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How seasonality, behavior and climate affect predator-prey cycles

Predator-prey interactions can generate cyclic population dynamics in temporally constant environments. Seasonal environmental variation can affect such cycles via organisms' behavioral adaptation to external constraints. Seasonal forcing is particularly strong in northern climates, and northern latitudes are also predicted to experience more significant climatic change than any other area on the globe. How these ecosystems respond to the expected changes is of central importance to our management of these areas. Previous modelling work on this topic has limited descriptions of seasonal forcing to a sinusoidal variation in parameters. We argue that some organisms display a more fundamental mechanistic shift in behaviour from one season to another, and that a different model structure is needed to explore the resulting dynamic regime shifts. We show how seasonal forcing and climate change impact the dynamics of these populations in a simple two-season environment.