

A NOTE ON TIGER CENSUS TECHNIQUE

BASED ON PUGMARK TRACINGS

by H.S. Panwar

Introduction

The pugmarks of one individual tiger are distinguishable from those of the other. Even where the broad lay out of different pugmarks appears similar, distinctions can be inferred through a minute examination. To enable such comparative examination accurate tracings of the pugmarks are taken on a glass plate and later transferred to paper along with other data. When these tracings and the data are subjected to analytical comparison it is possible to identify precisely the individual tiger. This paper gives an account of the equipment, the tracing technique, and the method of analytical comparison of the tracings for identifying the individual tigers in a population as also in a methodology to work out a near accurate population figure in the surveyed area.

Equipment

Evolved by S.R Choudhary, the "*Tiger Tracer*" is an extremely simple device to make accurate tracings of the pugmarks. It comprises of a colourless rectangular glass plate, of size: 20 cm x 25cm x 3 mm. It has 4 holes near the corners and each of these carries a screw holding on to the plate by a nut and washer. Each screw has an additional fly nut.

A couple of rubber bands which can wrap round the plate, a free flowing pen (such as a fiber-micro-tip pen), some paper and a one metre steel tape, complete the assortment of the equipment.

The tracing technique:—Although the equipment is quite simple the rendering of accurate tracings is an exacting job and calls for a good understanding of the morphological characteristics of the paws of the tiger. One must look for the special features in the pugmark and trace them accurately. A lot of tracing practice and experience in analytical comparison, by and by, enables a field worker to visualise the intricate differences that distinguish the pugmarks of one tiger from others. Following are the points of special significance :

(a) *The gait of the tiger*:—Like other quadrupeds, in a normal walk, a tiger's hindpaw of one side is placed at the same place where the front paw of the same side had earlier rested. This results in a partial or complete super-imposition of the fore pugmark by the hind pugmark. When the animal is moving faster, the rear foot over-shoots the fore pugmark and in such an event it will be possible to see both the pugmarks. In all cases, however, the rear pugmarks can be seen intact and it is for this and another

important reason (described later), that only the hind pugmarks are considered for the census work. In case of super-imposed pugmarks, i.e., when the gait is normal, the stride of tiger is fairly constant and should invariably be measured and recorded on the tracing sheet itself in the field. This provides a good supporting evidence in making analytical comparisons.

(b) *The morphology of the paw*:—The front limbs of the predator are the chief means of attack on the prey. The forearms of the front limb are used in gripping and pulling down the prey and are accordingly built massively in both the sexes. The toes, claws and the pad are also accordingly stoutly built. The fore paw is therefore substantially bigger than the rear one in both the sexes and if a tracing of the pugmark is enclosed in a linear frame, such frame tends to be squarish in shape. However, if the tracings of the pugmarks of the hind paws are compared those of the male fit in a prominently squarish frame whereas those of the female in a relatively rectangular frame. Thus it is from the tracings of the rear pugmarks possible to determine the sex of an individual tiger. It is primarily for this important reason that the rear pugmarks are used in the tiger census work.

The paw is a supple organ and adjusts itself to the ground available for resting it. It can splay out and appear bigger on a slushy ground and look smaller and compact on a hard subsurface with a thin cover of dust or sand. Even in such situations, however, the characteristics of each pugmark remain unchanged and the difference, mainly in the size, can always be appreciated with reference to the habitat. On the other hand a small gravel or a small hole can cause the pugmark to twist or get splayed on one side. As far as possible, therefore, a perfectly normal rear pugmark should be selected for preparing the tracing. If no single pugmark is seen in perfect condition, the tracing should be made from the best one and this should be corrected in the field by placing the plate on one or two other pugmarks having those segments in good condition which were found distorted in the first one.

