Strategic Compensation Studies

Efficacy of predator reduction measures – a literature review

Document Control

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About the OWEC SCS Project: The Strategic Compensation Studies (SCS) is a £3.5 million project running until the end of 2027 which forms part of the Offshore Wind Evidence and Change programme (OWEC), led by The Crown Estate (in partnership with the Department for Energy Security and Net Zero and Department for Environment, Food and Rural Affairs). Alongside the OWEC programme funding, the SCS project is supported through financial and in-kind contributions from participating Offshore Wind Industry Council (OWIC) members.

Further information can be found via the Strategic Compensation Studies webpage.

Purpose of this Report: This report forms part of the SCS predator reduction work package and considers whether certain predator control interventions are more effective than others in reducing predator numbers. It seeks to identify if there are opportunities to test novel or alternative predator reduction techniques.

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Acronyms

Acronym	Term
COWSC	Collaboration on Offshore Wind Strategic Compensation
Defra	Department for Environment, Food and Rural Affairs
DESNZ	Department for Energy Security and Net Zero
GES	Good Environmental Status
HSE	Health and Safety Executive
INNS	Invasive Non-native Species
IUCN	The International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
MMO	Marine Management Organisation
MRF	Marine Recovery Fund
NE	Natural England
OWEC	Offshore Wind Evidence and Change Programme
OWIC	Offshore Wind Industry Council
RSPB	Royal Society for the Protection of Birds
SCS	Strategic Compensation Studies project
SGARs	Second-generation anticoagulant rodenticides
SNCB	Statutory Nature Conservation Body
SoS	Secretary of State
SPA	Special Protection Area

Glossary

Term	Definition
Diversionary feeding	The use of food to divert the activity or behaviour of a target species from an action that causes a negative impact, without the intention of increasing the density of the target population.
Intraguild predation	Occurs when two species that share a host or prey (and therefore may compete) also engage in a trophic interaction with each other (parasitism or predation)

Term	Definition
IUCN Red List	The International Union for Conservation of Nature's Red List of Threatened Species is the most comprehensive information source on the global conservation status of animal, fungi, and plant species
Kleptoparasitism	A form of feeding in which one animal deliberately takes food from another.
Library Of Strategic Compensation Measures	A list of strategic compensation measures for offshore wind projects that have been approved by the Secretary of State for the Department for Environment, Food and Rural Affairs.
Marine Recovery Fund	The Marine Recovery Fund is intended to facilitate the delivery of strategic compensatory measures to compensate for unavoidable damage to Marine Protected Areas from offshore wind developments
Mesopredator release	An ecological phenomenon where the decline of an apex predator (a top predator) leads to an increase in the abundance or distribution of mesopredators (medium-sized predators)
Net Zero	Refers to achieving a balance between emissions produced and emissions taken out of the atmosphere via such activities as carbon offsets. It allows the production of emissions as long as they are offset by reducing the greenhouse gases already in the atmosphere
Population sink	A subpopulation within a larger metapopulation that cannot sustain itself independently.
Population source	A subpopulation with higher birth rates than death rates, leading to population growth and migration to other areas
Strategic Compensation	A collaborative approach that allows environmental considerations to be addressed at a more strategic level, across several offshore wind development projects for impacts that cannot be avoided, reduced, or mitigated through traditional methods.
Trophic Cascades	The indirect effects a change in one species has on other species within a food web, particularly when a predator is introduced or removed

Executive Summary

The offshore wind (OW) sector is set to expand significantly to meet ambitious Government targets under Clean Power by 2030 and achieving net zero. It is recognised that the scale and location of future OW developments will mean that the derogation process is increasingly likely to be triggered, hence there is a need for industry-scale consideration of how future-proof compensation will be delivered. Strategic compensation has been identified as a potential solution for addressing some of these issues and could help streamline consenting timelines and deliver improved environmental outcomes at a seascape scale.

The Offshore Wind Industry Council (OWIC)-led Strategic Compensation Studies (SCS) project, funded by the Offshore Wind Evidence and Change (OWEC) programme, within which this piece of work is being delivered, aims to investigate the effectiveness of certain potential strategic compensation measures through desk-based studies and practical pilots to increase confidence in measures, and provide compensation options for OW plans and projects.

