



# **Invasive Predatory Small Mammals on Islands Strategy**

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## 1. Aim of strategy

This strategy aims to provide a coherent framework for action to limit the impact of invasive alien predatory small mammal introductions to islands with important seabird colonies and to prevent associated impacts on breeding birds and island biodiversity in general.

This will be achieved by:

**Prevention of introduction** - It is widely accepted that the prevention of introductions of invasive alien species is by far the most cost effective strategy in tackling invasive species. This document sets out how this can be achieved in relation to invasive alien predatory small mammals on islands.

**Recommend monitoring** - In order to detect incursions and potential impacts on seabird communities, monitoring at key sites is required. To facilitate the establishment of an effective monitoring network, island habitats have been ranked, through a process of expert consultation by importance in terms of seabird colonies and potential impact.

**Eradication/control/mitigation** - This strategy sets out the process by which complete eradication for these species from offshore and inland islands may be achieved. A programme of works should only be undertaken when guided by sound scientific information that indicates an impact on the natural state of the islands biodiversity and the resources for a multiyear programme are available.

**Recommendation of mechanisms to reduce knowledge gaps** - The distribution and/or associated impact of these and other potentially invasive non-native species on islands is not readily available and is not regularly reported to a central repository or sent to statutory agents. This strategy recommends mechanisms by which this may be achieved and allow for more effective management and/or rapid response.

In this context, the term '**invasive predatory small mammals**', encompasses rat species, mice, feral cat, mink, ferrets and stoats.

## 2. Scope of strategy

The strategy contains information on:

- The species of concern.
- General outline of their impacts on biodiversity with specific information on protected bird species.
- Guidance on potential control measures.
- Template management plan.

While the strategy focuses attention on relevant control measures, managers need to take an adaptive approach, where by strategies employed should be updated as new information becomes available, or site specific factors mitigate against the chosen methodology.

## 3. Current views on predatory mammal eradications

Rodents, mustelids and cats can rapidly reach high numbers even if the founder population is few in numbers. Resources should be allocated to preventing the introduction of invasive alien species. If an invasive alien species has been introduced, early detection and rapid action are crucial to prevent its establishment. The preferred response is often to eradicate the population as soon as possible. In the event that eradication is not feasible or resources are not available for its eradication, containment and long-term control measures should be implemented. Any examination of benefits and costs (environmental, economic and social) should be done on a long-term basis.

Globally, since the 1980's the number and scale of invasive mammal species removal projects from vulnerable islands has steadily increased in terms of size of island and reported success rate. The removal of invasive mammal species from islands is one of society's most powerful tools for preventing extinctions and restoring ecosystems (Donlan and Wilcox 2007). Experience gained and lessons learnt outside of Ireland have provided us with an effective toolkit that renders most if not all of Ireland's offshore islands with populations of these mammals amenable to control at the very least but generally suitable for eradication with a high probability of success. Lake islands, due to their proximity to the mainland are more appropriate for targeted control programmes at prioritised sites.

## 4. Need for action

Islands harbour a disproportionate amount of the earth's biodiversity, but a significant portion has been lost due in large part to the impacts of invasive mammals (Aguirre-Munoz *et al.*, 2008). Island species are unique in their vulnerability. Of the 724 recorded animal extinctions in the last 400 years, about half were island species. Over the past century, island biodiversity has been subject to intense pressure from invasive alien species, habitat change and over-exploitation, and, increasingly, from climate change and pollution. That said, invasive mammals are the greatest threat to island biodiversity (Howald *et al.* 2007).

Invasive mammals have been shown to have a detrimental impact on island biodiversity. The species identified in this document are known to impact on native flora and/or fauna of island habitats. In Ireland, documented evidence of these impacts is not always easily found. Nonetheless, the impact of mink predation on breeding bird populations in County Mayo and the impact of rat predation on the Western Irish Sea islands bird colonies; coupled with experience in Britain and elsewhere, highlights the need for preventative and control/eradication measures to be put in place. Prevention is generally far more cost-effective and environmentally desirable than measures taken following introduction and establishment of an invasive alien species.

### 4.1 Ireland's seabirds

Britain and Ireland's seabird populations are an important component of global biodiversity and one of the richest areas in the world for seabirds. Just under 8 million seabirds from 25 species breed in Britain and Ireland, including 90% of the world's Manx Shearwaters, 68% of Northern Gannets and 60% of Great Skuas (Mitchell *et al.* 2004). Table 1 summarises the global context of seabird populations in Britain and Ireland (adapted from Mitchell *et al.* 2004) while Annex 1 indicates the overall importance of the island of Ireland for breeding seabirds (adapted from Mitchell *et al.* 2004).

**Table 1.** The global importance of seabird population in Britain and Ireland in respect to number of species and overall population estimates.

| Seabird centre      | Number of species | Population estimate |
|---------------------|-------------------|---------------------|
| Britain and Ireland | 25                | < 8,000,000         |
| Caribbean           | 22                | 1,300,000           |
| Falkland Islands    | 22                | 4,000,000           |
| Barents Sea         | 13                | 25,000,000          |
| New Zealand         | 20                | 55,000,000          |
| Alaska              | 20                | 24,000,000          |

Offshore and inland lake islands offer ground nesting bird species refuges from predation and human mediated impacts. These habitats provide isolated areas where species can achieve higher breeding success rates. When island breeding sites become invaded by predatory mammals such as mink, cats and rats, it places the colonies under increasing pressure.

## 4.2 Impact of predatory mammal on Ireland's important bird colonies

Invasive predatory mammals such as rats, cat and mink have been observed to attack and kill chicks, adult birds and take eggs from nest sites. Worldwide, invasive mammal species have led to the decline, extirpation and/or total extinction of bird and other species through predation and competition. In Europe for example, American mink predation has caused the decimation of seabird colonies and reduction of some waterfowl populations. Ireland is not immune to the impact of invasive mammals. Case Study 1, 2 and 3 highlight the impact these species are known to have on island ecosystems.

### Case Study 1: Impact of American mink on protected bird species in Lough Mask.

Lough Mask is designated as a candidate Special Protection Area (SPA 062) for wild birds under EU Directive 79/409. Both Common and Black-headed Gulls have significant nesting colonies on islands on Lough Mask. Although neither is listed under Annex 1 of this Directive, the Common Gull is amber listed and the Black-headed Gull has recently been Red-listed. Both are considered as species of conservation concern due to their unfavourable status in Europe and because their national breeding populations have declined by 25-50% in the last 25 years. Lough Mask holds a significant percentage of the national breeding population for both species (Mc Greal, 2007). The reasons for the decline in the breeding gull colonies in recent years are unknown, but it is considered that predation by American mink is a problem (SPA Site Synopsis). Mink are known to visit colonies and kill both adults and chicks.

Recently, a pilot mink control project has been funded on Lough Mask with the aim of protecting breeding gull colonies. Figure 1 below shows a trap used in this study. This project is currently ongoing.



**Figure 1.** Mink trap from Lough Mask in County Mayo. Photograph displays the technique used to make trap more attractive to mink. Door is solid galvanised metal which may allow personnel to check trap from a distance. Photo courtesy of BirdWatch Ireland

## Case Study 2: Western Irish Sea seabird colonies

Contributed by Steven Newton, Birdwatch Ireland ([snewton@birdwatchireland.ie](mailto:snewton@birdwatchireland.ie) [17/7/2008])

The east coast of Ireland has relatively few islands when compared to the west coast. Although most of these east coast islands support important seabird colonies and most also support populations of non-native rats (Table 5).

**Table 4.** Current status of rats on Western Irish Sea islands.

| County  | Island             | Rats present         | Main seabirds  | Rodent control |
|---------|--------------------|----------------------|--|----------------|
| Dublin  | St Patrick's       | Yes                  | Cormorant, Shag, large gulls   | No             |
|         | Colt               | Uncertain            | Large gulls  | No             |
|         | Shenick            | Yes                  | Large gulls, Fulmar  | No             |
|         | Rockabill          | No                   | Roseate, Common & Arctic Terns, Kittiwake, Black Guillemots  | n/a            |
|         | Lambay             | Yes                  | Fulmar, Cormorant, Shag, Gannet, Guillemot, Razorbill, Kittiwake, large gulls, Puffin, Manx Shearwater | Some           |
|         | Ireland's Eye      | Yes                  | Fulmar, Cormorant, Shag, Gannet, Guillemot, Razorbill, Kittiwake, large gulls, Puffin                  | No             |
|         | Maiden Rock        | No                   | Roseate, Common & Arctic Terns   | n/a            |
|         | Dalkey & Lamb      | Yes                  | Arctic Tern, Herring Gull, Great Black-backed Gull   | No             |
| Wexford | Lady's Island Lake | Yes                  | Sandwich, Roseate, Common & Arctic Terns, Black-headed & Mediterranean Gulls                           | Yes            |
|         | Great Saltee       | Yes                  | Fulmar, Cormorant, Shag, Gannet, Guillemot, Razorbill, Kittiwake, large gulls, Puffin, Manx Shearwater | No             |
|         | Little Saltee      | Uncertain but likely | Fulmar, Cormorant, Shag, large gulls, Puffin, Manx Shearwater  | No             |
|         | Keeraghs           | Yes                  | Cormorant, large gulls   | No             |

The above table indicates that:

- Tern colonies are only present on those islands without rats or with ongoing control programmes
- Nearshore islands tend to have seabird communities dominated by Cormorants and/or large gulls
- Burrow-nesting species (Puffin and Manx Shearwater) are present on the largest islands with the most diverse seabird communities (see below).

### Seabird Population Changes

The majority of species in the Irish Sea are doing well (stable or increasing): Fulmar, Gannet, Cormorant, Shag, Kittiwake, all terns, Guillemot, Razorbill and Black Guillemot.

The two burrow-nesting species, Puffins and Manx Shearwaters, plus Herring Gull are almost certainly in long-term decline. Herring Gulls have recently been Red-listed in Ireland. On Lambay, Manx Shearwaters are almost extirpated as a breeding species and although Puffin numbers have been approximately stable for ten years, very few appear to breed successfully.



