

Field Key for Elephant Population Estimation and Age and Sex Classification





Resource material for synchronized elephant population estimation using block count, line transect dung count method and waterhole count



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Photo credits: Front cover (clockwise), 1, page number 5; adult male elephant with 15 to 20 year old male and page 6: Dr. TNC Vidya; Front cover (clockwise) 2, pages 4 (adult male 25 to 30 years), 5 and 7: Dr. R. Sukumar; Pages 8 and 9: Mr. M. S. Nishant; Page 12 and back cover Dr. C. Arivazhagan and all other photos: Mr. Surendra Varma

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Elephant Population Count

Elephant numbers are estimated through a synchronized elephant population estimation using block count, line transect dung count method and waterhole count. This field key is an attempt to describe the methods and guidelines to be followed during the census operation.

Information to be collected

The enumeration exercise will primarily focus on collecting the following information

- **1.** Estimating the elephant population during the particular season (with statistical confidence limits).
- 2. No. of elephants in broad Age Groups (Adult, Sub-adult, Juvenile & Calf).
- **3.** The ratio to males to females (Bulls and Cows) in respect of Adult and Sub-adult categories only.
- **4.** No. of tuskers in respect of Adult and Sub-adult categories only.

Stratification of the enumeration zone should be attempted in all the methods based on habitat types or elephant densities viz., High density/high usage, Medium density/medium usage, Low density/low usage and No usage-elephant free

The area under the last category should be excluded from the 'effective elephant habitat' while extrapolating sample data and computing elephant densities.)

Block sampling with direct count

- Elephants are to be counted from sample blocks selected randomly across the entire division.
- For each division, approximately 50% of the beats to be randomly chosen and to be demarcated as census blocks.
- If the beat has large area, sub-block of about 500 ha. (5 sq.km) may be formed for the purpose of the count.

- Preferably 30 or more blocks to be sampled in each forest division; for smaller divisions the aim is to sample at least 20 blocks.
- The sample block area has to be marked on a map and the area of each block should be recorded correctly.
- The sample blocks are to be systematically surveyed (perambulated) by a team of two to three people and all the elephant sightings are to be recorded in the block count data sheet.
- Area of each sample block should be recorded correctly
- Where possible, the age and sex of all animals seen are to be recorded.
- Age and sex classification can be carried out using a key described in the water hole count method section below.
- As far as possible photograph elephant groups and try to photograph maximum individual in a group

Line transect dung count method

- Dung decay rate experiment should have begun about 4 months earlier.
- In all divisions, line transects are to be laid in all blocks where the block count was undertaken.
- In each sample block, a 2 km length of transect to be laid covering different altitudinal gradients and the transects are surveyed once to enumerate dung piles.
- On sighting dung piles from the transect, information such perpendicular distance to be recorded to the nearest 1 cm.
- Elephant densities to be arrived based on elephant dung density, daily elephant defecation rate and daily elephant dung decay rate. Elephant dung density for each division can be obtained using line transect dung count and the results of defecation rate (16.33) and decay rate (0.0097) from earlier studies could be used for estimating elephant densities.

Water hole count

- Water hole count is not for estimating population density or size but for recording population structure
- Approximately 30 -50% of perennial waterholes within each division can be selected.

- Elephant visit to the waterhole could be observed between 0700 to 1800 hours by a team positioned on a *Machaan* or watch tower where available.
- During this period all elephants visiting the waterholes are to be aged and sexed.

Based on their shoulder heights; elephants can be classified into following four major age classes;

	She	Male oulder height] Sh	Female oulder height
Age-classes	Feet	cm	Feet	cm
Calf (<1 year)	up to 4	up to 120	up to 4	up to 120
Juvenile (1 to 5 years)	4 to 6	120 to 180	4 to 6	120 to 180
Sub-adult (5 to 15 years)	6 to 8	180 to 240	6 to 7	180 to 210
Adult (15 years and above)	above 8	above 240	above 7	above 210

Further, it is clarified that –

- 1. Bulls include Tuskers and *Maknas* (Tuskless Bulls)
- 2. Tuskers also include elephants with single tusk (*Ganesh*)
- **3.** Any elephant (adult or sub-adult) which cannot be accurately identified as Bull or Cow will be categorized as **Unsexed**.

