THE CONSEQUENCES OF USING DIFFERENT ANALYSIS TECHNIQUES ON WILDLIFE STUDY DATA TO MODEL DISEASE TRANSMISSION

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The development of models of wildlife diseases is heavily dependent on the results and interpretation of wildlife ecological studies. Parameters, e.g., contact rates, animal movement, reproduction rates, and grid cell size, have to be derived from telemetry studies, den mapping, and hunting studies respectively[1, 2, 3]. Different analytical methods are available for examining the spatial and temporal pattern of animal behaviour, including the influence of human factors such as hunting. Therefore, wildlife ecological studies often produce a varying outcome due to the differences in the underlying theory[4].

Materials & Methods

For the first time, 31 red foxes (*Vulpes vulpes*) were monitored by telemetry from shortly after birth up to an age of one year[5]. Different radio tracking data analysis techniques, such as minimum convex polygons (MCP)[4], harmonic mean (HM)[4,] and kernel density estimation (KDE)[6], were used to estimate the size of the home range and the core areas preferred by the fox depending on its age. Bootstrap sampling was used to demonstrate the influence of the number of radio tracking fixes on the stability of home range sizes[4]. For estimation of the home range size using the minimum convex polygon technique we were able to develop an adjusting model[5]. 13602 radio fixes of foxes were recorded and analyzed using geographic information systems (ArcView 3.1, Spatial Analyst 1.1; ESRI, Redlands, USA). Vectorized data of lakes and streams, settlements, streets as well as land use data (topographical map; reference map scale 1:10,000) were utilized to describe the topography of the landscape.

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Results

Figure 1 shows an example for the increasing home range size of a fox depending on its age.

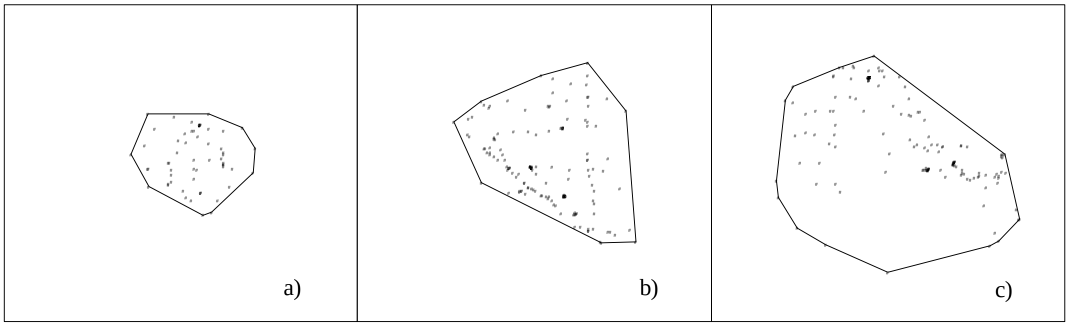

Fig. 1 Home range of a fox at an age of 3 months (a) (n = 65), 6 months (b) (n = 174) and 9 months (c) (n = 216)

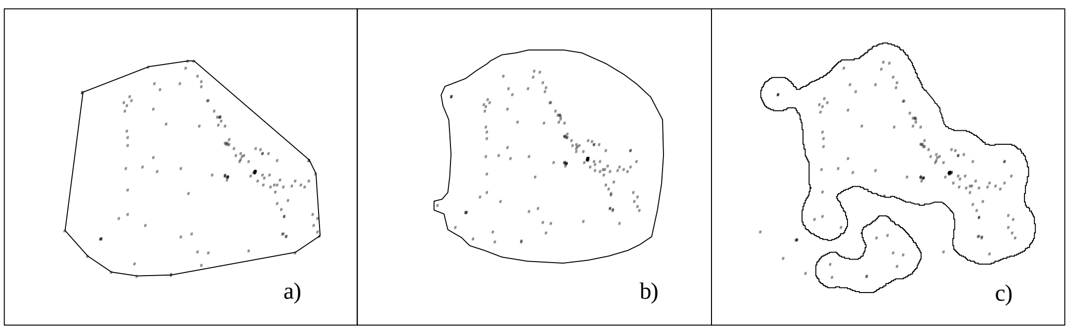

Fig. 2 A comparison of different home range analysis techniques using the same data set of an adult fox in one month (n = 154); (a) MCP, (b) HM 95% and (c) KDE 95% probability isopleth

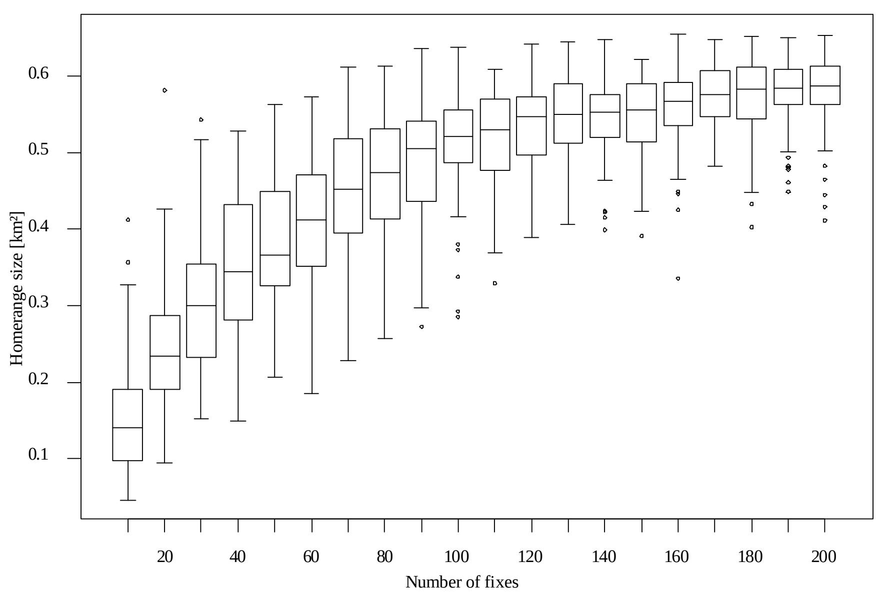

Fig. 3 Effect of the number of radio fixes on the estimate of the home range size of a sub-adult fox using the MCP method (n = 257; number of bootstrap replications = 100)

The analysis of the same radio tracking data sets, using methods cited in the literature, to determine the shape and size of a home range produce varying results due to the totally different underlying concepts of the algorithms (Fig. 2). Furthermore, the estimate of the home range size is heavily dependent on the number of radio fixes (Fig. 3), and it is necessary to determine by bootstrap sampling whether an asymptotic home range estimate has been reached. Habitat use and ranging behaviour of the foxes were also influenced by the seasonal and day-night changes of the home range pattern.

Discussion

The methods employed in this study show that parameters and model assumptions derived from literature or field studies should be carefully interpreted. For the same reasons, when comparing home range sizes, habitat use, and ranging behaviour from different studies, essential information such as age of the animal, analysis methods, number of radio fixes, and data on the season and time of radio tracking is necessary. The varying parameters resulting from different spatial and temporal analysis techniques may influence the results of simulation and ecological models, e.g., rabies and *Echinococcus multilocularis* infections of foxes. This may have a great influence on the model output and results.

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