**Table 5.** Status of Puffins on Western Irish Sea Islands

| Island        | Historical      | WW2       | OpSeaf  | SCR     | SB2K        |
|---------------|-----------------|-----------|---------|---------|-------------|
| Date          | c.1907          | 1939      | 1969/70 | 1985/87 | 1999/2002   |
| Lambay        | Immense numbers | 1000 prs* | 100prs  | No data | 260-265 ind |
| Ireland's Eye | A few           | 1000 prs  | 8 ind   | No data | No data     |
| Great Saltee  | No data         | 3000 prs* | 250     | 1128    | 1522 ind    |
| Little Saltee | No data         | No data   | c.25    | No data | 300 ind     |

\*These counts are from R.M. Lockley (Puffins) where he infers rats were having an impact at that time. Prs = pairs, ind = individuals, est = estimate, AOB = apparently occupied burrows.

**Table 6.** Status of Manx Shearwaters on Western Irish Sea Islands

| Island        | Historical                        | c. WW2                            | OpSeaf       | SCR        | SB2K                     | Recent  |
|---------------|-----------------------------------|-----------------------------------|--------------|------------|--------------------------|---------|
| Date          | c.1907                            | 1939                              | 1969/70      | 1985/87    | 1999/2002                |         |
| Lambay        | Breeding – no estimate of numbers | Present                           | 50-100 pr    | No data    | 3 AOB                    | 2 AOB   |
| Ireland's Eye | A few prs                         | No data                           | ≤ 20 burrows | No data    | Unlikely because of rats | No data |
| Great Saltee  | Present                           | Heard but no eggs or chicks found | No data      | 50-100 prs | Est. 220 AOB             | No data |
| Little Saltee | Nesting                           | No data                           | No data      | None       | No data                  | No data |

Thus, major declines over the last 100 years or so seem certain for Puffins on Lambay and Ireland's Eye. The situation on the Saltees is not so clear and likewise for Manx Shearwaters on all islands. However, if one compares Lambay and the Saltees with similar sized rat-free islands on the Welsh side of the Irish Sea (Skomer, Skokholm, Bardsey) then the likely impact of rats is apparent. The latter islands support around 150,000 pairs of Manx Shearwaters. Similarly, Puffin colonies in the southern North Sea (Isle of May, Farne Islands and Coquet) are increasing dramatically.

Rat eradications at Ailsa Craig and Canna (western Scotland) and Lundy (Bristol Channel) have shown that breeding Puffins and Manx Shearwaters can recover from 'extinction'. A similar exercise in Ireland is long overdue and such eradications should be priority conservation actions in the management plans for island Special Protection Areas supporting burrow-nesting seabirds. All aspects of biodiversity on these islands are likely to benefit from such eradications, particularly the vegetation/flora (Roger Trout and Alan Buckle, pers. comm.).

#### Surveys:

OpSeaf = **Operation Seafarer**, Cramp S, Bourne WRP, Saunders D. 1974. *The Seabirds of Britain and Ireland*. Collins, London.  
 SCR = **Seabird Colony Register**, Lloyd C, Tasker ML, Partridge K. 1991. *The Status of Seabirds in Britain and Ireland*. T & AD Poyser, London.

SB2K = **Seabird 2000**, Mitchell, P.I., Newton, S.F., Ratcliffe, N. & Dunn, T.E. (2004) *Seabird Populations of Britain and Ireland – Results of the Seabird 2000 Census (1998-2002)*. T & AD Poyser, London.

### Case Study 3 Status of Rats on Northern Ireland islands.

Contributed by Gregor Watson, Northern Ireland Environment Agency ([gregor.watson@doeni.gov.uk](mailto:gregor.watson@doeni.gov.uk) [17/02/2009])

| County                 | Island                                     | Rats present          | Main seabirds                               | Rodent control  |
|------------------------|--|-----------------------|---|---|
| Antrim                 | Rathlin Island                             | Yes                   | Puffin, Razorbill, Kittiwake, Guillemot     | Rats and mustelids known on island but not identified as a threat in Natura 2000 Standard Data Form for this SPA                    |
| Antrim                 | Sheep Island                               | Yes                   | Cormorant                                   | None identified in site synopsis but rats (species unknown) are thought to be present on the island (Neil McCullough, NIEA)         |
| Antrim                 | Larne Lough (Swan and Blue Circle Islands) | Uncertain             | Common Tern, Sandwich Tern and Roseate Tern | None specifically mentioned in Natura 2000 Standard Data form   |
| Antrim                 | Skerries                                   | 1.54 km from mainland | LBB Gull                                    | No information available  |
| Antrim                 | Carrickarede                               | Yes                   | Kittiwake                                   | No information available  |
| Antrim                 | The Maidens                                | No                    | Shag  | No  |
| Antrim                 | Muck Island                                | Yes                   | Razorbill                                   | Rats identified as issue with UWT and Abbie Patterson of NTS  |
| Antrim, Armagh, Tyrone | Lough Neagh and Lough Beg                  | Yes                   | Common Tern                                 | None identified but invasive mammals are highly likely to be present/gain access to islands from mainland                           |
| Down                   | Copeland Islands                           | No                    | Manx Shearwater and Arctic Tern             | None identified   |
| Down                   | Strangford Lough islands                   | Yes                   | Common Tern, Arctic Tern and Sandwich Tern  | Predation is identified as a potential impact. No information is available to ascertain this impact on islands included in this SPA |
| Down                   | Carlingford Lough (Green island)           | Uncertain             | Common Tern and Sandwich Tern               | None specifically mentioned in Natura 2000 Standard Data form. Predation is listed as a threat but species is not identified        |
| Down                   | Outer Ards (Cockle Island)                 | Uncertain             | Arctic Tern                                 | None specifically mentioned in Natura 2000 Standard Data form. Rats poisoned in past in harbour                                     |
| Down                   | Outer Ards (Burial Island)                 | Uncertain             | Arctic Tern                                 | No  |
| Down                   | Gun's Island                               | Yes                   | Kittiwake                                   | No  |



| County    | Island                    | Rats present | Main seabirds          | Rodent control  |
|-----------|---------------------------|--------------|------------------------|---|
| Fermanagh | Crunnish Island (LLE)     | Uncertain    | Common Gull            |   |
| Fermanagh | Gravel Ridge Island (LLE) | Uncertain    | Sandwich Tern, BH Gull | Predation is identified as a potential impact from RSPB |
| Fermanagh | Curley's Rock (LLE)       | Uncertain    | Common Gull            |   |
| Fermanagh | Black Rock (LLE)          | Uncertain    | LBB Gull               |   |

### 4.3 Impact on EU Directive goals

In Ireland and the UK, important drivers of conservation activities are EU Directives such as the Habitats Directive and the Birds Directive. The conservation objectives of these two significant pieces of legislation can be negatively impacted by invasive predatory mammals; especially on island habitats. For example, failure to control mink populations to protect tern colonies in Ireland has contributed to a European Court of Justice ruling against Ireland for failing to protect vulnerable bird species.

### 4.4 Economic Impacts

Worldwide, these species have contributed to economic impacts on both islands and mainland economies. Rat species, are known to chew through wires and cables, take grain and contaminate food supplies. Mink are known to predate on farm birds and also impact on aquaculture by taking farmed fish from cages. More specifically in Ireland, these species can contribute to the failure to attain goals of EU legislative objectives. This can, and has lead to the levying of substantial fines (European Court of Justice ruling in case C-418/04: Commission v. Ireland). Costs associated with control programmes for these species can vary but in general offer excellent value for money in terms of restoring native communities and achieving conservation objectives. Control programmes can also benefit island economies by expending money in the local area that otherwise would be invested elsewhere.

### 4.5 Additional impacts

The introductions of invasive species can lead to significant and unpredictable ecological change on island ecosystems. The complex mechanisms by which introduced species interact with each other and with native species can lead to a collapse of the native ecosystems. For example, the introduction of rodent or rabbit species after the previous introduction of a predatory species such as cat, mink or ferrets, can give the predator species an ecological advantage to better survive outside of the ground nesting bird breeding season. This can have the knock on effect of increasing the numbers of birds taken throughout the breeding season.

It is also important that environmental managers and policy makers are aware that on islands systems, where studies of the biodiversity have not been properly carried out the loss of species can sometimes go unrecorded.

## 5. Vectors and pathways

In order to prevent unwanted introductions, the vectors and pathways by which mammals may reach islands need to be addressed. The majority of these are human mediated. Prevention strategies to address these vectors and pathways may involve legislative or behavioural changes.

**Table 7.** Sectors associated with introductions that are currently active in Ireland

| Species | Sector  | Vector   |
|---------|---|--|
| Rat     | Tourism<br>Inshore and offshore boating<br>Shipping<br>Agriculture  | Stowaway on board boats<br>Natural dispersal       |
| Mice    | Tourism<br>Inshore and off shore boating<br>Shipping<br>Agriculture | Stowaway on board boats                            |
| Mink    | Fur farm trade<br>Animal rights activists                           | Escape<br>Intentional release<br>Natural dispersal |
| Ferret  | Pet trade<br>Pest control   | Escape<br>Intentional release                      |
| Cat     | Pet trade<br>Pest control   | Escape<br>Intentional release                      |

## 6. Prevention

Preventing the spread and introduction of these species to offshore and inshore islands should be a priority aim of this strategy. The financial costs associated with infraction proceedings for failing to meet EU legislative obligations, mitigation measures and eradication efforts are significant. The following actions are designed to guide and support prevention measures and subsequent response to new incursions to inhibit establishment of self sustaining populations.

### **Action 1: Promote awareness of the significant biodiversity value of Ireland's islands**

National awareness campaigns should run features on important island habitats. Island communities should be targeted with information that raises their awareness of the biodiversity value and encourage ownership of biodiversity issues.

### **Action 2. Promote awareness of the impacts of invasive non-native species**

An effective education and awareness strategy is extremely important. Currently, the only method controlling these species on islands is through trapping, hunting and laying of toxic bait which may be costly and attract negative public opinion. The ecological and economic impacts associated with these species are great. Targeted education and awareness programmes could aid control programmes yield cost effective results. These species should be included as featured species with appropriate fact sheets and downloadable articles on the [www.invasivespeciesireland.com](http://www.invasivespeciesireland.com) website.

### **Action 3: Education and awareness for householders and summer residents on islands**

Some of the species included in this strategy are widely kept as household pets. It is important that individuals that keep these animals on islands are aware of the ecological damage that could be caused if they are allowed to escape into the wild forming self sustaining populations. The incorporation of guidelines for pet owners on islands into education and awareness materials should be a priority. This should include guidelines on measures that can be taken to prevent domestic pets taking vulnerable bird species. Education and awareness materials such as signage and leaflets should be available at piers and harbours to target residents and island visitors.

