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Data and R scripts to reproduce the analysis of the effect of changes in environmental periodicity on the meerkat (*Suricata suricatta*) population.

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File list

```
MeerkatsData.csv  
01_Meerkats_VitalRatesEstimation.R  
02_Meerkats_MPMs.R  
03_Meerkats_Simulations.R  
04_Meerkats_Results.R  
05_Meerkats_Elasticities_Mean_SD.R
```

Description

`MeerkatsData.csv` – This dataset contains individual capture-recapture data collected on a population of meerkats (*Suricata suricatta*) between 1997 and 2016 in the Kuruman River Reserve, South Africa. For each individual at each capture, the data contains information on the season (dry or rain) and year of capture. The year for captures at the beginning of the wet season in October corresponds to the year of capture + 1, to have a combination of a wet and dry season in each year. In addition, the data contains information on the life-history stage (stage; J = juvenile, S = subadult, H = helper, and D = dominant), whether the individual survived (surv; 1 if it survived, 0 if not), whether it became dominant (transition; 1 if it became dominant, 0 if not), whether it emigrated (emig; 1 if it emigrated from its groups, 0 if not), and the number of pups the individual had (pups). The dataset also contains information on population home range (home.range; in km²), and on population density (density; in number of individuals/km²) and its squared value (density2). This dataset is used to estimate vital rates in the meerkat population and assess the effect of changes in vital-rate seasonality on the meerkat population dynamics.

01_Meerkats_VitalRatesEstimation.R – This script uses the individual capture-recapture data on the meerkat population to estimate survival, transition, emigration, and recruitment rates. We estimated vital rates using binomial (for survival, transition, and emigration rates) and Poisson generalized linear mixed models (GLMMs; for the recruitment rate). We included season, density, and squared density as fixed effects and year as a random effect either on the intercept only or both on the intercept and the difference between seasons. We selected the best random effect by looking at the part of the variance explained by a year random effect on the intercept only compared to that on the intercept and the difference between seasons and to no random effect, using the *r.squaredGLMM* function of the *MuMIn* R package. We selected the best fixed effect using the AICc. We checked for over- and under-dispersion in the recruitment models and fitted a quasi-Poisson model to account for it. At the end of the script, vital rates are stored in a data frame and all models are saved as .RData objects.

02_Meerkats_MPMs.R – This script provides the *meerkats.buildmat* function to build seasonal matrix population models (MPMs) for the meerkat population, using vital rates estimated in 01_Meerkats_VitalRatesEstimation.R. The function takes the year, season, and density as arguments and returns the corresponding MPM.

03_Meerkats_Simulations.R – This script provides the *stoch.sim.meerkats* function to perform simulations under a control scenario (no changes in vital-rate periodicity), and scenarios of high (higher vital-rate seasonality) and low seasonality (lower vital-rate seasonality) in subadult, helper, and dominant survival, helper emigration, transition from helper to dominant, and helper and dominant recruitment. The function takes the number of simulations (nsimul; default is 500), the number of years in each simulation (nyears; default is 100), the number of seasons (nseas, default is 2), the initial population vector (n0), the initial population density (dens0), the vital rate model for which to perturb seasonality (vr.model), the seasonal threshold (seas.threshold; default is 0.5, meaning half of the years for a given vital rate will be considered highly seasonal and the other half little seasonal), the density scenario (density; TRUE if density dependence should be taken into account, FALSE if simulations should be performed at average population density), and the seasonality scenario (seasonality; default is “control”, takes also “high” and “low”). The function returns a list of annual growth rates for each simulation, a vector containing a 1 if the simulation led to population quasi-extinction, and a list of yearly population densities for each simulation. The rest of the code performs all the simulations used in the manuscript and saves the results as a .RData object.

04_Meerkats_Results.R – This script processes the results of the vital-rate seasonality perturbation simulations for the meerkat population. It computes and plots the mean stochastic log lambda, variance across 100 log lambda, and quasi-extinction probability in each scenario across 500 simulations. The results are saved as a .csv file.

05_Meerkats_Elasticities_Mean_SD.R – This script computes and plots the elasticities of the population growth rate to changes in the mean and standard deviation of each vital rate in each season. In addition, for each vital-rate category (survival, transition, emigration, and reproduction), the script computes and plots the relative effect of variability.

This metric enables to evaluate the proportion of the stochastic elasticity E^S attributed to changes in the variability of a given vital rate category. The results are stored as `.csv` files.