

**A POPULATION CENSUS OF CHITAL OR SPOTTED DEER
AXIS AXIS, AND SOME OTHER WILD ANIMALS IN DEHRA
 DUN FOREST DIVISION, UTTAR PRADESH, INDIA**

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(With 4 Tables, 1 Text-figure and 2 Plates)

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I—INTRODUCTION

1. *General*

In view of the rapidly vanishing wild life of India, the Central Advisory Board of Biology recommended sometime ago the undertaking of a census of certain important species of the Indian wild fauna. The Board further recommended that, in the first instance, the census of the Spotted Deer (Chital), *Axis axis* Erxleben may be undertaken in the Dehra Dun Forest Division.

The present census was taken in March, 1962, jointly by the Zoological Survey of India and the Wild Life Preservation Organisation (Forest Department) of Uttar Pradesh. The local expenditure for such operations as the organising of beats, and the enumeration of animals, etc. was met with by the latter department.

2. Acknowledgements

We are indebted to Dr. M. L. Roonwal, Director, Zoological Survey of India, for his encouragement and valuable criticism and also for personally supervising a few "drives" in the Dehra Dun Forest Division. We are obliged to Shri R.C. Soni, Chief Conservator of Forests, Uttar Pradesh for the facilities provided for this work. For his helpful suggestions and the keen interest, we are grateful to Shri N. D. Backheti, then Divisional Forest Officer, Dehra Dun. Thanks are due to Shri A. S. Bist, Wild Life Warden, U. P., for his assistance in organising the field work. To Shri T. D. Soota, Officer-in-Charge of the Northern Regional Station of the Zoological Survey of India, Dehra Dun, and to Sarvashri Mamman Koshy, M. L. De and S. L. Verma of the same department and Amar Singh, Assistant Wild Life Warden, U. P., we are thankful for varied help in connection with this work. We also thank Shri S. Guha-Roy, Senior Statistical Assistant, Zoological Survey of India, for the statistical analysis of the data.

3. Previous work

The only existing records of the census of Indian wild animals are that of the lion in the Gir Forest, Saurashtra, and the rhinoceros in the Kaziranga Sanctuary, Assam. No census ever appears to have been undertaken of a fairly abundant animal like the chital. Periodic estimations over a period of years is essential for understanding the trend of growth of population.

4. Expenditure

The expenditure incurred in connection with the census, excluding the travelling expenditure of the staff, is given below :

	Rs. p.
1. Cost of cartridges, stationery, etc.	212-65
2. Labour hire charges for beaters, etc.	4,469-00
3. Petrol and lubrication for motor vehicles	175-82
4. Cutting and clearing of 10-foot lines	1,888-61
5. Charges of motor truck hired for transport of labour to site	581-24
Total	7,327-32