### **Action 4: Education and awareness of invasive species issues with planning authorities**

Planning authorities have an important role to play in the preventing invasive alien species becoming established. Through their function and ability to impose restrictions on developments and ensure that developers enact the required control measures significant reduction of associated risk is possibly.

### **Action 5. Promote awareness of effective pest control strategies**

The predatory mammals identified in this plan can be introduced to islands to control "pest" species on farmland. The efficacy of these species as a pest control mechanism is not always clear. These mammals will tend to attack easier to access prey such as ground nesting birds. Farmers and householders should be made aware of this and also made aware of cost effective and more suitable methods to control pest species.

### **Action 6. Promote awareness of Alien Watch with key stakeholders**

The development and supporting of rapid reporting mechanisms is key to the prevention of impacts associated with invasive alien species. In support of this, the Invasive Species Ireland project established the Alien Watch section which allows records/sightings to be submitted to the project and from there to the two biological records centre on the island of Ireland. It is clear that this is currently an under utilised and under publicised resource especially in terms of specific targeting professionals and state agency staff with specific expertise in species identification. Targeted awareness with these key stakeholders will facilitate response to new incursions and ensure that NPWS and NIEA are made aware of emerging issues in a timely fashion.

#### **Action 7. Address vectors and pathways of introduction**

The adoption of codes of practice, targeting awareness of preventative measures that key stakeholders can undertake and imposing/recommending preventative measures for inclusion in current/future developments will reduce the risk of invasion in the first instance. In all cases this will involve the development of partnerships and approaching local islanders and representative groups to facilitate good working relationships.

#### **Action 8: Enforcement of existing legislation**

Under the Habitats Directive, an Appropriate Assessment must be carried out in respect of any plan or project which:

- a. either alone or in combination with other plans or projects would be likely to have a significant effect on a European Site, and
- b. is not directly connected with the management of the site for nature conservation.

The inception of a programme or deliberate introduction of a species to an island that could potentially have an impact on the site designation features requires an appropriate assessment. Invasive species should be given due consideration in all cases where a plan or programme increases the risk of introduction.

## 7. Management

The invasive alien species specified in this action plan are widely distributed across the island of Ireland. Their ability to reach seabird islands through natural dispersal and human mediated mechanisms is clear. The guiding principles of the Convention on Biological Diversity direct governments to take action in respect to invasive alien species. This convention also gives a practical decision making framework as to when action should be taken in respect to economic interests as well as environmental concern and likelihood of success.

### 7.1 Republic of Ireland

In order to support this strategy and facilitate progress on the ground aimed at protecting vulnerable seabird colonies, an expert consultation exercise was undertaken to identify islands in the Republic of Ireland requiring programme of measures. National Parks and Wildlife Service (David Tierney and David Norriss) and BirdWatch Ireland (Steven Newton) contributed. Following this consultation exercise, three separate prioritised lists emerged. Notes on the lists are given below:

**Eradication/control:** This group of islands are those with a known impact on seabird colonies. Measures are required now to prevent further loss due to predation by one or more of the mammals identified in this document.

**Emergency measures:** This group of islands are those that either due to recent developments or possible sightings of the mammal species in this document require the establishment of a monitoring programme and/or response programme to prevent an impact on the sea bird colonies.

**Knowledge gaps:** This group of islands are those that have anecdotal evidence or where information is lacking to determine if the seabird colonies are subject to predation pressure of these mammals. It is noteworthy that some of these islands may have endemic populations of native mammal species that may be genetically distinct from mainland populations.

**Table 8** Prioritised list of islands for the Republic of Ireland

| Rank | Eradication/Control         | Emergency measures | Knowledge Gaps                        |
|------|-----------------------------|--------------------|---------------------------------------|
| 1    | Lambay                      | Blasket            | Tory                                  |
| 2    | Great Saltee, Ireland's Eye | Puffin             | Skerries Island SPA                   |
| 3    | Dalkey and Lamb             | Great Skellig      | Inch Loch and Levels                  |
| 4    | Lady Island Lake            |                    | Inish Bofin, Inishdooey and Inish Beg |
| 5    | Greers Island               |                    |                                       |

## 7.2 Northern Ireland

The situation in Northern Ireland differs for a number of reasons. Firstly, Northern Ireland has fewer islands than the Republic of Ireland, and secondly, Northern Ireland's islands generally lie much closer to the mainland and are therefore much more difficult to prioritise. Following consultations with NIEA experts (Gregor Watson) a short list for eradication and prevention has been developed based on current knowledge and risks to the protected seabird colonies.

### Eradication

Rathlin Island is considered amenable to eradication measures with a high probability of success.

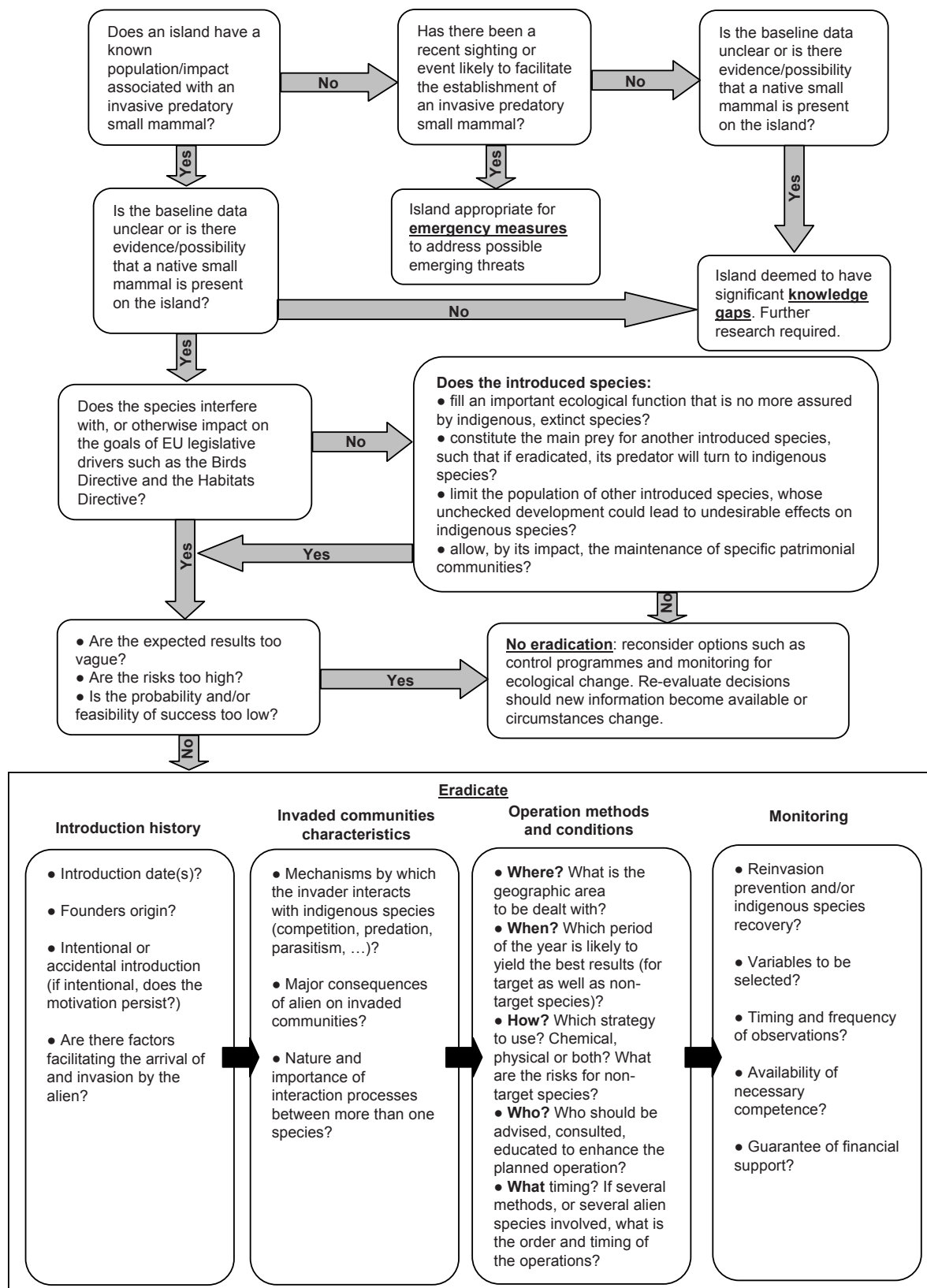
### Prevention

The important Manx Shearwater and Tern populations present on the Copelands Islands, coupled with the distance from the mainland and the level of boat traffic to this island group raises it to priority status for prevention efforts.

## 7.3 Future programmes in Ireland

To inform the process by which islands can be chosen for eradication in Ireland in the future, a decision flowchart adapted from Courchamp (2003) has been designed (Figure 2). This decision tree should be applied by funding bodies and managers on an island by island basis. The precautionary principle should be applied accordingly.





**Figure 2.** Decision diagram for the eradication of mammal species from islands (adapted from Courchamp, 2003). This decision tree should be applied to individual islands on a case by case basis and reviewed as needed.

**Action 8: Initiate programme of measures to address specific issues on identified islands in ROI and NI**

A programme of works is required to address the issues identified for each of the islands identified in Sections 7.1 and 7.2. These programmes will require the development of local partnerships and local level action plans. Where necessary, a communication strategy should be developed for each plan to ensure buy in and understanding by all stakeholders. Case studies/project information should be publicised through the Invasive Species Ireland website.

**Action 9: Ensure invasive species are included in the management plans for all current and future SPA's and SAC's**

Invasive species represent either an actual or potential threat to the conservation goals of SPA's and SAC's. All site synopsis/management plans should reflect this.

**Action 10: Objectively assess the vulnerability and need for action at seabird islands across the island of Ireland**

The prioritised lists of islands in Sections 7.1 and 7.2 are based on expert judgement. The decision tree facilitates future action in this area in both NI and ROI. These lists are intended to act as a springboard for practical action in the immediate future. However, there is a requirement to objectively assess the vulnerability of seabird islands to invasion by these mammals to facilitate compliance with Habitats and Birds Directives. It is recommended that seabird islands are assessed for their relative vulnerability to invasion from mainland Ireland. This should be done by a risk assessment approach that should take into account the distance from the mainland, level of boat traffic, size of boats capable of gaining access, ability to deploy a rapid response to an incursion and all other criteria relevant to the invasion process. High risk islands should be subject to permanent monitoring programmes and should be facilitated by stakeholders and state agency regional staff.