Only 4 of the toes get an imprint alongwith the pad in the pugmark. The fifth toe in the rear is well above the pad and does not touch the ground when walking. The retractile claws also do not come out at the time of walk and therefore leave no imprint, except sometimes when the tiger is walking on a slushy ground. The pad is broader at the base and narrows down at the top but retains a near flat edge at the top. Of the 4 toes that get imprinted, two lie above the

flat top edge of the pad and the remaining two lie one each alongside the two tapering sides a little lower than the middle toes. In the imprint, the upper edge of the pad leaves a straight line (or a near straight line) below the two middle toes whereas the tapering sides of the pad in the upper portion cave in a little near the extreme left and the extreme right toes. The lower part of the pad has large lobes on both sides. A third, much smaller lobe, lies in the middle part of the lower edge of the pad. The joints of these two side-lobes with the middle small lobe are in the form of conically tapering valleys that leave the mark of two conically tapering ridges with well defined tips in the bottom line of the pugmark. While tracing the pugmarks, it is very important to correctly trace the flat edge of the top of the pad, the shape of the lobes and the two conical tips. It is also important to correctly visualise the direction in which the two conical tips point. If the tracings incorporating these features are correctly made the different tracings of the pugmark of the same tiger walking on different soil types will remain still conducive to identifying that individual.

Precautions in tracing:—A well formed rear pugmark (either left or right) should be selected for tracing. The glass plate is placed above the pugmark and the fly nuts are so adjusted on the screws that the glass plate on pressing down comes close to the relief-edges of the pugmark but does not actually touch the edges. The Tracer should sit placing his knees on either side in such a way that he can bend over the plate and his eyes come vertically above it. The outlines

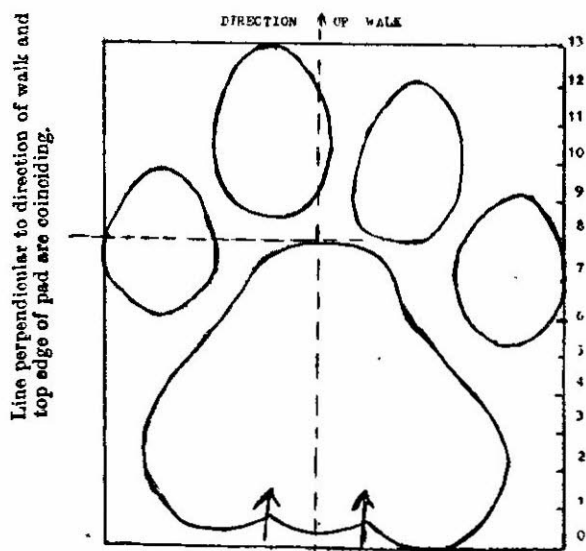
of the pugmark should then be traced with a free flowing pen taking care to avoid the parallax error by moving the eyes with the pen so as to keep always the line of sight vertically above the segment under tracing.

The tracings on the glass plate are easily transferred to a sheet of paper. The plate over-laid with the sheet of paper (held fast to the plate with the help of two rubber-bands at the top and bottom) is held against light and the tracing copied on the paper taking care to avoid the parallax error which can be material if the glass plate is thick.

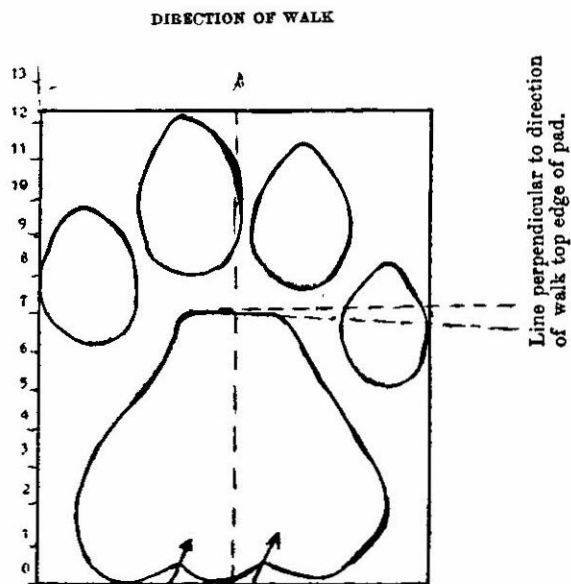
Caution with multiple tracks:—Tiger is an individualistic animal and associations between adults occur only in the courtship time. Bringing up and training the cubs is entirely the responsibility of the mother and therefore the mother-cub associations are quite usual. Normally the male is intolerant of the cubs but when the cubs are grown up enough and the female is again likely to court, the male may be accepted in the group. When movement occurs in such associations the pattern of tracks is confusing and extreme care should be exercised in identifying the rear pugmarks of the different individuals.

