

Reproductive behaviour and population viability: An example using sexual cannibals

Adam Fisher ^{*1}, Stephen Cornell ¹, Gregory Holwell ², Thomas Price ¹

¹ University of Liverpool

² University of Auckland

Eligible for student prize

Although behaviours are selected for, owing to the fitness advantages they provide individuals, they may affect how robust a population is to negative environmental processes. Sexual cannibalism is an extreme mating behaviour which typically involves a male being devoured by the female immediately before, during or after copulation. Sexual cannibalism is common amongst predatory invertebrates and has been most thoroughly studied in mantids and spiders. Although the individual-level effects of sexual cannibalism are reasonably well understood, very little work has been carried out to investigate the population-level effects of sexual cannibalism. We constructed both a mathematical model and an individual-based model to predict how sexual cannibalism might affect population growth rate and extinction risk. We found that in the absence of any cannibalism-derived fecundity benefit, sexual cannibalism is always detrimental to population growth rate and leads to a higher population extinction risk. Increasing the fecundity benefits of sexual cannibalism leads to a consistently higher population growth rate and lower extinction risk. However, even if cannibalism-derived fecundity benefits are large, very high rates of sexual cannibalism (>70%) can still drive the population to extinction. Pre-copulatory cannibalism was particularly damaging for population viability and was the main predictor of population extinction risk. Surprisingly, post-copulatory cannibalism had a largely positive effect on population growth rate when fecundity benefits were present and in some cases lowered population extinction risk. This study is the first to formally estimate the population-level effects of sexual cannibalism. We highlight the detrimental effect sexual cannibalism may have on population viability if a) cannibalism rates become high, and/or b) cannibalism-derived fecundity benefits become low.

