Elephant ID-kit

and elephant-related information

for

Mabalingwe Nature Reserve

Last update: 20/01/2022

Tables

Figures

The elephant identification kit was compiled by Elephants, Rhinos, and People (ERP). All photos of the reserve's elephants have been taken by Josh Frost. The data for the elephant identification kit were collected in the field. During the compilation, the elephants were observed, any characteristics were noted, their behaviour observed, and photographed whenever possible. Observing elephants is not an objective task, although objectivity is strived for – as a result, elephant behaviour towards humans can differ depending on the human present.
Please be aware that the drawings depicting the elephants' individual characteristics are not meant to be comparable from one elephant to another elephant. It merely depicts that particular elephant's characteristics, i.e. they are not proportional to each other in terms of for instance size of tusks or notches. The elephant identification kit should be continuously updated with regard to characteristics, such as notches and marks, and major events in the elephants' lives, such as dartings, injuries, deaths, and births etc.

Introduction

The intelligence of elephants is well-known fact by now. They are able to assess situations and solve problems, e.g. their ability to assess electrified fences, finding their weak spots, and breaking through, if they want to.

Research in elephant cognition has proven that elephants are a lot more complex than previously though. Although there are still only relatively few studies, the ones already published show that this aspect of elephants should be taken more into consideration in elephant management. Cognitive studies in the past have tended to focus on animals perceived as similar to humans, e.g. chimpanzees and gorillas etc. (Bates, Poole and Byrne, 2008). The cognitive experiments used on these animals, i.e. mirror-self-recognition, tool use etc., may not be appropriate in determining cognition in elephants. The mirror-self-recognition test has been performed on three captive Asian elephants, and showed that one of these passed all levels, i.e. the elephant knew it was looking at itself and not another elephant (Plotnik, de Waal and Reiss, 2006). Other experiments have shown elephants to have a level of self-awareness and self-understanding not previously imagined (Dale and Plotnik, 2017).

More ecologically relevant studies have been conducted in recent years. Studies focussing on elephant perception and memory in the field (Bates, Poole and Byrne, 2008). These studies have shown female elephants' ability to distinguish between vocalisations of approximately 100 other female elephants (McComb *et al.*, 2000), elephants' ability to use urine to distinguish specific family members (Bates *et al.*, 2008), and elephants' ability to categorise humans into subclasses based on the level of threat they pose through visual and olfactory cues (Bates *et al.*, 2007), as well as acoustic cues (McComb *et al.*, 2014).

In elephant societies, a large part of an elephant's life is to learn from its seniors. Young elephants are taught basic survival skills, e.g. edible and poisonous plants, location of water, routes to take to specific areas etc., but also more complex skills, e.g. language, appropriate behaviour depending on situations, raising future calves etc. Allomothers are an important part of this learning and a relatively unique feature for elephants. The teaching of skills and the ability to learn these skills require intelligence. Their behaviour is not an instinctual reaction to an event (Lee and Moss, 2011).

Other aspects of the level of intelligence in elephants, which are difficult to prove scientifically beyond anecdotal, are their empathy and their personalities. Elephants have been seen consoling distressed individuals and morning the dead of loved ones (Douglas-Hamilton *et al.*, 2006; McComb, Baker and Moss, 2006). Each elephant has a unique personality, e.g. some have a well-developed sense of humour, some are gentler, some are introverts and other extroverts, some are popular and some are not etc.

Elephants communicate through a range of sensory channels – visual, acoustic, tactile, and olfactory. These channels can be used separately and in synergy. An example of the latter is the greeting ceremony between bond groups, where all channels are used. Visually by raising their heads and lifting, spreading and flapping of the ears. Acoustic via vocalisations, e.g. rumbles and trumpets. Tactile by rubbing against each other, intertwining trunks and clicking tusks together. Olfactory by temporal glad secretion, urination, and defecation (Poole and Granli, 2011). The development of this many communication channels highlights the complexity of elephants.

Elephants have complex social network, known as a fission-fusion society. The core is made up of a family group consisting of blood relatives, i.e. mothers, daughters, sisters etc. Beyond the family group are bond groups, clans, independent males and bachelor groups of males. The different types of groups are not isolated from each other. The bonds that exist between members of a family group extends to other groups in the area. An example is bond groups. When a family group becomes too large, it will split in two. After such a split, the two new family groups do not move off in different direction never to have contact again. Instead, they remain in contact and will regularly meet (Moss and Lee, 2011).

In elephant research, it is a common and logical practice to name all members of a family group with a name beginning with the same letter, as Dr Cynthia Moss did in Amboseli during her studies, e.g. EB-family consisting of Echo, Ebony etc. At Mabalingwe Nature Reserve, it is important to know the identity of each elephant to ensure that it is the correct elephant being discussed. We have been informed that one elephant has been named, i.e. the matriarch seems to be called Tandy by some. As a result, we have named all 15

elephants by using words from Setswana describing a personality aspect or describing characteristic. In the individual ID-kits collated below we have provided space for two names, i.e. a common name if the reserve does have them named and a study name given by ERP's elephant monitor.

History of elephants at Mabalingwe Nature Reserve

Mabalingwe Nature Reserve was originally started in 1972 as a maize and game farm. It was transformed into a holiday resort in 1988. Over the years, additional land has been added to the reserve, i.e. Gorcum (1991), Serapa (1991), Itaga (1999), Elandsfontein (2000) and Cyferfontein (2002). According to the latest ecological management plan from 2017 made available to ERP, the reserve's area size is 12,500 ha (Unknown authors 2017), while the elephant management plan from 2017 places it at 8,275 ha (De Klerk and De Beer 2017).
While compiling this report, we have measured the size of the reserve, the areas used for human habitation, and the exclusion made for sable (*Hippotragus niger*) from satellite imagery. The total area size is 8,907 ha, while the area set aside for human habitation and sable is approximately 247 ha and 69,10 ha, respectively. Thus, the actual size of area available to elephants is estimated to be 8,591 ha (see Appendix C).

There seems to be some inconsistencies with regards to when the elephants were reintroduced to Mabalingwe Nature Reserve and how many are currently on the reserve. The information provided in the latest ecological management plan and the latest elephant management plan do not match. The reserve's elephant management plan states elephants were reintroduced in 1995 but does not provide a number, composition, or origin (De Klerk and De Beer 2017). However, according to the reserve's ecological management plan eight elephants (four males and four females) were introduced in 1998 (Unknown authors 2017). Furthermore, while the elephant management plan itself states a population of 21 individuals, the appendix reports the population to be 24 individuals (De Klerk and De Beer 2017). According to Hannes Wessels (pers. comm.), there were 19 elephants at the game count conducted in 2019, while the letter from Ian Wilcoks states that there were 20 elephants in April 2021. However, ERP has only observed 15 elephants since monitoring began in August 2021.
For an overview of the information please see Table 1 below.

	Elephant Management Plan 2017	Appendix to Elephant Management Plan 2017	Letter from Ian Wilcocks	Information from Hannes Wessels via WhatsApp	Observations by ERP
Year	2017	2017?	2021 (April)	2019	August 2021 – January 2022
Total population	21	24	20	18 (was 19)	15
Population composition	Females Adult: 4 Subadult: 1 Juvenile: Calf: 1 Males Adult: 1 Subadult: 4 Juvenile: Calf: 8 N.D.: 2	Females Adult: 4 Subadult: 1 Juvenile: Calf: 1 Males Adult: 1 Subadult: 3 + 6 Juvenile: Calf: 8	Females Adult: Subadult: Juvenile: Calf: Males Adult: Subadult: 5 Juvenile: Calf:	Females Adult: Subadult: Juvenile: Calf: Males Adult: Subadult: Juvenile: Calf:	Females Adult: 4 Subadult: 4 Juvenile: 3 Calf: 0 Males Adult: 0 Subadult: 0 Juvenile: 4 Calf: 0
Notes	- 2 elephants not assigned sex or age group			- Game count in 2019 – no info on composition - 1 calf died	

Table 1 Known information on elephants at Mabalingwe Game Reserve.

Major events in the elephants' lives

It is important to have as much knowledge on elephants' history as possible. Keeping a record of any major events in the elephants' lives can be very helpful – either for the reserve they are at or for a receiving reserve in case of a translocation. Knowledge on past experiences can help explain underlying reasons for any future unusual behaviour of individual elephants or a population.

Elephants are intelligent and complex individuals with a good memory. Events in their past can affect their behaviour, e.g. elephants can suffer from post-traumatic stress (Poole *et al.*, 1996; Bradshaw *et al.*, 2005; Bradshaw, 2010). Knowing their pasts can assist in explaining their current behaviour, in predicting possible future behaviours, and in guiding and assisting in the most appropriate management decisions.

It is also important to be aware that even an event aimed at one specific individual, e.g. a darting for treatment of injury or collaring, will most likely affect the rest of the elephants. The use of a helicopter on the reserve can affect the elephants due to past experiences, even if the purpose of the helicopter has nothing to do with the elephants.

By continuing to update the table below (Table 2), Mabalingwe Nature Reserve can keep a record of events in the elephants' lives. This record can become very useful in the future.

Date	Action / Event	Identification
1995	Unknown number of elephants reintroduced to Mabalingwe Nature Reserve[1]	Unknown
1998	8 elephants reintroduced to Mabalingwe Nature Reserve – 4 males and 4 females[2]	Unknown
2006	Dominant bull (±30 years old) translocated from KNP[1]	Lucky?
17/07/2015	Female elephant shot and killed during hunt for dominant bull[3] [4]	Unknown
11/09/2017	5 elephants donated to Matlabas Game Ranch[5] – 13 elephants remained on reserve after this operation[6].	Unknown (2 x adult female, 1 x sub-adult, 2 x calf)
2017	5 young male elephants culled/relocated [7]	Unknown
Beginning of 2018	Bull elephant killed	Lucky
26/03/2019	Matriarch collared [8]	Kitso
October 2019	Game count (19 elephants) [9]	
2019-2020	7-day old calf stuck in mud and left by herd, rescued by staff, and taken to sanctuary near Vaalwater where it died [10]	Unknown
~ 04-05/2021	Young calf dies Was seen with injury to left side of head end of March 2021.	Calf of Sethunya or Montlenyane
~ 08/2021	Young calf dies Carcass spotted during game count in October 2021 [11]	Calf of Sethunya or Montlenyane
06/09/2021	Matriarch collared	Kitso

Table 2 Major events in lives of the elephants at Mabalingwe Nature Reserve.

[1] (De Klerk and De Beer 2017 Mabalingwe Nature Reserve – Elephant Management Plan)

[2] (*Unknown authors* 2017 Mabalingwe Nature Reserve – Ecological Management Plan)

[3] (van Wyk 2015 – Female elephant mistakenly shot by hunters https://africageographic.com/stories/female-elephant-mistakenly-shot-by-hunters/)

[4] (Zeederberg 2015 – Mabalingwe Common Property Association (MCPA) Update on Elephants)

[5] (Boschpoort Safaris Facebook-page - https://web.facebook.com/boschpoortsafari/photos/pcb.1434747236632707/1434747069966057/)

[6] (Mabalingwe Game Reserve Facebook-page in answer to comment made under post on relocation)

[7] (Letter from Ian Wilcocks 2021)

[8] (Boschpoort Safaris Facebook-page - https://web.facebook.com/boschpoortsafari/photos/pcb.2099705890136835/2099705626803528/)

[9] Pers. comm. Hannes Wessels on WhatsApp-group between ERP and Mabalingwe on 06/09/2021.

[10] Pers. comm. between Hannes Wessels and Ida Hansen on 22/11/2021.

[11] Pers. comm. Between Neil de Wet and Ida Hansen on 11/11/2021.

At the time of writing, we still have limited information on any aspect relating to the elephants, e.g. population size, composition, and record of events since reintroduction. All the information we have on elephant numbers and composition are summarised in Table 1, while all information we have been able to collect on major events in the elephants' lives are gathered in Table 2. From what we have been able to gather, there have been quite a few major events in the elephants lives that could be important in explaining the current, and future, behaviour of the elephants, e.g. relocations, hunting, culling and death of calves. Sources of this information are the aforementioned management plans, newsletters, news articles, social media and personal communication with reserve personnel and landowners.
We have no information in the period from reintroduction in 1995 or 1998 to 2006, when a dominant bull was introduced from Kruger National Park. Then we have another gap in the information until 2015. During the winter of 2014, elephants caused damaged:

"*…in the Boekenhoutplaat / Elandsfontein area of Mabalingwe in uprooting many of the remaining trees and causing damage at a number of lodges in an attempt to get food and water. In a number of instances, 10 000 liter water tanks were smashed to pieces and water lines and pump installations damaged in the process.*" (Zeederberg, 2015).

It should be noted that this behaviour is not a sign of aggression. Rather it suggests that already then, people were feeding the elephants and luring them to their houses. Furthermore, as Zeederberg (2015) states there was a drought which extended the winter, and the damage was limited to that period of time.
According to Zeederberg (2015), the elephant bull started to show aggressive behaviour in 2014, i.e. a pregnant rhino was believed to have been killed by the bull in March 2014, and a vehicle was severely damaged in April 2015. Following this, specialists were consulted, and GnRH-treatment was recommended and apparently started (Zeederberg, 2015). However, it does not seem that the treatment was allowed very long to take effect with only one administration, and the fact that the destruction permit was applied for issued and used within 2.5 months. It seems the destruction of the bull was sold as a hunting experience (Zeederberg, 2015 and van Wyk, 2015). During the hunt, the company was surprised by a female elephant and believed themselves to be in danger and thus the elephant was shot (Zeederberg, 2015):

"*The morning of the hunters' arrival, the elephant herd was found on the northern side of the mountains on Serapa. The hunters, under the leadership of a professional hunger, stalked the bull on foot, and while they were approaching the herd, a young cow suddenly appeared from the bush and charged the hunting party. The hunters realized that this was a life threatening situation and responded to protect themselves. They were compelled to shoot the charging cow. As legally required, the incident was reported to LEDET.*"

From this narrative, it appears that the regulations for hunting elephants was not followed. According to the Norms and Standards of Elephant Management in South Africa, no elephant must be hunted in the immediate proximity of any female/calf group (DEAT, 2014 - 20(2)), but from the narrative it seems that the targeted male elephants was with the family group or in their vicinity.
Following this unsuccessful hunt, the bull was darted on the 20th of July 2014 to determine whether the aggressive behaviour was due to injury, disease etc. Nothing was found, and the bull was not in musth at the time of darting. It was administered a second dose of GnRH. In the newsletter, it states that destruction remains a possibility if the aggressive behaviour continues (Zeederberg, 2015). ERP has not been able to confirm what happened to the dominant bull. However, an owner has informed us that the bull was eventually shot, although a date has yet to be confirmed (confidential pers. comm.).

The next major event happened in September 2017, where five elephants were translocated from the reserve to Matlabas Game Ranch, Limpopo. From the photos and videos on the Facebook pages of Mabalingwe Game Reserve and Boschpoort Safaris, it appears to be two young adult females, one sub-adult

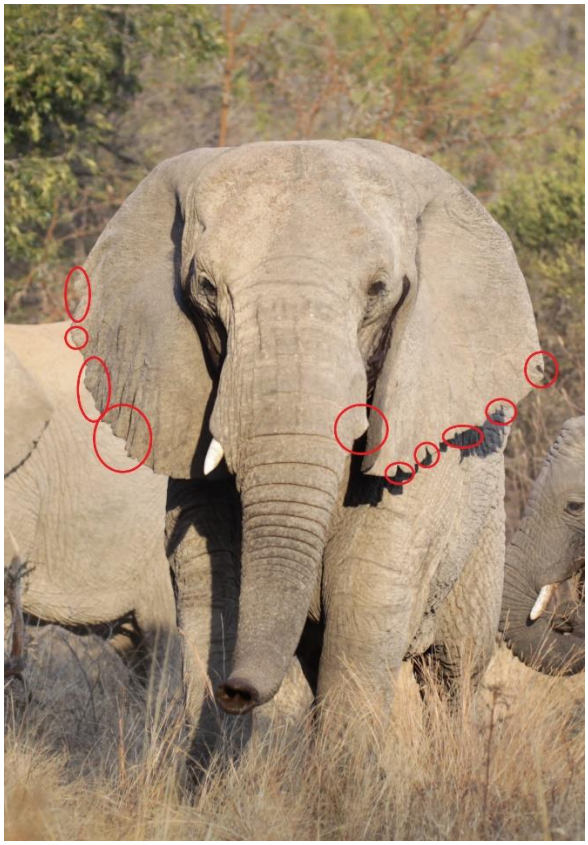
of unknown sex, and two juveniles, presumable the calves of the two adult females (see footnotes on page 3 for references).
It is uncertain whether elephants were also culled during 2017, as one comment to the post announcing the translocation on the Facebook page of Mabalingwe Game Reserve says: "*There are hardly any animals left… culling a few weeks ago??.. now donating???*". It is uncertain whether the culling refers to elephants or to other wildlife species. However, the letter ERP received from Ian Wilcoks in April 2021 offers vague mentions of culling referring to the majority of 'problem' elephants were culled, and others were donated or relocated in 2017. The letter also suggests repeating these actions taken in 2017 to manage the current situation.
On the post about the translocation to Matlabas Game Ranch, the administrator of the Mabalingwe Game Reserve's Facebook-page does inform that the elephant population following the translocation was 13 individuals.

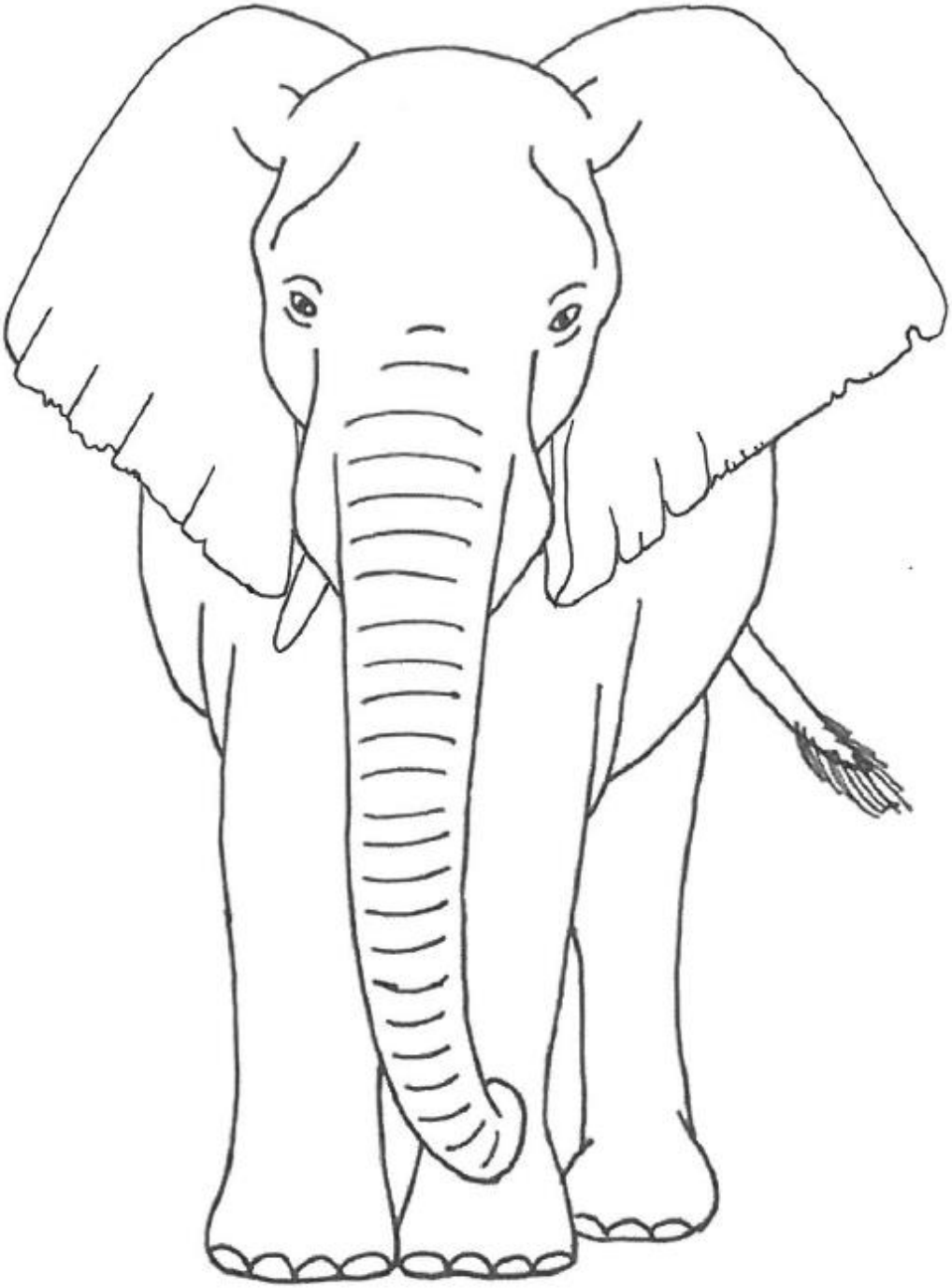
Another gap in the information follows until 2019. On the 26th of March 2019, the matriarch is collared. And a game count is conducted later that same year in October. These are both categorised as major events for the elephants. The collaring would directed have affected the whole herd, i.e. stress from being chased by a helicopter, being separated from each other and from the matriarch, and her following disorientation upon awakening would all have affected them negatively. Seven months later, the elephants would have been stressed again by the reappearance of the helicopter, even though it was not targeting them. The game count in 2019 provided a population of 19 elephants.

We have no information for the period between October 2019 and August 2021, apart from the letter from Ian Wilcocks, which suggests there should be 20 elephants and that five young male elephants should be translocated or culled.
ERP started to monitor the elephants in August 2021. By the end of January 2022, 15 elephants have been identified as belonging to a cohesive family group. The details on these elephants are given below in this report. According to the reserve, there is supposed to be an additional three young male elephants roaming the reserve separate from the herd. However, despite a permanent ERP monitor placed at the reserve and a 2-hour search by helicopter at an elephant collaring no other elephants or signs of other elephants have been seen.
In November 2021, we discovered that three calves had died in the last few years. One was a calf believed to be approximately 7 days old, when it was caught in a mud pool, left by the herd, and rescued by reserve staff who moved it to a sanctuary near Vaalwater. This is believed to have occurred in 2019 or 2020 (pers. comm. Hannes Wessels). Two calves were born around August 2019 to Sethunya and Montlenyane, judging by the photos and videos we have been able to find. Both of these calves died during 2021. One is suspected to have died in March or April 2021. At the end of March 2021, it was reported to reserve management due to an injury behind the left ear. The last photo we have been able to find of this calf is from the 16th of April 2021. The carcass of the other was spotted during in October 2021 during game counts. Examination of the carcass confirmed that this was not the calf with the injury but the other of similar age. Cause of death is unknown. For more information on this we refer to the reports "Report on the three unaccounted for elephant calves" and "Report on elephant carcass" sent to the reserve in December 2021.
Currently, we have a discrepancy of three elephants compared to the game count from 2019. It is unknown what has happened to these three elephants.

Identification of the elephants

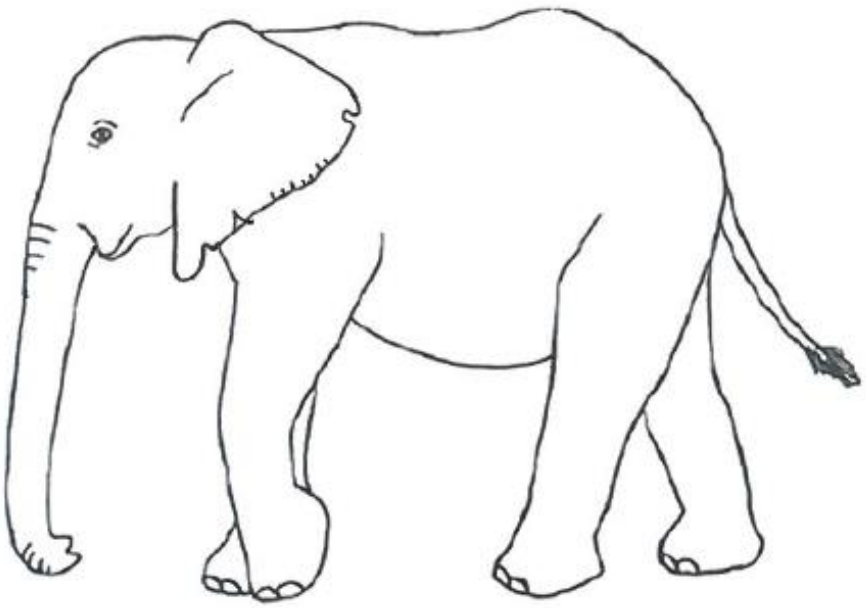
Common name	Tandy
Study name	Kitso (*Wisdom*) (MF1)
Sex	Female
Age class	Adult
Origin	
Relatives	Sethunya, Montlenyane (?), Neo, Maatla (all offspring)
Characteristics **- Ears** (from top to bottom) **- Tusks** **- Trunk** **- Forehead** **- Body** **- Tail** **- Height**	 Large lobes; Drooping; Hanging in waves; Serrated edges Left: Lobe curl outward; 1 x U-notch (midway); 1 X Finger-flap; 2 x V-notch (lower 1/3) Right: Many small nicks and slits Straight; Pointy; Short; One-tusker – One-Right Vertical folds between eyes and tusks Smooth; Indentations above eyes Elongated but not pronounced; Developed mammary glands Long; Long hairs 280 cm shoulder height
Notes	- Matriarch - Collared 06/09/2021 - Assumed to be one of the original elephants translocated.



