

2.1.a Kunene sampling method

A slight modification to the Smuts *et al.* (1970) mass capture method was developed by Philip Stander in the Kunene Region, Namibia, in an attempt to account for the constraints identified in the previous section. This modification attempts to reduce the expense and time constraint whilst increasing the accuracy of the estimate and incorporating a sampling element and therefore a measure of variance.

Apart from the inaccuracies and bias characteristic of any survey technique, lion population density and population structure is not static and will fluctuate. A good survey technique should be able to measure both survey bias and density fluctuations during the study period. The Kunene sampling method unfortunately does not yet measure survey bias (although several measures are in place to limit bias) but does give a measure of density variation. The method is explained in several steps.

First, a specific 'intensive study area' needs to be selected within the broader lion study area. The 'intensive study area' should be of manageable size and it is estimated that it should be at least similar to the average home range size of resident lions. It should also be representative of the broader study habitat and prey distribution, and have a good network of roads or good access by vehicle.

Second, all lions over the age of 18 months need to be captured and individually marked. It would be

Table 1:1. Worked example of density calculations.

DESCRIPTION OF CALCULATIONS	LION GROUP		
	A	B	C
Number of lions	4	2	7
Home range overlap with intensive study site	40%	60%	70%
Proportion of lion home range in study site	0.4	0.6	0.7
Proportion corrected for number of lions in group (this equals the calculated number of lions in the study area during the sample period)	1.6	1.2	4.9
Percentage of locations inside the study site	40%	60%	70%
Proportion of locations inside the study site	0.4	0.6	0.7
Proportion corrected for number of lions in group (this equals the calculated number of lions in the study area during the sample period)	1.6	1.2	4.9

advisable to radio-collar up to 80% of the adults and sub-adults. It is essential that all the lions that utilize the 'intensive study area' be marked and individually known. It might therefore be necessary to capture and mark lions that may spend little time in the 'intensive study area', and which generally live in a surrounding 'buffer area'.

Third, once all the lions have been marked the radio-collared they need to be located on a regular basis. It is essential that all the radio-collared lions be located on the same day to determine whether or not they are inside the 'intensive study area' and to determine the size and composition of each group.

Fourth, radio-tracking and location data can then be lumped into sample periods of one, two or three month duration, depending on the frequency of data collection. The home range size of each individual or group needs to be calculated using the Minimum Convex Polygon method for each time section. The density of lions for each sample period can be calculated by a) home range size as a percentage overlap with the 'intensive study area', or b) the percentage of locations in or outside the 'intensive study area'. The percentages then need to be corrected for the number of lions in the groups and converted to a proportion of lions inside the 'intensive study area'. The sum of these proportions from all the lions gives a precise measure of the number of lions in the study area for the sample period.

Fifth, if the period of assessing population density was, for example, 18 months and sample periods were divided into two-month sections, the researcher would have calculated nine separate (and partially independent) estimates of density. Using these estimates of density over separate time periods a mean density can be calculated, as well as a standard deviation, as a measure of the variation of density during the time period. In addition, 95% Confidence Limits give an indication of the precision of the mean density estimate. This scheme is illustrated in Figure 1:1 and Table 1:1.

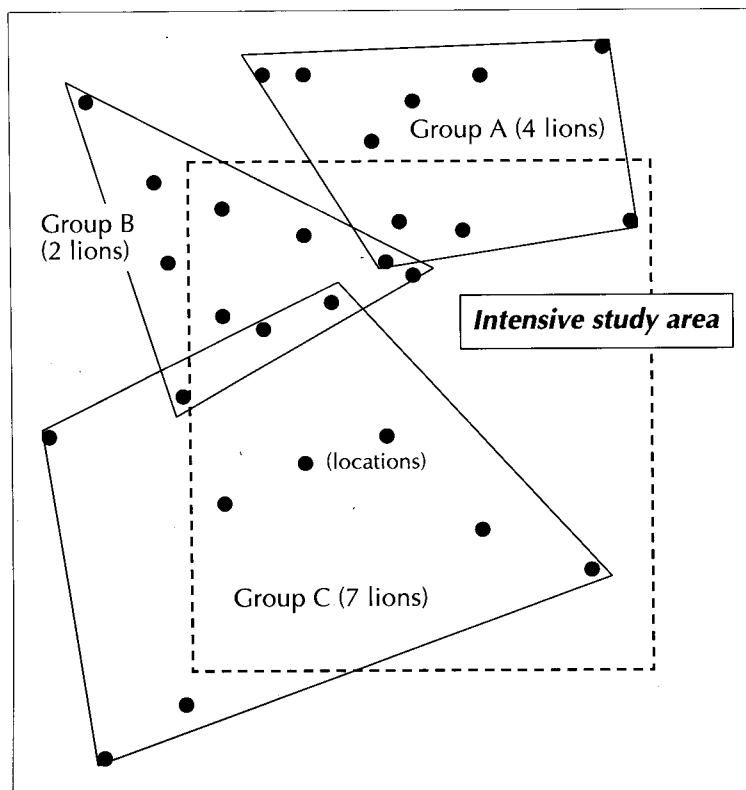


Figure 1:1. Schematic layout of calculating lion density using the Kunene sampling method.