

Korongoro People's Lion Initiative (KopeLion) c/o Ngorongoro Conservation Area Authority Box 1, Ngorongoro Crater Arusha, Tanzania

ANNUAL REPORT 2016

Attn: TAWIRI, NCAA, COSTECH

This Annual report covers the period from April 2015 to March 2016. It summarizes the activities and preliminary results from the on-going research project entitled, "**Balancing Pastoralist Livelihoods and Wildlife Management in Ngorongoro**", headed by Associate Prof. Goran Spong of the Swedish University of Agricultural Sciences (SLU). The study is conducted in the Ngorongoro Conservation Area by the initiative "KopeLion" (Korongoro People's Lion Initiative, previously called Ngorongoro Lion Project). The initiative combines lion research with community participatory lion conservation and monitoring.

1. Lion Monitoring

We have maintained the long-term demography monitoring of individually known lions in the Ngorongoro Crater, and in the region surrounding Lake Ndutu. We are also getting a clearer picture of the elusive and few lions that are inhabiting or traversing the central and southern bulk of NCA's multiple-use landscape. For lions that we can easily approach and observe we use individual recognition (lion in the Crater and in Ndutu region). We have been able to identify some of the more elusive lions, and in addition we will identify them with genetic analyses. Further, we explore lion presence and movements through telemetry, camera traps and indirect observations. To study lions's behavior through fine scale movement patterns we deploy GPS collars on a few individuals in the human inhabited parts of NCA. We explore lion presence in the same area by using motion triggered camera traps, and by documenting and GPS locating any signs of lions we encounter in area.

1.1 Lion demographics: Ngorongoro Crater

The number of lions on the Crater floor has remained relatively constant, with a tentative increase over the past eight years (Fig. 1). The total number are 76, the majority of them members in one of the six prides. See table 1 for the composition of the population into prides and age cohorts. The small MungeMbili pride appears to have left the Crater; on the 3 occasions they have been seen in the last 1.5 years, they were near or on the Crater rim.

In Sept. 2013, a new coalition of four males entered the Crater. Over the past 2,5 years they have become the resident males in three different prides, and have given rise to a cub boom. Fifteen

of the 19 cubs born to the Munges and MungeTatis in 2014 are still alive, reflecting the best cub survival in the Crater in many years. In May 2015 this male coalition took over the Lakes pride, which now had 10 young cubs.

In July 2015 a two-male coalition entered the Crater and became resident males in the small Lagunita pride, which now has 5 cubs. One of these males, Kijana, is of unknown origin, and has been seen occasionally on the Crater rim, alone or with females, since 2009. He joined with the Crater-born MG106 in 2015, and their combined strength presumably gave them an opportunity to take over prides in the Crater.

Genetic tests will be performed during 2016 to determine if the immigrating four-male coalition (two of which are still alive), and Kijana are genetically distant from the Crater females.

Table 1: The current composition of the Ngorongoro Crater lion population, divided into pride membership and age cohort (adult = at least 4 years old; sub-adult = 1 - 4 years; cub = 4 years).

Pride	Total	Adult females	Sub- adults	Cubs	Comments	
Munge	20	7	13	0	2 resident males (Eugene & Genius)	
MungeTati	5	3	2	0	2 resident males (Eugene & Genius)	
MungeMbili	2	2	0	0	Uncertain, found rarely near slope or outside Crater	
Lakes	16	5	1	10	2 resident males (Eugene & Genius)	
Lakette	12	5	4	3	1 resident male (MG91)	
Lagunita	8	3	0	5	2 resident males (MG106 & Kijana)	
Resident	5	In 3 coalitions: Eugene & Genius (the survivors from a 4-male coalition); MG106 &				
males		Kijana; MG91 (the only survivor from a Crater born 4-male coalition)				
Nomads	8	In 3 groups; 5 sub-adult males from Lakes pride; 2 adult males from Lakes Pride (seen				
		again in 2015 after 3 year's absence(?), and 1 aging male from Munge pride.				