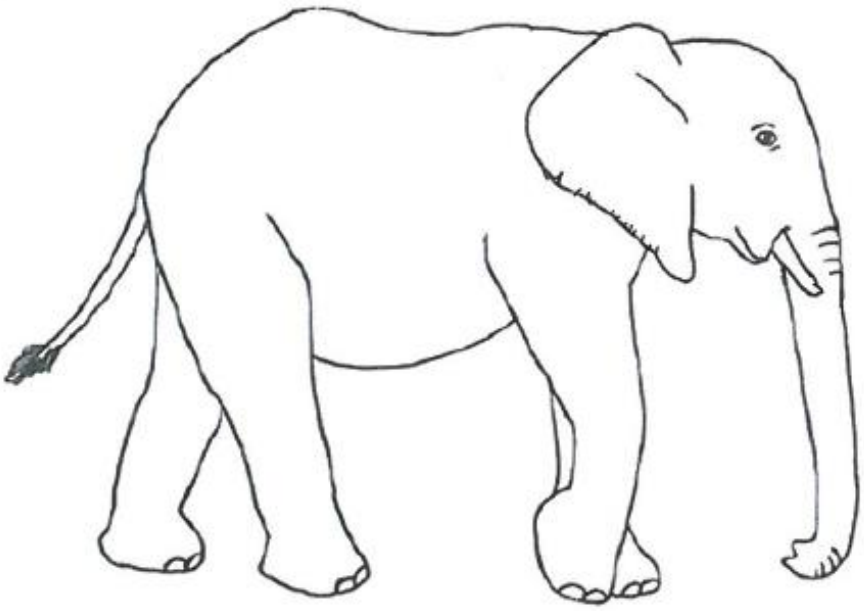


Kitso

Left

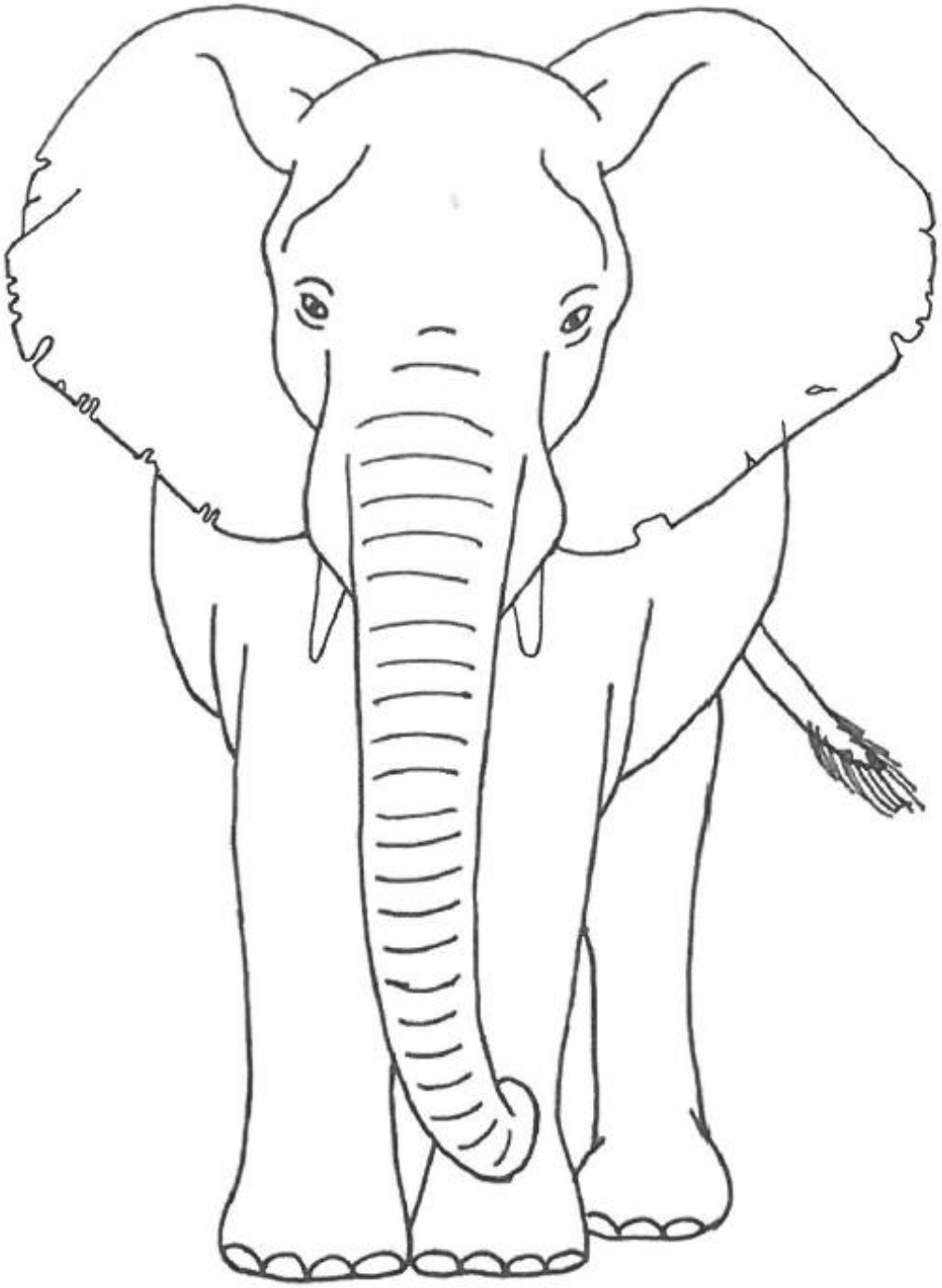


Right



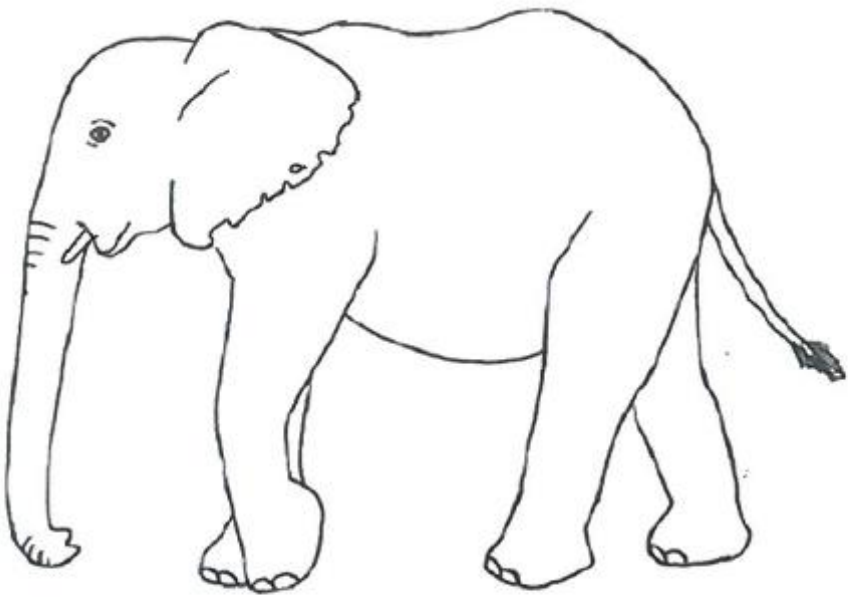
Kitso

Common name	
Study name	Sethunya (*Flower*) (MF1-1F)
Sex	Female
Age class	Subadult
Origin	Mabalingwe
Relatives	Kitso (mother); Montlenyane (?), Neo (sibling), Maatla (sibling); Unknown calf
Characteristics **- Ears** (from top to bottom) **- Tusks** **- Trunk** **- Forehead** **- Body** **- Tail**	 Large ears; Earlobes curl outward; Wavy/Folded; Serrated edges Left: 1 x V-notch (upper half); 1 x Finger-flap (midway); smaller slits; 1 x Square-notch (lower 1/3) Right: 1 x small U-notch (top 1/3); smaller U-notches; 1 x Slit-hole (midway); smaller U-notches Symmetrical; Straight; Pointy; Short tusks; Shorter left Vertical folds between eyes and tusks Smooth; Angular Short and round body shape; Developed mammary glands Long; Long hairs
Notes	- Seems to have had a calf judging by photos on social media of her and the calf and of her having developed and full mammary glands. Calf seems to have been around 2 years old with tusks just showing. Calf found dead in October 2021.

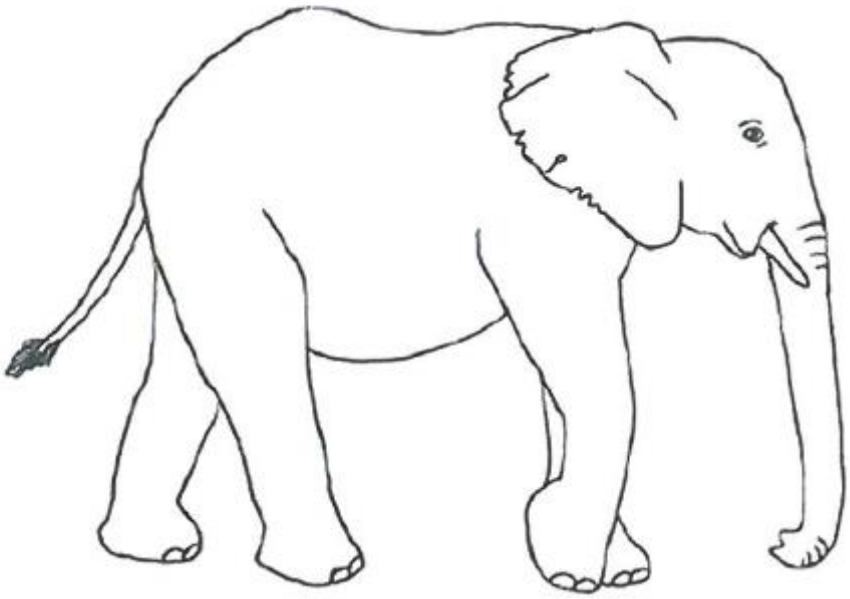


Sethunya

Left

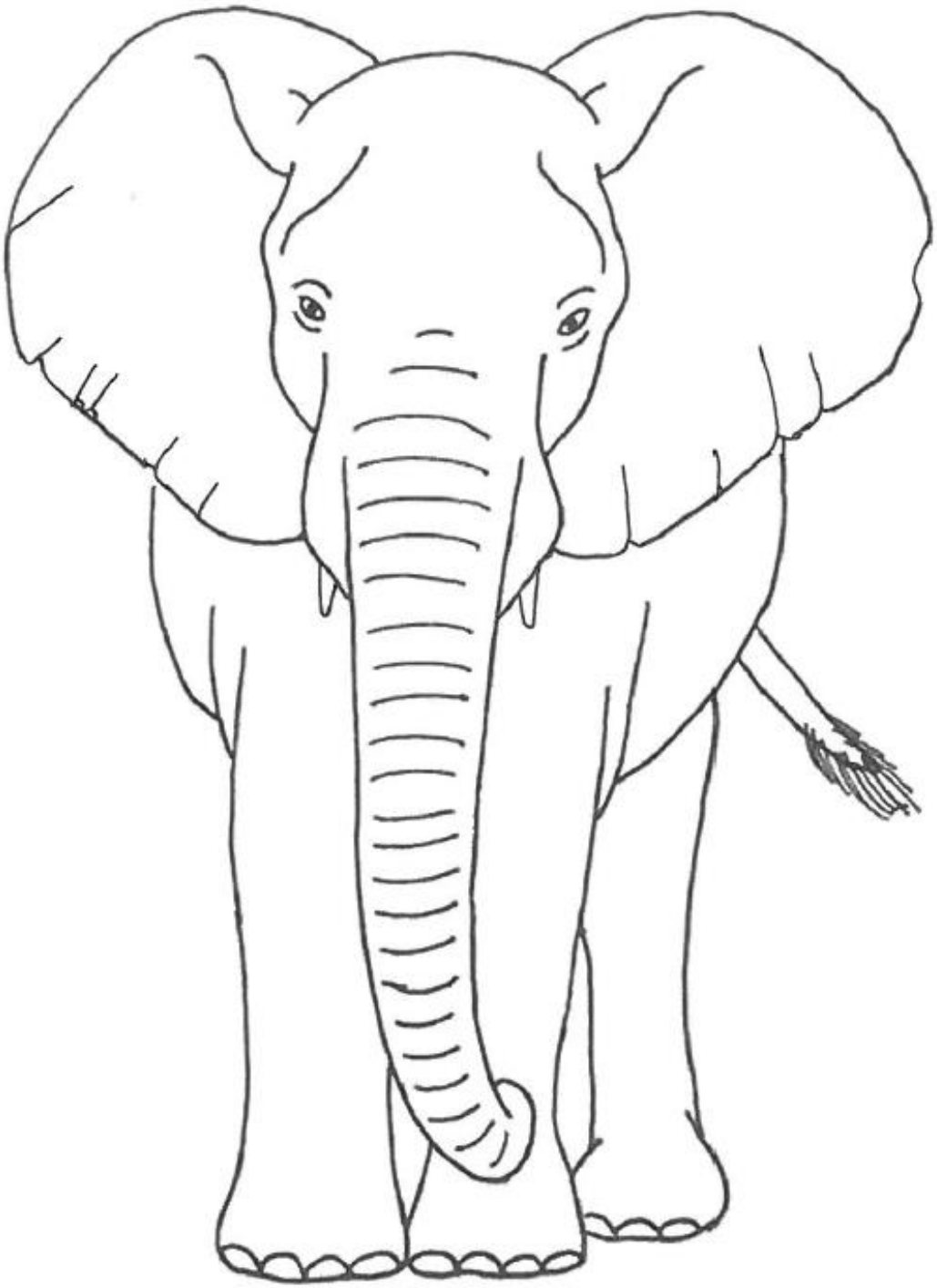


Right



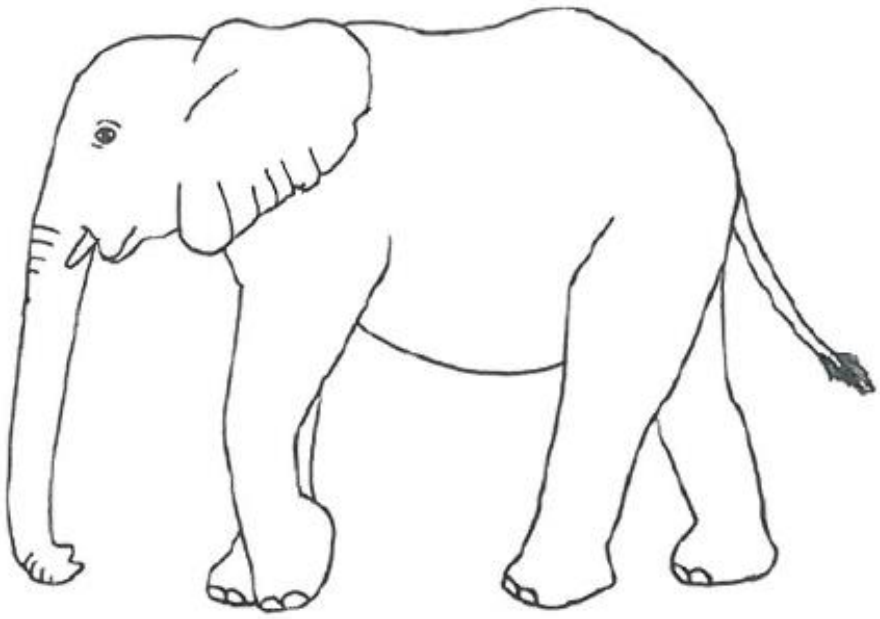
Sethunya

Common name	
Study name	Montlenyane (*Beautiful one*) (MF1-2F)
Sex	Female
Age class	Subadult
Origin	Mabalingwe
Relatives	Kitso (mother); Sethunya (sibling ?), Neo (sibling), Maatla (sibling); Unknown calf?
Characteristics **- Ears** (from top to bottom) **- Tusks** **- Trunk** **- Forehead** **- Body** **- Tail**	 Large ears; Earlobes fold outward; Wavy/Folded ears; Smooth edge w. tiny nicks/notches Left: 1 x U-notch (upper half) Right: Smaller U-notches/Slits Symmetrical; Straight; Pointy; Short tusks; Shorter right Vertical folds between eyes and tusks Angular; Wrinkled Short and round body shape; Mammary glands developed Long; Full tuft
Notes	- Seems to have had a calf judging by photos on social media of her and the calf and of her having developed and full mammary glands. Calf seems to have been around 2 years old with tusks just showing (presumed dead – carcass not yet found).

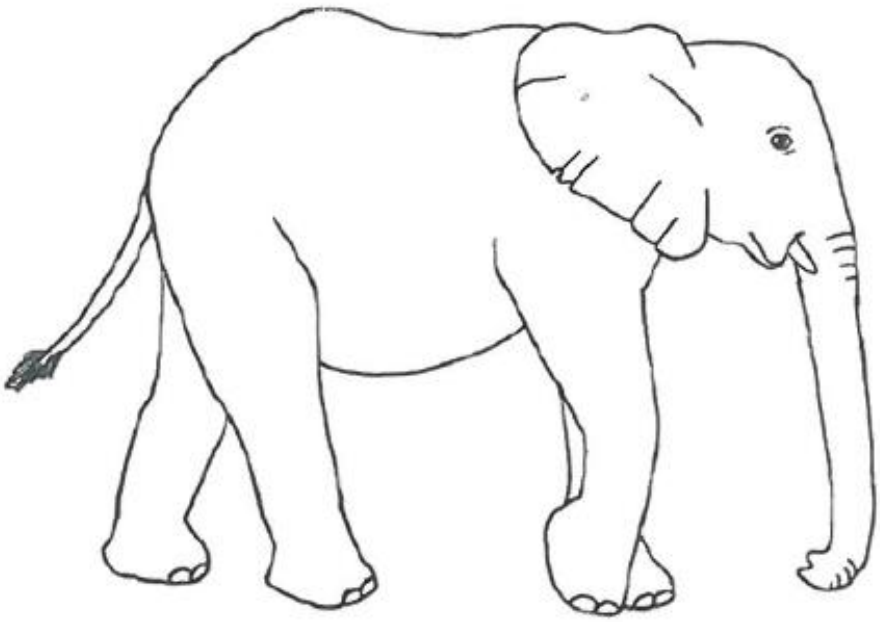


Montlenyane

Left

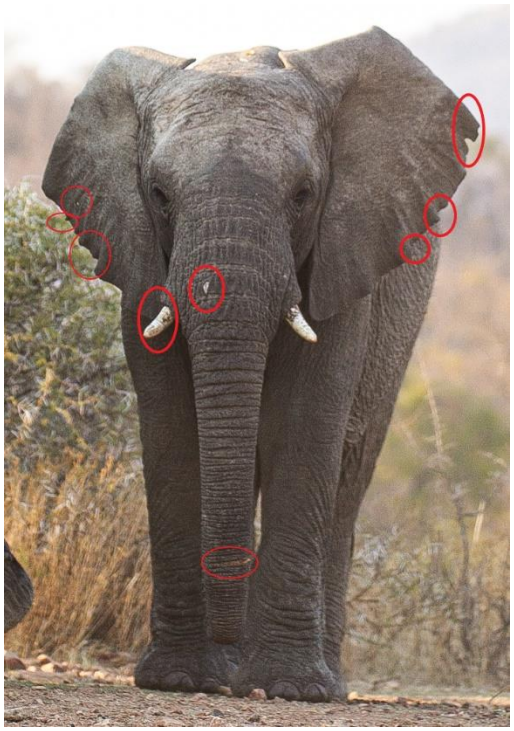


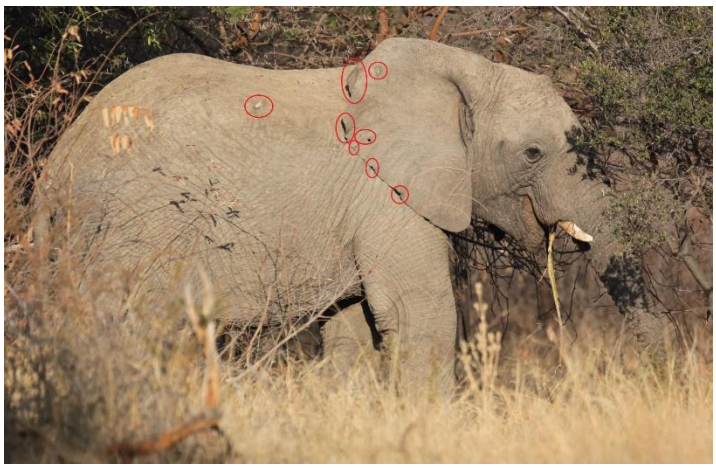
Right

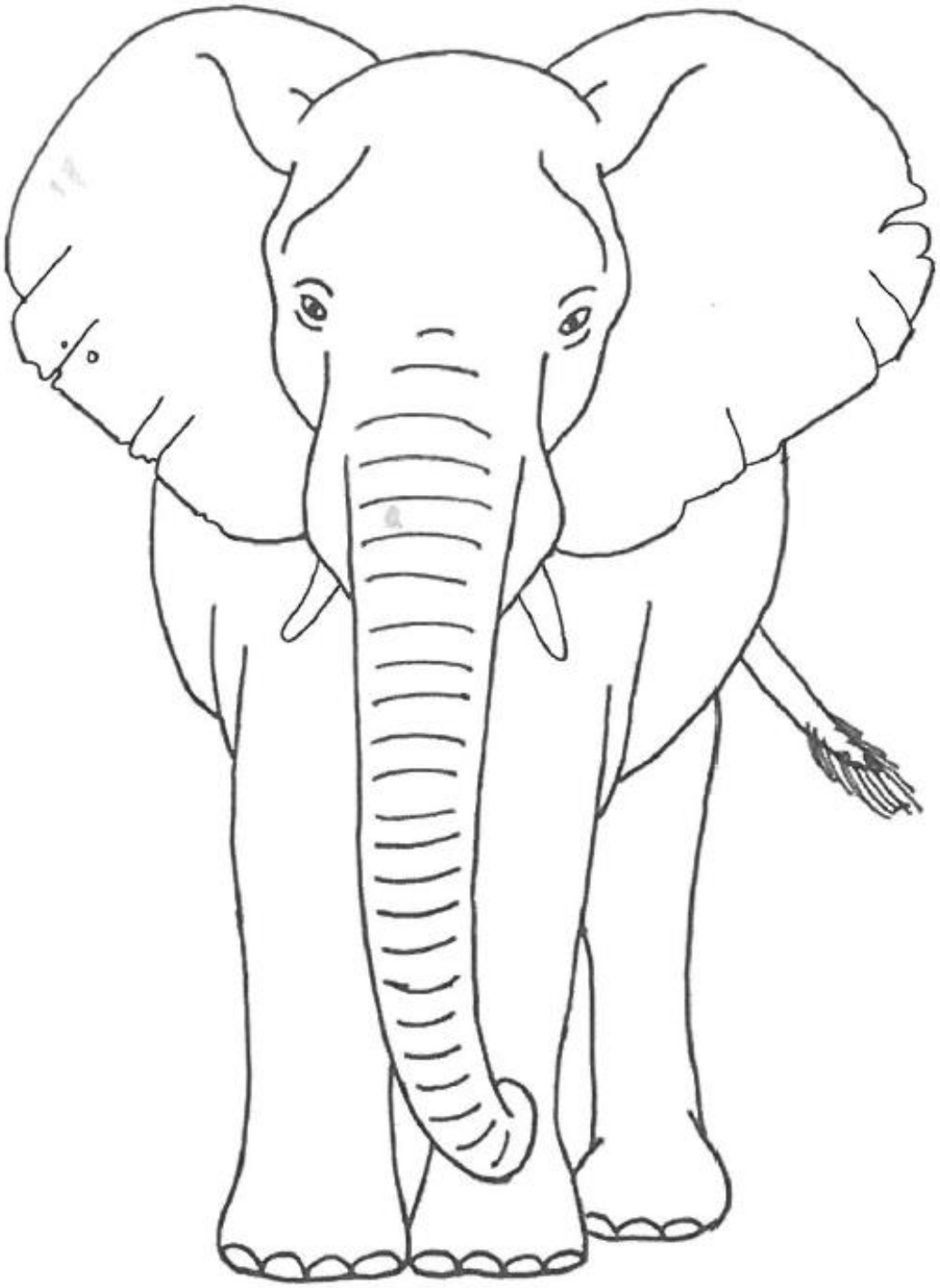


Montlenvane

Common name	
Study name	Neo (*Gift*) (MF1-3M)
Sex	Male
Age class	Juvenile
Origin	Mabalingwe
Relatives	Kitso (mother); Sethunya (sibling), Montlenyane (sibling ?), Maatla (sibling)
Characteristics **- Ears** (from top to bottom) **- Tusks** **- Forehead**	 Earlobes at jawline; Slightly wavy; Serrated edges Left: 2 x Finger-flap (upper 1/3); 1 x small V-notch (midway); Small U-notches (lower 1/3) Right: 1 x Fold (upper 1/3); 1 x Cup-notch; 2 x Holes (midway); 1 x Slit-hole; 2 x small V-notch (lower half) Symmetrical; Splayed; Slightly upcurved; Shorter right; No hourglass development Round; Bump; Slightly wrinkled
Notes	- Often has abrasions on body and head

