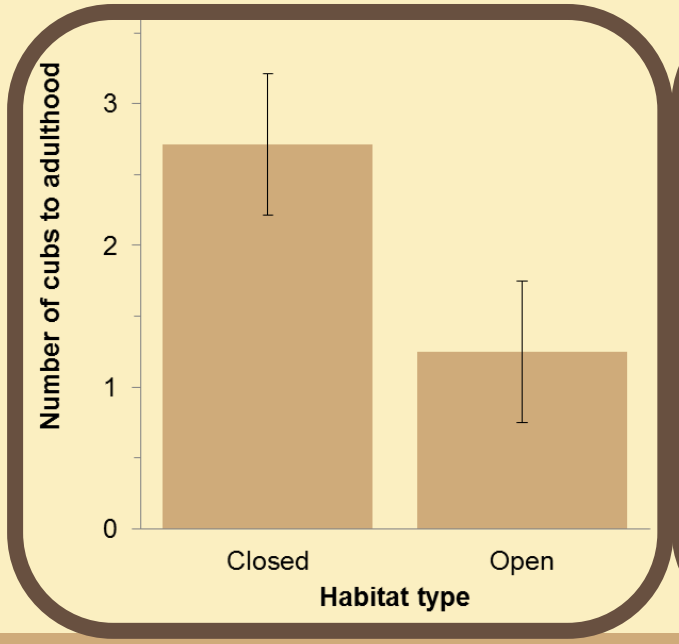
Births

In 2016 we recorded the births of 26 cubs to seven different females. Of these 11 have so far survived. Cubs tend to be seen for the first time when they start leaving their den, or lair, at about eight weeks. It is therefore possible that more cubs were born and died without us knowing. Based on the 14 litters that were found within three weeks after they were born, the **average litter size is 4.7** ± 1.2 cubs (mean ± standard deviation), with a minimum of two cubs and a maximum of six cubs.

Many cheetah cubs die within a year after being born and estimates from the Serengeti in Tanzania suggest that only 5% of cubs that are born will reach adulthood. Cheetah cubs can die from an array of natural causes including disease, starvation, abandonment and predation by other carnivores. Unfortunately, in most cases it is extremely difficult to establish the cause of death of cubs. Since 2013 **we have recorded 145 cubs across 40 litters**. Of these 45 cubs from 20 different litters made it to adulthood, 79 cubs died and 21 cubs from six litters are still with their mothers.

Survival

Of the litters that did make it to adulthood, the average **number of cubs per litter that left their mother was 2.3** ± 1.2 (mean ± standard deviation), ranging from 1 to 4 cubs. Interestingly, we have seen that there is a link between the number of cubs per litter that are raised to adulthood and habitat structure - mothers who spend a lot of time in open areas will raise fewer cubs per litter to adulthood than mothers who spend a lot of their time in more closed habitat types. This is probably becuase denser habitat provides more cover for a mother with cubs which means that they are less likely to be detected by other predators such as lions and spotted hyaenas.



Females in areas with good cover (acacia and croton) are more likely to raise more cubs per litter to adulthood.

Recommendation:

Ensure the availability of a mosaic of habitats by mimimising conversion from bushland to grassland.

Once cubs reach adulthood they will leave their mother to establish their own territory or home-range, this process is known as dispersal. Generally cubs will leave their mother when they are around 18 months old. In the Maasai Mara we have found that cubs **disperse when they are on average 16.9 months old.** The youngest disperser we recorded was 14 months and the oldest 22 months.

If there are several cubs in a litter of mixed sexes then usually the sibling will leave together and stick together for four to six months before splitting up. Once sub-adult cheetahs are completely independent, females will stay in a similar area to their mother whereas males will generally move away to another area. This is to avoid that they breed with their mother or sister. Female cheetahs (unless they have cubs) will always be solitary whereas males can form groups also known as coalitions.

Of the 45 cubs that we have seen disperse so far, 24 were male and 21 were female. Of the 24 males, 13 are still frequently seen in the study area and it is likely that some of them will have moved beyond the study area to establish a territory. Occasionally we also see new males coming into the study area. This year alone we have recorded 12 new young males across several different coalitions. The biggest of these was a rather unusual coalition of five young males, possibly from three different mothers. It is not unusual for males from different mothers to form groups and we have had two other cases this year where two related males teamed up with an unrelated male to form a three-male coalition. Of the 21 females that dispersed, 11 are still frequently seen in the study area, some of which have now had cubs of their own.

Deaths

It is generally difficult to find predators that have died. So far we have come across nine dead individuals. Of these the cause of death was known for eight of them; three died of disease (all male), four were killed by other predators (all female) and one died of old age.

Year	Cheetah ID	Sex	Suspected cause of death
2013	Nalepo	Female	Other predators
2014	Unknown	Male	Unknown
	Saba	Female	Old age
	Rongai female	Female	Other predators
2015	Oloololo	Male	Disease
	Kisiri's son 1	Male	Disease
	Kisiri's son 2	Male	Disease
	Narasha	Female	Other predators
2016	Nabiki	Female	Other predators

Satellite collars

The Mara Cheetah Project has been given permission by Kenya Wildlife Service, Narok County Government and the Maasai Mara Wildlife Conservancies Association to deploy five satellite collars on cheetahs in the Maasai Mara National Reserve and the surrounding conservancies.

What are collars and what do they do?

Collars collect location data (GPS) at set time intervals of the collared individual. These data are then received by the Mara Cheetah Project through satellite communication which allows the project to continuously and intensively monitor the collared individuals.

Why use collars rather than just sighting data?

Firstly, most sightings will be in areas and at times of day when cheetahs are most visible. As collars collect data at regular intervals (i.e. every 4 hours) it means that we will know where an individual has been even in times and areas when individuals are difficult to follow (such as at night or while outside wildlife areas). Secondly, collecting data based on sightings alone is time consuming and it will take several years to collect enough data that will be valuable for conservation. With collars the necessary data can be collected at high resolution within a relatively short time period (collars only last 1 year) which means that conservation actions can be timely.

How will the use of collars help conserve cheetahs?

Cheetahs face a kaleidoscope of threats but with the aid of collars we will able to better understand, identify and respond to threats. For example, the collars will enable us to:

- Determine the impacts of anthropogenic factors, such as settlements and fencing, on the movement and behavior of cheetahs.
- Identify areas where there is a high potential for human-wildlife conflict to occur so that these areas can be targeted by the project's outreach and community programmes.
- Determine the habitat used by cheetahs in order to assess the impact that habitat loss and conversion will have on cheetahs.
- Identify wildlife corridors to aid spatial planning and the creation of new wildlife areas.
- Immediately be alerted when a cheetah has died. The collar will send a mortality signal if the collar has been stationary for a significant period of time. This allows us to investigate any natural and human-caused death in a timely manner.

The tourist experience

We understand and fully appreciate that it is not always nice to see a collar on an animal. However, previous experience has shown that once the value of a collar is explained to a tourist, it can actually enhance their experience as they come to understand that conservation actions are occurring and adds another level of interest when updates are provided on a regular basis. Furthermore, to minimise the visual impact of the collar and to enhance the tourist experience we have undertaken the following:

- The belting of the collar is painted with a spot pattern and it is therefore less visible than the traditional black or brown collars.
- Brochures have been distributed to camps and lodges in the areas where cheetahs are collared giving information about the collars and their purpose.
- Regular updates on the collared cheetahs are provided in our reports.

Ethical considerations

Our mission is to conserve cheetahs and therefore we take the cheetahs' welfare extremely seriously. The following ensures that no harm will come to the cheetah:

- Collars weigh only 400grams which is about 1% of a cheetahs body weight - this is considerably less than the recommended weight. The collars will therefore not affect the cheetahs ability to hunt or run at great speeds.
- All immobilisations to deploy collars are done by a qualified KWS veterinarian.
- Project Director Dr. Femke Broekhuis has deployed ~80 collars on large carnivores and has extensive experience in the immobilisation of large carnivores and the fitting of collars.

FAQ

We are often asked why we use collars rather than microchips. Microchips are unfortunately not an option because:

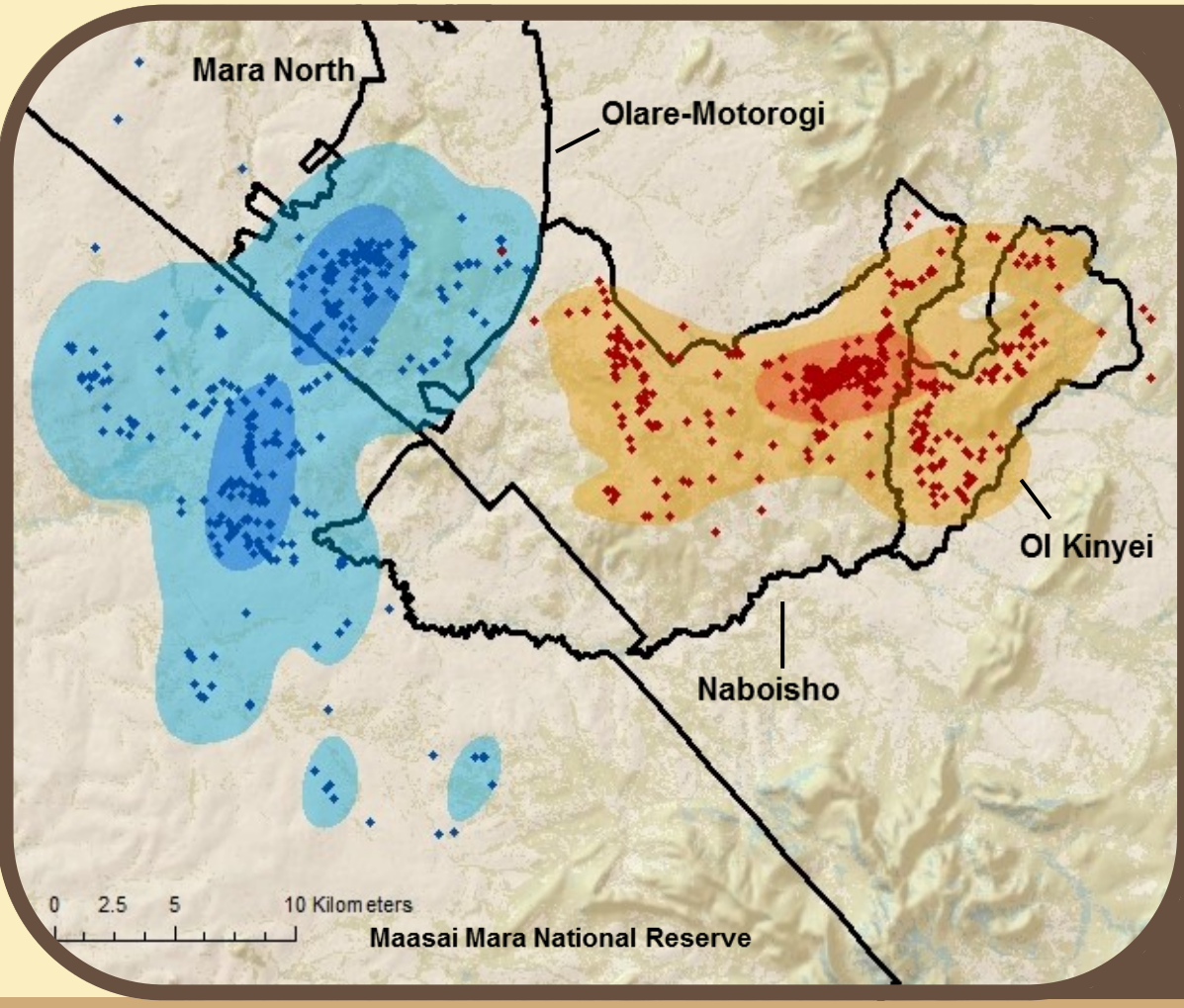
- Placing a microchip is very invasive as it involves surgery
- Microchips placed under the skin cannot communicate with satellites and therefore they are unable to collect GPS locations
- The battery power required to collect data makes the device too big to implant. The current collars are 400 grams which is much lower than the maximum that can be put on an animal (about 3% of body weight).

