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# Decision-making on space use negates dilution effect on vigilance

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## Abstract

Common responses to predation are grouping, increased vigilance and shifts in space-use. Most models of predator-prey interactions focus on the link between grouping and vigilance while it is known that these responses also interact with space-use. In addition, in groups, decisions about space-use may be more or less shared across group members. We integrated these different aspects in a model of prey foraging under predation risk. Prey are allowed to use vigilance and space use to deal with the trade off between predation and starvation risk. We obtained optimal prey behaviour for single individuals or, to account for the possible influence of dilution, individuals of a group having a despotic leader. We found that, in contrast with non-spatialised models, vigilance is not always lower in groups than in single individuals. This happened because individuals benefiting from dilution sometimes choose to spend more time in risky patches. Moreover, within a group, an individual following a despotic leader may sometimes have a reduced vigilance, but this is caused by the need to maintain a higher condition to cope with uncertainty in future space-use, rather than a benefit from dilution. This suggests that the studies of anti-predator behaviour need to better bring together vigilance and space use, accounting for decision-making processes occurring within groups.

**Keywords:** predator prey interactions, optimal foraging, predation risk, decision making, space use, vigilance, dilution, leadership

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