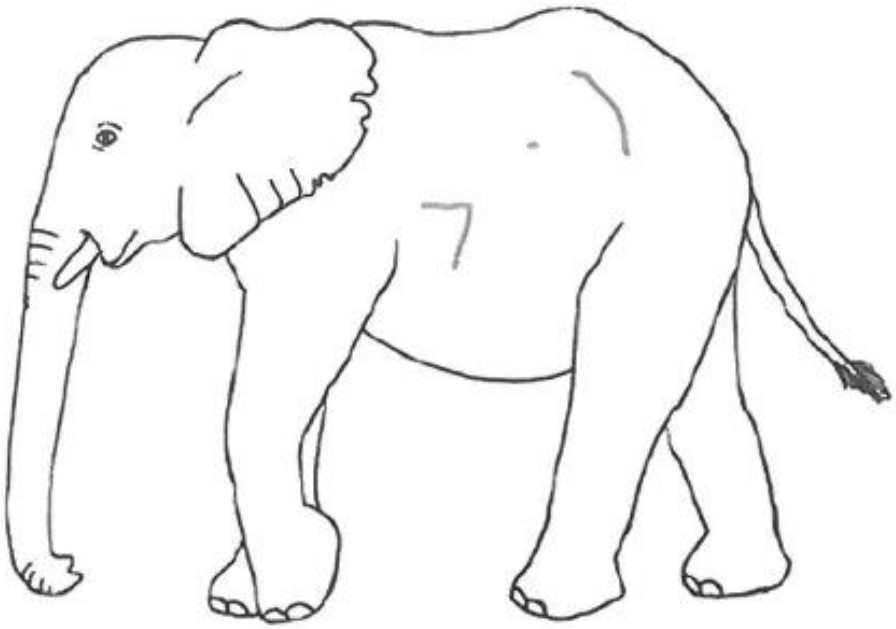




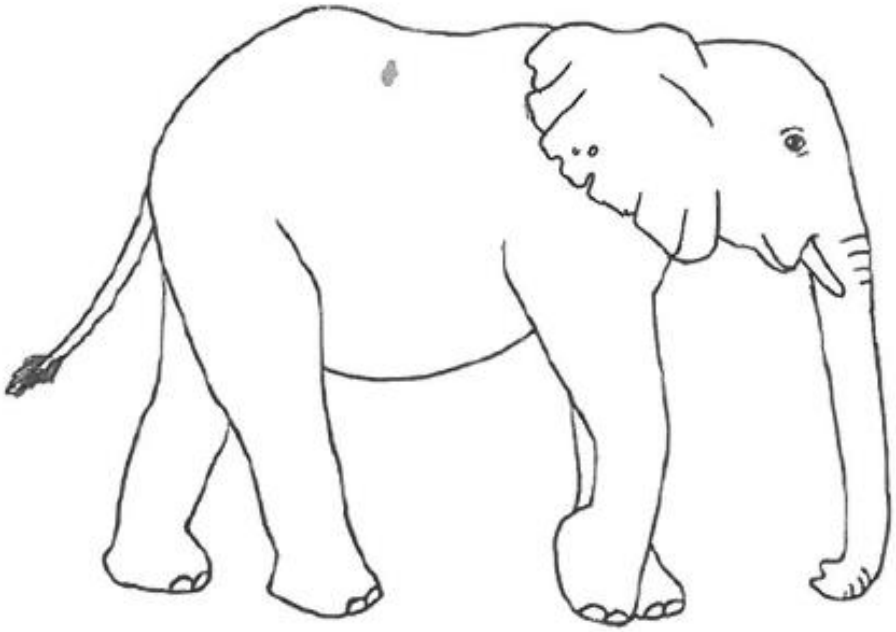


Neo

Left

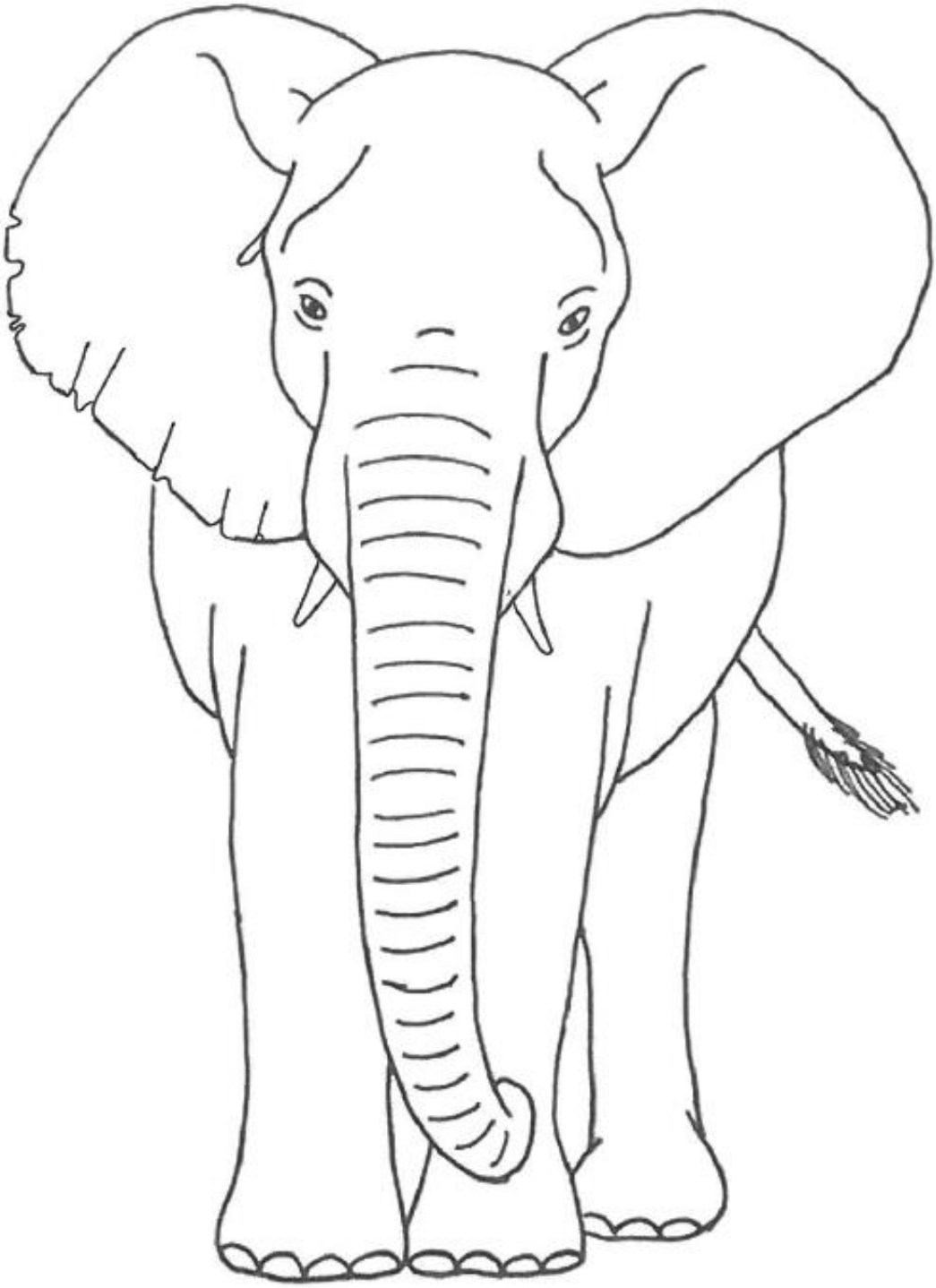


Right



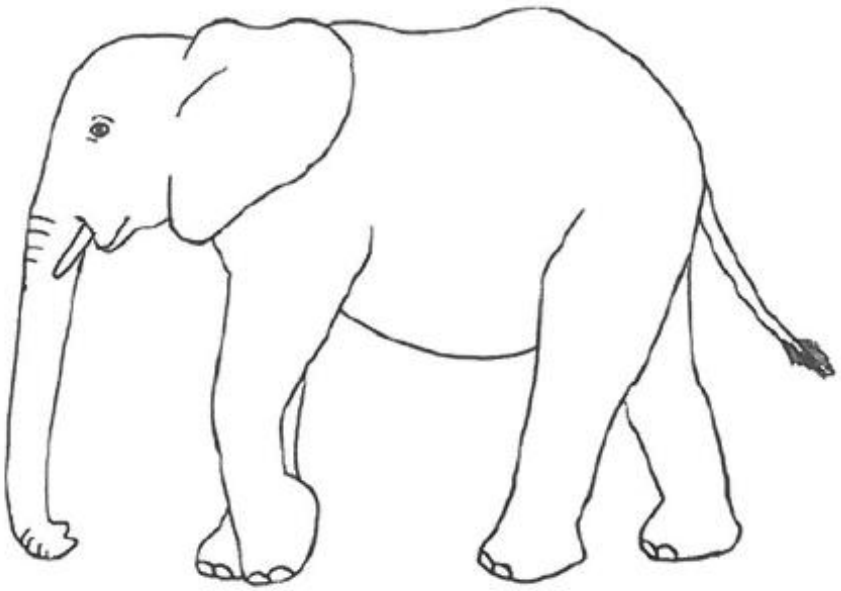
Neo

Common name	
Study name	Maatla (*Strength*) (MF1-4M)
Sex	Male
Age class	Juvenile
Origin	Mabalingwe
Relatives	Kitso (mother); Sethunya, Montlenyane (?), Neo (sibling)
Characteristics **- Ears** (from top to bottom) **- Tusks** **- Forehead / Head** **- Tail**	 Large ears; Slightly droopy; Smooth edges w. tiny nicks/slits/notches Left: Right: 1 x Flap-cut; 1 x U-notch (upper half); Small Slits and V-notches (lower half) Symmetrical; Straight; Pointy; Splayed; No hourglass development Round; Wrinkled; Flap between gland and ear (right) Short; Full tuft
Notes	

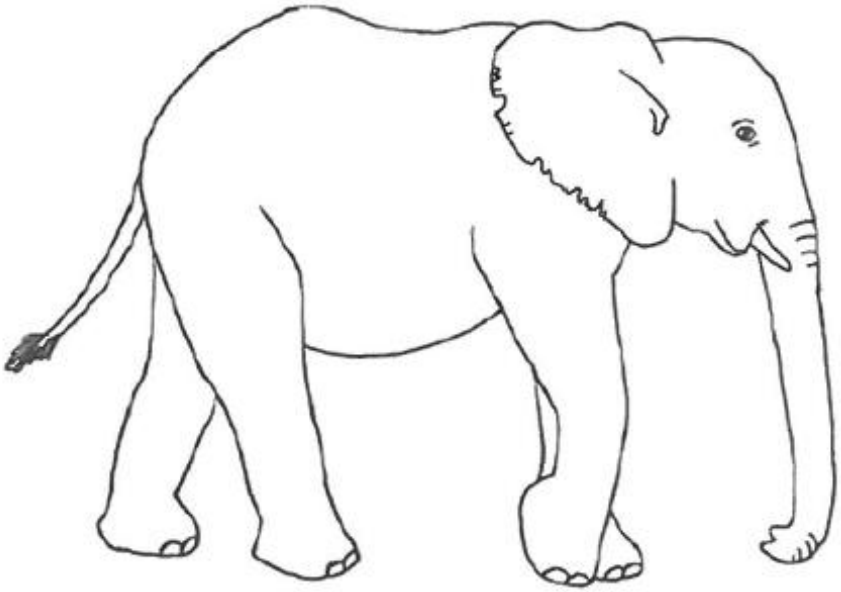


Maatla

Left

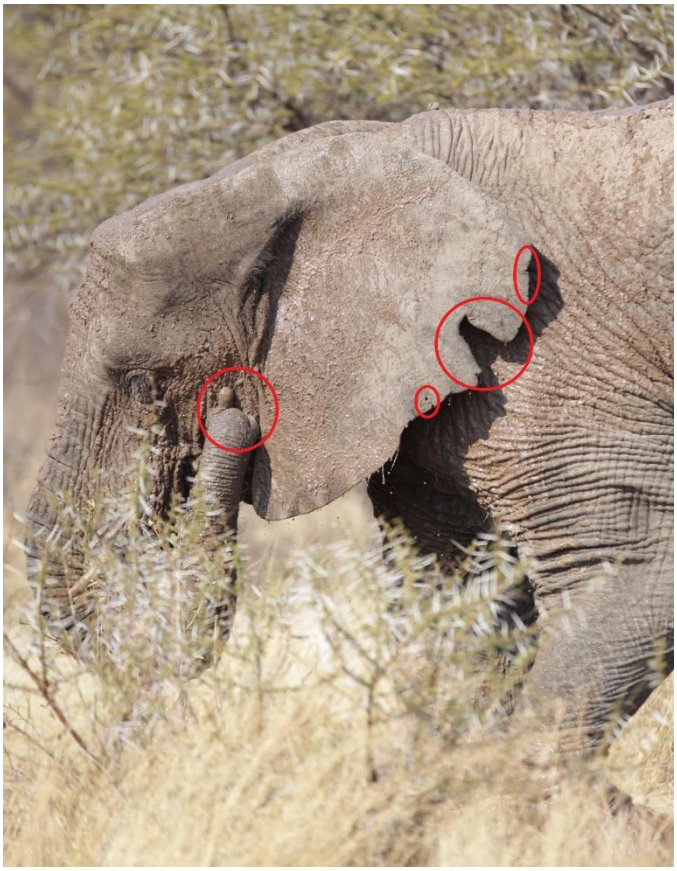


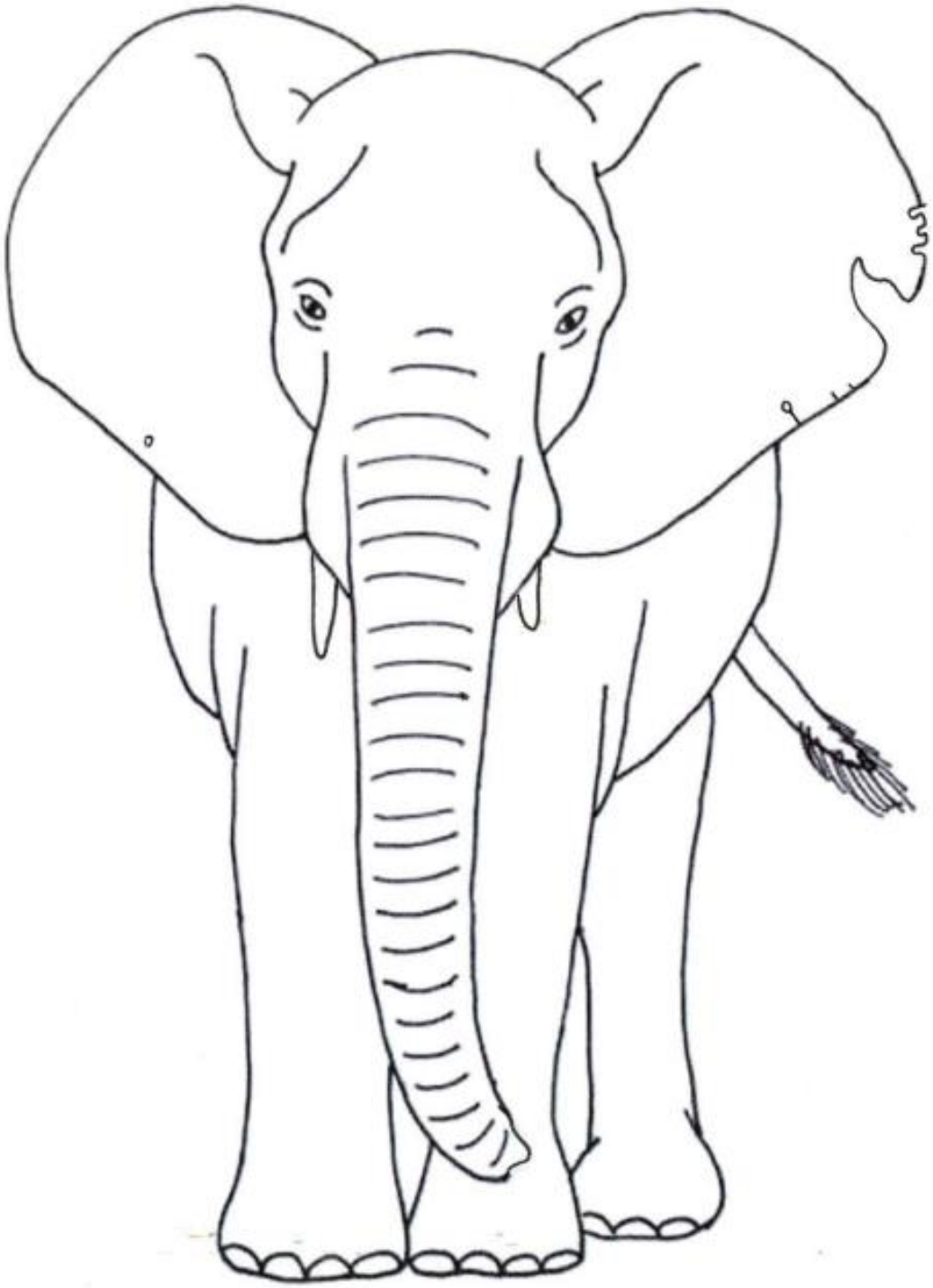
Right



Maatla

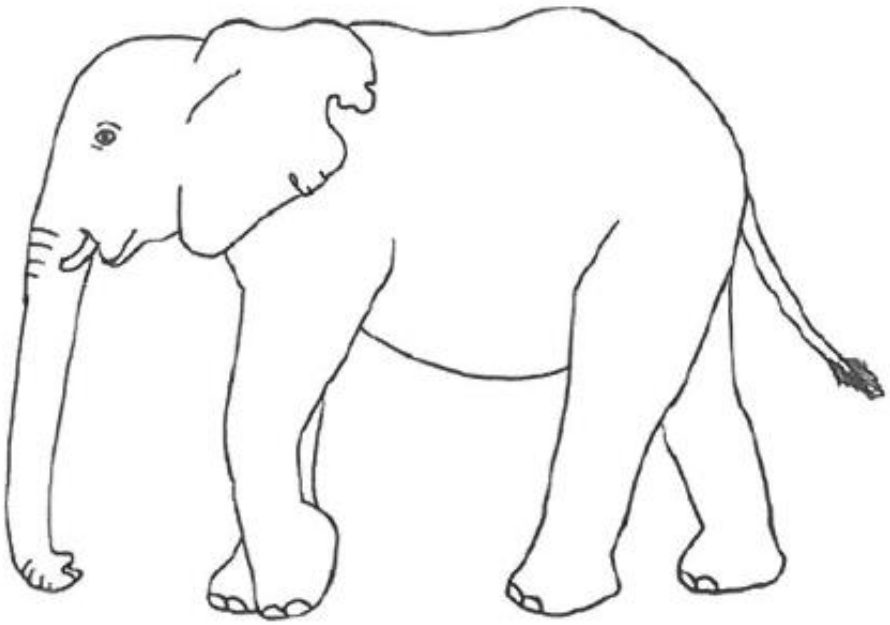
Common name	
Study name	Pelontle (*Beautiful heart*) (MF2)
Sex	Female
Age class	Subadult
Origin	Mabalingwe
Relatives	*Unknown*
Characteristics **- Ears** (from top to bottom) **- Tusks** **- Trunk** **- Forehead** **- Body**	 Large ears; Smooth w. tiny slits; 1 x distinctive notch (right ear) Left: Small slits (upper half); 1 x Flap-cut (midway); 1 x Hole (lower half) Right: Tiny slits; 1 x Hole (lower 1/3) Symmetrical; Straight; Pointy; Short tusks; Shorter left Partly amputated prehensile finger Angular; Wrinkled Short and round body shape
Notes	Unsure whether mammary glands are developed and thus whether she is mother to one of the calves that died recently.



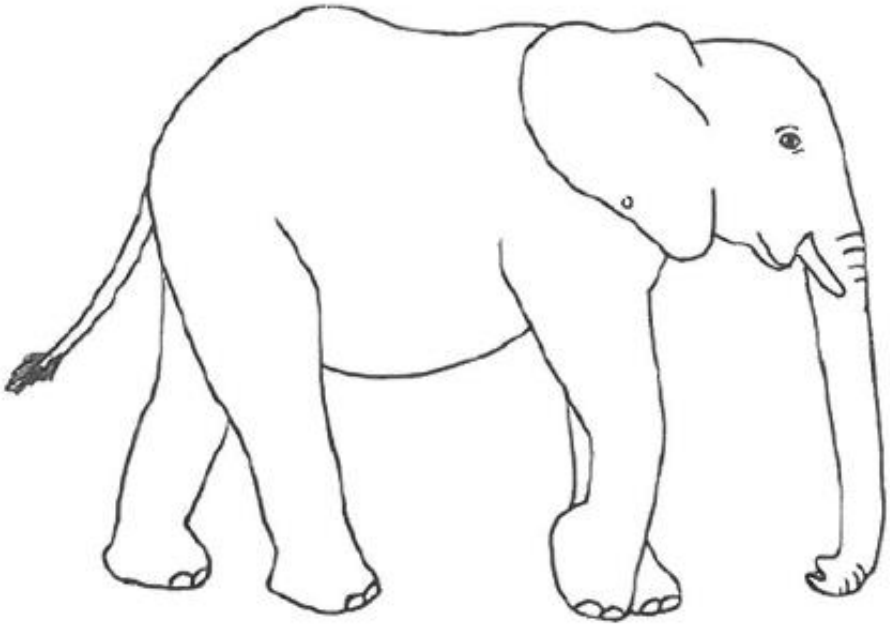


Pelontle

Left

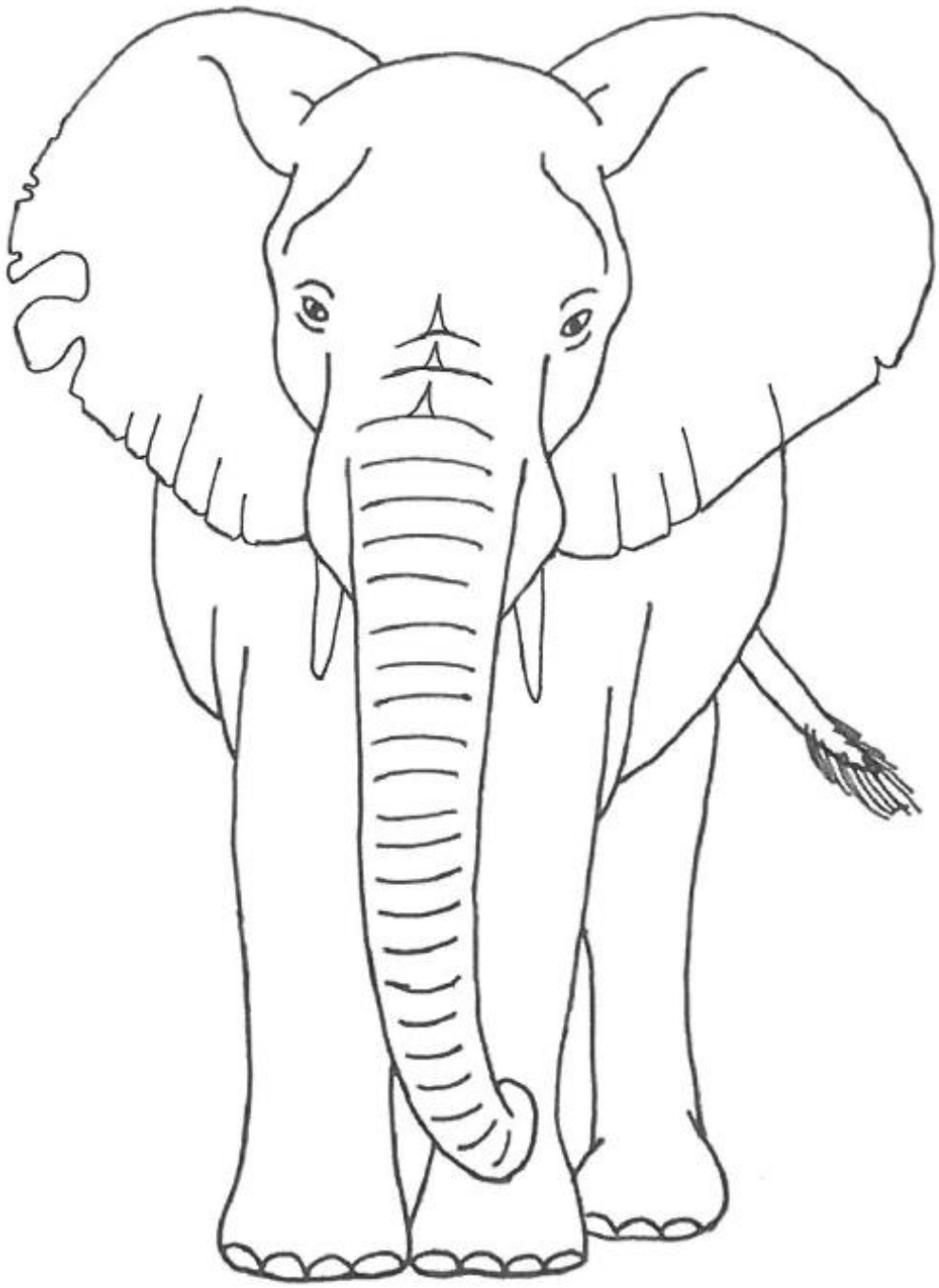


Right



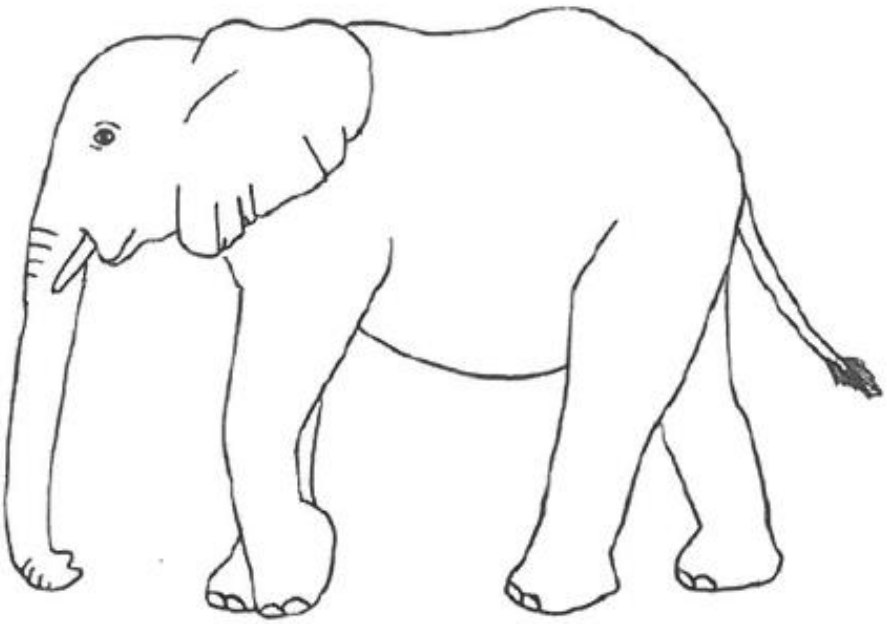
Pelontle

Common name	
Study name	Tumelo (*Faith*) (MF3)
Sex	Female
Age class	Adult
Origin	
Relatives	Dikeledi, Kagiso (offspring)
Characteristics **- Ears** (from top to bottom) **- Tusks** **- Trunk** **- Forehead** **- Body** **- Tail**	 Large, rounded ears; Prominent veins; Serrated edge; Distinctive notches (right ear) Left: Smooth w. tiny nicks/slits; 1 x V-notch (midway) Right: 1 x Finger-flap (upper 1/3); 1 x U-notch (midway); 1 x Flap-cut (midway); Small Slits (lower half) Symmetrical; Straight; Pointy; Slender; Shorter left 3 x distinct triangular wrinkles between eyes and trunk Angular; Wrinkled Short and round body shape Long; Full tuft
Notes	

