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A mink-free GB: perspectives on eradicating American mink *Neovison vison* from Great Britain and its islands

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ABSTRACT

This paper examines the case for, and plausibility of, eradicating American mink *Neovison vison* from mainland Great Britain and its associated offshore islands. This invasive species causes extensive damage to native fauna throughout Europe, and the UK Government is obliged to eradicate it, if feasible, under the Bern Convention. Current mink control buys time, but is patchy and dependent on substantial funding in perpetuity. If enacted, eradication would be cheaper in the long term and much more effective in preserving native wildlife. The methodology of an eradication campaign is explored, together with risks, challenges, and a tentative timeline and cost. We judge that mink eradication is now logistically feasible, due to technological developments and experience gained from landscape-scale control. Using live traps fitted with electronic sensors – 'smart' traps – as the primary means of catching mink would render the campaign efficient, humane and free of non-target mortality and negative environmental impacts. The ecological benefits of mink eradication would be profound, including greatly improving prospects for water vole *Arvicola amphibius* populations. Reinvasion is highly unlikely. The greatest logistical challenge is probably removing mink from Scottish west coast islands. Eradication might take around a decade and be dependent on co-ordination between many conservation, fishing, farming, and water-related organisations, together with the consent of landowners. By adding alarms to existing mink traps, land and water managers can pave the way to eradication now. A mink-free Great Britain would plausibly cost tens of millions of pounds, against which could be set the limitless future costs of mink control. Such a campaign would be by far the world's largest invasive predator eradication project by geographical area and would set a precedent for citizen-led conservation action globally. Regional trials would be extremely valuable in determining the costs and practicality of a GB-wide campaign.

INTRODUCTION

American mink *Neovison vison* (hereafter 'mink') were introduced to Great Britain for fur farming in 1929 (Cuthbert 1973). By 2002, when farming was banned, mink had become established in the wild throughout most of England, Wales, and Scotland. Today, mink occur from Cornwall in the south-west of England to northern Scotland, on many islands off the Scottish west coast and on Anglesey, North Wales. A lack of records from Shetland, Orkney, the Isle of Man and the Isle of Wight indicates that they are not established on these large islands, despite decades of opportunity for colonisation via vehicle ferry. Mink are widely distributed in mainland Europe and Ireland (Bonesi & Palazon 2007). Mink farms still operate within the European Union; indeed the Republic of Ireland has several, posing a threat of animals escaping or being released (Department of Agriculture, Food and the Marine 2012).

Mink damage native bird and mammal populations (Woodroffe et al. 1990, Craik 1997, Niemczynowicz et al. 2017) and are consequently termed ‘invasive’ – an invasive alien species or invasive non-native species. In Europe, the American mink is probably the most publicised invasive mammal species, not least because it threatens its native counterpart, the European mink *Mustela lutreola* with extinction (Macdonald et al. 2017). In Britain, populations of one charismatic small mammal, the water vole *Arvicola amphibius*, a priority species under the UK Biodiversity Action Plan, are often wiped out by mink (Macdonald & Harrington 2003, Lambin et al. 2019), and the vole species has declined in numbers overall by 96% since 1950, largely due to mink predation (Defra 2005).

Efforts to control mink in Britain by trapping have been ongoing for decades, varying in scale from individuals working on private land to multimillion pound landscape-scale campaigns (Baker 2010, Lambin et al. 2019, Macleod et al. 2019). But, if it occurs at all, in most areas trapping is temporally and geographically discontinuous, and with few exceptions the effects are temporary; if and when the work stops, mink return (Baker 2010, Lambin et al. 2019, Macleod et al. 2019). There is growing recognition that current efforts in Britain to control the damage caused by mink to native wildlife, especially water voles, are not even containing the problem in many areas (McGuire & Whitfield 2017) and would eventually cost more than a co-ordinated eradication campaign (Moorhouse et al. 2015).