Elephants to be sexed based on presence or absence of tusks in the case of adults, sub-adults and juveniles.

Tuskless adult elephant seen alone expected to be a makhna

Care to be taken to differentiate *Makhnas* from females using body characteristics and shape of genitalia.

From the age and sex classification data the sex ratio can be calculated for adults in each division

Age and Sex Classification Females





Males













Identification of different age and sex class in the wild



А

С

Males

В

A: Adult male elephant (Note the depigmentation and folding of the ear, thickness of the tusks and the swelling of the temporal gland as the elephant is in 'musth'. All of which may characteristics of an adult male elephant).
B: Sub adult male elephant (Note the slight folds and the depigmentation of the ears and size of the tusks).
C: Juvenile male elephant (Note the back folding, complete absence of depigmentation of the ear, size of the tusk and the forehead of the animal in question being in line with the middle of the adult's belly).



Females

D: Adult female elephant (Note the folding of the ear, depression of the temporal region and the buccalcavity). **E:** Sub adult female elephant with a calf (Note the slight folds and depigmentation of the ear and the peak of the calf being just above the belly of the sub adult. The peak of a calf would be under the belly for an adult elephant).

F: Juvenile female elephant (Note the back fold and absence of depigmentation of the ear. Also the peak of the animal in question is in line with the middle of the adult female's belly).







	Hei	ight				
1 00	(ci	m)	Weigł	nt (kg)	Tusks i	in males
Age (years)	Μ	\mathbf{F}	Μ	F	CTLL (cm)	Weight (kg)
0	90	89	120	120	-	-
1	121	119	330	310	-	-
2	139	135	520	470	-	-
3	155	149	705	610	7.6	0.1
4	169	161	920	710	9.8	0.2
5	180	170	1130	810	11.9	0.4
6	190	177	1340	930	13.8	0.7
7	198	183	1540	1055	15.7	1.1
8	205	188	1730	1180	17.4	1.5
9	212	193	1900	1300	19.0	2.1
10	217	197	2065	1415	20.5	2.6
11	222	200	2200	1525	21.9	3.2
12	225	203	2320	1635	23.3	3.9
13	228	206	2400	1735	24.5	4.6
14	231	209	2500	1830	25.7	5.3
15	235	213	2645	1925	26.8	6.1
20	250	228	2970	2300	31.3	10.0
25	262	234	3400	2560	34.6	13.6
30	268	238	3650	2740	37.0	16.8
40	272	240	3800	2930	40.0	21.4
∞	274	240	3900	3000	43.4	27.4

Age and growth parameters in Asian elephants

M: Male, F: Female

CTLL: Circumference of Tusk lip length

The height is twice the circumference of the front foot (CFF) for all ages.

Weights in juvenile animals are based on small sample size

Look for opportunity to photograph elephants (as examples figures given below) to verify the age-sexing latter with experts



Elephants photographed for age and sex classification

Identifying different individuals based on distinct features (note a hole on the left ear of a female elephant)

ELEPHANT CENSUS BLOCK COUNT DATA SHEET

Date	:		General vegetation type :
Forest Division	:		Weather (Sunny/Cloudy/Rainy):
Reserve forest Name			Forest Range
Beat Name	:		Starting Time :
Location of Block	:		Ending time :
Area of Block	:	km ²	Observer's Name :

S. No.	Sighting Time	Number of individuals		Elephant classification										
			AF	SAF	JF	AM	SAM	JM	Calf	UI				
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														

AF – Adult Female > 7 ft, SAF – Sub-Adult Female > 5-7 ft, JF - Juvenile Female – 4-5 ft

AM – Adult Male > 8 ft, SAM – Sub-Adult Male > 5-8 ft, JM – Juvenile Male 4-5 ft

Calf - 3-4 ft, UI = Unidentified Individual

* Adult makhna should be recorded in remarks



Bandipur National Park (Karnataka) with different beats (note these unequal sized beats could be considered as blocks and randomly selected blocks (beats) are to be used for sampling)

