Let's Count Tigers: Census of Tiger and Leopard. (Based on Note by L. A. K. Singh)
In: Patnaik, B.K.; Singh, L.A.K.; Kar, S.K. and Kar, C.S. (2008): Wildlife Census in Orissa. Wildlife Headquarters, Forest Department, Govt. of Orissa, Bhubaneswar, 132 pages.

Let's Count Tigers

CENSUS OF TIGER AND LEOPARD

The presence of Tiger in the forest is normally known from evidences like the animal-kill, pugmark, claw-mark on the road and tree, urine-mark on the bush, scat, mating call, normal roaring, and the alarm call by prey animals like the langur, chital or sambar. Unless the ground vegetation is thin and sparse, Tiger is as elusive as ever to permit easy sighting. It is rightly said that (in a good forest) 'before we see the Tiger once, the Tiger must have seen us a hundred times'!

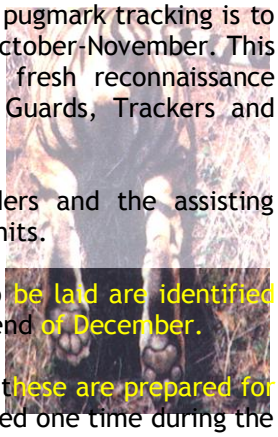
Footprints (the pugmarks) are left behind as the Tiger moves on. It may not leave any other evidence! The tale-telling distinctiveness of the pugmark depends on the ground soil. A good track tells us whether it is that of a Tiger or a Leopard; a male, female or a cub; and whether a particular pugmark is that of the front or hind, and left or the right.

Pugmark Tracking – *Traditionally ours!*

The idea for using pugmark tracking for determining the numbers of Tiger in India was first given by Saroj Raj Choudhury, when he served as Senior Research Officer at the Forest Research Institute, Dehra Dun. Later, he became the founder Field Director of Similipal Tiger Reserve in 1973, and in 1983 was posthumously honoured with Padmashree. Although 'pugmark tracking' was practiced for the "First All India Estimation of Tiger Population" in the year 1972, the technique was made robust with several refinements and addition of new dimensions after 1987 onwards. The refinements have been possible because of thorough and sustained observations in Similipal Tiger Reserve. The description given below is for the refined technique as is used it in Orissa. Unless otherwise mentioned, the descriptions refer to Tiger and its pugmark tracking.

PREPARATIONS BEFORE CENSUS

For any Tiger or Leopard area, the routes along which pugmark tracking is to be carried out are identified at first in the month of October-November. This is based on information from the previous census, fresh reconnaissance surveys, and the current field knowledge of Forest Guards, Trackers and villagers.



The numbers of census units, the census unit leaders and the assisting personnel (one two) are identified and assigned their units.

The locations where PIPs (Pug Impression Pads) are to be laid are identified during identification of census routes, and laid before end of December.

Census route charts with day-by-day itinerary to cover these are prepared for each census unit. Usually, all routes and PIPs are checked one time during the

first three days of census. These are rechecked in the same sequence again in a sequential order followed during the first three days.

Facsimile of Tiger Census Route Chart (not to scale)

SIMILIPAL TIGER RESERVE. Year: 1998 Range: UBK .

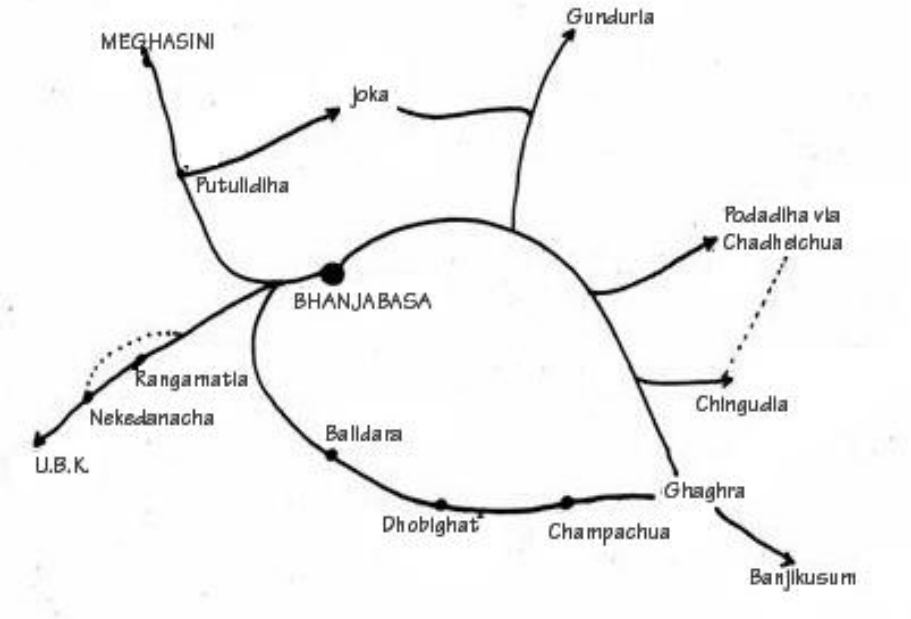
Tiger Census Unit No……., Name of Unit: BHANJABASA-I .

Unit Leader: SRI BAIJU CHARAN MAJHI, FG .

Assistants:……., ……..

Non-official Member…….

NAME OF THE ROUTE	DISTANCE IN KM.	NO. OF PIPS	CENSUS DATES
1. BH.BASA-PUTULIDIHA-MEGHASINI RD.-CHADHEICHUA-KUMBHAGHAI	8	15	05 + 08
2. BH.BASA-GUNDURIA-CHINGUDIA	11	20	06 + 09
3. BH.BASA-CHAMPACHUA-	12	18	07 + 10



Arrangements are made for non-official participation through invitations, circulars, selection and their training. Each non-official gives an undertaking to the fact that he is aware of the risks involved in Tiger census and that he will not hold the department responsible for any mishap during his participation. In Similipal around 25 non-officials participate in each census.

Other preparations include (i) laying of PIPs, (ii) supply of census kits, (iii) erecting machans for enumerators where other accommodations are not available, (iv) training arrangements for staff, (v) selection of proper assisting personnel for census work of six days, (vi) coordination with census units

during field data collection, (vii) training and transportation of non-official participants.

Census Kit

The census kit is meant to facilitate collection of data during the census period and subsequently analysis of data.

For collection of data in the field the Census Unit Leader gets (a) a haversack (45x45cm) (b) a 'Tiger Tracer' having a 25x20cm good quality clear glass fitted to a 2cm wide wooden frame, (c) measuring tape (150cm), (d) plastic mug (1000ml.), (e) water bottle(2000ml), (f) Plaster of Paris – of good Medical Grade, in packets of 500gm, (g) field note book, (h) ball pen, (i) sketch pen, (j) self-sealing sample bags (25x25cm) to keep scat samples, (k) pugmark tracing forms (Form-D), (l) 'Daily Diary' forms, (m) a set of common medicines to meet emergency, and (n) a copy of census guidelines.