Mink control over much of Britain has hitherto been organised at county level, e.g. by county Wildlife Trusts. The median area of British counties is ca. 2000 km^2. In this paper, the term region refers to a cluster of contiguous counties, and the term GB-wide refers to the British mainland and its associated offshore islands. Northern Ireland is excluded from consideration because of the mink farms in the adjacent Irish Republic. Attempting the eradication of feral mink there could be futile while the risk of escapes from farms remains.

Conflict with native otters *Lutra lutra* and polecats *Mustela putorius* may plausibly diminish mink density and/or range (Bonesi et al. 2006), although a recent review concluded that there was no evidence of otters having caused a decline in mink numbers in Britain (Harrington et al. 2020). Certainly, otters and mink co-exist in many parts of Britain (Bonesi & Macdonald 2004), and the mink is now so well established that it is highly likely to perpetuate without concerted human intervention. The only long-term solution to the ‘mink problem’ in Britain is to remove them entirely – a prospect that has long been considered by scientists and conservationists (Thompson 1968). However, the eradication of invasive mustelids is notoriously challenging (King et al. 2009), and the logistics and cost have hitherto been considered insurmountable after a failed eradication attempt in the 1960s (Macdonald & Strachan 1999, Baker 2010).

As difficult as it would be to eliminate this mustelid over such a large island, relevant precedents have been set in Britain. Native polecats and pine martens *Martes martes* were exterminated over much of their range by gamekeepers using traps (Lovegrove 2007). Mink appear to be just as vulnerable to trapping, and have been greatly diminished over, or entirely removed from, vast areas of Scotland due to well-co-ordinated, persistent trapping regimes (Bryce et al. 2011, Macleod et al. 2019). In this respect, mink eradication may be feasible in principle, although success would be dependent on finding a way to detect and destroy the last, possibly trap-shy, animals in each area (Zuberogoitia et al. 2010). Removing mink could, importantly, be achieved without collateral damage. The use of live traps as the primary means of capture leaves no toxic residues, and non-target animals captured can be released. Mink eradication would be as close to a ‘surgical’ process as any pest eradication could be.

Given the large sums currently spent on mink control projects in Britain (Lambin et al. 2019), their limited geographical reach and ephemeral results, it is surely appropriate to keep under review the wisdom of maintaining the management status quo rather than attempting a permanent solution. Indeed, recognising the damage caused by American mink throughout Europe, the Bern Convention on the Conservation of European Wildlife and Natural Habitats, of which the UK is a signatory, recommends that ‘Contracting Parties carry out campaigns aimed to eradicate mink, where feasible’ (Council of Europe 2017). The only recent true eradication (rather than control) campaign in Britain is that which has sought to eliminate mink from the northern islands of the Outer Hebrides (Moore et al. 2003). By early 2019, that campaign had been almost, but not totally, successful (Macleod et al. 2019). The difficulty in extinguishing the last few animals is reminiscent of the successful English coypu *Myocastor coypus* eradication campaign in the 1970s and 1980s (Gosling & Baker 1989, Baker 2010), and an illustration of the very significant differences between control and eradication operations.

In recent years, technological and design innovations have been trialled and/or implemented in mink control operations, and others are expected to be available soon. Together, these developments render the detection and removal of mink more humane and much more efficient. As the scale, complexity, benefits and awareness of successful invasive predator eradications grows (Jones et al. 2016, Martin & Richardson 2019, Martin et al. 2019), so does the vision and ambition to achieve even greater ecological restoration nationally and internationally (Russell et al. 2015, Gardiner 2019). Ecological problems caused by invasive alien species that once seemed insurmountable are increasingly recognised as potentially solvable; as experience is now showing, geographical scale, in itself, is no barrier to success (Martin et al. 2019).

This paper explores the prospects of eradicating mink from Great Britain using the improved methodologies and technologies now available. It discusses the risks and challenges, possible ways of overcoming those challenges, the likely timescale of the operation and provides a tentative estimate of the financial costs involved.

IS ERADICATION REALISTIC AND SUSTAINABLE?

