

# Heterogeneity in behaviour and movement can influence the stability of predator-prey periodic travelling waves

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Cyclic predator-prey systems are often observed in nature. In a spatial setting these can manifest as periodic traveling waves (PTW). Environmental change and direct human activity are known to, among other effects, increase the heterogeneity of the physical environment which prey and predator inhabit. Aiming to understand the effects of heterogeneity on predator-prey PTWs we consider a one-dimensional infinite landscape Rosenzweig-MacArthur reaction-diffusion model, with alternating patch types and study the PTWs in this system. Applying the method of homogenisation we show how heterogeneity can both stabilise and destabilise PTW solutions. We illustrate how the effects of heterogeneity can be understood and interpreted using Turchin's concept of residence index (encapsulating diffusion rate and patch preference). In particular, our results show that prey heterogeneity acts to modulate the effects of predator heterogeneity, by this we mean that as prey increasingly spend more time in one patch type over another the stability of the PTWs becomes more sensitive to heterogeneity in predator movement.