The satellite collars give us a unique insight into the life of a cheetah in the Mara. The collar allows us to track the individuals even during times of day or in areas when and where it would be difficult to find or follow them. Currently there are two collared males, Leomom and Forester both of which were collared in October 2016. Previously we also had two females collared, Nabiki and Noosura. Noosura's collar was removed in October 2016 as it was no longer working. Nabiki died in May and we suspect that she was killed by spotted hyaenas.

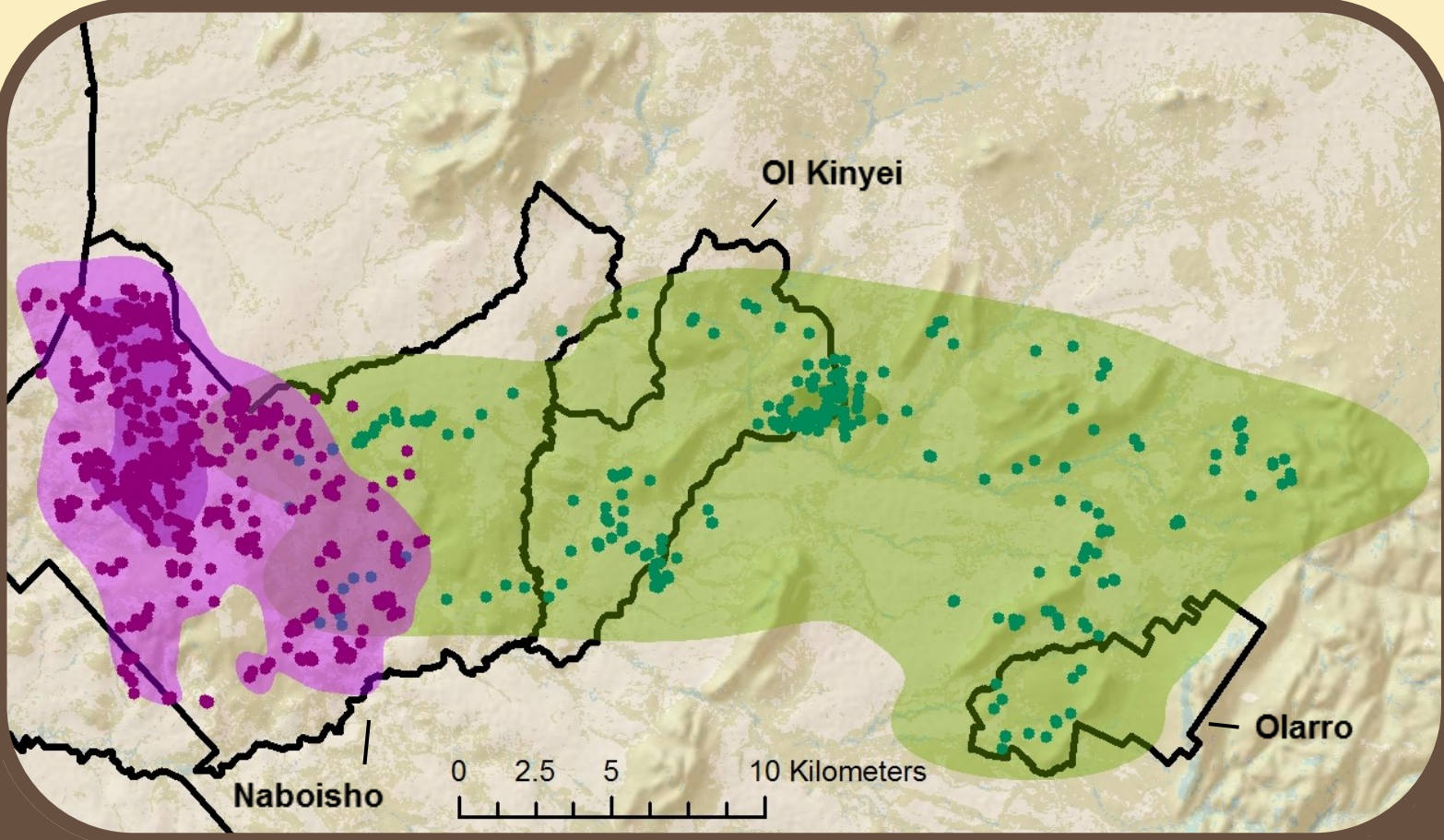
Home-ranges

Using the location data (the dots on the maps) from the collars we can determine their ranging behaviour, home-range size and identify core areas that the cheetahs use. The home-ranges of the collared cheetahs (area where they spend 95% of their time - lighter shading) ranged from 117 to 399 km². Most of the core areas (where they spend 50% of their time - darker shading) fell within the protected areas.

Cheetah	Sex	Home-range size (km²)		Locations		Number of days
		50% (core)	95%	% Inside PAs	% Outside PAs	
Noosura	Female	4	399	49.1%	50.8%	60
Nabiki	Female	21	117	98.4%	1.6%	124
Leomom	Male	47	284	100%	0%	82
Forester	Male	21	185	98.6%	1.4%	80



These are the home-ranges of the two collared males, Leomom (blue) and Forester (orange).



These are the home-ranges of the two collared females, Nabiki (pink) and Noosura (green).

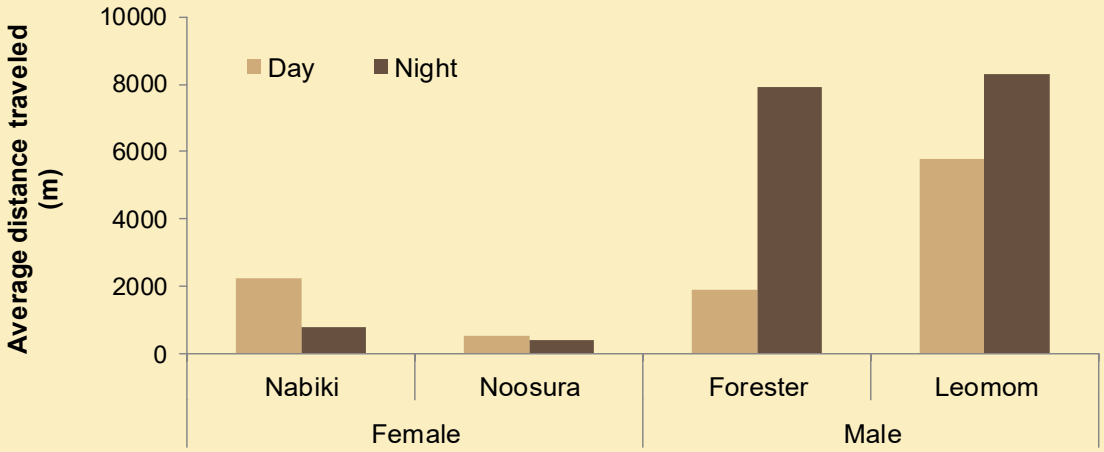
Interestingly, of the four cheetahs that have been collared thus far, Noosura (who had four big cubs at the time) has been the only one who spent a considerable amount of time outside the protected areas (PAs). The other three collared cheetah rarely left the PAs and if they did, they did not venture more than 900 metres from a PA boundary. There are no fences around the PAs so it is likely that changes in the environment are influencing the cheetahs' distributions.

Based on cheetah data from the collars, sightings and reports in combination with environmental data on habitat, settlements and livestock presence we suspect that cheetahs are unlikely to venture into human-dominated areas where there is little vegetative cover or areas where there is a lot of human disturbance. Based on this we believe that cheetahs will roam outside the protected areas South of Naboisho and East of Ol Kinyei conservancies towards Siana, Olarro and Maji Moto but that they are very unlikely to venture North of Naboisho conservancy into the Pardamat area. We also suspect that cheetahs will rarely move from Olare-Motorogi to Naboisho (and vice versa) and from Olare-Motorogi to Mara North (and vice versa) due to high human-disturbance (livestock, settlements and fences) along those boundaries (see page 34).

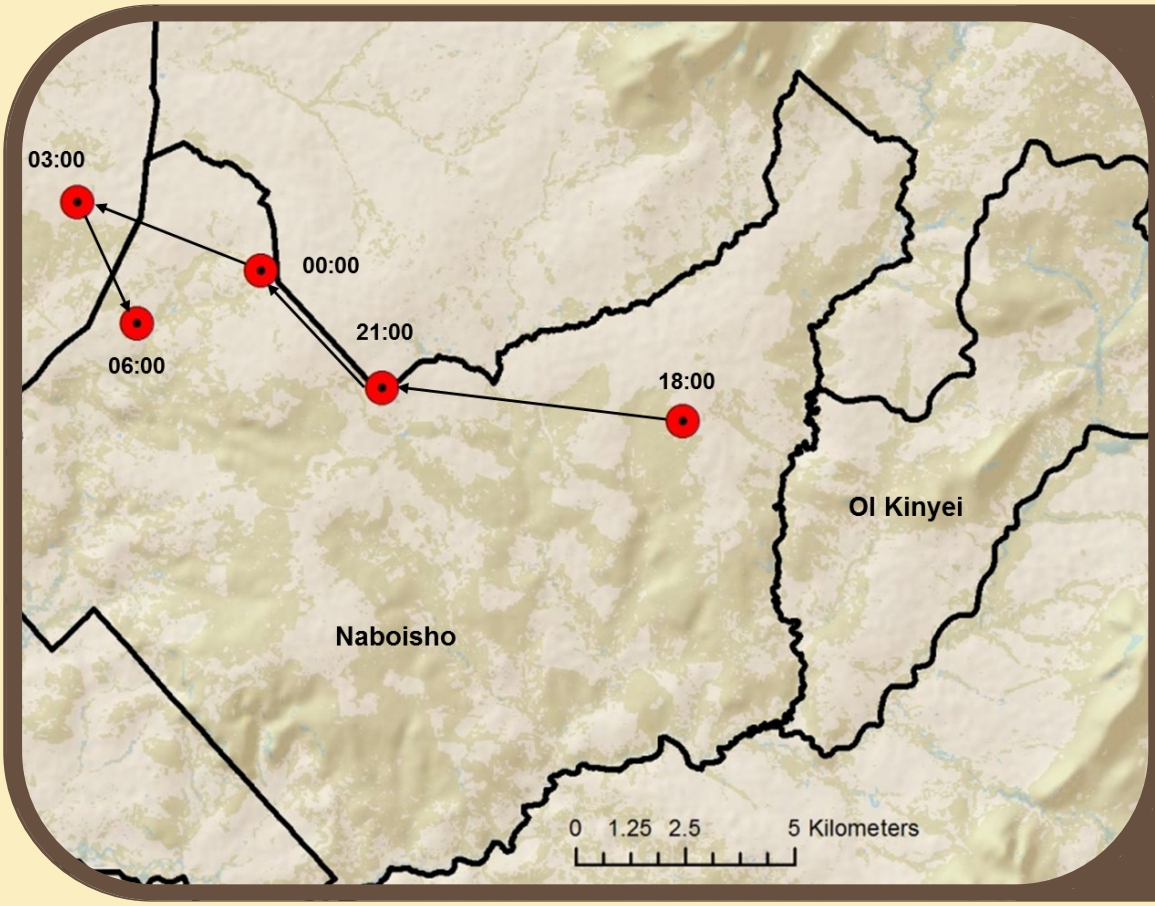
Cheetah distribution is influenced by high human-disturbance (settlements, livestock and fencing) especially in areas where there is little or no vegetative cover.