This report forms part of the SCS predator reduction work package and aims to review the current evidence around the effectiveness of different predator reduction methods. This report considers whether certain interventions are more effective than others in reducing predator numbers and seeks to identify if there are opportunities to test novel or alternative predator reduction techniques; for example, different types of nest protections or fence types, or options to trial existing techniques on species for which evidence is currently limited. Ensuring the most effective methods are used (when feasible) could result in improved performance of predator reduction as a strategic compensation measure and reduce the need for adaptive management in the future.

The report concludes that given both mammalian predator eradication on islands, and predator control and exclusion on inshore islands, mainland sites, or on parts of larger islands are already approved as strategic compensation measures for seabirds in the UK, and there is considerable scientific evidence of the effectiveness of both these methods as a means of controlling/ eliminating predator numbers (and thereby increasing breeding success in

seabirds) it is not recommended that any further work to test or trial additional techniques be taken forward under the SCS project.

Although there are some additional control measures for which evidence of effectiveness is either lacking or less robust, the literature suggests these need to be considered on a species and location specific basis. Many of the control measures would also be difficult to deliver at the scale required to be considered as strategic measures. As such, these are not seen as a priority for additional work at this time, in relation to mammalian predators. These measures could be explored through avenues outside the SCS project.

It is noted that several of the control methods are more suited to controlling avian predators. Recommendations for work in this area have been outlined in a separate report created by the SCS project in relation to reducing the pressures from avian predators – OWEC SCS Report No. 01 (OWIC, 2025).

1 Scope of this Report

The offshore wind (OW) sector is set to expand significantly to meet ambitious Government targets around net zero. It is recognised that the scale and location of future developments will mean that the derogation process is increasingly likely to be triggered, hence there is a need for industry-scale consideration of how future-proof compensation will be delivered. Strategic compensation has been identified as a potential solution for addressing some of these issues and could help streamline consenting timelines and deliver improved environmental outcomes at a seascape scale.

The Offshore Wind Industry Council (OWIC)-led Strategic Compensation Studies (SCS) project, funded by the Offshore Wind Evidence and Change (OWEC) programme, within which this piece of work is being delivered, aims to investigate the effectiveness of certain strategic compensation measures through desk-based studies and practical pilots to increase confidence in measures, and provide compensation options for OW plans and projects.

The SCS project will provide more confidence in different measures by carrying out practical trials and collating evidence to help fill data gaps, ensuring that OW projects can be consented/conditions discharged in a timely way and that the relevant frameworks and mechanisms are in place for compensation delivery. The SCS project also aims, where possible, to promote additional measures for approval into the library of strategic compensation measures (LoSCM) to support the acceleration of OW delivery in the UK.

The SCS project includes six technical work packages, as follows:

- Work package 1 – artificial nesting structures
- Work package 2 – predator reduction
- Work package 3 – habitat creation and restoration
- Work package 4 – infrastructure removal
- Work package 5 – delivery mechanism and overarching actions
- Work package 6 – supporting measures

This report forms part of the SCS predator reduction work package and will review the current evidence around the effectiveness of different predator reduction methods, including those focused on control, eradication, and exclusion. This report will consider whether certain interventions are more effective than others in reducing predator numbers. It will also seek to identify if there are opportunities to test novel or alternative predator reduction techniques; for example, different types of nest protections or fence types, or options to trial existing techniques on species for which evidence is currently limited. Ensuring the most effective methods are used (when feasible to do so) could result in improved performance of predator reduction as a strategic compensation measure and reduce the need for adaptive management in the future.

As the impacts of OW developments are focused on the marine environment, where possible this report will pay particular attention to evidence in relation to predator control effectiveness in relation to seabirds. This review will also focus on the efficacy of measures on mammalian predators given that this is the extent of the measure currently approved to the LoSCM and the SCS project has carried out a separate review considering the potential for reducing pressures from avian predator control to be used as a strategic compensation measure (OWIC, 2025).

