

Mara Cheetah Project

Kenya Wildlife Trust



KENYA WILDLIFE TRUST

Annual Report

2015

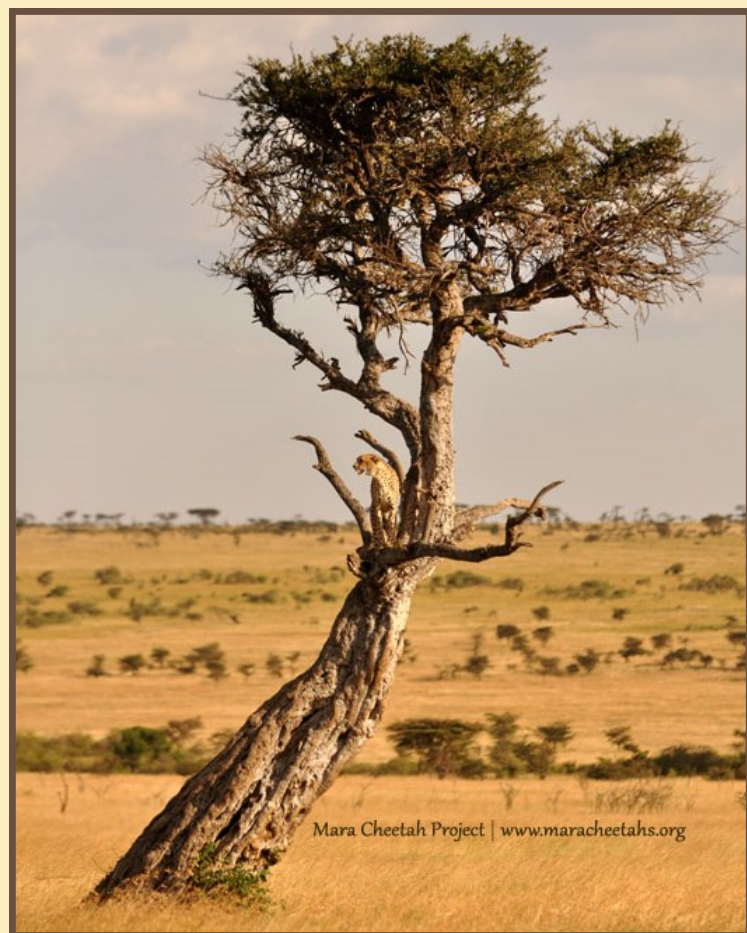
Executive summary



It has been another busy, but very productive year. This is not to say that we have not had our challenges! The weather for one has been interesting. We have had a lot more rain compared to the previous year which has made our work challenging both for the field team and for the community team. We have all had our bouts of deep river crossing and getting stuck but luckily there have been many kind people who have helped us get out of some of these sticky situations. Despite all this we have still managed to achieve a great deal!

One of the Mara Cheetah Project's main objectives is to determine how many cheetahs there are in the Maasai Mara and to monitor these numbers over time. To achieve this we have teamed up with Dr. Arjun Gopalaswamy and we are using a spatially explicit capture recapture method to accurately estimate cheetah densities in the Mara. We are still finalising the analysis but the numbers will be out soon! This year also saw the launch of the Biomedical project, a partnership with the Kenya Wildlife Service and the Smithsonian Institute. We have managed to collect some important genetics and disease samples that we are planning on analysing in the coming year. The Mara Cheetah project has also been given permission to deploy collars on cheetahs which is an exciting achievement. The collars should give us some useful data that will give us a unique insight into cheetah movement and space use.

This year we have had a big outreach into the communities around the Mara. The community team have successfully set up Wildlife Clubs in five different schools in the Aitong and Talek areas, interviewed 818 people about human-wildlife conflict problems and completed 52 film screenings to a total of 602 people. This has allowed the community team to engage with the communities on several different levels which has generated some very interesting (and sometimes heated!) discussions. The next step is to give feedback to the communities on some of the issues that were discussed.



With the support that everyone has given us we have been able to achieve a significant amount in the past year. Some of the key achievements are highlighted in more detail in this report.

Contents



Mara Cheetah Project

- **Project overview 4**
- **Where we work 5**
- **Meet the Team 7**

Research

- **Monitoring 10**
- **Satellite collars 15**
- **Biomedical research 19**
- **Environmental variables 21**

Community

- **Wildlife Clubs 23**
- **Human-wildlife conflict 24**

Outreach

- **Training 28**
- **Publications and media 29**
- **Collaborations and partners ... 30**

Future plans 31

Acknowledgements 32

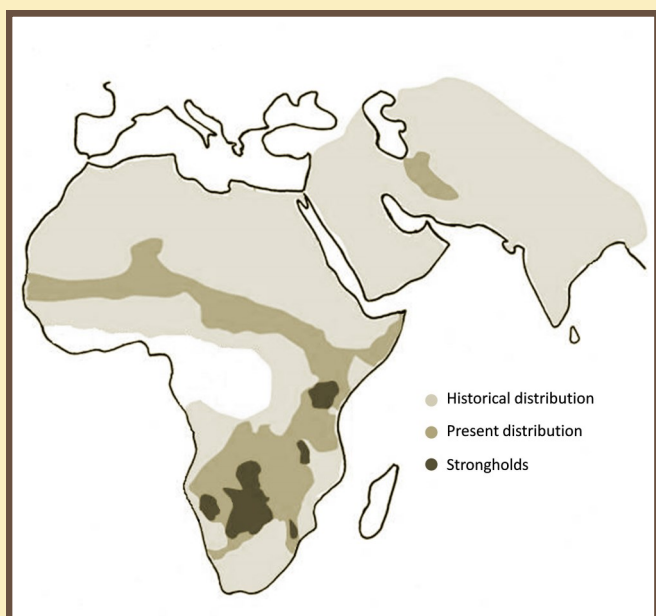
How you can help 34

Project overview



Background

The global cheetah population is rapidly dwindling and with an estimate of 7,500 and 10,000 individuals left in the wild, cheetahs are vulnerable to extinction. The remaining populations will continue to decline unless something is done. Realising this, the Kenya Wildlife Trust set up the Mara Cheetah Project in June 2013 in order to determine the threats that cheetahs face in the Maasai Mara landscape and to develop sustainable solutions to mitigate them. To achieve this, the Mara Cheetah Project is using a research-driven conservation approach through a combination of long-term population monitoring, ecological research and community-based conservation.



Aims and objectives

Using a research-driven conservation approach the main objectives of the project are to:

1. Determine the current and long-term status of the cheetah population
2. Collect baseline data on cheetah ecology and behaviour
3. Identify the threats that cheetahs are facing
4. Develop sustainable solutions to mitigate threats

The Mara Cheetah Project has developed close working relationships with on the ground practitioners, policy makers and stakeholders. In the Mara, we are continuously liaising with conservancy managers, Narok County Government officials and the Kenya Wildlife Service. Since its inception, the Mara Cheetah Project has enjoyed a close working relationship with the Kenya Wildlife Service both in the Mara and at their head offices in Nairobi. This relationship has evolved into a series of collaborations on a variety of projects with exciting prospects for the future.

