Strategies to improve landscape scale management of mink populations in the west coast of Scotland: lessons learned from the Uists 2001-2006

S. Roy

Food and Environment Research Agency, Sand Hutton, York, YO41 1LZ. <sugoto.roy@fera.gsi.gov.uk>.

Abstract Phase One of the Hebridean Mink Project (HMP) ran from 2001-2006 at a cost of £1.6 million and successfully eradicated invasive mink (*Neovison vison*) from 1100 km² of the southern islands of the Hebridean Archipelago, North Uist, Benbecula and South Uist (The Uists). Mink were also heavily controlled in South Harris to the North of the Uists to prevent reinvasion. A total of 532 mink were removed, and no further animals were caught or recorded in the eradication area in the last six months of the project. The project is now in its second phase and is continuing to remove mink from the remainder of the Outer Hebrides using lessons learned from the original eradication. This paper outlines the strategies developed in the first phase of the HMP. The strategies involved were: logistical, such as trap design and staff training; and ecological, such as using information on the behaviour of the population in space and time to effectively allocate resources.

Keywords: *Neovison vison*, eradication, Hebrides, adaptive resource management

INTRODUCTION

Invasive alien species (IAS) are currently listed as one of the greatest threats to global biodiversity, along with hunting and habitat loss (Atkinson 1996; Diamond 1984; Vitousek et al. 1997). They often prey on, compete with, or spread diseases, to native species. This is particularly true on offshore islands, where ecosystems tend to be impoverished; populated with less stable and more vulnerable restricted range species (Cronk 1997; Simberloff 2000).

The American mink (*Neovison vison*) is listed as one of the world’s worst 100 IAS by the IUCN’s Invasive species Specialist Group (www.issg.org). Mink now have a wide invasive range established as a result of deliberate or accidental releases from fur farms (Fig. 1; Bonesi and Palazon 2007; Dunstone 1993). The species can achieve high population densities, and has major impacts on native fauna, such as ground nesting birds. In continental Europe, mink have negative effects on indigenous European mink (*Mustela lutreola*) through direct interspecific competition including direct aggression (Sidorovich et al. 1999), and they have been implicated in the local extinction of water voles (*Arvicola amphibius*) in Great Britain (Strachan and Jefferies 1993). All countries of the European Union have international obligations to protected birds and habitats in Special Protected Areas (SPA) and Special Areas of Conservation (SAC) designated under the EU Birds and EU Habitats Directives. The directives were developed in response to the Ramsar Convention (1994) and Berne Convention (1979) to protect wildlife and habitats, and the Bonn Convention to protect migratory species (1980). Because of the effects of mink, their control or eradication is required in areas where these directives apply.

Feral mink populations established on the Western Isles of Scotland (Hebrides) after escaping or being deliberately released from two fur farms at Carloway on the Isle of Lewis in the 1950s (Angus 1993; Cuthbert 1973). The mink have since spread southwards through Harris. Attempts were made to stop mink from colonising the Uists (North and South Uists and Benbecula) (Angus 1993), but they successfully established feral populations across the entire archipelago within 40 years, most recently on South Uist in 2002.

On the Western Isles, mink have had severe effects on populations of fish (Bilsby 1999; 2001) and ground-nesting birds (Clode and MacDonald 2002). As up to £30 million of the Western Isles economy is based on tourism, with a large proportion of that based on wildlife tourism, hunting and fishing, mink potentially have an important economic as well as an ecological impact on the islands (Areal and Roy 2009; Moore et al. 2003; Roy 2006).

In this paper, I describe the history of an eradication programme against mink on the Outer Hebrides Islands, review the strategies applied and identify those that led to a successful eradication. Since the purpose of the paper is to demonstrate the lessons learnt, detailed analysis is only provided for those results that highlighted important strategic developments as the eradication progressed. These key developments enabled continual refinement of techniques that resulted in the elimination of populations of mink on large inhabited islands throughout the eradication are without detrimental effects on native populations of mammals.

THE HEBRIDEAN MINK PROJECT 2001-2006

The first phase of Hebridean Mink Project (HMP) ran from 2001-2006 (Roy 2006), and aimed to protect ground nesting bird colonies by: (i) eradicating mink (http://www.jncc.gov.uk/ProtectedSites/SACselection), in the Uists and (ii) reducing South Harris populations to prevent recolonisation over a total area of 1100km² (Fig. 2). The project was also acted as a pilot study for an island wide eradication campaign and was supported by a PhD research project (Helyar 2005).

The main method of removal was through live trapping and dispatch. Although the use of lethal traps is legal in the UK, these need to be checked daily. Furthermore, compared with live traps, lethal traps are more expensive, require more maintenance, more time and more skill to operate. We thus concluded that lethal trapping would not have saved time in this project.

