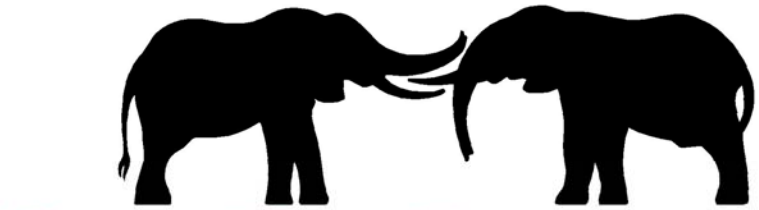


Aging elephants - a practical guide

Compiled and illustrated by Michelle Henley

2012

INDEX

Functional, behavioural age classes of bulls (Henley & Henley 2005)

Juvenile

Still dependent on mother for nutrition

- neonate < 1yr
- yearling 1-2yr
- juvenile ≤4 yr

Sub-adult

Sexually immature; physiologically independent but still with strong bond to natal herd

Adult

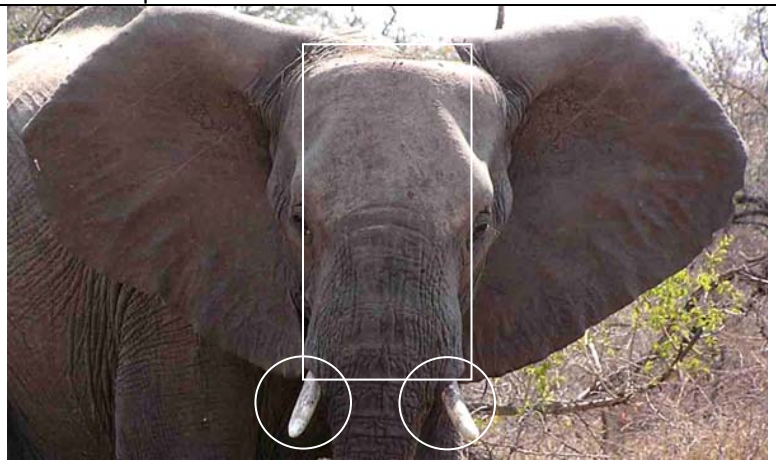
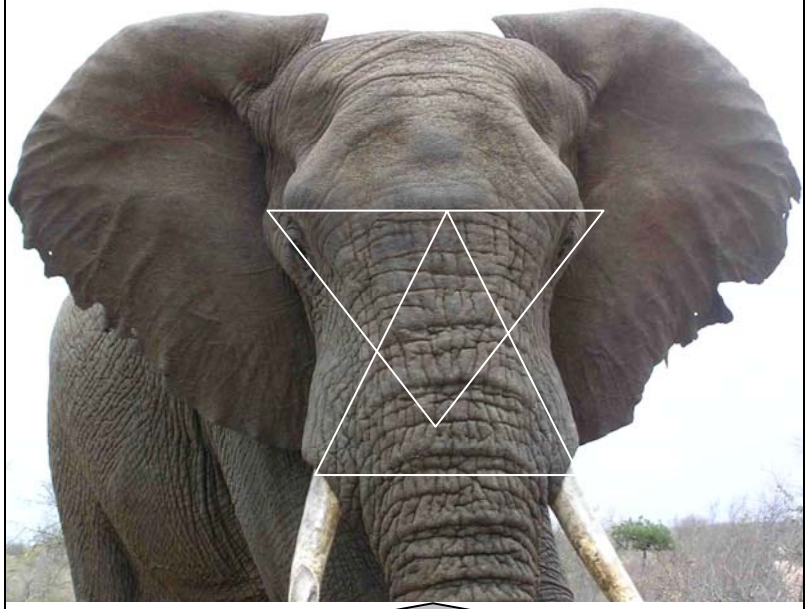
Independent, mature individual

