System for Elephant Ear-pattern Knowledge (SEEK) to identify individual African elephants

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Abstract

Elephant numbers have drastically declined over the past century with illegal killings, habitat fragmentation and human-elephant-conflict representing the greatest threats. Information on estimates of abundance and demographics are important to understand the long-term implications of these threats. Mark-resighting studies can provide valuable insights but depend on the individual identification of numerous elephants within populations across both Africa and Asia. Most photographic elephant identification studies are still reliant on human memory and manual matching of known individuals. A process that is not only labour intensive but also largely dependent on experiential skills that need to be developed over time by researchers. Over the course of almost 25 years, Elephants Alive has developed a unique System of Elephant Ear-pattern Knowledge (SEEK), which makes allowance for rapid individual identification of savannah elephants with reduced observer bias using basic software while also accommodating missing information or changes in identification features over time.

Résumé

L'effectif de la population d'éléphants d'Afrique connait un déclin rapide depuis le début du siècle avec pour principales menaces, le braconnage, la fragmentation de leur habitat et les conflits hommes/éléphants. Les estimations de leur abondance et les données démographiques sont importantes pour comprendre les implications à long-termes de ces menaces. La méthode capture-marquage-recapture utilisée dans les études, fournie des informations précieuses mais dépend de l'identification individuelle de nombreux éléphants au sein des populations d'Afrique et d'Asie. La plupart des études d'identification photographiques d'éléphants dépendent toujours de la mémoire humaine et de l'appariement manuel d'individus connus. Un processus qui est non seulement minutieux et chronophage mais aussi largement tributaire des compétences expérientielles qui doivent être développées au fil du temps par les chercheurs. En près de 25 ans, Elephants Alive développé un système d'identification unique «System of Elephant Ear-pattern Knowledge (SEEK)», qui utilise le dessin du contour des oreilles des éléphants de savane pour une identification rapide de l'individu avec un biais d'observation réduit, en utilisant un logiciel basique qui tient compte des informations manquantes et des changements des caractéristiques d'identification au fil du temps.

Introduction

A number of mark-recapture models have been developed for animal species in order to estimate population abundance and demographics (Krebs 1999). For the African savannah elephant (*Loxodonta africana*), physical capture-mark-recapture techniques are not only expensive and dangerous but impractical as elephants can move over large areas and also occur at high densities in open systems with sufficient resources (De Knegt et al. 2011). Aerial surveys are cost prohibitive on a larger scale, while dung counts are influenced by vegetation type and population size, thereby requiring the use of alternative techniques such as mark-resighting studies (Morley et al. 2007). The use of photo-identification, which depends on unique physical features has mostly been applied in marine mammals with special reference to cetaceans (Weideman et al. 2017). In elephants, photographic records have been used since 1972 to identify and match individuals but this has largely depended on manual matching techniques and human memory (Douglas-Hamilton 1972, Whitehouse and Hall-Martin 2000, Moss 2001). Exploration of alternative techniques using automated software models to run photographic identification studies of elephants, is fast gaining momentum but still requires additional development (Weideman et al. 2020).

Understanding the implications of long-term elephant population trends and making future predictions due to specific management interventions often requires an in-depth detailed knowledge of demographic data (Henley 2013). Where elephant populations are recovering from high levels of illegal killings causing the recent continental declines (Chase et al. 2016), reliable demographic data may prove invaluable (Goswami et al. 2007). Behavioural studies also require individual identification to understand social organisation, anthropogenic and environmental effects on different levels and individual traits within a population (Murphy et al. 2019, Caitlin et al. 2020). The escalation of Human-Elephant Conflict (HEC) situations often requires mitigation, which may involve remedial action, or the classification of the elephant as a “Damage Causing Animal” (DEA 2007). Consequently, identification of the correct individual involved in the conflict, needs to take place with a high degree of certainty. Due to the diverse value of long-term photographic mark-resighting studies, we outline the history and use of the System for Elephant Ear-pattern Knowledge (SEEK) developed by the South-African non-profit organisation, Elephants Alive to encourage the implementation of elephant photo-identification studies.

Materials and methods

Study area and experimental setup

On the western border of the Kruger National Park (KNP) in South Africa, a group of privately-owned reserves (Timbavati-, Thornybush-, Klaserie-, Balule- and Umbabat Private Nature Reserve) form a consolidated conservation area of approximately 2,000 km^2 known as the Associated Private Nature Reserves (APNR) (fig. 1). The fences separating the APNR from the KNP were removed in 1993–1994. In the early 2000s the KNP removed sections of its eastern boundary fence with neighbouring Limpopo National Park in Mozambique. The northern border of the KNP has always been porous for elephants, since historical times, to cross the Limpopo River and specifically link with other elephant populations in Gonarezhou National Park, in Zimbabwe. The transboundary Protected Areas collectively form the Great Limpopo Transfrontier Conservation Area (GLTFCA) covering an area of 35,000 km^2. The known connectivity across the regions increases the potential number of elephants that can be encountered within the APNR, site of the headquarters of Elephants Alive where field-based research has been conducted since 1996 and officially registered since 2003. A total of 3,108 elephants were counted in the APNR (Peel 2019), while 31,277 elephants have been estimated within the wider GLTFCA (Thouless et al. 2016).