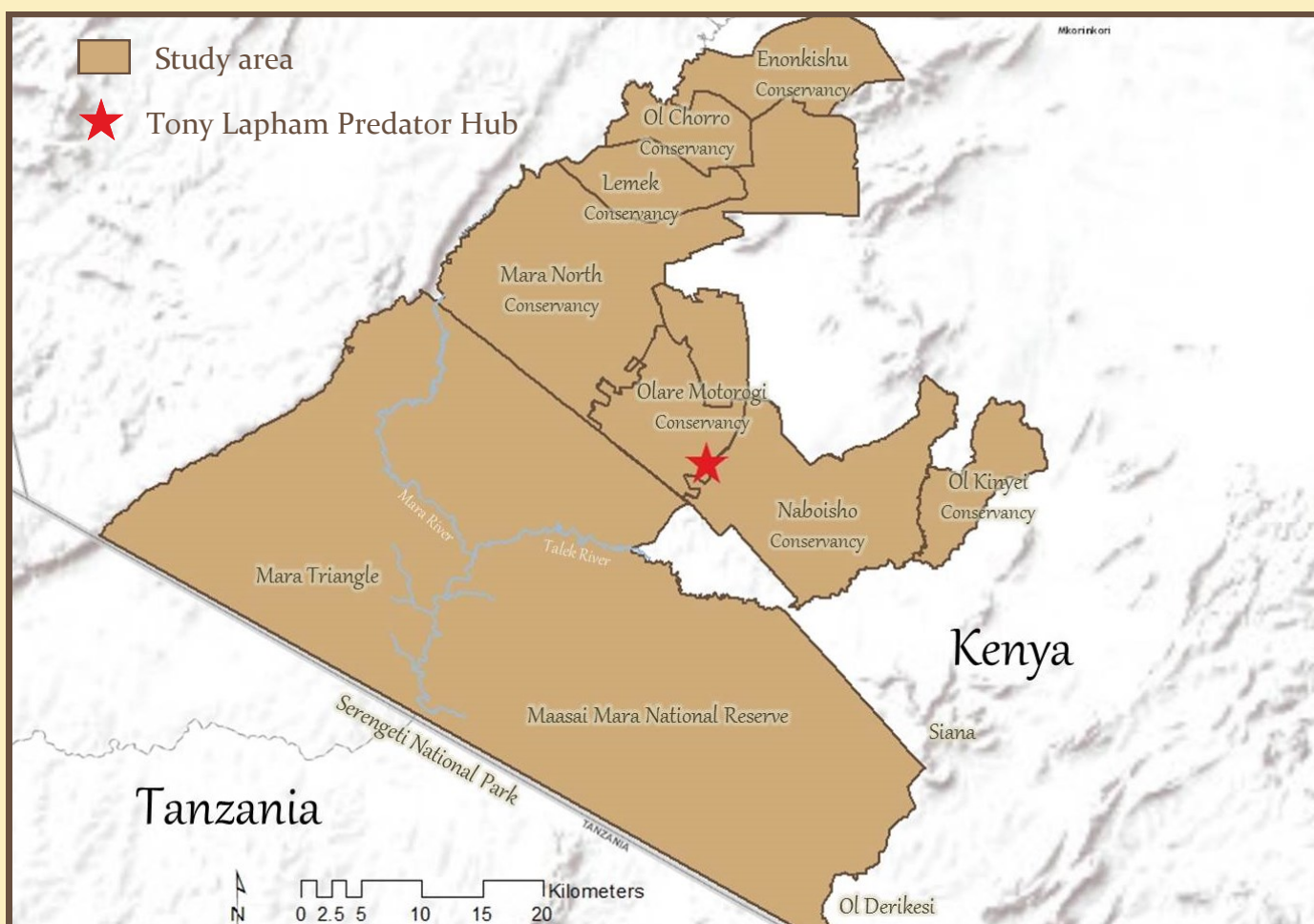
Due to our research-driven conservation approach and good relationships with relevant stakeholders, this long-term project is looking to make a significant contribution to cheetah conservation both in Kenya and in the rest of Africa.

Where we work



Study area

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 run by private management companies. 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 to 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 as are other prey species such as Grant's gazelle, impala and hares.

Where we work



Tony Lapham Predator Hub

The Tony Lapham Predator Hub, or 'The Hub' as it is more commonly known, is intended as a long-term predator research centre for the Mara and is the research base for both of the Kenya Wildlife Trust's flagship projects, the Mara Cheetah Project and the Mara Lion Project. The Tony Lapham Predator Hub was built through the kind donations of Nick Lapham and Skip Dunn in memory of Tony Lapham. Situated on the boundary between Olare-Motorogi and Naboisho conservancies, the Predator Hub is perfectly positioned at the interface between wildlife and the surrounding communities.



Fig 1: The new staff housing provided by the Kenya Wildlife Trust for the field team based at the Tony Lapham Predator Hub in the Maasai Mara. Above: Staff housing under construction, Below: Completed staff housing

In the last year the teams have grown significantly so there was a need to expand and improve some of the infrastructure. Through a generous donation from both the Delta Trust and the BAND foundation the Kenya Wildlife Trust upgraded the staff housing for the Mara Cheetah and Mara Lion Project team. The new staff housing includes 6 rooms, two bathrooms, a living space, a kitchen, a solar system for power and plenty of water tanks to collect rain water (Fig 1). In the coming year the Kenya Wildlife Trust is planning on upgrading the office space.

Meet the Team



The team has grown! In the last year we have had five people based in the Mara, three for fieldwork and two for the community projects, and an additional two people based in Nairobi, one in the Kenya Wildlife Service's lab and one intern based at the Kenya Wildlife Trust's office.

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.



Mr. Saitoti Silantoi - Research Assistant

Saitoti was born and raised in Naroosura, an agricultural hub below the Loita hills. Growing up surrounded by wildlife he was immediately attached to them. He attended Kuntai Primary School, Ole Ntutu Arid Zone, Tenwek High School and later the Kenya Wildlife Service Training Institute for a diploma in Wildlife Management. He worked in Olare-Motorogi Conservancy as a wildlife warden and communications officer before joining the Mara Cheetah Project.



Meet the Team

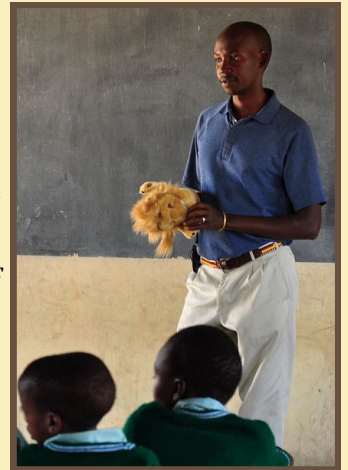


Mr. Michael Kaelo - Chief Community Officer

Michael was born and raised in Enkobiletai (Enoonkishu Conservancy – 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 research 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 is a very valuable member of our community team.

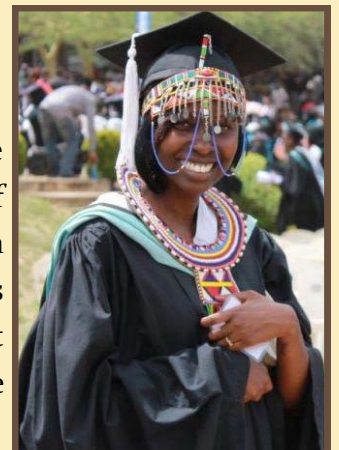


Dr. Patrick Chiyo - Geneticist and lab technician

Patrick completed his M.Sc. at Makerere University (Uganda) and his Ph.D. at Duke University (USA). For both degrees he investigated elephant ecology and socio-ecology and the relationship to crop raiding in both Kibale National Park (Uganda) and in Amboseli (Kenya). Patrick is currently working part-time for the Kenya Wildlife Trust and is conducting the genetic analysis for the biomedical project.

Ms Fiona Naiya Tande - Intern

Fiona is a Maasai from Ngong, Kajiado. She holds a Bachelor of Arts degree in Community Development from Daystar University and has a couple of years' experience in wildlife conservation. Fiona joined the Mara Cheetah Project in May 2015 to help with the cheetah identification software that is being developed by the University of Surrey as well as helping set up Wildlife Clubs of Kenya and entering the data from the human-wildlife conflict questionnaire.





Research



Monitoring



The Greater Mara Ecosystem is a critical part of the global cheetah range but little is known about cheetah numbers, ecology and behaviour in this area. Our objective is therefore to fill this gap both through long-term monitoring of cheetahs and through hypothesis driven research.

Together with the Mara Lion Project we spend a significant amount of time in the field finding cheetahs (and other predators) and recording data on their location, structure of social groups, kills made and behaviour. In addition we collect faecal samples when following cheetahs for genetic and dietary analysis.

All data, including cheetah sightings, sightings of other predators, livestock, and tourist cars are recorded using an in-house application built in Cybertracker. In addition, 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 (Fig 2).