Figure 1. Monthly population totals for lions living on the Crater floor, from 1962 until 2016. Dotted blue line includes all individuals; dark blue only includes adults that are at least four years of age.

1.2 Lion demographics: Ngorongoro Crater Rim and Highlands

Lions are frequently seen on the Crater rim, but observations are difficult owing to dense vegetation, steep terrain and the elusive nature of these animals. However, we can confirm that these 2 adult males and at least 4 adult females and 6 cubs are not members of the prides on the Crater floor. The two adult males (Kalamas and Mr. X) are of unknown origin, and have been seen on the Crater rim, in the Crater (a few day's visit in Nov 2015 when Kalamas mated with a Crater female), and in the L. Eyasi escarpment. We also have un-confirmed observations of this Kalamas from Kakesio.

1.3 Lion demographics: Ndutu region

In March 2016, five prides containing at least 47 lions (including 23 cubs and yearlings) resided in Ndutu region (upper Olduvai); current group compositions are:

- Big Marsh pride: 4 adult females, 7 cubs, 2 resident males (Romulus & Remus, since Dec. 2014)
- Masek pride: 2 adult females, 7 yearlings, 1 resident male (Katavi, aka Manati)
- Twin Hill pride: 2 adult females, 6 cubs, 1 resident male (Katavi, aka Manati)
- Thin pride: 3 adult females, 2 resident males (Romulus & Remus).
- Matiti pride: 1 adult female, 3 cubs, 1 resident male (Katavi, aka Manati)
- In addition, there is Cassandra's group of 8-9 sub-adults and one adult female that ran away from Big marsh pride as Romulus and Remus took over this pride.

In addition, nomadic lions and nearby prides from Serengeti NP visit the area. In the rainy season of 2016 we have received reports of a group of 14 lions on the plains and in Olduvai woodlands east of L. Ndutu. Most likely these are seasonal visitors from Kusini.

1.4 Lion demographics: Mortality

We have 9 documented cases of lion deaths since 2015; 2 killed by spearing, 1 killed in poisoning, 2 (possibly 4) killed by other lions, 2 killed by disease or natural causes.

1.5 Lion movements: GPS collars

We have continued fine scale monitoring of lion movements by GPS collars. See Table 2 for the operation of collars since we received collaring permission in 2012, and Fig. 2 for a map of the movement patterns. The collars are scheduled to take hourly positions during the nighttime, and typically one position at noon. We noted occasional daytime activity for some of these animals, including predation attempts on livestock, and subsequently increased the frequency of positioning. We receive position updates regularly through satellite transmissions, showing the lion's current whereabouts and enabling our team to warn nearby herders about the lions' presence. The later has proven an effective tool in keeping both livestock and lions safer. A good example of this is the GPS collared Nayomi and her small pride with six cubs that all survived the high-conflict dry season, thanks to increased protection from our team.

While in close proximity to Maasai, the collared lions typically avoided conflicts by becoming highly nocturnal and hiding in dense bush or steep ravines during the day. When wildlife prey was scarce, some of our collared lions (Puyol and Nayomi) avoided closely guarded livestock, feeding on a combination of wild prey and abandoned livestock. Another (Orbili) occasionally visited livestock enclosures at night. The recently collared Museum is

proving to be more of a problem animal. Despite abundant wild prey in his area, and close monitoring by our team, he often targets livestock. The attacks are mainly in daytime out at pasture n cattle being herded.

