

Global Trends in Mammalian Reproductive Ability: A Cross-Species Study of Sperm Abnormalities over Time

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INTRODUCTION

- Abnormalities in reproductive traits could lead to difficulties in successful reproduction, preventing animal populations from growing.
- Despite the fundamental importance of reproductive health, however, little is known about how reproductive traits are changing over the years, let alone across a wide-range of species.
- Although past studies have indicated potential declines in sperm quality of horses and humans, the generality of these declines is unknown (Harris et al., 2023; Levine et al., 2017).
- Our over-arching aim was to characterize global trends in mammalian reproductive health over time.

OBJECTIVES AND METHODS

Objective 1: Assess the current state of data availability regarding sperm quality in mammals.

- Conducted a literature review for peer-reviewed journal articles with the search: "scientific name" OR "common name" OR "alternative names" AND Sperm* OR Semen* OR Reproduct* OR Semin* OR Ejaculat* AND Normal OR Abnormal OR Motil*
- Resulted in 277 semi-randomly selected mammalian species searched with papers ranging from 1977 – 2024.

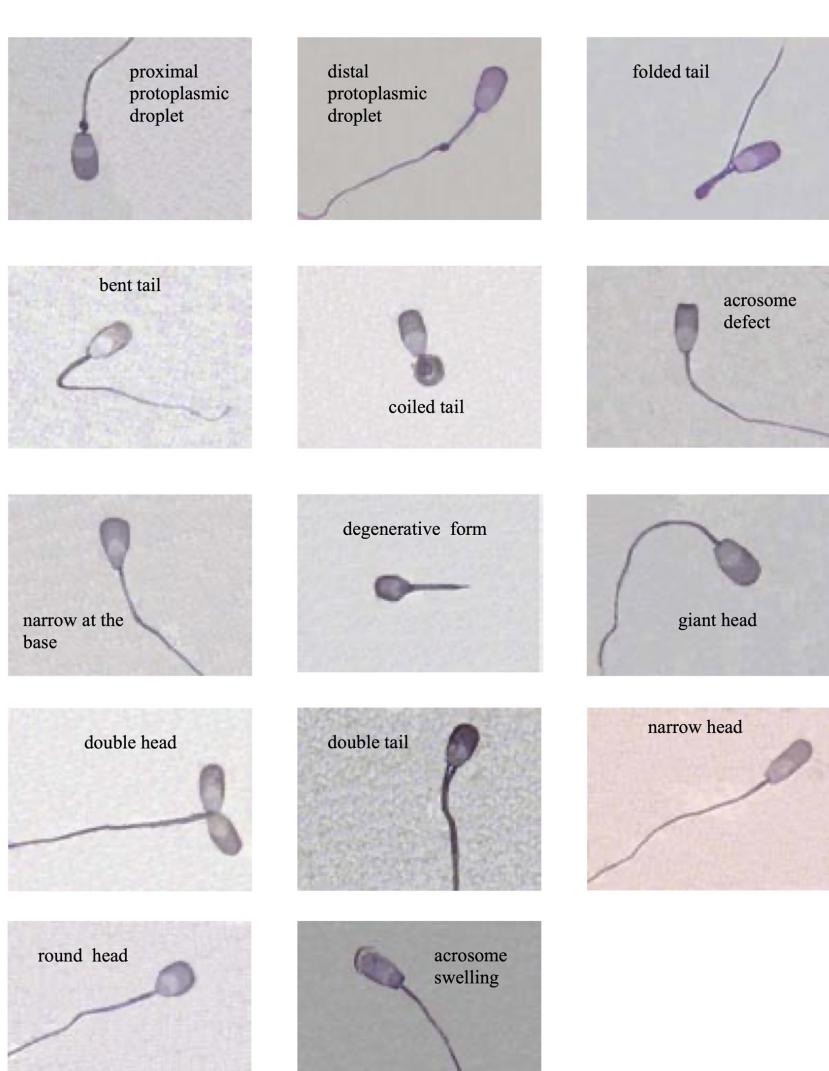
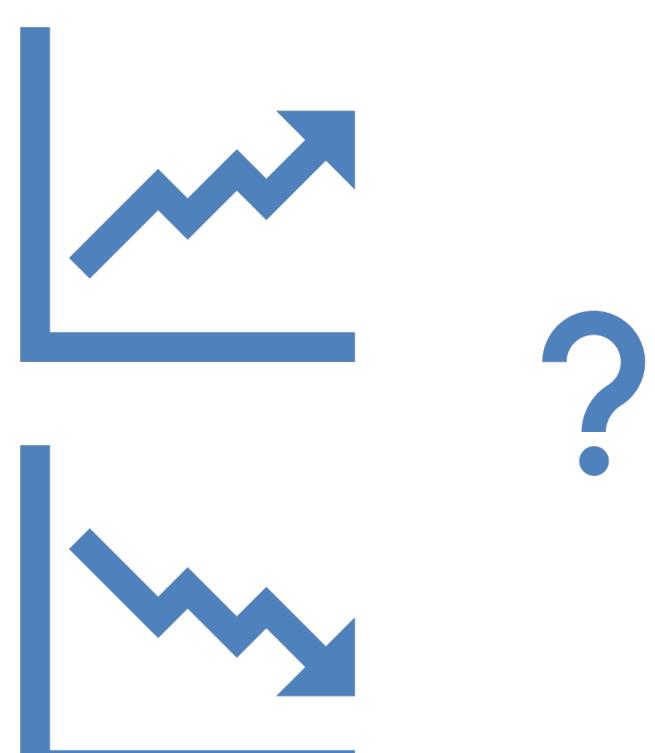


