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SOME INFERENCES ON THE BIOLOGY OF TIGER AND LEOPARD IN SIMILIPAL TIGER RESERVE

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INTRODUCTION

Most data on tigers (*Panthera tigris*) are limited to a few locations in its distributional range. Important among these are those from Kanha (Schaller 1967, Panwar 1979), Chitwan National Park (Mc Dougal 1977, Sanquist 1981), and Sundarbans (Hendrichs 1975, Choudhury and Chakrabarty 1979). Data from the wild in Similipal Tiger Reserve have largely been on predatory-aberrations (Choudhury 1979). In the following note we present some of our observations related to tiger's biology in Similipal based on data collected with pugmark tracking.

METHODS

In Similipal Tiger Reserve census of tiger and leopard were carried out consecutively for four years during 1989 through 1992. During this period several refinements have been made. These are particularly about identifying leopard and tiger tracks, identifying front and hind pugmarks, identifying left and right pugmarks, distinguishing the sex from pugmark, etc. (e.g., Sagar and Singh 1990, 1991). All these refinements were to the cooperation method of tracking devised by Mr Saroj Raj Choudhury during his tenure as Senior Research Officer at the Forest Research Institute (Choudhury 1970, 1972, 1976, 1979a).

We have changed the census period to the winter months of December-January when the routes for examination were minimal in numbers as the ground covers are still intact. At this time the weather remained friendly for day-long movement over six days of census. As a standard practice, over 3700 soft soil pads, called PIPs (Pad/Pug Impression Pads) were laid down each season to make the ground along tiger-movement-routes suitable for registering the pug-marks.

All measurements used in analysis refer to hind pugmark length (PML). After transferring the tracing of pug from 'Tiger Tracer' to a census data-sheet (protocol) our prescription is to draw a quadrangle. The quadrangle gave dimensions of pugmark length (PML) and width (PMB) for analysis with reference to spatiotemporal data from the field. Males of tiger and leopard were identified from females using hind leg PML measurements. For tiger male the accepted difference between PML and PMB were less than 1.5cm and for leopard male it was less than 1.0cm.

PML data from each census season were analysed to prepare distribution maps and tables showing sex, size and movement areas of each tiger (*Panthera tigris*) and leopard (*Panthera pardus*). The elimination of overlaps were rigorous so that analysis provided the minimum size of the population of tiger and leopard in different PML size classes.

RESULTS

Data collected from pugmark tracking over the four study years were combined and analysed for biological inferences. Results were kept very simple and intelligible to all staff who participated in the exercises.

TIGERS:

(1) The tiger population (Table-1) appeared stable around 94 individuals including male, female and cub. The mean total numbers of tigresses was 49-50 females in the population. The mean male:female ratio was $1:2.2\pm 0.2$ (Table-2).

(2) The numbers of tigers with PML 12.0-12.9cm were the highest, 27% in total tiger population (Fig.1), and 36% in total adult tiger population (Table-2, Fig.2).

(3) The cubs represented three classes of age from the first to third year. A total of 86 cubs were recorded in four years (Table-2, Fig.2). The youngest cubs identified with mother were in the range 7.0-7.9cm PML and they comprised 23% of total cubs. Cubs with PML 10.0-10.9cm, the oldest among cubs, were 36% of total cubs. In PML 8.0-8.9cm class there were 35 or 41% of all cubs.

(4) Because of track overlaps usually single cubs could be identified with the mothers. Therefore, when mean numbers of cubs were 22, the mean numbers of mothers identified were 18 (Table-3). The mean number of cubs that accompanied mother tigress was 1.23 ± 0.19 . Thus 36% of total numbers of females held cubs in three age-classes.

(5) About 72% of the total cub-holding-mothers (Table-3, Fig.3) were within 12.0-13.9cm PML.

LEOPARDS:

(6) The numbers of young leopard identified in the tracking were very few. All leopards were within the PML 5.0-9.9cm. PML-class 7.0-7.9cm was the most abundant, 42% of total leopard population (Table-4, Fig.4). The largest PML-class 9.0-9.9cm had 13% of total leopards.

(7) The size class 8.0-8.9cm showed the most stable representation, with little fluctuation in the PML-class among adult leopards (Table-4).

(8) The mean male:female ratio for leopard was one male for 1.8 ± 0.3 nos. of females.