The mean annual rainfall of the APNR varies around 600 mm and temperatures average 22°C throughout the year. There is considerable variation in vegetation types throughout the APNR with some areas containing dense *Colophospermum mopane* (mopane) woodland as well as isolated *Senegalia nigrescens* (knob thorn) and *Sclerocarya birrea* (marula). In other areas *Combretum apiculatum* (red bush willow), *Lanneaschweinfurthii* (false marula) and *Terminalia sericea* (silver cluster leaf) occur regularly (De Villiers 1994). The moderately dense woody cover of the APNR presents more of a challenge for elephant photo-identification than in the open savannahs of East Africa.

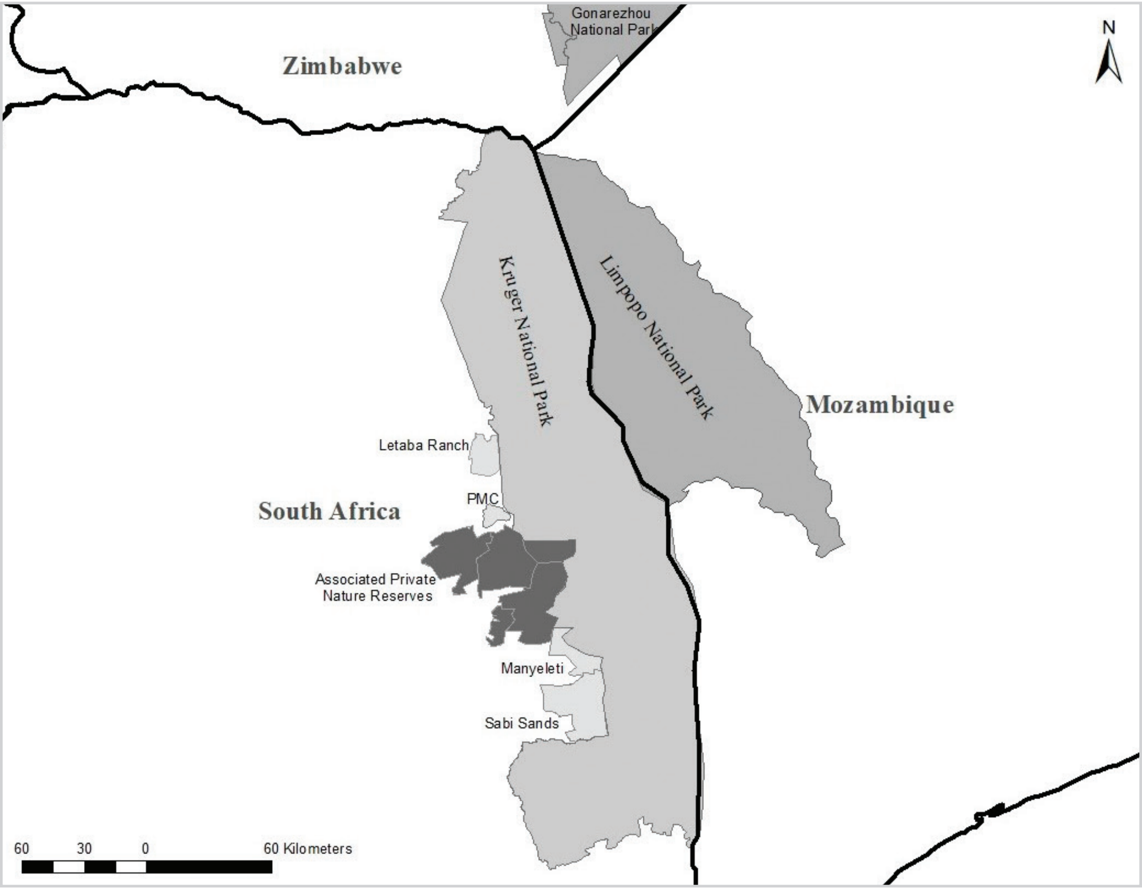


Figure 1. The Associated Private Nature Reserves (APNR) within the Greater Limpopo Transfrontier Conservation Area, Southern Africa. The APNR represent the darkest shade of grey, adjacent to the Kruger National Park, South Africa.

The development history of the SEEK database

African savannah elephants have large triangular shaped ears covering their shoulders that can grow as large as 2 m by 1.5 m (Estes 1999), which allows for visualisation even in thick vegetation. A simplified coding system which was started in 1996 and depended primarily on detailed drawings of ear features made in the field on an ad hoc basis, had amassed to over 500 drawings by the time the study was registered with South African National Parks (SANParks) in 2003. The study has continued until the present day with all sighted individuals photographed in the field and categorised as new or thereafter resightings before detailed drawings are made for easy reference. The elephant identification study has primarily focussed on the bull population to maximise accuracy due to the denser vegetation, smaller group sizes of bachelor herds, and to keep the study manageable because of the potential size of the entire neighbouring elephant population. Also, cows within family units have been more widely studied within South Africa (Whitehouse and Hall-Martin 2000, Delsink et al. 2006). Individuals within independent family groups were also photographed, however, and filed with the family group identified to herd level based on the identification of a few characteristic cows within the group. Young bulls less than 20 years of age that lacked distinctive ear features, be theyassociating within natal herds—or bachelor groups, have also been filed and will be identified to individual level upon further refinement of the SEEK coding database.