II—METHODS

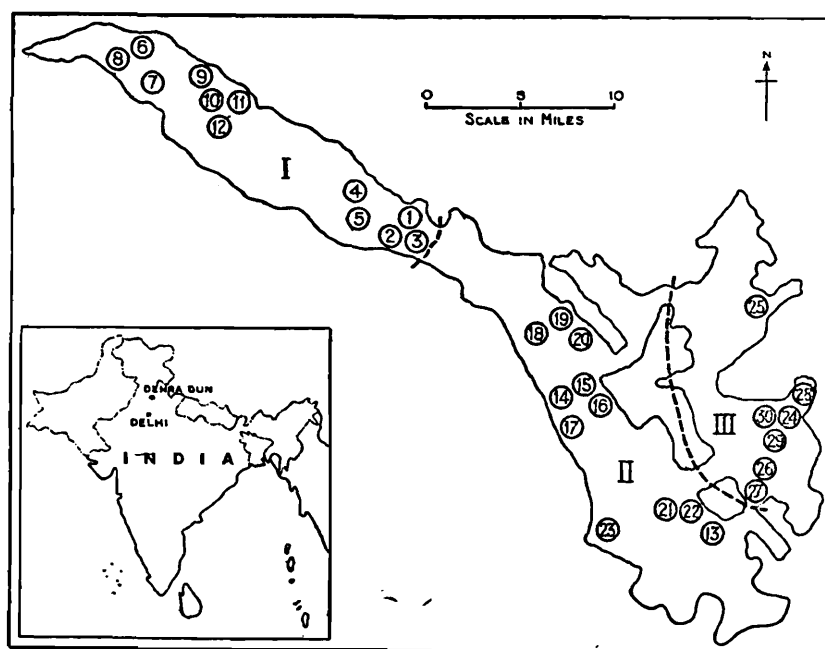
1. General

There are three usual methods of taking an animal census : (i) By direct enumeration of the whole population or samples therefrom. (ii) By ratios based on trapping, banding and recapture of samples. (iii) By indirect observations of population density by the use of suitable indices.

From what we know about the habits of chital, the direct count is by far the best technique and the only practicable one (*vide* Dharmakumarsinhji, 1959, 1960). As the area involved in the present work was very large, only representative sample areas could be censused and the total population was calculated from these samples. Direct enumeration of the total number of heads in the entire Division is impracticable in execution and prohibitive in cost.

2. Procedure and design

The census was confined to the reserved forest areas of the Dehra Dun Forest Division, Uttar Pradesh. The Division is divided into a



TEXT-FIG. 1.—Map of the Dehra Dun Forest Division (Uttar Pradesh, India), showing the three strata (I, II & III) and the Sample Compartments (1—30). (See Appendix for details.)

number of unequal Forest Blocks which are subdivided into Forest Compartments. In view of the diversity of the geographical and vegetational features, the Division was arbitrarily divided into three Strata* for accuracy in sampling, *viz*, Stratum I (Western Siwaliks, *i.e.*, west of Dehra Dun-Saharanpur main road); II (Eastern Siwaliks, *i.e.*, east of Dehra Dun-Saharanpur main road and bounded in the north-east by the Song river); and III (Thano-Barkot forests, *i.e.*, the plains blocks of Thano forest Range and the entire Barkot forest Range, except the Thapoban and Birbhaddar blocks). The sampling design was a stratified two-stage sampling of Blocks and Compartments. Twelve first-stage units of Blocks were selected by simple random sampling without replacement with due consideration of the proportion of the number of units in the strata. Thirty second-stage units of Compartments were selected based on the same method, but later on three Compartments were combined to yield a total of twenty seven sampling units. These sample Compartments constituted an area of 12,144 acres. The proportion of the sample area to the total area is 7.7 per cent. The sample Compartments were found to vary from 166 to 872 acres in extent. The stratum-wise distribution of the sample Compartments with other

*Stratum I consisted of 13 Blocks; and stratum II and III of 14 Blocks each.

details are given in the Appendix. Some forest Blocks, known by long experience to be more or less devoid of game, were excluded. These were :

- | | |
|---------------|------------------|
| 1. Dumet | 10. Sansarukhala |
| 2. Langha | 11. Maidan |
| 3. Chandpur | 12. Suridhar |
| 4. Bainkhala | 13. Birbhaddar |
| 5. Jajra | 14. Tapoban |
| 6. Paled | 15. Saura |
| 7. Talai | 16. Kachar |
| 8. Patharkahn | 17. Rampur Mandi |
| 9. Ladwajoj | |

3. Enumeration

The number of chital and other animals in the individual sample Compartments was determined by conducting "drive counts" which were organised in the following manner :—