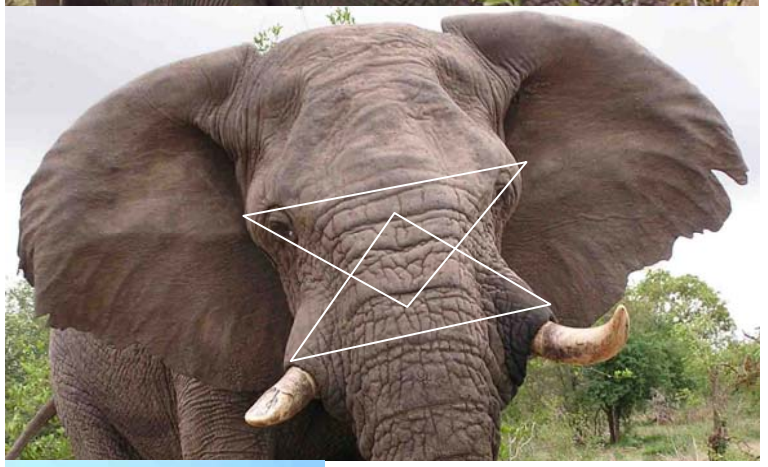
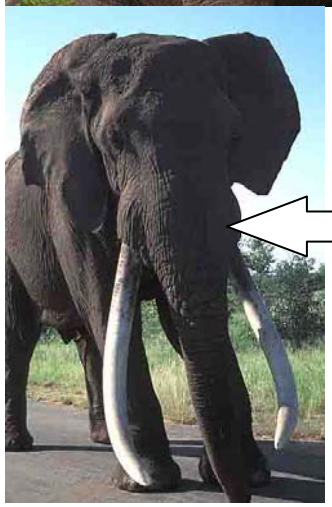
- young adult
- adult
- senior adult
- senescing adult

Bulls: functional age classes

- juvenile: <4 years old; still dependent on mother for nutrition
- sub-adult: 5-<15 years old; still bonded to natal herd
- young adult: 15-<25 years old; independent of family group; no musth
- adult: 25-35 years old; short and erratic musth periods
- prime/senior adult: >35-55 years old; regular and protracted musth cycle
- senescing adult: >55 years old; last set of molars worn and in physical decay

Criteria for categorising bulls into various size categories (Henley & Henley 2005)

Size category	Behavioural characteristics	Physical attributes	Illustrative photos	Age categories
Immature bulls ■ Juvenile ■ Sub-adult	■ Small bulls physiologically dependent on their mothers (not weaned from their mothers) ■ Bulls that have been weaned but which are still in close association with the family unit (psychologically depend on 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. ■ Frontal head shape is narrow and square and similar to young females.		■ Juveniles would be between 1-3 years of age ■ Sub-adults would be aged between 5-<15 years.
Young adult **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 breeding herd which they accompany. These breeding herds may or may not be their natal herd. ■ Young adult bulls are also frequently found within bachelor groups or could be temporarily solitary. ■ Bulls may start to experience short, sporadic musth cycles from about 25 years of age.	■ 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 hour glass 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 ■ All bulls within this category are larger than mature females within the breeding herd.	 Note that the top triangle is broader than the bottom one.	■ Young adult are 15 - <25 years old ■ Adults are between 25- 35 years old

Prime/Senior adult	■ 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 from 35 to approximately 55 years of age.
Senescing/retired	■ Bulls will no longer experience musth 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	 Tusk sockets appear to become limp and elongated in retired bulls	■ Retired bulls can be anywhere between 55 and 65 years old

Detail on the senescing/retired bull category (Henley & Henley 2008)

Very few elephants live out there full lifespan and consequently reach a very old age because there is a steady attrition in numbers throughout life (Moss 1988, Spinage 1994).