**Action 11: Design and practice contingency plans**

Contingency plans are required to ensure that any future incursions are dealt with in a timely and cost effective manner, thus minimising or preventing impact. Roles of responsibility and resource implications should be identified with all necessary organisations and stakeholders engaged. Contingency plans should also be practiced to refine methodologies and linkages between initiation of the programme and its target goal. Lessons learnt should be incorporated back into the contingency plan. If appropriate, local/mass media attention should be utilised to increase awareness of the issues and understanding of why the plan is required.

**Action 12: Drafting of rapid response protocols for key/prioritised offshore and lake islands**

There is a need for rapid response to new incursion events of invasive predatory mammals on seabird islands. These species are highly adaptable to island environments. Rapid response to incursions will present managers and government with value for money by reducing the costs associated with control/eradication of established populations while also preventing potential infraction proceedings under relevant EU legislation.

## **8. General Guidance for Managers Embarking on an Eradication Programme**

Eradication of high impact invasive alien species is a powerful conservation tool, able to significantly reduce biodiversity loss and to mitigate negative impacts associated with the invasions.

### **8.1 Decision making**

In all plans/programmes considered and initiated the desired outcomes should be clearly defined. In small-scale projects (e.g. new incursion events), based on the precautionary approach, the aim is the prevention of possible future impacts and to guide the eradication of current populations of invasive mammals on islands. In large-scale campaigns the desired outcomes should be described in detail (e.g. the recovery of a breeding bird population or the reintroduction of an extirpated species after the removal of a predatory species).

An eradication programme should not be attempted unless it is ecologically feasible and has the necessary financial and political commitment. Public support for the project may be an important factor in its success and should be considered carefully. The feasibility of eradication should be assessed on the basis of the most relevant biological characteristics of the target species, the ecological relationships of the species with the invaded area, the socio-economic aspects, the political commitment, the legal framework, public support and the availability of funds.

The decision to proceed with an eradication or control programme should be based on a clear and justifiable decision making process. In the case of an identified impact on the conservation goals of a designated site or species, then eradication should be a priority, especially if there is a high chance of success and low chance of reintroduction.

### **8.2 Public Awareness**

The importance of public awareness and understanding cannot be understated. In a lot of cases programmes can fail or be severely delayed because of lack of buy in from stakeholders. A media and communication strategy is required that informs the general public on why the programme is necessary and what are the potential benefits for not only the environment but also the local community and economy. Case Study 4 provides an example whereby a rapid response to a possible incursion of rats to an Scottish island was subject to some negative publicity on an online forum. Managers should give due consideration and attention to developing a media and communication programme.

#### Case study 4 Rapid response to possible incursion of rats on St. Kilda, Scotland

The islands of St Kilda hold over half a million breeding seabirds including the world's largest populations of northern gannet, puffins, fulmars and guillemots. It is a World Heritage Site, inscribed in 1986 and extended in 2004 and 2005. The seabird colonies are of international significance. There are no trees or predators on the islands. Native birds nest on the ground or in burrows. St Kilda is home to Fulmar, Shag, Great Skua, Common Gull, Lesser Black-backed Gull, Herring Gull, Greater Black-backed Gull, Kittiwake, Guillemot, Razorbill, Puffin, Manx Shearwater, Storm Petrel, Leach's Petrel and Gannet.

On the 01 February 2008, the fishing vessel "Spinningdale" ran aground against steep cliffs at Village Bay during a force-nine gale. Conservationists recognised the possibility of rats stowing away on the vessel. The St Kilda World Heritage Site Management Plan identified the introduction of rats, cats and mink as potentially the biggest threat to the seabird colony and had mechanisms in place to address this including a rat contingency plan. In light of this, a rapid response was initiated. National Trust for Scotland and Ministry of Defence civilian staff laid rat traps and monitoring stations baited with chocolate flavoured wax bait to determine whether rats were present. National Trust staff remained on the island for three days and detected no signs of rats. Currently, no information is available to indicate that this situation is unchanged.



**Figure 3:** FV Spinningdale run aground on St. Kilda, Scotland. Photo: Maritime and Coastguard Agency Press.

#### Lessons learnt

The operation received considerable national, local and sector specific attention in both the mainstream media and on online fora. Although no rats appear to have been found on this occasion the rapid response, in terms of nature conservation appears to be justified and proportionate to the risk factor.

The online forum <http://www.trawlerphotos.co.uk> has opinions of fishermen and other interest groups on this incident and the subsequent clean up. While it appears there is some understanding of why the rapid response was necessary not all stakeholders agreed with the expenditure of money on this occasion. It would seem prudent that should a rapid response be initiated, media attention should focus on the reasons why it is necessary as well as the operation itself. A more clear understanding and justification of spending of public money may help future operations in terms of public opinion and stakeholder engagement.

## 9. Impact of the control programme

Prior to the initiation of a control programme, managers must consider the potential impact to the habitat and non target species. Possible impacts include

- Disturbance by personnel during the operation
- Direct exposure to toxic substance
- Secondary exposure to toxic substance
- Becoming trapped in the traps set for target species

In most cases, if not all, these potential impacts can be overcome or do not have a lasting implication to the wellbeing and survival of the species. Personnel should record any and all collateral damage caused by the programme of works as well as sightings of birds of prey/ scavenging bird species that may ingest a target animal that has eaten a toxic substance. Good trap and bait station design and placement has the potential to minimise the risk of non target species becoming directly exposed to the poison.

The control programme can also have unpredicted impacts. The loss of one invasive species can lead to the predatory or competitive release of another invasive species. It may be appropriate to consider committing to multiple species control programmes, simultaneously or successively, depending on the availability of resources. Managers may have to consider control programmes for species not covered in this plan. For example, introduced rabbits are known to have catastrophic effects on islands, either by direct destruction of the vegetative cover, or by the resulting disturbance of indigenous vertebrates.

## 10. Programme success, monitoring and post eradication checks

Even if the vast majority of the population is removed, some members may persist in very low numbers that are difficult to detect. Managers and funding bodies need to be aware of the fact that the cost of removing the last few remaining individuals can be comparatively higher than the cost per individual for the bulk of the population. This is an important consideration that should be taken into account when planning the programme of work and budget expenditure.

Given that the risk of substantial population increase is high if even one breeding pair remains, monitoring protocols must be put in place. Monitoring the success of the eradication is crucial. Methods capable of detecting species at very low densities are needed. An adaptive approach, based on a constant revision of the programme in light of results obtained, is the best option.

Monitoring the recovery of species and/or habitat of conservation concern should be an integral point of an invasive species control/eradication plan.

Monitoring for reintroduction is a vital component to any eradication plan. Permanent traps or mammal indicator techniques should be established at points around the island and at sites of high colonisation risk e.g. marinas, docks and bird breeding grounds. These should be checked regularly and if signs of re-invasion are found a rapid response should be initiated.

## **11. Resourcing this strategy**

### **11.1 Exclusion**

Effective resourcing of the exclusion options identified in this strategy will minimise costs associated with introductions of invasive mammals. Preventative actions generally focus on the education and awareness of the general public and key stakeholders with a particular emphasis on permanent and seasonal island residents, the tourism sector, larger leisure crafts and industrial boats, marina/harbour operators, those that import materials to islands and planners in terms of the role they have in the development of private and public ventures that can lead to increased boat traffic in terms of numbers and size.

### **11.2 Contingency and implementation**

Should efforts to prevent arrival not be successful or an eradication/control programme is considered, the costs associated will vary according to the scale of the incursion, availability of staffing/voluntary involvement and the availability of resources such as traps and vehicles.

- For small scale introductions or introductions that are detected early and a rapid response initiated, costs associated can be quite low. In the first instance, where suitably trained volunteers and staff are engaged costs can be expected to fall less than £10,000 (€12,000).
- For larger scale or established introductions on larger islands costs can be much greater. It is not possible to give an estimate of costs at the time of preparing this plan. Factors such as risk of reintroduction, terrain, ease of access and number of species involved can greatly affect costs. It is also anticipated that if the introduction is beyond a certain critical point agencies will need to assess if private contractors will be required to carry out the eradication programme. However, in most islands on Ireland, eradication of these species is possible and represents excellent value for money in terms of achieving the conservation objectives for both seabird species and other species such as protected or rare plants.

### **11.3 Monitoring**

All programmes should have an element of monitoring incorporated into project budget estimates. Monitoring should focus on island biodiversity recovery that includes flora and fauna as well as monitoring for re-invasion.



## 12. Invasive mammal on offshore and inshore islands eradication plan template.

Use this template in conjunction with Annex 6 for to help formulate a management plan outlining how you are going to proceed and what you will need.

Site Manager(s)/Owner(s): \_\_\_\_\_

Site Name(s): \_\_\_\_\_

Central grid reference: \_\_\_\_\_

License to proceed with plan acquired? Yes ☐ No ☐

Is an Appropriate Assessment required? Yes ☐ No ☐

### Island details

|                                    |  |
|------------------------------------|--|
| Manager/lead organisation details: |  |
| Telephone:                         |  |
| Email:                             |  |
| Agencies/persons involved:         |  |
| Date:                              |  |
| Species of concern:                |  |

### Invasion history

|   |  |
|---|--|
| Date of introduction:                         |  |
| Original location of introduction:            |  |
| Date of first report to competent authority:  |  |
| Method of introduction:                       |  |
| Additional information on introduction event: |  |

### Site information

|  |  |
|--|--|
| Total site area:   |  |
| Total area colonised:  |  |
| Total area of relevant habitats:                                 |  |
| Reference of ecological studies carried out on the island:       |  |
| History of previous site management of invasive mammals, if any: |  |

| Designation   | On site | Near site | None present |
|---|---------|-----------|--------------|
| <b>Details:</b><br><br>Establish if there is a requirement to apply for a license/notify before proceeding with plan. |         |           |              |

| Rare and threatened species   | On site | Near site | None present |
|-------------------------------|---------|-----------|--------------|
| Red Data Book or BAP species: |         |           |              |

|                                       |  |  |  |
|---------------------------------------|--|--|--|
| Rare, threatened or protected species |  |  |  |
|---------------------------------------|--|--|--|

#### Current identified impacts

| Impacts | Minimal | Moderate | Severe |
|---------|---------|----------|--------|
|         |         |          |        |