2 Predator Reduction - an overview

2.1 Background

Predator and prey species evolved together and have co-existed for millennia; in prey through developing adaptations to help them avoid being eaten and in predators by developing strategies to make them more effective at catching their prey. Predators play an important part in healthy ecosystems, dispersing nutrients and seeds and helping regulate the abundance, distribution, and diversity of species lower in the food chain – an effect known as trophic cascades.

Although predator-prey numbers fluctuate naturally across time, additional stressors, such as human activities and climate change, are resulting in increased disruption to predator-prey dynamics. The number and distribution of species has been, and continues to be, heavily altered by human activity with animals and plants currently disappearing 1000 times faster than they have at any point in the past 65 million years (WWF, 2016). In addition, 'meso-predator release,' where the removal of top predators by humans has allowed populations of mid-level species of predators to thrive, has shifted the balance between some predators and their prey species. This has led to situations where predation can cause reductions of already struggling wildlife populations and/or prevent recovery.

For birds, as with many species, the rapid global declines in their numbers can be linked back to anthropogenic actions such as habitat loss, overexploitation, and the introduction of species such as rats, pigs and dogs that raid nests and compete with them for food. Amongst the top threats seabirds face are a reduction in food availability, invasive non-native species (INNS), bycatch in fisheries, diseases such as highly pathogenic avian influenza and climate change (De L Brooke *et al.,* 2017).

INNS, such as American mink *Neogale vision* and feral cats *Felis catus*, are species that have been introduced into areas outside their natural range and pose a threat to native wildlife which evolved in their absence and are not always adapted to evade or cope with the effects of their predation. By nesting on islands, seabirds evolved away from the threat of ground-based predators and instead are adept at evading capture from above (by avian predators) e.g. by burrowing underground. The absence of ground-based predators, even those native on the mainland such as foxes *Vulpes vulpes* and badgers *Meles meles*, has allowed high-densities of ground-nesting birds to develop and thrive on offshore islands and the subsequent introduction of these species can be very damaging, and in some cases catastrophic, to these important seabird populations (Scottish Rural Development Programme, 2021). A 2024 study found that ground-nesting birds are 86% more likely to decline than species with other nesting strategies, such as tree or burrow nesters (McMahon *et al.,* 2024).

2.2 Relevance to Offshore Wind

In addition to the threats at breeding colonies described above, seabirds spend time at sea foraging, and this can bring them into contact with OW development. Seabirds can be affected through collision with turbine rotor blades or by being displaced from foraging habitats and migrations routes, with a linked increase in energy expenditure. As part of project development, OW projects will avoid and minimise impacts on key species as far as possible. Where impacts cannot be avoided in full and there are residual impacts, a project may be required to compensate for the predicted losses by implementing compensatory measures such as predator reduction.

Given the challenges around delivering compensatory measures for birds in the marine environment, in Spring 2023 a Predator Reduction Expert Group comprising the Marine Maritime Organisation (MMO), Department for Environment, Food and Rural Affairs (Defra), Department for Energy Security and Net Zero (DESNZ), Natural England (NE), Joint Nature Conservation Committee (JNCC), The Crown Estate, Royal Society for the Protection of Birds (RSPB), and OWIC was formed to consider options for seabird compensatory measures. The group was responsible for agreeing measures which were acceptable 'in principle' as strategic compensation and could be added to a wider 'library of strategic compensation' which could be delivered through the Defra-led Marine Recovery Fund (MRF) once in place (although developers can also deliver measures at a project level, with agreement from Statutory Nature Conservation Bodies (SNCBs)).

In late 2023, the expert group made a recommendation to the Collaboration on Offshore Wind Strategic Compensation (COWSC) Delivery and Oversight boards confirming the ecological efficacy, theoretical deliverability and strategic value of predator eradication, control, and exclusion as strategic compensation measures when supported by subsequent biosecurity. In February 2024, the Defra Secretary of State (SoS) approved mammalian predator eradication on islands, and predator control and exclusion on inshore islands, on mainland sites, or on parts of larger islands as strategic compensation measures for seabirds.

The COWSC group identified a list of species which might be most impacted by predatory mammals and for which compensation measures may provide benefit by boosting productivity and/or increasing the area of suitable nesting habitat (Table 2.1).