For analysis of data the coordinators are given a 'Tiger Tracer', a graph sheet in cm scale, a measuring tape (150cm), ball pen, sketch pen, pugmark tracing forms (Form-D), set-square for plotting quadrangles around pug-tracings, access to computer with database software

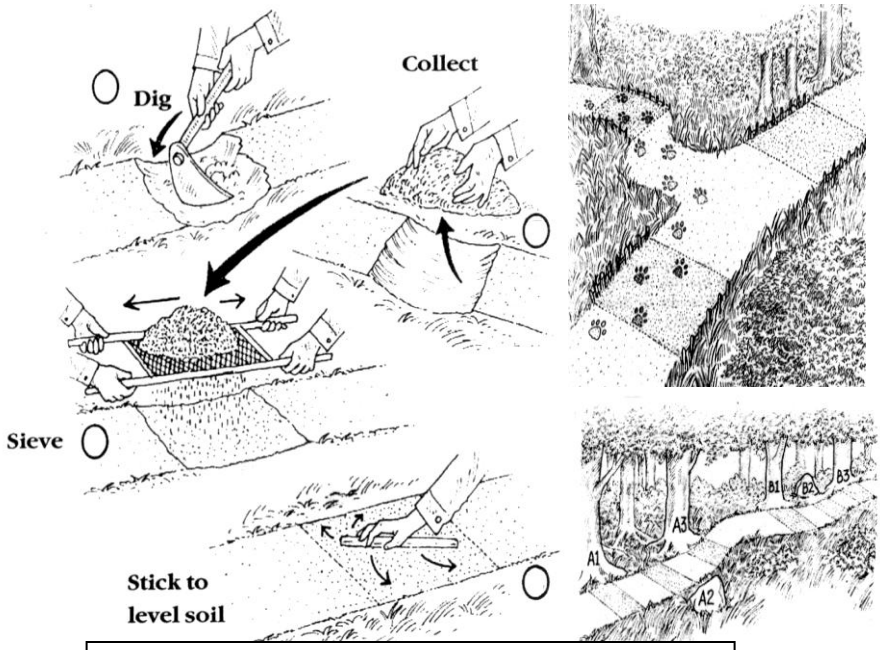
Laying of PIPs

When the ground is hard, in order to obtain good pug impressions, PIPs (Pug Impression Pads) are created along the possible movement routes. PIP is created as a patch of 2cm deep dusty earth 2m long along the length of the track and covers the entire width. This is large enough to register 3 to 4 foot prints of Tiger passing over it. PIPs bring uniformity in soil-condition for pugmarks.

At cross roads and at the beginning of other roads 3-4 PIPs are laid down at 50-100m apart each. After about 500-1000m again a cluster of 3-4 PIPs are laid with 50-100m spacing between two PIPs. Keeping in mind the importance of a route, the above number or pattern of PIPs is changed. To cite an example, during the year 2002, in 71 Census Units of Similipal 8946 PIPs were laid over 1773km of tracking routes, from which 764 pugmark tracings were collected along with 316 plaster casts.

For preparation of the ground or laying the PIPs the Census Unit Leaders is provided with (a) a piece of fine-mesh wire-net (100x75cm) designed to function as a swing to sieve the soil, and (b) two wire brushes to clean the mesh or brush the ground for creating a dust pad.

Animals are sometimes weary of stepping on newly prepared PIPs. The soil used for making the PIP is preferred from the same surrounding area. PIPs are so located that Tiger using the route cannot avoid it. Preparation of PIPs is completed about 4-5 days before beginning of enumeration.



Laying of PIP : the procedure and distribution on forest roads

Training

Training programmes on census techniques, logistics and coordination are arranged at state headquarters for 'Trainers'. The Trainer in turn give training to other staff at Circle headquarters and Range headquarters. This is completed before laying of PIPs. All non-official participants are also given training on census techniques, and precautions they are to take during their participation.

FIELDWORK DURING CENSUS

Winter season is ideal for 'Pugmark Tracking'. During the first and second weeks of January the number of routes available for tracking is relatively few. Field work for the entire day is less tiring. Deterioration of pugmarks due to wind or water is the minimum. Besides, sun-rays falling on the ground in an angle offer better visibility of the tracks.

In sanctuaries and Tiger-rich areas all participants take position in their census unit headquarters by the evening of 3rd January or early morning of 4th January. Data collection is carried out during 5th to 10th of January, on all six days, from morning till late afternoon. The routes scheduled for checking are covered on foot. Normally, the routes cover PIPs, river banks, dry river beds, water-holes, the vicinity of salt-licks, forest paths, animal tracks, and other dusty roads, etc. where Tiger would have walked.

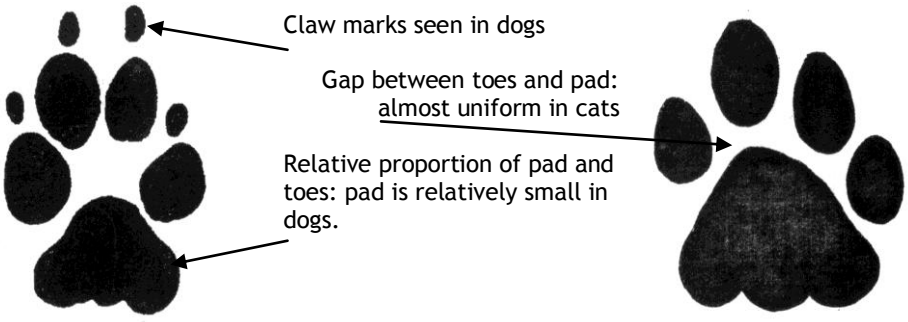
Outside sanctuaries where territorial activities are going on, pugmark tracking is completed before 1000hrs. After that vehicles are allowed for normal activities until about sunset.

Searching for Tiger Pugmark

In the field the common types of footprints are those of elephants, those of animals having hooves, the foot prints of animals from the dog group, and the soft-pawed cat pugmarks. Data collection gets focused to those of cat pugmarks.

The foot of Tiger showing paw, toes and 'dew-claw' of front paw

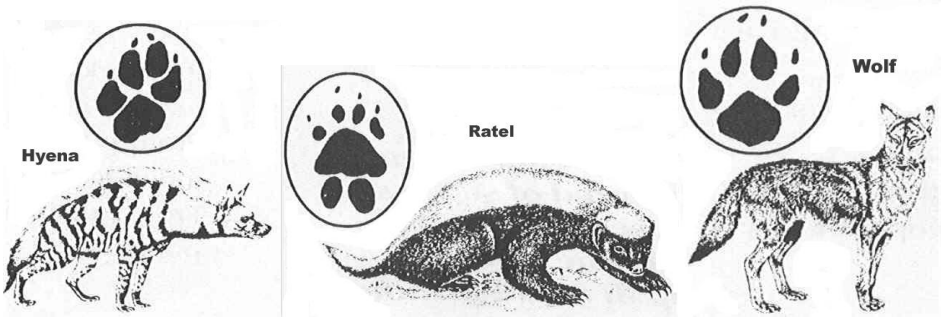
The cat pugmark shows the impression of a paw (pad) and four toes. The fifth toe, commonly called the 'dew-claw' on the front paw only, is held high and doesn't touch the ground. Hence, there are marks of four toes on the ground. The pad is 3-lobed at the rear end. Pugmarks of large cats include those of Tiger and Leopard.



DOG FOOTPRINT

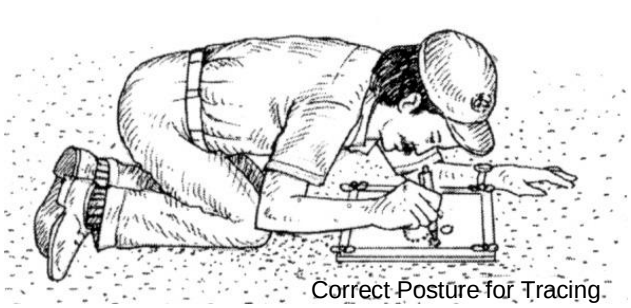
CAT PUGMARK

Footprints Commonly Misidentified



Bringing the Pugmark from Field to Lab

There are two methods to bring the pugmark from field to the analysis room, -- in the shape of a pugmark tracing with all accessory field data in Form-D and as a plaster cast. When a staff is not good at tracing he brings the plaster cast but with all field information duly filled-in in Form-D.