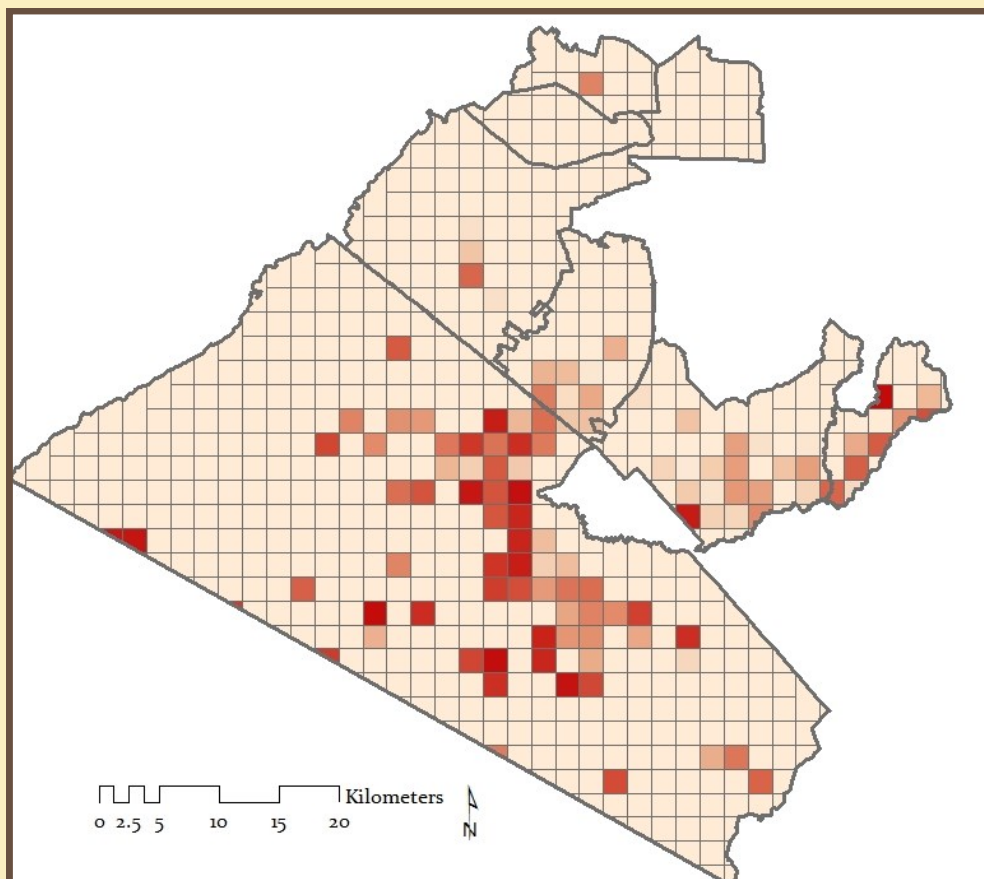


Fig 2: Cheetah sightings in 2015 weighted for the amount of effort in each 2 km x 2 km grid cell. Red areas have high cheetah sightings per unit effort and light pink areas have low cheetah sightings per unit effort.

Species	Number of sightings
Aardwolf	2
Bat-eared fox	80
Black-backed jackal	926
Caracal	1
Cheetah	260
Leopard	29
Lion	768
Serval	6
Side-striped jackal	6
Spotted hyaena	994
TOTAL	3072

In 2015 we spent a total of 2557 hours in the field and jointly travelled a distance of 32,056 kilometres. During this time we recorded 3072 predator sightings, of which 260 were of cheetahs (Table 1).

Table 1: Number of predators seen in the Maasai Mara in 2015.

Monitoring



Cheetah sightings

In 2016 we saw 38 different adult cheetahs (19 male and 19 female) over 271 of our own sightings (11 of which were not logged using the Cybertracker app; Fig 3). The number of sightings of individual cheetahs ranged from 1 - 49. Table 2 is a summary of 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 and therefore some individuals would have been seen in two or three different areas. For this reason the sum of the totals in Table 2 will not be the same as the number of individuals that are reported to be seen (38).

Table 2: Number of cheetahs seen in the different management areas in the Maasai Mara. The numbers in parenthesis are the number of females that were seen with cubs.

Management area	Area (km ²)	Adult females	Adult males	Total
Maasai Mara National Reserve	1025	8 (5)	8	16
Mara North Conservancy	345	2 (1)	2	4
Mara Triangle	500	1 (1)	3	4
Naboisho Conservancy	210	5 (3)	2	7
Ol Chorro Conservancy	53	0 (0)	1	1
Ol Kinyei Conservancy	63	5 (3)	1	6
Olare-Motorogi Conservancy	138	8 (4)	6	14

While these are the number of adult cheetahs that we have seen in 2015 we used a capture mark recapture technique to estimate the density of cheetahs (page 12).

We received data on an additional 70 sightings through various 'citizen scientists' who sent emails, uploaded sightings on our online 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).



Fig 3: Mara Cheetah Project's research assistant collecting data at a cheetah sighting in the Maasai Mara.

Understanding variations in densities over both space and time is key for conservation and management. Therefore, to accurately estimate the densities of cheetahs in the Maasai Mara we partnered with Dr. Arjun Gopalaswamy who at the time was working Wildlife Conservation Research Unit (WildCRU) at the University of Oxford in the United Kingdom (Fig 4). Dr. Gopalaswamy has a vast experience in spatially explicit mark-recapture methods to accurately estimate densities, especially of elusive carnivores such as tigers. This method is based on identifying individual cheetahs and resighting them within a given timeframe to estimate the number of individuals in an area. This method is often used for camera trap studies but we have adapted it to our sighting, or ‘search encounter’ data collection methods.



Fig 4: Collaborator Dr. Arjun Gopalaswamy on his visit to the Tony Lapham Predator Hub. Dr. Gopalaswamy is using spatially explicit mark-recapture methods to estimate cheetah densities in the Maasai Mara.

In order 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 problems related to increase or decrease of the population through birth/death or immigration/emigration. Based on our cheetah sightings we have come to the conclusion that a three month period is likely to represent a 'closed' population. As a result we have divided our fieldwork into four blocks (Fig 5); two intensive monitoring session (red) where we collect data to calculate the estimated cheetah density in the Maasai Mara both during and out of the migration and we have two less intensive sessions (light brown) where we still collect data in the field but we also spend time managing and analysing data and writing up results for reports and publications. In the coming years we will adhere to this workplan so that we can start monitoring changes in cheetah densities over time.

	January	February	March	April	May	June	July	August	September	October	November	December
Monitoring sessions												

Intensive monitoring
 Less intensive monitoring

Fig 5: Workplan of both our intensive and less intensive monitoring sessions. The sighting data collected during the intensive monitoring sessions are used to estimate cheetah densities throughout the Maasai Mara.

Monitoring



Cub births and survival

In 2015 we recorded the births of 30 cubs to nine different females. Of these 16 have so far survived but as some of these cubs are still young we expect the mortality to increase. Cheetahs cubs die due to an array of reasons including disease, starvation, abandonment and predation by other carnivores. Unfortunately in most cases it is extremely difficult to establish the cause of death. There was however one case reported of a 16 month old cub that was killed by a crocodile while crossing the Talek river with its mother and siblings.

'New' adults

In 2015 we sighted 7 'new' individuals—5 of these were dispersers and 2 were adult males. Cubs tend to leave their mother when they are around 18 months old but this can range between 14-22 months. In 2015 we recorded two dispersal events of two cubs from two resident females. This is lower than in 2014 where five cubs dispersed from two females. However, with the large number of cubs that were born in 2014 and 2015 we suspect that there will be a high rate of dispersal in 2016.

In addition to the dispersal of cubs from known cheetahs in the Mara we also came across a group of three young males who were likely dispersals from another area. The three males were first seen in the Maasai Mara National Reserve in June 2015 and during the following weeks they were sighted in Mara North, Ol Chorro and Naboisho before 'disappearing'.

Adult deaths

Of the 44 adult cheetahs that were sighted in 2014, 31 were resighted in 2015. While it is possible that the majority of the 13 individuals that were not sighted in 2015 might appear again at a later date, some of them would have died.