Before attempting eradication of any plant or animal, some basic questions should be answered and, in each case, a negative answer ought to cause the project to be abandoned. These five key questions, derived from the Island Eradication Advisory Group (the New Zealand Government's world leading authority in this field), are listed below and augmented by a supplementary question derived from Bomford and O'Brien (1995). In each case, we offer a response for the particular case of mink in Britain:

1. Can all individuals be put at risk by the eradication technique? The vast majority will be trappable (e.g. Bryce et al. 2011, Roy et al. 2015, Macleod et al. 2019). The final few percent will prove to be extremely challenging, especially in remote locations. Those on the uninhabited islands and coasts of north-west Scotland would take substantial resources, but in principle all mink could be put at risk.
2. Can they be killed at a rate exceeding their rate of increase? Experience already shows that the answer is yes (e.g. Roy et al. 2015).
3. Is the probability of pest re-establishment manageable to near-zero? Possible means of re-establishment are by: (1) vehicle on a ferry or train within the England–France channel tunnel; (2) walking through the channel tunnel itself; (3) escaping from zoos or private collections; or (4) deliberate reintroduction. That several large islands served by ferry are still mink-free indicates that (1) is extremely unlikely. The risk of (2) is extremely low because of the length of, and environment within, the tunnel. Zoo escapes are possible, and measures would be needed to reduce that risk to near-zero. Deliberate reintroduction is a risk, but a small number of animals is unlikely to become established if they disperse, and constant vigilance ought to detect a new population before it can spread widely, allowing the animals to be found and destroyed.
4. Is the project socially acceptable to the community involved? Although there may be objections, mink control in Britain has been carried out for decades with relatively little resistance, perhaps because the wildlife benefits of the work are accepted. Any landowners determined to protect mink could present problems, although statutory measures are available to deal with this. In their thoughtful review of the water vole/mink dilemma in Britain, Moorhouse et al. (2015) conclude that 'there is no shortage of public support…for mink eradication'. Further discussion of this important aspect of an eradication campaign is offered under the heading 'Major risks and challenges' below.
5. Do the benefits of the project outweigh the costs? This is a subjective judgment, but millions of pounds are annually committed to eradicating invasive alien species in Britain, including mink (Lambin et al. 2019), so the concept is not new. In financial terms, the cost of an eradication would, in time, be less than the ongoing costs of control and mink damage, so the logical answer to the question is yes.
6. Can animals be detected at low densities? Yes, mink leave visual and olfactory cues of their presence. Trained dogs are readily able to detect single mink. New molecular techniques (see below) should soon be available to simplify the search for mink at low densities and render the task of finding them much less expensive.

In summary, although the scale and complexity of the task is vast, there are no obvious insurmountable barriers to success. Given adequate resources of time and money, a pragmatic plan, a suitable management structure, organised preparations and dedicated people to do the work, there should be a good chance of eradicating mink from Great Britain and of keeping them out.

WHAT HAS CHANGED?

Three innovations since the turn of the millennium have proved, or likely will prove, to be transformative. The first innovation is the mink raft. Pioneered by the Game & Wildlife Conservation Trust, the standardised mink raft offers a proven technique for catching mink in a live cage trap that is floating on a raft (Reynolds et al. 2004). Otters are excluded by body size, and other non-target creatures can be released unharmed. Mink are semi-aquatic, so rafts can be placed in the range of most individuals in Britain, although in many locations a trap on land may prove to be as effective and less vulnerable to flood damage.