The required number of "beaters" were posted in one of the four boundaries of the Compartment roughly at 30-40 feet intervals. On the two side-boundaries, "stops" were posted also at regular intervals. Enumerators were stationed on the fourth boundary which was chosen to fall, as far as possible, either on a motorable road or on the 100 feet line. Beaters and stops were usually unskilled labourers recruited for the purpose from local villages but enumerators were trained departmental personnel. All the three categories of persons, *viz.*, beaters, stops and enumerators, were given preliminary training in experimental beat operations. Beaters and stops were posted along the two side-boundaries of the Compartment under study with the least possible disturbance and the Compartment encircled. The signal to commence the beat was given by firing a gun. The beaters then advanced in one line, raising a hullabaloo. Some departmental hands, interspersed in the line of beaters, helped in controlling and co-ordinating their progress in one file to keep the "leakage" of animals to the minimum. However, in the hilly and otherwise difficult Compartments, this procedure was not adequate, and the beaters were instructed to unfailingly report the number of animals that were seen retreating. The stops remained clapping and shouting at their posts to prevent the animals from escaping on either side. Here also a few animals, especially of the deer family, did break through the side-boundaries and records of these were also maintained. For each operation, the number of beaters and stops together varied from 93-180, and the enumerators from 5-30, depending upon the length of the Compartment and visibility on the boundary. They stood facing the Compartment in such a manner that each was visible to the man on his left.

The number and sex of the driven animals were recorded by the enumerators in blank schedules provided by us. Each enumerator recorded the game that emerged on his right hand side only. In instances where the Compartments were adjacent or lay very near each other,

the possibility of the same set of animals being counted twice in the data was eliminated in the following manner: If manageable, the adjacent Compartments were combined and treated as single units for the purpose of enumeration. When the Compartments were near enough to one another, beats were directed away from each other. In a few instances the near compartments were beaten out on different days, giving sufficient time to the animals to return to their normal haunts.

Two beats a day was the rule, but when the Compartments were small and the approach not difficult, three beats were held. In some difficult Compartments one beat alone occupied the whole day. All thirty, Compartments of the sample were covered by twenty seven beats in a period of fourteen days from three camps. The time taken for the actual beat depended on the size of the Compartment and generally varied from 30 minutes to one hour, though the combined Compartments took as much as an hour-and-a-half.

III—RESULTS

(Pls. 16 and 17 ; and Tables 1-4)

The sample areas comprised of four distinct vegetational types, *viz.*, (i) *sal* (*Shorea robusta* Gaerten.) forests ; (ii) miscellaneous forests ; (iii) grasslands and river beds ; and (iv) mixed forests on hilly terrain. The *sal* forests were composed mostly of *sal* trees of various ages with usually dense undergrowth. In the miscellaneous forests, the trees consisted of miscellaneous, deciduous species, and the undergrowth resembled that in the *sal* forests. The third type consisted of unproductive grasslands or open forests or dried up river beds. The last type comprised areas under protection on mountainous terrain, often steep to precipitous, the vegetation being a variable mixture of species. The distribution of these four types of areas in the total sample was as follows :

	Per cent
<i>Sal</i> forest	71.4
Miscellaneous forests	10.3
Grasslands, etc.	6.9
Mixed forests	11.4

Although intended primarily to collect data for the chital population, the other wild fauna which emerged in the beats was also enumerated. The enumeration thus included the following animals :—

MAMMALS

- Axis axis* Erxleben. (Chital or Spotted deer)
- Muntiacus muntjak* Zimmerman. (Kakar or Barking deer)
- Cervus unicolor niger* Blainville. (Sambar)
- Sus scrofa cristatus* Wagner. (Wild boar)
- Panthera pardus* Linnaeus. (Panther)
- Panthera tigris* Linnaeus. (Tiger)
- Melursus ursinus* Shaw. (Sloth bear)
- Canis aureus* Linnaeus. (Jackal)

BIRDS

Gallus gallus Linnaeus. (Jungle fowl)

Pavo cristatus Linnaeus. (Peafowl)

In addition, the wild cat, the hare, the porcupine, the hog deer and monkeys were also spotted occasionally, but records of these were not maintained as their estimate, based on the present drive-count technique, was not likely to be comprehensive. Much reliance could also not be placed on the present estimation of the Carnivora.