#### Human sensitivities/vested interests at site

| Issue | Human receptor |
|-------|----------------|
|       |                |

#### Management options (tick box for method/s chosen)

- Bait station ☐  
 Live trapping ☐  
 Trapping ☐  
 Hand broadcasting ☐  
 Aerial broadcasting ☐  
 Spotlight hunting ☐  
 Tracking ☐

#### Justify why you have chosen this approach

|  |
|--|
|  |
|--|

#### Actions and resources

| Management options | Responsibility | Date to undertake |
|--------------------|----------------|-------------------|
|                    |                |                   |

| Resources needed | Responsibility | Date to undertake |
|------------------|----------------|-------------------|
|                  |                |                   |

#### Data to be recorded: Bait station method

|   |  |
|---|--|
| Total number of transects:                            |  |
| Transect distance apart:                              |  |
| Bait station distance apart:                          |  |
| Final grid size (e.g 5 x 5m /100 x 100m grid):        |  |
| Total number of bait stations:                        |  |
| Chosen bait station type:                             |  |
| Chosen lure:  |  |
| Chosen toxin:   |  |
| Date all stations in place (no bait present):         |  |
| Date all stations in place and active (bait present): |  |
| Revisit:  |  |
| Personnel employed to conduct visits:                 |  |
| Predicted end date:                                   |  |

### Data to be recorded: Hand broadcast method

|   |  |
|---|--|
| Total number of transects:                            |  |
| Transect distance apart:                              |  |
| Broadcast station distance apart:                     |  |
| Final grid size (e.g 5 x 5m /100 x 100m grid):        |  |
| Total number of broadcast stations:                   |  |
| Chosen toxin:   |  |
| Date all stations in place (no bait present):         |  |
| Date all stations in place and active (bait present): |  |
| Revisit:  |  |
| Personnel employed to conduct visits:                 |  |
| Predicted end date:                                   |  |

### Details trapper should record in the field.

|                |                                   |
|----------------|-----------------------------------|
| Trap Number    | Unique trap number required       |
| OS sheet       | OS map sheet code                 |
| Easting        | Full grid reference required      |
| Northing       | Full grid reference required      |
| Location       | Local name                        |
| Date first set | Date and time                     |
| Trapper        | Trapper details must be traceable |

|              |  |
|--------------|--|
| Bait or lure | Details of method and amount used                |
| Mon          | Day of first set or subsequent check in one week |
| Tue          | As above   |
| Wed          | As above   |
| Thu          | As above   |
| Fri          | As above   |
| Sat          | As above   |
| Sun          | As above   |
| Date closed  | Date and time                                    |

### Monitoring and evaluation

|                  |                   |           |  |
|------------------|-------------------|-----------|--|
| Name of person/s | Date to undertake | Report to | Additional treatments date (if required) |
|                  |                   |           |  |

### 13. References

- Aguirre-Muñoz, A., Croll D.A., Donlan C.J., Henry III, R.W., Hermosillo, M.A., *et al.* (2008) High-impact Conservation: Invasive Mammal Eradications from the Islands of Western México. *AMBIO: A Journal of the Human Environment*. 37, 101–107.
- Courchamp, F., Chapuis, J. and Pascal, M. (2003). Mammal invaders on islands: impact, control and control impact. *Biological Reviews*. 78. 347-383.
- Donlan, C.J. and Wilcox C. (2007) Integrating invasive mammal eradication and biodiversity offsets for fisheries bycatch: Conservation opportunities and challenges for seabirds and sea turtles. *Biological Invasions*. DOI 10.1007/s10530-007-9183-0
- Eason, C.T., Morgan, D.R. and Clapperton, B.K. 1992. Toxic bait and baiting strategies for feral cats. Pp. 371-376 in Borrecco, J.E. and Marsh, R.E. (Eds): *Proceedings of the 15th Vertebrate Pest Conference*. University of California, Davis, California.
- Howald, G., Donlan, C., Galvan, J., Russel, J., Parkes, J., Samaniego, A., Wand, Y., Veitch, D., Genovesi, P., Pascal, M., Saunders, A. and Tershy, B. (2007). Invasive rodent eradication on islands. *Conservation Biology*: 21:121-124.
- Mc Devitt, A.M., and Casey, C., 1999. The Corncrake (*Crex crex*) in Ireland. In Schaffer, N. and Mammen, U. (eds.) (1999) *Proceedings International Corncrake Workshop 1998*, Hilpoltstein/ Germany.
- Mc Greal, E. 2007. Progress Report on Black-headed and Common Gull Colour-ringing Study, Lough Mask, County Mayo. A report prepared for the National Parks and Wildlife Service.
- Mitchell, P.I., Newton, S., Ratcliffe, N. and Dunn, T.E. 2004. *Seabird Populations of Britain & Ireland*. T. & A.D. Poyser, London

**Annex 1** Ireland's seabird species indicating percentage of each species known to occur in Ireland (adapted from Mitchell *et al.* 2004).

| Species                  | Northern Ireland | Republic of Ireland | All-Ireland | % GB and Irish population known to occur in Ireland |
|--------------------------|------------------|---------------------|-------------|---|
| Roseate Tern             | 4                | 734                 | 738         | 93.42%  |
| European Storm-petrel    | 0                | 99065               | 99065       | 79.39%  |
| Great Cormorant          | 663              | 4495                | 5158        | 37.85%  |
| Common Tern              | 1704             | 2485                | 4189        | 28.90%  |
| Sandwich Tern            | 1954             | 1762                | 3716        | 26.07%  |
| Razorbill                | 24084            | 27446               | 51530       | 23.85%  |
| Common Guillemot         | 98546            | 138108              | 236654      | 15.18%  |
| Northern Gannet          | 0                | 32758               | 32758       | 12.63%  |
| Black-legged Kittiwake   | 13060            | 36100               | 49160       | 11.82%  |
| Great Black-backed Gull  | 76               | 2243                | 2319        | 11.76%  |
| European Shag            | 301              | 3426                | 3727        | 11.54%  |
| Manx Shearwater          | 4633             | 32545               | 37178       | 11.19%  |
| Black Guillemot          | 1174             | 3367                | 4541        | 10.64%  |
| Black-headed Gull        | 10107            | 3876                | 13983       | 9.85%   |
| Little Tern              | 0                | 206                 | 206         | 9.57%   |
| Northern Fulmar          | 5992             | 32918               | 38910       | 7.23%   |
| Arctic Tern              | 767              | 2735                | 3502        | 6.24%   |
| Mediterranean Gull       | 2                | 3                   | 5           | 4.42%   |
| Herring Gull             | 714              | 5521                | 6235        | 4.18%   |
| Lesser Black-backed Gull | 1973             | 2876                | 4849        | 4.16%   |
| Atlantic Puffin          | 1610             | 19641               | 21251       | 3.54%   |
| Common Gull              | 557              | 1060                | 1617        | 3.25%   |
| Leach's Storm-petrel     | 0                | 310                 | 310         | 0.64%   |
| Great Skua               | 0                | 1                   | 1           | 0.01%   |

## Annex 2 Some seabird species under threat from invasive mammals

### 2.1 The European Storm Petrel *Hydrobates pelagicus*

The European Storm Petrel is perhaps Ireland's most important seabird species. Coastal islands off the west coast of Ireland harbour nearly 80% of the total population of Britain and Ireland. These colonies constitute some of the largest in a global context. European Storm-petrels are pelagic, returning to land only to breed, and choose to nest on remote offshore islands. They nest below ground, appearing above ground only during darkness (JNCC).



### 2.2 Puffins *Fratercula arctica*

Atlantic Puffins typically nest underground in burrows dug in the soil of offshore islands. Where such habitat is in short supply, they nest among boulder screes or at low densities in cracks in sheer cliffs rather like Black Guillemots or Razorbills. Puffins are highly colonial and most colonies occur where the nesting birds are safe from mammalian predators i.e. islands with no predatory mammals present or where access is difficult (JNCC).

### 2.3 Black-headed gull *Larus ridibundus*

Although the Black-headed gull is not listed under Annex 1 of the Birds Directive it is currently red-listed as species of conservation concern due to their unfavourable conservation status in Europe and because their national breeding populations have declined by 25-50% in the last 25 years. Lough Mask holds a significant percentage of the national breeding population of this species. Mink are known to predate upon eggs, chicks and adults of this species and the common gull at this site (JNCC).





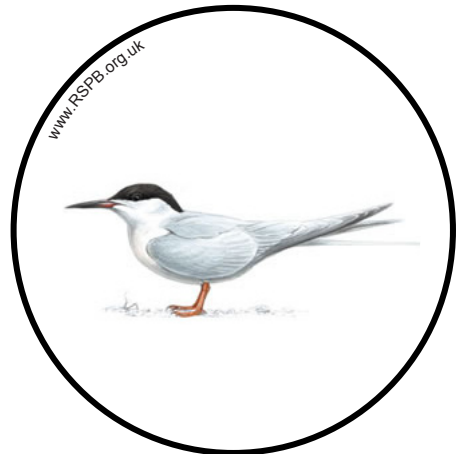


#### 2.4 Manx Shearwater *Puffinus puffinus*

Manx Shearwaters spend most of the year at sea returning to land only to breed. They nest in burrows and under boulders, and come ashore during the hours of darkness in order to evade predators such as Great Skuas and Great Black-backed Gulls. They breed exclusively on islands, usually free of rats that predate eggs, chicks and adults. Manx Shearwaters were believed to have been exterminated from their eponymous colony on the Calf of Man by the introduction of rats from a wrecked ship in the late 18th Century. More recently, in 2000, rats and cats were responsible for the extirpation of Manx Shearwaters from Canna (JNCC).

#### 2.5 Roseate Tern *Sterna dougallii*

Roseate Terns are a globally threatened species and are listed under Annex 1 of the Birds Directive. Ireland is known to have the largest populations in Northern Europe with over 90% of the total populations of Britain and Ireland. This species is known to nest at Rockabill, Lady's Island Lake and the Dalkey Islands (JNCC).



#### 2.6 Corncrake *Crex crex*

The corncrake *Crex crex* has suffered serious and often rapid declines over most of its European range and is listed as threatened with global extinction, the only Irish bird to be so classified (Mc Devitt and Casey 1999). The Corncrake has undergone a decline throughout its range due to major agricultural change, most notably the switch from hay to early cut silage. In Ireland it survives in key areas such as North Donegal, the Shannon Callows and west Mayo. Island habitats such as Tory Island off the north coast of Donegal are emerging as a vital refuge for this species. While habitat management is identified as a major factor in the protection of this species, the breeding success can be impeded by non native mammalian predators. By taking eggs or chicks, they prevent successful breeding from one year to the next.