The second innovation is the trap closure alarm. Trap closure alarms detect when a trap door closes and then rapidly send a message by email and/or text to nominated recipients advising which trap has been triggered. In most cases, this results in the captive animal being in the trap for much less than 24 hours, and good alarm reliability means that a trap need only be visited when it has closed, thereby greatly reducing the workload. Trap alarms are effectively free of false negatives (i.e. an animal is trapped, but the alarm is not triggered), and they deliver few false positives (i.e. a message is sent, but no animal is in the trap). Alarms are routinely programmed to check the trap door and send an 'all ok' message every 12 hours, thereby exceeding the legal requirement for daily checks (Natural England 2016). During three years of deployment in Cambridgeshire, during which time 18 mink were caught, trap alarms [trade names *Remoti* (www.remotisystems.com) and *Mink Police* (www.minkpolice.com)] reduced the number of raft visits per capture by 99% (authors' unpublished data). Alarms currently require a mobile phone signal, so there are areas where they cannot be deployed with existing technology. Satellite-linked alarms would, however, work in even the remotest parts of Britain, are under trial and are expected to be producible at similar cost.

In short, trap alarms offer improved animal welfare and should increase the number of mink caught because they greatly reduce the burden of checking traps. These devices turn an ordinary trap into what could be termed a 'smart' trap.

The third innovation is the development and refinement of molecular identification techniques. One of the biggest problems facing a pest eradication campaign is knowing where the target animals are and, equally importantly, where they are not. The process of detecting mammals, especially at low density, is currently expensive, time consuming, and imprecise. In recent years, geneticists have been experimenting with ever more sensitive ways to detect the presence of animals forensically, and today it is feasible to identify even a few mammalian cells in a litre of water (using eDNA; Barnes & Turner 2016, Padgett-Stewart et al. 2016, Wilcox et al. 2018). The implication is that analysis of water samples may be used to demonstrate whether mink are present, or not present, in a particular river (upstream of the sampling site) or lake. The technique would prove especially beneficial in targeting the last remnants of mink populations. Furthermore, the number and gender of the remaining animals could be determined from genetic material most readily available from scat samples (Hedmark et al. 2004, Gillett et al. 2010).

HOW MIGHT AN OPERATION WORK?

Because mink are vulnerable to trapping, the vast majority could be removed by trap networks along waterways throughout their range in a 'knock-down' phase. Establishing the networks would take time but, once they are in position, few mink should remain after a year, and very few indeed after two years. To achieve this, traps would need to be active permanently, replacing the current practice of detecting mink on rafts using clay pads and then setting traps for short periods. Detection and trapping would thereby happen simultaneously rather than sequentially. The mobility of mink, whereby they often move tens of kilometres during juvenile dispersal and pre-breeding prospecting (Melero et al. 2018), renders them likely to encounter many traps, and reduces the risk of gaps in trap coverage leading to mink avoiding capture. The percentage of the population captured during this phase would probably need to be in excess of 90% for eradication to be feasible, but that is realistic (Bryce et al. 2011, Roy et al. 2015). Much would depend on what percentage of mink are trap-shy, and can only be removed by other means, of which there are few options. The use of toxic bait is not appropriate for this species. Even if an attractive bait could be found, the consequent mortality of non-target fauna would be unacceptable.

Once knock-down has been achieved in a region, with concomitant high levels of manpower to maintain the trap network and deal with caught mink, a much reduced rate of capture would mark seamless progress to a 'mop-up' phase. This period would be characterised by high trapping effort (the number of active traps would remain as before), but lower demand for fieldwork time because relatively few trap visits would be required other than for routine maintenance and release of captured non-target animals. In principle, mop-up could be maintained for years, during which time native wildlife would be expected to suffer insignificant levels of mink predation. Moreover, trap networks in mop-up areas would act as sinks, catching roaming mink from adjacent areas still in knock-down phase. Only when all land within the maximum mink natal dispersal distance had been managed in mop-up mode for at least ca. two years would it make sense to progress any area to the last 'monitoring and final few removal' phase. At this point, absolute costs would increase, as would the cost per mink removed, because the work would be labour intensive. The speed of progress would be largely dependent on the means of locating the remaining animals. The detection of eDNA should be a routine process by this time, but specially trained mink detector dogs would always be needed to locate the last individuals.