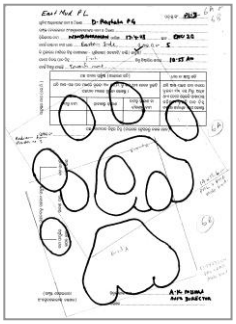

Correct Posture for Tracing.

Form-D Data

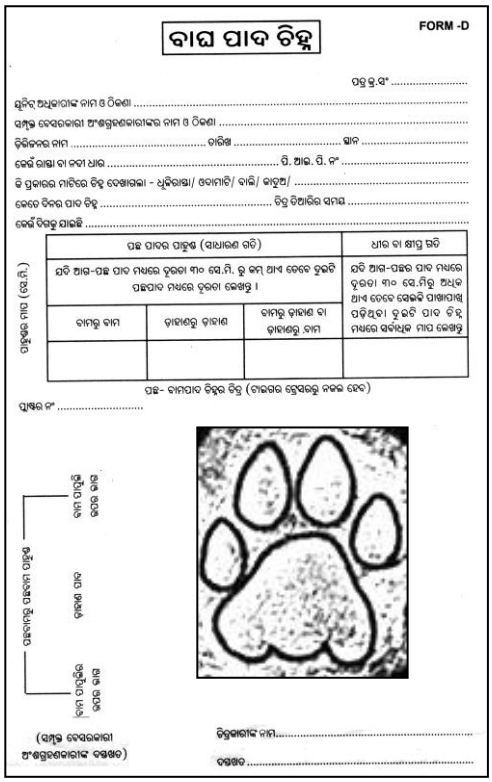
Form-D is used to draw a tracing of the pugmark, record details about the location where the pugmark is located, the unit-to-unit direction of movement of Tiger, age of the pugmark to suggest how long back the Tiger


Pugmark traced on 'Tiger Tracer'


Transferred to 'Form-D'



moved on the route, the stride measurements, etc. For tracks showing normal movement stride is measured from front end of a particular pug (say, left hind) to the next front end of that particular pug. Tracing of pugmark is done by using a 'Tiger Tracer', and then transferred to Form-D.



ବାଘ ପାଦ ଚିହ୍ନ

FORM -D

ପତ୍ର ନ୍ୟ.ସଂ .....

ସୂଚିତ୍ ଅଧିକାରୀଙ୍କ ନାମ ଓ ଠିକଣା .....

ସାମ୍ପୁକ ଦେଖରଖାରୀ ଅଂଶଗ୍ରହଣକାରୀଙ୍କର ନାମ ଓ ଠିକଣା .....

ବିଭିନ୍ନତର ନାମ ..... ତାରିଖ ..... ସ୍ଥାନ .....

କେଉଁ ରାସ୍ତା ବା ନଦୀ ଧାର ..... ପି. ଆଇ. ପି. ନଂ .....

ଚି ପ୍ରକାରର ମାଟିରେ ଚିହ୍ନ ଦେଖାଗଲା - ଧୂଳିରାସ୍ତା/ ଓଦାମାଟି/ ବାଲି/ କାଦୁଅ/ .....

କେତେ ଦିନର ପାଦ ଚିହ୍ନ ..... ଚିତ୍ର ତିଆରିର ସମୟ .....

କେଉଁ ଦିଗକୁ ଯାଇଛି .....

ପଛ ପାଦର ପାହୁଞ୍ଚ (ସାଧାରଣ ଗତି)			ଧୀର ବା କ୍ଷୀପ୍ର ଗତି
ଯତି ଆଗ-ପଛ ପାଦ ମଧ୍ୟରେ ବୃତ୍ତରା ୩୦ ସେ.ମି. ରୁ କମ୍ ଥାଏ ତେବେ ବୁଝାଇ ପହଞ୍ଚପାଦ ମଧ୍ୟରେ ବୃତ୍ତରା ଲେଖନ୍ତୁ ।			ଯତି ଆଗ-ପଛର ପାଦ ମଧ୍ୟରେ ବୃତ୍ତରା ୩୦ ସେ.ମିରୁ ଅଧିକ ଥାଏ ତେବେ ସେଇଟି ପାଖାପାଖି ପଡ଼ିଥିବା ଦୁଇଟି ପାଦ ଚିହ୍ନ ମଧ୍ୟରେ ସର୍ବାଧିକ ମାପ ଲେଖନ୍ତୁ
ବାମରୁ ବାମ	ବାହାଣରୁ ବାହାଣ	ବାମରୁ ବାହାଣ ବା ବାହାଣରୁ ବାମ	

ପଛ- ବାମପାଦ ଚିହ୍ନର ଚିତ୍ର (ଟାଇଗର ଷ୍ଟ୍ରେସରରୁ ନକଲ ହେବ)

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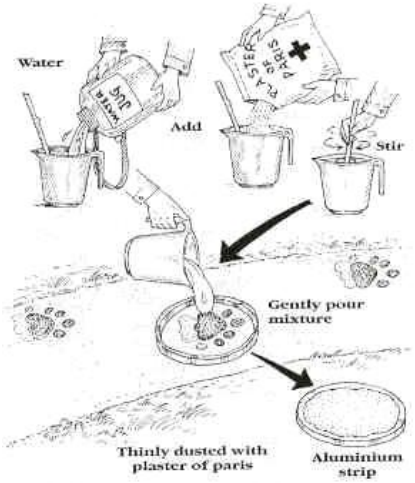
(ସାମ୍ପୁକ ଦେଖରଖାରୀ ଅଂଶଗ୍ରହଣକାରୀଙ୍କ ଦସ୍ତଖତ)

Making a Plastercast

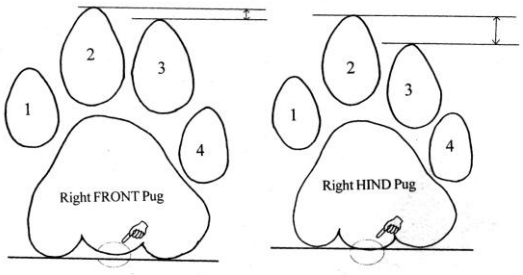


Allow plaster cast to dry and harden

A deep pugmark looks good but needs skill for interpretation

Selection of pugmark for tracing and plaster-cast

For any census year it is decided before hand to collect the tracing and plaster casts of left hind pug. In the absence of left hind pugmark, or an unsuitable impression of it on the ground, the next choice is right hind pug, then front pug. Hind pugmarks are better for interpretation than the front pugmarks.



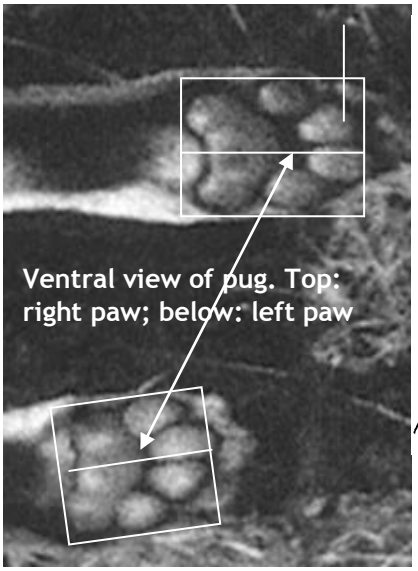
Distinguishing the hind from the front pugmark

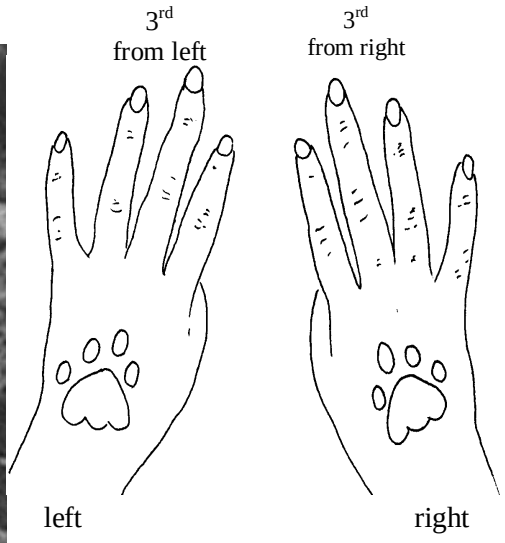
Front pugmarks are larger than hind pugmarks. In a front pugmark, the forwardmost points of the two middle toes are almost at the same level. In hind pugmarks, the tips of the two middle toes are distinctly at different levels.