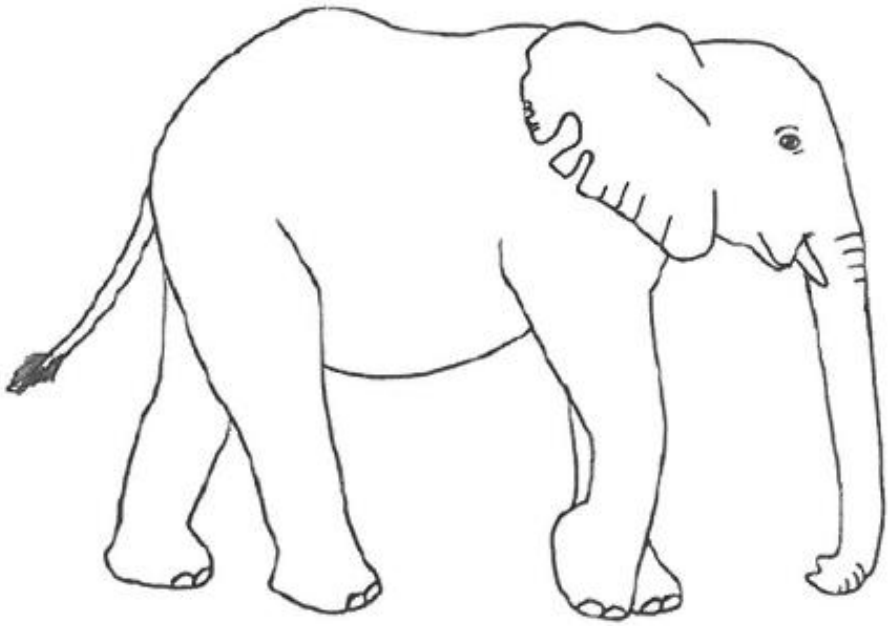


Tumelo

Left

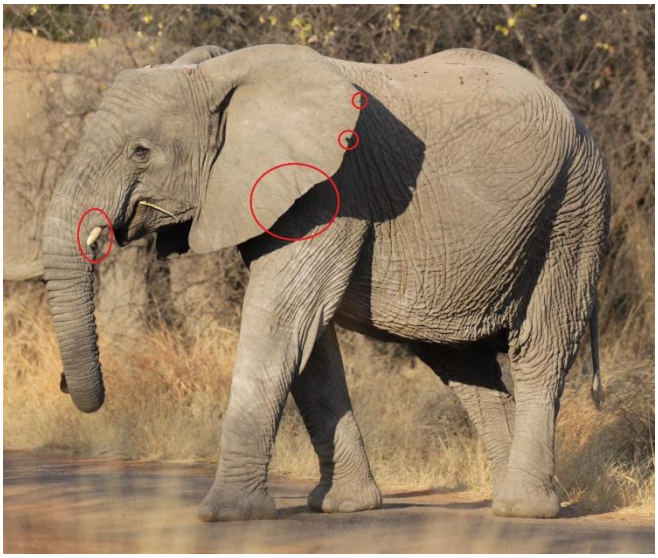


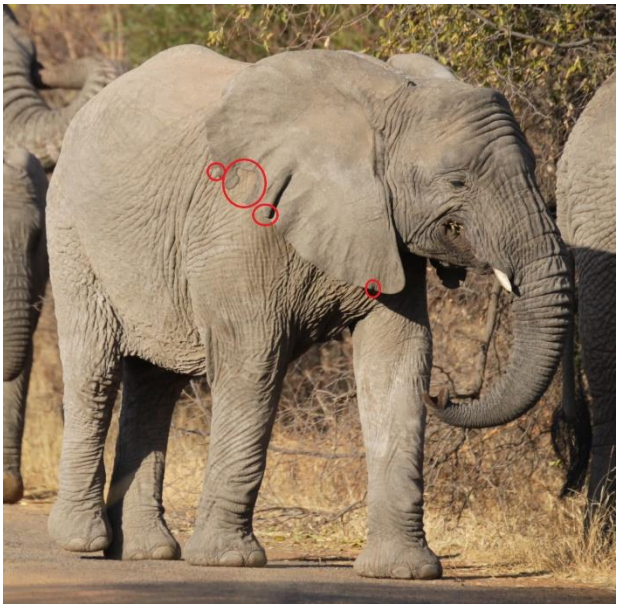
Right

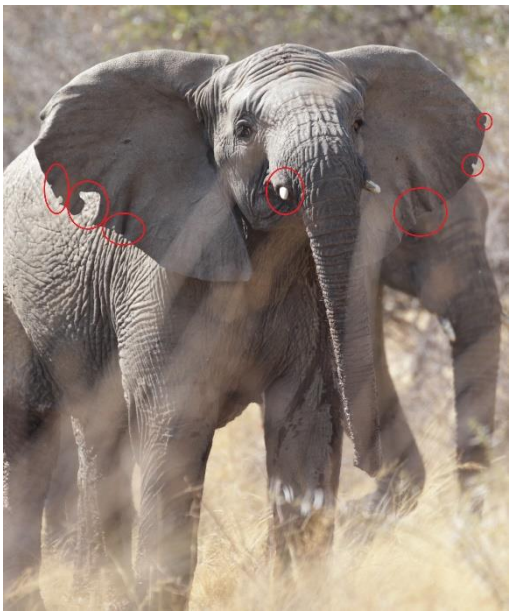


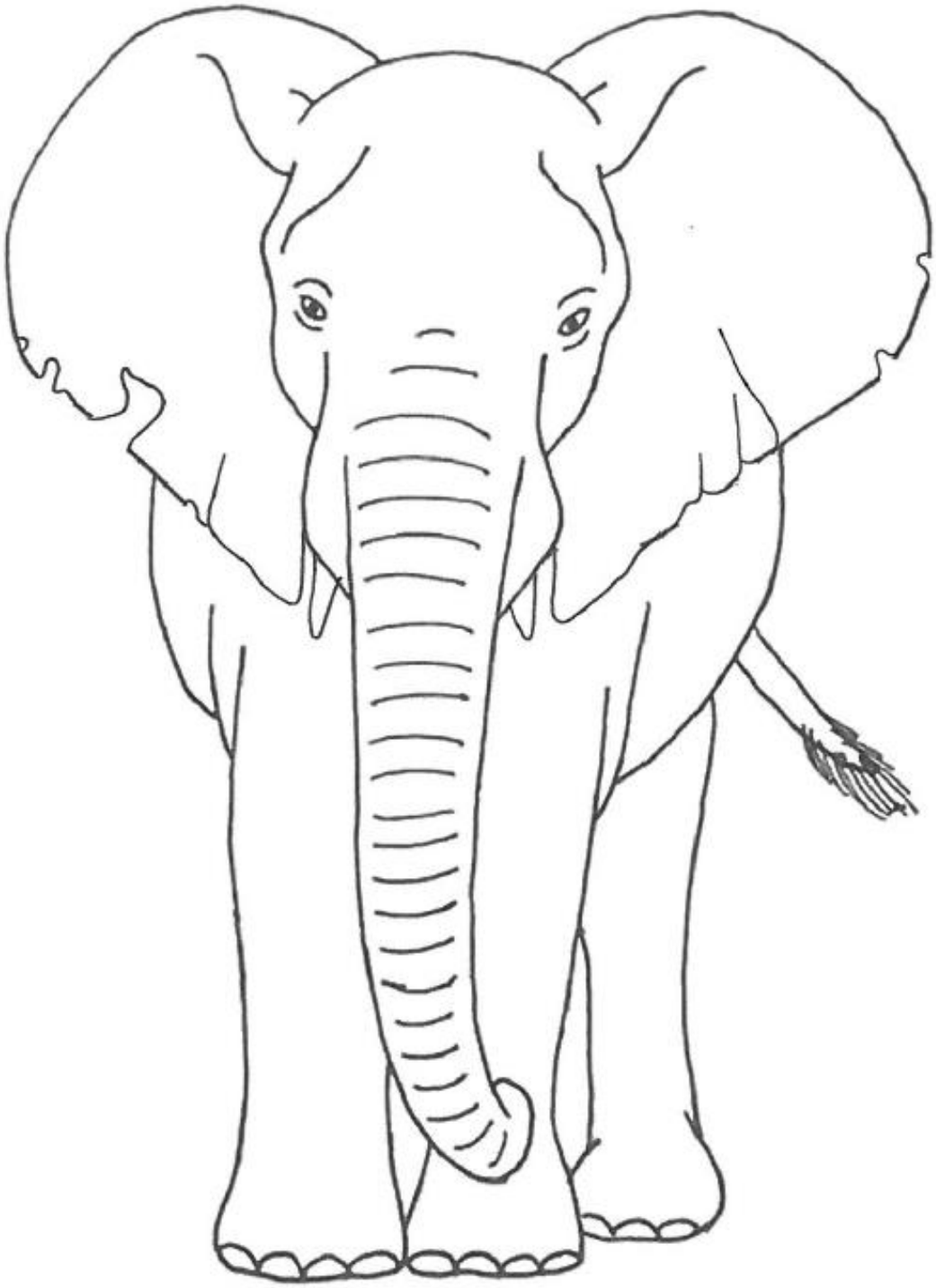
Tumelo

Common name	
Study name	Dikeledi (*Tears*) (MF3-1F)
Sex	Female
Age class	Subadult
Origin	
Relatives	Tumelo (mother); Kagiso (sibling)
Characteristics **- Ears** (from top to bottom) **- Tusks** **- Forehead** **- Body** **- Tail**	 Earlobes curl outward; Smooth edges w. tiny nicks/notches (left) and distinctive notch (right) Left: 1 x U-notch; 1 x U-notch (midway); 1 x Triangular fold (lower half) Right: 1 x U-notch; 1 x irregular Square-notch (midway); 1 x Triangular fold (midway); 1 x U-notch Symmetrical; Straight; Pointy; Slender; Short; Shorter left Angular; Wrinkled Short and round body shape; No developed mammary glands Short; Sparse tuft w. short hairs
Notes	



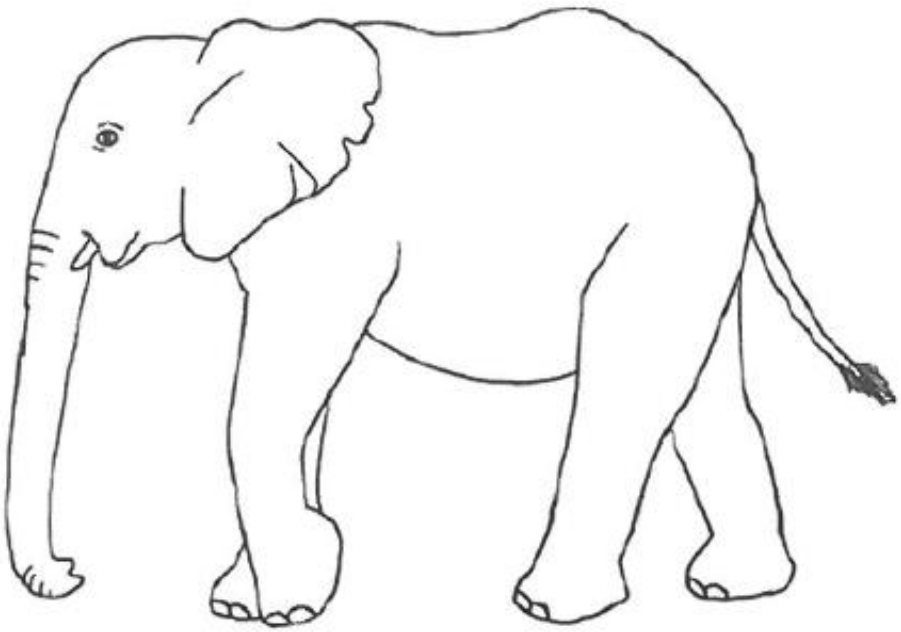




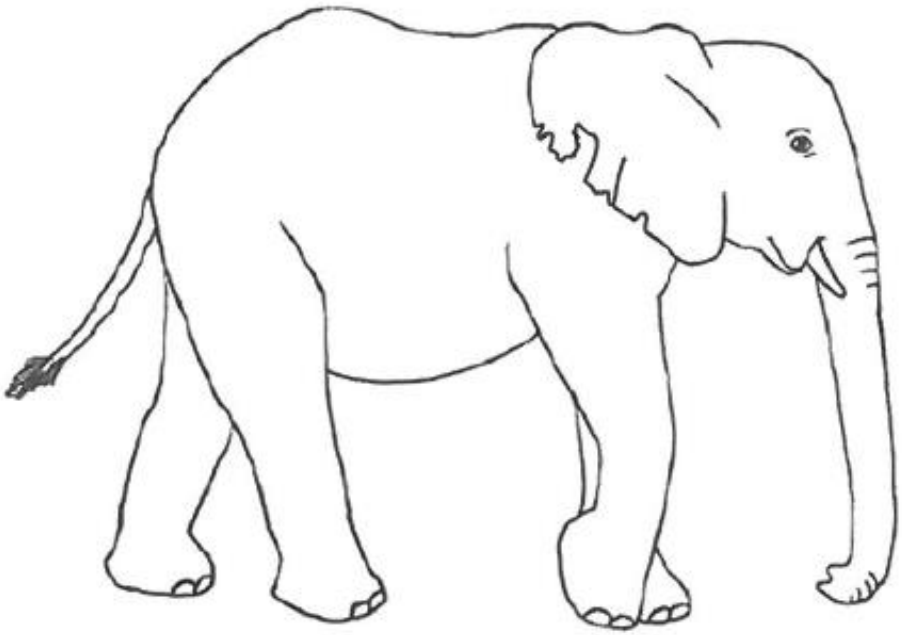


Dikeledi

Left

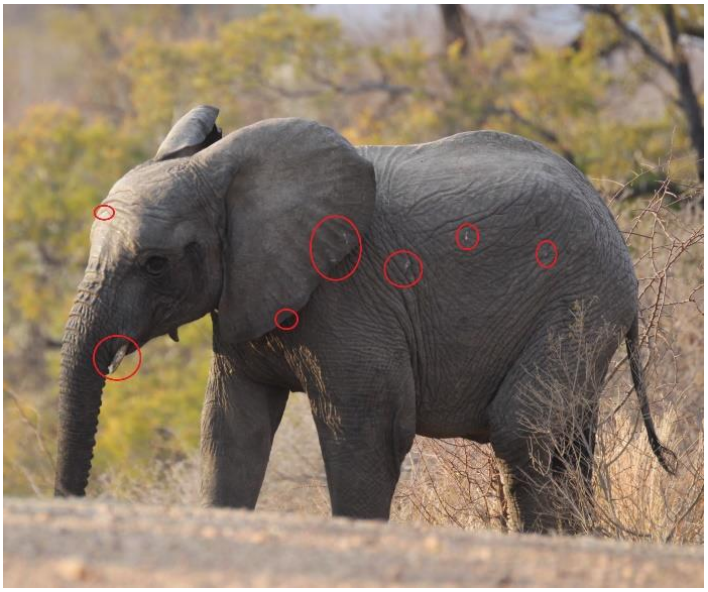


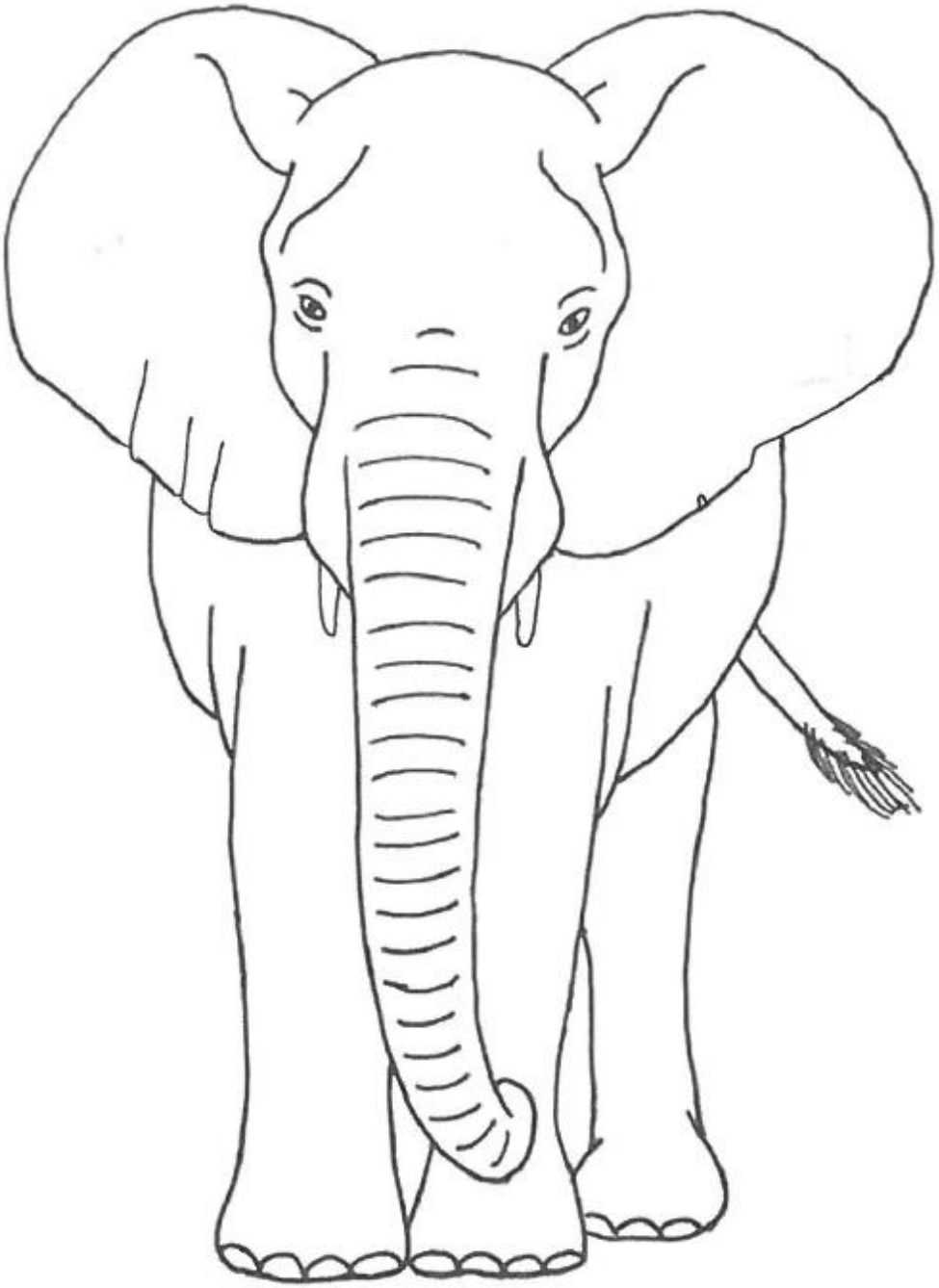
Right



Dikeledi

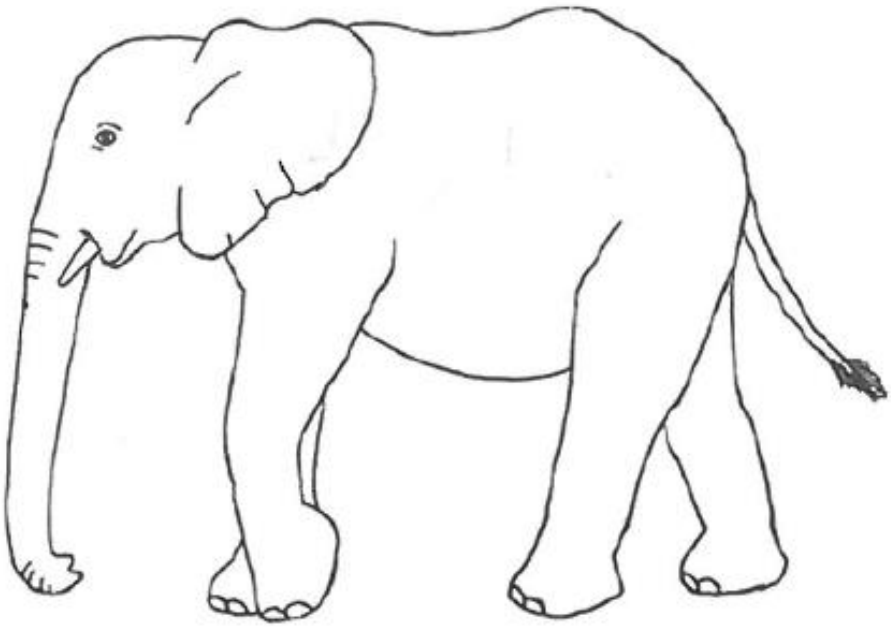
Common name	
Study name	Kagiso (*Peace*) (MF3-1F)
Sex	Female
Age class	Juvenile
Origin	Mabalingwe
Relatives	Tumelo (mother); Dikeledi (sibling)
Characteristics **- Ears** (from top to bottom) **- Tusks** **- Forehead** **- Body** **- Tail**	 Large ears; Earlobes curl outwards; Smooth edges; Slightly wavy Left: 1 x shallow, elongated Dip-notch (midway); 1 x small U-notch (lower 1/3) Right: 2 x small bumps (upper 1/3) Symmetrical; Straight; Pointy; Short tusks; Shorter right Rounded; Wrinkled Short and rounded body; No developed mammary glands Short; Sparse tuft
Notes	



