Appendix 1

Analyses of annual range estimates

The number of locations required to accurately determine home range size has been frequently discussed but with inconsistent results (see Laver and Kelly 2008). Sampling frequency can severely influence estimates of space use patterns (Mills et al. 2006; Girard et al. 2002) and to accurately determine home range size it is important to consider both the number of locations and the sampling duration. For species with very large home ranges that typically takes many days or weeks to traverse and an increased duration of the study period can counteract a lower frequency of locations but a high frequency of locations may not counteract a minimum duration. Börger et al. (2006) suggest that following a greater number of individuals over a longer time span is preferable to increasing sampling frequency.

In order to determine how many months of data collections that was required to accurately estimating an annual wolf home ranges in our study area we used R (R Development Core Team 2011) and the R package adehabitatHR (Calenge 2006). We created individual ranges using 100% Minimum convex polygon starting with all data (i.e. 12 months) and then subsequently resampled the data by removing 1 random month at a time. We created up to 200 ranges per individual and number of months (1-11 months) using different combinations of monthly location data.

We used a subset of the data which included 34 individual wolf years, all with 12 months of data and a least 5 locations per month (minimum required for adehabitat to create a home range) after extreme outliers were removed. The number of locations ranged from 5 to 1264 per month and from 138 to 6470 for the whole year. The results were plotted for each individual using box plots (Fig. A1). We calculated mean home range size per set of months (1-11) separately for each individual wolf year. Based on these mean values we estimated the mean proportion of the complete annual range (12 months) by the number of months included in the range estimation. We decided that a cut-off of a 10 % maximum loss in range size for the majority of individuals (>25th quartile) was acceptable for estimating an annual home range. After plotting the proportion of decrease in range size from an annual range (see Fig. 2 in main paper), we estimated that a minimum of 9 months of data was required to adequately represent an annual range. Because the analyses were done on a dataset with a wide range in sampling frequency, expected variation dependent on the number of locations used were automatically included. We conclude that the duration of sampling is more important than sampling frequency for a reliable estimate of an annual home range (see also Börger et al. 2006).

References

Kie JG et al. (2010) The home-range concept: are traditional estimators still relevant with modern telemetry technology? Philosophical Transactions of the Royal Society B-Biological Sciences 365:2221-2231
**Fig. S1** Four examples, with different annual home range size, showing the decrease in range size when number of sampling month was reduced (Orig = 12 months of data). (The x-axis represent the number of months removed (1-11) i.e. $R_2 = 2$ months removed $= 10$ months of data. The values represent $\leq 200$ simulations of randomly selected ranges for different combinations of monthly location data. Note: The scales on the Y axis are not similar among the graphs.

The script is available on request (geir.rauset@slu.se).