Activity patterns

Based on the GPS locations we can calculate how far each of the collared individuals travel between points. Using these data we have found that male cheetahs cover more ground than females, likely because they need to patrol their territory in addition to finding food. Interestingly, males are also more active at night than during the day. In one case, one of the collared males travelled over 18km in one night!



Male and female cheetahs have different activity patterns - males move a lot more than females and males are more active at night than during the day.

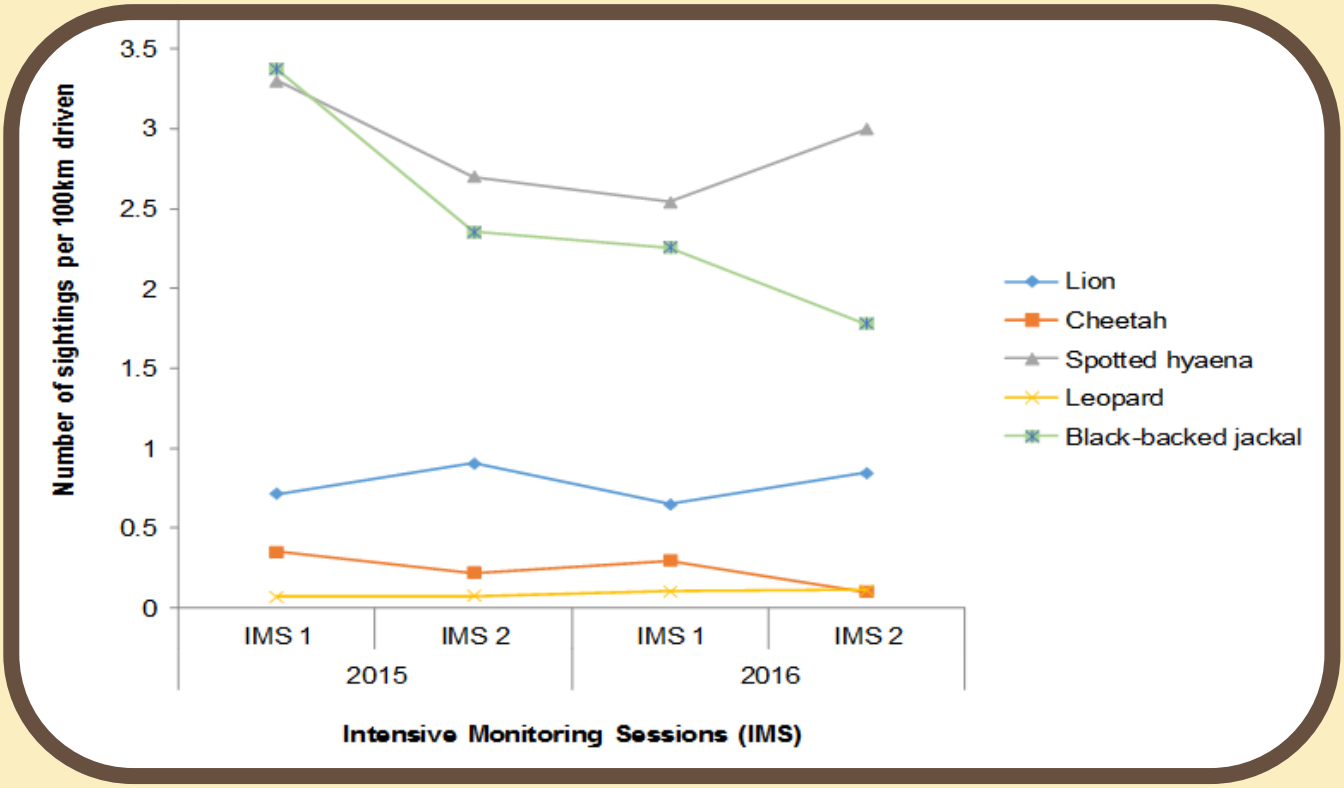


An example of the night-time movement of one of the collared males (Forester). In one night he traveled over 18km.

Temporal and Spatial Trends

All year round we monitor the cheetah (and other predator) population in the Maasai Mara. However, we intensive our data collection during two Intensive Monitoring Sessions (IMS), once out of the migration period (February-April = IMS 1) and once during the migration (August-October = IMS 2).

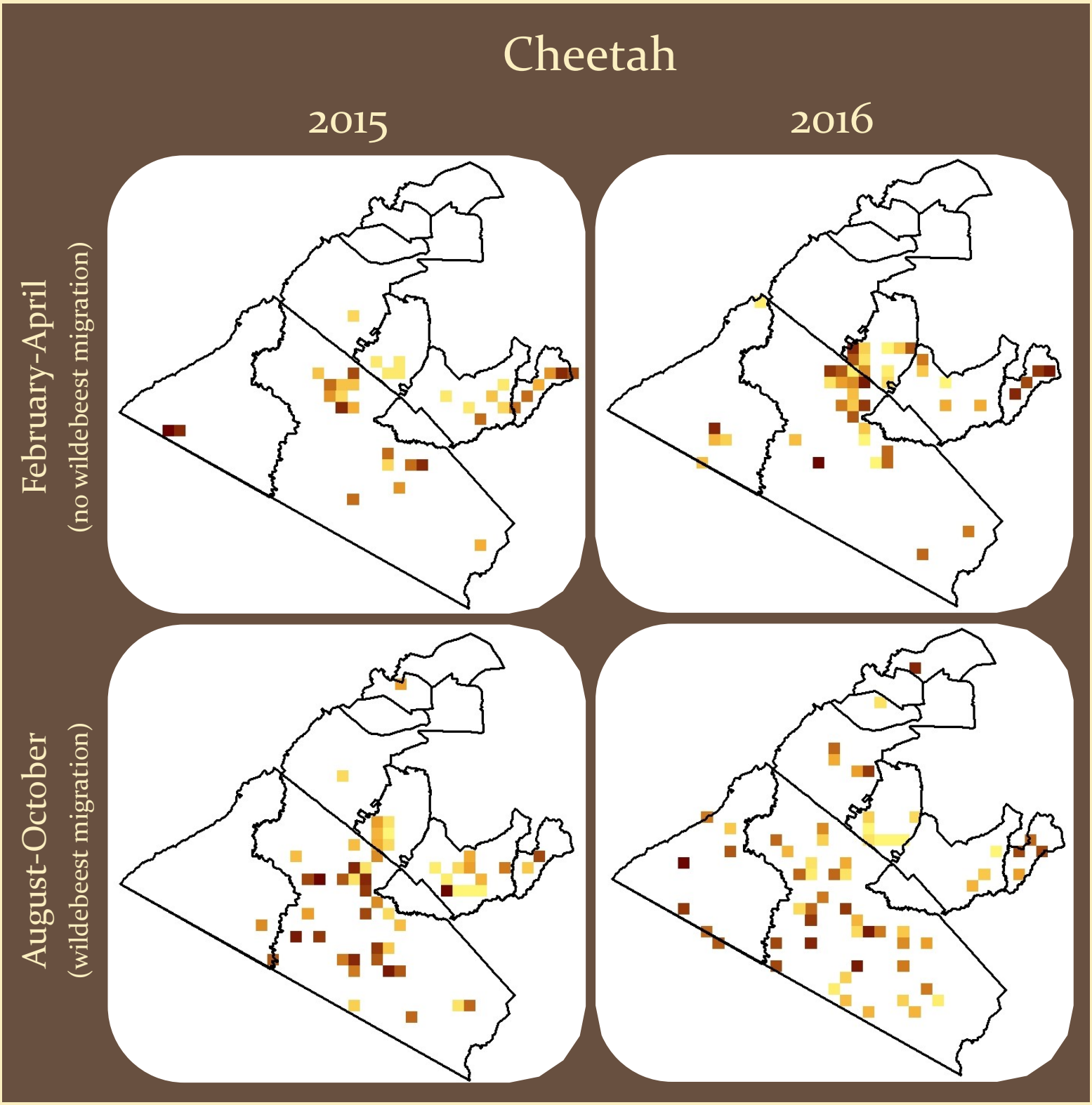
With the data collected during these Intensive Monitoring Sessions we can calculate densities (see page 21), abundance and distribution. As these data are collected in a consistent manner we can compare these data across the Intensive Monitoring Sessions thereby giving an insight into changes in abundance and distribution over time.



A basic preliminary analysis has revealed some interesting trends in the predator populations in the Maasai Mara. Based on the number of sightings per 100km driven we have found that cheetah sightings (orange line) are higher outside of the migration period (IMS 1) than during the migration period (IMS 2). Lions (blue line) on the other hand are showing the opposite trend where sightings are higher during the migration period (IMS 2) compared to outside the migration period (IMS 1). Spotted hyaena sightings (grey line) steadily dropped between the beginning of 2015 to the beginning of 2016 but increased slightly at the end of 2016. The number of black-backed jackal sightings (green line) have steadily decreased which is concerning. Leopard sightings (yellow line) seem constant but there are too few leopard sightings to make any inferences.

Cheetah sightings drop during the annual wildebeest migration while lion sightings peak during this time. While cheetah and lion sightings seem relatively stable, black-backed jackal sightings have decreased over the years.

