Intro

The *Eidolon helvum* colony in Ghana has been well studied, both in terms of bat demography and in terms of hunting pressure. Previous studies have shown that mortality risk is constant across age categories (Hayman) and that hunting pressure could be deemed high across the country (Kamins), though specific hunting pressure at the colony that data were collected from was low (Hayman pers obs, Kamins). However, the high degree of connectivity shown through telemetry (Hayman) and inferred through population genetics demonstrating sub-Saharan continental populations are panmictic (Peel) suggest that risk may be constant across the continent due to connectivity. If hunting pressures differed and localized movement were lower than predicted by genetic data, in some parts of the continent we may expect to see differing demographic structures. Therefore, we wished to test two alternative hypotheses relating to hunting pressure and demography. Firstly that different levels of hunting pressure might lead to different host demographic structure due to local effects, or alternatively that population connectivity might lead to constant risk across age classes, despite locally differing age classes. To do this we analyze age class data obtained from tooth cementum annuli…blah blah… from different locations (…).

Methods

Hayman et al. for a full description. Briefly, to estimate annual survival probability from age frequencies, and to test whether there was evidence for variation in survival probability with age we fitted life table models to age frequency data derived from tooth cementum annuli data, assuming a stationary age structure. As we did with the data from the Ghanaian colony, we tested four candidate models based on competing risks models proposed by Siler (1979). This approach assumes a constant baseline mortality risk operating throughout life and considers two additional factors, maturation (decreasing risk in early life) and senescence (increasing risk in later life). Annual probability of survival at age *x* under constant baseline risk is given by:



and maturation and senescence elements are defined respectively by:



where *a* is the initial hazard for each element, *b* is the rate at which hazard decreases or increases with age during maturation or senescence respectively, and *x* denotes age in years. Subscripts 1-3 denote respectively maturing, constant and senescing elements. Overall survivorship is then given by the product of desired components, such that the four models tested were constant risk (*lx* = *lx,2*), maturing risk (*lx* = *lx,1 lx,2*), senescing risk (*lx* = *lx,2 lx,3*), and both maturing and senescing risks (*lx* = *lx,1 lx,2 lx,3*). In contrast to our previous work (Hayman), because we had small sample sizes in some samples, we chose to fit these four non-linear models within a Bayesian framework. We used a normal error structure with ‘uninformative’ (flat) priors (see supplementary data). We chose normal distribution priors for the model parameters, except a, the scalar (which represents the initial numbers at birth) from which we sampled from a uniform prior >0. Thus our full model was:

Where:

Results

We found that overall the best fitting models had constant risk (Table X), or when other models had a better DIC score, the effect of the improved fit and additional parameters did not lead to any models that suggest risk was substantially different from constant throughout life. When other risk structure models, e.g. maturing risk (*lx* = *lx,1 lx,2*) or senescing risk (*lx* = *lx,2 lx,3*) had a better (i.e. smaller) DIC (Table X), the effect on survival across ages was minimal (Figures X, Y and Z).

Blah blah…

DIC table

Figures

Discussion

Compare DIC, even though in X cases DIC suggests another model fits better, the effect is marginal (see figures X). Thus, we conclude that constant mortality risk is likely true across all populations.

Explanation of the constant risk: Likely population connectivity spreads risk, but equally non-targeted hunting may account for this.