Fig 1. Example sperm abnormalities in boar semen (Cefovsky et al., 2005), CC BY-NC 4.0 DEED

Objective 2: Identify overall trends in sperm quality over time.

- Collected proportion measurements of six different sperm morphology traits
- Fit phylogenetically controlled generalized linear models (GLMs) to estimate how these proportions may be changing over time.

Objective 3: Compare effect sizes across different taxa.



- Conducted a phylogenetic analysis to compare the degree of change in the proportion of normal sperm across various groups of species.
- Identification of which taxa are experiencing harsher changes than others can aid in shaping the scopes of future conservation plans.

RESULTS

There is an overall decline in proportion of normal sperm in samples over the years. Some sperm quality traits improved, while others impaired.

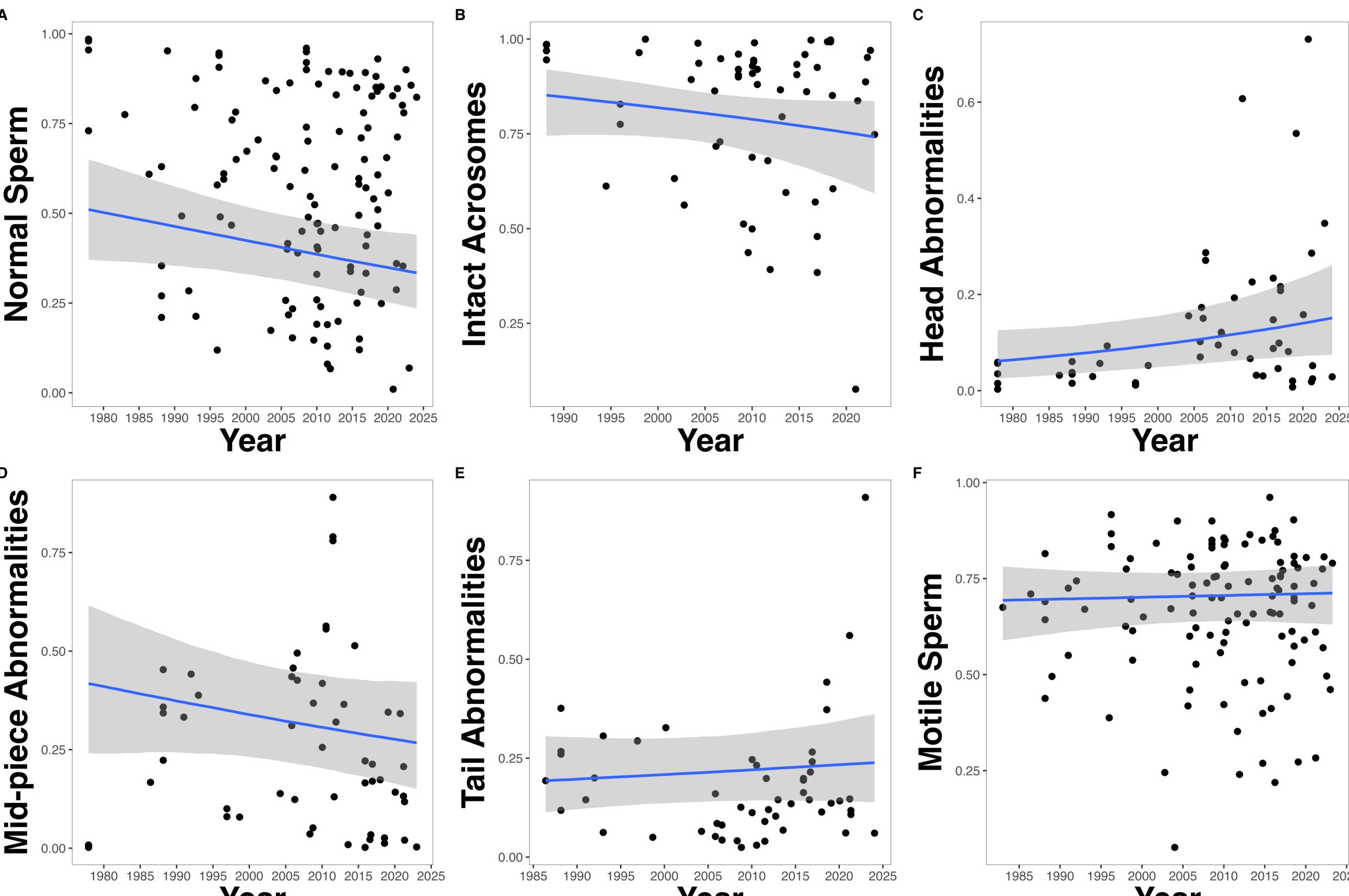


Fig 2. Prediction plots derived from beta GLMs illustrating overall trends in spermatic trait proportions over time (maximum n=119 for 63 species in normal sperm). The publish date of the papers were used as an estimate of data collection date.

The change in proportion of normal sperm per year varied across taxa, with both increases and decreases. Many taxa are also missing data.