The methodology described above should be applicable to almost all freshwater habitats in mainland Great Britain. Along coasts, however, traps would usually be better placed on land rather than on rafts, to reduce the risk of loss or damage. In very remote locations, where trap visits may not always be possible, lethal traps could be an effective alternative if non-target mortality was likely to be low.

This broad plan of fieldwork would require substantial administrative and logistical support involving a suite of responsibilities including recruitment, volunteer management, land access requests, fund raising, financial management, insurance, transportation, procurement and training. Much of this would be best carried out at local or regional level, but assets such as specialist dog and handler combinations may be better funded and shared over greater geographical areas because of cost.

SCALE OF THE TASK AND GEOGRAPHICAL ORGANISATION

Great Britain is the world's ninth largest island, covering over 209000 km^2 and with a coastline length of almost 18000 km. The road distance between extreme south-westerly and north-easterly points is 1400 km. A GB-wide mink eradication campaign would represent by far the largest invasive alien species eradication attempt in the world.

Of obvious importance to a project aimed at a semi-aquatic mammal is the length of waterways on which it may occur. There are over 10000 rivers and streams in Britain, with a cumulative length of almost 400000 km (Holmes & Raven 2010). Drainage ditches, marshes, lakes, coasts and cliffs add to the amount and complexity of habitat from which mink would need to be cleared or from where their long-term absence would have to be confirmed. Local knowledge would be of great importance in making best use of scarce resources in targeting areas where mink may be present. Any estimate of the length of waterways that would need to be covered by a GB-wide mink eradication operation can be no more than an informed guess at the present time. A figure of 100000 km might serve as a useful provisional idea of the scale of the task, but reality could be double this. At a nominal trap density of one every 2 km (but recognising that density and placement would vary according to several factors, including habitat), many tens of thousands of trapping sites would be required, though not all would necessarily need to be active concurrently.

As with implementation, although some organisational processes would likely benefit from being carried out centrally, most would be better delivered at region or county level, as they are now with mink control. Regional boundaries would need to be established taking account of geography to minimise their length and complexity, but they could reflect existing co-operation between wildlife trusts or similar conservation charities. Excellent communications within and between counties would be essential, to facilitate synchronisation, information exchange, the filling of any gaps in geographical coverage, and mutual support. Synchronisation between counties and regions would be crucial, to ensure that a poorly managed area did not generate mink when neighbouring areas were investing heavily in catching their last few animals.

Most of the mink trapping carried out in Britain to date has relied on volunteer networks managed and organised by paid staff in conservation non-governmental organisations or government statutory bodies. In many cases, volunteers are gamekeepers, water bailiffs, or other professionals engaged in management of countryside resources. It is unlikely that a GB-wide eradication effort would attract sufficient funding to allow the work to be carried out entirely by professionals, so planning should embrace volunteers and methodology that makes best use of their time. In particular, the introduction of trap alarms would allow volunteers to monitor more traps over a greater area, and for those traps to be permanently active. The role of volunteers, and the proportion of the operation that they undertake, would likely vary between counties and regions, dependent on factors such as landscape, the density and distribution of residents, and local experience of mink trapping.

Currently, the very success of a control project in reducing mink density often causes problems by diminishing the motivation of volunteers who may check a trap hundreds of times without catching anything (Beirne & Lambin 2013). This situation should not arise when smart traps are deployed because volunteers would only need to visit a trap when there is a high probability of a mink capture or for periodic routine maintenance. For this reason, the number of traps that could be operated simultaneously by each trapper may increase, year-on-year, as the capture rate diminishes. A small group of volunteers working collaboratively could maintain tens of traps in lowland Britain once mink are reduced to very low levels, assuming infrequent non-target captures. This impact of smart traps could plausibly tip the balance in favour of eradication becoming feasible.

Barring extreme scenarios, the density of mink in any area would make little difference to campaign methodology because project organisation and fieldwork are essentially the same, however many individuals are involved. The trap network must be comprehensive, regardless. This is another important way in which eradication differs from control campaigns, wherein limited resources must be deployed selectively and targeted for greatest effect. In eradication operations, there is little or no targeting until the population has been reduced to very low densities, and individual animals are then sought.