Distinguishing the right and the left pugmark

Distinction is clear in hind pugmarks.

In the left pugmark the third toe, counted from left, is placed ahead of others. Similarly, in the right pugmark the third toe, counted from right, is placed ahead of others.

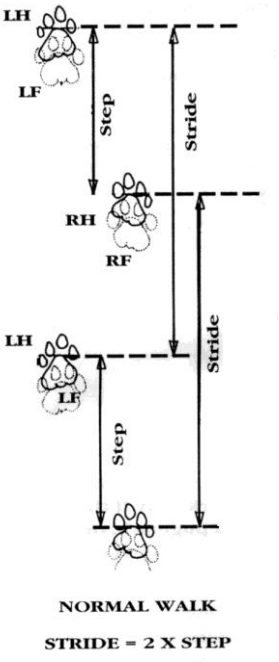




View based on pug-impression on ground

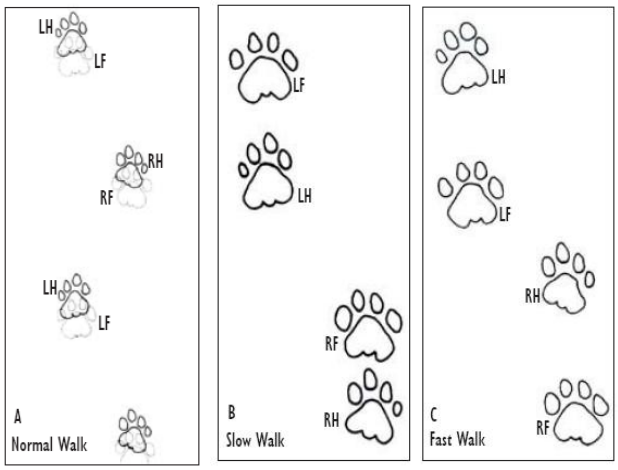
Measurement of Stride

Data on stride measurement is used to retrace a track to that of a Tiger cub or an adult Leopard. For Tiger cub, stride is about 10times its PML. For Leopard the stride is 12-13 times the PML. Data on stride is also used in distinguishing two Tigers of same sex having pugmarks of similar size.



NORMAL WALK

STRIDE = 2 X STEP

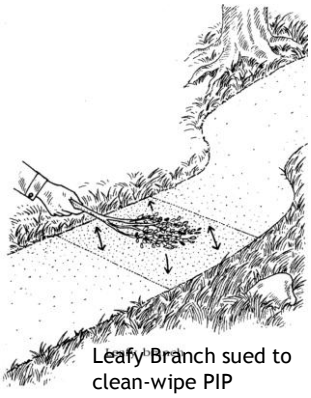


Tracks due to fast walk or slow walk show all four pug marks (right-left, front-hind). If the measurement between any two pug marks is more than 30cm then the stride is about three times of it.

Preparing the Plaster Cast

The plaster cast is prepared after all field data are collected and tracing is made on the Tiger Tracer and transferred to Form-D. For preparing a plaster cast a good impression is selected. First a thin layer of French-chalk powder or plaster-of-Paris powder is dusted over the impression. By using sand, stick, cardboard or a strip of paper a ridged boundary is placed all around the pugmark. In a 1-litre mug about 200ml water is taken. To this plaster-of-Paris powder is added gradually with quick constant stirring till a thick solution (not paste) is made. It is then gently poured over the pugmark. After about 15-20 minutes the plaster hardens. Over it the name of the Unit, its leader, date, place, reference ID number of the plaster-cast, etc. are written down. As the cast hardens, it is dislodged and lifted carefully with support from underneath. Care is taken to ensure that the plaster-cast is not rubbed to clear off sand or earth clinging to it. If necessary, water is poured gently over the plaster-cast so that loose particles of sand are washed off.

For each plaster-cast an ID-number is given and it is mentioned on Form-D having the pugmark-tracing.



Leafy Branch sued to clean-wipe PIP

After all data are collected, tracing is transferred to Form-D and preparation of plaster-cast is complete, the PIP is brush-cleaned.

AFTER THE FIELD WORK (DATA ANALYSIS)

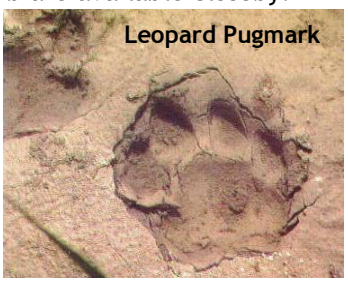
Around each pugmark-tracing a quadrangle is drawn for measuring the Pugmark Length (PML) and Pugmark Breadth (PMB). In those cases where the plaster cast exists but the tracing is not good, by using the plaster cast a tracing of the pugmark is redrawn. With care it is possible to locate the outlines of the paw and toes even in plaster casts from deep mud.

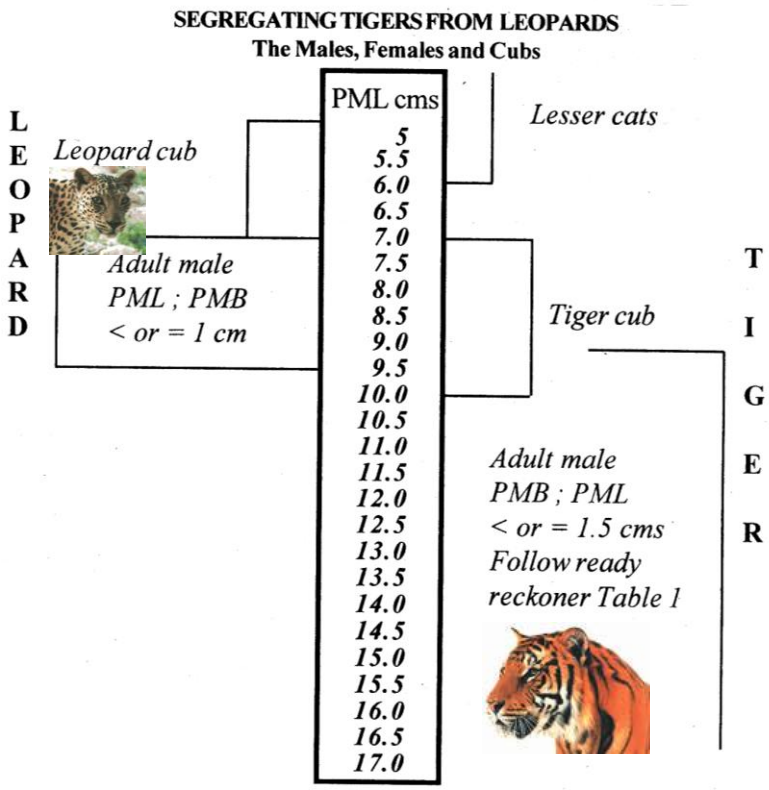
Cast from deep mud

Cast from thin soil

Distinguishing Tracks of Tiger and Leopard

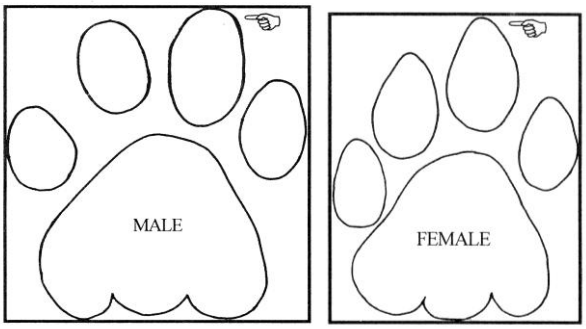
The pugmark of adult Leopard and Tiger cub may appear similar in size. These are separated on the basis of four options. (i) The pug impression of an adult Leopard is compact. The pad and the toes are held closer together. The pugmark made by a Tiger cub is more splayed out. The pad and the toes are held more loosely. (ii) The toes of Leopard are relatively smaller and narrower than those of a Tiger cub. (iii) The length of the hind pugmark of Leopard ranges between 7.5 to 9.5cm. But the stride of Leopard is longer than that of Tiger cub. For Leopard the stride is about 13-14 times the pug length but for Tiger cub it is about 10 times. (iv) Moreover, the cub normally remains close to the mother. Therefore, the pugmarks of both mother and cub are available closeby.