Table 1 gives the observed number of the different animals, their unbiased estimated population, the density and the proportion of animals in the forest territory under consideration. The size of the chital population of the Dehra Dun Forest Division in 1962 is estimated at $13,010 \pm 1928$ head. The chital thus constitutes nearly 41 per cent of the total "fauna" recorded, and the territory averages twelve acres per chital head (Table 4). Among the deer family, the chital constitutes 80.3 per cent, kakar 13.3 per cent and sambar 6.4 per cent (Table 2). The estimated sex-ratios (male : female) for the chital, kakar and sambar respectively are : 38 : 62 ; 50 : 50 ; and 41 : 59 (Table 3.) The sex-ratio for the chital was observed to vary considerably in the three Strata, the proportion of males being lowest in Stratum III and highest in Stratum I. A point of note is that the sex-ratios for the chital and the sambar are much alike in comparison with that of the kakar. The ratio of the number of young over adult is : chital 15, kakar 3 and sambar 8.

Sal occupies 71.4 per cent of the sample area. The value of the correlation coefficient between the characters *viz.*, the percentage of *sal* and the recorded number of chital therefrom is 0.46 with a standard error of 0.23. The correlation, paying due regard to its standard error, is statistically significant, which means that in the *sal* forests chital are more abundant. This fact, however, is subject to corroboration from future work.

The relative abundance of each species is given below being measured by the percentage of the compartments in which a given species is present :—

Chital	..	..	..	..	..	..	..	92.6
Wild boar	..	..	.					77.8
Kakar	..	..	..	..	.		..	74.1
Sambar	..	..	..	..	..	..	.	63.0
Jackal	..	..	..	..	..	..		51.9
Panther		.	.		.	.		40.7
Tiger	..	..	..	..	..	..	..	18.5
Bear	.		.	.	..	..	.	7.4

Thus, the chital is the most abundant mammal and is also most widely distributed ; and the bear, the least abundant. There is not even a single Compartment in the sample where at least one of the species of the deer family was not represented.

IV—SUMMARY

A census of the chital or spotted deer, *Axis axis* Erxleben, and other wild game was carried out in the Dehra Dun Forest Division, Uttar Pradesh, in March 1962, by the "drive-count" technique in forest compartments selected at random. The chital was observed to be the most abundant mammal and its population was estimated at about $13,010 \pm 1928$ head.

V—REFERENCES

- DHARMAKUMARSINHJI, K. S., 1959. A field guide to big game census in India.—*Leaflet Indian Board Wildlife*, New Delhi, No. 2, 4+iii+94 pp., 4 un-numbered charts.
- DHARMAKUMARSINHJI, K. S., 1960. Some methods of censusing big game in India.—*J. Beng. nat. Hist. Soc.*, Darjeeling, 31, pp. 4-13.

TABLE 1.—*Estimated population of some wild animals of the Dehra Dun Forest Division, U.P. (March, 1962).*

Animals	Number of sampled individuals	Estimated population (No. of head)	Per cent of total "Wild life"	Average area per animal (acres)
1. Chital	893	13,010	41.3	12
2. Kakar	171	2,159	6.9	73
3. Sambar	68	1,043	3.3	151
(Deer family)(Sub-total : 1-3)	(1,132)	(16,212)	(51.5)	(10)
4. Wild Boar	180	2,469	7.8	64
5. Jackal	30	371	1.2	426
6. Tiger	7	98	0.3	1,611
7. Panther	14	214	0.7	738
8. Bear	5	79	0.2	1,999
9. Jungle fool	870	11,240	35.6	14
10. Pea fowl	80	846	2.7	187
TOTAL	—	31,529	100	—

TABLE 2.—*Distribution of relative estimated population for each species of the deer family (chital, kakar and sambar) in the Dehra Dun Forest Division (March, 1962).*