The live trapping was supplemented with dogs, which searched for female mink in dens. Dogs were also used throughout the year as part of a mink monitoring campaign.
within the control areas. The time devoted to searches with dogs was not recorded as a quantifiable measure of mink presence or absence (e.g., Theobald and Coad 2002), because dogs, dog handlers and search conditions varied throughout the project. However, sighting records were collated throughout the project and were weighted according to the member of the public making the report (Birks et al. 2004; Proulx et al. 1997).

Four and a half thousand traps approximately 400 m apart (actual distances ranged from 380-510 m) were entrenched into the ground along the coast and along the edge of inland waterways. The performance of each trap was monitored for the duration of the project. All trappers were involved in establishing trap lines in the first three months of the project throughout the control area on a zone-by-zone basis until traps covered the entire area. Thus trap lines and zones were not trapper specific. Once established, traps were only opened and set in coordination with the overall trapping programme, which usually lasted for a two weeks. Otherwise the traps were left unset to prevent accidental capture, until they were revisited later in the year. Most traps were revisited four to five times a year. When open, traps were checked daily; each trapper checked 30-50 traps a day. The project had a total of eight long-term trappers, with extra staff drafted in to assist during those seasons when mink are more mobile and easier to catch. In total, traps were opened for approximately 200,000 trap nights over the five year duration of the project. Traps were baited with fish in the first year of the project, but subsequent work showed that traps baited with commercially purchased mink scent gland (Kishel Scents and Lures, Saxonburg, USA) had significantly higher capture rates. As mink in traps rarely consume baits, all traps were baited with scent gland. Once caught, mink were humanely dispatched using hand held 0.22 calibre air pistols (J. Graham and Co. Inverness). The mink were aged as kits, juveniles or adults from tooth-wear, and sexed (Helyar 2005). Feral ferrets (Mustela furo) and rats (Rattus spp.) that were caught were also dispatched.

Sea bird colonies, in particular those of terns and gulls, were monitored annually during their breeding season, within and outside of the control area from 2002-2006. Data were gathered on productivity, hatching success, and nest failure (Ratcliffe et al. 2008; Roy et al. 2006).

Results 2001-2006

A total of 532 mink were removed from the control area (Table 1), with catch/ trapnight ranging from 0.015 to 0.0008 animals/trapnight/10km$^2$. The last mink was captured on the Uists in March 2005, with no further animals caught or detected for the remainder of the project, which ended in April 2006. The associated monitoring of tern colonies has also showed lower rates of predation-related failure (Fig. 2). Predation on tern colonies may also be by otters (Lutra lutra) and feral ferrets, which confound these data. These analyses assumed that the densities of the other predators, such as otters that prey on terns, remained constant throughout the project (Strachan 2006).

Table 1 Mink numbers caught on Harris and the Uists over the entire project lifespan.

<table>
<thead>
<tr>
<th></th>
<th>Harris</th>
<th>Uists</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>162</td>
<td>93</td>
<td>255</td>
</tr>
<tr>
<td>Female</td>
<td>131</td>
<td>117</td>
<td>248</td>
</tr>
<tr>
<td>Unknown</td>
<td>9</td>
<td>20</td>
<td>29</td>
</tr>
<tr>
<td>Total</td>
<td>302</td>
<td>230</td>
<td>532</td>
</tr>
</tbody>
</table>

Strategies developed and lessons learned

The eradication of mink was conducted within tight budgetary and time constraints, which required the development and implementation of logistical and ecological strategic guidelines. Here strategy has been broadly defined as the application of resources in space and time to maximise outcomes.

Logistical strategies

The greatest efficiencies were obtained from equipment and staff following an analysis of two areas: trap design and the skill of the trapper.

Trap design

The trap design selected had solid metal doors that were reliably visible with binoculars from 100m distance (Fig. 3). This highlights the difficulty in seeing traps from a distance and the importance of the solid metal door.
trap disturbance. Also, being highly visible, a large number of supplementary traps could be set by the roadside and checked while trappers were driving to and from “walking traplines”.

It was estimated that when walking formal traplines the visible metal doors saved approximately 2-5 minutes in checking a trap (pers. obs.). Eight trappers were able to check 40 traps/day, only having to walk up to traps to set them on a Monday and close them on a Saturday. By checking the traps from a distance for the remaining four working days in a week (unless something was caught), there was the potential to save between 5.3 and 13.33 hours a week. Formal traplines were operated throughout the year with the exception of a 16-week period when animals were denning. If a trapper works for 49 weeks a year (excluding holidays approximately 1800 hours a year), the time saving over a year could potentially amount to 176-440 trapper-hours. This time could be redirected to check more traps, or carry out other tasks. In financial terms, if a trapper earns approximately £7.5/hour, this time amounts to £1300-£3300 a year, which could be used to purchase a further 120-300 traps.