MAJOR RISKS AND CHALLENGES

Eradication operations are dependent on every individual target animal being placed at risk of being trapped; there can be no inaccessible refuges of sufficient size that a mink could permanently live within them. This condition implies the requirement of physical access to all waterways and coasts where mink may occur. The scale of that task alone would be immense even if every landowner could be contacted and consented to unrestricted access. It becomes even more difficult when they cannot be located or access is denied. Fortunately, in the last resort, government legislation in the form of Species Control Orders could be used to prevent individual landowners from jeopardising the campaign.

Physical access is a real challenge on remote islands and coasts, especially along the west coast of Scotland, where mink may be present on hundreds of islands of various sizes and hundreds of kilometres of complex coastline. Frequent poor weather and rough seas, together with the ability of mink to swim in marine waters, add to the difficulties in ensuring that no mink could be overlooked. Remote islands with breeding seabirds attract mink in summer but the mink move to larger land areas or richer coastlines in winter, when they may be easier to trap (Clive Craik, personal communication).

A further possible risk, faced by all invasive animal eradication projects, is that objectors may intervene. Given that mink control has been carried out in Britain for decades, and that its primary justification is to save the water vole – a species with social resonance – the risk of significant disruption in the future may be relatively low. However, experience of attempted pest eradication operations on (human) inhabited islands has demonstrated that trouble can flare up for a number of reasons (Wilkinson & Priddel 2011, Slezak 2016, Martin 2018), and that any operation should include an element of public education and liaison. A clear and open explanation of the reason for carrying out the work and, more importantly, the consequences of not doing it, is often the most effective way to secure public support (Pearson et al. 2019). The fact that animal 'liberationists' were responsible for releasing thousands of farmed mink into the wild, often to the dismay of other animal welfare groups and long after mink damage to native wildlife was recognised (e.g. BBC 1998), may partly explain why mink control efforts have not encountered much resistance to date.

A more predictable source of difficulties, especially in and near conurbations, is vandalism to rafts. In rural areas, explanatory signs near rafts are often enough to prevent potential interference, but in some areas any visible structure is likely to be vulnerable to damage or theft. Mitigating this type of risk will be dependent on local knowledge.

The above issues aside, there are no obvious risks that cannot be overcome with the right planning, organisation, people, and money. But obtaining adequate finance is itself a substantial risk. The multi-year duration of the project (see below) is both a challenge and fortuitous in this regard, because it would not be necessary to have all funding in place at the outset. The project could commence with sufficient resources to get some traps and co-ordination in place, an expectation of continued support from the counties and a central fund-raising team in place with an annual target.

WHERE TO WORK AND WHERE NOT TO WORK

In an eradication campaign, it could be disastrous to assume incorrectly that an area or island has no mink. Best practice dictates that the target species must be assumed to occur everywhere without proof of absence. Although proving a negative can be almost impossible, if eDNA fulfils its current promise the task of demonstrating beyond reasonable doubt that an island or waterway holds no mink may be achievable at reasonable cost. Clearly, being able to do this would potentially save the project vast amounts of time and money, but in most cases the investigations would need to be concurrent with trapping effort in adjacent areas that have, or may have, mink. It would be a grave error to declare an offshore island free of mink and decide not to deploy traps on it, for example, only to discover later that mink had invaded from nearby islands.

The greatest challenge in this regard would almost certainly be in deciding which of the hundreds of islands and islets off the west coast of Scotland must be trapped. Even those considered to be free of mink should have some traps placed on them for safety if they are within mink swimming range of the mainland or another island with mink. Elsewhere, the mobility of mink dictates that few areas could be safely ignored by trappers.