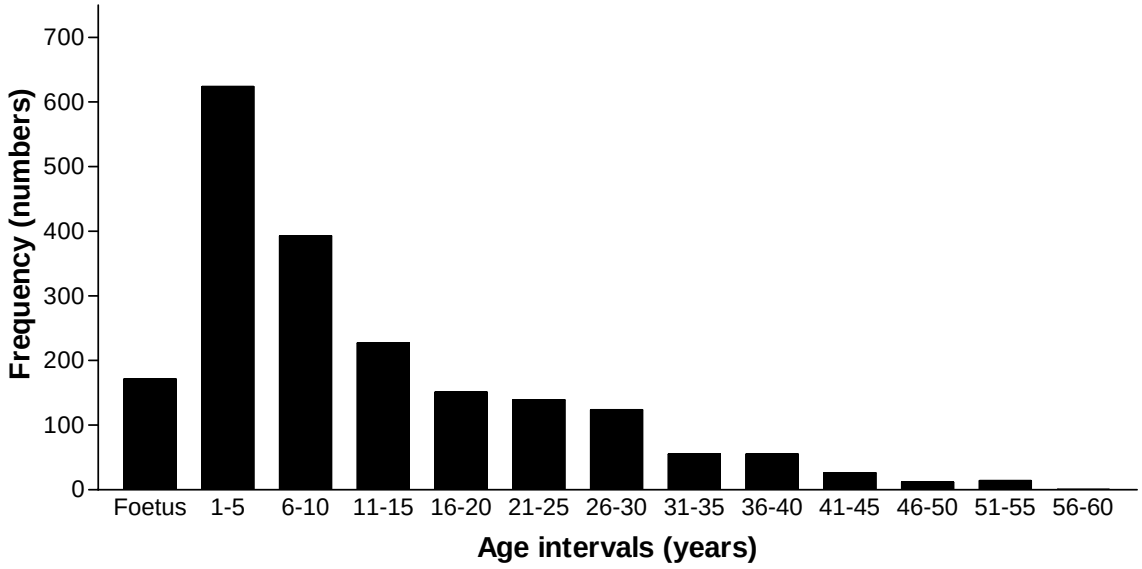


Figure 1. Frequency of bulls (including the number of male fetuses) in different age groups obtained from elephants that were culled or removed from 1974 until 1996 (data provided by I.J. Whyte). Ages were determined by examining the lower jaws according Laws (1966).

Bulls were culled in the Kruger National Park according to a random process, consequently the data obtained from culled bulls can be used to determine the age distribution of the male population (Figure 1). However, very large tusked individuals were avoided during culling operations (Whyte 2001). Relatively few animals were found in the older age classes (51-55 years of age) while no animals were recorded in the older than 55 years of age category. An elephant's tusks grow throughout their life and in bulls they grow at an accelerated rate towards the end of their life (Laws 1966). Very old bulls may be absent from the dataset simply because they had the largest tusks and were not included in the culling operations.

In bulls the rate of tusk growth increases progressively throughout life to at least 240lbs (109 kg) at 60±5 years (Laws 1966). This represents six times that of females or is equal to 1.5% of the potential body weight of a bull. For bulls the rate at which the tusks increase in weight accelerates as the pulp cavity of the tooth fills. The pulp cavity in bulls increases in

size to at least 30 years of age but only starts to fill in during old age (Spinage 1994).

Various methods have been proposed to estimate the age of elephants based on their shoulder heights (Laws 1966, Hanks 1972, Douglas-Hamilton 1972, Jachmann 1988, Lee & Moss 1995, Shrader *et al.* 2006) or footprint measurements (Western *et al.* 1983). The methods proposed have an important limitation, especially for males. By the age of 25 years, males have grown to approximately 80% of their asymptotic height (Laws 1966). Hence distinctions in sizes between different-aged animals can be made up to approximately 30 years and thereafter size differences become too fine and subject to individual variability to reliably relate age to shoulder height differences (Croze 1972). Within the Kruger National Park population the same limitation would apply as found elsewhere in Africa (Figure 3).

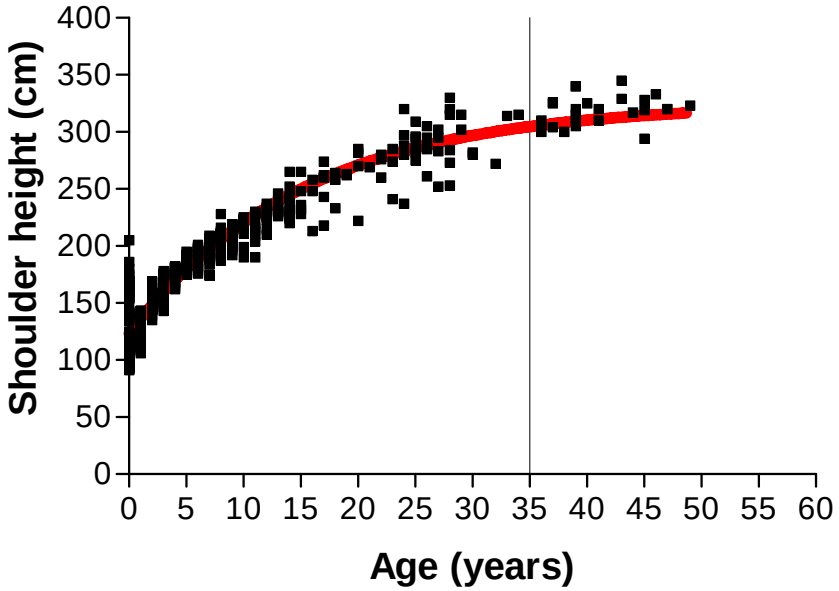


Figure 3. The relationship between shoulder height and age for elephants that were culled or removed from 1974 until 1996 (data provided by I.J. Whyte). Ages were determined by examining the lower jaws according Laws (1966).