In 2015 we recorded the deaths of four adults (1 female and 3 males). While we suspect there might have been a few more individuals that have died during this period, we did not find their remains. Of the four remains we found we suspect one was caused by conflict with a lion and the other three were a result of disease (see page 20 for more details).



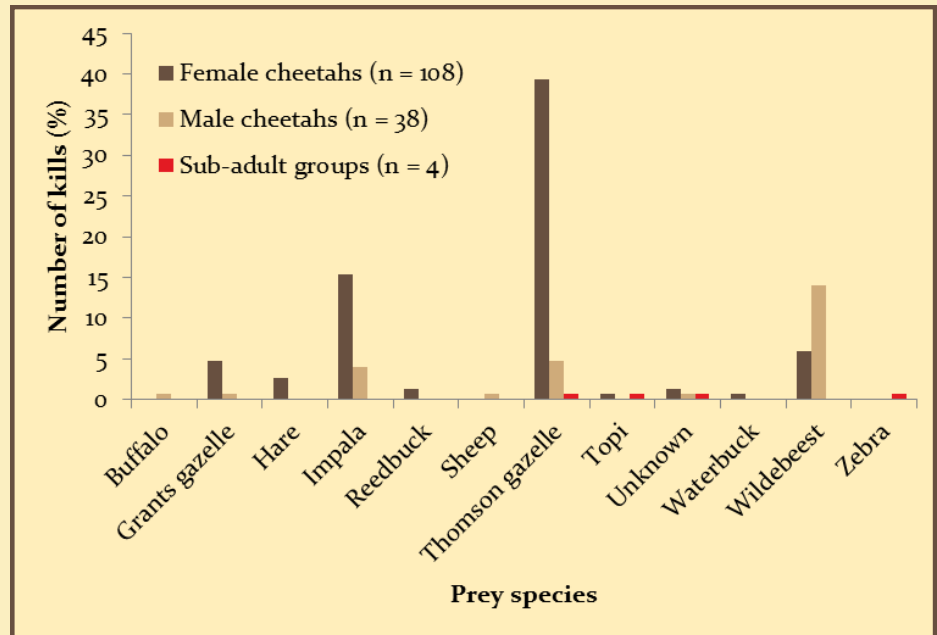
Monitoring



Kills

Since the beginning of the project we have recorded a total of 150 cheetah kills - 108 made by female cheetahs, 38 by male cheetahs and four by sub-adult groups that dispersed from their mothers (Fig 6). Based on these data there is a clear differentiation in prey selection - female cheetahs tend to take down more Thomson's gazelle and impala whereas male cheetahs tend to take down more wildebeest.

Fig 6: Prey preference of cheetahs in the Maasai Mara split according to social groups.



Interactions with other predators

Cheetahs suffer from negative interactions with other predators through direct mortalities and kleptoparasitism (stealing of kills). To quantify the rate of kleptoparasitism we try and stay with cheetahs on a kill until the cheetah leaves its kill. On 83 occasions we managed to stay with the kill until the cheetah left it and kills were only stolen 8.3% of the time. This is lower than the rate of kleptoparasitism recorded in the Serengeti National Park (Tanzania) and Kruger National Park (South Africa) where approximately 12% of all kills were stolen. Interestingly, on one occasion a guide from one of the Asilia camps reported seeing an adult cheetah with three big cubs stealing a kill from a spotted hyaena (Fig 7).



Fig 7: An adult female cheetah chasing a spotted hyaena away from a kill it just made. Photo credit: Onesmus Irungu

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 (MCP) through satellite communication which will allow 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 be able to better understand, identify and respond to threats. For example, the collars will enable us to:

- Identify important areas and habitats that are used by cheetahs incl. wildlife corridors
- Understand how anthropogenic changes (i.e. erection of fences) will effect cheetah movement and behaviour
- More easily keep track of cubs being born and be more likely to accurately determine the cause of death
- Determine how much time cheetahs spend outside wildlife areas and therefore determine how prone they are to human-wildlife conflict
- 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 will allow us to investigate any natural and human-caused death in a timely manner.

Satellite collars



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 will undertake the following:

- The belting of the collar is painted with a spot pattern and will therefore be 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 satellite and therefore unable to collect GPS locations
- The battery power required to collect data makes the device too big to implant. The current collars are 400gr which is much lower than the max that can be put on an animal (about 3% of body weight).

Satellite collars



Collared cheetahs

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.

To date we have managed to collar two individuals. We were hoping to have deployed all the collars by the end of the year but the coordination of target cheetah and KWS veterinarian is proving to be slightly challenging. In addition, some of the individuals that we were planning to collar have currently got cubs and for the safety of the cubs we do not want to immobilise mother when the cubs are too young. The two individuals that we have collared are known as Noosura and Nabiki.

Noosura

In April we deployed a satellite collar on Noosura, a female cheetah who at the time had four cubs (Fig 8). Noosura was chosen because, based on sightings, we believe that she spends a significant amount of time outside the wildlife areas where she is likely to be encountering human settlements and livestock. The collar was giving us some great data, but after several months it unfortunately stopped sending data. Since then Noosura has been seen once with the collar but we were unable to get a veterinarian to remove the collar. We are still searching for her but since she spends a lot of time outside the wildlife areas we are finding it difficult to locate her. If you see her, please let us know as soon as possible so that we can try to remove the collar.



Fig 8: Noosura with an AWT satellite collar.

Nabiki

In September we deployed a second satellite collar, this time on a female called Nabiki (Fig 9). The Mara Cheetah Project team has known Nabiki since the beginning of the project and with help from guides and tourists we have established that she was born in September 2010 which means she was 5 years old when we collared her.