Table 2.1: Seabird species identified as potentially benefitting from each measure by COWSC

Species	Compensation measure		Reasons for applying measure
	Predator eradication on islands	Predator control and exclusion	
Lesser black-backed gull	✓	✓	Ground-nesters on both islands and mainland sites. Likely to benefit from both measures
Herring gull	✓	✓	

Species	Compensation measure		Reasons for applying measure
	Predator eradication on islands	Predator control and exclusion	
Great black-backed gull	✓	✓	Ground-nesters on both islands and mainland sites. Likely to benefit from both measures
Sandwich tern	✓	✓	
Common guillemot	✓		Nest on cliffs to avoid predators, but also nest in boulders or low-lying accessible rocky shores on islands where mammalian predators are absent. Eradication of predators from islands will free up additional nesting habitat. Island biosecurity will protect nesting habitat in accessible areas. Predator control/exclusion would be difficult to implement at mainland coastal rocky sites.
Razorbill	✓		
Atlantic Puffin	✓		Burrow nesters accessible to all mammalian predators, mostly confined to predator-free islands.
Red-throated diver	✓	✓	Floating nests on small remote island lochans on the Scottish mainland and offshore islands. Susceptible to aquatic predators. May benefit from rat eradication on some offshore islands and local culling of non-native mink near current and former breeding sites.
European storm-petrel	✓		Burrow nesters accessible to all mammalian predators, totally confined to predator-free islands.
Leach's storm-petrel	✓		
Manx shearwater	✓	✓	Burrow nesters accessible to all mammalian predators, mostly confined to predator-free islands.
Great skua	✓	✓	Ground nesters on northern Scottish mainland sites and islands. Likely to benefit from rat eradication on some offshore islands and local culling of INNS near current and former breeding sites.

2.3 Current Usage

2.3.1 Islands

Although islands occupy only c.5% of terrestrial surface area, 37% of all critically endangered bird species on the International Union for Conservation of Nature's (IUCN) Red List inhabit islands (Tershy *et al.,* 2015). Due to ecological and evolutionary processes, islands tend to have fewer species than continents meaning organisms are under different evolutionary pressures, many of which make island species more vulnerable to introduced predators from which they would have been previously isolated.

Currently, 75% of threatened birds on oceanic islands are affected by INNS (Birdlife, 2008). However, the control of problematic species is often more achievable on islands than the mainland due to their comparatively small size. A 2007 review found that globally 248 islands had been successfully cleared of invasive rodents (Howard *et al.,* 2007), whilst at least 47 had been cleared of feral cats (Nogales *et al.,* 2004), with more than 1,200 projects undertaken worldwide (DIISE, 2015).

Of the 9,688 distinct islands around the coast of the UK, 21% of those greater than 10 ha have brown rats *Rattus norvegicus* present and 23% are impacted by American mink (Stanbury *et al.,* 2017). Rats have been eradicated from nine UK islands since 1990.

2.3.2 Mainland Sites

For mainland sites complete eradication of a predator is rarely feasible, and instead methods to reduce and control predation are generally used.

Some of the best examples of successful predator control at scale come from New Zealand where the government are working towards the complete eradication of three of the country's most damaging predators by 2050. This includes rats (including the ship/black rat *Rattus rattus*, Norway/brown rat and Pacific/Polynesian rat *Rattus exulans*), stoats *Mustela erminea* and common brushtail possums *Trichosurus vulpecula*. For example, predator control fencing has been used successfully to achieve conservation outcomes for multiple threatened species including grey-faced petrel *Pterodroma macroptera* and sooty shearwater *Puffinus griseus* (Burns *et al.,* 2012).

In the UK, most predator control at mainland sites has been carried out to protect game birds. However, recently there has been some effort to control INNS such as American mink, with groups coming together to carry out concerted eradication effort at a wide geographical scale – for example the Waterlife Recovery East project in East Anglia that started in 2019. In addition, some conservation organisations carry out vertebrate control within their reserves to aid conservation efforts. The RSPB, for example, have controlled grey squirrel to help increase red squirrel numbers, and culled lesser black-backed *Larus fuscus* and herring gulls *Larus argentatus* to aid Roseate *Sterna dougallii* and Sandwich tern *Thalasseus sandvicensis* conservation (RSPB, 2023).