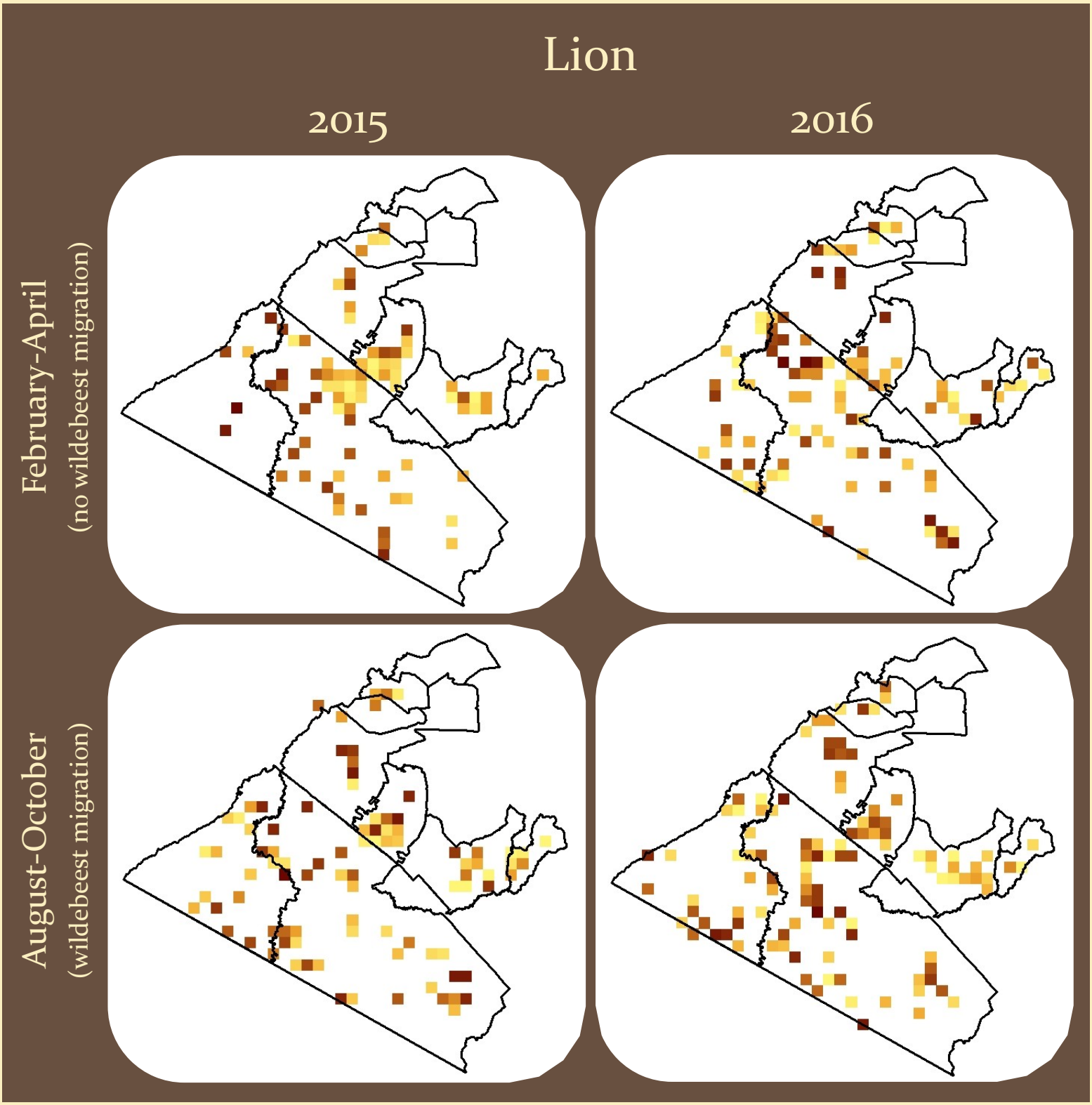
Cheetah



The distribution of cheetahs varies depending on the wildebeest migration from the Serengeti. Out of the migration period the cheetah distribution is more concentrated and cheetahs are more likely to be found in the Northern section of the Maasai Mara National Reserve and the conservancies. During the migration the cheetahs are more widespread, especially in the Southern section of the Maasai Mara National Reserve. This suggests that cheetah distribution is, in part, influenced either directly or indirectly by the distribution of prey.

Cheetah distribution is influenced by the annual migration of herbivores from the Serengeti.

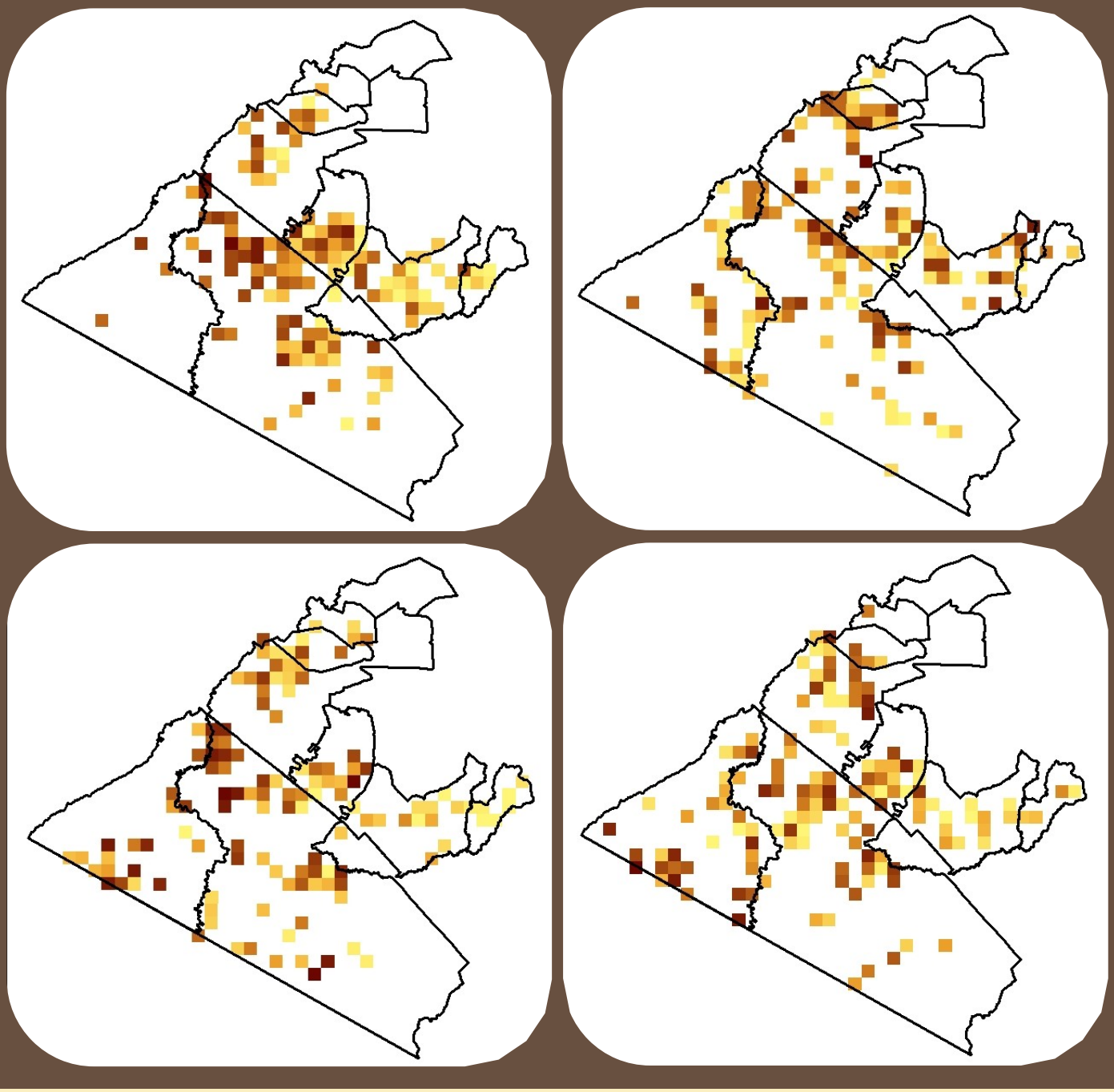
Lion



It is often thought that cheetahs avoid areas where there is a high chance of bumping into lions. However, recent research, including our data, shows that this is not always the case. Cheetahs often use the same areas as lions do, possibly because of prey availability. Cheetahs can coexist with other predators such as lions, especially in areas where there is good vegetation cover. Areas where the habitat provides good cover are therefore more likely to support high densities of large carnivores.

Good habitat cover allows for coexistence therefore areas with good vegetation cover are likely to support high densities of large carnivores.

Spotted hyaena



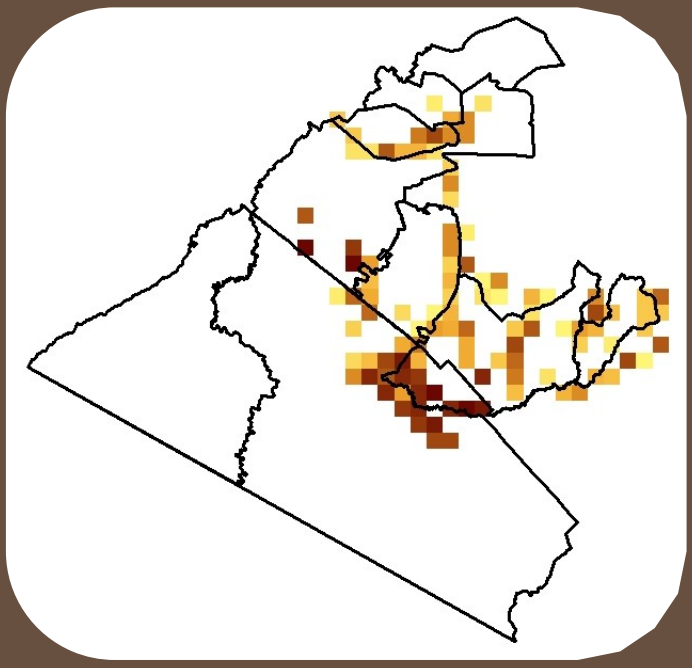
We record the presence of other large predators, such as lions and spotted hyaenas, as they are known to kill cheetahs (adults and cubs) and steal their kills. Lions and spotted hyaenas are often considered to be a threat to cheetahs, however these species have always coexisted alongside one another. Other predators can only really be considered a 'threat' if there is evidence that they are negatively impacting cheetahs as a result of human influence.