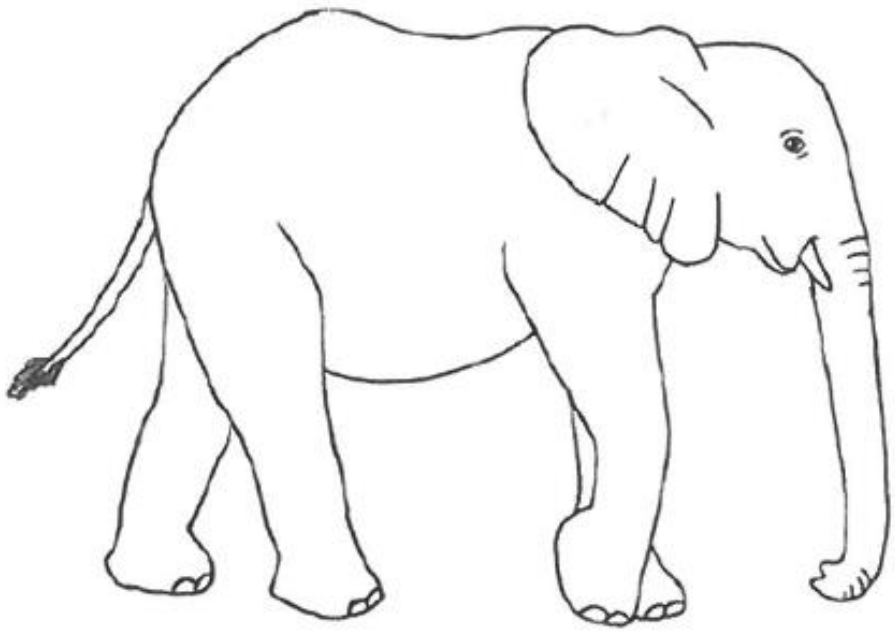


Kagiso

Left

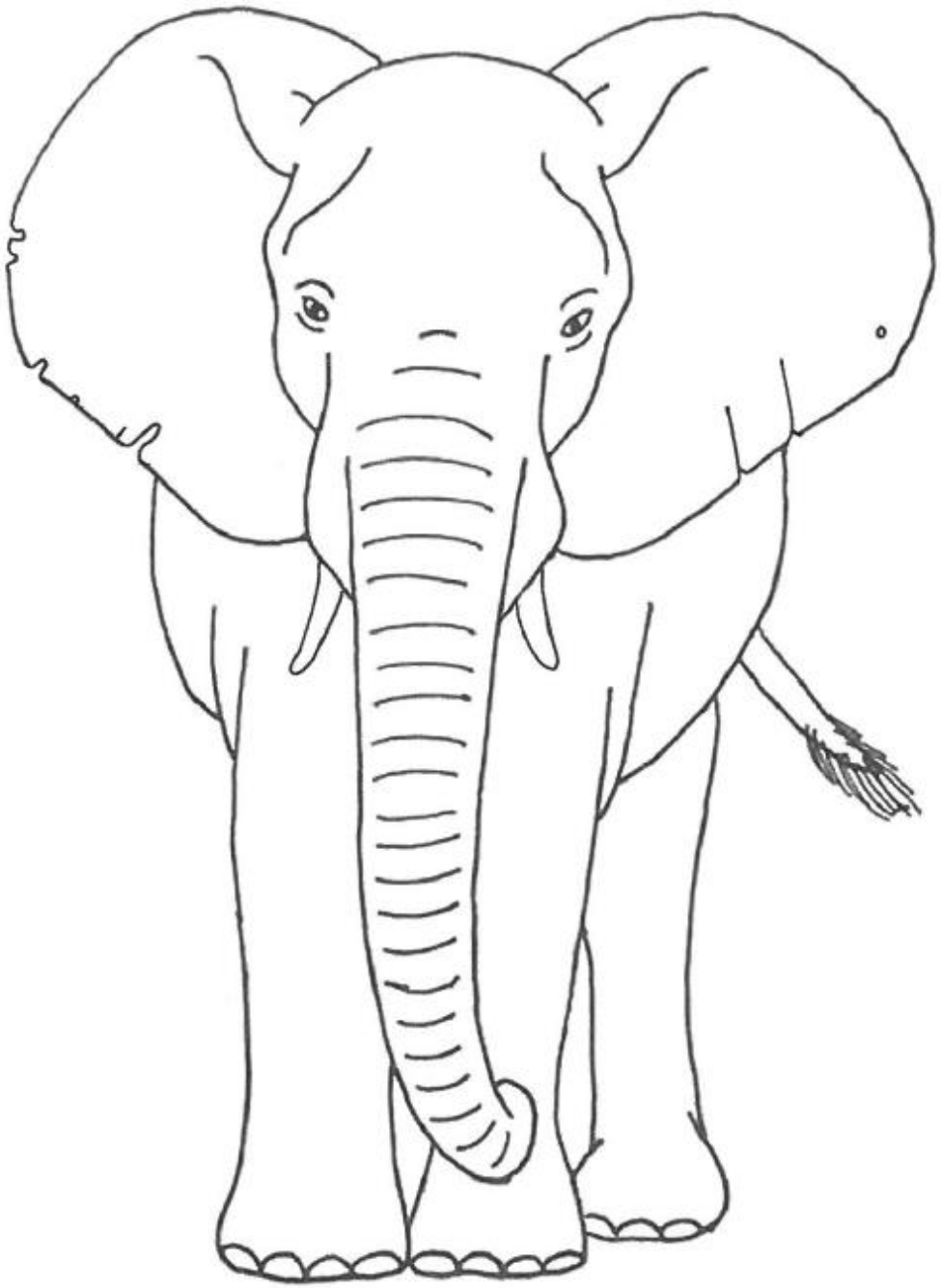


Right:



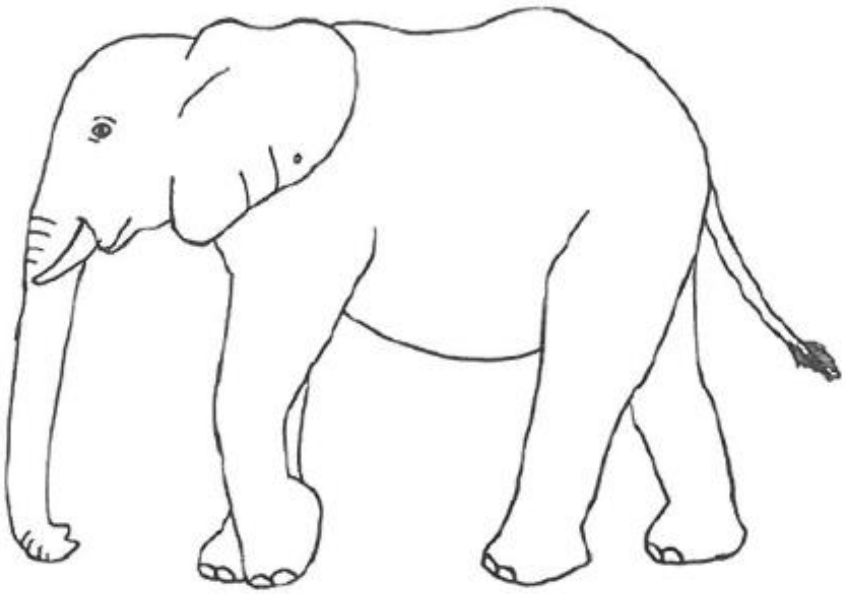
Kagiso

Common name	
Study name	Iteta (*Brave*) (MF4)
Sex	Female
Age class	Adult
Origin	
Relatives	Sediba, Morena (offspring)
Characteristics **- Ears** (from top to bottom) **- Tusks** **- Forehead** **- Body** **- Tail**	 Wide ears; Smooth w. tiny nicks/notches; Left earlobe folds outward Left: 1 x Hole (upper half) Right: 3 x U-notch (upper half); 1 x Slit-hole (lower 1/3) Symmetrical; Upcurved; Shorter left Angular; Relatively smooth More elongated; Developed mammary glands Long; Full tuft
Notes	- May be one of the original elephants reintroduced. - Separates from Kitso with own group at times. - Suspected to be more prone to visit houses. - Short tempered with other elephants - Harasses Seeiso

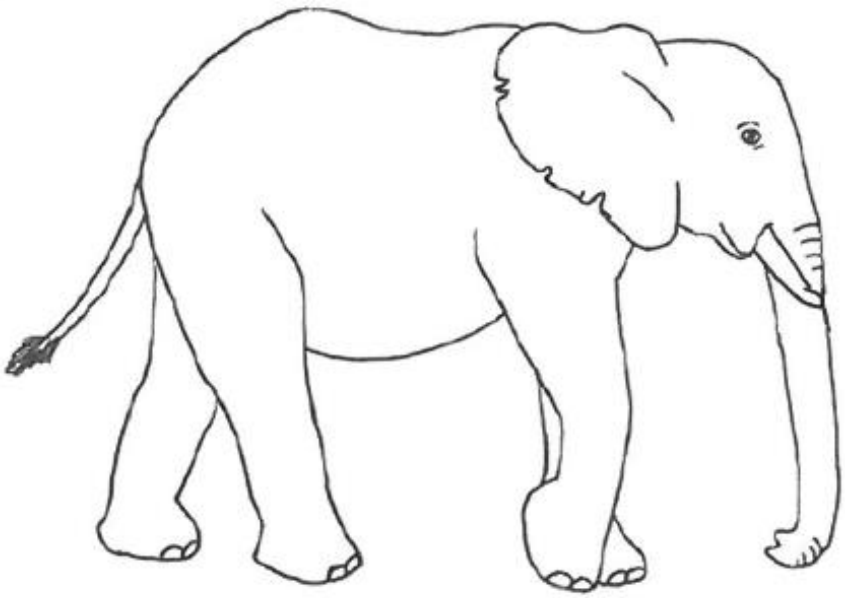


Iteta

Left

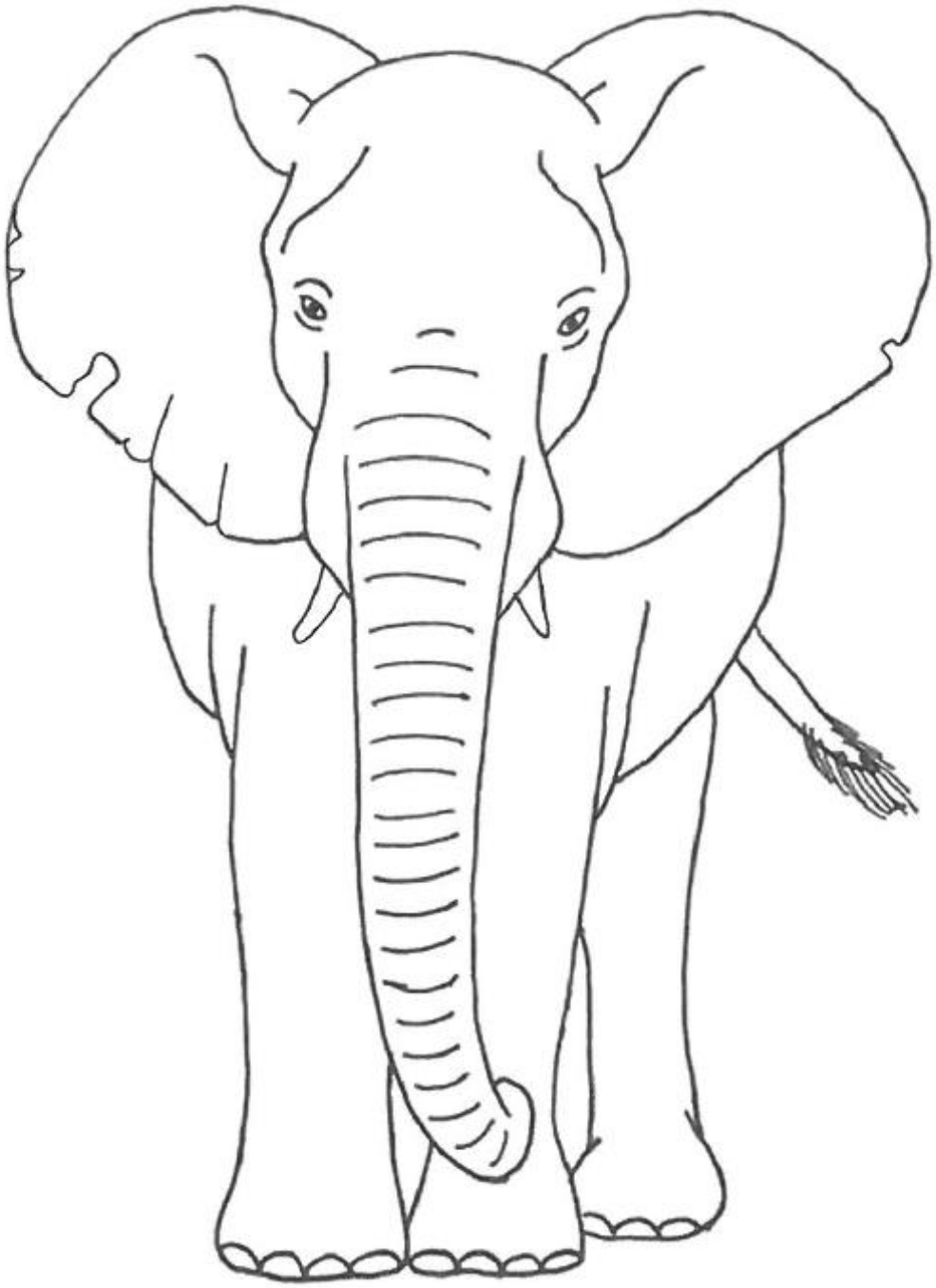


Right



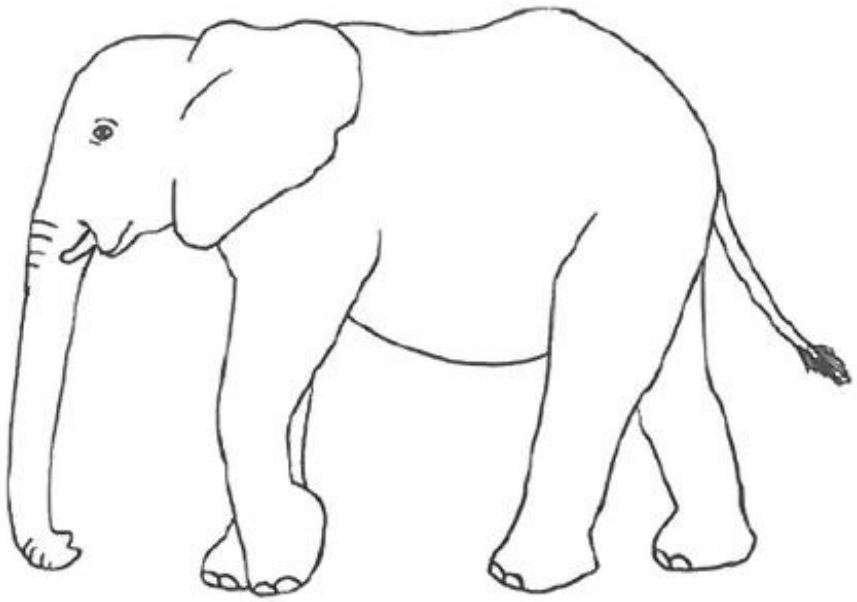
Iteta

Common name	
Study name	Sediba (*Spring*) (MF4-2F)
Sex	Female
Age class	Juvenile
Origin	Mabalingwe
Relatives	Iteta (mother); Morena (sibling)
Characteristics **- Ears** (from top to bottom) **- Tusks** **- Forehead** **- Body** **- Tail**	 Short, wide ears; Smooth edges w. distinctive notch (right) Left: Right: 1 x U-notch (midway); Smaller slits and notches (lower 1/3) Symmetrical; Slightly upcurved; Slender; Shorter left Angular; Few wrinkles Short and rounded body shape Long; Full tuft
Notes	

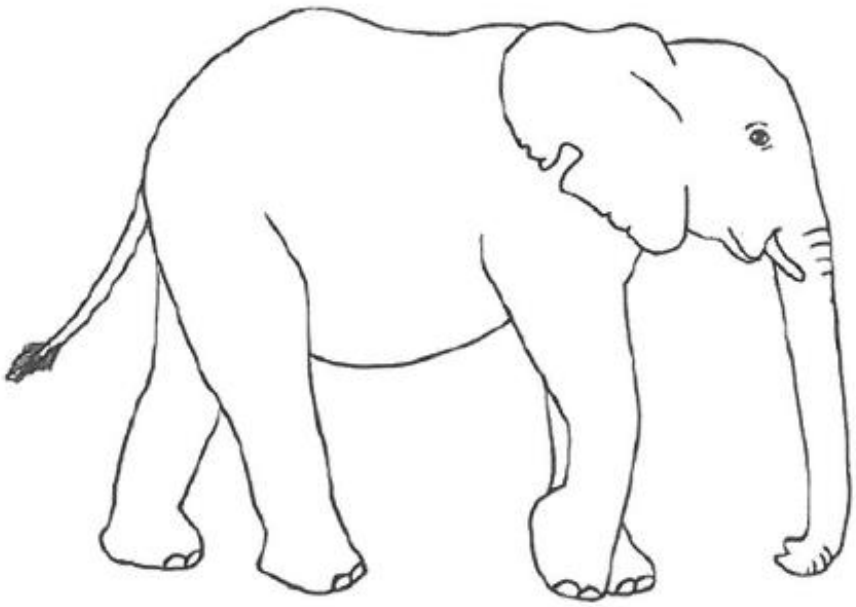


Sediba

Left

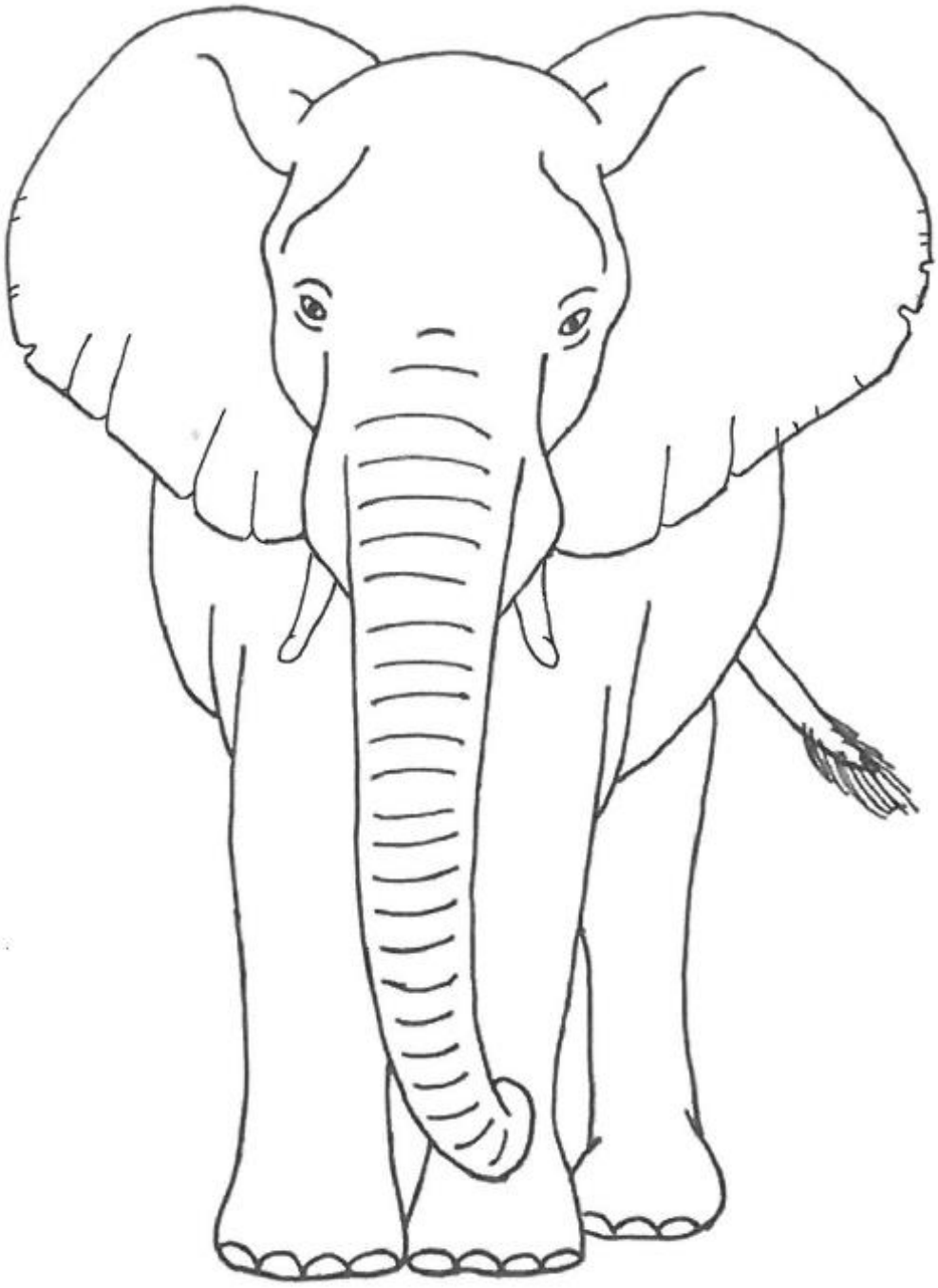


Right



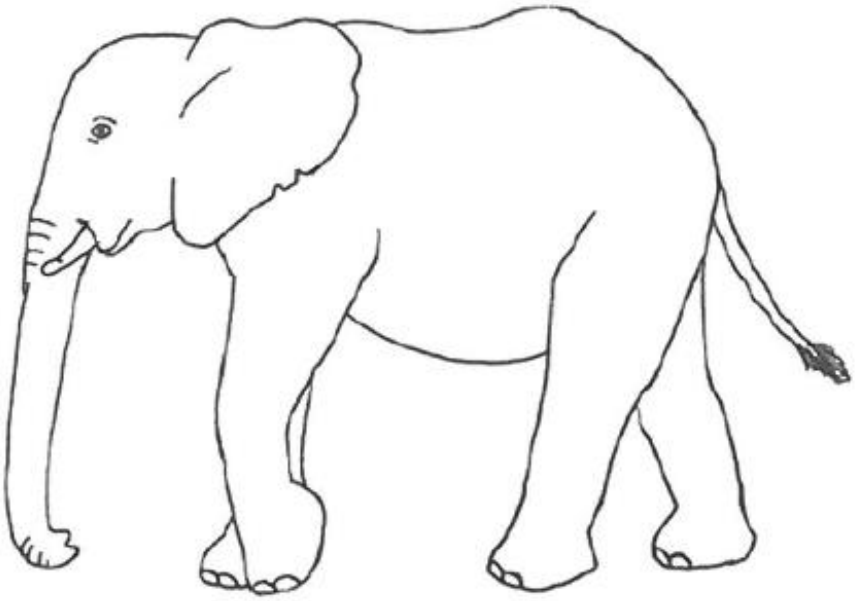
Sediba

Common name	
Study name	Morena (*Gentleman*) (MF4-3M)
Sex	Male
Age class	Juvenile
Origin	Mabalingwe
Relatives	Iteta (mother); Sediba (sibling)
Characteristics **- Ears** (from top to bottom) **- Tusks** **- Forehead** **- Tail**	 Earlobes small; Smooth edges w. tiny nicks/notches; Wavy in folds Left: Earlobe curl outward; Small nicks/notches/slits (midway) Right: Small nicks/notches/slits; Bump (lower 1/3) Symmetrical; Splayed; Shorter right; No hourglass development Slightly angular; Wrinkled Long; Short hairs
Notes	