2.3.3 Seabirds

In order the achieve Good Environmental Status (GES) for breeding seabirds the UK has a target to reduce the risks to island seabird colonies from invasive predatory mammals (HM Government, 2012). To help support this the UK Marine Strategy, Part Three (HM Government, 2015) states future implementation of a UK-wide programme of quarantine (or biosecurity) against invasive, non-indigenous mammals from island seabird colonies and the strategically targeted removal of mammals from some islands should be taken forward.

Of the 42 Special Protection Areas (SPAs) designated to protect the UK's most important seabird colonies, an assessment in 2018 found high-impact mammals were absent from 30 and were present on 12. In addition, the risk from incursion had been minimised through effective biosecurity at six sites and partially minimised at a further ten sites (Mitchell *et al.,* 2018). Following this assessment a multi-partner project, Biosecurity for LIFE, ran from 2018 to 2023, with the aim of putting biosecurity measures in place at all 42 island SPAs. By developing UK capacity to plan and implement measures the project hoped to safeguard seabird islands against the threat of invasive non-native mammalian predators arriving and becoming established.

Outside of the SPA network there have been a number of UK success stories including the eradication of brown and black rats at Lundy Island which resulted in the total number of seabirds tripling to over 21,000, with Manx shearwater *Puffinus puffinus* increasing from just 297 pairs to more than 5,500 and Atlantic puffin *Fratercula arctica* from a low of 13 in 2001 to 375 by 2019

(Landmark Trust, 2017). On St Agnes and Gugh in the Isles of Scilly, Manx shearwaters increased from 22 to 200 pairs post brown rat eradication with the islands being declared rat free in 2016 (Isles of Scilly Wildlife Trust, 2023).

2.3.4 Offshore Wind

Predator reduction measures have been proposed, and in some cases implemented, for a number of offshore wind projects to increase the productivity of seabird species impacted by the relevant developments. These include Norfolk Boreas and Norfolk Vanguard (the 'Norfolk projects'), East Anglia ONE North, East Anglia TWO, Hornsea Four, Outer Dowsing Offshore Wind and Berwick Bank.

For the Norfolk projects the developer enclosed 4ha of habitat suitable for lesser black-backed gull with predator-proof fencing to exclude mammalian predators at the Alde-Ore Estuary SPA in Suffolk. Predator eradication on islands in the Channel Islands has been consented as a compensatory measure for Hornsea Project Four and has been proposed at Plémont Reserve, Jersey and on Handa Island, Scotland for Outer Dowsing Offshore Wind and Berwick Bank respectively.

3 Predator Reduction Methods

Predator control is a long-established method of land management in the UK, historically primarily for the protection of game and livestock. However, there is an increasing interest in how targeted predator control could play a role in the conservation of vulnerable wildlife, in particular ground-nesting and wading birds. This is backed up by considerable scientific evidence.

Selection of the most appropriate predator reduction method is dependent on the type of site and the species of predator present. Generally, predator eradication is limited to offshore islands where the prevention of re-incursion is more achievable in the long-term (with appropriate and stringent biosecurity). Predator control and exclusion tends to be used at colonies/sites where eradication is not possible or not practicable, such as mainland colonies and inshore islands which mammals can easily access by swimming. Control may also be more appropriate for larger islands or locations with large resident human populations.

It should be noted that there are strict rules on the methods that can be used for the control of predatory mammals. These include poisoning, shooting, cage traps, spring traps and snares. This is not covered in detail within this report but is acknowledged as a potential constraint to the delivery of predator control measures.

