Turning back the tide of American mink invasion at unprecedented scales in partnership with communities

Lambin, X., Atkinson, S., Bryce, R., Davies, L., Gray, H., Oliver, M.K, Urquhart, J.
School of Biological Sciences, University of Aberdeen, Zoology Building, Tllydrone Avenue, AB24 2TZ, Scotland, UK, x.lambin@abdn.ac.uk

DOI: 10.5073/jka.2011.432.008

Abstract

Successful eradications of harmful invasive species have been mostly confined to islands while control programs in mainland areas remain small, uncoordinated and vulnerable to recolonisation. We took an adaptive approach to achieve large scale eradication of invasive American mink in a mainland area in North East Scotland. Capitalising on the convergent interests of a diverse range of local stakeholders, we created a coordinated coalition of trained volunteers to detect and trap mink. Starting in montane headwaters, we systematically moved down river catchments, deploying mink rafts, an effective detection and trapping platform. Volunteers took increasing responsibility for raft monitoring and mink trapping as the project progressed. Within 3 years, all breeding mink had been removed from 10,570 km^2 with the involvement of 186 volunteers. Capture rate within sub-catchments increased with connectivity to mink in other sub-catchments and with proximity to the coast where there is more productive habitat. The main factor underpinning the success of this project was functional volunteer participation.

Keywords: adaptive management, *Arvicola terrestris*, Cairngorms, compensation, dispersal, genotyping, *Neovison vison,* participation

Introduction

Eradication of invasive vertebrates has hitherto been restricted to islands, has nearly invariably been performed by paid professionals and has rarely been achieved on a significant scale in mainland areas. As a result, native biodiversity in mainland areas remains severely affected by nefarious invasive species. To allow the recovery of threatened native species, innovative management strategies are required to remove invasives from large areas durably. We describe the strategy adopted and achievements to date of a project that has implement the largest mainland invasive species eradication effort worldwide and, through an adaptive management approach, use the convergent interests of local communities to maximum benefit to secure a pest-free area at such a scale as to considerably reduce recolonisation.

Methods

The strategy of the project consisted of coordinating and optimising the efforts of an existing, local and skilled workforce with convergent interests to deliver coordinated, systematic sub-catchment by sub-catchment eradication and monitoring of American mink, so as to achieve maximum conservation benefit on a scale not previously attempted anywhere worldwide. A key component of the strategy was to promote the systematic use of mink rafts, floating platforms with a footprint-recording plate made of moist clay and sand under a wooden tunnel. Mink rafts record footprints and are designed to act both as a monitoring device and as a trapping site for American mink. Raft monitoring also provides feedback on the impact of trapping, which helps to motivate volunteers.

The strategy of the project was to expand mink control spatially and establish a 'rolling carpet', deploying rafts and recruiting volunteers to operate them in each sub-catchment, moving downstream from the headwaters of the 5 main river catchments that flow from the Cairngorms National Park but retaining the network of rafts behind the expanding control front to ensure detection and removal of immigrants. Our long-term management goal was to achieve sustainable catchment-wide removal of mink, hence creating suitable conditions for the recovery of the focal native species on a large scale by promoting ownership of biodiversity resources by local communities.

The project was initiated with only partial knowledge of upland mink populations. Specifically, we did not know how large an increase in mink trapping effort beyond the baseline level was required to bring about a sustained decline in the local mink population. We thus chose to use an adaptive management approach, with information gained in the early stages used to optimise the project's conservation benefit,

sustainability and cost effectiveness. It was thus essential to systematically collect data from all aspects and participants of the projects to inform management. Volunteers were trained in the use of rafts. Project staff monitored mink rafts where volunteers were unavailable. Volunteers were instructed to set cage live-traps on rafts whenever mink footprints or sightings were recorded and/or contact a project officer or named volunteer to carry out trapping and dispatch of mink. Those willing were trained to dispatch mink humanely using air rifles or pistols of sufficient power. Culled mink were aged based on X-ray and cross-sectioning of canines. They were genotyped at twelve microsatellite (Zalewski et al., 2009) and parentage was reconstructed. From this, we inferred rich information on natal dispersal and compensatory immigration.

Results

Within 3 years, the project removed 376 mink from 10,570 km^2 with the involvement of 186 volunteers. By the 4th year, the number of mink removed had exceed 600 and 4 river catchment were effectively cleared of breeding mink (Bryce et al., 2011).The proportional contribution of volunteers to the project increased steadily over time. By the end of 3 years, volunteers monitored 86% of all rafts and caught 51 % of mink. The overall probability that a volunteer remained actively involved in the project per 6 month period was 86.8 % but this varied according to profession. Fisheries staff had the highest retention, game keepers had the lowest and the retention rates of wildlife conservation professionals, local residents and land managers varied over time with evidence of gradual improvement.

Mink capture rate within a focal sub-catchment was affected by the intensity of mink control and erosion of mink numbers in the rest of the catchment. Connectivity, reflecting the distance to and the number of mink remaining in surrounding sub-catchments, was the dominant effect predicting within sub-catchment mink capture rate, with proximity to the coast where there is more productive habitat also contributing. Genotyping and parentage assignment of culled mink revealed exceptionally long natal dispersal (mean=19 km max: 138 km), hence the need to work over very large scales and prevent mink born in lowland areas from impacting biodiversity in the uplands. Localised upland sub-catchments characterised by the presence of sheep hill farms and short swards suitable for rabbits had high ratios of immigrants (Oliver et al., 2009), highlighting how concentrating trapping efforts on those prey rich area and turning them into attractive sinks can negatively influence wider scale mink dynamics.

Discussion

The main factor underpinning the success of this project was functional volunteer participation. Optimising the effectiveness of the volunteer workforce was thus central to the use of functional participation. The technical simplicity of mink raft method is conducive to its use in a community conservation project. Given the need to maintain a level of over-watch through the area cleared of mink to guard against a decreasing risk of reinvasion, it will remain essential that project officers continue supporting, motivating and engaging volunteers for the long term. A developing understanding of habitat selection by recolonising dispersers will help focussing long term monitoring as will the gradual expansion of the project area to cover 20.000 km^2 by 2014. The defining factors underpinning the success of the project are strong volunteer involvement, efficient and systematic methods of monitoring and control, an adaptive approach to suit local conditions, the strategic use of topography to minimise recolonisation and an ambitious vision; elements that are applicable to other invasive species and areas. It is a strong testament to what can be achieved when empowering local communities to take a stake in their local biodiversity and thus reason for optimism that the tide of invasion can be rolled back on a large scale where the convergent interest of local communities can be harnessed.

References

Bryce R, Oliver MK, Davies L, Gray H, Urquhart, J, Lambin X 2011 Turning back the tide of American mink invasion at an unprecedented scale through community participation and adaptive management. Biological Conservation, 144: 575-583

Oliver M, Luque-Larena JJ, Lambin X 2009 Do rabbits eat voles? Apparent competition, habitat heterogeneity and large-scale coexistence under mink predation. Ecology Letters 12: 1201-1209

Zalewski A, Piertney SB, Zalewska H, Lambin X 2009 Landscape barriers reduce gene flow in an invasive carnivore: geographical and local genetic structure of American mink in Scotland. Molecular Ecology 18: 1601-1615