Ages of elephants can however be estimated using a combination of characteristics based on size, physical development, eruption of tusks, the length and circumference of the tusks and body shape and proportions (Moss 1996). The following practical points are meant to assist in the visual estimation of **bulls in older age classes (> 30 years)**:

- The lip-line doubles between the time a male leaves the family unit until about 30 years of age (Hanks 1979)
- The shoulder height increases by approximately 100cm between the time bulls leave the family unit until 30 years of age (Hanks 1979)

- Bull with foot print lengths of over 50cm are more than 30 years old (Moss 1996)

The following practical points and photographs (Figure 5) are meant to assist in the visual estimation of **bulls older than 55 years**:

- Senescing bulls can be anywhere between 55 and 65 years and identifying them in the field will depend on whether their molars have worn down to such an extent that they can no longer maintain a good enough body condition to come into musth.
- Old elephants are usually in bad body condition and often die in the dry season because when the last molar (M6) is reduced to 7 x 10cm in area its surface is almost smooth and the elephant is unable to effectively masticate dry woody vegetation effectively (Spinage 1994).
- There is usually a rapid decrease in grinding area in both sexes after 50 years (Laws 1969).
- The amount of tooth ware will depend on many factors like diet or soil structure (granites versus basalts) and can thus differ from area to area. Variations in diet cause variations in tooth ware but individual variation could also be due to genetic variation both within and between populations (Hanks 1979, Lark 1984)
- In both sexes the forehead broadens with age resulting in a more depressed and sunken temporal region of the skull (Spinage 1994). Although the variation in the depressions in the cheeks or temples is often due to nutritional factors, very old elephants develop a gaunt appearance where facial hollows increase with age (Shoshani 1992).
- It is important to remember that prime bulls which are still breeding can look thin after they have just completed their musth cycle as this is an energetically demanding period which can last 3-4 months. Consequently musth in older bulls can lead to severe weight loss. It is therefore easy to confuse senescing bulls with prime breeders that have just dropped out of musth if you are basing your observations on body condition alone (Figure 4).
- Old males are bonier around the shoulders and head (Moss 1996).
- The tops of the ears of old bulls fold down more and appear to be positioned lower in relation to the head and shoulders than younger males (Moss 1996).

Figure 4. Classic in peak body condition at the beginning of musth and toward the end of his musth cycle. Note the difference in the temporal depressions, the visibility of the shoulder blades and his easily mistaken 'aged' appearance because of his poor body condition even though he is one of the APNR's prime breeders.

- By 25 years of age bulls are only 55% of their asymptotic weight of 6000kg (Laws 1966). The body of old bulls is overall heavy set and because the growth in length continues even after growth in the shoulder height may cease or greatly slow down, the body appears longer (Laws 1969). Nevertheless, the shoulder development dominates the back development causing a more pronounced 'hollow back' appearance.
- The neck appears very thick (Moss 1996).