3.1 Predator Eradication/Removal

3.1.1 Overview

Previous reviews have shown that, where a predator is limiting a population of its prey, the removal of predators results in improved nest survival of prey in 23 of 27 studies (85%) (Newton 1993, 1998), increased post-breeding population size (autumn densities) in 12 of 17 studies (71%) and increased subsequent breeding numbers in 10 of 17 studies (59%) (Gibbons *et al.,* 2007). An update to this review carried out by Nordström in 2003, which considered an additional eight studies, found similar improvements in nest survival (84%), post-breeding population (70%) and subsequent breeding size (61%). It is noted that most of the studies focused on ground nesting species, specifically gamebirds or waterfowl, which may be more vulnerable to predation than birds that nest in less accessible sites.

A meta-analysis of 20 published studies in 1997 showed that predator removal had a large, positive effect on hatching success – removal areas showed a 75% higher hatching success on average than control areas – and led to a significant increase in post-breeding population size, although no significant impact was detected on breeding population size (Cote and Sutherland, 1997).

In 2010, a systematic review found that predator removal tended to lead to increased reproductive success (hatchling and fledgling) and breeding populations in birds. These responses stood true whether predators were native or not, regardless of the population trend of the bird population and whether the species was migratory or a game species (Smith *et al*., 2010).

3.1.2 Predator eradication on islands sites

Humans have introduced mammalian predators to hundreds of islands across the world, most frequently black and brown rats, mice *Mus spp* and cats but many other species as well. These introduced species have had a devastating impact on island bird populations, with the historic probability of extinction on islands being well correlated with the number of introduced mammal species (Blackburn *et al.,* 2004).

Most control efforts for rodents are through poisoning (with a 2007 review suggesting that bait stations are more effective than broadcast baiting, Howald *et al.,* 2007) – see section 3.1.3 for more on the use of rodenticide in the UK - whilst trapping and hunting appears more effective for cats and larger non-native mammals (Nogales *et al.*, 2004). Native mammals that are considered invasive at a site can also be removed by non-lethal means i.e. they can be live-trapped and relocated to other sites where they will have less of an impact.

A paired sites study in Finland (Blackburn *et al.,* 2004) and a literature review in the UK (Howald *et al.,* 2007) found increased bird species richness and abundance (Blackburn *et al.,* 2004) or population recoveries and recolonisation (Howald *et al.,* 2007) in islands following the control or eradication of mammalian predators. Predators removed included American mink, rats, pigs *Sus spp*, cats, dogs *Canis spp* and grey foxes *Urocyon cinereoargenteus*.

3.1.3 Seabird responses to predator eradication

Seabirds frequently nest on the ground or in burrows where they are vulnerable to predation by a number of species. This is exacerbated by many seabirds being poor walkers as they are specialised for flying and swimming, making it harder for them to evade predators (Williams *et al.,* 2012).

Of 16 before-and after studies, one paired study and one literature review from around the world, all described positive seabird responses to the removal or control of mammalian predators (mainly rats and feral cats) from islands. Seven found either large population increases or recolonisation following predator eradication or control (Bryd *et al.,* 1997; Zino *et al.,* 2001; Lock 2006; Regher *et al.,* 2007; Ratcliffe *et al.,* 2009, Amaral *et al*., 2010; Ratclife *et al.,* 2010). Twelve found increases in reproductive success and survival (Cooper and Fourie 1991; Cruz and Cruz 1996; Seto and Conant 1996; Zino *et al.,* 2001; Parrish 2005; Igual *et al.,* 2006; Smith *et al*., 2006; Hughes *et al.,* 2008; Zino *et al*., 2008) or decreases in predation and mortality (Cooper and Fourie 1991; Cruz and Cruz 1996; Zino *et al.,* 2001; Keitt and Tershy, 2003; Igual *et al.,* 2006; Rodriguez *et al.,* 2006; Hughes *et al*., 2008, Peck *et al*., 2008; Ratcliffe *et al.,* 2010) following predator control.

A before-and-after study on Lundy Island (445 ha) in southwest UK found that Manx shearwaters and Atlantic puffins both returned to breed on the island after an absence of 45 and 20 years respectively, following the successful eradication (by poisoning) of brown and black rats in 2004 (Lock, 2006).

3.1.4 Rodenticide use

There are strict restrictions and guidelines on how and where rodenticides can be used in the UK. Currently, the application of second-generation anticoagulant rodenticides (SGARs) is the recommended approach to eradicating rat populations from offshore islands and no ground-based eradication programme in the UK should proceed based on the application of first-generation anticoagulant rodenticides alone, as the risk of eradication failure is too high (Thomas *et al.,* 2017).