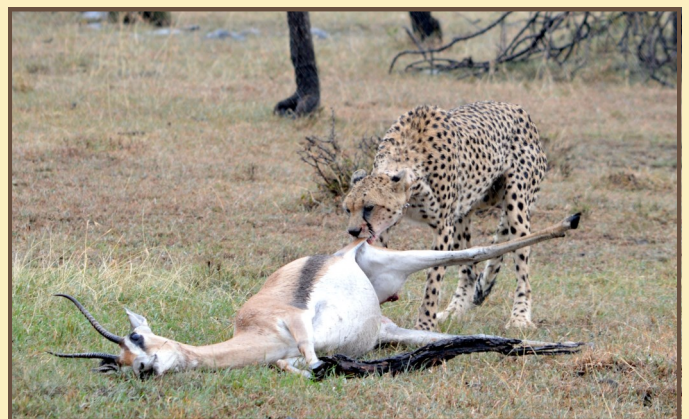
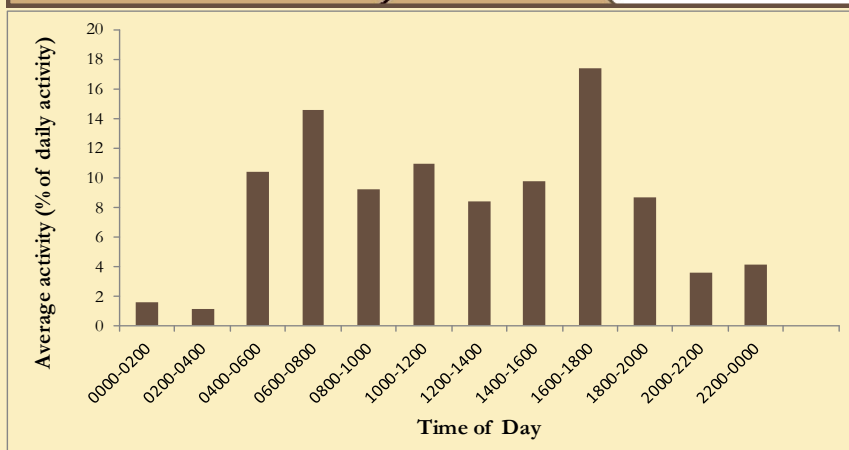
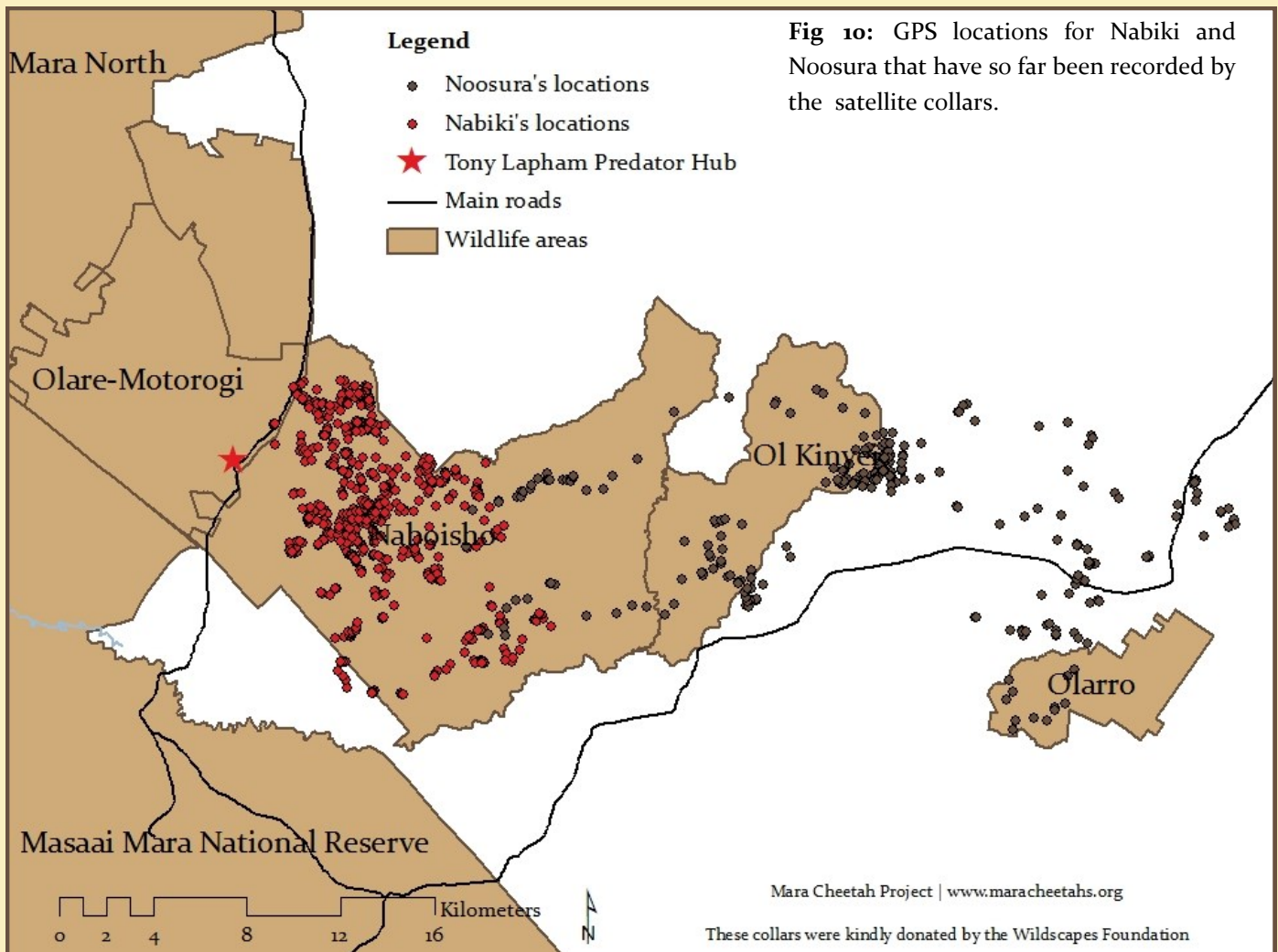


Fig 9: Nabiki was seen taking down this big Grant's gazelle the day after she was collared.

Satellite collars



The collar deployed on the cheetahs record GPS locations every 2 hours. The locations for Noosura and Nabiki can be seen on the map below (Fig 10). The two females exhibit contrasting ranging behaviour; Noosura spent a significant amount of time on the Eastern border of Ol Kinyei conservancy but also spent a significant amount of time outside the wildlife areas. Nabiki on the other spends most of her time within Naboisho conservancy and has so far only ventured outside of the wildlife area once. On average the collared cheetahs travel approximately 2km a day.



In addition to recording GPS locations, the collars also record the cheetahs' activity. The collared cheetahs are least active between midnight and 04h00 and peak their activity between 06h00 and 08h00 in the morning and between 16h00 and 18h00 in the evening. However, the cheetahs are surprisingly active throughout the day (Fig 11).

Fig 11: The daily activity patterns of the two collared cheetahs.



Biomedical



With funding provided by the BAND foundation we have embarked a 'Biomedical' project in partnership with the Smithsonian Institution (USA) and the Kenya Wildlife Service.

As part of this project we have been granted permission by KWS to collect biological samples (tissue, blood, bone, faeces etc.) from cheetahs. These samples will be used for various research projects including genetics and disease monitoring. To ensure that the samples are preserved properly we have bought the necessary equipment for a proper 'cold chain' so that samples can get from the field to the KWS laboratory in Nairobi in the best condition possible. Some of the equipment purchased include a -80 freezer that is currently in the diagnostics laboratory in Nairobi, sampling equipment for the field team to collect samples and a liquid nitrogen tank to store the samples while they are in the Mara.

Genetics

In order to come up with a comprehensive conservation strategy for cheetahs in the Maasai Mara landscape a clear understanding of their genetic make-up is imperative. In terms of genetic material, the Mara Cheetah Project mainly collects faecal samples that are collected during observational follows. So far we have managed to collect multiple samples from 23 different individuals (13 males and 10 females). When possible we also try and collect tissue and blood samples as the quality of the DNA in these samples is much higher than faecal samples. Tissue and blood samples have mainly been collected from dead cheetahs and during immobilisations. In addition we also obtained some samples through a biopsy exercise.

In September 2015 the Mara Cheetah Project, in collaboration with the Mara Lion Project, Smithsonian Institute and the Kenya Wildlife Service, carried out a six day genetic sampling



Fig 12: Dr Nic Elliot (Mara Lion Project) and Moses Otiende (Kenya Wildlife Service) processing a biopsy sample in the field.

exercise. The aim of the exercise was to obtain tissue samples from the individual cheetahs and lions in the Maasai Mara through the use of biopsy darts (Fig 12). A biopsy dart is a dart with a hollow needle attached to it which is fired at a big muscle mass of the animal which upon impact falls out scooping a small tissue sample. All darting was done by the Kenya Wildlife Service veterinarians and no drugs were used to immobilise the individuals. In total we collected 57 lion samples from 18 different social groups and four cheetah samples (2 males and 2 females).

In total we have collected samples from 30 individual cheetahs in the Maasai Mara. We have obtained faecal samples from 23 individuals and tissue and/or blood samples from 10 individuals (7 of which we did not have faecal samples for). These samples are now at the KWS diagnostics laboratory in Nairobi waiting to be extracted, sequenced and analysed.

Biomedical



Disease

Disease is of great conservation concern, especially for large carnivores like cheetahs that naturally live at low densities. While some diseases are part of the natural cycle, there is a concern that with an increasing human-wildlife interface there is an increased risk of disease transmission from domestic animals to wildlife.

Apart from mange, a skin-disease caused by mite, little is known about diseases and pathogens that might be affecting cheetahs in the Mara landscape. This year we came across four adult male cheetahs, all showing similar symptoms that included swollen heads, excessive discharge from the nose and mouth and problems breathing. As a result three of the four males died.

The first case was seen in February 2015, involving a coalition of two young brothers. The two males died within 24 hours of each other. Dr. Limo and the KWS veterinary team conducted a post-mortem examination of the second cheetah and results indicated that both cheetahs died as a result of an infectious viral disease.