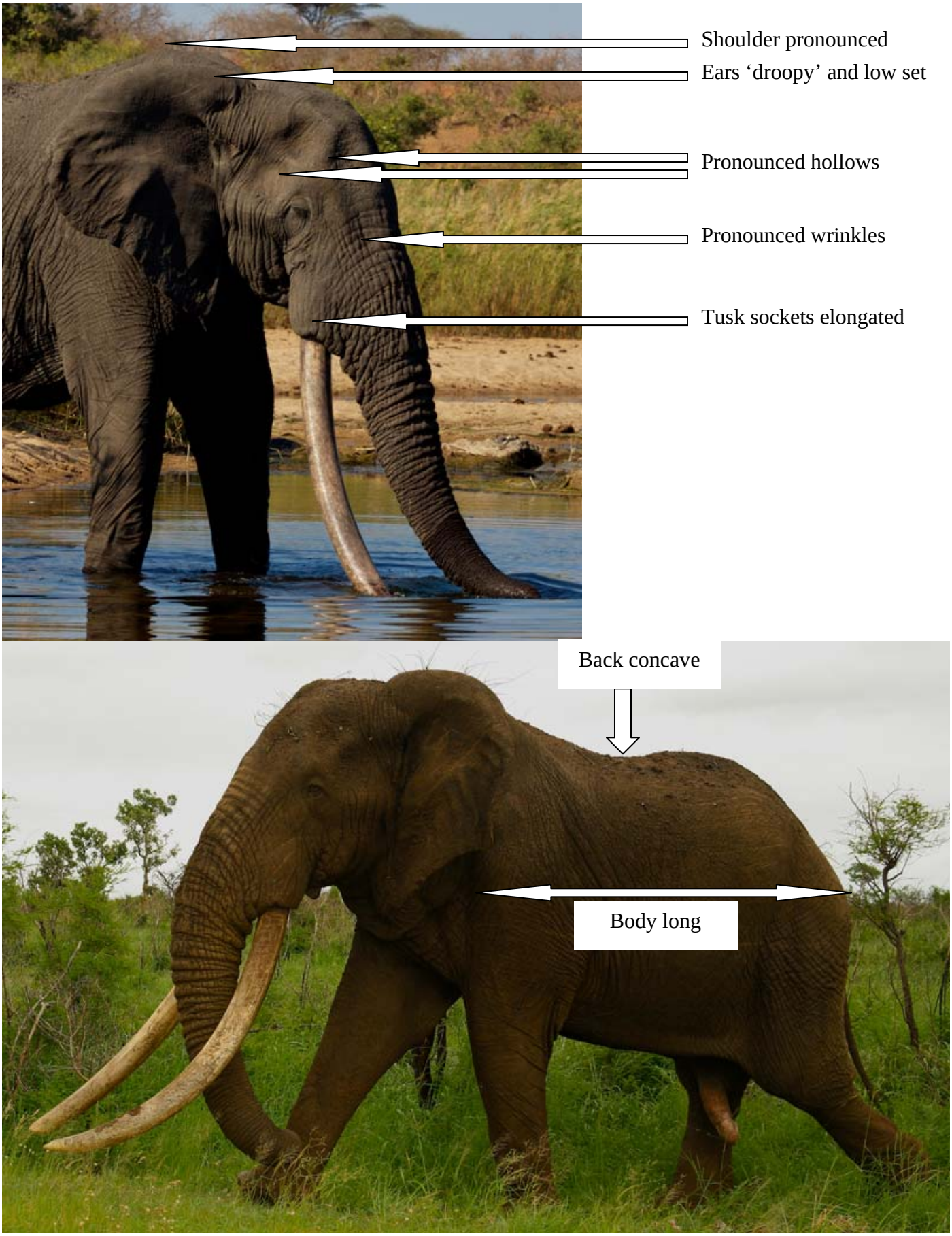


Figure 5. Characteristics of senescing bulls found within the Kruger National Park (courtesy of Dr. Johan Marais).

General, broad field classification (Stokke & Du Toit 2000)

Class	Criteria
Adult male	Huge hourglass-shaped face with temporal depressions and rounded forehead: overall huge body size
Sub-adult male	Size of mature cow or slightly smaller; lacking characteristics of adult male
Sub-adult female	Undeveloped mammary glands but clearly no longer visible
Juvenile	Male or female not yet sub-adult; noticeably dependent on mother; tusks absent or stubby
Male group	Group comprising adult males only; independent from family units
Family units	Group comprising a matriarch and other females with their sub-adult and juvenile offspring; sometimes attended by adult males

Aging criteria
Whitehouse (2001)

Age class	Class in years	Description
yearlings	0-12 months	Calf can walk underneath mother and other distinguishing characteristics especially coloration and co-ordination
juvenile	>1-3 years	At 1-3years calf still suckling and generally still youngest calf of mother. Tusk buds of males calves visible from approximately two and a half years of age.
subadult	4-10 years	Four year olds are usually weaned and often have a younger sibling. By 10 years elephants have reached about ¾ the size of the adult female but are still sexually immature
Young adult	11-19 years	From 11 years female's breasts may start developing with the pregnancy of their first calf. Males are spending more time on the periphery of their family eventually becoming fully independent. About 17 year old males reach the same height as the largest female in the herd.
Adult	>20 years	Fully mature adult elephants. Females generally more than one calf. Males begin to come into musth from about 25 years of age.