SGARs, by their very nature, are highly potent anticoagulants with long biological half-lives. As such, they present a potential risk to non-target animals and the environment and have been linked to the deaths of non-target animals. They have also been detected in the bodies of non-target species, some of which have high conservation value such as barn owl *Tyto alba*, red kite *Milvus milvus*, kestrel *Falco tinnunculus* and peregrine falcon *Falco peregrinus* (Ozaki *et al.,* 2023*).* This resulted in an industry-led withdrawal of legal authorisation for use of SGARs in open areas from the 31st of December 2024 in the UK.

However, the use of SGARs for the specific purpose of predator eradication and incursion response on offshore islands is considered a highly effective conservation action for breeding seabirds. As such, the Health and Safety Executive (HSE), as the relevant regulatory agency, can issue critical situation permits that allow for the temporary and controlled use of biocidal products in Great Britain in specific circumstances.

Given the highly time-sensitive nature of incursion responses, HSE have agreed a procedure effective from 1st January 2025 for pre-approved organisations to use to apply for rapid approval of critical situation permits for seabird island incursion response for pre-registered projects (in relation to brown rats only). Other users can apply for a critical situation permit for incursion response, but if their organisation / island is not on the list the application may take longer to process.

For mainland and inshore island control, there are no exceptions for SGAR use, and HSE are unlikely to grant critical situation permits. There may be other suitable products for control purposes e.g. Cholecalciferol baits, but this would have to be considered for each location on a case-by-case basis.

The use and availability of rodenticide for predator eradication within the UK should therefore be considered as a potential limiting factor for predator control measures.

3.2 Predator Exclusion

Defined as the use of a structure, such as a fence or nesting protection, to reduce the rate at which a predator encounters the prey species, either individuals or colonies (Smith *et al.,* 2011).

The exclusion of predators by use of fencing is often the most suitable measure, along with targeted population reduction or eradication within the perimeter of the fence but there are alternative methods of excluding/limiting predator access to nest sites.

3.2.1 Fencing

Physical barriers, such as fencing, can greatly reduce the number and rate of mammalian predators encountering their prey. Within the UK fencing has generally been used to protect smaller areas, such as nature reserves, with high densities of birds but much larger-scale projects have been undertaken in Australia and New Zealand. Utilising geography, by fencing headlands and peninsulas provides a reduced area for overland incursion and a natural seawater barrier against some species (Dickman, 2012).

Fencing designs vary between sites, but can involve electrification (Moseby and Read, 2006). Options range from simple stranded electric fences to more permanent combination fences which consist of a livestock fence with the addition of live wires above the livestock netting. (Scottish Rural Development Programme, 2021). The combination fence design is more expensive, but is more permanent, requires less maintenance and acts as a livestock fence. Electric fencing must have a high voltage to work effectively, and vegetation should be cleared along its length to prevent the fence from shorting to the ground. Using such fencing around areas of up to 50ha on wetland nature reserves in England was found to increase lapwing *Vanellus vanellus* breeding productivity from 0.23 to 0.79 fledged young per pair. As at least 0.6 fledged young per pair is thought to be necessary to maintain a stable population the fencing turned lapwing population sinks into sources for recolonising surrounding areas (Malpas *et al.,* 2013).

Generally, fences that have been successful in excluding invasive mammals have the following specifications in common (Sellarés de Pedro, 2021):

Table 3.1 Fence specification for predator exclusion

Specification	Reason
At least 1.9 metres high	Cats can jump over 1.7m unassisted
A hood or cap	To prevent mammals from climbing over the fence
Mesh squares no wider then 7mm	To exclude juvenile rats or mice
An underground skirt extending at least 350mm from the base of the fence	To prevent burrowing under the fence
Sits on a level platform	To prevent water run-off
4m clear of vegetation or other structures outside of the fence	Helps prevent damage to fence and stops predators using vegetation to aid entry
No overhanging trees	Helps prevent damage to fence and stops predators climbing tree to enter exclusion area

Exclusion fencing is most effective when used in-combination with targeted population reduction or eradication measures immediately following fence construction to remove/reduce any remaining predators within the enclosure (Miller *et al.,* 2010). Periodic removal of predators may also be required in areas where predators can walk or swim around the fence ends.