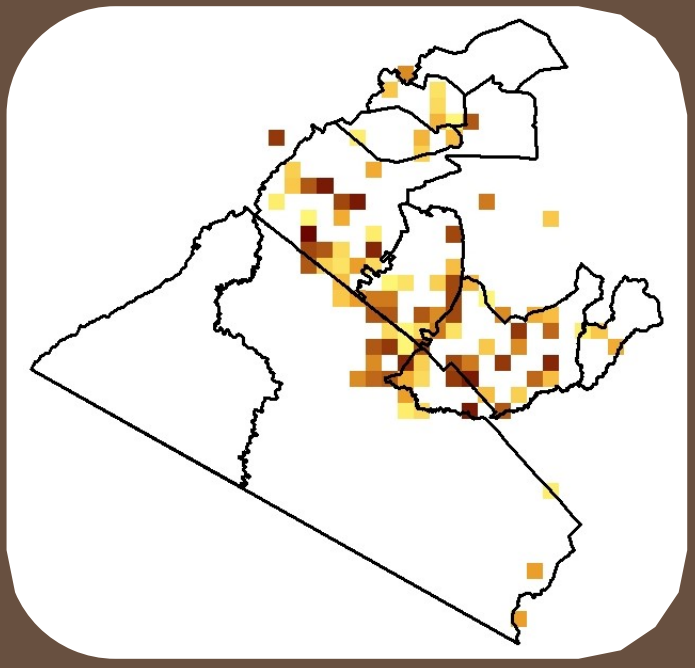
Cheetahs, lions and spotted hyaenas often use the same areas which can occasionally lead to negative interactions resulting in death or loss of kills. These are natural interactions unless they occur because of human presence.

Cattle

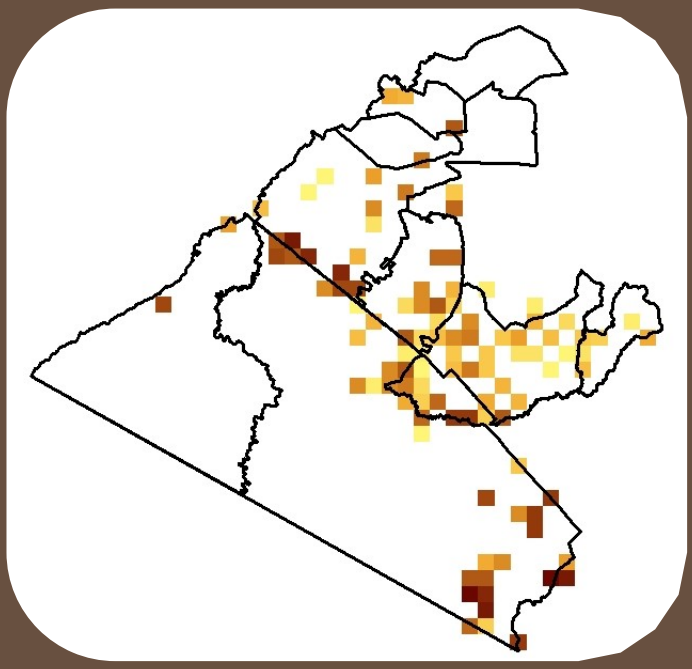
2015 2016

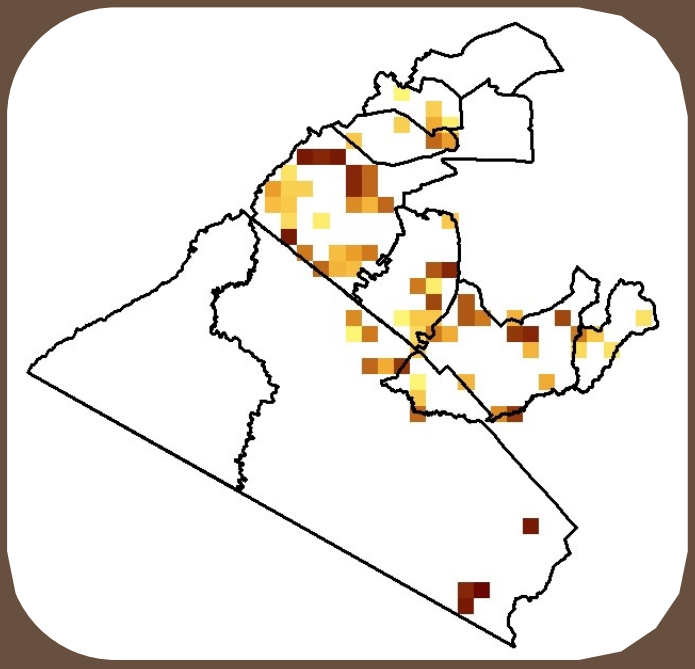
February-April (no wildebeest migration)





August-October (wildebeest migration)





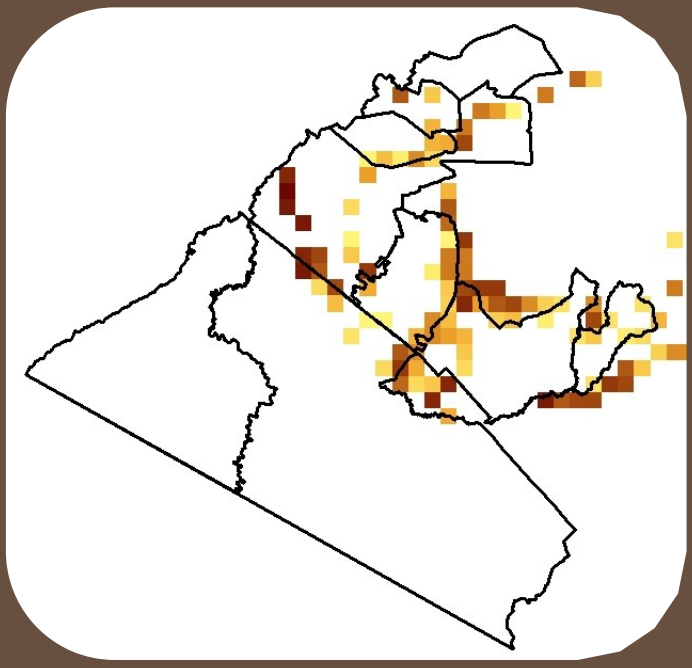
Cheetahs hardly ever kill cattle and if they do then they tend to kill calves. However, we have found that certain cheetahs, females with cubs more so than males, are often disturbed by the presence of large herds of cattle, the noise of cattle bells and the whistles of the herders. While it is not always the case, we have recorded several cases where cheetahs were getting visibly stressed by the presence of cattle resulting in cheetahs running away or abandoning their hunts.

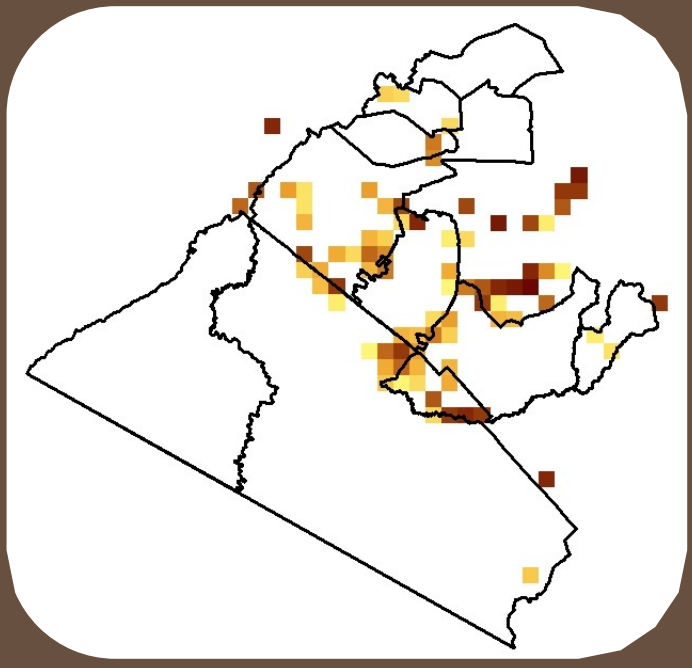
Cheetahs can get stressed by the presence of cattle and herders. In areas where controlled grazing is allowed, cattle should be grazed away from cheetahs.

Sheep and goats

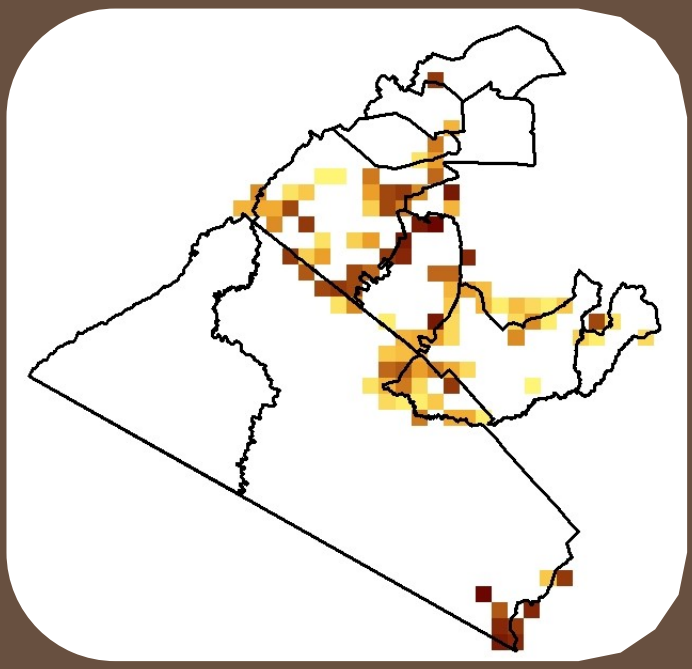
2015 2016

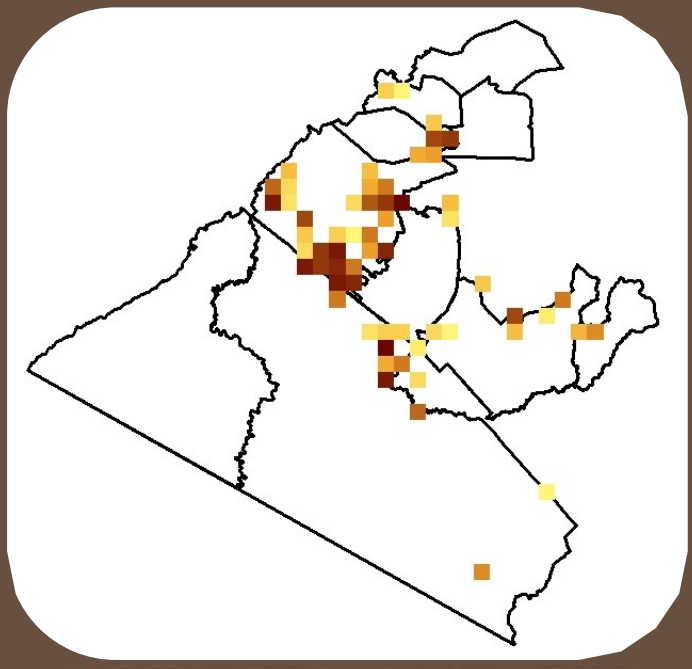
February-April (no wildebeest migration)





August-October (wildebeest migration)





Cheetahs are not always associated with human-wildlife conflict, but they do occasionally kill sheep and goats (shoats). Similar to cattle, high disturbance caused by the presence of shoats can influence cheetah presence and distribution (see pages 25-26).

Cheetahs are more likely to kill shoats than cattle

Human-wildlife coexistence

Livestock depredation

This year we only have one record of a cheetah killing a sheep but it is possible that more incidences have occurred. Depredations of livestock by predators can be minimised by adopting good herding and husbandry practices.