Members of deer family	Male		Female		Sex unknown		Young		Total	
	Estimated population (No. of head)	Per cent of total	Estimated population (No. of head)	Per cent of total	Estimated population (No. of head)	Per cent of total	Estimated population (No. of head)	Per cent of total	Estimated population (No. of head)	Per cent of total
1. Chital	4,121	76	6,805	82.3	370	56	1,714	91.9	13,010	80.3
2. Kakar	921	17	922	11.2	244	36.9	72	3.9	2,159	13.3
3. Sambar	377	7	540	6.5	47	7.1	79	4.2	1,043	6.4
TOTAL	5,419	100	8,267	100	661	100	1,865	100	16,212	100

TABLE 3.—*Age-wise and overall estimated population and sex-ratio in the deer family (chital, kakar and sambar) in the Dehra Dun Forest Division (March, 1962).*

Members of deer family	Estimated population					Overall estimated population	95 per cent confidence limits for overall estimated population	Sex-ratio (Male : Female)	Age-ratio (Young Adult)
	Adult				Young				
	Male	Female	Sex unknown	Total					
									Per cent
1. Chital	4,121	6,805	370	11,296	1,714	13,010	9,230—16,790	38 : 62	15
2. Kakar	921	922	244	2,087	72	2,159	1,305—3,013	50 : 50	3
3. Sambar	377	540	47	964	79	1,043	576—1,510	41 : 59	8
TOTAL	5,419	8,267	661	14,347	1,865	16,212	11,973—20,451	—	—

TABLE 4.—*Stratum-wise distribution of estimated population of the deer family and their density and relative abundance in the Dehra Dun Forest Division (March, 1962).*

Stratum	Area (acres)	Chital			Kakar			Sambar		
		Estimated popula- tion (No. of head)	Density (average area in acres per animal)	Relative abundance (percentage of occur- rence in compart- ments)	Estimated popula- tion (No. of head)	Density (average area in acres per animal)	Relative abundance (percentage of occur- rence in compart- ments)	Estimated popula- tion (No. of head)	Density (average area in acres per animal)	Relative abundance (percentage of occur- rence in compart- ments)
				Per cent			Per cent			Per cent
I	50,110	2,683	19	100	920	54	80	86	583	60
II	76,128	6,197	12	90	881	86	70	787	97	70
III	31,677	4,130	8	85.7	358	88	71.4	170	186	57.1

APPENDIX

Details of Sample Compartments in the Dehra Dun Forest Division, U.P., for wild life census (March, 1962).

SERIAL NO. OF COMPARTMENT	RANGE	BLOCK	COMPARTMENT NO.	AREA (acres)
STRATUM I				
1.	Asarori	Laldhang	2	305
2.	„	„	4	207
3.	„	„	7	215
4.	„	Malhan	1	175
5.	„	„	2	435
6.	Timli	Dararit	1	577
7.	„	„	4	397
8.	„	„	11	607
9.	„	Dharmawala	2	304
10.	„	„	6	453
11.	„	„	8	221
12.	„	„	11	517
STRATUM II				
13.	Motichur	Jamankhata	3	430
14.	Lachiwala	Amsot	1	459
15.	„	„	4	293
16.	„	„	8	276
17.	„	„	12	610
18.	„	Phandowala	2	166
19.	„	„	6	390
20.	„	„	9	333
21.	Motichur	Koelpura	2	434
22.	„	„	3	437
23.	„	„	7	872

APPENDIX—*concl'd.*

STRATUM III

SERIAL NO. OF COMPARTMENT	RANGE	BLOCK	COMPARTMENT NO.	AREA (acres)
24.	Barkot	Chandna Rao	2	781
25.	Jajra	Bidhalna	3	360
26.	Barkot	Golatappar	2	344
27.	„	„	7	504
28.	„	Sainkot	2	467
29.	„	„	6	287
30.	„	„	8	288