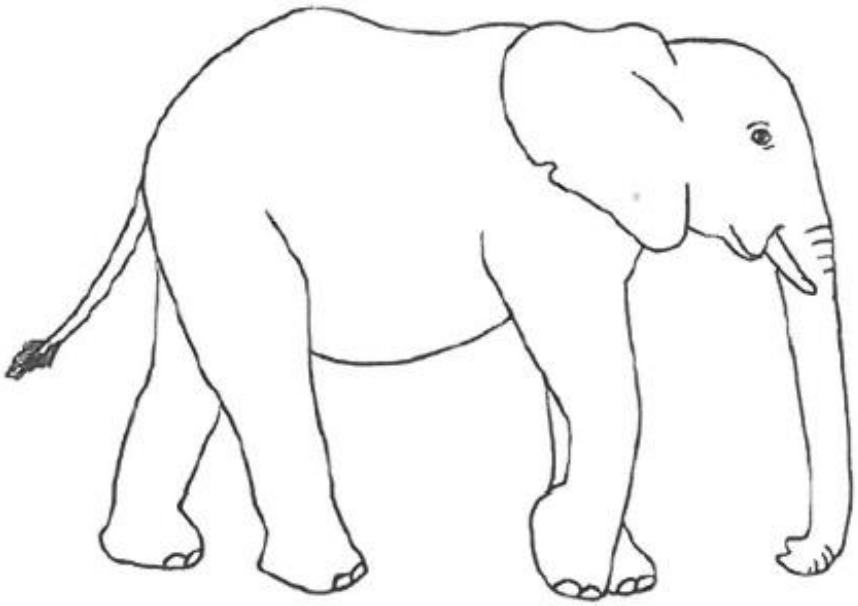


Morena

Left

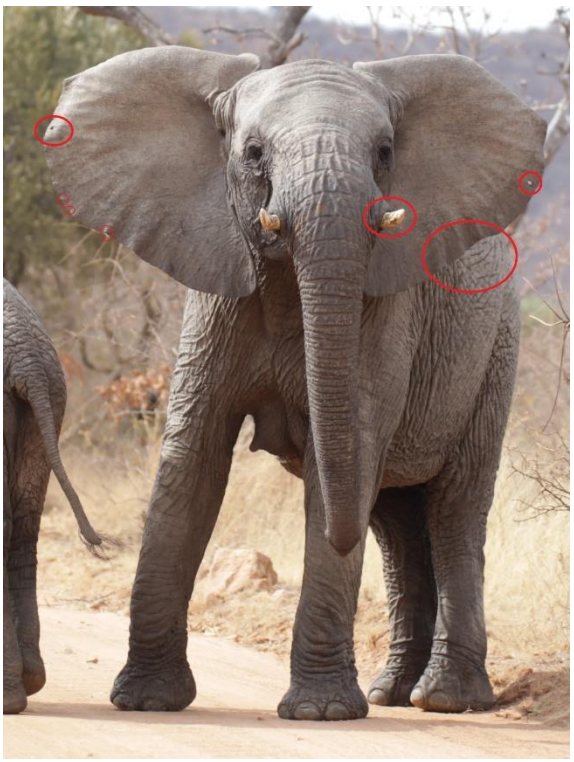


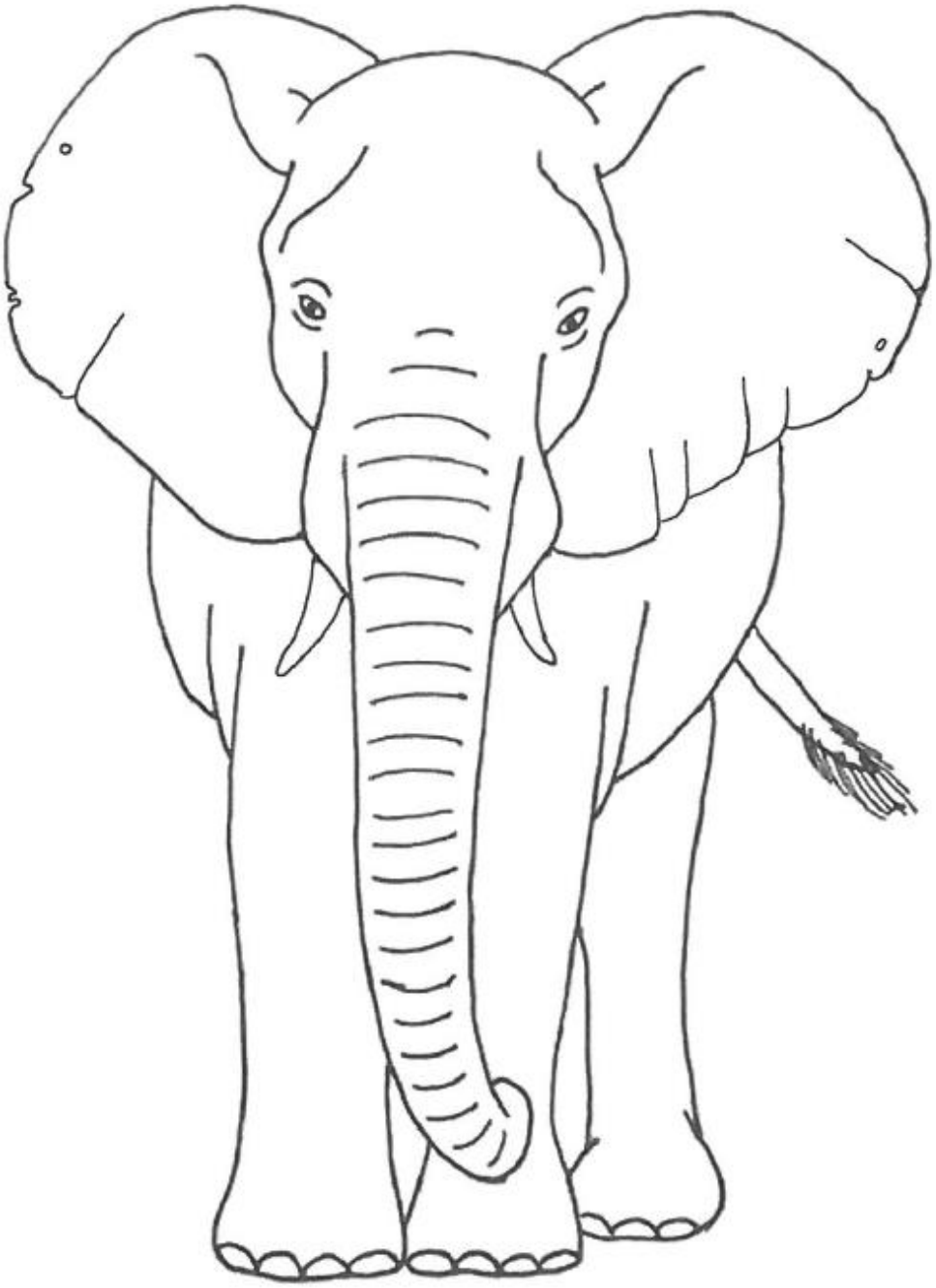
Right



Morena

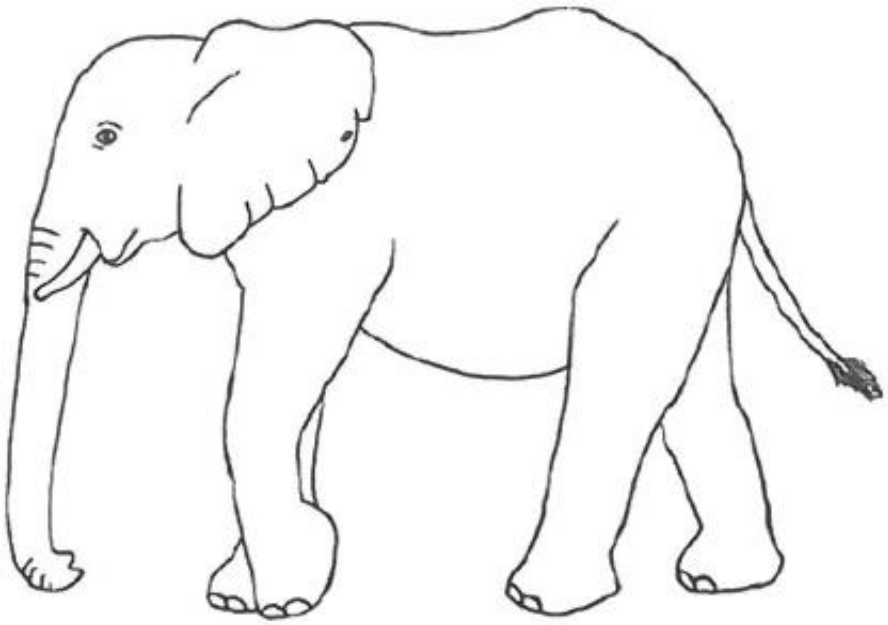
Common name	
Study name	Seeiso (*Outcast*) (MF5)
Sex	Female
Age class	Adult
Origin	
Relatives	Pelonomi (calf)
Characteristics **- Ears** (from top to bottom) **- Tusks** **- Forehead** **- Body**	 Rounded ears; Earlobes curl outward; Smooth edges w. tiny nicks/notches Left: 1 x Hole (upper half); Small nicks/notches (lower half) Right: 1 x Hole (midway); Small nicks/notches (lower half) Symmetrical; Slightly upcurved; Slender; Shorter left Angular; Relatively smooth Short and round body shape; Mammary glands developed
Notes	- Is often at the back of the herd and gets easily separate from the rest on sightings. - Low-ranking and is often harassed by Iteta.



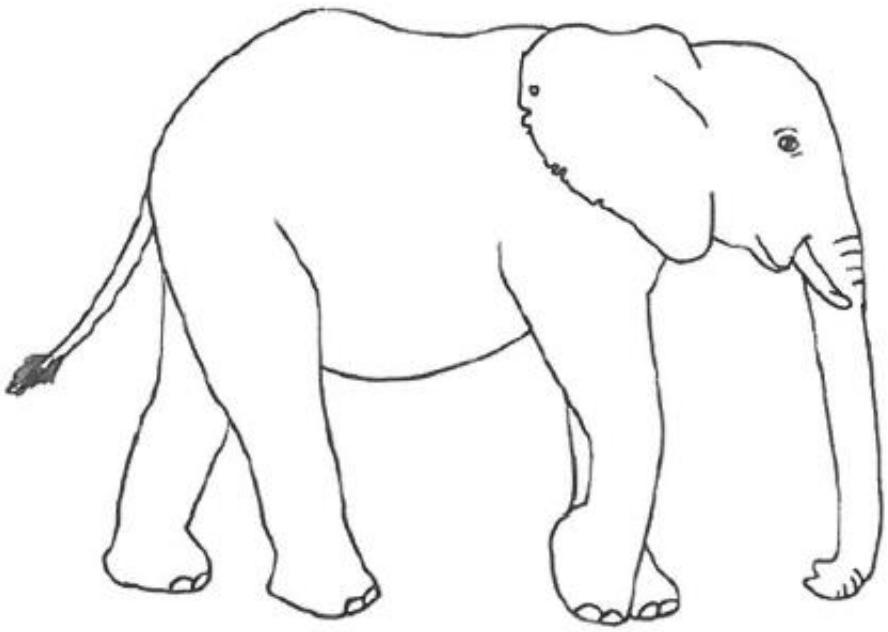


Seeiso

Left

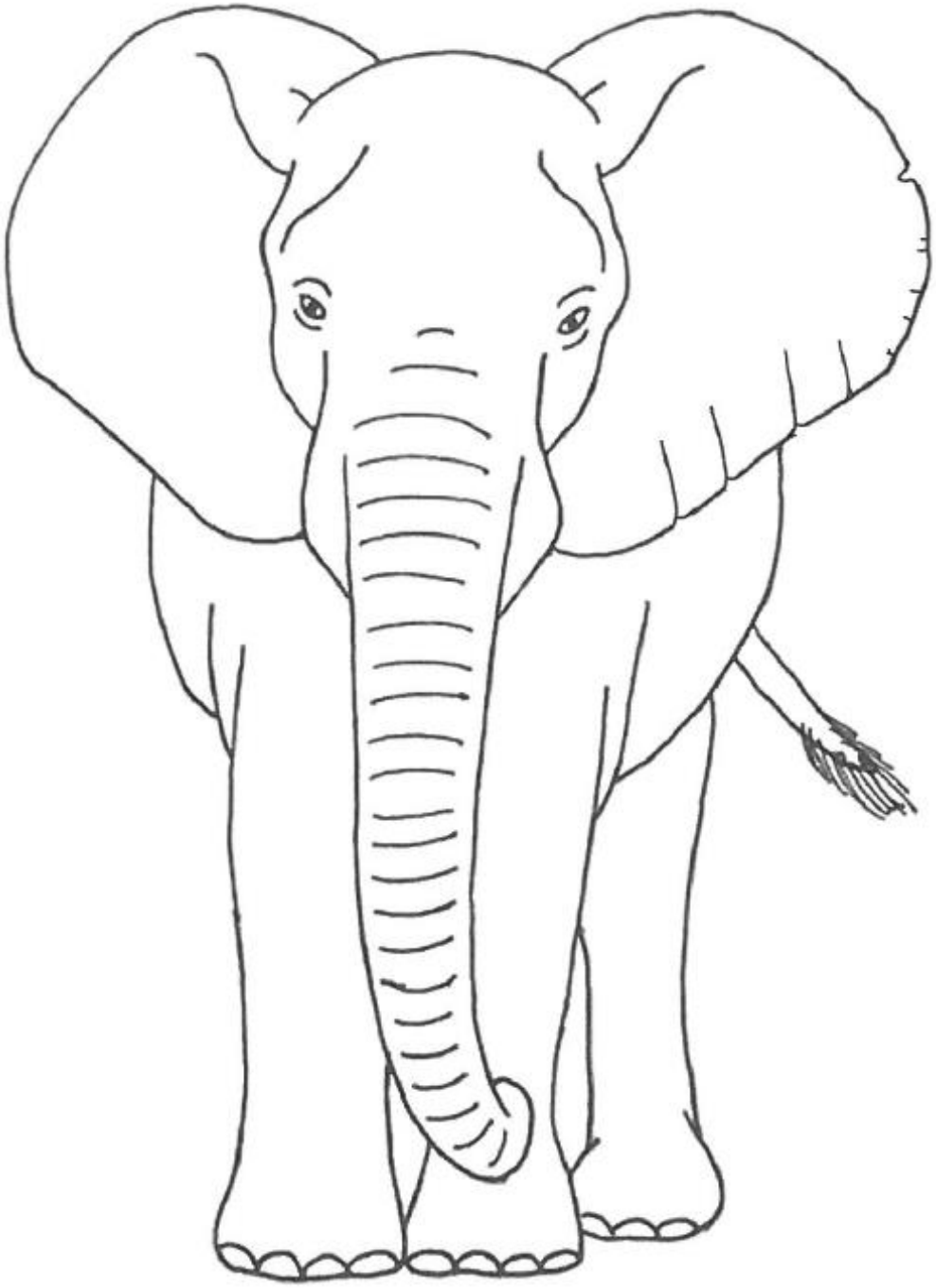


Right



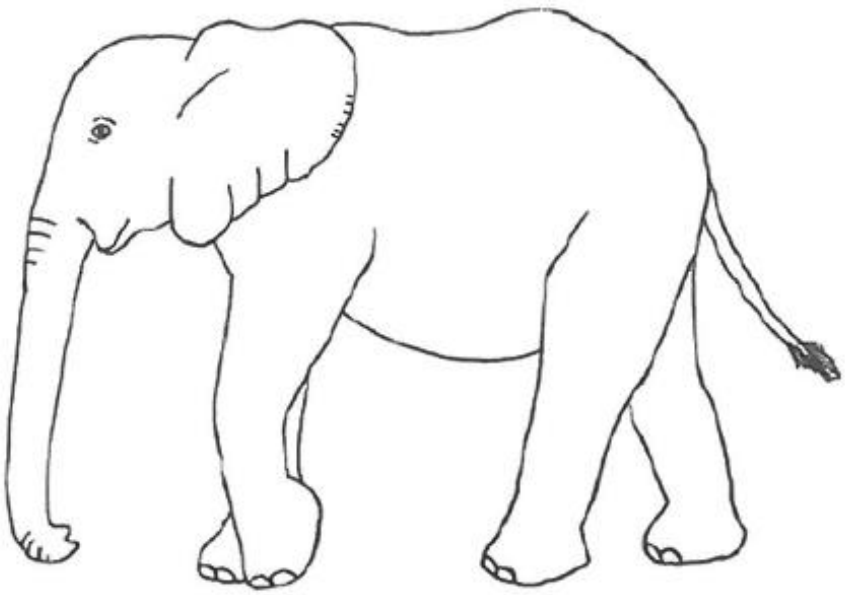
Seeiso

Common name	
Study name	Pelonomi (*Noble heart*) (MF5-1F)
Sex	Female
Age class	Juvenile
Origin	Mabalingwe
Relatives	Seeiso (mother)
Characteristics **- Ears** (from top to bottom) **- Tusks** **- Forehead** **- Tail**	 Earlobes short; Rounded ears; Smooth edges w. few, tiny nicks/notches Left: Tiny nicks/notches Right: No tusks Angular; Wrinkled Sparse tuft
Notes	

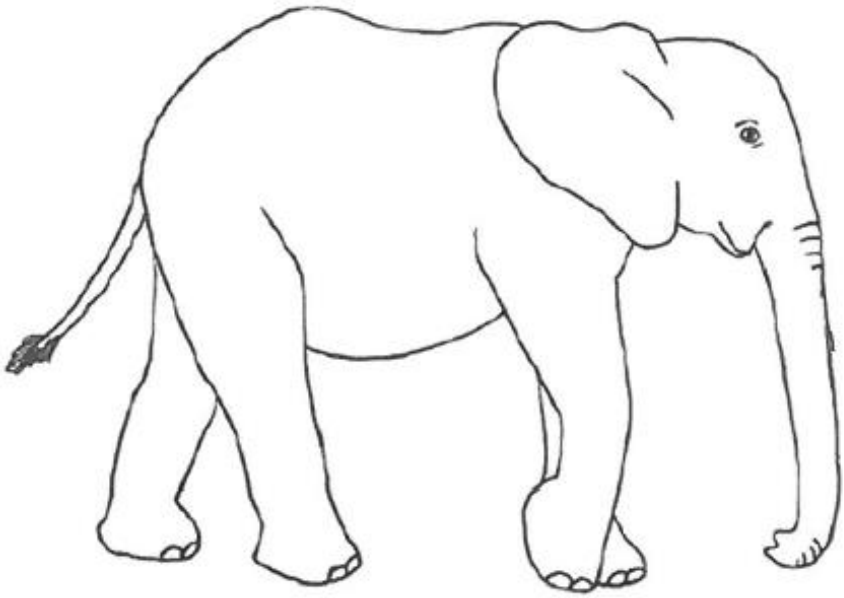


Pelonomi

Left

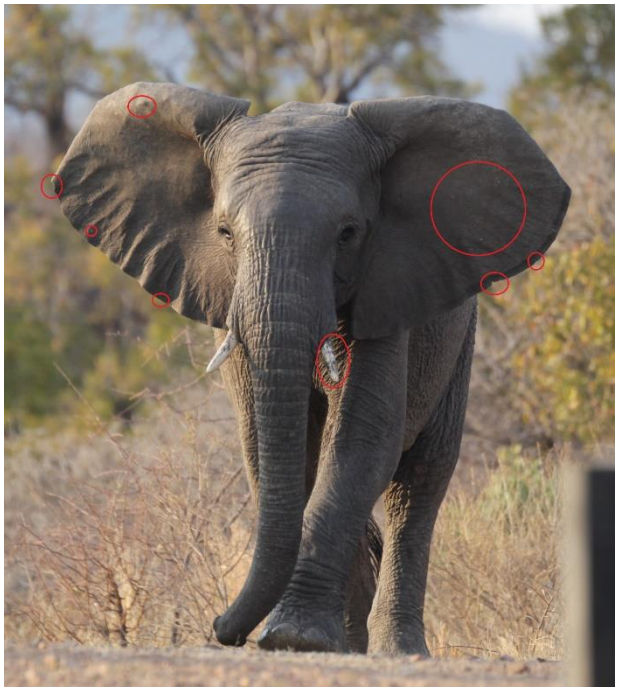


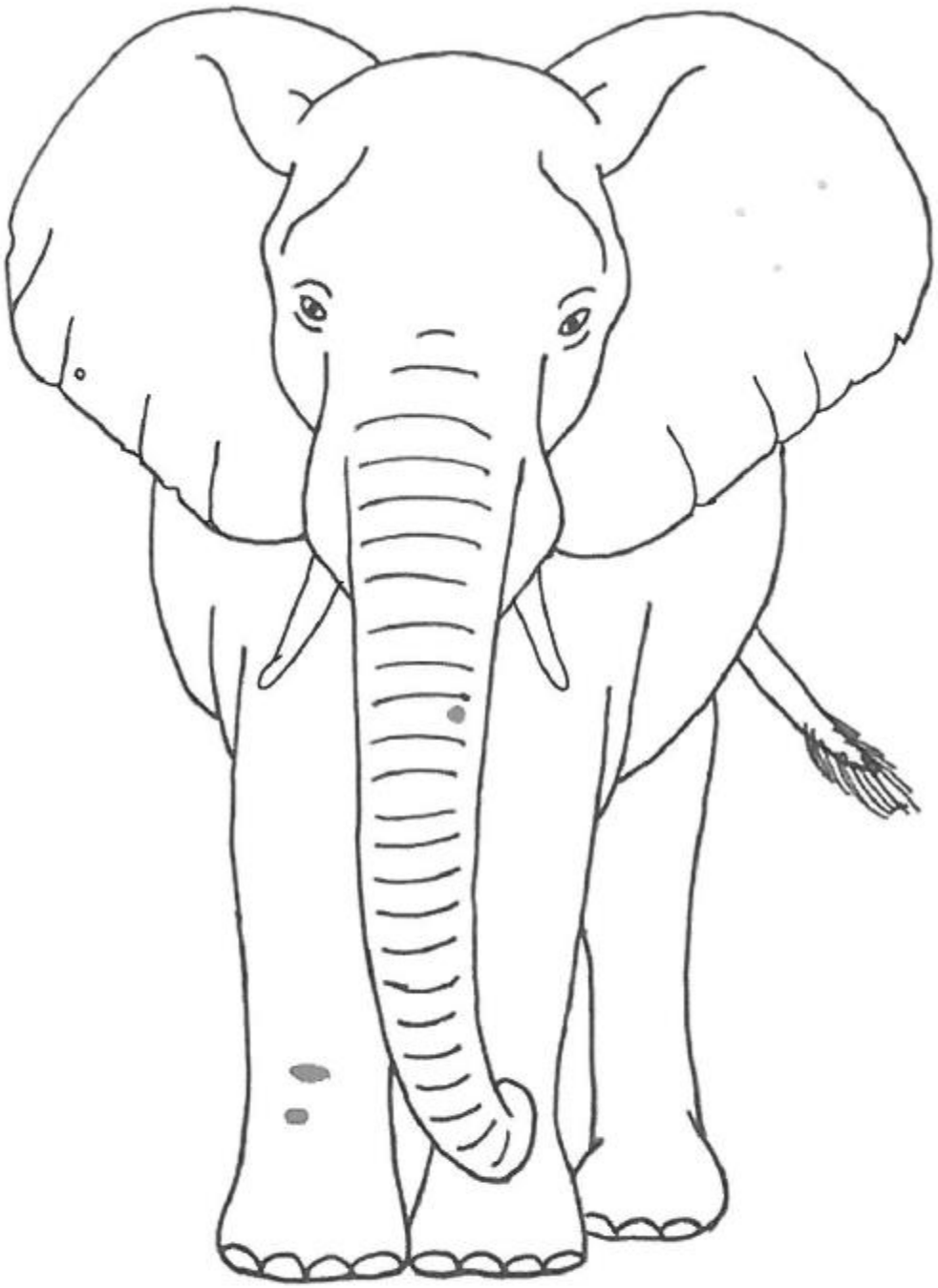
Right



Pelonomi

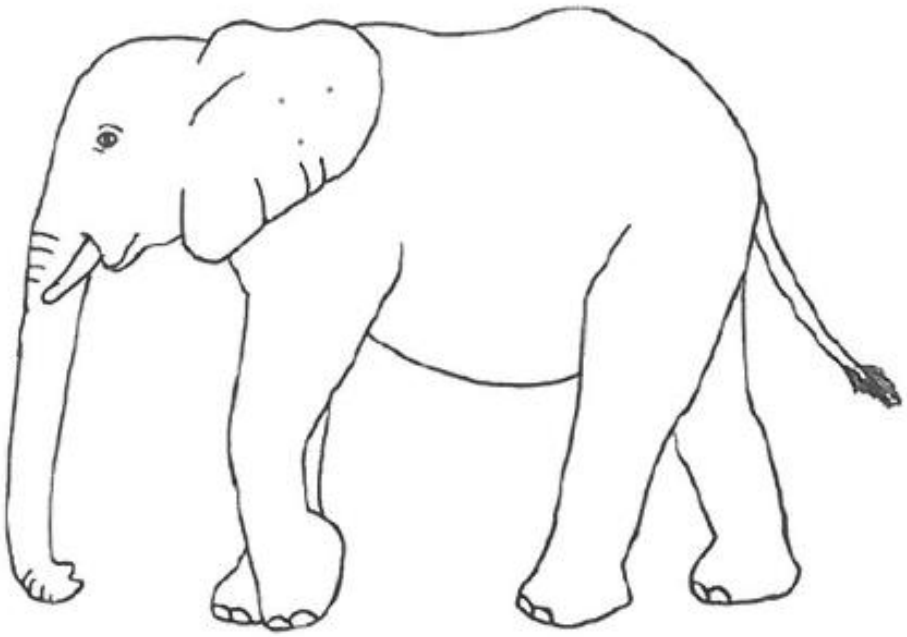
Common name	
Study name	Tshepo (*Hope*) (MM1)
Sex	Male
Age class	Juvenile
Origin	Mabalingwe
Relatives	
Characteristics **- Ears** (from top to bottom) **- Tusks** **- Forehead** **- Tail**	 Earlobes curl outward; Wide ears; Wavy/In folds; Smooth edges w. tiny nicks/notches Left: Bump (upper 1/3), 1 x Dip-notch; 1 x Hole (midway) Right: 1 x V-notch (lower half); 3 x abrasion in triangle Symmetrical; Splayed; Slightly upcurved; Shorter left; No hourglass development Slightly angular; Wrinkled Long; Long hairs
Notes	



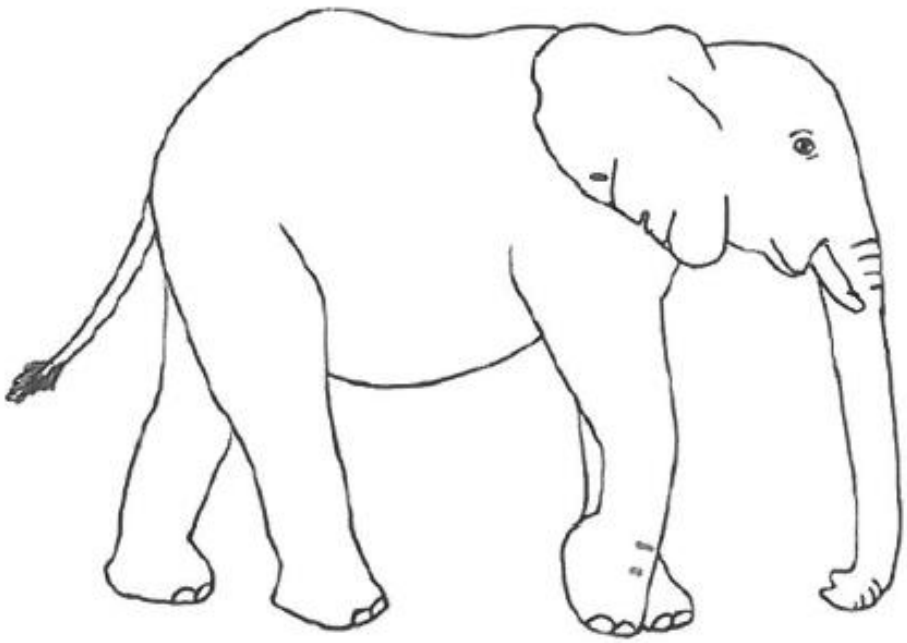


Tshepo

Left



Right



Tshepo

Collar information

The elephant collar is from African Wildlife Tracking (AWT). The collar has both VHF and GPS-link. The collar is set to update every 1 hour.

Serial/ID number	Frequency	Identity	Date of activation	Date of inactivation	Active / Inactive
IR-SAT 5147	149.970	Kitso	06.09.2021		Active

Table 3 The collar used at Mabalingwe Nature Reserve.