Based on a comprehensive questionnaire survey that was conducted in 2015, we found that livestock depredation by cheetahs is most likely to occur:

- On shoats (collective name for sheep and goats)
- During the day when shoats are grazing outside the *bomas*

It has also shown that predation is more likely to occur when there are no herders attending to the livestock or when livestock are herded by children rather than adults. We found that, out of 2933 shoat herds recorded, 29% of the herds did not have a herder watching over them. Of the herds that did have a herder, 25% were watched over by children with no adults present.

Children carry off a sheep that was killed by a spotted hyaena as they were watching over their herd

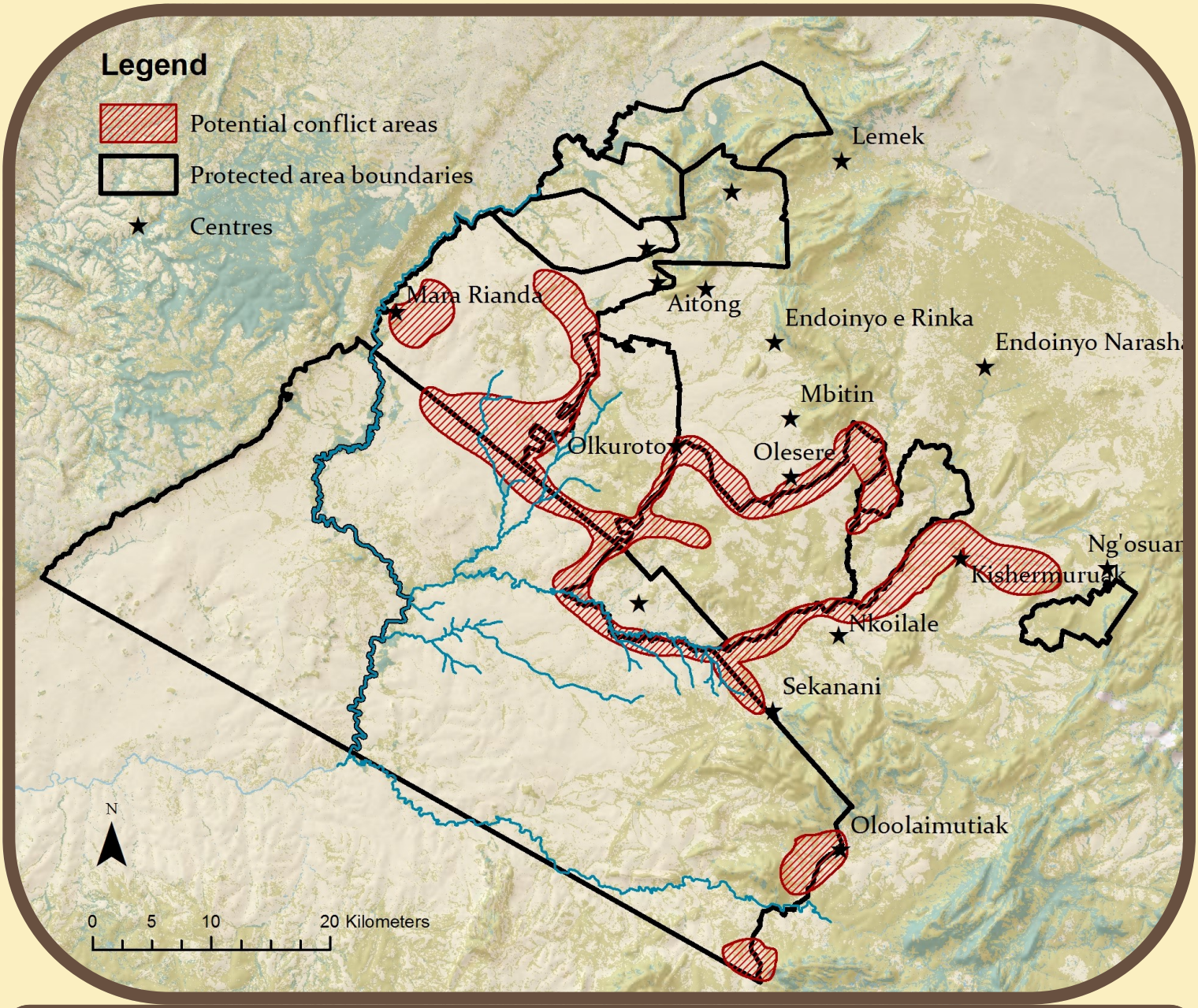
Depredation of shoats by cheetah is most likely to occur outside bomas during the day when there are no herders present or when herds are watched over by children

Recommendations:

Good herding practices should be encouraged and adopted by only having adults herd livestock

Areas where conflict by cheetahs is likely to occur can be determined using data on shoat distribution (see page 34), cheetah distribution (sightings and collar data) and predation events. The following map (page 36) highlights the areas where there is a high possibility of cheetahs predating on shoats when they are outside the *bomas*.

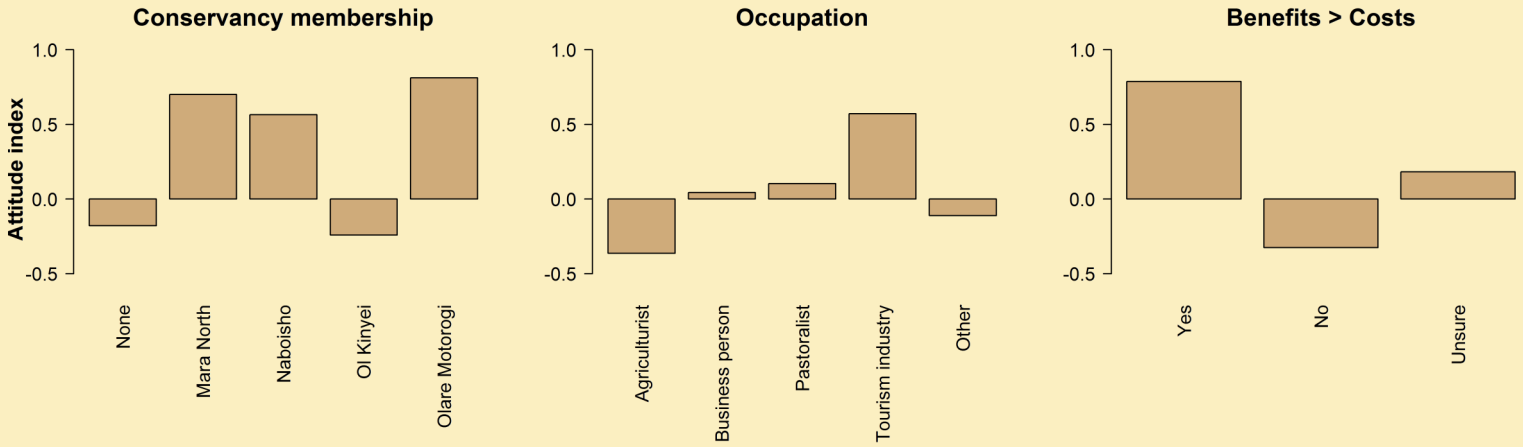
Shoats, especially goats, can have a significant impact on the environment and on predator populations. Goats feed on vegetation that is often unpalatable to other herbivores and when they are grazed in the same area for long periods of time it leads to overgrazing, which can prevent the regeneration of plants which in turn causes soil erosion. This, in addition to the physical disturbance caused by sheep and goats, displaces wild herbivores thereby minimising prey availability for cheetahs (also see page 38). If cheetahs do not avoid areas with high disturbance then they are likely to move through them very quickly. To ensure good connectivity between the different regions within the protected areas (the reserve and the conservancies) and to minimise the chances of cheetahs killing livestock, shoats should be removed from the protected areas, especially along the Northern boundary of the reserve and the boundaries between Mara North and Olare-Motorogi and Olare-Motorogi and Naboisho conservancies. This disturbance is likely to explain some of the cheetah distribution described on pages 26 and 27.



To ensure good connectivity within the protected areas (the reserve and the conservancies) and to minimise depredation, shoats should be removed from the protected areas.

Retaliatory killing

Retaliatory and preventative killing of predators is a major driver of population declines worldwide. Coexistence strategies rely on the notion that by minimising the costs and increasing the benefits associated with predators, people will develop more positive attitudes and be more likely to coexist with them. However, whether human attitudes have a direct bearing on their actions towards predators is variable and case-specific. We conducted structured interviews (n = 747) with communities on the periphery of the Maasai Mara to explore this link. The majority of interviewees (57.52%) were positive and thought that people should coexist with predators. People were more positive if they were members of a conservancy but this varied across the different conservancies. People were also more positive if their primary source of income came from working in the tourism sector, if they lived closer to a wildlife area and if they felt that there were more benefits than costs associated with coexistence. People's attitude towards predators had a direct bearing on their actions as those who thought that humans and predators should not coexist were more likely to kill predators following livestock depredation. Our results suggest that consistent management policies across conservancies, coupled with a more even spread of community-based initiatives and increased employment of people living around wildlife areas in the tourism industry, may improve conservation initiatives.



Negative attitudes are linked to retaliatory killing of predators

Recommendations:

- **Consistent management policies across conservancies**
- **Employ people from around the wildlife areas in the tourism industry rather than people from further afield**
- **Even spread of community based initiatives**

Holistic Resource Assessors programme:

The Holistic Resource Assessors programme has two main objectives:

1. Determine the factors that cause human-wildlife conflict
2. Minimise human-wildlife conflict in the priority cheetah and lion areas

The programme was initiated to better understand the challenges facing predators in priority landscapes within the Mara ecosystem and come up with recommendations as well as activities geared towards promoting coexistence. The unique aspect of this programme is that we examine the ecosystem in a broad context to better understand the drivers of change in the priority areas.

For the initial work, we recruited and trained five community members living in critical landscapes outside of the protected areas. We demarcated a "zone" for each person to patrol within, collecting data on human settlements, human-wildlife conflicts, herbivore communities and grassland health. These five personnel engage with the community on livestock husbandry in an effort to improve ecosystem health and reduce human-wildlife conflicts.

Conflict bomas

Daily each holistic assessor visited two bomas to ask them about human-wildlife conflict incidents they may have experienced in the previous seven days. By always visiting the same bomas each week we are able to continuously map out conflict incidents across 50 bomas. In total the bomas were visited 775 times during which 63 conflict cases were reported.

Herbivore counts

Twice a week the holistic assessors visited two different plots to record grass height and cover, in addition to the number of herbivores, both wild and domestic. All zones had a great deal more livestock, especially shoats, than wild herbivores. Wildebeest were particularly scarce which is of concern for the Loita migration. Future work will focus more on understanding the current extent of this migration.

Camera traps

We set out 15 camera traps at bomas within the HRA zones. The cameras were all set to take pictures at night as we were interested to document the presence of predators in an area. Several predators were captured on camera including leopards, lions, spotted hyaenas and a surprising number of striped hyaenas but their presence rarely resulted in attacks.

