Nonlinear modelling of rodent population cycles: constrasting the roles of direct vs. delayed density dependence

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Abstract: Population cycles in voles and lemmings are often thought to require one-year delayed density-dependence of the annual population growth rate (Lambin et al. 2006), with specialist predators causing crashes. Re-analysing controversial data from French common voles, and replacing popular log-linear autoregressive models with non-linear ones, we show that direct density-dependence (DD) is less stabilising than previously thought, and that delayed DD can have a different role than suggested by the classic theory (Turchin 2003). Sum of squares and leave-one-out cross-validation (Turchin 2003) are used to rank models, with our best models including cycle phase. We highlight the importance of good practice in communicating results (e.g., what exact timescales are considered to define density-dependence of the population growth rate?), and conclude that the observed population cycles in France are in-between what Turchin (2003) calls first- and second-order cycles.

References

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