Caution with superimposed tracks:—When tracing a rear pugmark which is superimposed on a fore pugmark, the outer peripheries of the bigger fore pugmark can also be seen at the margin. In such cases careful examination is necessary to identify and trace the rear pugmark.

Distinction from Leopard Tracks:—It is difficult to distinguish a leopard pugmark from that of a young



Rt. Rr. male



Rt. Rr female

tiger cub. However, the largest leopard pugmark cannot be bigger than that of a 6 month old tiger cub. Confusion may arise while identifying the pugmarks of a young tiger cub below 6 months of age and that of a leopard. Here it is helpful to remember that such a young tiger cub will never move alone and will always be found to trail his/her mother. Small pugmarks unaccompanied by bigger pugmarks can therefore safely be presumed to belong to a leopard.

Information to be recorded on the tracing sheet in the field:—The following information should be recorded in the field on the tracing sheet soon after tracing.

1. Date of tracing.
2. *Location* should be described by specifying section of a road, foot—path, dry stream bed etc. so that approximate location of tracing point on a map may later be possible.
3. Direction of movement.
4. Surface requisites.
 - (a) *Soil type* such as sandy, loamy or clayey, etc.
 - (b) *Texture* fine, medium, coarse, gravel, etc.
 - (c) *Moisture level:* dry, moist, wet, slushy.
5. *Freshness of the pugmark:*—Estimate the time when the tiger may have walked (such as previous night, one day or two days old, etc.). This helps in establishing reliability of the quality of pugmarks and also in distinguishing or correlating apparently similar pugmarks traced the same day.

6. *Recording of deformity twist etc.:*—Some tigers may have an injury mark on the pad or one of its toes. Sometimes a toe or a part it may be missing altogether from one of the paws leaving a sure means of identification. Some tigers may have a twist in one of the paws and this will be clearly seen in the pugmarks. Some tiger may also walk with a slight inclination in the pugmark to the direction of walk and this is seen consistently in the pattern of pugmarks. All these peculiar features must be recorded.

The left and the right paws are the laterally inverted images of one another and it should not make any difference even if tracings are prepared from any one of these. However, it is such cases that abnormalities or deformities in a particular paw become relevant and hence it is advantageous to have the traces of only the left or right rear pugmarks. As already mentioned earlier the deformed or abnormal pugmarks will in all cases have to be traced whether front or rear, left or right.

7. *Stride:*—This should be measured and recorded whenever the gait is normal.

8. *Sexes:*—This should be identified and recorded from the shape of the pugmark as described

earlier.

9. The tracer should record his name and put his dated signatures.

Organisation of field work:—The work of tiger census should be carried out at such time of the year when there is highest probability of the tiger tracks being conveniently located. In winters tigers shun the dew and prefer to walk on the roads during the night. It may also be convenient in other areas to locate the pugmarks near water—holes during the night. It may also be convenient in other areas to locate the pugmarks near water—holes during the summer. This should best be decided by the local officials. It must be remembered that the higher the intensity of replications the greater is the reliability of results.

A suitable number of tracers who have an intimate knowledge of the area should be detailed early morning everyday allotting them a specified tract for survey for locating the tiger tracks. The trackers should be previously instructed to “preserve” the pugmarks. This can be done for example, on a road surface by cordoning off a small stretch of well defined pugmarks with boulders or sticks. Tracing work should be entrusted only to well trained and experienced hands having good mobility to reach different areas on receipt of information from the trackers.

The traces brought in should be carefully kept and even while the work is in progress, comparisons and correlations should be attempted. As the patterns of identification emerge it will be advantageous to plot the individual tigers and the dates on a large scale map.

Analysis

This is done mainly by comparing the tracings. The date on which and the area where tracings were made are good means of initial classification. The size of the pugmark (after accounting for the likely variation due to surface type), the length and the inclination (to the direction of walk) of the flat top edge of the pad, the shape of the lobes, the placing of the two conical tips in the bottom edge and the direction in which they point are the main features which are individualistic and are a good means of identification. The deformities, inclination and twists are of course very important in such analytical comparisons. After a week or so of intensive survey and tracing a consistent pattern of pugmarks with respect to different areas starts becoming apparent.