Lion ID	Born	Sex	Collar on	Collar off	Area	Comment	
THI-A (Tom)	2010	М	22/10/2012	03/12/2014	Ndutu, Makao	Collar released automatically at pre-set date	
Puyol	2008	М	14/02/2013	28/10/2014 (died)	Masek	Died, likely from septic wound caused by lion fight	
Orbili	2011	М	14/02/2013 02/09/2013 Orbili		Collar remotely removed after 6.5 months (to avoid getting too tight on this still-growing lion)		
Bahati	2007	М	02/12/2014	/12/2014 22/09/2015. Killed, suspected poisoning. Collar destroyed Orbili, Kakesio		Shortly after collaring this male went to Kakesio ward. Killed in retaliatory poisoning in Osinone.	
MAS-9 (Laetolia)	2012	М	08/03/2015 20/6/2015. Killed by spearing		Endeulen, Esirwa	Lion from Masek pride, now nomad	
Nayomi	2008	F	17/03/2015	Still on Naibarda		A seldom seen female, known since 2011.	
Kijana	2006	М	11/07/2015	30/12/2015 Removed (collar failure)	Crater rim, Crater floor	Known initially as a nomadic male of unknown origin, from the Crater rim highlands. Became a resident Crater male. Collar had technical issues, and was removed after 3 months	
MAS-11 (Museum)	2012	М	26/02/2016	Still on	Malanja, Oloirobi	Lion from Masek pride, now nomad. Laetolia's Twin brother.	

Table 1: GPS collars status in NCA, showing date of collaring and collar removal, and the typical home range or territory of that animal.

Laetolia and Museum are twin brothers from Masek pride in Ndutu, thus documenting the dispersal of lions from the Serengeti plains to the Crater highlands. Initially they were three brothers. In late June 2015 Laetolia was killed by spearing following a cattle attack that resulted in growing anger, gathering a mob of lion hunters. Since Museum was collared in Feb. 2016 we have only seen him alone or in company with a female. With the GPS collars we have documented how these nomadic lions visit the Crater floor, often remaining invisible in denser vegetation on the inner slopes. Their Crater visits have only lasted a few days after which they return up to the highlands.

We currently have two GPS collars deployed on lions and plan to re-use our removed and refurbished collars. Priority areas for collaring are Oldeani, the Lake Eyasi escarpment, and a non-Crater pride near the NCA headquarters. We have observations indicating that an adult male with massive dark mane and long hair on lower abdomen traverse between the Crater, along the Eyasi escarpment, Kakesio and Maswa GR. Together with the collaborative NCAA and TAWIRI veterinarians we aim to capture and GPS collar this male so as to better understand the dispersal potentials in this multi-use landscape.



Figure 2: Map of the Ngorongoro study area, showing locations of seven GPS collared lions. Yellow = Tom, a 5-year-old resident male that became nomadic male; Red = Puyol, a 6-year-old resident male; Purple = Bahati, a ca. 8-year-old resident male; White = Orbili, a 2.5-year-old nomadic male, dispersing from his natal pride; Blue = Laetolia, a 3-year-old nomadic male that was dispersing from the Ndutu region to the Ngorongoro highlands; Green = Nayomi, a 7-year-old female in a pride w another adult female and 6 cubs; Black = Kijana, an 8-year-old male that became resident male on the Crater floor.

1.6 Lion movements: Camera traps

To assess lion movements and habitat use on the landscape scale, we rolled out an occupancy survey in Sept 2015, based on motion triggered camera traps. We will also test the feasibility of estimating relative lion population estimates and trends via a long-term camera trap survey that could be used in an incentive-based Performance payment system. We will compare the population estimates obtained from camera traps to those from individual recognition, DNA assessments, and spoor tracking. We currently operate 43 camera traps in 20 7x7 km grid-blocks, covering a 980 km² area. While the survey is operating very well for most parts, we are facing challenges with theft and vandalism in some areas and/or during certain seasons, especially when pastoralists from elsewhere visits area for periodic grazing. To reduce these challenges, we have put considerable effort meeting with communities, explaining the use of cameras and showing them photos. By having our local Maasai scouts manage the cameras and starting with fewer camera traps, we have already seen a major reduction in theft and vandalism. The sites for camera placements are chosen using a combination of lion habitat selection (as indicated from GPS collared lions) and from the existing local knowledge of lions. In 2016/2017 we aim to expand the survey to include 100 camera traps (3-4 in each block) to assess lion occupancy and estimate lion population trends.