DISCUSSION

The population of tiger in Similipal appears to be fairly stable according to the results of census conducted during four consecutive years from 1989 to 1992. The numbers of tigers plotted against different PML classes appear wavy with two peaks at 8.0-8.9cm and 12.0-12.9cm PML. The PML-class 10.0-10.9cm were at the first depression in numbers, and adult numbers declined after 12.9cm PML (Fig.1). The first depression at 10.0-10.9cm PML indicate the approach towards sub-adulthood when the young have started separating from the mother but is yet to establish its own territory. This phase in the life-cycle of the tiger, though not quantified in such terms earlier, is, however, recognized to be a wandering phase in tiger's biology (Sunquist, 1989; Karanth undated). Tigers in this age/size range may have disappeared from the normal movement routes.

The descent of the curve showing numbers of adult tiger after 12.9cm PML (Tables-1 and 2 and Fig-1) suggests stage beyond peak breeding class and their shifting away from the normal movement routes. From these observations it appears that inadvertently our recognised census-routes superimpose the territories which are normally covered by the prime breeding adults. It may be mentioned that the census routes radiating out of the headquarters of each census unit extend to about 12-15km, and very often certain inaccessible deeper forest areas remain un-searched during census. Such remote areas may be the retreats for the young ones separated from the mother and the displaced old adults as well.

The main cubbing month for tigress in Similipal is known to be August and the census months are December-January. The 36% of adult females which had cubs include mothers which littered in the same season about four months back to about 28 (4+12+12) months at the most. Therefore, about 12% of the adult female population is expected to be cubbing every year.

We have observed litter sizes of four cubs but during the census we have not been able to account for more than one cub with most mothers and just two cubs with a few. This is a reflection of limitations originating from PIP-based pug-mark census. The technique need to be further improved beyond the improvements already made recently (Sagar and Singh 1990 and 1991).

The pug-mark of a leopard may rarely exceed 9.9cm. As seen with the tiger, certain size-classes among leopard also disappear from the population. Leopard with PML below 7.0cm and above 8.9cm may constitute the unsettled and expelled-out phases, respectively, with respect to known territories. Because the female:male ratio is smaller in leopard (1.8 ± 0.3) in comparison to the tiger (2.2 ± 0.2), it is inferred that polygamy is more pronounced in tiger. Similarly, the numbers of female superimposing into the territory of males is less in the leopard.

The census technique calls for improvement in order to determine an improved estimation for the leopard cubs.

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We are grateful to the Forest and Environment Department (Wildlife wing), Govt. of Orissa and Project Tiger, Govt. of India for supports for the census work in Similipal Tiger Reserve.

SUMMARY

Data collected from pugmark tracking over four years from 1989 to 1992 were combined and analysed for biological inferences. Results were kept very simple and intelligible to all staff who participated in the exercises. During the period 1989-1992 the tiger population appeared stable around 94 including male, female and cub. The mean male:female ratio was 1:2 for tiger and 1.8 for leopard. The tiger cubs at 10.0-10.9cm PML (hind Pug Mark Length) were low in numbers, suggesting their disappearance from the main population. This size corresponds to stage of separation from mother and entering a wandering phase before creating own territory. Because of track overlaps usually single cubs could be identified with the mother tigress, and 36% of total numbers of females held all cubs in three age-classes. It appeared that about 12% of the female population litter in a season. About 72% of the total cub-holding-mothers were within 12.0-13.9cm PML. There is scope to refine the census technique for Similipal Tiger Reserve to account for all the cubs with their mothers.

ACKNOWLEDGEMENTS

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Table-1

Numbers of tiger detected during census of 1989 to 1992 in Similipal Tiger Reserve, Orissa, India. PML in cm.					
PML (starting length in particular class)	1989	1990	1991	1992	Total in size class
(1)	(2)	(3)	(4)	(5)	(6)
7.0	4	8	4	4	20
8.0	13	5	8	9	35
9.0	4	8	10	9	31
10.0	4	3	2	4	13
11.0	9	11	31	18	69
12.0	22	32	24	24	102
13.0	23	22	9	19	73
14.0	10	4	5	7	26
15.0	1	1	1	0	3
16.0	0	0	0	1	1
Total	90	94	94	95	373