### Annex 3 Notes on seabird species nesting habits

| Species                  | Notes on distribution and nesting habit  |
|--------------------------|--|
| Arctic Skua              | Passage only   |
| Arctic Tern              | Arrive in May and leave in August and September, nests on ground   |
| Atlantic Puffin          | Only comes to land during breeding season where it nests in burrows on islands or cliffs   |
| Black Guillemot          | Present all year round, nests in holes/boulder fields etc.   |
| Black-headed Gull        | Present all year round, nests on ground  |
| Black-legged Kittiwake   | Nests on cliffs  |
| Common Guillemot         | Nests on cliffs  |
| Common Gull              | Present all year round, but absent from colonies (where nests on ground, roof tops, cliffs) during autumn/winter                   |
| Common Tern              | Arrive in April and leave in August and September, nests on ground   |
| European Shag            | Present all year round, nests on cliffs or offshore islands  |
| European Storm-petrel    | Summer migrant, nests in holes/cavities on offshore islands  |
| Great Black-backed Gull  | Present all year round, nests on cliffs and roof tops - found inland most in winter  |
| Great Cormorant          | Present year round, but nests in in trees (near freshwater) or on cliffs (marine)  |
| Great Skua               | Nests on ground on offshore islands  |
| Herring Gull             | Cosmopolitan nests sites in a variety of locations (e.g. cliffs, islands and roof tops)  |
| Leach's Storm-petrel     | Summer migrant, nests in holes/cavities on offshore islands  |
| Lesser Black-backed Gull | Present all year round, but absent from colonies (where nests on ground, roof tops, cliffs) during autumn/winter                   |
| Little Tern              | Nests on ground on beaches   |
| Manx Shearwater          | Only comes to land during breeding season where it nests in burrows on islands   |
| Mediterranean Gull       | Rare breeder, but slowly colonising Ireland, likely to be found nesting on ground within Black-headed Gull or Common Gull colonies |
| Northern Fulmar          | Present in Irish waters all year round, but comes to nesting cliff from winter onwards   |
| Northern Gannet          | Nests in large very distinct offshore or onshore cliff colonies  |
| Razorbill                | Nests on cliffs  |
| Roseate Tern             | Nests on ground on offshore islands  |
| Sandwich Tern            | Nests on ground (including beaches) on offshore and onshore (freshwater) islands   |

## Annex 4 Time of year seabird species nest in colonies

This information may be used to help chose time of year to initiate programme or embark upon species specific protection activities.

| Species                  | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | Species                  |
|--------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|-----|-----|-----|--------------------------|
| Arctic Skua              |     |     |     |     |     |     |     |     |      |     |     |     | Arctic Skua              |
| Arctic Tern              |     |     |     |     |     |     |     |     |      |     |     |     | Arctic Tern              |
| Atlantic Puffin          |     |     |     |     |     |     |     |     |      |     |     |     | Atlantic Puffin          |
| Black Guillemot          |     |     |     |     |     |     |     |     |      |     |     |     | Black Guillemot          |
| Black-headed Gull        |     |     |     |     |     |     |     |     |      |     |     |     | Black-headed Gull        |
| Black-legged Kittiwake   |     |     |     |     |     |     |     |     |      |     |     |     | Black-legged Kittiwake   |
| Common Guillemot         |     |     |     |     |     |     |     |     |      |     |     |     | Common Guillemot         |
| Common Gull              |     |     |     |     |     |     |     |     |      |     |     |     | Common Gull              |
| Common Tern              |     |     |     |     |     |     |     |     |      |     |     |     | Common Tern              |
| European Shag            |     |     |     |     |     |     |     |     |      |     |     |     | European Shag            |
| European Storm-petrel    |     |     |     |     |     |     |     |     |      |     |     |     | European Storm-petrel    |
| Great Black-backed Gull  |     |     |     |     |     |     |     |     |      |     |     |     | Great Black-backed Gull  |
| Great Cormorant          |     |     |     |     |     |     |     |     |      |     |     |     | Great Cormorant          |
| Great Skua               |     |     |     |     |     |     |     |     |      |     |     |     | Great Skua               |
| Herring Gull             |     |     |     |     |     |     |     |     |      |     |     |     | Herring Gull             |
| Leach's Storm-petrel     |     |     |     |     |     |     |     |     |      |     |     |     | Leach's Storm-petrel     |
| Lesser Black-backed Gull |     |     |     |     |     |     |     |     |      |     |     |     | Lesser Black-backed Gull |
| Little Tern              |     |     |     |     |     |     |     |     |      |     |     |     | Little Tern              |
| Manx Shearwater          |     |     |     |     |     |     |     |     |      |     |     |     | Manx Shearwater          |
| Mediterranean Gull       |     |     |     |     |     |     |     |     |      |     |     |     | Mediterranean Gull       |
| Northern Fulmar          |     |     |     |     |     |     |     |     |      |     |     |     | Northern Fulmar          |
| Northern Gannet          |     |     |     |     |     |     |     |     |      |     |     |     | Northern Gannet          |
| Razorbill                |     |     |     |     |     |     |     |     |      |     |     |     | Razorbill                |
| Roseate Tern             |     |     |     |     |     |     |     |     |      |     |     |     | Roseate Tern             |
| Sandwich Tern            |     |     |     |     |     |     |     |     |      |     |     |     | Sandwich Tern            |

## Annex 5 Overview of invasive mammals in question

### 5.1 Black Rat *Rattus rattus* and the Norway Rat *R. norvegicus*

Globally, the black rat is known to attack and kill at least 39 bird species, while the brown rat has been recorded preying on at least 53 species (Courchamp, 2003). Rat predation has been positively correlated with population declines and/or extirpations of Manx Shearwater and Puffins.

Invasive rat species can also have a significant impact on vegetation communities. These impacts on isolated island ecosystems are extremely important. Rats are known to eat leaves, seeds, flowers, bark and stems of many plant species, some of which are endangered of extinction due to their isolation on island ecosystems and lack of adaptations to the new predator. Rats are also known to prevent the regeneration of woodlands by damaging young saplings and adult trees.

In Ireland, there is currently little in the way of documented evidence of impacts on island vegetation communities. Ireland does however hold important plant communities on island habitats designated under the EU Habitats Directive and so a precautionary approach should be taken.

***Rattus rattus* is ranked among the Worlds Worst 100 Invaders by the IUCN.**



### 5.2 Feral cat

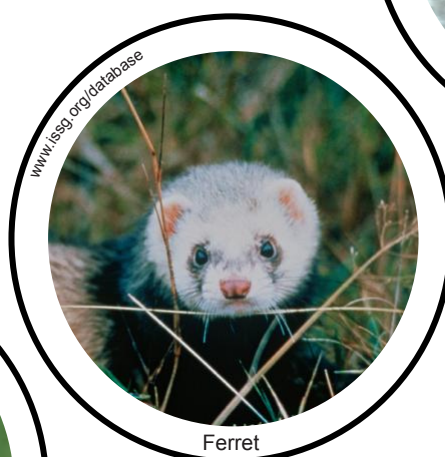
Cats are very adaptable to island ecosystems. Associated with inhabited and uninhabited islands, cats can be introduced deliberately to control rodent numbers, as companion animals or accidentally when they escape from ships. As a predatory mammal, cats are known to have a significant impact on the populations of ground nesting birds. On islands where birds are not present all year round, cats are known to survive by preying on rodents or rabbits until the following breeding season. The current distribution of feral cats on islands in Ireland is not known.

***Felis catus* is ranked among the Worlds Worst 100 Invaders by the IUCN.**



### 5.3 American Mink and other mustelids

The American mink, stoats, and the ferret are all known to predate on a wide range of bird species. Like other predators, these species are known to visit nest sites and take eggs, chicks or adults. In some cases they are known to attack and kill more than their requirements. In that respect, breeding bird colonies can be severely impacted in a short period of time. The distribution of stoats on islands in Ireland is unclear. This species is included as a precaution and intended to inform managers that encounter issues with this species.



## Annex 6 Planning your eradication programme: Some specific points to address

### First steps

- **Confirming species present and numbers involved.** Initially, surveys should be carried out to confirm what species are present on the island and the numbers involved, if possible. This work should identify the seasonal behaviour and favoured habitats. All information gained from this initial work will aid the implementation of a successful eradication programme.

**Table 6.1:** Summary of methods that aid the detection of presence of an invasive mammal.

| Method                             | Procedure   | Target species   |
|------------------------------------|---|--|
| Identification of tracks and signs | Identification of footprints, chew signs, scats, prey remains, dens and other signs   | All species of small mammals                                 |
| Tracking tunnels and runs          | Use of a tunnel with a central ink well and white papers either side. Animals will tend to walk through tunnel and leave prints. Tunnels can be baited with appropriate lure<br><br><i>or</i><br><br>Tray/area filled with absorbent floral foam saturated with water, covered with a layer of clay and sand mixture. Tunnels can be baited with appropriate lure | Rat species<br>Mice<br>Stoats<br>Ferret<br>Mink<br>Feral Cat |
| Hair tunnels                       | Use of tunnel with a sticky surface such as tape that catches hair  | Rat species<br>Mice<br>Stoats<br>Ferret<br>Mink<br>Feral Cat |
| Detection aids                     | Use of non toxic aids such as chew sticks, chocolate, soap and wood dipped in cooking oil   | Rat<br>Mice  |
| Trapping                           | Live trapping or snap traps appropriate for target species  | All species of small mammal                                  |

- **Site access.** The inclusion of all stakeholders at an early stage in the planning of an eradication may aid the overall outcome of the project. A partnership approach can yield benefits with voluntary help and permission to access land easily acquired without expended much need time and money. When embarking upon a programme, managers must ensure that all necessary permissions are in place to gain access to private property. Written proof of permission is required. Managers should make land owners aware of their activities e.g. using trained dogs, setting bait stations etc. and ensure that any restrictions set by the land owner are met. Managers must ensure that all personnel respect private landowners and pay due care and attention to any restrictions placed on the programme by landowners.

If landowners are unwilling to give permissions, powers of access, where available, should be exercised to complete the programme. However, this may illicit negative public and



community opinion so should be considered after other avenues of access have been investigated.