Education and Outreach

Wildlife Clubs

To ensure that there is a future for wildlife in the Maasai Mara, it is key to engage with the younger generation by exposing them to wildlife and conservation related topics. In 2016 we continued with the five Wildlife Clubs that we started in 2015 in ADCAM Academy, St. John Paul Academy, Irbaan Primary, Loigero Primary and Mara Hills Academy. So far, 170 children have joined the Wildlife Clubs which take place once a week and are led by the Wildlife Club patron of the school together with Dominic Sakat who is the project's Community Liaison Officer. This year was a success as all the planned activities, which ranged from essay writing competitions and club debates to school clean-ups and the creation of kitchen gardens, were carried out.

Some of the highlights of the year included the annual game drives in the Maasai Mara National Reserve and the conservancies (Mara North and Olare-Motorogi). All 170 members managed to go on the game drives and they had some great sightings of leopards, lions, elephants, cheetahs and the famous wildebeest migration. We also organised various wildlife-related competitions between the five wildlife clubs including the annual art competition and a drama and singing competition that was lead by a local dance group called the Buffalo Dancers.

Our first ever holiday kids' camp was organised and held in August (15^{th}-18^{th}). We hosted 20 children (10 boys, 10 girls) from Mara Hills Academy at the Tony Lapham Predator Hub and engaged them in a series of learning activities. The aims of the kids camp were to engage kids in fun and learning activities during the holidays as well as give them a chance to learn more about the work we do and participate in some of the research activities, so as to make them enthusiastic about wildlife conservation. Some of the other activities they engaged in were drawing of artwork, quiz nights, tutorials, nature walk, films and documentaries, games and game drives into the MMNR.

170 primary school children participated in the Wildlife Clubs, 20 of whom were given the opportunity to attend our first ever Carnivore Kids Camp.

Local meetings (*barazas*)

In 2016 we engaged with more than 700 community members on conservation related issues through 14 local meetings (*barazas*)

Local meetings, also know as *barazas*, are a good platform to engage with the community about conservation and wildlife issues around the Mara. The project organised various *barazas* throughout the year not only to share information about the project and our findings with the community but also to give the community the opportunity to ask questions, share concerns and discuss problems. One of the main aims of the *barazas* was the give the community feedback on the questionnaire survey that was conducted in 2015 and the discussion groups that were held around the Community Film " Because of the Predators".

The first *baraza* was organised for 10 leaders from the community (commonly known as Wamama/ Wazee wa Vijiji) to create awareness about conservation issues and to forge partnerships with the grassroots leaders in protecting predators. At most of the meetings the discussions centred around reducing conflict with predators which included; better bomas with iron sheets on the sides to prevent hyaenas from digging underneath the boma, keeping dogs, lighting fires at night and also ensuring that adults look after livestock to avoid depredation of livestock during the day. Over 600 people from the community attended the 11 meetings that were organised.

As conservation related discussions tend to be dominated by men, three *barazas* were organised just for the women from the community. In total 90 women attended the meetings and the discussions ranged from fences, livestock husbandry to their perceptions towards wildlife. As many of the women had never been in a wildlife area before, we took them on game drives in Naboisho and Mara North Conservancies. They were absolutely thrilled at seeing elephants, lions and hippos on their drives.

Partnerships

Kids game drive with Kicheche camps

In collaboration with Kicheche Camps, a team of 30 children and four teachers from Mara Hills Academy were taken on a game drive in Olare-Motorogi Conservancy. After their game drive the group visited Kicheche Bush Camp where they received drinks, snacks and school supplies that had been donated to Kicheche Camp by one of their guests. This was a unique opportunity for the children to visit a tourist camp and appreciate the role that predators play in uplifting the economy of the country as well as inspire them to want to be conservationists and naturalists. Thanks to Kicheche Bush Camp for the use of their vehicles and excellent guides (James Nampaso and Johnson Kipira). We are keen for as many children as possible to experience wildlife in their natural surrounding so if your camp is keen to take children from the community on game-drives then we would be happy to help organise this.

Dental clinics with The Safari Collection

In November we took part in a series of dental clinics which were organised by The Safari Collection giving us a good opportunity to screen and discuss our in-house film "Because of the Predators" whilst the patients were waiting. The project's Community Team was also instrumental in doing translations for the dentists as they treated the people who required medical attention. We attended the three clinics that were held in Endoinyo Narasha, Talek and Aitong where about 150 people were treated. These events are instrumental in demonstrating that wildlife conservation and tourism play a role in community development and support welfare activities.

Stakeholder engagement

Narok County Government Spatial Planning meeting

In July, Femke Broekhuis was invited by the Narok County Government to attend one of their spatial planning meetings. For this process three thematic groups have been developed: environmental, social and economic, and the final spatial plan will be developed based on the agreed negotiated position of all three groups. The aim of this specific meeting was to sensitise and seek support from stakeholders on County Spatial Plan's Precautionary Zoning of the Environment and Conservation Thematic area. The County Spatial Plan is a long-term territorial strategy to guide physical development activities within Narok County.

KWS Annual Carnivore Conference

This year's KWS annual conference was held on the 13th and 14th of November. The theme for this year's conference was ***"Integrating land use plans to carnivore conservation and diseases affecting carnivores"***. Michael Kaelo, Femke Broekhuis, Dominic Sakat and David Thuo took attended the conference that was held at the KWS headquarters. Michael Kaelo gave a presentation entitled "Coexistence with large carnivores: Attitudes and Actions in Maasai Mara". The presentation was an excerpt from a paper that we have so far submitted for publication in a reputable journal.

Pathways Conference

Michael Kaelo and Francis Sopia were privileged to attend the Pathways Conference held at Fairmont Mt. Kenya Safari Club in Nanyuki from 10th-13th January. Pathways Kenya was an international gathering of 200+ scientists (mostly from academia but also from NGO and government agencies) and practitioners (NGO leadership, government wildlife management agency employees, ranchers/pastoralists involved in conservation, etc.) from 27 countries. The conference offered sessions ranging from human-wildlife conflict to wildlife governance and community-based conservation.

Other Project Activities

Personal Development

Photography workshop

Good photographs, both for predator identification and our media, are essential to our work. As such, the Mara Cheetah and Lion Project arranged for a two day photography workshop for the entire team. Professional photographer Lorna Buchanan-Jardine gave the workshop at the Tony Lapham Predator Hub on 19th and 20th January 2016. Lorna did a wonderful job and the photographs from the team members have improved significantly as a result.

Drama workshop

The drama workshop was held on 8th January 2016 at The Maa Trust. The aim of the workshop was to equip participants with skills for involving/engaging communities in decision making. The training was facilitated by Professor Drew Khan a theatre professor at Buffalo State University of New York. It was a very participatory workshop which involved people emulating the decisions made by another i.e one person would say/ do something and the rest repeat it and then a change where each individual would make a sound unique to themselves. This served to illustrate the complexity of decision making in a society and hence the need to appreciate and take into account values of different actors in a project set up.

GIS training

Understanding and interpretation of spatial data is very key to the studies of free ranging wildlife species. As such, the project supported David Thuo to attend a five-day Geographic Information Systems (GIS) course at the Regional Centre for Mapping of Resources for Development (RCMRD). David hopes to utilize the skills he acquired in the analysis and interpretation of the data that Mara Cheetah Project has collected over the years.

Monitoring and Evaluation training

In April, Michael Kaelo attended a two-day workshop on Monitoring and Evaluation (M&E) organised by Ewaso Lions and held at their base in Samburu. The workshop was aimed at equipping conservation practitioners with the relevant knowledge of measuring progress towards achieving goals and objectives set out in their organisations. Shivani Bhalla (Director of Ewaso Lions) and Heather Gurd (Conservation Manager for Ewaso Lions) were the trainers and the participants came from various organisations in Kenya.

The training covered an introduction to M&E, why it is important and the process of carrying out an M&E with practical sessions included. The training also included a conflict and coexistence training which highlighted issues of decision making and resolving conflicts arising from different stakeholders involved in conservation of wildlife. The training was vital at instilling skills necessary for measuring impacts of an organisation as well as planning for changes to improve performance of an organisation.

Wildlife Poisoning Response training

On 15th-17th November Femke, Michael and Dominic attended the first ever Wildlife Poisoning Training in Kenya. The workshop was organised by the Mara Lion Project, Peregrine fund, Nature Kenya and Birdlife International. Wildlife poisoning expert Andre Botha (Endangered Wildlife Trust) took the participants through a series of lectures and practical sessions detailing how to handle a wildlife poisoning incident from site arrival, collecting evidence, filling forms, documenting the evidence and chain of custody for evidence and finally decontamination of the site. The training was attended by over 35 participants from 35 different organisations ranging from Conservancy managers, rangers, wardens, and researchers among others.

The whole team upskilled this year by attending various workshops and training sessions that ranged from photography to dealing with wildlife poisoning events.

Publications

This year the Mara Cheetah Project produced the following publications in peer-reviewed journals, all of which were featured in various media outlets:

Counting Cats: Spatially explicit estimates of cheetah (*Acinonyx jubatus*) using unstructured sampling data

Authors: Femke Broekhuis and Arjun Gopalaswamy

Journal: PLOS ONE

Summary: Many ecological theories and species conservation programmes rely on accurate estimates of population density. Accurate density estimation, especially for species facing rapid declines, requires the application of rigorous field and analytical methods. However, obtaining accurate density estimates of carnivores can be challenging as carnivores naturally exist at relatively low densities and are often elusive and wide-ranging. In this study, we employed a new method to provide the first rigorous population density estimates of cheetahs in the Maasai Mara, Kenya. We estimate adult cheetah density to be between 1.28 and 1.34 individuals/100km^2. Our spatially explicit approach revealed 'hotspots' of cheetah density, highlighting that cheetah are distributed heterogeneously across the landscape. This sampling and modelling framework will help determine spatial and temporal variation in cheetah densities, providing a foundation for their conservation and management.

Role reversal: Record of cheetah (*Acinonyx jubatus*) kleptoparasitizing a kill from a spotted hyaena (*Crocuta crocuta*)

Authors: Femke Broekhuis and Onesmus Irungu

Journal: African Journal of Ecology

Summary: It is well known that lions and spotted hyaenas kleptoparasitise, or steal, kills from cheetahs. However, while it is rare, cheetahs do occasionally steal kills themselves. In this publication we report on a rare sighting where a female cheetah with three older cubs stole a kill from a spotted hyaena. This sighting suggests that cheetahs might be more flexible in the way that they acquire food than we might have realised, adding to the natural history of this species.