The second case was seen at the end of September, again with a coalition of two males (Oloololo males). The males were first sighted in the Maasai Mara National Reserve with swollen heads, excessive discharge from the nose and mouth and one of them was struggling to breathe. The KWS veterinary team from the Mara came and treated both the males with antibiotics in the hope that this would help their recovery. However, a few days later the two males were seen in Olare Motorogi Conservancy (OMC) and the male with the more severe symptoms had died (Fig 13 - left). Because of the severity of the situation, the Mara Cheetah Project brought out a KWS team from Nairobi to investigate the situation. The KWS team made the decision to immobilise the surviving male to treat him again and to take diagnostic samples (Fig 13 - right). The procedure went smoothly and the remaining Oloololo male is frequently sighted and has seemingly recovered fully.

In both cases samples were taken and are waiting to be analysed by the KWS diagnostics laboratory. If you see or hear of any cheetahs that are looking unwell or behaving strangely please let us know as soon as possible (phone: 0701158737, email: info@maracheetahs.org).



Fig 13: Left - a male cheetah investigating his dead coalition mate. Right - Dr. Femke Broekhuis (MCP) and Dr. Titus Kaitho (KWS) treating and collecting samples from one of the sick cheetahs.



Environmental variables



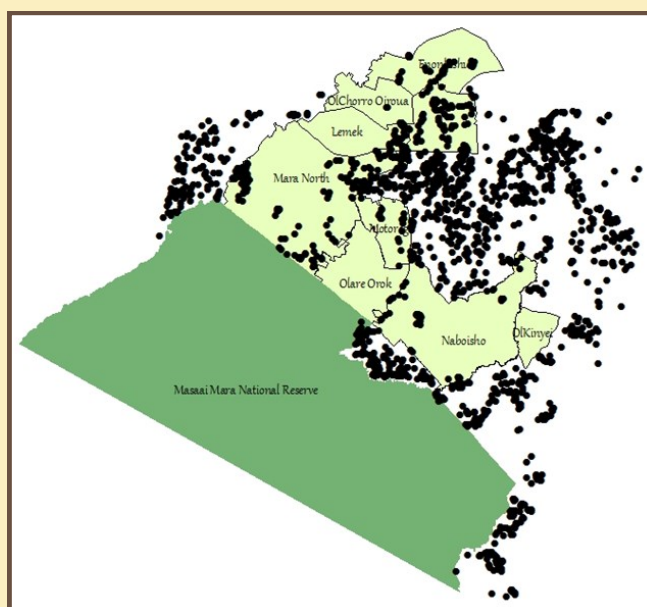
In January 2015 we obtained high resolution SPOT5 satellite imagery from the years 2011 and 2013 from ISIS (CNES). This satellite imagery has been used to map *manyattas* (settlements) and habitat in the Mara.

Settlements (*manyattas*)

The settlement map has been completed and a total of 1635 *manyattas* were mapped, mostly based on the imagery from 2011 (Fig 14). While it is likely that some of these *manyattas* no longer exist and that new ones have appeared, this map gives us a good indication of where the *manyattas* are. This map has so far been very useful for both our community and research projects as it has been used to locate *manyattas* for the human-wildlife conflict questionnaire and the predator film (see section on 'Human-wildlife conflict').



Fig 14: Left - Example of the *manyattas* that can be seen from the satellite imagery. Right - The 1635 *manyattas* (black dots) that were mapped for the Mara using satellite imagery from 2011.



Habitat map

Habitat availability and use is key to understanding animal ecology, behaviour and distribution. As such great effort is being taken to produce an accurate habitat map of the study area. The habitat layer is based on several cloud-free Landsat 8 images and the image processing has been carried out in statistical software R using the *Random Forest* package. The map has now been ground-truthed using the SPOT satellite imagery and by visiting locations on the ground resulting in an classification accuracy of approximately 82% for three different habitat types: open, semi-closed and closed (Fig 15).

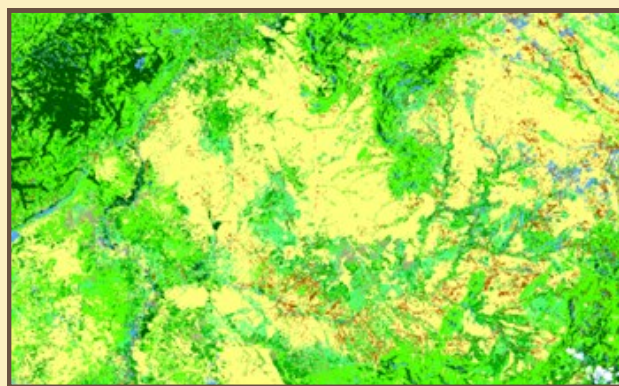


Fig 15: Using satellite imagery (left figure) and data points collected throughout the study area to create a habitat map (right figure) which will form the basis for subsequent analyses.



Community



Wildlife Clubs



This year we set up Wildlife Clubs in five different schools around the Mara. The five schools include ADCAM Academy and St. John Paul Academy in Aitong and Irbaan Primary, Loigero Primary and Mara Hills Academy in Talek area. In total 150 school children from class 4 to 8 have signed up to the Wildlife Clubs. Officials from the Wildlife Clubs of Kenya (WCK) in Nairobi visited the five schools to train the patrons of the Wildlife Clubs and to formulate an action plan for each school. The action plans will help guide activities that increase the children's knowledge on conservation challenges and help solve them in their schools and communities. Despite the challenges of teachers strikes in the area, the community team still had a successful year and undertook several different activities with the club members including tree-planting and game drives.

Tree planting

A tree planting exercise was undertaken in each of the five schools (Fig 16). In total 500 tree seedlings were purchased, organic manure transported from neighboring *manyattas* and trees planted around the school compounds. Dominic Sakat, the project's Community Liaison Officer, explained to the children the importance of trees, including halting of erosion and harvesting for crops or materials. With this years rains the seedlings have been thriving.



Fig 16: Wildlife Club members planting seedling in their schools.

Game drives

In September the Wildlife Club members were taken for field trips to the Maasai Mara National Reserve and Mara North Conservancy (Fig 17). The aim of this exercise was to give the children a chance to experience and appreciate the wildlife in their natural habitat as opposed to the stories of human wildlife conflicts that they are accustomed to. This opportunity gave the children a chance to experience what is on their doorstep so they can appreciate the ecological and economic role wildlife play which will hopefully foster the need to conserve them.



Fig 17: Wildlife Club members at a cheetah sighting in the Maasai Mara National Reserve.

Human-wildlife conflict



Wherever there are people and wildlife living in close proximity there is human-wildlife conflict. In an effort to understand the prevalence and 'hotspots' of human-wildlife conflict and to develop solutions to minimise conflict we carried out an interview-based questionnaire survey and screened a predator film for discussion groups.

Questionnaire survey

The questionnaire addressed topics such as livestock husbandry, grazing areas, predator identification by the interviewees and their attitudes towards predators. It also included questions on the prevalence of conflict and retaliation directed towards predators and questions relating to their socio-economic status.

For the questionnaire survey, we trained ten interviewers from around the Mara on how to conduct the interviews and how to use a GPS to find the *manyattas* (settlements) that were randomly selected (Fig 18). In total, 818 people were interviewed across the Mara landscape. All the data were entered towards the end of 2015 and have therefore not yet been fully analysed but we will present some preliminary results here. As the people were randomly selected, the results presented should be a fair representation of the population as a whole.

Of the respondents:

- 58% owned land that they leased to the conservancies
- 52% were Christian, 47.5% had traditional beliefs and 0.5% were Muslim
- 62% had no formal education, 23% completed primary school, 11% completed secondary school and 4% completed tertiary education
- 74% were pastoralists, 14% worked in the tourism sector, 6% were businessman, 3% were agriculturalists and 2% worked in other sectors

Livestock owned by respondents:

- 99% owned cattle
- 98% owned shoats
- 20% owned donkeys



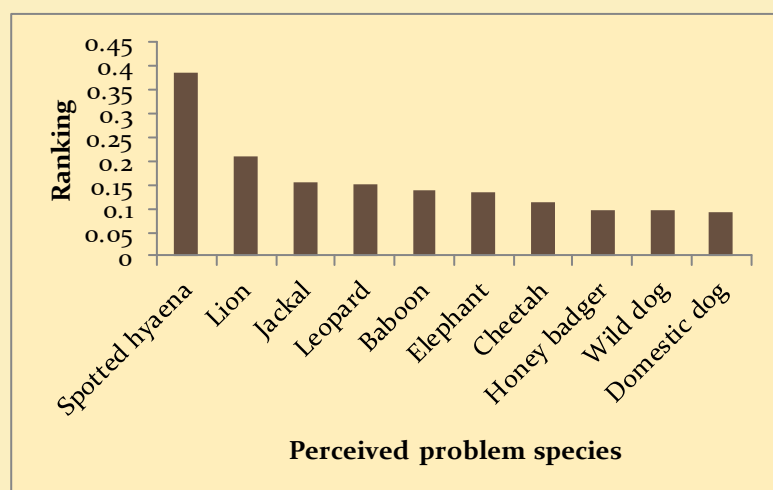
Fig 18: The team of community members who were trained to carry out the questionnaire survey. In total 818 people were interviewed.