Conclusion

The method of tiger census based on tiger pugmark tracings can be fairly accurate but entails painstaking work in every step. From my own experience I can vouch for the reliability of this method.

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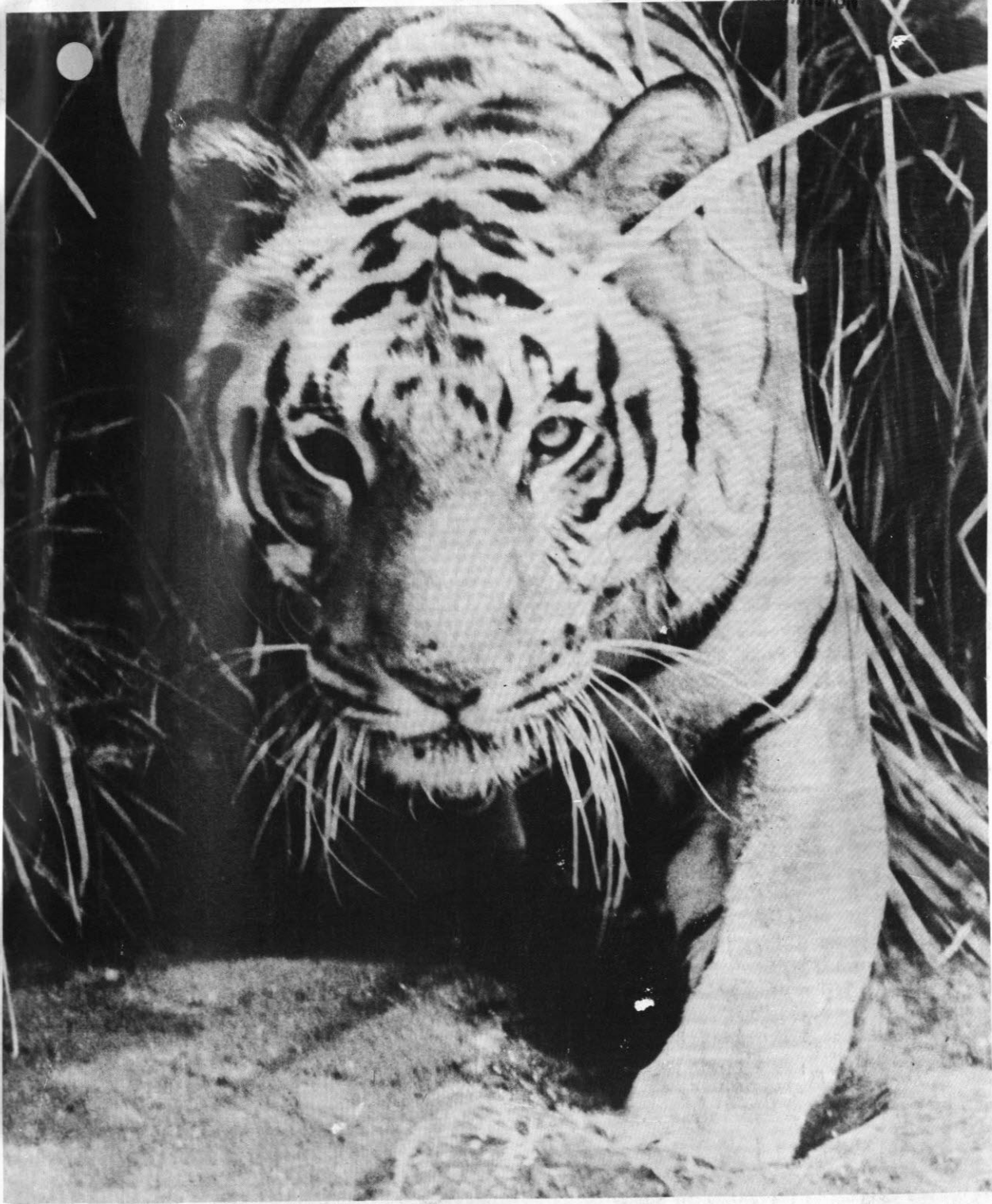
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