Widely used age classes recommended for long-term studies
(Moss 1996)

Class	Age (years)
0A	0-4.9
0B	5-9.9
1A	10-14.9
!B	15-19.9
2	20-24.9
3	25-34.9
4	35-49.9
5	50+

Guide to aging (Moss 1996)

From Kangwana (1996)

BOX 7.2: GUIDE TO AGEING

ZERO TO 10 YEARS OLD (MALES AND FEMALES)

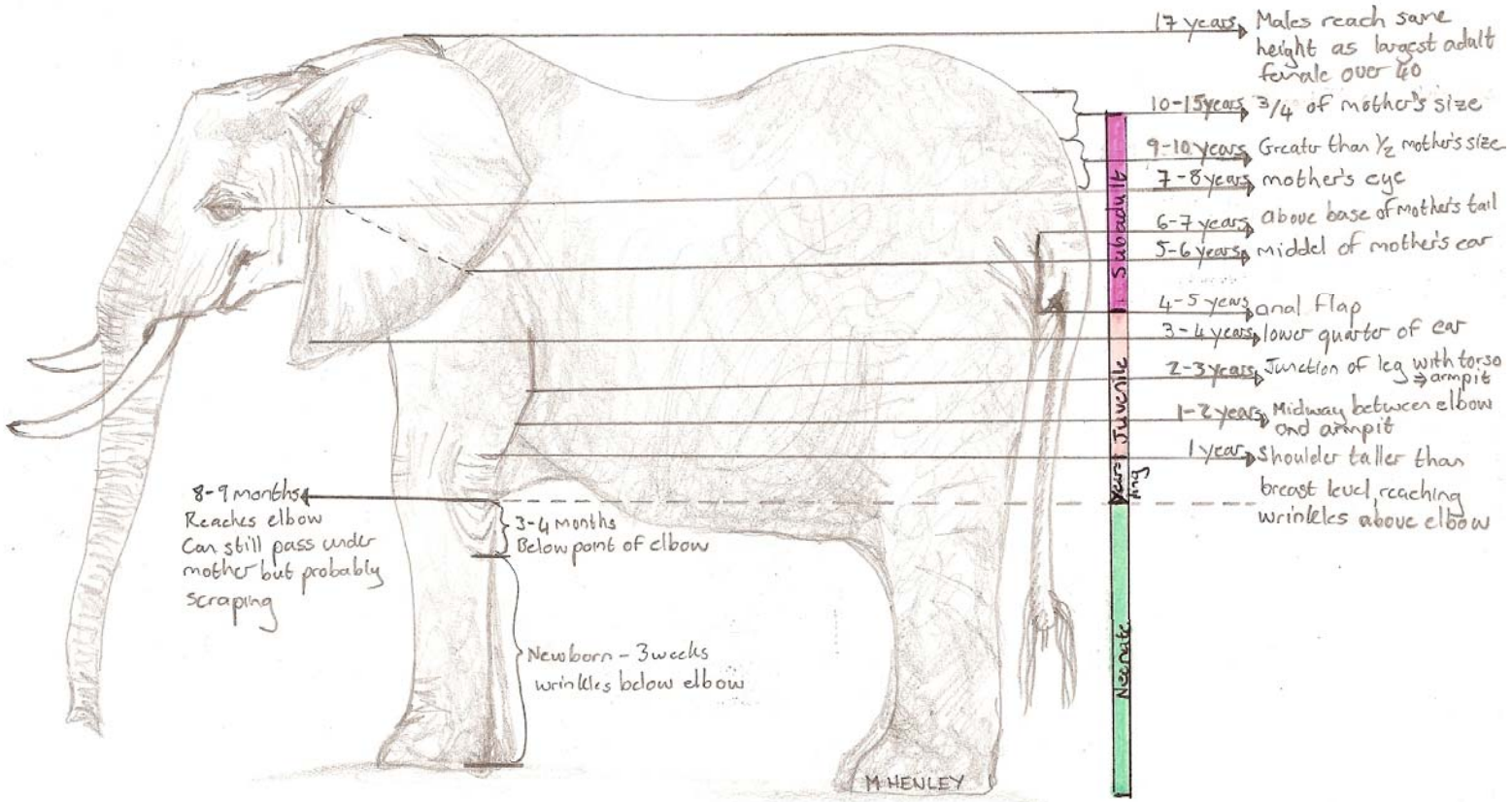
The calf sizes given below are relative to an adult female between 25 and 45 years old with a should height of about 250cm. Allowances have to be made for claves with younger or older mothers.

