**Understanding snow leopard distribution and their spatial ecology through Spatial Capture Recapture Analysis**

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Accurate estimates of ecological state variables such as population density provide key metrics for monitoring population changes over time in response to changes in environmental conditions or protection regimes. Changes in populations can be defined in terms of habitat use, abundance or distribution. One can define habitat use as a hierarchical process in terms of species distribution, home range placements within the distribution range, and space use within the home range. Snow leopards are known to have large home ranges, several hundreds km2 in size. They also have strong spatial preferences for certain habitats where patches of suitable can often be smaller than individual home range sizes. Density is often also strongly correlated with the habitat quality and with availability of prey, whereas individuals’ movements, and hence detection are associated with availability of markable sites or sites with critical resource such as water bodies.

We investigate the effect of environmental variables and protection regime on snow leopard populations in three sites with different regimes and somewhat different environments, using camera trap data. We present estimated density surfaces based on ecologically relevant covariates and investigate similarities and differences in how density depends on the covariates across the three sites. While we find differences in average density per site, our results indicate that density depends on ruggedness covariate in the same way across the sites irrespective of their protection regime. Differences in the average density of each site can be explained by differences in the amount of suitable habitat in each site.

As regards individuals’ habitat use, our best model included ‘compensatory heterogeneity’ (Efford and Mowat 2014) between range and intercept parameters of detection functions, suggesting that animals moving in larger ranges were less likely to be detected at their activity centres and vice-versa. Our results also suggest that animals with activity centres near water-bodies had smaller ranges and higher detection probabilities, but this relationship varied between the three regions. Similarly, traps in canyons were more likely to have detected snow leopards compared to those on ridgelines or steppe. Estimated snow leopard density ranged from nearly 0 to 5 per 100 km2, depending on location. Camera traps are often placed at locations where encounter rates are expected to be highest, and often not placed where they are expected to be low. This results in over-sampling of high density regions and positive bias in density and abundance if the spatial variation in density is not taken into account in analysis. Our results show that in the hierarchical order of habitat selection, availability of suitable habitat governs abundance of snow leopards, where they tend to be robust in their selection at the level of their activity ranges, but are more sensitive to differences at the level of space use within activity ranges.

Reference:

Efford, M.G. and Mowat, G. (2014) Compensatory heterogeneity in spatially explicit capture–recapture data. *Ecology* **95**: 1341–1348