During the first eight years of the study from 2003 to 2011, a total of 83,212 photographs of individual

'Feature' describing a characteristic ear: (*On the **Left** (**L**) side, the **ear** has a **tear** (R) which originated from an oval (**O**) hole and the size of the tear is large (capital 'O') in position between **4 and 5 o'clock** (4)*)

Elements	**L**	**RO**	**4**
Sequence	**Side**	**Part+Type+Size**	**Position**
Code	**1 character**	**2 characters**	**1 digit**

Figure 2. An example of one feature with four elements consisting of characters (letters) or digits (numbers).

elephants, were collected to produce identification drawings for 1,125 and 353 individually identified bulls and cows respectively. These identikits were collected during 3,186 encounters with multiple or lone elephants, which transcribed to 6,460 individual encounters with either a bull or a family group as a collective unit.

From 2011 until 2013 photographs were also collected of the frontal line patterns of the face from the base of the tusks to the forehead to make allowance for individual identification via pattern recognition software (Conservation Research Ltd.; Extract Compare V1.18, Cambridge; L. Hiby 2011). The efficacy of the software proved to be very dependent on suitable lighting conditions and the aspect of the elephant frontal view so that overall, an experienced elephant identification researcher performed better than the software. However, the method of using the wrinkle patterns of the face once extracted or even captured manually, may still hold promise for use with smooth-eared individuals.

In 2012, the first comprehensive coding system was developed, initially grouping the animal according to sex and age then incorporating a feature and element system, which applied to markings on both the right and left ears of the elephant. A feature consisted of four elements (fig. 2). An element is a piece of information that would help identify the appropriate side of the elephant (left or right), the characteristic body part (tusk, ear or body marking), the shape (type of marking with the size indicated in lower case letters for small types and upper case letters for big types) and the position of the marking using digits (numbers). A recommended total of three features were included to support identification, for each side of the elephant.

A set of rules were formulated to prioritize the elements with size>type>position. The position of a marking was recorded by initially dividing the ear into four sections based on the angle of the photograph, but this was latter narrowed down to three sections per ear. All known elephants were coded on an excel sheet and the filtering system applied to call up individuals with the closest matches to the ''unknown'' individual. This system was refined over time (2012–2016) with regular new versions aimed at minimising observer bias as the type of ear marking, the shape of tears, notches or nicks is heavily depended on photograph's angle and quality. By this point in time, the SEEK coding methods had successfully narrowed the search for unknown individuals, however, if the type of marking was not correctly selected by the observer, some individuals were still excluded prematurely.

In 2017, the SEEK coding methods were simplified further to reduce observer bias. Only the position number of four potential elements in a right and left ear feature were used for identification. The type of elements was limited to just the tears/notches/nicks/holes/pinpricks thus excluding observer bias in terms of more detailed shapes previously involved. Extreme and special elements of a feature such as larger than usual tear/notches or holes and deformities were recorded after the ear features, instead of upfront as had been done previously to fast forward the search. The current coding system assigned to each individual elephant, was developed following rules of the "Search Function" of Microsoft Excel and Microsoft Word (Microsoft Office 365), narrowing search results as elements are added, enabling us to search for individuals that were hard to describe due to poor quality photos, the obstruction of certain features by vegetation (field circumstances) or potential changes overtime. From January 2003 until December 2019, a total of 23,495 individuals of all ages and sex have been sighted (mean ± SE sightings per day =2.33±1.53, range=1–12) of which 191,888 photographs have