1.7 Lion monitoring: Samples and Genetics

For DNA assessment we opportunistically collect lion scat, hair and saliva, and in collaboration with the NCAA veterinarians, we collect tissue samples using biopsy darts. To estimate levels of inbreeding in the Crater population, and to characterize genetic structure and relatedness of lions across the wider NCA we have obtained samples from:

- 51 individually recognized lions, including 17 tissue samples from the Crater
- 27 individually recognized lions, including 15 tissue samples from the wider NCA
- 142 findings of feces or hair from unknown lions from the wider NCA
- 6 tissue samples from unrecognizable lions from the wider NCA

In Nov. 2015 we received permission, and exported 264 samples containing DNA from lions to our lab at SLU for genetic analyzes. We expect to have preliminary results ready in 2016.

Since 2012 we have collected 161 full scat samples from the wider NCA outside the Crater, which we will use to estimate the ratio of wildlife:livestock in the lion's diet. We hope to collaborate with a local student for this analyses.

2 Human – wildlife interaction patterns

Here I present preliminary results from data collected following a predator – livestock attack events from 2012-2016. The data is collected by our local lion scouts that work from their home areas. Our data-set contains a full year of reported depredation events within our study area. Community members were encouraged to report all depredation events to the project as we had community meetings, but were given no other incentives to do so. After an initial year of data covering attacks by all predator species, the lion scouts gathered reports from only lion-livestock attacks. See Fig. 3 for the spatial distribution of depredation events across our study area.

During this period we gathered reports from a total of 803 attack events (Cattle: 356, Shoat: 375, Donkey: 56, Dog: 15). Using the subset of data when reports where gathered from all predators (N 677, 1 year of data) a breakdown of responsible predators are: Leopard 31%, Hyena 30%, Lion 18%, Striped Hyena 4%, Mixed (e.g. leopard & Hyena, Lion & Hyena) 5%, Other predators 11% (e.g. jackal, cheetah, wild dog).

3 Community engagement

Our participatory approach for lion research and conservation has led to a positive relationship and growing trust with the local communities. We currently employ six local Maasai as lion scouts. Their duties include collection of information on depredation events, managing camera traps, treating wounds on livestock injured by predators, and some lion monitoring. In many depredation events, surviving livestock sustain severe injuries. The treatment of wounds (thorough cleaning with antiseptic, applying antibiotic spray), and advice to livestock owners is tangible and highly appreciated.

An important goal of our project has been to implement a Lion Guardians program (see <u>www.lionguardians.org</u>) as a suitable coexistence model for the area. In 2014 we received full agreement from the communities of Endulen ward. Thus, in partnership with the organization that developed the model, the Lion Guardian's Ltd. we hired, trained and

employed 10 NCA residents in late 2014. Here in Ngorongoro these Lion Guardians trained pastoralist warriors are titled **Ilchokuti** (Caretaker or Guardian in *Maa*). Each Ilchokuti is responsible for covering a 70-100km² area surrounding his home village. Duties include conflict mitigation (finding and retrieving lost livestock, warning herders of lion presence, reinforcing bomas), monitoring lions and reducing threats of lion killings.

The achievements in conflict mitigation and resolution, and lion monitoring by our local staff; the lion scouts and the Ilchokuti is listed in Table 3 below.

Table 5. Achievements by Ropezion team in connet mitigation and non monitoring activities since 2013									
Lost Livestock	Found Livestock	Reinforced bomas	Treatment of wounded livestock	Stopped lion hunts	Reported lion observation				
8,742	8,398 (~ 96%)	137	195	5	316				

Table 3. Achievements by KopeLion team in conflict mitigation and lion monitoring activities since 2015.



Fig. 3. Map of our study area, the central bulk of NCA, showing the locations of active bomas (located during wet season 2013; black dots), lion-livestock attacks (red crosses); and attacks from all other predators (yellow dots).

4 Acknowledgement

We thank the Tanzanian authorities, TAWIRI, COSTECH and not the least NCAA, for permissions, support and positive collaboration in the past year. We are also grateful to the NCA communities for their inspired engagement. We look forward to another year of good partnership.