PROJECT DURATION

The overall duration of a mink eradication project would be largely dependent on the rapidity of setting out the trap network in each region and on the level of synchronisation between regions. Table 1 shows a tentative operational schedule within each region; this could be the schedule for an GB-wide campaign only if synchronisation between regions was perfect. There are so many uncertainties in a project of this scale that flexibility and adaptive management would be crucial for it to succeed, the latter requiring research support upon which to base decisions.

There would, of course, be no reason for existing trapping efforts to cease during the planning phase of the GB-wide campaign; indeed that would be counterproductive. Table 1 sets out what might be considered a default timetable, but many areas might be able to embark upon the knock-down phase immediately, to the benefit of all.

Table 1. Operational phases of the proposed mink eradication project and their possible duration in each region

	Years
Phase 1: Planning, preparations, recruitment, training, management set-up, initial fund raising, equipment procurement	2
Phase 2: Knock-down (including trap deployment; removal of majority of mink)	4
Phase 3: Mop-up (continued trapping with reduced capture rate)	2
Phase 4: Monitoring and removal of the final few mink	2
Total	10

FINANCIAL COST

Just as the amount of time required to carry out the task can only be roughly estimated at this stage, so too the financial cost. Success would depend upon universal roll-out of smart traps, and as yet there is little experience of how best to manage large smart-trap networks, or the cost of so doing.

Expenditure can be divided into two elements – central and county/regional – the latter involving both administration and fieldwork. Central costs might reasonably cover high-level organisation and a fund-raising team tasked with generating at least enough money to cover the cost of central administration.

County/regional costs would depend on many factors, including local landscape and existing levels of mink control, and would consequently vary throughout the target area. The campaign would also require substantial start-up finance, to facilitate the purchase of smart traps and their rafts (£12.5 m, based on 50000 smart traps and rafts each costing £250), vehicles for professional trappers, and boats and other field gear for the teams covering the Scottish west coast. Money should also be made available to help county/region teams to set up organisationally; a sum of £5 m would, pro rata, allow £41000 for a median-sized county.

Based on British experience to date and the known costs of trapping equipment, we estimate that a GB-wide mink eradication campaign would be likely to cost in the high tens of millions of pounds sterling, a figure consistent with an earlier estimate of some £30 m (Macdonald & Strachan 1999).

A RELUCTANT PLAN B

If a GB-wide eradication was judged to be far too expensive or difficult to achieve, a radical alternative might be possible, based on recognition that the western isles and west coast of Scotland probably represent the single biggest and most costly challenge, with an associated higher risk of failure. This alternative would be to establish a near mink-proof boundary across the mainland and carry out a simpler, cheaper eradication to the south of this. The shortest distance between east and west coasts is the 53 km between Dumbarton on the Clyde and Alloa on the Forth, at a latitude of about 56ºN. It should be possible to set up an intensively trapped buffer zone along this line, perhaps funded by central project monies. This would be far less satisfactory than a GB-wide campaign, but far better than the status quo. Properly resourced and managed, the buffer zone could not only keep Inverclyde, east and west Dunbartonshire, Clackmannanshire and Falkirk effectively free of mink, but would allow southern Scotland and all of England and Wales to remain mink free in perpetuity. Given current successes north of this boundary, it may then just be a matter of time until it too was cleared of mink.

DISCUSSION

This paper provides a starting point: an example of what might be involved in producing a mink-free Great Britain. It also gives an opportunity to consider whether the potential outcome of such a project would justify its possible cost. In this context, it is crucial to recall that mink control is already being carried out in many parts of Britain, at great expense. The key question, we suggest, is therefore not whether it is justifiable to spend a huge sum on eradicating this particular invasive predator rather than another (because substantial money is already being spent on mink, and that expenditure is expected to continue). Rather, it is whether the money could and should be spent on a relatively short-term eradication campaign rather than on piecemeal mink control efforts, and limitless water vole reintroductions, in perpetuity. However expensive eradication might be, if successful it would likely be a cheaper and far more effective alternative to the status quo, a similar conclusion to that reached by Panzacchi et al. (2007) for the case of coypu in Italy.