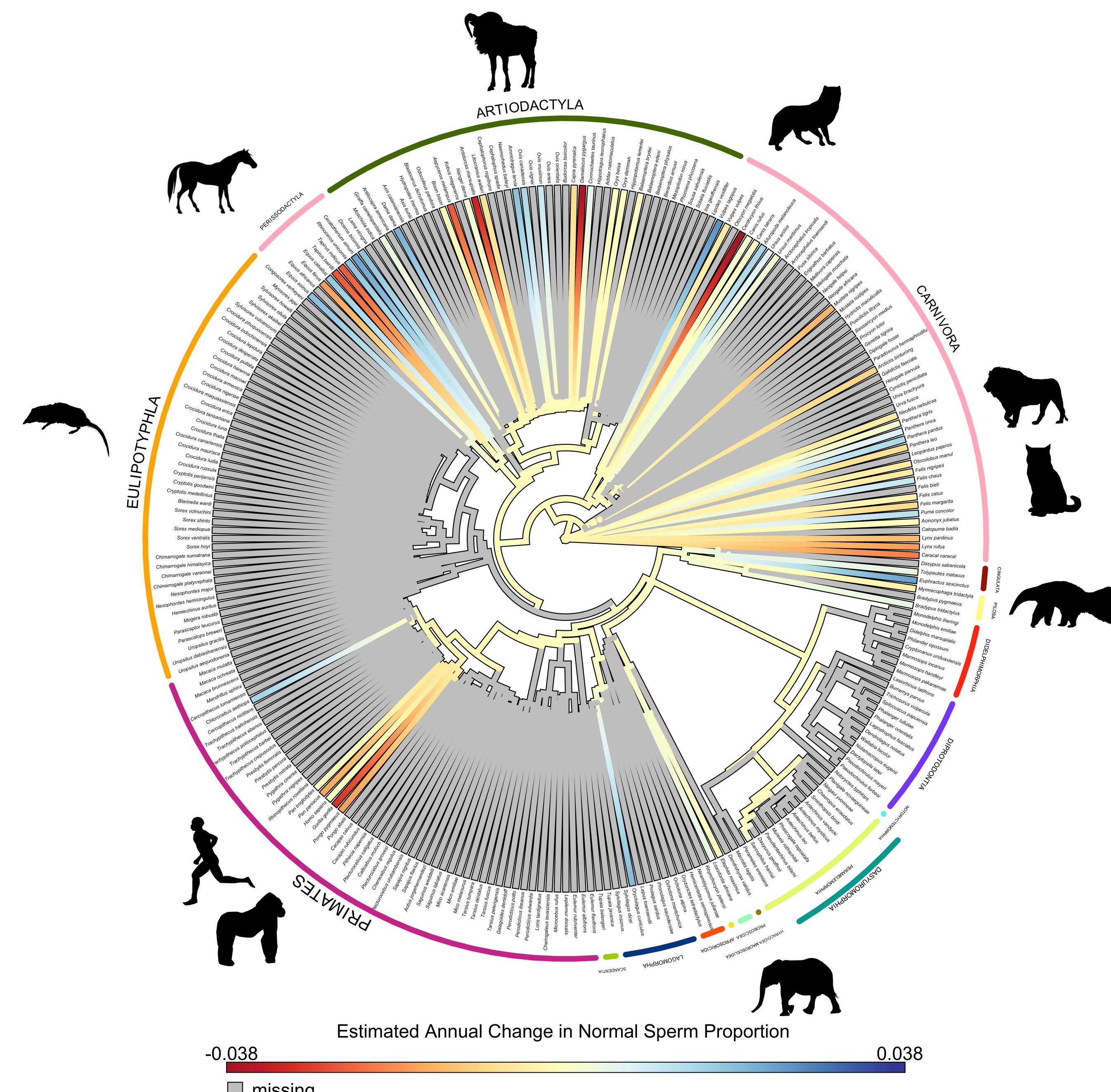


Fig 3. Phylogenetic tree of all 277 species involved in the literature review. Colored branches indicate the estimated annual change in normal sperm proportion. Grey branches indicate species with missing data. Exterior arcs indicate locations of phylogenetic orders.

CONCLUSION AND FUTURE WORK

Current Work

- There seems to be an overall decline in mammalian reproductive health over the years.
- However, due to the lack of data and small sample sizes within species, the estimates of the extent of decline may not be reliable.
- Since we are only looking at the change in reproductive traits, we cannot comment on which species had a flat slope, but low proportions of normal sperm to begin with (such as the cheetah).

Future Work

- Expand dataset to include more species, and more samples per species.
- Identify potential mechanisms behind the variation in effect sizes across taxa.
- Rethink approaches to conservation planning with reproductive conditions given the available information.

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DATA AVAILABILITY

The full dataset as well as R code used for analysis is openly available on GitHub.

Scan the QR code to visit the study repository



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