AGE	SHOULDER HEIGHT	DEVELOPMENT
Newborn	Top of shoulder reaches lower Wrinkles below mother'selbow'; can easily walk beneath her back.	Thin, stiff-legged; sometimes part of umbilical cord attached; whites of eyes often red; backs of ears bright pink; often hairy on head and
2-3 weeks	Same as above.	Walking well' more filled out in body' backs of ears no longer pink; trunk is short and slender but exploring, picking up sticks.
3-4 months	Reaches to below point of mother's elbow.	More rounded, fatter, begins trying to feed on grass; spends time away from mother, plays with other calves.
8-9 months	Reaches elbow; can still pass under mother but probably scraping.	Feeding adeptly and continuously for long stretches; capable of drinking with trunk.
1 year	Shoulder taller than breast level of mother, reaching to wrinkles above elbow.	Head and ears look in proportion to each other and body.
1-2 years	Top of shoulder midway between elbow and junction of leg withtorso, the "armpit".	Trunk looks more in proportion; tusks of male calves may show beyond the lip from 18 months on (depending on region of(Africa).
2-3 years	Reaches mother's armpit.	Tusks of most male calves and many female calves will show; mother may show signs of trying to wean calf.
3-4 years	Top of shoulder above mother's armpit; backalmost level with anal flap and reacheslower quarter of mother's ear.	Almost all calves will show at least 5-7 cm of tusks; most calves still suckling, but some may be weaned.
4-5 years	Reaches mother's anal flap or above.	Tusks are 15-18cm long; has probably Stopped suckling and may have a younger sibling.
5-6 years	Appears to be about one-quarter the size of an adult female' back almost level with middle of mother's ear.	Tusks area bout 20-23cm long; has probably male and female behaviour become more pronounced: female calves allomother younger calves; male calves seek out other males for sparring.
6-7 years	Shoulder and back height above base of mother's tail and above middle of ear.	Tusks begin to splay out in both males and females; sexual differences discernable: males have thicker tusks and heavier bodies.
7-8 years	Back level with adult female's eye and well above base of tail.	Tusks are usually splayed by now; no longer Look calf-like, but more like a small adult.
8-9 years	Overall size in height and length over half an adult female.	Tusks are about 25-30cm.
9-10 years	Overall size almost three quarters of an adult female.	Males are larger than females of same age And spend more time on periphery of family; females are more integrated in family.

From Kangwana (1996)

10 AND ABOVE – SUGGESTED AGE CLASSES FOR FEMALES.	
10-15 years	Thin tusks, probably still splayed rather than convergent; more square in body shape than older females who are rectangular.
15-20 years	Tusks begin to take on their adult configuration, that is convergent, straight, or asymmetrical with one higher than the other.
20-35 years	Circumference of tusks at base distinctly bigger than teenaged females.
35-50 years	Tusks marginally thicker; back has lengthened so that animal appears long in body.
Over 50 years	Hollow above the eyes, ears held lower, longer back length, sometimes long tusks.
10 AND ABOVE – SUGGESTED AGE CLASSES FOR MALES	
10-15 years	Male head shape (sloping rather than angular) more noticeable; tusk circumference and should height greater than females of same age.
15-20 years	At about 17 years old males reach same height as largest adult females over 40.
20-25 years	Taller than all adult females; but most still slender and narrow in the head compared to older males.
25-40 years	At about 25 years old male head shape has changed to an hour glass shape, that is wide at eyes and wide at base of tusks; the head gets broader as it moves through this age class; shoulder height increases steadily.
Over 40 years	Very big, tower over largest females by three feet or more at shoulder; neck thick; overall body heavy set; tusk circumference at lip strikingly greater than younger males and all females.

Illustration and guide to aging animals within a family unit (Henley 2006)



- All measurements refer to where the younger animal's shoulder or back level reaches
- all measurements for 3 weeks until 10 years are applicable to both males and female

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