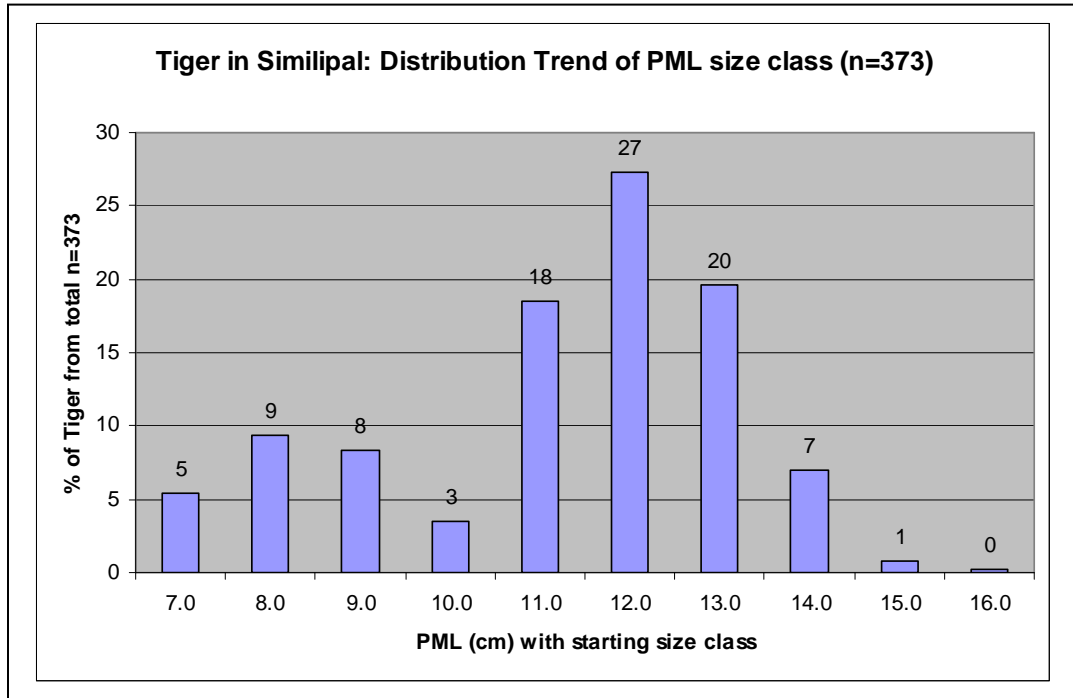


Fig.1

Table-2

**Results of census of tiger (Male:Female:Cub) in Similipal Tiger Reserve during 1989-1992.
The sex of tigers with PML less than 10.0cm could not be ascertained.**

PML (starting length in particular class)	1989			1990			1991			1992			Total male	Total female	Total cub
	Male	Female	Cub	Male	Female	Cub	Male	Female	Cub	Male	Female	Cub			
7.0	0	0	4	0	0	8	0	0	4	0	0	4	0	0	20
8.0	0	0	13	0	0	5	0	0	8	0	0	9	0	0	35
9.0	0	0	4	0	0	8	0	0	10	0	0	9	0	0	31
10.0	2	2	0	2	1	0	1	1	0	2	2	0	7	6	0
11.0	2	7	0	6	5	0	14	17	0	8	10	0	30	39	0
12.0	8	14	0	10	22	0	7	17	0	7	17	0	32	70	0
13.0	4	19	0	4	18	0	1	8	0	5	14	0	14	59	0
14.0	4	6	0	0	4	0	0	5	0	2	5	0	6	20	0
15.0	0	1	0	0	1	0	0	1	0	0	0	0	0	3	0
16.0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
Total	20	49	21	22	51	21	23	49	22	24	49	22	89	198	86

