Modeling source and sink dynamics in the spread and subsequent eradication of an invasive non-native species

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Abstract: We investigate the role of source and sink dynamics in the spread and successful eradication of an invasive non-native population in heterogeneous landscape. Relatively few case studies exist with temporal and spatial data of non-native species distribution during spread and establishment as well as their decline by control. We use a 50 year time-series of ruddy duck (*Oxyura jamaicensis*) abundance in the UK to determine key site characteristics in the establishment phase and make inferences about the role of particular sites in the species spread. Population growth at some sites had a lag-phase, we use broken-stick regression models to determine how the length and duration of the lag phase correlate with site characteristics. We investigate how the spatial distribution of duck densities at sites changes through time and hypothesese which sites may act as source populations. Across the same landscape we analyse site level changes in bird numbers in response to a national control programme where ruddy duck numbers were reduced by 95% over 5 years. We model the spatial and temporal dynamics of ruddy duck distribution and cull regimes using bayesian regression models to test for spatially variable effects. We demonstrate that different sites may contribute to the national population as sinks or sources and these roles may differ from the establishment phase. We seek to determine where generalities may be derived from the eradication process, which could in turn inform policy decision making, in particular where to apply control effort to a spatially heterogeneous population.
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