Human-wildlife conflict



Livestock mortalities:

- 92.6% of the respondents had lost cattle. The major reason for losing cattle was drought (59%), followed by disease (21%) and then depredation (19%).
- 91% of the respondents lost shoats. The major reason for losing shoats was disease (56%) followed by depredation (28%) and then drought (7%).



Depredation:

The respondents were asked to rank different species according to the severity of the problems that they cause (Fig 19). The species that was perceived to cause to most problems was the spotted hyaena followed by lion. Of the ten species, cheetah was ranked as the seventh most problematic species.

Fig 19: Ranking of various species by the perceived problems that the respondents think that they cause.

Benefits of living with predators:

While the community benefit from wildlife through direct employment in the tourism sector and indirectly through infrastructure development, only 38% of the respondents thought that the benefits of living with predator outweighed the costs (Fig 20). Sixteen percent of the respondents thought that people within the community killed predators and 15% of respondents actually admitted to having killed at least one predator in their life. Of the predators that were admitted to being killed, 65% were lions, 20% spotted hyaenas, 6% jackals, 4% leopards and 4% cheetahs. The reason that the six cheetahs were killed were due to predation on shoats (n=3) but also to show off to peers (n=3).



Fig 20: Approximately 200 sheep killed by spotted hyaenas at Empoo village in the Oloolaimutia area. Whilst the wildlife brings benefits to people, there are also a lot of costs to endure.

Human-wildlife conflict



Predator film and discussion groups

In collaboration with the Mara Lion Project, we produced a film about the positives and negatives of living with predators in the Mara (Fig 21). The purpose of the film and the subsequent screenings was two-fold: first to create a film, in the Maasai language, to show to the community to build awareness on the importance of conservation, both to local livelihoods and also from a cultural heritage perspective. The second objective was to hold focus groups where issues to do with human-predator conflict were discussed and addressed. This was an opportunity to discuss and impart information relating to the myriad of solutions available to human-predator conflict.

In total we completed 50 screenings, with 602 people watching the film. During the discussions, participants were encouraged to critically address their problems and come up with sustainable solutions so that livestock loss would be minimised as would subsequent retaliatory killings. Our participatory approach saw participants identifying problems and solutions and then ranking those solutions in terms of (a) preference and (b) whether or not that would result in not killing offending predators. As the screenings were only completed in mid-December, analysis of the results and the creation of a management document is ongoing. However, some preliminary results are presented below:

- 100% of participants were concerned about the state of their immediate environment
- Only two groups thought lion lights were a good solution
- No one wanted fences around the wildlife areas

Participants thought that the best solutions to reducing depredation were:

- Community awareness
- Herder vigilance
- Reduce livestock

In 2016, thorough analyses will be conducted of both the questionnaire and the film. In February and March 2016 the results and outputs will be presented and discussed with various communities at local meetings (*barazas*). In addition, the analysis will be written up in management documents and scientific articles and the outputs will guide future conservation efforts and accordingly aid the planning of intervention strategies.

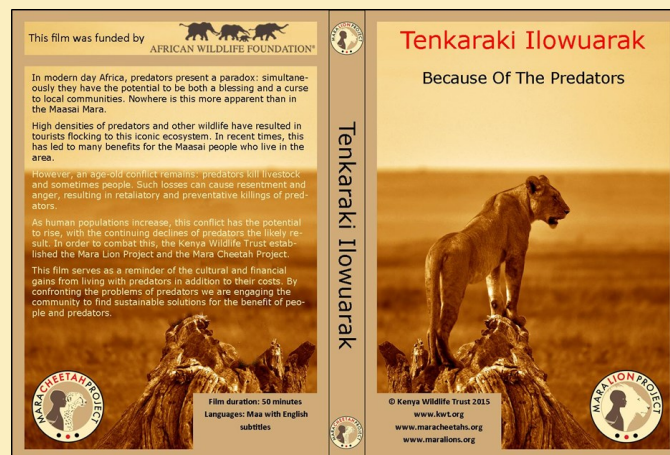
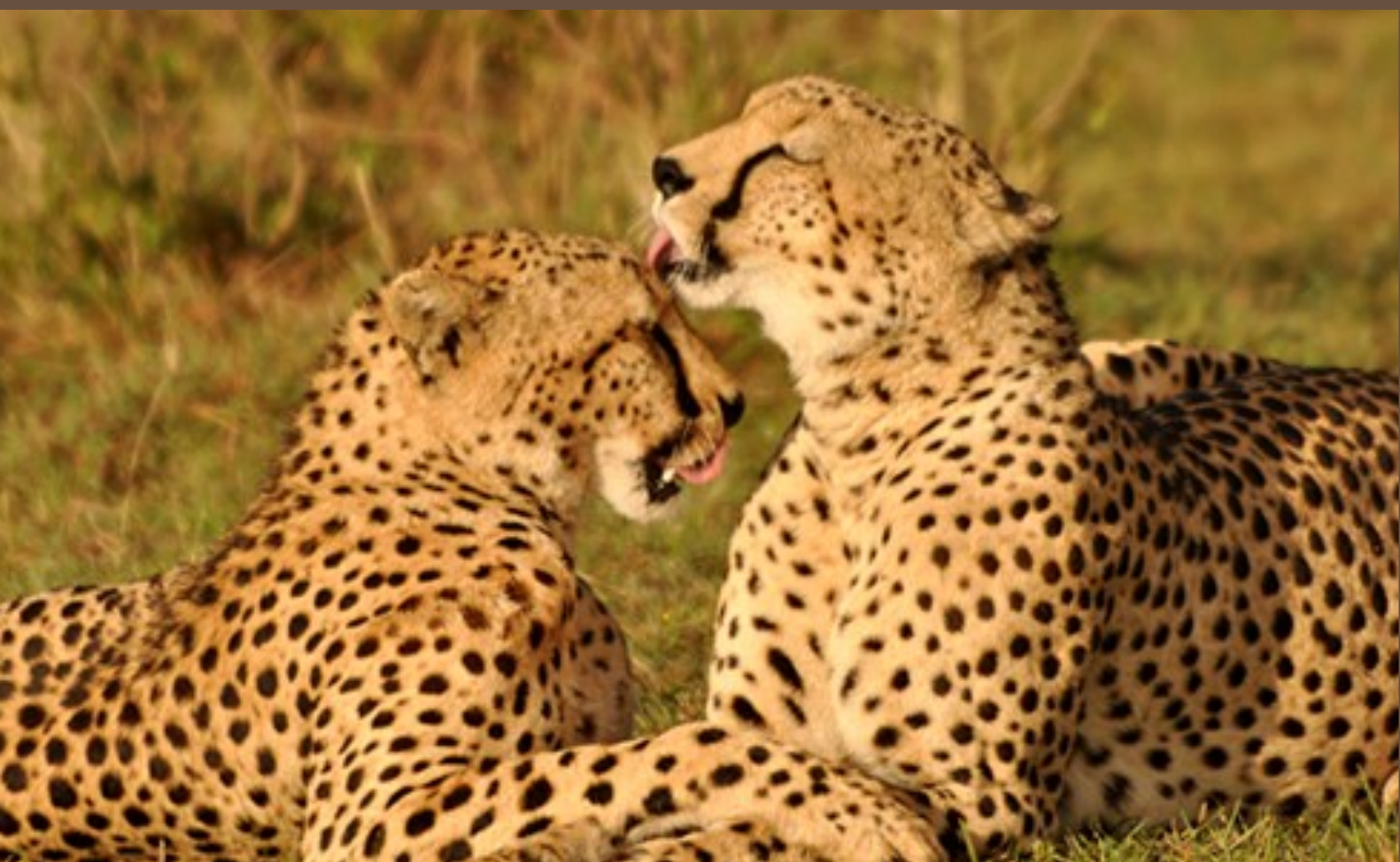


Fig 21: The cover of the Predator Film that was screened in communities throughout the Maasai Mara.