- **Identification of resources needed.** Prior to initiation of the eradication programme, managers and sponsors should be cognisant of the financial and time commitments required to achieve goals. Agencies should note that if an eradication attempt is initiated or carried out by their staff this will require dedicated staff resources. This should be taken into account at the planning stages. Funding should be secured and made available to the project team without delays or possibility that monies will be cut from the budget until completion.
- **Stakeholder engagement.** Public information and awareness are fundamental aspects not only for eradications but more generally to address the problems of invasive alien species. Publicity campaigns on the issue should be a priority. If appropriate, eradication projects should include dissemination of information to the public, about the impact of the invasive alien species, why control is needed, the outcomes of the campaign, and the efforts to recover native ecosystems. Managers can also boost public opinion if they are able to state a monetary value of the project that will directly benefit the economy of inhabited islands. Stakeholder engagement may also be required to gain access to lands during the programme.
- **Identification of suitable time window, if appropriate.** In general, eradications should avoid times when concentrations of breeding seabirds and other available food sources are present. Such concentrations provide large quantities of alternative food resources, and the target species may be less inclined to take bait, and may also occupy much smaller territories. Target species breeding may peak at this time; due in part to the abundant availability of food. There is a danger that breeding animals may be more selective in their choice of foods. Also, nearly-weaned young may not have access to the poison bait and may survive a control operation.
- **Identification of possible non-target species impacts.** The identification of possible non target species impacts is an important stage in the implementation of an eradication programme. Efforts should be made to minimise the risks to non target species at all times.
- **Monitoring** of undesired effects should be included in the planning, and eradication methods should be revised if significant impacts on non-target species are recorded. This does not refer to other non native species of mammals.

### Skills required for successful programmes

- Managers need a good working knowledge of target species ecology and the prey ecology to manage operations effectively.
- Trappers should have a good working knowledge of target species behaviour.
- Specific on job training in the use of traps is essential.
- A consistently high standard of setting traps is essential.
- Trappers must be dedicated to the work.
- Trappers need sound navigational skills involving compass and map reading.

### Eradication/control protocols

Presently, mink and rats are believed to be causing the greatest impact on ground nesting birds in Ireland. Mink have caused significant loss in tern numbers on Lough Mask and rats have been associated with declining numbers of puffins and Manx Shearwaters on Western Irish Sea islands. Ferrets are known from Rathlin Island where they can impact on ground nesting corncrake as well as colonies of seabirds. No data is available to make an assessment on the distribution of feral cats on islands.

### Bait stations / Live trapping

This method can involve the use of toxic chemicals that are harmful to the target organism. Alternatively, managers can opt to catch the target species and dispatch the animal in a humane manner. The recommended trapping/bait station densities, suitable toxin and suggested bait for each species are given in Table 12. While the bait station method can be used in most cases, it is not always the most appropriate method to consider in the first instance. Please consult the additional information available for each species in Section 8.

#### Some general points to note when undertaking a programme are:

- If possible, initiate programmes in winter/early spring or at another time of year when food supply is low. This will help reduce bait aversion.
- Always use gloves and adopt practices that will minimise human smell on traps and the area around the trap.
- When setting out grid systems, use a tape measure or a measured length of rope or string to set out grids of stations - do not attempt to 'guess' the distances. GPS devices can be used but this depends largely on the accuracy of the device influenced by cover, prevailing weather conditions and other factors outside the control of the operator. If accuracy cannot be guaranteed, GPS devices should not be employed.
- When setting out grid systems, stations do not need to be *precisely* at the prescribed distance - if possible pick the best-looking place within about 5m radius. Preferably there should be some cover close by.
- Grid points should be clearly marked to facilitate re-location and given a unique ID number to ensure no traps/stations are missed. This should be done in a manner that will not startle the target species.
- Good trap/station placement will result in the target species feeling more comfortable about investigating and entering an unfamiliar structure. Consider if traps should be buried in ditches or trenches.
- Refuse/household waste sites may need to receive extra attention.
- In the case of rats, stations/traps should be put in place at least two weeks prior to the commencement of baiting. This will allow the animal to familiarise themselves with the stations and reduce neophobia (avoidance of unfamiliar structures).
- The majority of mustelid captures will usually occur during the first 3 days of trapping. Traps should remain in place for 5 days then moved to a new site.
- Maintain accurate and complete records when setting out traps or bait stations. Good record keeping will ensure that no trap is missed when revisiting and also contributes useful information to help analyse the success or failure of any programme.
- Extra stations should be used in areas of high target species activities.
- If appropriate, information leaflets and signage for members of the public should be integrated into your eradication programme.

#### Some general points to note when undertaking a bait station programme are:

- Place bait stations/traps on flattish ground, so that the ends of the station are level and water (from rainfall) will not run through.
- Maintain the stations in position for (at least) several weeks after the last evidence of bait take. Periodically check the baits. After this time and without any further sign of the target species, the stations can be removed. However, ideally and if possible, leave a small quantity of bait in each station over the summer period. This bait has the dual role of acting as an additional monitoring tool and potentially killing any individuals that may have survived.
- Use uniform amount of bait at every station. Measure and record any bait loss every time you visit the station. Top up as necessary.
- Bait stations can be supplemented by trapping, especially where signs of target species activity persist. This will also help target individuals that are not taking bait.

### Some general points to note when undertaken a trapping programme are:

- Test each trap to ensure it is in working order before first use and check the trap on a regular basis thereafter.
- If live trapping, ensure you can check traps frequently. If you are unable to carry out these checks, especially in hot weather, consider leaving traps closed.
- It is recommended that air rifles are used instead of firearms to dispatch any live animals caught. Regardless of whatever weapon is used to dispatch an animal, the individual using the weapon must have all necessary training and licences in place.
- Handle all animals with due care and attention for personnel safety and also due care and respect for the animal.
- Ensure that the chosen trap is fit-for-purpose and that the trapping system used will kill the animal acceptable quickly.
- When trapping for mustellids and cats, traps should be placed along preferred habitats and runs.

### Trap maintenance

A formalised maintenance regime is important. Traps should be regularly maintained, including checking for worn pivots, weakened springs. Traps should be regularly cleaned with a wire brush. This removes mould, fur and bits of dead animals. Hair or animal matter found in the trap should be retained, if possible. This will allow for the identification of animals that have/can escape from the trap. Un-sprung traps should be set off at regular intervals.

### Bait selection

The ideal bait is one that is (1) palatable and lethal to the target species after a single feeding event, (2) persistent in the environment long enough for the target species to be exposed but short enough to minimise non-target species exposure, (3) has a low probability of engendering bait shyness in target organisms, and (4) is nontoxic or unpalatable to non-target species (Howald, 2007). Second-generation anticoagulants, such as brodifacoum, bromadiolone, difenacoum, and flocoumafen are used in the vast majority of rodent eradication campaigns (see Howald, 2007).

Larger mammals such as cats tend to receive 1080. Cats have been shown to be very sensitive to this substance with death generally occurring within 12 hours after exposure. 2 mg dose of 1080 is sufficient to for cats of 5 kg weight and the substance has been described as presenting a humane death for the animal (Eason, 1992). **This substance is not currently licensed for use in the UK.**

### Non target species and toxic substance handling considerations

Prior to embarking on a poisoning campaign for an invasive mammal, potential impacts on non target species must be evaluated and mechanisms to reduce risks put in place. Native species become exposed to the toxic substance either by directly consuming the bait or by secondary poisoning, for example, when a scavenging bird ingests a poisoned target animal. At the end of the programme, or period of time during the programme, leftover toxin and contaminated bait items should be diluted to non-toxic levels and/or disposed of in an appropriate manner. See manufactures guidelines on disposal options.

**Table 6.2:** Summary table of bait station / live trapping method for invasive mammal species.

| Target species                   | Appropriate method                                     | Trap layout  | Toxin                               | Additional information  | Suggested bait  |
|----------------------------------|--|--|-------------------------------------|---|---|
| Rats                             | Bait station<br>Snap trap                              | Grid system<br>50 x 50 m<br>in dense<br>grass<br>100 x 50 m<br>in open<br>Smaller grid<br>systems can<br>be used | Bromadiolone<br>Difenacoum          | Leave traps<br>in place 2<br>weeks prior to<br>commencement<br>of programme<br>Maintain in<br>position for<br>several weeks<br>after last evidence  | Chunky peanut<br>butter<br>White chocolate<br>Wax blocks with<br>oatmeal                          |
| Mice                             | Bait station<br>Snap trap                              | Grid system<br>25 x 25 m   | Bromadiolone<br>Difenacoum          | Maintain in<br>position for<br>several weeks<br>after last evidence   | Chunky peanut<br>butter<br>White chocolate<br>Wax blocks with<br>oatmeal                          |
| Cats*<br>(see<br>section<br>8.2) | Spotlight<br>hunting*<br>Bait station<br>Live trapping | Grid system<br>25 x 50<br>– 100<br>m apart<br>depending<br>on terrain  | None<br>recommended<br>at this time | Set trap in shade<br>Check morning<br>and evening<br>Dispatch live<br>animals with a<br>single shot to the<br>head<br>Do not harm<br>domestic pets  | Fresh fish or<br>tinned cat food<br>Blended mixture<br>of faeces and<br>urine as an<br>attractant |
| Mink*<br>(see<br>section<br>8.3) | Live trapping<br>Tracking<br>and humane<br>dispatch*   | Target known<br>activity sites   | n/a                                 | Light weight<br>and collapsible<br>traps for easy<br>transport or Game<br>Conservancy<br>Trust Mink Raft<br>River bank<br>trapping can also<br>be used<br>Dispatch live<br>animals with a<br>single shot to the<br>head | Mink scent<br>glands  |
| Ferret<br>and<br>weasel          | Trapping   | Target know<br>high activity<br>sites and runs   | n/a                                 | Trap lines should<br>follow habitat<br>perimeter, ridges,<br>tracks, altitudinal<br>contours and<br>waterways<br>Dispatch live<br>animals with a<br>single shot to the<br>head  | Scent gland<br>Fresh rabbit   |

\* indicates species whereby the bait station method should be considered secondary, or to supplement the primary recommended approach. Details of these methods have been given in the identified sections.

## Tracking

Radio collaring a number of individual target animals offers the eradication programme a number of advantages. This will allow the eradication team to ascertain the habitats frequented by the target species and also help establish the species home range and/or daily dispersal patterns. All animals should be aged, sexed, tagged and released. Mortality sensors can also be fixed to the radio collars.

Tracking tunnels can be used to ascertain any population reduction. See Table 11 for details on tracking tunnels. This technique will allow managers to statistically measure the average proportions of tracking tunnels visited between the pre- and post-poisoning periods.