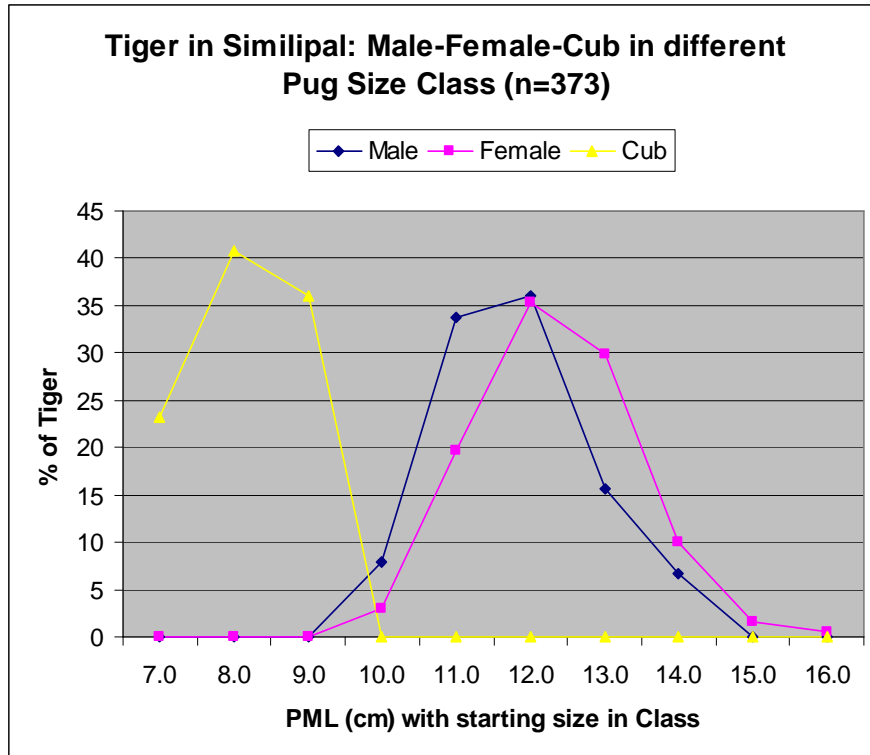


Fig.2

Table-3

Mean numbers of tigress in different pug-class and the minimum numbers of cubs accompanying them according to census of 1989 to 1992 in Similipal Tiger Reserve, Orissa, India. PML in cm.

PML (starting length in particular class)	Mean numbers of female in PML class	Numbers of females with cubs	% of mother tigress
10.0	2	0	0
11.0	10	3	17
12.0	16	7	39
13.0	15	6	33
14.0	5	2	11
15.0	1	0	0
16.0	0	0	0
Total	49	18	100

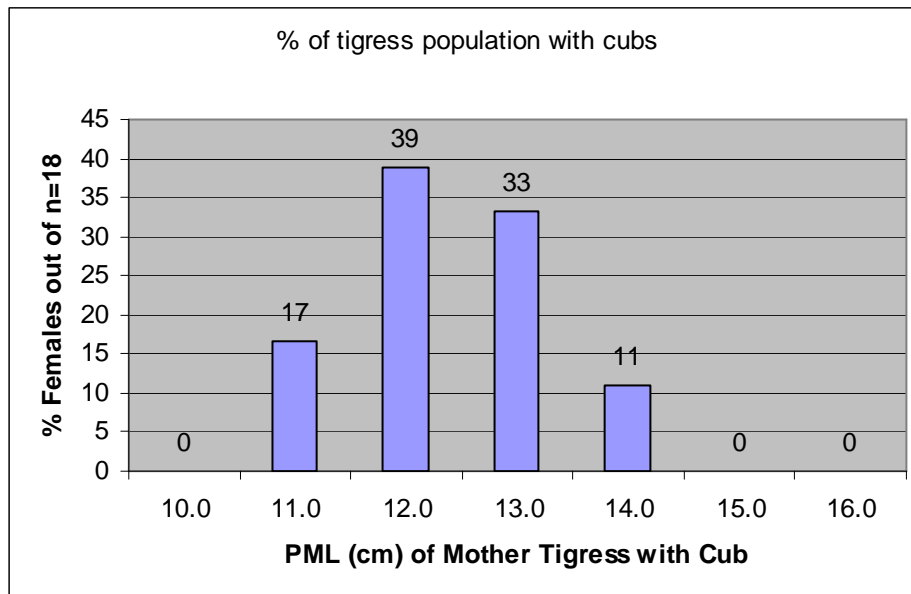


Fig..3

Table-4

Similipal Tiger Reserve (1989-1992): Evidence of male and female Leopard collected during pugmark tracking. Figures indicate PML or Pugmark length in cm.

