Supplement Appendix 1: Field Guide for Aging Tigers

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Herein we describe a field technique developed and used by us for this study to age tigers into six age groups (stages: cubs <12 months, juveniles 1-2 years, sub-adults >2-3 years, young-adults >3-5 years, prime-adults >5-10 years, old-adults >10 years). Field ageing of carnivores has been done using body characteristics and measurements (Schaller 1972, Smuts et al. 1978, Ashman et al. 1983, Goodrich et al. 2010, Banerjee & Jhala 2012), tooth eruption, wear and colouration (Ashman et al. 1983, Smuts et al. 1978, Stander 1997, Van Horn et al. 2003, Goodrich et al. 2010, Banerjee & Jhala 2012), gum line recession (Laundre et al. 2000, Fabregas and Garces-Narro 2014) and nose pigmentation (Whitman et al. 2004).

In the absence of any comprehensive published method for ageing tigers from field observations, we developed ageing criteria based on observations of known-aged tigers in the wild, and close inspection of >20 tigers captured for research purpose whose age was known to the closest three months. We use body size, body characteristics, teeth eruption, wear and colouration, nose pigmentation and gum-line recession to age tigers in the field.

Tigers often "yawn" when in proximity to people, probably showing their teeth in a non-confrontational manner, as a means to intimidate. This helps to closely observe teeth condition and gum-line recession (if any), with binoculars or telelens photographs (Fig.1). Teeth eruption, wear and colouration as well as gum line recession (Fabregas and Garces-Narro 2014) are highly correlated with age of the tiger.

1. Cubs (<12 months):

Cubs were usually observed after they were about two months old. At 2-3 months they are the size of a large domestic cat (S1a). Before this time, they rarely accompany their mother and are restricted to their birth site. In small cubs, the colour of the iris is blue-grey and begins to turn amber by 3-4-month age. Cubs are born toothless and develop their milk dentition by one to one and half month age. They start to eat some meat by two-month age but largely depend on their mother’s milk, which changes to more meat diet by 4-5 months. By 5-6 month cubs become as large as a jackal and reach the belly of their mothers (S1b, S1c), at this stage, they accompany the mother to nearby kills to feed and are usually weaned. The scrotum of the male cub is visible from early on, and there is a distinct size difference between male and female cubs by the age of 6-8 months (S1d).

2. Juveniles (1 to 2 years):

Juvenile tigers accompany their mothers to larger kills and are usually not photographed alone, making size comparison easy (S2a, S2b). Tigers at this stage are roughly half the size of their mothers (about the size of a leopard, 50-120 Kg). Male tigers show faster growth than females and are seen to be substantially larger. Face proportions are cub like, with a shorter snout and smaller face and has developed or partly developed permanent dentition (which begins at the age of about 9-10 months and is completed by 12-14 months, Mazak 1981) (S2c, S2d).
3. Sub-adults (>2 to 3 years):

At the sub-adult stage, the males are substantially larger than the females. Often sub-adult tigers move around with their siblings, but by 30 months they become more solitary. The body is almost as large as adults and can no longer be used for size comparisons as most of the camera trap images are of solitary tigers. In exceptional cases, sub-adult males can weigh as much as 200 Kg and females as much as 120 Kg by 30 months (YV Jhala,
unpublished data). However, most sub-adult males are usually between 130-170 Kg and females 80-100 Kg.

The body proportions begin to fill up like adult tigers after 20-22 months (S3a, S3b), the face is close to that of the adult, losing its juvenile proportions as the snout elongates. Close inspection with binoculars by an experienced observer can still distinguish facial features of sub-adults from that of adults. The belly of sub-adults is flat and taut (S3a, S3b) compared to a more rounding of the belly in adults. Skin flap on the belly is missing in sub-adults. The definitive feature to identify sub-adult tigers from adult tigers is their teeth observed with binoculars or photographed with a telelens.

In sub-adults the permanent dentition is fully formed, the canines are milk white often with a pinkish tinge, tips are pointed without any wear, and there are no signs to show a receding gum line. A prominent ridgeline on the inner side of the canines and a groove on the outer edge of the canines is clearly visible (S3c, S3d). The nose is usually pink with no black specks or pigment (S3c, S3d). Facial hair in the form of a short mane below the lower jaw/ cheek is usually seen even in camera trapped photos of males.

4. Young-adults (>3 to 5 years):

By three years most tigers are close to full adult size (S4a, S4b), but continue to accumulate weight up to 4-4.5 years of age (Sankhala 1978). Adult males range from 200 to 260 kg, while adult females range from 110 to 180 kg showing a pronounced sexual dimorphism in size (YV Jhala, unpublished data). By this stage, the face is no longer cub like with full snout and adult skull proportions. Belly gets rounded, often with a slight sag which increases with age (S4a, S4b). Often a skin fold on the belly begins to show.