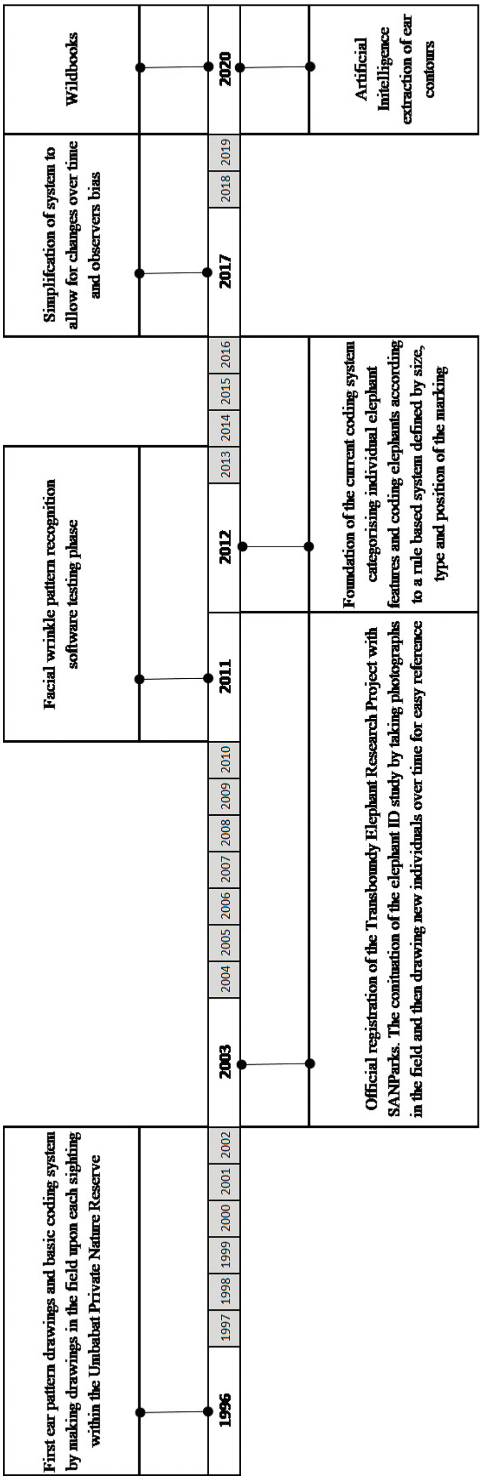


Figure 3. The development of the SEEK database, represents the best of all systems explored throughout the years and incorporates the use of an extensive identification photographic library matched by hand-drawn, detailed drawings per individual elephant, thereby making use of both conventional and newly developed methods to most accurately identify elephants. The use of Artificial Intelligence and Wildbooks holds promise for the future.

been collected. Approximately 5,529 bulls over the age of 20 have been sighted of which 2,000 bulls have been identified from both resightings and new sightings and categorised in our library. Currently, the SEEK coding database consists of an extensive coding library with a photo identification and hardcopy drawings reference library of new and resighted individual elephants (fig. 3).

The SEEK coding system

Six feature blocks of code are used to identity each individual elephant (Sex, Age, Tusks, Ears, Extreme—and Special features). All codes are assigned according to a set format where the order of the feature blocks with no spaces between them, is upheld and populated by the individual elements derived from studying the detailed photos of the elephant (fig. 4). Once an elephant has been coded, the code and detailed elephant drawing is added to the coding library database (see fig. 5 for example).

A potentially unknown or resighted animal is first searched for by using the "Search Function" of Microsoft Excel and Microsoft Word (Microsoft Office 365) to narrow the search results as characters are added. When a drawing looks like a possible match, the photographs in the photo library of the possible candidates are inspected to confirm an identification. Only if three different features can be matched, can the elephant be classified as a resighting individual.

The Search Function also allowed usage of the Microsoft Office Wildcard functions to search for individuals that were hard to describe as the Microsoft Wildcard function widens the search for unknown or resighted elephants with less available data. Hence, Microsoft Wildcard functions make allowance for part of the code to be replaced by a question mark, thereby allowing the search to return elephants with a similar code that contains any value for the character replaced with a question mark. For example, if the observer is uncertain about the age of the elephant, the two elements of the age-feature can be replaced by "??" which then searches for an elephant with the same remaining features but across all ages. Alternatively, if only one ear could be photographed, the information corresponding to the second ear can be replaced by question marks and the system will search all codes, which may contain only the one ear's related elements.

The initial stages of developing a SEEK database

Field data collection

Records of sighted animals are collected by taking detailed photographs aimed to capture the unique patterns of tears, nicks, holes, and veins in the ears in combination with other features on the body of elephants encountered during fieldwork. Elephants are sexed (Appendix 1 from Henley and Henley 2006) and aged (Appendix 2 from Henley 2015) in the field. To photograph elephants, they are approached by one of our vehicles in a respectful quiet manner, often after anticipating their line of movement and waiting for them to approach rather than pursuing them. Whenever possible a photograph is taken of the left and right ear separately with frontal photos of spread ears only taken if circumstances naturally allow for this. Special attention is given to photographing tears, notches, nicks, pinpricks, any extreme features or special features like jagged ear margins, wavy ears or markings at the back of the top fold of the ear (Appendix 3). It is useful to take "separator photos" of non-elephant objects in between individual elephant photos within groups as this helps when processing and sorting photos per individual for identification when back at base.

Developing a coding library

Processing individual identification photos involves grouping photos within "separator photos" taken in the field and double-checking that the same individual's photos are within one folder. If the ear pattern do not contain distinct ear markings or vein patterns, this may involve looking for subtle markings such as mud, scratches, scars or deformities on the body, tail hairs and even background position of the individual within photo frames. If the unknown individual is not found after searching in the coding library and checking all possible matches with the photos of potentially matching and already known individuals,, the individual is considered a new elephant that needs to be added to the existing records. All researchers busy with processing photographs (usually two or more) cross check with each other to ensure that the unknown animal represents a new animal. Thereafter

EAR Feature

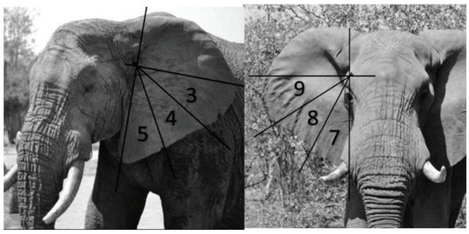
E --------Right ear------- (1) (2) (3) (4) - --------Left ear-------- (1) (2) (3) (4)

Tear: Tear with/without a flap of skin hanging down

(1) = Position of the most prominent Tear
(2) = Position of the most prominent Hole
(3) = Position of the second most prominent Tear
(4) = Position of the second most prominent Hole

Code	Position on the Ear
3	Position 3
4	Position 4
5	Position 5
7	Position 7
8	Position 8
9	Position 9
Code	Other
0	Not present
_ (underscore)	Unknown

Positions : clock-face "3" to "9"



RULES FOR CODING

- Presence of two equally "obvious" features of the same type (tears or holes) → the deepest tear and biggest diameter hole will be coded for first.