Trained dogs have been used in the tracking of animals to achieve conservation goals. This technique, as recommended here, is to track animals only and not intended to hunt, maim or kill the animal.

## Timing of eradication programme

The timing of an eradication programme is a very important factor when targeting invasive mammals. Timing the bait delivery or trapping programme to the time of year when the target mammals are in decline or during lows in their annual food dependent population cycle may improve probability of eradication by increasing competition for bait. Targeting the species earlier than this period can result in capture of animals that are likely to die of natural causes and thereby increase effort with no impact on the success rate of the operation. Timing of bait delivery may also minimise possible non-target impacts caused by the application or by the physical nature of the campaign.

## Species protection control programmes

In order to protect species of conservation concern, managers may need to consider adopting a control programme aimed at preventing predation on the species at a time when it is most vulnerable. For example, to protect gulls during the breeding season, mink populations must be low while the gulls are nesting and until the chicks fledge; and to protect invertebrates, rats should be controlled year round. Once these short term goals have been achieved and resources become available to initiate a full scale eradication the programme should be conducted at the recommended time of year. Full scale eradication of an invasive species will free up resources needed for other conservation projects. Please see Table 4 for details on seabird breeding seasons.

## Species specific information

### Rodents

Rodent eradication programmes can be conducted by trapping as outline above or by the broadcast method. Both methods offer similar prospects of success. The decision as to which technique used depends on the circumstances on individual islands and in part the preferences of all involved, including island inhabitants.

When embarking on a rodent eradication programme, island communities may need to change their refuse storage and disposal methods. Rubbish sites, either legal or illegal, will inevitably attract rats and may provide additional/supplementary food supply for the target species. Considerations of island residents habits and assessment of the need to help islanders to deal with household waste in a manner that will not provide rodents with a supply of alternative food to the bait may be required. This may, in some cases involve an awareness campaign/public meeting or may require the provision of appropriate bins.

### Hand broadcast delivery

The hand broadcast method is more suitable to flat islands that allow easy access by personnel to all areas. The maximum size of island that can be covered is largely dependant on the topography, terrain, shape and vegetation of the island. It may be easier to ensure full and accurate coverage on a long, thin flat island than a circular-shaped or high island. Islands with low vegetation will be physically easier to spread bait on, so larger islands in this category may be considered.

This method requires the establishment of a grid system across the island with transects set 25 - 50m apart, running parallel. Personnel walk transects, stopping every 5m to deliver bait to the area. The total area covered by each worker at the predetermined baiting points should equal to (5m x 5m) 25m<sup>2</sup>. Bait should be delivered at a concentration of 600-750 grams per stop. Avoid times of heavy or persistent rain.

On grassy islands, a baiting density of 5-6 kilograms per hectare is sufficient, but this may need to be increased to 8-9 kilograms per hectare if early season eradication is planned or if rat numbers are unusually high. More rats are still alive in the late autumn/early winter compared with in late winter/early spring, meaning more bait is required to ensure toxic doses to all rodents. If possible, all programmes should be initiated in winter/early spring or at another time of year when food supply is low.

### Aerial bait delivery

Aerial broadcast by helicopter is becoming more and more common as a method of rodenticide delivery. This bait delivery system may be more appropriate for uninhabited islands that are also not used for livestock. The advantages gained here is that a larger area can be covered in shorter periods of time. Inaccessible areas, such as steep cliffs and hills can also be treated, thereby reducing refuges for rodents to survive treatment. Sub metre GPS devices must be used during the delivery of the rodenticide. Because broadcasting entails a single or double bait-application event, usually 10–14 days apart, and bait station campaigns last up to 2 years, broadcasting significantly shortens the eradication campaign (and thus the period of risk to nontarget species).

**Table 6.3:** Summary table of the advantages and disadvantages of broadcast method versus the bait station method. (Adapted from the Guidelines for the Eradication of Rats From Islands Within the Falklands Group, Accessed 08 July 2008: [http://www.falklandsconservation.com/wildlife/conservation\\_issues/rat\\_eradication-guidelines.html#An14](http://www.falklandsconservation.com/wildlife/conservation_issues/rat_eradication-guidelines.html#An14))

|                                       | Hand-Broadcasting   | Bait Stations  |
|---------------------------------------|---|--|
| <b>Advantages of the technique</b>    | <p>Very quick - can usually be achieved in less than one day</p> <p>The most cost-effective option</p> <p>Inaccessible or dangerous cliff areas can be treated more easily by casting bait from nearby areas</p> <p>Good for islands that are isolated or have difficult access (lower logistics and fewer visits required)</p> | <p>Probably safer for birds that may be attracted to baits</p> <p>Baits are protected from rain which may damage baits</p> <p>Smaller quantities of poison used</p> <p>Bait stations can be re-used on other islands</p> <p>Essential for use in the presence of stock</p> <p>Better able to monitor rat decline</p> <p>Ability to physically verify bait coverage through measuring gaps between stations</p> |
| <b>Disadvantages of the technique</b> | <p>Baits are more available for other species</p> <p>More prone to error, through insufficient coverage or too wide gaps</p> <p>Uses more bait per hectare - extra cost &amp; greater quantities of toxin into the environment</p> <p>Cannot be used in areas where stock are grazed</p>  | <p>Time-consuming - it requires daily checking of all stations, usually for 2-4 weeks (depending on station density)</p> <p>Increased logistical requirements for each operation</p> <p>Labour and associated costs are much higher per unit area treated</p> <p>Bait stations may need to be purchased - extra cost</p>   |



## Cats

The recommended approach to systematical remove feral cat populations is by spotlight shooting at night and using trained dogs to locate cats during the day. These technique are labour intensive and require the use of trained personnel. Cats should be humanely dispatched using .22 and .222 calibre weapons are recommended. Trained dogs should only be used to locate the animal and under no circumstances should the dog be allowed to maim, course or kill the target species.

Trapping of cats can be used to support the spotlight hunting approach or to locally protect species of conservation concern. Again, trapping as a control method is labour intensive.

- Soft-jawed traps, such as the Victor Soft Catch™ traps, have been used for the live capture of feral cats. Soft catch traps have an adjustable pan that tensions the trap to prevent lighter non-target species from being caught.
- Cage traps are also widely used, but are generally ineffective for trapping feral cats. Cage traps have, however, been effective in trapping stray and domestic cats around rubbish dumps and in nature reserves close to urban development.

To combat trap shyness, variations of methods may need to be considered towards the end of the programme, when cat numbers are low.

## Note on domestic cats

The domestic cat and feral cat are one and the same animal - *Felis catus*. The family pet is classed as the personal property of its owner and any unjustified control may lead to prosecution. Although the cat's owner cannot be held liable for its actions, they could sue for damages should their cat come to any harm or go missing. All programmes should involve a measure of protection for domestic pets.

The recommended approach is:

- a) Contact households and inform them of your programme and why it is necessary
- b) Inform them of when you intend to initiate your programme of works and when they should keep their pet indoors and safe from exposure
- c) Inform them when the programme of works has been completed
- d) Encourage pet owners to neuter their pet
- e) Encourage pet owners to adopt practices that will minimise the risk to breeding birds and wildlife

If agreement with pet owners cannot be reached, consider the use of live trapping methods only. Remember that pet owners may have the right to prosecute or seek damages for loss of household pets. Also, an apparent lack of consideration for island inhabitants and their pets may lead to hostility and thus hinder eradication programmes and chances of success.



## **Mink**

Trapping is considered one of the most effective methods for mink control. This is labour intensive and traps must be checked every day. Live trapping and selective killing is usually necessary to prevent any harm to native wildlife. Mink trapping is a little unusual in that the habitat along which most females can be found is easily definable. However, trapping is not always 100% reliable and individual animals may show a marked reluctance to enter traps, particularly females. Increasing trapping intensity during the rutting and dispersal season has the greatest impact on mink numbers.

### **Trap placement**

Evidence from the Hebridean Mink Project has shown that setting several traps in close proximity to den sites, as opposed to line trapping alone, increases trap success rate. The use of close-proximity traps in the Hebridean Mink Project was only used after den searches and in the mink breeding season.

Baiting with mink scent glands, as opposed to fish or other lure may increase trap catch rate. This may also increase the success rate of catching females. Using trained dogs to locate the den sites and the identification of tracks and signs will aid the programme. Trap lines should be closed down after a period of 2 weeks as mink are usually caught within a few days of trap placement.

Managers should also consult the Game Conservancy Trust Mink Raft guidelines on deployment methods for this type of trap and additional mink trapping information: <http://www.defra.gov.uk/wildlife-countryside/vertebrates/reports/minkraftleaflet.pdf>. Managers should be aware that in high rainfall areas the mink raft method may not be appropriate.

Conservationists in Finland have successfully eradicated mink from a group of islands of the Archipelago National Park by using trained dogs to track mink to their hiding places. After locating the mink, personnel used leaf blowers to flush the mink out of hiding.

There is evidence to suggest otters are hostile towards mink and facilitation of otter recovery could be an important component of mink control.

### **Ferrets and stoats**

Trapping is the recommended approach to control ferrets and stoats. It may be better to conduct programmes for these species in winter and spring, when populations are naturally low. During this time window, animals that are removed are essentially the breeding population and control conducted during this period may have a bigger impact on future numbers of ferrets. Please see Section 5.3.1 for details on how to deploy a successful eradication programme for these two species.

Preparation of ferret and stoat trapping is important. Make sure traps are firm and stable in the ground. Adult not go into unstable traps or tunnels. It may be a useful to place traps in holes (e.g. rabbit holes) with bait at the back. Campaigns should be conducted during mid to late winter, when the availability of prey items is likely to be at its lowest.

Ferrets and stoats tend to concentrate where there is a good source of food or shelter and along access ways such as domestic livestock tracks. Typical hot spots include:

- Farmyard buildings
- Riparian habitats
- Roadsides
- Beside tracks or drain pipes under tracks
- Clear areas under trees
- Rabbit holes
- Trees in the open or felled logs
- Gateposts (especially those marked by dogs)
- On bridges and approaches
- Bases of banks
- Edges of vegetation

By radio tracking ferrets or stoats managers can assess the optimal spacing and location for traps and bait stations so that most ferrets encounter them.

If managers choose to follow a systematic grid protocol it is recommended that trap lines are set at a maximum of 800m apart and that traps are place 100 to 200m apart along each line.



The Invasive Species in Ireland Project is undertaken, in partnership, by EnviroCentre and Quercus.



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