SPECIFIC GUIDELINES FOR BLOCK COUNT

- For counting elephant numbers cover the maximum area of each block selected for the count
- Avoid spending too much time in sex and age classification of elephants or photography of elephants while counting them by block count; this will reduce the area covered for counting within the time specified.
- ➢ Use a uniform number of enumerators across the blocks and divisions
- If volunteers (non forest staff) are involved in the elephant population count, only one volunteer per block or beat must to be allowed; if there is a difference in the number of volunteers used across the blocks and divisions, a uniform effort in detecting elephants will not be achieved (more volunteers may result in counting more elephants; however they can also become a source of disturbance in detecting and counting elephants)

LINE TRANSECT DUNG COUNT DATA SHEET FOR ELEPHANT POPULATION ESTIMATION DATA SHEET

Date:

Reserve Forest Name: Forest Range: Transect length (Km): Starting Point GPS reading: Vegetation type: Forest Division: Beat Name: Location (Beat/Com.): End point GPS reading:

	Perpendicular distance of	
C Ma	dung pile from transect (in	Remarks
5 . NO.	m up to 1 decimal)	
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		

Tally mark at every 50 m of rope lengths

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

Diagrammatic representation of a line transect dung count method



SPECIFIC GUIDELINES FOR LINE TRANSECT INDIRECT COUNT

- ➤ The line transect should be ideally of 2 km in length
- Lay transect across altitudinal gradient
- Transects should represent all strata [habitat types or areas of low, medium and high use by elephants] of a given division
- Number of transect for each stratum should in proportion to the strata
- A minimum of 60 sample size (of dung piles) need to be obtained for each division but for better accuracy obtain as higher sample size as possible
- ▶ Use 50 meter nylon rope for measuring the transect length exactly
- Only one observer should walk along the line transect [rope]
- Only dung pile/s seen by the observer should be recorded
- Use measuring tape to measure the perpendicular distance to the nearest cm should not be rounded to the nearest meter
- Perpendicular distance to each dung pile from the line to middle of the dung should be recorded
- Perpendicular distances should be recorded exactly
- > Do not approximately measure transect length
- Do not have more than one observer for sighting the dung piles
- Observer should not go away from the line in search of dung piles
- Dung pile/s seen by people other than the observer should not be recorded
- > Do not measure perpendicular approximately without measuring tape
- Do not round-off the perpendicular distance records

Examples of types (stages) of dung piles expected to be encountered, which are to be enumerated



Examples of types (stages) of dung piles expected to be encountered, which are not to be enumerated



ELEPHANT WATERHOLE COUNT DATA SHEET

Date	•	General vegetation type	:
Forest Division/WLS/NP/TR	:	Weather (Sunny/Cloudy/Rainy)	:
Forest Range	:	Location (Beat/Com.)	:
Waterhole	:	Starting Time	:
GPS Reading	:	Ending Time	:

S.No	Arrival Time	Number of individuals			Departure Time	Remarks*						
· 1			AF	SAF	JF	AM	SAM	JM	Calf	UI		
2												
3												
4												
5												
6												
7												
8												
9												
10												

AF – Adult Female > 7 ft, SAF – Sub-Adult Female > 5-7 ft, JF - Juvenile Female – 4-5 ft AM – Adult Male > 8 ft, SAM – Sub-Adult Male > 5-8 ft, JM – Juvenile Male 4-5 ft Calf – 3-4 ft, UI = Unidentified Individual *adult makhna should be recorded in remarks

Observer's Name:

SPECIFIC GUIDELINES FOR WATERHOLE COUNT

- Identify waterholes in advance with maximum use by elephants
- Selection of waterholes need not necessarily be from the same block where block and dung count were carried out; they can be selected from anywhere within the division
- Give importance to taking photographs of individuals and groups for classification
- Collect the photographs from the volunteer before he/she leaves the division
- Catalog the photographs systematically (in terms of date; location and other details)

Examples of elephants visiting waterholes



Suggested readings

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