Year of census	4.0-4.9	5.0-5.9	6.0-6.9	7.0-7.9	8.0-8.9	9.0-9.9	Total
Male							
1989	0	1	1	7	9	3	21
1990	0	0	0	17	11	6	34
1991	0	0	4	13	9	3	29
1992	0	0	7	17	8	1	33
Total male in four years	0	1	12	54	37	13	117
% of males out of total male (n=117)	0	1	10	46	32	11	100
% of males out of total leopard (n=117+197=314)	0	0	4	17	12	4	37
Female							0
1989	0	0	1	7	13	9	30
1990	0	1	10	29	18	4	62
1991	0	0	5	19	19	8	51
1992	0	0	7	23	17	7	54
Total female in four years	0	1	23	78	67	28	197
% of females out of total leopard (n=117+197=314)	0	0	7	25	21	9	63
Total Leopard	0	2	35	132	104	41	314

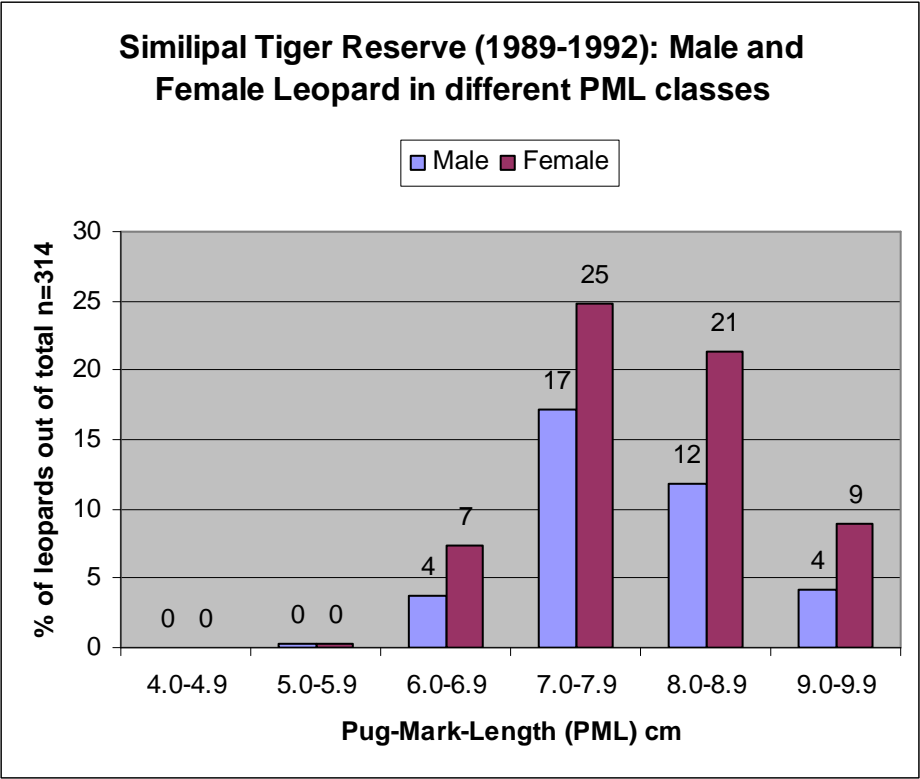


Fig.4

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Abstracts



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ABSTRACT

**SOME INFERENCES ON THE BIOLOGY OF TIGER AND LEOPARD IN SIMILIPAL
TIGER RESERVE**

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The details of pug marks census data on tigers and leopards were used to draw the inferences on their biology in Similipal. The population curve showing the numbers of tigers in different classes of pug length indicated the disappearance from the study area of animals in size classes 9.0 -10.9 cm and 13.0 cm onwards. Similar disappearances were seen with the leopard pug length classes of below 7.0 cm and above 8.9 cm. For each species the stated smaller class is considered to be of those young who have separated from mother but are yet to establish their territories. The larger class is of those which have been displaced out of their territories. Polygamy, and therefore the number of females superimposing over the male territories, is more pronounced in tiger than leopard. Female:male ratio for tiger was 2.2 ± 0.2 S.D., and for leopard was 1.8 ± 0.3 S.D. The adult population of tiger and leopard during four consecutive years from 1989 to 1992 appear to be stable, 23:50 tigers and 29:50 leopards (male:female). 72.2% of tiger cubs were with mothers having 12.0-13.9 cm pug size. About 12% of the female tigers litter in a season. There is scope to refine the census technique for Similipal Tiger Reserve to account for all the cubs with their mothers.