Disappearing spots: The global decline of cheetah and what it mean for conservation

Authors: Lead by Dr. Sarah Durant and co-authored by researchers from various organisation across the cheetah's range, including Femke Broekhuis

Journal: Proceedings of the National Academy of Sciences

Summary: Establishing and maintaining protected areas (PAs) are key tools for biodiversity conservation. However, this approach is insufficient for many species, particularly those that are wide-ranging and sparse. The cheetah *Acinonyx jubatus* exemplifies such a species and faces extreme challenges to its survival. Here, we show that the global population is estimated at ˜7,100 individuals and confined to 9% of its historical distributional range. However, the majority of current range (77%) occurs outside of PAs, where the species faces multiple threats. Scenario modeling shows that, where growth rates are suppressed outside PAs, extinction rates increase rapidly as the proportion of population protected declines. Sensitivity analysis shows that growth rates within PAs have to be high if they are to compensate for declines outside. Susceptibility of cheetah to rapid decline is evidenced by recent rapid contraction in range, supporting an uplisting of the International Union for the Conservation of Nature (IUCN) Red List threat assessment to endangered. Our results are applicable to other protection-reliant species, which may be subject to systematic underestimation of threat when there is insufficient information outside PAs. Ultimately, conserving many of these species necessitates a paradigm shift in conservation toward a holistic approach that incentivizes protection and promotes sustainable human–wildlife coexistence across large multiple-use landscapes.

Most cheetah occur outside protected areas and when cheetah population growth rates are suppressed outside protected areas, extinction risk increases markedly.

Recommendation:

Cheetah conservation requires a holistic approach that engages rather than alienates local communities.

For a complete list of publications visit **www.maracheetahs.org/publications/**.

Media coverage

News

The work and outputs of the Mara Cheetah Project got a lot of coverage in the news this year through various TV, radio and online outlets. Here is a selection of some of the news pieces:

- BBC News - Cheetahs heading towards extinction as population crashes
- BBC World Service - interview with Femke Broekhuis about cheetah numbers in the Maasai Mara
- BBC Radio Oxford - interview with Femke Broekhuis on counting cheetahs in the Maasai Mara
- Huffington Post - Counting cheetahs: a new approach yields results in the Maasai Mara
- The Times - Error spotted in cheetah population
- Chicago Tribune - Cheetah numbers decline as African habitat shrinks
- Narok Newspaper - Maasai Mara: Estimates of cheetah numbers are 'guesswork'
- EarthTouch - Scavenger switch: cheetah family steal a meal from a spotted hyena
- New Scientist - Cheating cheetahs seen chasing hyena before stealing its prey

Documentaries and TV series

In 2016 the Mara Cheetah Project was featured in the following productions:

- NTV Wild Talk - Saving Kenya's Big Cats. The Mara Cheetah Project was featured through an interview with Femke Broekhuis. The episode was aired on NTV, a Kenyan TV station.
- Passion Passport and Adobe created a photojournalism story on the Mara Cheetah Project for an exhibition that took place in Los Angeles in April 2016 www.passionpassport.com/passport-to-creativity-kenya/
- Warner Brothers came to the Mara for five days in December to film the Mara Cheetah Project for a 45 min episode for a series on researchers living out in the wilderness. The episode will be aired on NPO1, a Dutch TV station, mid-2017 and it is expected to reach a viewership of 1 million.

Popular articles

The Mara Cheetah Project published the following popular articles:

- Cheetah: Is the fastest land mammal racing to extinction? – Femke Broekhuis (Swara, October-December 2016)
- Counting cheetahs: a new approach yields results in the Maasai Mara – Femke Broekhuis (The Conversation, May 2016)

Partners and collaborators

We are proud to be working with both local and international partners, without whom we would not have been able to achieve what we have. We would like to thank the following partners for their continued support and we look forward to continuing these partnerships going into the future:

- **Narok County Government**
- **Kenya Wildlife Services (KWS)**
- **Maasai Mara Wildlife Conservancies Association (MMWCA)**
- **Mara Lion Project**
- **Dr. Arjun Gopalaswamy**
- **Smithsonian Institution**
- **Wildlife Conservation Research Unit (WildCRU), University of Oxford**
- **Mara Triangle (Mara Conservancies)**
- **Mara North Conservancy**
- **Olare-Motorogi Conservancy**
- **Naboisho Conservancy**
- **Ol Kinyei Conservancy**
- **Lemek Conservancy**
- **Ol Chorro Conservancy**
- **Enonkishu Conservancy**

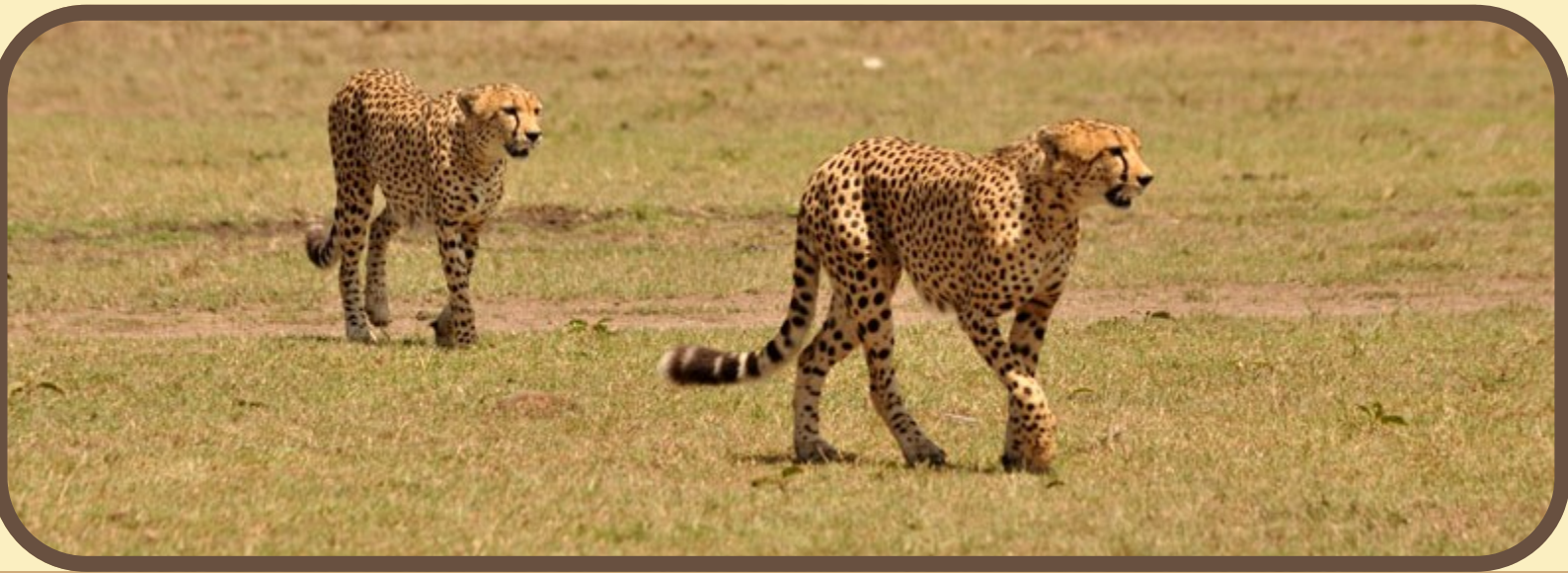
Acknowledgements

We would like to thank everyone who has supported us in this project and we hope your support will continue into the foreseeable future. We have been truly touched by your enthusiasm and passion.

Donations

The running costs, from vehicle fuel and maintenance to salaries and equipment, are the hardest things to find funding for, yet without it we would not be able to monitor cheetahs on a day-to-day basis and collect the necessary data needed to establish the ecology and threats that cheetahs face in the Maasai Mara. We are therefore particularly grateful to the following donors for their unrestricted funding which enables us to run this project:

- **Delta Trust**
- **Evergreen II Trust**
- **Angus & Margaret Wurtele**
- **Mason Thalheimer and Samlyn Capital**
- **J.A. & H.G Woodruff, Jr. Charitable Trust**
- **Asilia Africa**
- **Margaret Prentice and John Dyson**
- **Naboisho Camp**
- **Sala's Camp**
- **Rekero Trust**
- **William and Crystal Ribich**
- **Big Cat Rescue**
- **Various donors who donated through our CrowdRise campaign**



We would also like to thank the following donors for supporting specific projects:

- **BAND Foundation** for providing the funding for the biomedical project.
- **Banovich Wildscapes Foundation** for funding the purchasing of five satellite collars and for covering veterinary costs.
- **VIDDA Foundation** for providing funding for the purchase of field vehicles and for covering running costs.
- **Base Camp Foundation** (BCF) for supporting various community projects including the Wildlife Clubs and the human-wildlife conflict questionnaire survey and for covering costs of local salaries of the community team.
- **African Wildlife Foundation** (AWF) for funding Holistic Assessor Program and covering local salaries and vehicle running costs - without which we would not be able to do our work.
- **Kicheche Bush Camp** guests for their generous donation of equipment such as binoculars.

In addition to the financial support there are various individuals, organisations and projects who have supported the Mara Cheetah Project through the provision of photographs and locations of cheetahs and through logistic support.

Data and photos

Thank you to all of you who have provided us with photos and reports on cheetah sightings. In particular we would like to thank the numerous guides from Naboisho Camp, Rekero Camp, Sala's Camp and Kicheche Bush Camp for reporting cheetahs sightings. We would also like to thank the following:

- Dr. Irene Amoke for providing the data on accommodation in the Mara
- MMWCA for providing the shapefiles for the conservancy boundaries and centres
- Maasai Mara Science and Development Initiative for providing data on fences

Logistic support

We would like thank Olpurkel and the Maa Trust for their support in running the Tony Lapham Predator Hub. We would also like to thank Asilia, The Safari Collection, Seiya and Kicheche for their support on the ground.

How you can help

There are various ways in which you can support to work by the Mara Cheetah Project.

Report cheetah sightings

Sightings of cheetahs help us in our monitoring efforts. If you would like to help then please provide your cheetah sightings through one of the following channels:

- Download Spot-a-Cat (http://www.maracheetahs.org/spot-a-cat/), an Android App available in Google Play that allows everyone to record cheetah sightings. The App allows users to upload sightings with photos, view an interactive map of their sightings and learn about cheetahs in the "fact file".
- Fill in the online sighting form on the project website (http://www.maracheetahs.org/how-to-help/cheetah-sightings/).
- Email your sightings to sightings@maracheetahs.org

Make a donation

To ensure the long term success of the Mara Cheetah Project it is crucial that there is funding available for the core running costs which include staff salaries, vehicle maintenance and fuel, fees for permits and basic project equipment. With these costs covered the team can continue with the important day-to-day monitoring of the cheetah population in the Maasai Mara.

US $300

Can purchase a camera which can be used by safari guides to help with cheetah monitoring

US $1,500

Covers the cost of research equipment needed to monitor and collect data on cheetahs

US $2,000

Covers the cost of fuel and vehicle maintenance for all project vehicles for 3 months

US $7,500

Covers the salary for a local research assistant

Donations can be made through the Mara Cheetah Project website (http://www.maracheetahs.org/how-to-help/donations/).

Email: info@maracheetahs.org
Website: www.maracheetahs.org
Twitter: www.twitter.com/MaraCheetahs
Facebook: www.facebook.com/MaraCheetahProject
Instagram: www.instagram.com/MaraCheetahs