Distinguishing male and female from pugmark
The shape of toes in a male is more rounded. The shape of toes in a female is elongated.

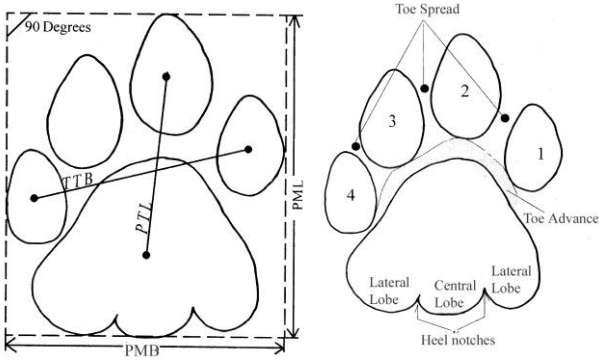
Male and female Tigers are easily distinguished from the hind pugmark. The pugmark of a male almost fits into a square. For male Tiger pugmarks, the difference between PML and PMB (Pugmark Length and Pugmark Breadth) is less than 1.5cms.



The pugmark of a tigress fits into a rectangle. The difference between PML and PMB is more than 1.5cms.
The difference between PML and PMB is less than 1cm in case of the pugmark of a male Leopard.

When the PMB of front pugmark is larger than PML, the pugmark is that of a male Tiger. Because of suppleness of the pug, the PMB gets squeezed on a deep semidry mud. The information on ground condition helps to judge this and conclude the sex of the Tiger.

If the tracing is that of the front pug, and PMB is greater than PML, the pugmark is that of a male.



For tracks seen in border areas of two Tigers of same sex and around same size, individual identification is based on morphological peculiarities of pugmarks like, a lost toe, a particular pattern of toe impressions, angles of curves on the pad or its lobes, etc.

Elimination of duplications and overlaps
The plaster casts and tracings along with field information are together analysed with a map of the area to remove repetitions and overlaps in pug-evidences collected for the same Tiger.

All tracings are sorted into six groups--, Tiger male, Tiger female, Tiger cub, Leopard male, Leopard female and Leopard cub. Those which cannot be given identified are grouped as 'unidentified sex' among Tiger or Leopard.

All identical and similar looking pugmarks of the same sex in the broad age categories (adult or cub) are matched and duplications are determined first within the area of the same unit, then with adjoining units. Duplications indicate the movement area of a particular animal. Therefore, territorial attributes of Tiger play major consideration. Two pugmarks of same sex and similar size from adjoining areas are designated to separate Tigers only if conclusively confirmed from peculiarities or identifying characteristics like angle of heel notches, toe-spread, toe-advance space, toe-to-toe breadth and pad-to-toe length, etc.

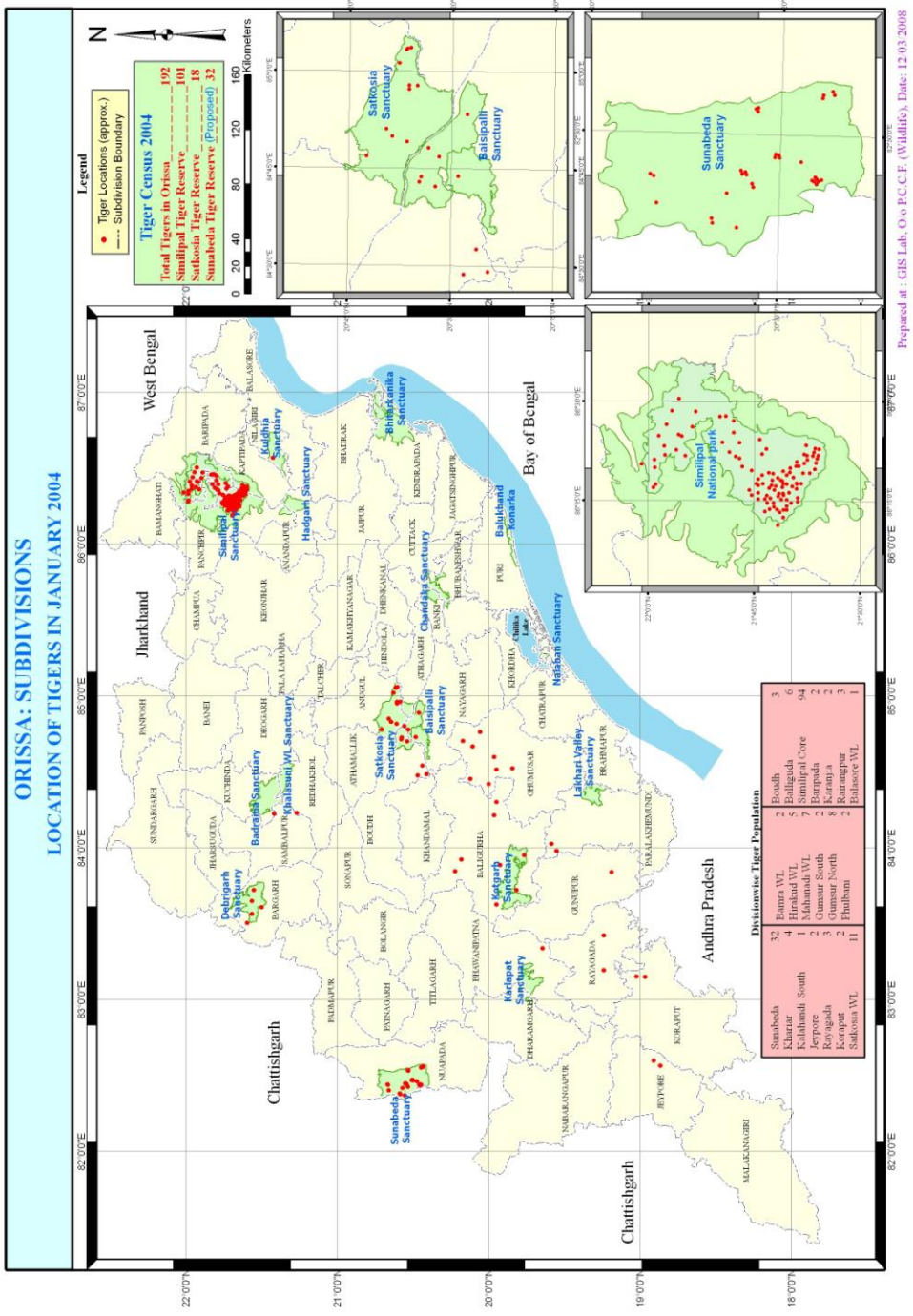
The Final Result

The final result indicates the (a) total numbers of male, female and cub of Tiger and Leopard, (b) their pugmark dimensions with stride where available, (c) the names of locations where the pugmarks of each Tiger have been traced to show the gross movement area separately for each Tiger (d) interrelationship among different Tigers by linking each male to female and the latter to cubs tracked in the movement area, and finally (e) the spatial distribution map.