African Wildlife Tracking has an online tracking system with several features relevant for monitoring elephants. It is possible to see the latest location of the elephant and the movement history in a chosen time period, to download reports with movement data, change the update interval on the collars, and set up geofences and an alert system. The tracking system can be accessed via the website www.awt.co.za through a profile.

We have set up profile for the relevant people at Mabalingwe Nature Reserve as directed by the reserve itself. In addition to this, we have set up geofences for the perimeter and for human habitation within the reserve.

Contraception options in elephants

The general consensus in the industry and the literature is that contraception for free-roaming, wild animals should have the following requirements (Bertschinger *et al.*, 2008, 2012; Kirkpatrick, Lyda and Frank, 2011):

- effective, i.e. reduce/inhibit fertility;
- reversible, i.e. must not lead to infertility post-treatment period;
- physiologically safe, i.e. no negative impact on health or on existing pregnancies, and be safe for consumption in food chain;
- behaviourally safe, i.e. no alterations to social behaviour;
- possible with remote delivery to reduce duration of stress and costs;
- affordable.

Contraception in elephants is a relatively new field of research relative to the longevity of the species it is being tested on. Additionally, due to their complex social structure and behaviour, as well as the relatively long interval between births and long gestation period, it is not yet possible to determine the effects of contraception on elephants in the long-term – socially, physiologically, and ecologically. This is important to keep in mind, before investing all in contraception (Kerley and Shrader, 2007). There is still a need for a great deal more research and for time to pass before it is possible to confirm or deny the applicability of contraception in elephants and how it will affect elephant herds in the long-term. Up until then, caution should be executed regarding contraception.

Many of the articles on contraception deal with contraception studies in a variety of species. The results of contraception studies on one species are used to support findings on contraception studies in other species. An example is the fact that feral horses have been used as a model for both pZP and GnRH in elephants, due to the similarities between horses and elephants. However, care should be taken in doing so, as it is not certain that the effects of contraception on one species is the same as in another species due to differences in the species' life strategies, sociality, behaviour etc.

A major concern about contraception was voiced by Kerley and Shrader (2007). Namely, that the wildlife industry is in the process of making the same mistake with contraception as was made with culling, where the effects of this population control method was not apparent until years later, after it had been widely used in South Africa.

There are three contraception methods in wildlife:

- Immunocontraception, e.g. GnRH- and pZP-vaccinations.
- Hormonal, e.g. oral, depot-injections or implants of oestrogens, androgens etc.
- Surgical, i.e. vasectomy (males) and tying of fallopian tubes (females).

In the following, we will introduce the different options. An in-depth review is beyond the scope of this identification kit. But if there is a need for more information, it can be sent separately. We will only focus on immunocontraception and surgical contraception, as hormonal contraception has large been discontinued due to serious side-effects and cumbersome delivery systems (Bertschinger *et al.*, 2008).

Porcine zona pellucida (pZP) vaccine (female elephants)

Porcine zona pellucida (pZP) is a non-hormonal and non-steroidal vaccine (Delsink et al. 2007). The vaccine stimulates the immune system to produce antibodies, which prevents the sperm from penetrating the egg and thus preventing fertilisation. The vaccinated individual will continue the normal estrous cycle, but will be infertile (Fayrer-Hosken, Grobler and Van Altena, 2000).

There are concerns relating to reversibility, if the individual is treated for 2-5 consecutive years. A rotational contraception programme, where no female is allowed to be treated with pZP for more than two consecutive years, may at this stage be the safest option. Additional concerns relate to physiological and behavioural side-effects. It is unknown whether the reproductive organs are affected by pZP, as this has been observed in other species. Research into possible behavioural side-effects is limited. However, the lack of calves in family groups is a concern, as the structure of female elephant groups is believed to have evolved as a strategy to increase protection and care for the calves (Kerley and Shrader, 2007). One of the unique features of elephant family groups are the allomothers, i.e. the opportunity for younger females not yet reproducing to help in caring and educating elephant calves prior to their own procreation. With time the older individuals of the family group will die and with them the knowledge that was supposed to be passed on to the younger generations (Kerley and Shrader, 2007).
The increase in estrous that follows from contraception is a concern. Whereas female elephants not on contraception only come into estrous once about every four years due to their long gestation period and nursing calves, female elephants on contraception will come into estrous four times a year and will be chased, harassed and mounted by elephant bulls more often than usual (Moss, 1983; Kerley and Shrader, 2007; Poole, Lindsay, *et al.*, 2011).
Additionally, there may be ecological side-effects. Female elephants treated with pZP will not have small calves, and thus, will not have the same nutritional requirements to forage and proximity to a water source (Kerley and Shrader, 2007). It will take years, before it is possible to determine whether this is a side effect of contraception.
In the approximate 20 years that experiments with pZP on elephants has been conducted, behavioural effects such as range use, matriarchal status, herd fragmentation, unusual behaviour etc. has been investigated and seems to not have been affected by the treatment with pZP (Bertschinger et al. 2008; Delsink et al. 2007).

Gonadotropin-releasing hormone vaccine (both sexes)

Gonadotropin-releasing hormone is a naturally occurring neurohormone in mammals. It is secreted from the hypothalamus to the bloodstream and transported to the pituitary gland. Here it stimulates the synthesis and secretion of follicle-stimulating hormone (FSH) and luteinizing hormone (LS) (Lüders and Oerke, 2016). Gonadotropin-releasing hormone controls the process of reproduction and is activated in puberty (Ebling, 2005).
Gonadotropin-releasing hormone vaccine (GnRH-vaccine) is an immunological castration. The vaccine activates the production of antibodies that bind to the naturally occurring GnRH in the blood, i.e. stimulating the immune system to fight its own hormone, thereby preventing GnRH from binding to the GnRH receptor. The main reasons for the development of the GnRH-vaccine were to reduce the production of testosterone

and reduce aggression. It was mainly used in captive elephants, where recurring periods of musth prevented the human handlers from interacting with the elephant bulls safely.
In male elephants, the GnRH-vaccine prevents spermatogenesis and the development of testosterone by inhibiting the release of FSH and LS (Lüders and Oerke, 2016).
In female elephants, the GnRH-vaccine causes anoestrus (Joonè *et al.*, 2019) by preventing the release of FSH and LS, which are vital for the ovulation and secretion of oestrogen and progesterone (Lüders and Oerke, 2016).

There are numerous concerns with the GnRH-vaccine, and there is very limited knowledge with regards to dosages, side-effects, longevity, reversibility etc.
The GnRH-vaccine was never designed to be reversible. Thus, the longer it is administrated, the longer it will take to reverse the effects – if they can be reversed. It is suspected that the effects of the GnRH-vaccine may be irreversible after two injections, especially in prepubertal individuals, as the reproductive organs will already be adversely affected (Lüders and Oerke, 2016). Physiologically, the GnRH-vaccine results in reduced testicular size, non-existent testosterone production, underdeveloped penis, reduced bodily growth, and non-existent sexual interest (Lueders *et al.*, 2014, 2017; Lüders and Oerke, 2016). Furthermore, since the GnRH-vaccine is not tissue-specific, it will target all GnRH present in the bloodstream, not just the GnRH in the pituitary gland and related to reproduction. Thus, the GnRH-vaccine will affect all tissues with GnRH-receptors (Kirkpatrick, Lyda and Frank, 2011).
Behaviourally, the most serious side-effect in wild, free-roaming elephants relates to dominance. Domination in elephant male society is not only related to body size and strength, but also very much to being in musth (Poole, 1989a; Poole, Lee, *et al.*, 2011). Choosing to administer the GnRH-vaccine on one elephant bull to reduce potential aggressiveness during musth may lead to the vaccinated elephant bull not being able to manage in an aggressive situation with other musth bulls. It will simply not have the testosterone and aggression necessary to be able to defend itself in aggressive situations[12]. Dominance rank in male elephant societies will always be changeable due to musth periods, but the overall dominance rank will change with the administration of GnRH-vaccines in only some individuals. Observations of GnRH-vaccinated elephant bulls show that they become more androgynous and will not behave as non-vaccinated bulls. Their behaviour changes from one of being mostly away from family groups to one of being with female groups almost constantly. This unnatural addition to the family group disrupts the social dynamic within the group and puts unnecessary stress on the females, who will not be able to push out a grown elephant bull, regardless of that bull being on the GnRH-vaccine or not[13]. In addition to this, the GnRH-vaccinated bulls have been observed to lose condition due to the differing feeding strategies between the sexes. In normal elephant societies elephant bulls will spend more time in one spot feeding, while female elephants will continuously move while feeding. As a result, the GnRH-vaccinated elephant bull will not be able to feed in the manner most appropriate to his sex as their urge to follow the family group outweighs their nutritional needs, resulting in the elephant bulls losing condition[14].
Lately, GnRH-vaccine have been administrated to elephant bulls in attempt to reduce the risk of fence-breaking. This is a very flawed approach not taking the purpose and handling of the GnRH-vaccine into consideration. The GnRH-vaccine is designed to lower testosterone production and reduce aggression. However, the breaking of fences has nothing to do with testosterone or aggression. It is more likely linked to resources (forage and water), space, human pressure, poorly maintained fences, and inappropriate land-use on neighbouring properties[2]. Both male and female elephants break fences (e.g. Mutinda et al. 2014; Thouless and Sakwa 1995). As such, it is very unlikely that the administration of GnRH-vaccines would have any effect on fence-breaking behaviour. The Elephant Specialist Advisory Group (ESAG) states that the GnRH-vaccine will not effectively treat behavioural aspects that are not related to androgen hormones, e.g. testosterone (Garaï *et al.*, 2018), i.e. fence-breaking behaviour.

[12] Personal observations and experience by Ida Hansen, ERP.

[13] Personal observations and experience by Ida Hansen, ERP; and discussions with other elephant researchers.

[14] Discussions with other elephant researchers.

In female elephants, the knowledge on the side-effects of the vaccine is very limited. Primarily because the most frequently used contraception vaccine in female elephants is the pZP-vaccine described above. Thus, it is not known how the GnRH-vaccine affects physiology and behaviour, or whether or not the GnRH-vaccine is irreversible.

Surgical sterilisation (both sexes)

In-field laparoscopic sterilisations of both male and female elephants have been performed. Surgical sterilisations are generally primarily used on male elephants – possibly due to the reversibility, costs and being "outcompeted" by pZP which at the time was showing promise as a means of contraception in female elephants. In laparoscopic vasectomies the elephant bull is immobilised in a standing position assisted by a sling hooked onto a crane. The elephant bull is kept under anaesthesia by continuous infusion and ventilated with oxygen. The surgery itself requires a few incisions of approximately 8-10 cm length, through which the laparoscopic equipment is inserted. A 4-8 cm segment of the vas deferens is removed, thereby inhibiting the sperm from moving from the epididymis to the ejaculate duct (Marais *et al.*, 2013), i.e. sperm will not be present in the ejaculate.

There are concerns with this method as well. Only 45 African elephant bulls had been subjected to a laparoscopic vasectomy by 2013 (Marais *et al.*, 2013). In addition to this, there is currently only one long-term monitoring programme of vasectomised elephant bulls. This programme involves seven vasectomised elephant bulls, with the first vasectomies conducted in 2008 (Doughty *et al.*, 2014; Zitzer and Boult, 2018). Thus, there are gaps in the knowledge of the effects of vasectomies in elephant bulls.
Physiologically, there should be no changes in hormonal balance, as the testes are not removed and testosterone will continue to be produced and secreted, allowing the elephant bull to physically develop naturally and to enter into musth (Doughty *et al.*, 2014). On the same basis, it is speculated that behaviour and sociality will not be affected in elephant bulls. Further studies are necessary.

Table 4 Summary of benefits and caveat of each contraception option

	Vasectomy (males)	GnRH (females)	GnRH (males)	pZP (females)	
Pros	- One-off operation. - Less stress for individuals as no further treatment is required. - Testes not removed, leaving the hormonal balance intact, i.e. musth and dominance hierarchy does not seem negatively affected. - No ongoing costs with repeat treatments.	- Non-lethal population control method. - Reduces population growth. - 70-100 % efficacy. - Remote delivery system. - Safe for consumption in food chain. - Assumed not detrimental to foetuses.	- Non-lethal population control method. - Reduces population growth. - 70-100 % efficacy. - Remote delivery system. - Safe for consumption in food chain.	- Non-lethal population control method. - Reduces population growth. - Non-hormonal and non-steroidal vaccination. - 70-100 % efficacy. - Remote delivery system. - Safe for consumption in food chain. - Assumed not detrimental to foetuses. - No effect on range use, matriarchal status and herd fragmentation.	Pros
Cons	- Irreversible. - Physically invasive. - Risks associated with procedure, e.g. infection, complications, death etc. - Risk of losing natural genetic selection when dominant bulls are treated. - Younger, un-vasectomised males may father offspring when possible to mate unchallenged by musth male at beginning and end of female estrous cycle. - Lack of knowledge on side-effects (physiological and behavioural) due to limited candidates and studies. - Only one long-term monitoring research programme to date. - Costly (R23,700 in 2013 primarily associated with costs of helicopter and anaesthesia).	- Lack of knowledge on dosage, duration, reversibility, side-effects (physiological and behavioural). - Not designed to be reversible. - Not intended as a contraception method, but to suppress musth in captive elephants. ESAG is recommending it is not used for contraception in free-roaming elephants. - Not tissue-specific, leading to wider-reaching effects than intended. - Erroneous perception of ability to hinder " problem" behaviour, i.e. fence-breaking. - Increased stress in elephants due to repeated vaccinations - Ongoing costs associated with re-vaccinations twice a year (R200 per dart with 5mL Improvac 1,000 mg in 2018; additional costs: helicopter, veterinarian, staff)	- Probably irreversible with repeated and/or consecutive treatments. - Not designed to be reversible. - Not intended as a contraception method, but to suppress musth in captive elephants. ESAG is recommending it is not used for contraception in free-roaming elephants. - Immunological castration, leading to inhibition of natural physiological state important for development. - Not tissue-specific, i.e. wider-reaching effects than intended. - Erroneous perception of ability to hinder " problem" behaviour, i.e. fence-breaking. - Permanent, detrimental physiological side-effects, e.g. reduced testes, penis atrophy etc. - Behavioural side-effects, e.g. change in dominance hierarchy, androgynous appearance, unnatural attachment to family groups leading to disruption of social dynamics in family groups, loss of condition etc. - Lack of studies on side-effects of medium- and long-term duration. - Increased stress in elephants due to repeated vaccinations - Ongoing costs associated with re-vaccinations twice a year (R200 per dart with 5mL Improvac 1,000 mg in 2018; additional costs: helicopter, veterinarian, staff).	- Probably irreversible with repeated and/or consecutive treatments. - Lack of knowledge on physiological side-effects, e.g. ovarian abnormalities/dysfunction in other species. - Lack of knowledge on behavioural side-effects, e.g. skewed age-structure, redundancy of allomothers, increased harassment from males due to continued estrous cycle, nutritional requirements. - Lack of knowledge on duration/reversibility of side-effects. - Lack of studies investigating side-effects of medium- and long-term duration. - Ongoing costs associated with annual re-vaccinations.	Cons

Sighting procedures

The purpose of a game drive is for guests to have a sneak peek into the lives of the animals. The best way to do this is to make sure that the presence of people does not disturb or influence the animals, i.e. the animals do not change whatever activity and/or behaviour they were doing before the presence of people.

The following are suggestions on how to minimise the effect of human presence on elephants:

- **Respect the elephants' personal space**. A sighting distance of 50 m is recommended by the Elephant Specialist Advisory Group. Sighting distances will vary depending on the elephants and on the day-to-day circumstances. On one day, they may accept a distance of 40 m, while on another day they may accept a distance of 60 m, before they show signs that you are too close.
- **Approach the elephant sighting slowly**. Do not rush into a sighting, as this can be perceived as aggressive and elicit a defensive or aggressive response from the elephants. Rather approach slowly so the elephants are aware that you are there and approaching.
- **Let the elephants approach you**, and not the other way around. Keep a minimum distance of 30 m between you.
  If they move closer than 30 m, turn the vehicle on, wait a couple of seconds and slowly move away from the elephant.
  If they show signs of being uncertain, then turn the vehicle off, wait a couple of seconds to see if the elephant will retreat. If not, then turn the vehicle on again and leave the sighting slowly.
- **Never let the elephants touch the vehicle or any people**, as this will break a boundary that should not be broken. The elephants should only be habituated to people/vehicles to a certain point.
- **Do not pursue** the elephants, if they decide to move away from you. This is a way for them to communicate that they have had enough (fight or flight). Just enjoy the time that you had with them.
- **Do not block the elephants' path**. If the elephants are moving in a specific direction, then give them space to move as they wish.
- **Do not separate the herd** by driving in between them. When you are at a sighting, make sure that you know where all of the elephants are in relation to each other and to you. Separating a herd puts unnecessary stress on them and can lead to aggression.
- **Do not surround the elephants**. If at all possible, make sure that the elephants are approached from the same direction. If the elephants are surrounded by vehicles, feel threatened, and are not able to escape, they can become aggressive (fight or flight).
- **Ensure an easy and fast escape route without obstacles**, but park in a way that the guests will be able to have a clear view of the elephants. A sighting can change quickly, which means that it can quickly become necessary to leave the area. Without a clear and unobstructed escape route guests are put in unnecessary danger. You will not be able to escape a full-on charge from elephants in reverse.
- **Be aware of other vehicles/walking safaris**. Radio contact on elephant sightings are necessary in order to prevent possibly dangerous situations for both elephants and people, for instance to prevent that the elephants are surrounded by vehicles and people on foot (fight or flight).
- **Be aware of the dangers when walking elephants**, and make sure that your guests know the risks involved and are able to move fast if necessary. Elephants are generally more comfortable with people in vehicles than people on foot.
- **Be careful with elephant bulls in musth**. Even though they can seem relaxed, their behaviour can change in an instant. Rather avoid elephant bulls when they are in musth. If approached, then do so with extreme caution and with a clear escape route that does not involve reversing away from him. Keep a sighting distance of more than 50 m.
- **Always be aware of the elephants' communication and respect what they are saying**. Knowing elephant behaviour and their displays reduces the risk of overstaying your welcome, reduces unnecessary stress for the elephants, and a "translation" can heighten the guests' experience.

If an elephant shows signs of being anxious/apprehensive/uncertain, then slowly leave the sighting and give space.
If an elephant shows threatening signs, turn the vehicle on, wait a few seconds and slowly back away from the elephant and give space. If turning on the vehicle aggravates the elephant, turn it off immediately, wait a couple of minutes, and try to leave slowly again.

- **Night drives and elephants are not recommended**, as it can lead to potentially dangerous situations, where darkness can make it impossible to respect their space, to see that the herd is separated, to know that you are blocking their path etc. Do not shine spotlights in the elephants' eyes, as this can agitate them and cause aggression.
- **Limit the number of vehicles present at a sighting to two at a time**. By limiting the number of vehicles present at a sighting at the same time, you will limit the amount of pressure put on the elephants and you will make the experience more personal and exclusive for the guests.
- **Limit disturbances and sound** by avoiding driving forwards and reversing constantly. Instead, turn the engine off (unless the vehicle is unable to start immediately), keep guests quiet, keep speech low and short etc.
- **Do not make any sudden movements or stand up** when in a sighting, as it can frighten the elephants and result in aggression.
- **Do not use flash-photography**, as this agitates elephants, which could lead to an aggressive reaction. It puts unnecessary stress on them.
- **Do not bring fruit (especially citrus)** on a game drive.

Treat the elephants with respect and understanding. Elephants have a great sense of smell, hearing, and memory. If they associate a scent with previous stress or danger, they will react to that scent – either by running away or charging. Do not put yourself in a situation where the elephants will associate your scent with danger – the same is true for the sound of your vehicle.
The best way to avoid dangerous situations with elephants is to avoid getting into that situation by respecting them and the behavioural signs, gestures, and displays that they give.

Elephant communication

As mentioned, elephants are very complex and intelligent. They are also fairly patient creatures with excellent memories. However, if they are continuously pushed, they will eventually retaliate. An example of this is elephants in captivity, who take their revenge on abusive handlers years after an event (Bradshaw, 2010). Another example is elephants in a game reserve, who have been pushed continuously by game drive vehicles, until one day when they start retaliating by chasing and/or charging a vehicle that comes too close. Before a situation escalates to a point where an elephant charges a vehicle or a person, there will usually have been signs that the elephant is unsettled and anxious, as well as threatening behavioural displays. Below are listed some behavioural signs that should be taken as a warning and the correct response would be to back off and give the elephants space.

Anxious behaviour

These behaviours can be seen when the elephant feels uneasy and is unsure of what to do. The displays can either be seen separately or in combination.

Trunk-Twisting

The elephant will be standing still and will be listening and/or observing or moving, while the tip of the trunk is twisted back and forth.

Figure 1 Trunk-Twisting is a sign that the elephant is unsure what to do in a situation. Photos by Ida Hansen (left) and Elephant Voices (right).

Displacement-Feeding and Displacement-Grooming

These two forms of behaviour are seen in conflict situations. They are not proper feeding or grooming, as they are inappropriate behaviours in that situation. The feeding will not be proper, as the vegetation may be picked up, but will not be ingested or only eaten distractedly. The grooming can be throwing dust or grass on itself.

Figure 2 Left: Calf is Displacement-Feeding. Right: Displacement-Grooming in a conflict situation. Photos by ElephantVoices.

Touch-Face

The elephant is using its trunk to touch its face or parts of its face, such as the mouth, trunk, ears, tusks, or temporal glands. This seems to be for reassurance in a situation where the elephant feels uneasy.


Figure 3 Elephant showing Touch-Face by touching mouth and eye. Photos by Ida Hansen.

Foot-Swing

The elephant will raise its front leg and swing it back and forth intermittently in situations where it is uncertain of its next action. The hindfoot can also be used, but is less commonly observed.


Figure 4 Elephant lifting and swinging front foot back and forth in a display of Foot-Swing. Photos by ElephantVoices (left) and Ida Hansen (right).

Threatening behaviour

All of these behavioural displays should be watched carefully and responded to appropriately, if the presence of humans is the cause of them. Even if the presence of humans is not causing them, it could lead to a dangerous situation where the humans are targeted out of frustration or just caught in the middle of it. These behaviours can either be seen on their own or in combination.

Head-Shaking

This is a sign that the elephant is irritated with either a situation or another individual (elephant or human). The head is twisted to one side and rapidly rotated from side to side. It causes the ears to flap hard against the side of the head with a loud noise and causes dust to fly from ears and body.


Figure 5 Head-Shake is directed at the irritating object or subject. Photos by Ida Hansen (left) and ElephantVoices (right).

Ear-Spreading

The elephant will be facing the target head-on with the ears fully spread in a perpendicular angle to its body. It is a way to look bigger and to intimidate the opponent/threat.

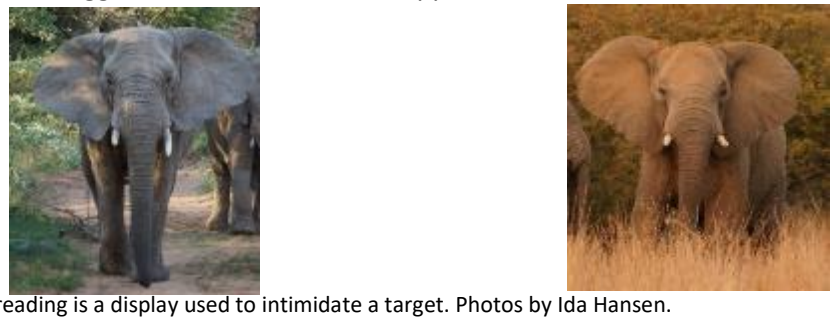


Figure 6 Ear-Spreading is a display used to intimidate a target. Photos by Ida Hansen.

Ear-Folding

The ears will be folded horizontally on the middle of the ear by pressing the lower part of the ears under and back.

Figure 7 Ear-Folding can be viewed as an indicator of "foul mood". Photos by ElephantVoices.

Standing-Tall

The elephant will be facing the target head-on with the head held above the shoulders (but not outwards) and the tusks lifted, while gazing directly at the opponent/threat.

Figure 8 Standing-Tall is a threatening display to intimidate the target. Photos by ElephantVoices

Forward-Trunk-Swing

The elephant will lunge forward while swinging its trunk in the direction of the target. It will often blow air through the trunk simultaneously. It is used to frighten away other animals (or at times just for fun).

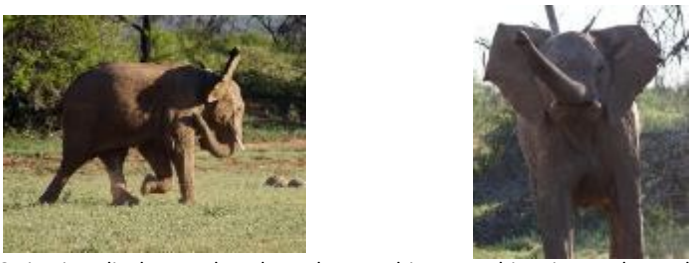


Figure 9 Forward-Trunk-Swing is a display used to show that an object or subject is too close. Photos by Ida Hansen.

Tusk-Ground

The elephant will use its tusks to gorge the ground and lift vegetation. This is a demonstration of strength. It is usually seen between two musth bulls, but can also be directed at humans by musth bulls.

Figure 10 Tusk-Ground is a way to demonstrate strength and intimidate opponents. Photos by Ida Hansen (left) and ElephantVoices (right).