- Presence of two equally "obvious" features of the same type and same size are present → the higher positioned feature will be coded for first.

_ _ _ T _ _ E _ _ _ _ - _ _ _ _ X _ _ S _ _ _

GENDER

_

Code	Definition
B	Elephant Bull
C	Elephant Cow

TUSK Feature

T __ __

Code	Definition
0	Absence
1	Presence

Note: Broken tusks are not recorded as it can regrow or break again

EXTREME Feature

X __ (Right ear) __ (Left ear)

A tear or a hole is classified as extreme when it extends 1/4 or more in length towards the inner ear and/or is 1/4 of the total ear margin width.

Code	Definition
0	Absence
1	Presence

AGE

_ _

Code	Birth Year Bracket
60	1900 - 1969
70	1970 – 1979
80	1980 – 1989
90	1990 – 1999
00	2000 – 2009
10	2010 – 2019

Refer to Appendix 2 for details

SPECIAL Features

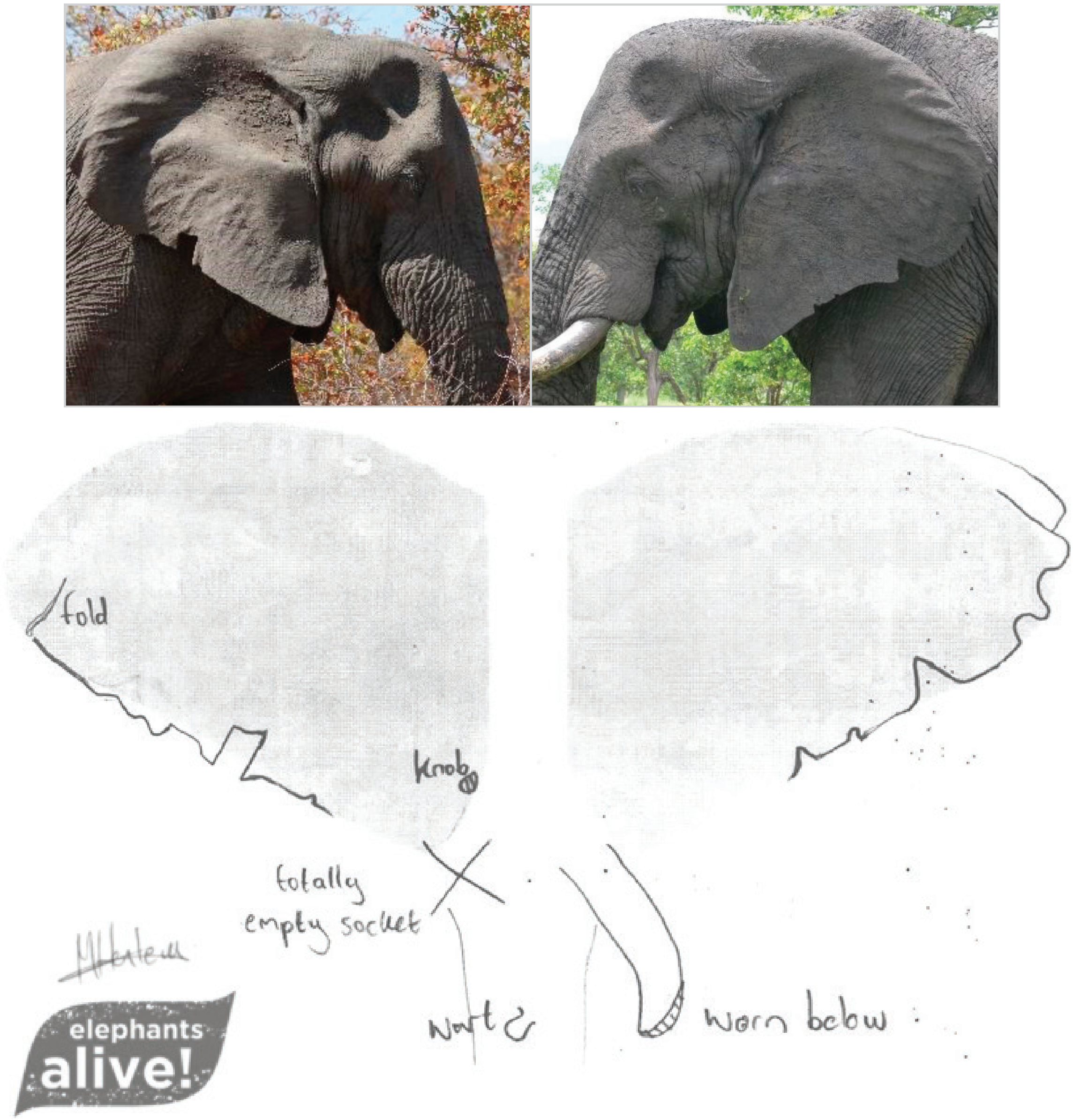
S __ (Right ear) __ (Left ear) __ (Body)

Code	Definition
0	Absence
1	Presence

ears deformities = scars, significant growths, skin issues, wavy ear, floppy ear, jagged ear or any marking at the back of the top fold of the ear
body deformities = scars, significant growths, skin issues or missing or deformed tails

elephants alive! ©SEEK Elephants Alive

Figure 4. System for Elephant Ear-pattern Knowledge (SEEK) developed by Elephants Alive over a quarter of a century.