It is clear that even large-scale mink control projects on mainland Britain require continuous funding, organisation and trapping effort if they are to maintain their hard-won benefits, but sequential Scottish projects do show that vast areas of challenging terrain can be freed of mink, even without the benefit of labour-saving trap alarms (Lambin et al. 2019). As such, they demonstrate that a finite term, volunteer-based eradication campaign is feasible and should have every chance of success. A multi-agency initiative in South West England in the early 2000s, with the active participation of nature reserve staff and volunteers, caught many mink and also produced dramatic wildlife recovery during the time it was operating (Marshall-Ball 2010).

Meanwhile, the long-running Norfolk Mink Project, with its extensive network of volunteers, is an excellent example of how citizen conservationists can be motivated and organised to maintain mink control at low cost across a large English county (Norfolk Mink Project 2018).

Although the English, Scottish, and Welsh governments are likely to be supportive of mink eradication, it is unlikely that they would substantially finance the work. If eradication is to happen, therefore, the money, initiative, and leadership would overwhelmingly have to come from non-governmental sources. Importantly, conservation groups, fishing interests, national parks, farmers, private landowners and managers of land and water up and down the country have demonstrated over many years that they are willing to invest in mink trapping because of the cost to wildlife, natural resources, fishing interests, and farmed poultry of not acting. Furthermore, very substantial National Heritage Lottery funding has already been awarded to mink control work (Lambin et al. 2019), so there is widespread precedent that could be built on in a co-ordinated GB-wide campaign.

Overwhelmingly, British conservation charities managing nature reserves recognise predator control to be necessary. Mink trapping is often part of that work, but hitherto has been mostly carried out intermittently and patchily, substantially because of the considerable burden of physically inspecting each trap daily. But if that burden could be greatly reduced by augmenting traps with alarms, then long-term, humane freedom from mink predation is achievable. Although formal nature reserves cover but a small proportion of Britain, they could contribute disproportionately to mink eradication simply by doing more effectively what they already do. In short, all land managers could immediately improve protection of native wildlife and enhance the humaneness of their mink control at low cost. These measures would reduce mink numbers overall and prevent that land becoming a mink refuge (Melero et al. 2018), thereby contributing to any co-ordinated eradication effort, overtly or not.

Synchronised trapping across all of Great Britain would minimise the duration of an inescapably long project. However, the reality is that the starting point in the various counties and regions is far from uniform, as some areas are already effectively into the knock-down stage, while others may have no mink trapping at all. It would certainly be counterproductive for the more 'advanced' areas to pause and wait for the 'slower' ones to catch up. Indeed, a successful GB-wide conclusion would likely be hastened if pioneering counties or, better still, groups of adjacent counties, forged ahead to place smart traps on all their waterways and develop the infrastructure and co-ordination needed to achieve a status close to eradication. The lessons learned in such regional trials, including financial costs, might then inform, prepare, and inspire others, as well as securing the legacy of existing, often long-term control work. Furthermore, in the event that eradication could be achieved on a regional scale, and the boundaries of the mink-free area were being expanded on a 'rolling front', redundant trapping equipment could be safely relocated to areas yet to be cleared. In this way, co-ordination on a national scale could substantially reduce the cost of eradication.

CONCLUSIONS

Technological developments, an improved understanding of mink behaviour, and experience of landscape-scale operation now offer the possibility of much more effective and efficient mink control. If intensified and rolled out across Britain, these improved techniques would greatly diminish mink numbers and could, if augmented with the means to find and destroy the final, possibly trap-shy animals, plausibly result in mink eradication. The task would take a decade or more and would face very considerable logistical, organisational, and financial challenges. But the ecological benefits of mink eradication would be profound, and the prospect of being able to stop mink trapping and endless water vole reintroductions is appealing. The merits of modernising and expanding existing control efforts are persuasive and, if co-ordinated regionally, may demonstrate that citizen-led mink eradication on a hitherto unthinkable scale is achievable.

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