Pug-mark enumeration provides the minimum number of Tiger and Leopard. From spatial distribution map showing the movement area of Tiger and Leopard the pressure areas in a Tiger habitat are identifiable.

Table 5.1.
Example of report available after each 'Pugmark Tracking' census showing identity, movement area and Tiger families (From 2002 report: Similipal).

STR Sl.No.	Range Sl. No.	Unit	Pug L x B x S	Movement Area
Tiger				
M1	PTM1	Badamakabari (Pithabata Range)	11.7 x 11.4 x 110	Kukudakhumpi-Sahubandha
M12	UTM1	Bhanjabasa	13.0 x 12.2 x 128	Bhanjabasa-Champachua-Balidara
M28	BTM1	(Kaptipada Range)	11.9 x 12.2 x 128	Balidara-Champachua-Kenduchua
F8	N TF1	Joranda	13.6 x 9.8	Joranda-Ring road- Guhal Pahad (TC14)
F10	N TF3	Khadkei	11.4 x 9.3 x 138	Daudidarha-Pandabandha-Sasanajharan (TC6, TC7)
F18	J TF4	Nuagaon / Devasthali	12.4 x 10.1	Nuagaon –(Devasthali-Golakund-Solamundi-Nuagaon-Bamandiha-Sarudala-) (TC25, TC26)
C6	CTC4		7.9 x 6.2 x 78	Baunsakhal-Purunapani (TF10)
C7	CTC5		7.5 x 6.4 x 76	Baunsakhal-Khadkei (TF10)
C14	NTC1	Joranda	8.8 x 9.0 x 95	Joranda-ring road- Guhalpahad (TF8)
C25	UTC9	Mahabirsala	8.0 x 7.8	Mahabirsala-Sarudala (TF18)
C26	UTC10	Mahabirsala	7.9 x 8.5	Bachhurichara-Sarudala (TF18)
Key for symbols in first and last columns: C = Cub, F = Female, M = male, T = Tiger				

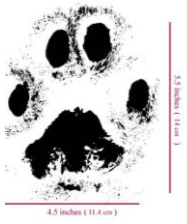


The total duration taken for 'Pugmark Tracking' is about 5 months including preparation (about 2 months), census (6 days) and analysis (about 3 months).

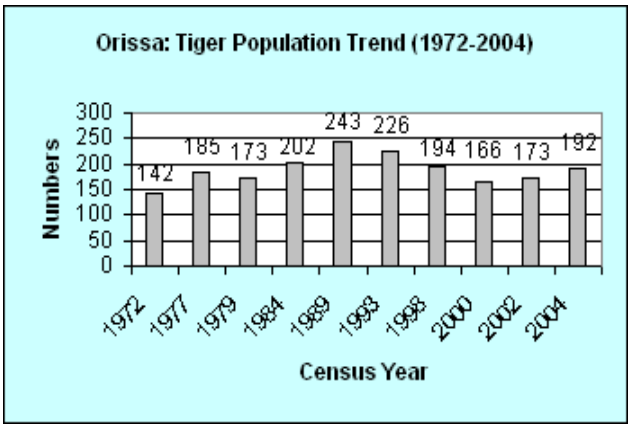
Table 5.2.
Tiger and Leopard population in Orissa (1972-2004)
determined on the basis of Pugmark Tracking

TIGER					
Year	Male	Female	Cub	US	Total
1972	53	42	17	30	142
1977				185	185
1979	58	100	15	0	173
1984	74	107	21	0	202
1989	82	113	29	19	243
1993	67	98	36	25	226
1998	57	87	11	39	194
2000	52	67	43	4	166
2002	51	72	43	7	173
2004	57	75	60	0	192
LEOPARD					
Year	Male	Female	Cub	US	Total
1984				260	260
1989				279	279
1993	129	168	33	48	378
1998	151	179	17	54	401
2000	119	166	25	12	322
2002	184	218	45	1	457
2004	196	248	43	0	487

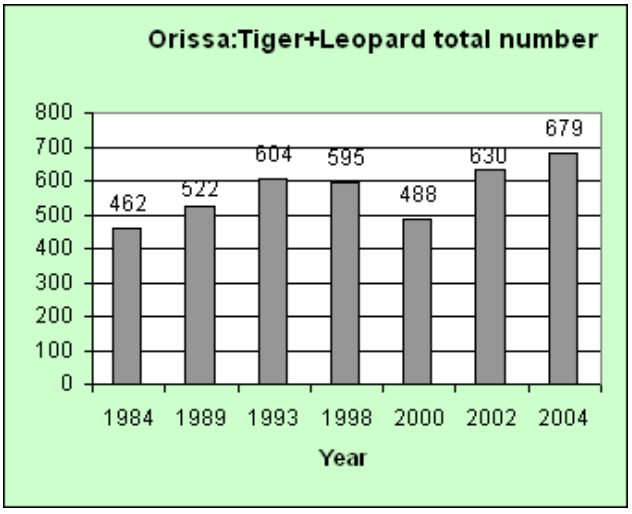
TOTAL POPULATION OF TIGER AND LEOPARD			
Year	**Tiger**	**Leopard**	Total
1984	202	260	462
1989	243	279	522
1993	226	378	604
1998	194	401	595
2000	166	322	488
2002	173	457	630
2004	192	487	679



Near water-holes only the front pugmarks may be available for interpretation.



'Fluctuating numbers' is an order of natural population dynamics. Some anthropogenic impacts could set irreversible trends!



Leopards take over places vacated by Tigers, can adapt to changing situations, and maintain the overall status of large carnivores in a habitat.

The success and results of Tiger enumeration using 'Pugmark Tracking' depend on good PIPs, availability of field details in Form-D, accuracy of pugmark tracings, quality of pugmark plaster cast, and the knowledge base of the 'data analyser' about Tiger biology and the terrain where census is conducted.

Table 5.3.
Trend of Tiger population
Similipal Tiger Reserve (US: unidentified sex)

Year	Male	Female	Cub	US	Total
1972				17	17
1975				30	30
1976				46	46
1977	23	29	4	0	56
1979	22	39	4	0	65
1984	31	43	7	0	81
1986	32	51	6	0	89
1989	21	51	21	0	93
1990	22	52	20	0	94
1991	24	50	22	0	96
1992	24	49	22	0	95
1993	24	49	22	0	95
1995	25	47	25	0	97
1997	26	48	24	0	98
1999	28	44	26	0	98
2000	29	39	29	2	99
2002	29	43	27	0	99
2004	28	42	31	0	101

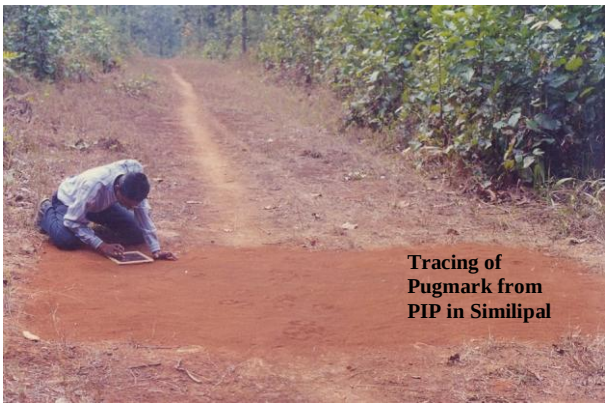

Tracing of Pugmark from PIP in Similipal

Table 5.4.
Trend of Leopard population in Similipal Tiger Reserve

Year	Male	Female	Cub	Total
1989	28	42	0	70
1990	34	50	12	96
1991	40	47	11	98
1992	33	54	12	99
1993	33	54	12	99
1995	37	47	16	100
1997	39	49	26	114
1999	32	59	24	115
2000	37	65	17	119
2002	44	62	20	126
2004	45	68	19	132