Trapper skill

Though often widely spoken of, the skill of a trapper in catching animals is hard to quantify. In the HMP, success rates for each of the eight core trapping staff were assessed over the lifetime of the project, with dramatic results. It should be noted that all eight staff had equal access to trap lines and trap areas as they were established in the first three months of the project. Also all core trapping staff were able to tweak and modify traplines throughout the project.

Catch rates in traps set by different trappers showed great variation, with some trappers better at placing and setting mink traps than others (Fig. 4). When investigated further, the most successful traps were found to be operated by trappers three, four, and six. These were experienced gamekeepers and trapper four in particular had a long history of working on mink projects prior to this project. This information was later used to develop “quality assurance” roles for the most successful trappers, who regularly checked and tweaked trap lines and trained new trappers.

Ecological strategies

Ecological strategies were those developed to capitalise on mink behaviour, seasonal changes in population movements, and the way mink used space (different habitats) throughout the year. Trapping regimes were modified to maximise capture rates as a result.

Mink behaviour

Like many small mustelids, mink use olfactory communication. For example, Roy et al. (2006) discuss in detail the effectiveness of mink scent glands to improve catch/unit effort. Traps baited with scent glands either extracted from culled animals or procured commercially (mink scent gland; Kishel Scents and Lures, Saxonburg, USA) provide a catch success an order of magnitude greater than traps using traditional fish baits (Fig. 5) There is also increasing anecdotal evidence that the use of predator scents may reduce the capture of non-target species (I. Macleod, Hebridean Mink Project Phase 2 pers. comm.). The use of scent-based lures thus had the advantage of leaving a greater proportion of traps available for mink capture. It also remained effective for several days after baiting, while food based baits often decomposed.

Seasonal changes in population movements

Mink have well defined seasonal patterns of behaviour (Dunstone 1993). In the northern hemisphere: 1) they establish and defend territories from November to January; 2) mate from January to April; 3) females set up breeding dens and rear young from the end of April to early July; and 4) disperse from late July to October. The mink are highly mobile and trappable during the dispersal and territorial periods, while during the denning period they are sedentary and difficult to catch (Fig. 6). In the HMP, this variability was exploited by drafting in extra staff and checking as many formal traplines as possibly during the periods when the mink were mobile. During the denning period, nine trained dogs (spaniels) were used to locate den sites where females and young were subsequently trapped.
A total of 11 active dens were found in 2004-2005, and these yielded 28 young and 10 adult females. Den sites were not excavated, because on the Hebrides mink re-use traditional den sites over several generations. Undamaged dens were used as a post eradication monitoring tool to ensure that no breeding mink were remaining on cleared areas (Helyar 2005).

The use of space by mink

Radio-tracking and capture-mark-recapture studies on a population of mink on Harris (Fig. 2) showed that mink on the Hebrides are primarily coastal (Helyar 2005), with exceptionally high densities seen on offshore islands and the associated coastline (Fig. 7).

As a result of this information on spatial ecology of mink, a large number of previously untrapped offshore islands, including very small ones less than 1ha, were trapped and mink were successfully removed from many of them.

CONCLUSIONS

This project highlights the importance of applied research in developing project-specific strategies for large scale invasive species management programmes. Throughout its lifespan, regimes used in this project have evolved and been refined to great effect. Both the logistical and ecological data were collected, collated, combined and analysed to make informed decisions through a process of adaptive resource management. Such approaches become necessary when it is not always possible to undertake well-designed experiments due to time and financial constraints (Walters and Holling 1990). Applied information of the type needed by invasive species managers, information that combines ecological and logistical elements, and information on failures as well as successes, is not always readily available in the literature (Roy et al. 2009). The HMP succeeded because this information was recorded and used from the outset, having been collected from short, targeted research projects such as experimentation with scent glands, and from an applied PhD study associated with the project (Helyar 2005). Learning from the successes and failures from projects such as this one means operations can be scaled up more effectively to incorporate larger land areas and carry out eradications and control operations at ever increasing landscape scales.

ACKNOWLEDGEMENTS

The project was funded by the EU-LIFE programme, SNH, The Scottish Executive, The Western Isles Council and Western Isles Enterprise. Bird monitoring was carried out by the RSPB. The authors would like to express gratitude to the landowners allowing access to their land and to the trappers for their hard work.

REFERENCES