Right ear   Left ear

CODE: B70T01E808_-403_X00S00_

- Bull (B)
- Born in the 1970s (70)
- Missing right tusk (T01)
- Two big tears in position “8” in his right ear (E8_8_)
- No prominent holes in his right ear with the presence of any secondary holes (pinpricks) unknown (E_0__)
- The biggest tear in his left ear is on position “4” followed by the second biggest one in position “3” (-4_3_).
- No prominent holes in his left ear with the presence of any secondary holes (pinpricks) unknown (E_0__)
- No tears or holes are big enough to be classified as extreme (X00)
- There are no special elements on either of the ears. Any special elements on the body are unknown as the wart on his nose too small and may disappear with time (S00_).

Figure 5. An example of how an individual with specific features is coded before the entry is submitted to the SEEK coding library.

the new animal is named and a comprehensive detailed drawing is made by the same person on a predefined ear template to ensure consistency in drawing techniques over time. All elephant photos of the same individual are then stored by date and individual elephant name in a unique folder, which is added to the photo reference library. The animal is then coded based on the SEEK coding system outlined below and linked to the drawing of the ears (fig. 6). It proved to be quicker to scroll through possible candidates based on a constant ear template instead of having to refer back to numerous photos within the photo reference library taken with different lighting conditions, angles and sizes of the various features. Where resighted individuals' identification features changed over time, the codes and drawings were amended so that the coding library could stay up to date.

Conclusion

Our photographic elephant identification study has primarily focussed on bulls. Bulls are often the target of either illegal killings, hunting pressure or HEC as they not only carry larger tusks than their female counterparts they are also often less risk adverse than the members of family units who innately protect their young (Cook et al. 2015). Bulls also represent vital trailblazers willing to take the risk to link Protected Areas and by so doing map the connective potential of landscapes at very large scales (Douglas-Hamilton et al 2005). Due to their physical features (tusks) and willingness to take risks, bulls largely affect the reproductive potential of the population, thereby necessitating robust estimates of adult male numbers (Taylor et al. 2019). Furthermore, as reproduction allocation increases with age in elephants, the removal of dominant males from the population has several negative consequences. Human-driven selection could have lasting implications for elephant life history. Thus, SEEK is a further tool for applied

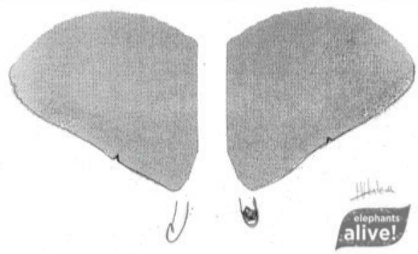
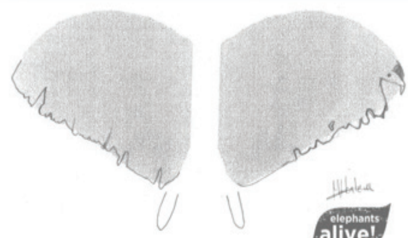
NAME	EAR_CODE	Drawing
CORNELIUS	1B70T11E80__-335_X00S01_	
CORTES	1B90T11E80__-30__X00S___	
CORTONI	1B90T11E907_-34__X00S10_	

Figure 6. An excerpt of the SEEK developed by Elephants Alive.

wildlife conservation management and can aid in the protection of critically important mature bulls. Photographic identification studies could therefore contribute towards survival estimates of various cohorts of the bull population, whilst also identifying vital trailblazing elephants or potential crop-raiders (Goswani et al. 2007).

To build up reliable photographic records within an open system such as the APNR represents a challenge not only due to the investment in time and finances required, but also in terms of the acquisition of skills necessary to successfully identify individuals (Henley 2013). As the SEEK coding database can accumulate large volumes of valuable data over time, encryption by password protection can easily be employed to ensure data protection. While most biologists eagerly await the entry of artificial intelligence platforms to lessen the load, Elephants Alive has made substantial progress. The development of the SEEK coding database which can operate on basic software makes allowance for changes in savannah elephant identities over time and has removed much of the observer bias confronted during its almost 25 year developmental stages.