Mock-Charge

In a mock charge, the elephant will rush towards the target with the head held high on the shoulders and ears spread. It will not follow through with the charge, but will stop abruptly, resulting in a lot of dust being kicked up. This is often associated with a shrill trumpet blast, but not always.

Figure 11 Mock-Charge is an aggressive threat meant to scare off any threats. Photos by ElephantVoices (left) and Ida Hansen (right).

Real-Charge

In a real charge, the elephant will rush towards the target with the intention of following through the attack. The head can be held high or low, the ears are spread, and the trunk is curled so the tusks will be the first to impact the target. It is usually silent, but not always.

Musth

Musth is a period in which male elephants experience heightened levels of testosterone, leading to increased aggressiveness and sexual activity. Male elephants start producing sperm between the ages of 8 and 16 years, while they become sexually interested in females at 17-25 years old. In a normal functioning elephant society, they will experience their first musth period when they are 25-35 years old. In the beginning, their musth periods will only last days or weeks, while in older males it will last several months (Poole, 1987; Poole, Lee, *et al.*, 2011). Older musth males suppress musth in younger males by repeatedly threatening and chasing them, until they cease to show signs of musth (Poole, 1989a). The musth periods of male elephants from year to year are fairly consistent, especially in older males. However, it can change a bit due to seasonal circumstances affecting the reproductive success and changes in rank in dominance hierarchy (Poole, 1987).

Musth is an honest signal of condition, as it requires energy, strength, and longevity to reach the age where musth is a yearly event. Musth elephants spend more time searching for estrous females and guarding them when found than on feeding, which results in a loss of condition. Thus, only males in good condition will be able to sustain musth for long periods. Strength is necessary for the inevitable contests between musth bulls and chasing of younger non-musth bulls. Finally, longevity means that the bull has been able to survive to an age with consistent musth periods. In Amboseli National Park, only 25 % of male elephants reach the age of 40 (Poole, Lee, *et al.*, 2011).

Musth is not a prerequisite for mating, but it does help. Studies have shown that estrous females tend to favour musth males (Poole, 1989a, 1989b; Poole, Lee, *et al.*, 2011) and females have specific behavioural displays (Poole and Granli, 2011) and vocalisation aimed at musth bulls (Poole, 2011). Non-musth males will usually have their chance of mating at the beginning and end of a female's estrous period, when the interest from musth males is limited (Poole, Lee, *et al.*, 2011).

One of the fascinating aspects of musth is that it alters the traditional dominance hierarchy in male elephants, i.e. dominance is usually determined by body size. However, a musth bull is at the top of the dominance hierarchy – regardless of body size. That means that a smaller bull in musth will outrank a larger bull not in musth. Between musth bulls body size does determine dominance, as encounters between musth bulls often leads to contests and fights, especially when in the presence of estrous females.

Some behavioural displays are associated only with musth elephants. Below is a description of some of these. It is important to be aware that an elephant bull can be in musth, even though he is not urine-dribbling or secreting from the temporal glands.

Musth-Walk

The elephant will walk with a swagger with the head held high, the jaw tucked in, and ears stiff.

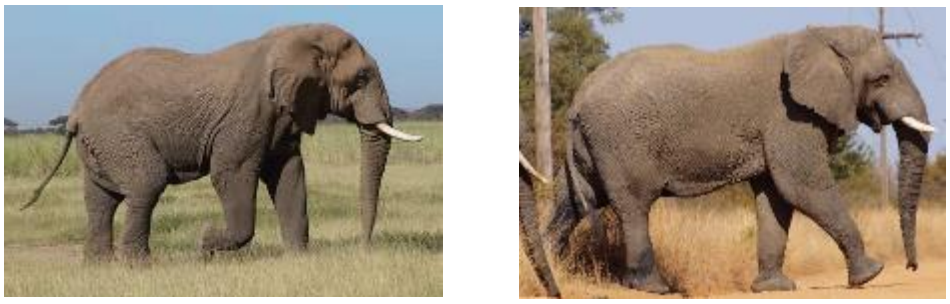


Figure 12 Musth-Walk is most likely an advertisement to other bulls and females. Photos by ElephantVoices (left) and Ida Hansen (right).

Ear-Wave

The upper parts of the ears are held stiff while they are forcefully swung forward. As a result, the lower parts of the ears are swung even further forward and flap upward. This creates the appearance of a wave on the ear. This may be an advertising behaviour to waft the odour from the temporal glands.


Figure 13 One of the displays of musth males is the Ear-Wave. Photos by ElephantVoices.

Urine-Dribbling

Urine will continuously drip from a sheathed penis. It can vary from a few drips to a gushing stream. It has a very pungent odour. When tracking a musth elephant, drips can be seen in amongst the tracks and will smell for a long time even when it has dried.


Figure 14 The constant Urine-Dribbling will stain the inside of the bull's hindlegs and drops will be visible in amongst the tracks. Photo by ElephantVoices (left) and Ida Hansen (right).

Musth-Temporal-Gland-Secretion

Both male and female elephants secrete from the temporal glands (called Temporin). However, the musth secretion from the temporal glands is different from Temporin, as it is thicker and has a very pungent odour. The glands swell during musth, which contributes to the appearance of a larger head.

Figure 15 Musth secretion is stronger in older, higher-ranking musth bulls. Photo by Ida Hansen.

Trunk-Drag

The lower part of the trunk is dragged on the ground, which makes a rasping sound. It may function as a threat at very close range. When tracking a musth elephant, it can be seen in amongst the tracks as a snake-like mark.


Figure 16 Trunk-Drag by elephant bull (left) and the marks left on the ground after a Trunk-Drag (right). Photos by ElephantVoices.

Head-Toss

The head can either be raised up and down with the trunk curled up, or the head and trunk is lifted and swung with force, sometimes in a figure-eight movement. In intense displays, the elephant bull will bend the hindlegs and lower the hind portion of the body, which results in the head and trunk being even higher.


Figure 17 Head-Toss displayed by musth bulls. Photos by ElephantVoices.

Musth-Rumble

This is a rumble that is only associated with elephant bulls in musth. It is a very distinctive and pulsating rumble. It lasts about 12 seconds. It is usually heard in aggressive interactions with other males, when feeling challenged by vehicles, aircrafts and people, when musth-marking, or when approaching a group of females. It is an advertisement of musth to females, rivals, threats etc.

References

Bates, L. A. *et al.* (2007) 'Elephants Classify Human Ethnic Groups by Odor and Garment Color', *Current Biology*, 17(22), pp. 1938–1942. doi: 10.1016/j.cub.2007.09.060.

Bates, L. A. *et al.* (2008) 'African elephants have expectations about the locations of out-of-sight family members', *Biology Letters*, 4(1), pp. 34–36. doi: 10.1098/rsbl.2007.0529.

Bates, L. A., Poole, J. H. and Byrne, R. W. (2008) 'Elephant cognition', *Current Biology*, 18(13), pp. 544–546. doi: 10.1016/j.cub.2008.04.019.

Bertschinger, H. J. *et al.* (2008) 'Reproductive Control of Elephants', in Scholes, R. J. and Mennell, K. G. (eds) *Elephant management*. Johannesburg, South Africa: Wits University Press, pp. 257–328. doi: 10.18772/22008034792.17.

Bertschinger, H. J. *et al.* (2012) 'Porcine zona pellucida immunocontraception of African elephants (Loxodonta africana): Beyond the experimental stage', in Cain III, J. W. and Marshal, J. P. (eds) *Proceedings of the IVth International Wildlife Management Congress. Cooperative Wildlife Management Across Borders: Learning in the Face of Change*. Durban, South Africa: The Wildlife Society, pp. 95–102.

Bradshaw, G. A. *et al.* (2005) 'Elephant breakdown', *Nature*, 433(7028), p. 807. doi: 10.1038/433807a.

Bradshaw, I. G. A. (2010) *Elephants on the edge: What animals teach us about humanity*. Yale University Press.

Dale, R. and Plotnik, J. M. (2017) 'Elephants know when their bodies are obstacles to success in a novel transfer task', *Scientific Reports*, 7(November 2016), pp. 1–10. doi: 10.1038/srep46309.

de Klerk, G. J. and de Beer, G. C. O. (2017). Management plan for elephants on Mabalingwe Nature Reserve. Reserve document

de Wet, S. 2015. ´Female elephant mistakenly shot by hunters´. Africa Geographic. 17 July 2015

DEAT (2014) *Norms and standards for the management of elephant in South Africa to be amended*, *Government Gazette*. Available at: https://www.environment.gov.za/mediarelease/normsandstandards (Accessed: 28 February 2017).

Delsink, A. K., Van Altena, J., *et al.* (2007) 'Implementing immunocontraception in free-ranging African elephants at Makalali Conservancy', *Journal of the South African Veterinary Association*, 78(1), pp. 25–30. doi: 10.4102/jsava.v78i1.282.

Delsink, A. K., Kirkpatrick, J. F., *et al.* (2007) 'Lack of social and behavioural consequences of immunocontraception in African elephants .', *Journal of Zoo and Wildlife Medicine*, 44(4S), pp. S52–S74.

Doughty, L. S. *et al.* (2014) 'The impact of male contraception on dominance hierarchy and herd association patterns of African elephants (Loxodonta africana) in a fenced game reserve', *Global Ecology and Conservation*, 2, pp. 88–96. doi: 10.1016/j.gecco.2014.08.004.

Douglas-Hamilton, I. *et al.* (2006) 'Behavioural reactions of elephants towards a dying and deceased matriarch', *Applied Animal Behaviour Science*, 100(1–2), pp. 87–102. doi: 10.1016/j.applanim.2006.04.014.

Ebling, F. J. P. (2005) 'The neuroendocrine timing of puberty', *Reproduction*, 129(6), pp. 675–683. doi: 10.1530/rep.1.00367.

Elephant Voices (no date) *www.elephantvoices.org*.

Fayrer-Hosken, R. A., Grobler, D. G. and Van Altena, J. (2000) 'Immunocontraception of African elephants', *Nature*, 407(September), p. 149. doi: 10.1038/35025136.

Garaï, M. E. *et al.* (2018) 'Non-lethal elephant population control methods: Summary of the first workshop of the Elephant Specialist Advisory Group of South Africa', *Bothalia*.

Joonè, C. J. *et al.* (2019) 'Researching immunocontraceptive vaccines with mares (Equus caballus) as both a target and model for African elephant (Loxodonta africana) cows: A review', *Animal Reproduction Science*. doi: 10.1016/j.anireprosci.2019.06.002.

Kerley, G. I. H. and Shrader, A. M. (2007) 'Elephant contraception: Silver bullet or a potentially bitter pill?', *South African Journal of Science*, 103(5–6), pp. 181–182. doi: 10.1073/pnas.1016234107.

Kirkpatrick, J. F., Lyda, R. O. and Frank, K. M. (2011) 'Contraceptive Vaccines for Wildlife: A Review', *American Journal of Reproductive Immunology*, 66(1), pp. 40–50. doi: 10.1111/j.1600-0897.2011.01003.x.

Lee, P. C. and Moss, C. J. (2011) 'Calf development and maternal rearing strategies', in Moss, C. J., Croze, H., and Lee, P. C. (eds) *The Amboseli Elephants: A long-term perspective on a long-lived mammal*. The University of Chicago Press.

Lüders, I. and Oerke, A.-K. (2016) 'GnRH Vaccination in Elephants', pp. 1–11.

Lueders, I. *et al.* (2014) 'Suppression of testicular function in a male Asian elephant (Elephas maximus) treated with gonadotropin-releaseing hormone vaccines', *Journal of Zoo and Wildlife Medicine*, 45(3), pp. 611–619. doi: 10.1638/2013-0233R.1.

Lueders, I. *et al.* (2017) 'Effects of GnRH vaccination in wild and captive African Elephant bulls (Loxodonta africana) on reproductive organs and semen quality', *PLoS ONE*, 12(9), pp. 19–33. doi: 10.1371/journal.pone.0178270.

Marais, H. J. *et al.* (2013) 'Laparoscopic Vasectomy in African Savannah Elephant (Loxodonta Africana); Surgical Technique and Results', *Journal of Zoo and Wildlife Medicine*, 44(4s), pp. S18–S20. doi: 10.1638/1042-7260-44.4s.s18.

McComb, K. *et al.* (2000) 'Unusually extensive networks of vocal recognition in African elephants', *Animal Behaviour*, 59(6), pp. 1103–1109. doi: 10.1006/anbe.2000.1406.

McComb, K. *et al.* (2014) 'Elephants can determine ethnicity, gender, and age from acoustic cues in human voices', *Proceedings of the National Academy of Sciences*, 111(14), pp. 5433–5438. doi: 10.1073/pnas.1321543111.

McComb, K., Baker, L. and Moss, C. J. (2006) 'African elephants show high levels of interest in the skulls and ivory of their own species', *Biology Letters*, 2(1), pp. 26–28. doi: 10.1098/rsbl.2005.0400.

Moss, C. J. (1983) 'Oestrous Behaviour and Female Choice in the African Elephant', *Behaviour*, 86(3/4), pp. 167–196.

Moss, C. J. and Lee, P. C. (2011) 'Female social dynamics: Fidelity and flexibility', in Moss, C. J., Croze, H., and Lee, P. C. (eds) *The Amboseli Elephants: A long-term perspective on a long-lived mammal*. The University of Chicago Press.

Mutinda, M. *et al.* (2014) 'Detusking fence-breaker elephants as an approach in human-elephant conflict mitigation', *PLoS ONE*, 9(3).

Plotnik, J. M., de Waal, F. B. M. and Reiss, D. (2006) 'Self-recognition in an Asian elephant', *Proceedings of the National Academy of Sciences*, 103(45), pp. 17053–17057. doi: 10.1073/pnas.0608062103.

Poole, J. H. (1987) 'Rutting Behavior in African Elephants: The Phenomenon of Musth', *Behaviour*, 102(3/4), pp. 283–316.

Poole, J. H. (1989a) 'Announcing intent: the aggressive state of musth in African elephants', *Animal Behaviour*, 37, pp. 140–152.

Poole, J. H. (1989b) 'Mate guarding, reproductive success and female choice in African elephants', *Animal Behaviour*, 37(PART 5), pp. 842–849. doi: 10.1016/0003-3472(89)90068-7.

Poole, J. H. *et al.* (1996) *Studying Elephants*. Edited by K. Kangwana. Nairobi, Kenya: African Wildlife Foundation. doi: 10.1080/0963928021012234.

Poole, J. H. (2011) 'Behavioral Context of Elephant Acoustic Communication', in Moss, C. J., Croze, H., and Lee, P. C. (eds) *The Amboseli Elephants: A long-term perspective on a long-lived mammal*. Chicago and London: The University of Chicago Press, pp. 125–161.

Poole, J. H., Lindsay, W. K., *et al.* (2011) 'Ethical approaches to elephant conservation', in Moss, C. J., Croze, H., and Lee, P. C. (eds) *The Amboseli Elephants: A long-term perspective on a long-lived mammal*. The University of Chicago Press, pp. 318–326.

Poole, J. H., Lee, P. C., *et al.* (2011) 'Longevity, competition, and musth: A long-term perspective on male reproductive strategies', in Moss, C. J., Croze, H., and Lee, P. C. (eds) *The Amboseli Elephants: A long-term perspective on a long-lived mammal*. The University of Chicago Press, pp. 272–290.

Poole, J. H. and Granli, P. K. (2011) 'Signals, gestures, and behavior of African elephants', in Moss, C. J., Croze, H., and Lee, P. C. (eds) *The Amboseli Elephants: A long-term perspective on a long-lived mammal*. The University of Chicago Press.

Thouless, C. R. and Sakwa, J. (1995) 'Shocking elephants: Fences and crop raiders in Laikipia District, Kenya', *Biological Conservation*, 72, pp. 99–107.

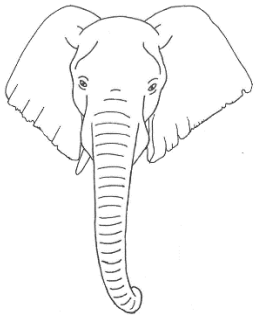
Unknown authors (2017). Mabalingwe Natuurreservaat. Reserve document

Zeederberg, J. (2015) ´Mabalingwe Common Property Association - Update on Elephants´. Reserve document

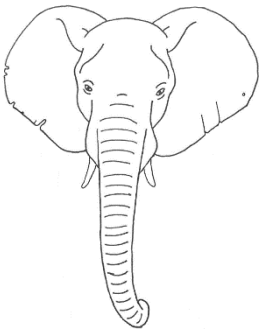
Zitzer, H. R. and Boult, V. L. (2018) 'Vasectomies of male African elephants as a population management tool: A case study', *Bothalia*, 48(2), pp. 1–9. doi: 10.4102/abc.v48i2.2313.

Appendix A – Sketches of elephant faces

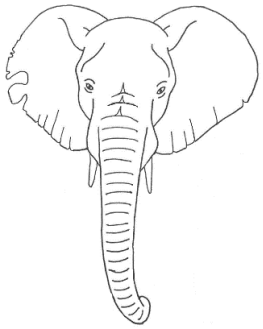
Female elephants



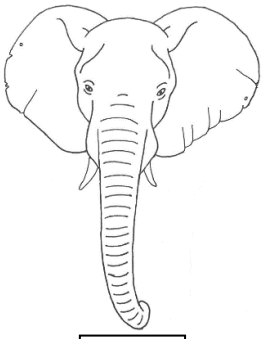
Kitso



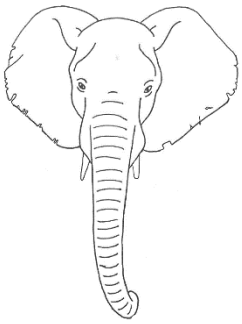
Iteta



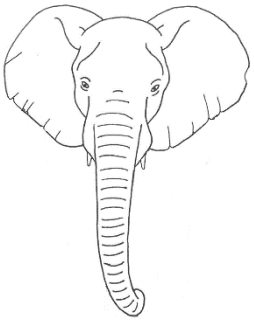
Tumelo



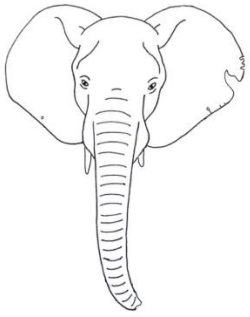
Seeiso



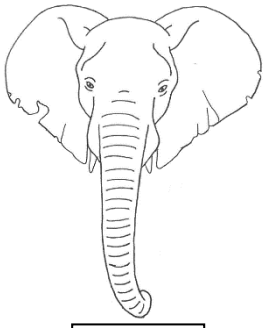
Sethunya



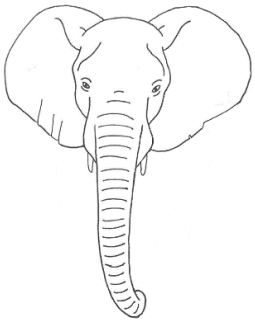
Montlenyan



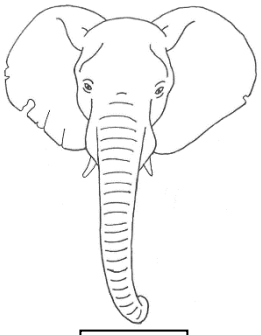
Pelontle



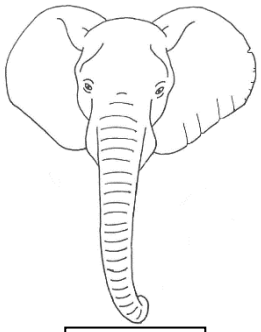
Dikeledi



Kagiso

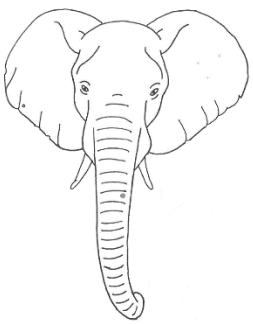


Sediba

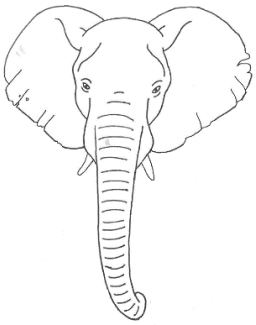


Pelonomi

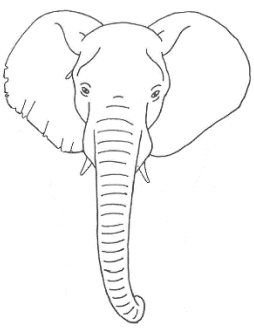
Male elephants



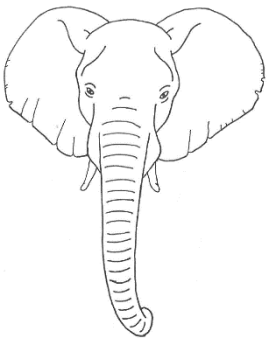
Tshepo



Neo



Maatla

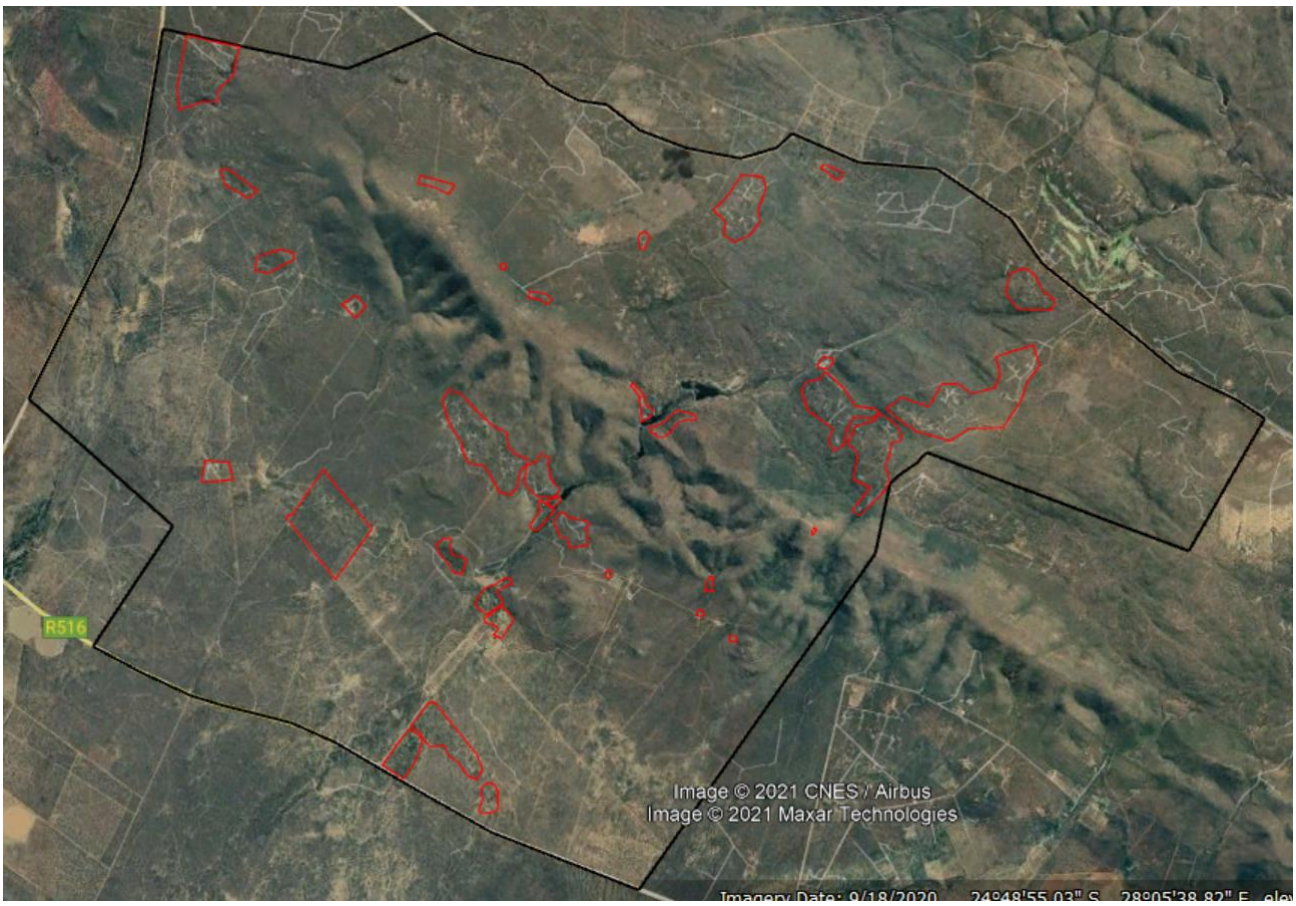


Morena

Appendix B – Measurements of elephants at darting

ID	Age class	Estimated age	Sex	Side lying on	Body				Trunk		Left tusk		Right tusk		Front foot			Rear foot		
					Weight (kg)	Shoulder height (cm)	Body length (cm)	Tail length (cm)	Length (cm)	Width at tusks (cm)	Length (cm)	Width at base (cm)	Length (cm)	Width at base (cm)	Length (cm)	Width (cm)	Circ. (cm)	Length (cm)	Width (cm)	Circ. (cm)
Kitso	Adult	30 +/-	F	L	N.D.	280	280	84	199	N.D.	None	None	42	22	44	37	129	50	29	123

Appendix C – Map of Mabalingwe Nature Reserve with geofences



	Area size (ha)	Perimeter (km)
Total reserve	8907,00	43,30
Exclusion area (sable)	69,10	3,46
Human habitation	246,59	50,12
Area available to elephant	8591,31	