

This short paper presents a concise analysis documenting a consistency in over-winter change in mass of male roe deer relative to females, with magnitude apparently modulated by winter severity from one study area to the next. The analysis is appropriate and uses an impressive dataset. I only have a few comments for the authors to consider, which could result in a major revision or even possibly a recasting of the paper (if the second comment is followed-up on).

- 1) As we are talking about a trait that is likely under sexual selection, I am curious about the adult (if not operational) sex ratio in each of the populations (averaged among years?) and whether study-area specific differences existed, that could also account for the observed results. Adult sex ratios can vary for many reasons, including selective harvesting and with increasing density, if males suffer more than females from overcrowding (e.g., Clutton-Brock et al. 1997. Density-related changes in sexual selection red deer. *Proc. R. Soc. Lond. B* 264: 1509-1516). Right now, the paper is built around winter severity as the driving explanation at a macro-ecological scale, but the analysis does not directly incorporate any of environmental variables except as a study-area factor in the discussion. This raises some questions about the study areas, e.g., does the sensitivity of over-winter change in mass of roe deer depend on the sex ratio at breeding more or less than the winter severity measure, or is there an interaction that could be informative? We are talking about a sexually selected trait that should be subject to selective pressure exerted by the sex ratio. It is possible that these data do not exist, but I would suspect adult sex ratio would factor into the results somewhere.
- 2) It also possible that natural selection for heavier-bodied animals in colder climates is perhaps an important factor to consider, noting the heaviest males (25 kg and higher) are only found in the populations with a January temp less than 4 degrees. I bring this up because, for the Swedish populations, it becomes harder to argue that body size is a sexually selected trait, as both males and females are large to begin with and sexual size dimorphism is weakest anywhere on the timeline from January 1 through March 21st. When I look at Fig. 1, what stands out for me (if I were to formulate a hypothesis from reading the paper) is that body size appears to be a strong intrasexually selected trait, leading to sexual dimorphism, but only where the climate allows; and is overshadowed by natural selection for large body size (both sexes) at higher latitudes (which thus weakens dimorphism). In the north, the changes in body mass become a seasonal phenomenon divorced from sexual selection; but in the south there is something else going on.

Try this...sort Fig. 1 top to bottom from warmest to coldest January: Chizé-Aurignac VCG-Trois-Fontaines-Bogesund-Grimsö. The gradual change in slopes is interesting (TF is the transition area), and what looks like a sexual-size dimorphism story in response to intrasexual selection among males is replaced by lack of sexual-size dimorphism and a story of natural selection for body size in colder climates. I suspect that in a larger statistical framework study area or winter severity would stand out as a slope-influencing variable that can be quantified.

Reduction in the strength of sexually selected body-size related traits and the antlers that go along with them is corroborated by the smaller antler sizes in Bogesund noted during the period of data collection (Vanpé et al., the *Am Nat* paper), if I recall this paper correctly. This all

reminds me of horses, where due to their social system and length of breeding season, maintaining anything but a little sexual dimorphism becomes a losing game for males, and so intrasexual selection involves behaviour, intimidation, and weapons that must be yielded with agility (hoof kicks, tusks to bite ankles), not body size contests paired with big horns or antlers.

Other minor comments:

Abstract: In “most” polygynous vertebrates...not all polygynous vertebrates show this, even among large mammals (e.g., zebras, horses, notwithstanding canines).

Also remove the word “the” in front of secondary, first sentence.

This is a very tight paper, and I have no other comments.

--End.