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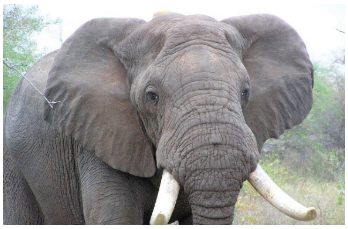
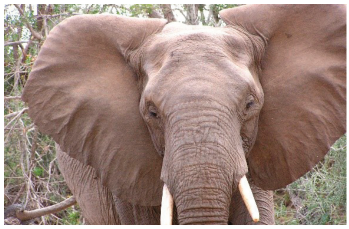
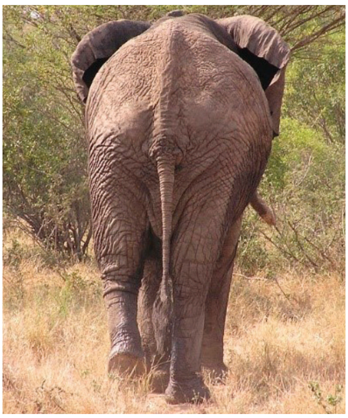
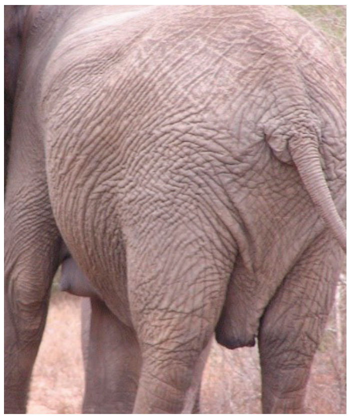
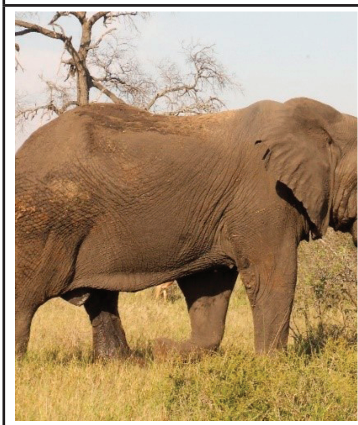
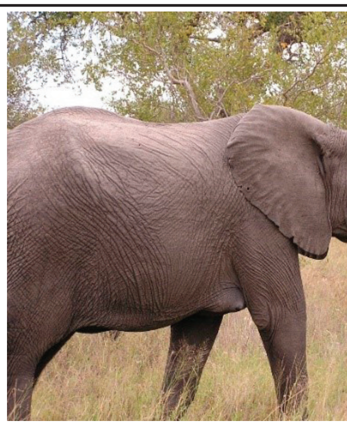
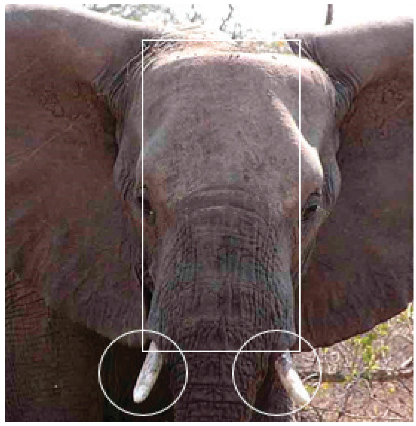
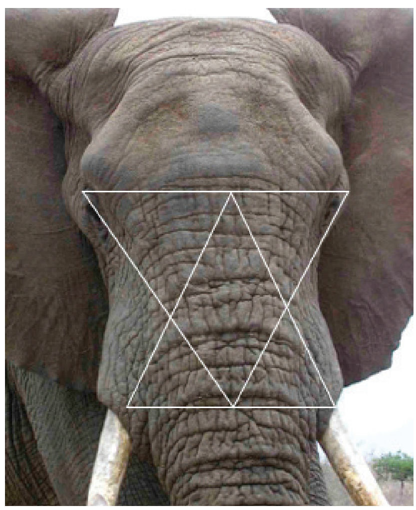
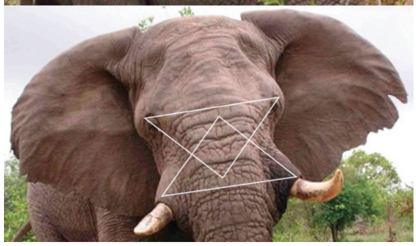
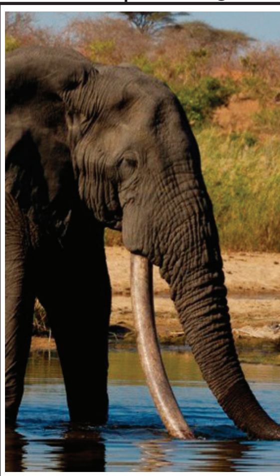
Appendix 1: Guide to sexing elephants

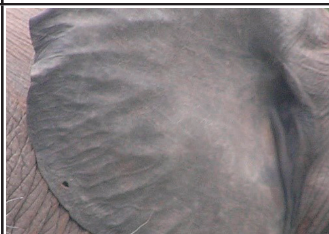
SEXING ELEPHANTS			
BULLS		**COWS**	
Head shape - lateral view			
	• forehead rounded • tusks thick set at their base and tapering		• forehead is triangular and pointed • tusks narrow with width almost even until the tip
Head shape - frontal			
	• forehead broad with hourglass shape visible in older bulls		• forehead is not broad and as tusk sockets are not extended, no hourglass shape in older animals
Caudal view			
	• narrow shape • ridge of skin stretches from the base of the tail to form the penis sheath which faces forward • the edge of the ridge between the legs is rounded		• body shape round with sides often extending beyond the pelvis width • ridge from the base of the tail is lacking • vulva is squared off and facing downward
Body - lateral view			
	• penis is often visible • forms a square to triangular shape when contracted • breasts not visible		• parallel ridge from the back legs tapering forward is visible in older cows • often appears as a belly-button like structure in younger individuals • breasts visible

