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Local spatio-temporal resource variations can strongly influence the population dynamics of small mammals. This is particularly true on islands which are bottom-up driven systems, lacking higher order predators and with high variability in resource subsidies. The influence of resource fluctuations on animal survival may be mediated by individual movement among habitat patches, but simultaneously analysing survival, resource availability and habitat selection requires sophisticated analytical methods. We use a Bayesian multi-state capture–recapture model to estimate survival and movement probabilities of non-native black rats (*Rattus rattus*) across three habitats seasonally varying in resource availability. We find that survival varies most strongly with temporal rainfall patterns, overwhelming minor spatial variation among habitats. Surprisingly for a generalist forager, movement between habitats was rare, suggesting individuals do not opportunistically respond to spatial resource subsidy variations. Climate is probably the main driver of rodent population dynamics on islands, and even substantial habitat and seasonal spatial subsidies are overwhelmed in magnitude by predictable annual patterns in resource pulses. Marked variation in survival and capture has important implications for the timing of rat control.

**Keywords:** bottom-up, capture–recapture, Mediterranean, rainfall, *Rattus rattus*, survival.