Teeth start to turn cream colour to yellowish by three to four years and are no longer milky white. By five years of age, the yellow canines begin to get brownish stains. The canine ridge and groves are visible, with little or no wear on teeth (S4c, S4d). The nose is usually pink, but sometimes a few black specks or pigmentation are seen.

Pregnant and lactating tigress: A heavily pregnant tigress (S4e) can be distinguished from a fully fed tigress by the visibility of prominent teats and udders. After birth, the belly is normal with full udders where nipples show signs of intense suckling (S4f). For un-bred females and early days following first births the nipples are pink in colour (S4g) and become pigmented, darkened grey and keratinised after cubs suckle intensely. Nipples subsequently retain this grey coloration throughout life.

5. Prime-adults (>5 to 10 years):

The belly is sagging and rounded, often belly fold is visible (S5a, S5b). Teeth are brownish-yellow and begin to show wear which is visible on canines (no sharp points but rounded) and incisors with a binocular or through telephoto photographs (S5c). The canine ridge is almost indiscernible, and the groove is highly worn out (S5c). Careful inspection shows a receding gum line on canines, making the canines appear larger (S5d). Black spots on nose and slightly sagging lips on the lower jaw are often seen.
6. Old-adults (>10 years):

Belly and belly skin fold are sagging; nose shows pigmentation (S6a). Canines and incisors are worn down, often broken or missing and with dark brown stains (S6b, S6c), Jaw and lips are often sagging the lips show a fold. Close observation with binoculars/telephoto-photographs show receded gum-line on worn canines (if any).

Body condition of tigers is usually not a good parameter to use for ageing. Often very old tigers that have lost their canines can be in poor condition (S7a) but can regain condition with just a couple of good meals (S7b).

We believe that by using the criteria described above an experienced researcher can age an adult tiger to its stage accurately with an error margin of about a year, and younger tigers (sub-adults and juvenile) to about 3-4 months. Cubs can be aged with the accuracy of about a month by field observations.

References:

1. Cubs (<12 months):

S1a: Very young (less than 3 months) old cubs with their mother.

S1b: Young cub (4-5 months) accompanying its mother.

S1c: A 6-7-month old cub showing round face and amber colour of the iris.

S1d: Three 9-10 months old cubs with their mother.
2. Juveniles (1 to 2 years):

S2a: Juvenile tigers of 15-17 months are about half the size of their mother.

S2b: Juveniles tigers (of 20-22 months) approaching the sub-adult stage.

S2c: A juvenile tiger (10-11 month old) showing eruption of its permanent canines.

S2d: A juvenile tiger (20-22 months old) showing almost sub-adult size canines.
4. Sub-adults (>2 to 3 years):

S3: Sub-adult tiger showing flat belly, no belly fold and an almost adult body size, a) female and b) male. Often scrotum is seen even in camera trap photos to permit sexing.

S3c: Sub-adult tiger with fully formed permanent dentition. The teeth are milk white often with a pinkish tinge. Nose is clean pink with no black specks.

S3d: A sub-adult tiger ‘yawning’ to show its canines. The pointed tips of canines show no ware and no gum-line recession is seen.
4. Young-adults (>3 to 5 years):

S4: Young adult tigers, a) female and b) male. Note the rounding of the belly, facial features are no longer cub-like. Belly fold begins to appear.

S4c: A young-adult tiger showing yellowing of teeth and slightly receded gum-line, but little to no ware.

S4d: A young-adult tiger ‘yawning’, ridge and groves are clearly visible.
4. Pregnant and lactating tigress:

**S4e**: A heavily pregnant female before parturition.

**S4f**: A female after giving birth, nipples showing signs of intense suckling (grey to black keratinised nipples).

**S4g**: First time a mother has pink nipples (in the picture) which turn grey and keratinised with intense suckling and retain this colouration subsequently.
5. Prime-adults (>5 to 10 years):

S5: Prime-adult tigers a) female and b) male. Belly become rounded and belly fold visible.

S5c: A prime-adult tiger showing its canines. The ridge and groves are visible but show signs of rounding off. Yellow teeth are often seen with a dark stain.

S5d: A prime-adult tiger ‘yawning’, showing receding gum-line and intact canines. The canines look longer due to receded gum-line. The tips of the canines are often rounded and can be distinguished from the sharp points of sub-adult and young-adult tigers. Often nose has some black specks.
6 & 7. Old-adults (>10 years):

S6a: An old-adult showing saggy body condition with heavily worn teeth.
S6b: An old-adult with canines and incisors worn down, broken and missing. Nose with several dark black specks.

S7: An old tigress- (a) emaciated body condition and (b) regained its body condition subsequently.
S8: A prime-adult tigress (a) that lost its canines at the age of 7 years due to an accident (killing crocodiles), the same tigress at the age of 18 years (b) lost all its canines and incisors. The nose at her prime age (a) showing no pigmentation (black speckles) while in old age (b) black speckles are prominent.