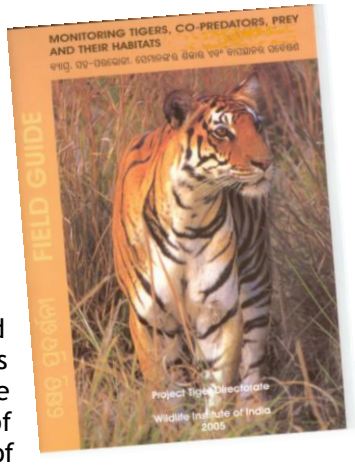
Advantages in Pugmark Tracking

Pugmark Tracking has been used over 32 years (1972-2004). It is time-tested and improved. Lot of research has been undertaken to standardise the technique. It is used in all Tiger-range countries. All staff can understand the technique, use it in the field and can make conclusions. Actual composition of population is known (Male–Female–Cub and their spatial relationship) in the result. Cub is linked to mother, and territory of female is linked to that of male territory. The traditional skill of people is used and preserved. It is economic. It is quick (PIP-laying 7days, data collection 6days, and analysis 2-3months).

Refinements to Pugmark tracking in 1990s in Similipal

Collection of data on surrounding habitat (Forms-A and D) and herbivores in Form-B.
Simplification for easy understanding
Clarity and Transparency
Participation of non-officials is from the state, country and even overseas.
Literature produced in English, Hindi and Oriya with international peer review.
A/V training material produced in Oriya.
Standardisation of season, census unit, route, PIPs
Distinguishing male and female
Distinguishing left pug from right
Distinguishing front pug from hind pug
Distinguishing pugs of Tiger cubs and adult Leopard
Territories of mother-cub; females-male are plotted on spatial distribution maps

NEW METHOD FOR TIGER MONITORING



In the year 2004-05, the Project Tiger authorities and the Wildlife Institute of India together devised a monitoring method. In this method, there were two approaches to collect field data. First, information on habitat conditions and different signs of Tiger evidences were to be collected, and second, by using camera traps Tiger photographs were to be obtained from all Tiger areas.

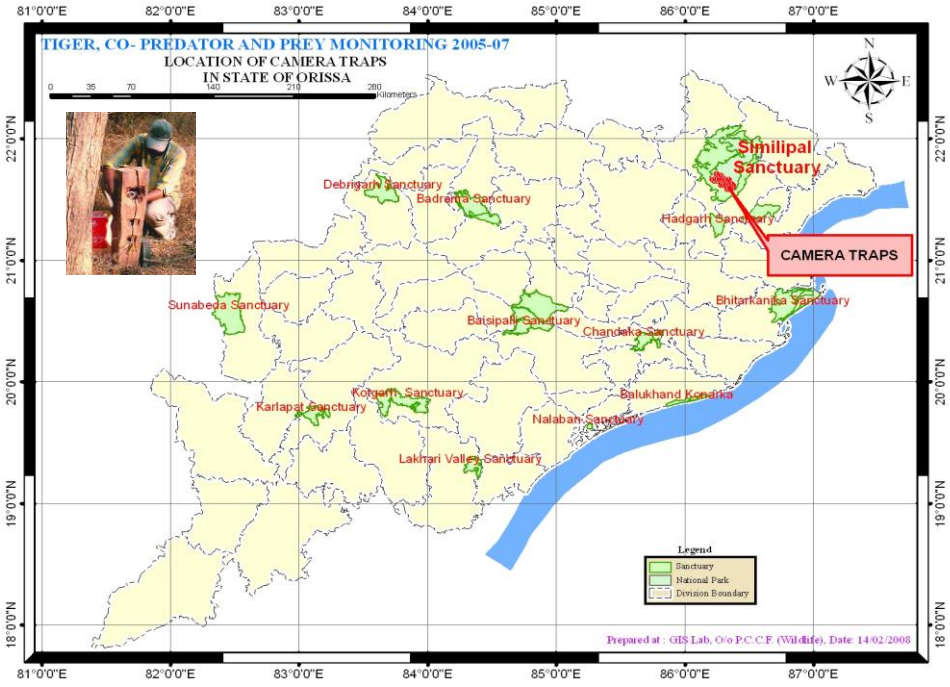
During **Phase-I** of the "New method" conducted during 18-25 January 2006, field data was collected from 3618 Beats of fifty forest/wildlife divisions and provided to Wildlife Institute of India. The field data contained geo-coordinates of all 3618 Beats and information in seven different types of Datasheets.

Datasheet-1 contained information on Tiger and Leopard sightings, livestock predation, and carnivore signs encountered on three different routes sampled on three consecutive days over a total distance of 15km. As per our review, inspite of inexperience of staff with the new method, per-km density of signs noticed was 11.6. A total of 1647 signs were collected over the three days.

The ratio of 'Tiger-sign:Leopard-sign' was 1:1.29. **Datasheet-2** contained information on sighting of herbivores on Line Transects. Each line transect was 2km long and wide enough to walk along and make observation of animals from a distance. **Datasheets 3A, 3B and 3C** were used to record and provide data, respectively, on vegetation, signs of human disturbance and ground cover from the line transects. Data on vegetation and human disturbance on line transects were recorded from 15m-radius plots at 400m intervals, and data on ground cover was recorded from 1m-radius plots at 400m intervals. **Datasheet-4** was used to record availability of herbivore faecal matters at 400m intervals on 20mx2m-plots, each running sidewise on the transect.

As per the methodology, **Phase-II** was analysis of remotely sensed data and maps of forest cover, forest type, land use, etc. in GIS domain. To help in analysis, 1:50,000 topographic maps showing Division-level administrative lay outs of all 3618 Beats were provided. WII has taken up the digitization work with the Survey of India.

In **Phase-III** of the method, Research Fellows from Wildlife Institute of India made sample studies in rapid appraisal mode in Similipal, Satkosia and Sunabeda areas of the state.



In **Phase-IV** of the Method, from 26th March 2007, four researchers from WII placed 15 pairs of Camera over an area of 114sq.km in the southern-most part

of Similipal for recording photographs of Tigers using those routes. Two types of cameras namely, Trailmaster and Deercam were used. Two separate Leopards and seven separate Tigers were photographed in the process. Six of the Tigers were photographed from an area of about 64sq.km in southern Similipal.

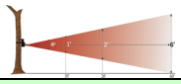
All the above work was coordinated and analysed by Scientists from WII. The data have been used to project the status of Tiger for the entire state.

Six zones have been created for analysis of data collected from all over the country. These zones are (1) Shivalik-Gangetic Landscape Complex, (2) the Central India Landscape, (3) Eastern Ghat, (4) Western Ghats Landscape Complex (5) North East Hills and Bramhaputra Flood Plains, and (6) Sunderbans (West Bengal).