Appendix 2: Guidelines to age an African elephant

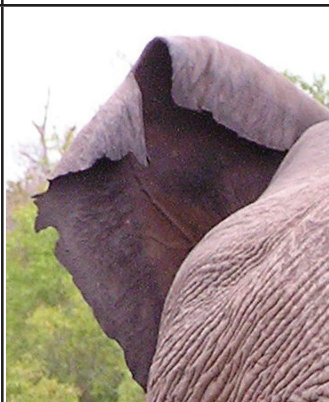
SIZE CATEGORY	Behavioural characteristics	Physical attributes	Age categories
IMMATURE			
• Juvenile	• Small bulls physiologically dependent on their mothers (not weaned from their mothers).	• All bulls within this category are smaller than large, mature females within the herd. • Tusks are either visible as buds or are splayed rather than convergent.	• Juveniles would be between 1–4 years of age.
• Sub-adult	• Bulls that have been weaned but which are still in close association with the family unit (psychologically dependent on their mothers).	• Frontal head shape is narrow and square and similar to young females.	• Sub-adults would be aged between 5-<15 years. 
YOUNG ADULT	• Bulls within this age category are independent of the family unit but haven't experienced their first musth cycle. • Young adults spend time on the periphery of the family unit, which they accompany. These family units may or may not be their natal herd. • Young adult bulls are also frequently found within bachelor groups or could be temporarily solitary.	• The tusks begin to take their adult configuration i.e. convergent, straight or asymmetrical. Tusks are still not thick set at the base as with prime bulls. • The head shape is slowly taking more of an hourglass shape although the sockets from which the tusks protrude are still narrow and not in line with temporal protrusions (eye sockets and temporal glands) when viewed from the front. • Bulls older than 17 years of age are the same heights as the largest female in the herd.	• Young adults are 15-<25 years old. 
ADULT	• Bulls may start to experience short, sporadic musth cycles from about 25 years of age.	• All bulls within this category are larger than mature females within the family unit.	• Adults are >25–35 years old.

PRIME	• Bulls within this category would have distinct musth and non-musth periods. Musth periods are predictable for each animal and can last 2–4 months depending on the body condition of the bull. Musth periods are spent in search of breeding females while non-musth periods are spent on their own or mostly within bachelor groups in areas distinct from those occupied during musth. • Bulls older than 50 years will still experience regular musth cycles.	• Bulls have an overall huge body size, which can be up to twice the size of adult females. • The shoulder height and back length increases steadily and becomes hollower between the shoulder blades and the pelvic area. • The tusks are usually thick set at the base. • The head has a distinct hourglass shape, which is wide at the eyes and base of the tusks and is generally broad with visible temple depressions.	• Bulls within this category range in age >35 years of age to approximately 55 years of age.  
SENESCING/ RETIRED	• Bulls will no longer experience extended musth periods and will retire to areas with soft vegetation such as riverine areas.	• The ears are held lower on the head and the back is usually considerably hollow. As the last set of molars come into wear from 45 years of age and could take 15 years to wear down, a loss in body condition with accompanying deep temporal depressions and an overall gaunt appearance may only become visible in the very last few years of the bull's life. • Tusks are sometimes large and long.	• Retired bulls >55 years old.
Physical characteristics to look for are the pronounced shoulder blades, hollows above the eyes and laterally to them. The wrinkles on the frontal section of the face are also deeply grooved. The upper ear ridges are droopy while the tusk sockets are elongated. Lateral views of the body show a concave back because of the pronounced shoulder blades and a long body. Illustrative photographs (*Johan Marias*)	 		

Appendix 3: Examples of ear elements

<table>
<tr><th colspan="4">EXAMPLES OF ELEMENT TYPES
Shadows behind the ears with lateral views help to accentuate the markings</th></tr>
<tr><th colspan="2">Tear</th><th colspan="2">Notch</th></tr>
<tr><td></td><td>• flap of skin hanging down, or upright or horizontal
• usually formed when a hole pulls through to the ear margin over time</td><td></td><td>• tear but the dangling skin is gone
• usually formed after a tear</td></tr>
<tr><th colspan="2">Nick</th><th colspan="2">Pinprick</th></tr>
<tr><td></td><td>• small tear or notch that might not be visible without binoculars or if the animal is covered in mud</td><td></td><td>• small hole that might not be visible without binoculars or if the animal is covered in mud</td></tr>
<tr><th colspan="2">Extreme feature</th><th colspan="2">Top fold markings</th></tr>
<tr><td></td><td>• tear, hole or notch that extends ¼ or more in length towards the inner ear

and/or

• tear, hole or notch that is a ¼ or more of the total ear width</td><td></td><td>• any type of marking found on the ventral side of upper ear margin, which is folded backwards toward body
• positioning on ear hard to define thus classified as an element type of a special feature</td></tr>
<tr><th colspan="2">Jagged</th><th colspan="2">Wavy</th></tr>
<tr><td></td><td>• repeated notches in close succession of each other giving the ear a sawn appearance
• positioning on the ear hard to define thus classified as an element type of a special feature</td><td></td><td>• the ear edge is very wavy as the distal end of the ear tends to hang like the folds of a curtain
• positioning on the ear hard to define thus classified as an element type of a special feature</td></tr>
</table>