Outreach



Training



Workshops

Team workshop

At the beginning of the year Femke Broekhuis, together with Dr. Nic Elliot (Project Director of the Mara Lion Project) gave a two-day workshop for the rest of the predator team. The workshop included a refresher on how to use the Cybertracker software, which both projects use to collect all field data, an exercise on spatial capture recapture models used to estimate animal density and abundance and a practical on how to collect faecal samples needed for the planned genetics research.

Camera trapping workshop

In January, Femke Broekhuis attended a camera trapping workshop at the Kenya Wildlife Service headquarters that was organised by the Zoological Society of London (ZSL). The course covered various topics from camera trap survey objectives and design, to data management, data preparation and finally data analysis including calculating species abundance and indices.

Conferences and symposia

Kenya Wildlife Trust Symposium

In May, the Kenya Wildlife Trust held a Symposium at the African Wildlife Foundation (AWF) headquarters. The aim of the symposium was to bring together all the projects that are either fully or partially funded by the Kenya Wildlife Trust to present some of the successes and the challenges that they face. Fiona Tande and Femke Broekhuis were present from the Mara Cheetah Project and Femke Broekhuis gave a presentation.

Capacity Building for Conservation and Resource Management Conference

Michael Kaelo, our Chief Community Officer, attended the Capacity building for Conservation and Resource Management Conference held in Nairobi July, 2015. Over 190 delegates from more than 90 countries attended the conference. It was a platform where ideas were exchanged, new knowledge shared and networks were established. Networking was probably one of the biggest achievements from the conference as Michael got to interact with a diverse number of people from diverse organizations with a common interest for conservation.

KWS Annual Carnivore Conference

This year Femke Broekhuis, David Thuo and Fiona Tande attended the two day conference at KWS in Nairobi. The afternoon of the second day was set aside to review the Eastern African Regional Strategy for Cheetah and Wild dogs which included updating the distribution maps of both these species and the threats that they face. Femke chaired sessions on both days of the conference.

Publications and Media



Publications

This year Project Director Femke Broekhuis authored or co-authored the following articles that were published in peer-reviewed journals:

Broekhuis, F. 2015. Cat eats cat: leopard consumes an adult cheetah in the Maasai Mara Game Reserve, Kenya. *CAT News* 65, 33-34.

Durant, S. M., Becker, M. S., Creel, S., Bashir, S., Dickman, A. J., Beudels-Jamar, R. C., Lichtenfeld, L., Hilborn, R., Wall, J., Wittemyer, G., Badamjav, L., Blake, S., Boitani, L., Breitenmoser, C., **Broekhuis, F.**, et al. 2015. Developing fencing policies for dryland ecosystems. *Journal of Applied Ecology*.

Reports and updates

Every three months we write up our findings and activities in a quarterly report which are then combined and added to in our Annual Report at the end of each year. Additionally, we provide informal updates on the cheetahs in the Mara in a newsletter called 'Cheetah Chat'. All our reports and updates are available online: <http://www.maracheetahs.org/reports-and-updates/>.

Media coverage

This year the Mara Cheetah Project was approached by the production and film team filming the new BBC natural history series called 'The Hunt' for inside information on the cheetahs in search of good candidates to film. In addition, Dr. Femke Broekhuis was interviewed by the team for the Open University. The interview, which can only be viewed in the United Kingdom, can be found at: http://www.open.edu/openlearn/science-maths-technology/science/biology/top-tips-budding-biologists?in_menu=317902

Additionally, the Mara Cheetah Project has been featured in the following magazines, books chapters and online articles:

- Conservation insight (Interview with Femke Broekhuis) – Jo Price (BBC Wildlife Magazine, December 2015)
- What's being done in Kenya's Maasai Mara to protect cheetahs – Femke Broekhuis (The Conversation, December 2015)
- Protecting the Maasai Mara ecosystem – Femke Broekhuis and Michael Kaelo (Climate Change and Satellites, 2015)
- Up close and personal – Femke Broekhuis (Swara magazine, September 2015)
- Mara Cheetah Project – Femke Broekhuis (Ndege magazine – AirKenya, June-August 2015)

The links to most of the full articles can be found online: <http://www.maracheetahs.org/publications/>.

Collaborations and partners



Wildlife Conservation Research Unit (WildCRU), University of Oxford

Dr. Femke Broekhuis attained her PhD at WildCRU and has since attained her affiliation with WildCRU as a member of WildCRU's research staff. WildCRU was founded in 1986 by Professor David W. Macdonald and is now one of the leading units for carnivore conservation.



Kenya Wildlife Services (KWS)

In the past year the Mara Cheetah Project has worked closely with the KWS team in the Mara, including Dr. Limo, the head veterinarian and Mr. Kimutai, the Senior Scientist based at the KWS research station in the Maasai Mara National Reserve. Information relating to the health status of cheetahs is regularly transferred between the two entities and a good working relationship has resulted. In addition the Mara Cheetah Project is working together with KWS to start a genetics, hormone and disease study.



Mara Lion Project

Like the Mara Cheetah Project, the Mara Lion Project was also set up by the Kenya Wildlife Trust. Since lions and cheetahs face many of the same issues, The Mara Cheetah Project is working together with the Mara Lion Project both in terms of data collection and our community conservation efforts.



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Future plans



Research

We will continue to **monitor cheetahs** throughout the year but more frequently during our intensive monitoring periods. We will also rekindle the development of the **cheetah identification software**. This project was started towards the end of 2014 but has been put on hold due to lack of funding. However, we are now back on track as WWF have kindly offered to fund the project. So far



all the cheetah photos needed to train the software have been processed and catalogued by the Mara Cheetah Project team. The software itself will be developed by the University of Surrey. We are hoping that the software will be up and running by the end of 2016. In addition we are planning on **deploying the remaining collars** so we can get a better understanding of cheetah ecology, especially their movement and space use. We will also continue with the biomedical project in partnership with KWS and Smithsonian Institute and **complete the genetic analysis**. With all the ecological and biomedical data that we have collected since the projects inception in June 2013 we are in the process of writing up several **scientific articles** that will be submitted to peer-reviewed journals in the coming year.

Community projects

In February and March 2016 our community team will engage with the various communities around the Mara to give the **community feedback** on the outputs of both the questionnaire and the film. The results and outputs will be presented and discussed at local meetings (*barazas*). In addition, the analysis will be written up in management documents and scientific articles and the outputs will **guide future conservation efforts** and accordingly aid the planning of intervention strategies. This will go hand-in-hand with the **holistic resource assessors programme** that we will be launching together with the Mara Lion Project in March 2016. We will also be continuing with the **Wildlife Clubs** and we hope that there are not teachers' strikes this years so that the activities will run smoothly. Some of the activities that we have planned include a **Carnivore Kids Camp** and a **Carnivore Art Competition**.

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**
- **Ros Perkins**
- **J.A. & H.G Woodruff, Jr. Charitable Trust**
- **The Romeo Trust**
- **Asilia East Africa**
- **James Fendt**
- **Margaret Prentice and John Dyson**
- **Naboisho Camp**
- **Sala's Camp**
- **Rekero Trust**
- **William and Crystal Ribich**



Acknowledgements



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 the production and screening of the predator Film and covering costs of local salaries of the team
- **World Wildlife Fund** (WWF) for funding the cheetah identification software
- **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 Mara Lion Project for their continued support in the field and numerous guides from Naboisho Camp, Rekero Camp, Sala's Camp and Kicheche Bush Camp for reporting cheetahs sightings.

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/>).





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