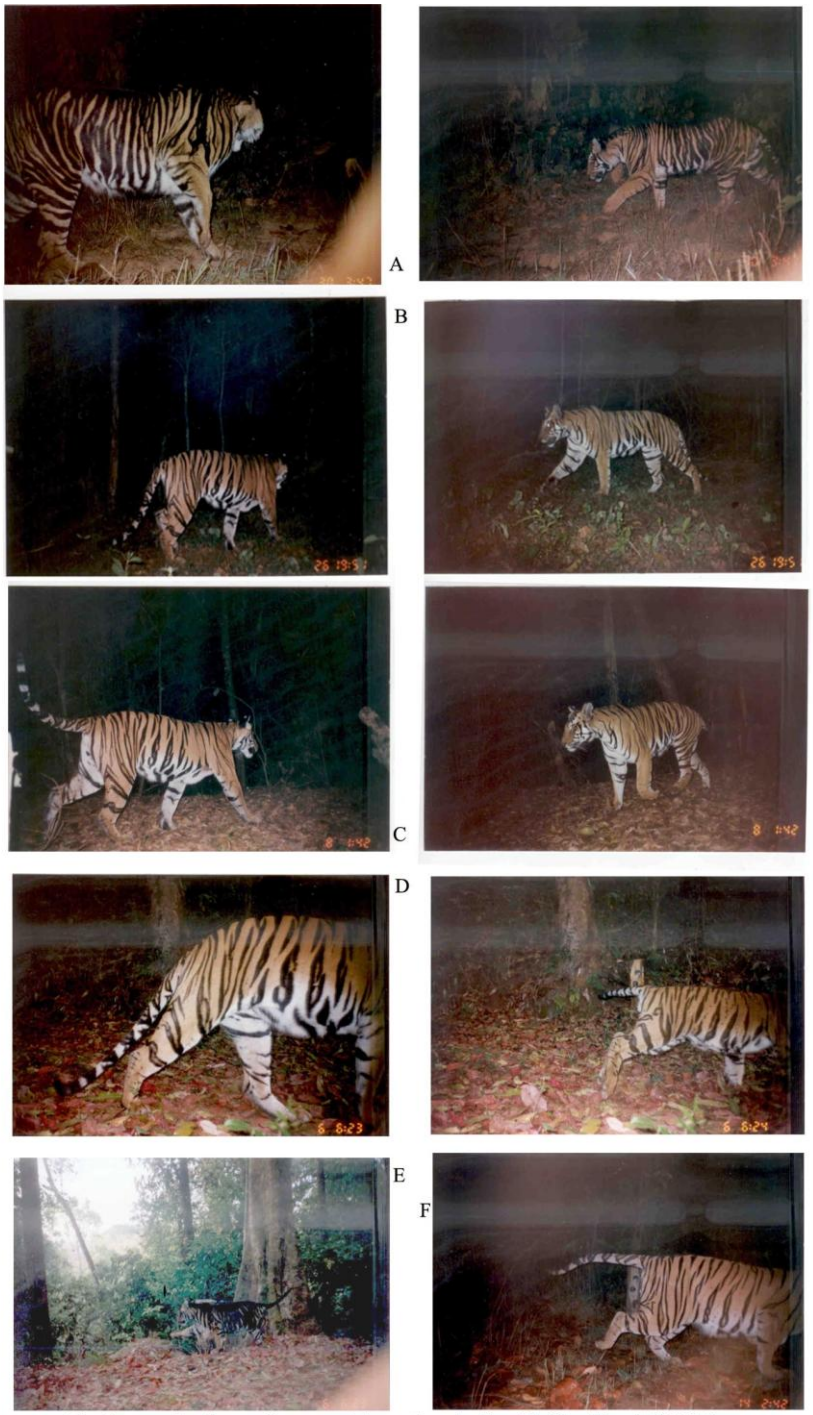
Orissa is included in the Central India Landscape with areas like Kanha, Pench, Satpura, Melghat, Palamau, Indravati, Bandhavgarh, Panna, Ranthamore, Kuno-Palpur, Tadoba and Simlipal.

According to the result that has been projected in the new method, the number of Tigers, excluding the cubs, in Orissa comes in the range of 37 to 53, and in Similipal 17 to 23. The break-ups given for different areas of Orissa are as follows.

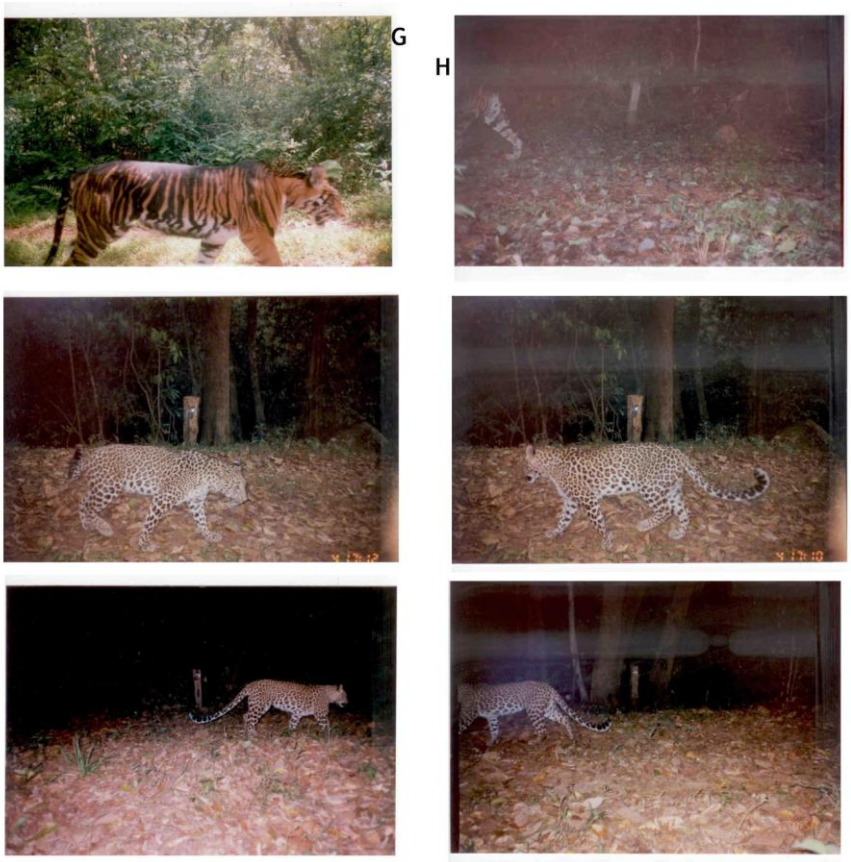
Table 5.6.
Results of Pugmark Census-2004 and
New Method of Tiger Monitoring-2006

	Pugmark-Tracking 2004	New Method 2006-08
Similipal	69	20 (17-23)
Satkoshia	15	6
Sunabeda	21	9
Sporadic occurrence	27	6
Orissa Total	132	45 (37-53)

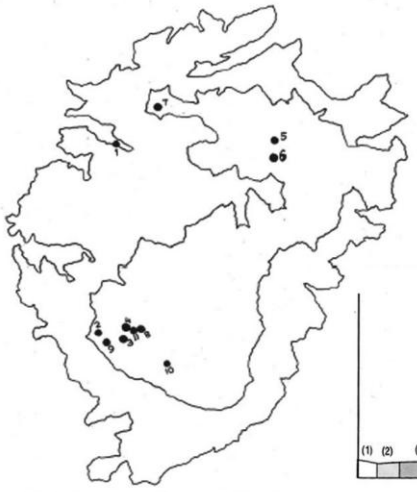
The analysis by which the projections were made for the entire state is not clear. The new method needs to be further tested in different kinds of habitats. However, the photographs captured in camera-trap showed the presence of melanistic Tigers, which substantiates postulations that were made on the basis of research carried out in Similipal on colour aberration in Tiger and detailed in the work “Born Black: The Melanistic Tiger in India” published in 1999 by WWF-India.



Photographs from Camera Trapping in South Similipal (2007)



Photographs from Camera Trapping in South Similipal (2007)



Sighting-locations of black and melanistic Tigers in Similipal as reported in "Born Black" (1999)

Range of body colour in Tiger: from stripeless white (1), white (2,3), shades on normal (6), melanistic (10) to and black (12). *From "Born Black" (1999)*