Guidance on predator exclusion fencing is available, covering site selection, fence design, and installation planning (White and Hirons, 2019). However, some aspects of this guidance are outdated and no longer considered best practice. Additional guidance specific to predator exclusion fencing for ground-nesting seabirds exists, including recommendations for tern species (Babcock and Booth, 2020). Bespoke advice should be sought from relevant SNCBs, the landowner and conservation bodies such as the RSPB.

Case studies, such as Dalrymple (2023), provide insights into the effectiveness of exclusion fencing, including its application to protect ground-nesting gull species (herring gull, lesser black-backed gull, and great black-backed gull *Larus marinus*) in North-West England.

An advantage of fencing is that, once installed, it requires a much lower amount of resource to manage when compared to the effort required for methods such as trapping. It can also be effective against predators such as badgers, which are themselves protected, for which control is difficult. Downsides are that fences can be breached and so may require additional control measures. In addition, fences do not deter avian predators – and these may partially replace the level of predation removed through the exclusion of mammals (Smart and Ratcliffe, 2000). Fences can also result in unintended consequences for a range of unrelated species, reducing habitat connectivity by decreasing the permeability and ease with which wildlife can move across the landscape (Isaksson *et al.,* 2007).

Examples of OW projects who have proposed the use of anti-predator fencing as compensation include:

- Norfolk Projects Offshore Wind Farms in relation to lesser black-backed gull (MacArthur Green / Royal HaskoningDHV, 2022).
- Outer Dowsing Offshore Wind has proposed predator fencing and eradication measures as compensation for impacts on auk species (awaiting a consent decision at the time of writing) (Outer Dowsing, 2025).

3.2.2 Nest Enclosures

An alternative to fencing entire colonies is to protect individual nests using nest enclosures. Nest enclosures are protective cages placed over nests that allow adults and chicks free entry and exit but hinder predators from reaching the nest.

A small before and after study on a breakwater in Lake Erie, Canada in 1990 found no common tern *Sterna Hirundo* were predated by herring gulls or ringbilled gulls *L. delawarensis* over 12 days following the provision of small plywood shelters compared with ten chicks being predated in the eight days between first hatching and shelter provision (Burness and Morris, 1992).

Other results have been mixed (Johnson and Oring, 2002) with studies in Sweden showing that for lapwings and common redshank *Tringa tetanus* nest enclosures resulted in higher hatching success but that incubating adult redshanks were more likely to be predated from protected nests – likely because redshanks tended to flush late (when a predator was close) and were then unable to escape in time (Isaksson *et al.,* 2007).

Consideration also needs to be given to whether the provision of nest enclosures may attract predators if they learn to associate the structure with potential prey. Three replicated and controlled studies from North America (Murphy *et al.,* 2003; Neumann *et al.,* 2004) and Sweden (Niehaus *et al.,* 2004) showed higher levels of predation on adult birds when nesting in enclosures whilst another Swedish study found predation was no higher (Isaksson *et al.,* 2007).

3.3 Predator Control

3.3.1 Managing predator numbers

When predators exist on continental/mainland sites, rather than islands, the chances of eradicating them is far smaller, may not be desirable and is more resource intensive, hence reducing numbers is seen as the more achievable option. Evidence suggests that trapping and hunting is the most effective method of predator control for cats and larger non-native mammals (Nogales *et al*., 2004).

A replicated, randomised, paired site study from March-July in 2000–2008 in two pairs of plots (9.3–14.4 km^2) in Northumberland, UK (Fletcher *et al.,* 2010) found that plots where predators were experimentally controlled displayed increased density and fledgling success of breeding birds. Reductions in foxes and carrion crows *Corvus corone* led to an average threefold increase in the percentage of pairs fledging young of lapwing, golden plover *Pluvialis apricaria,* European curlew *Numenius arquata*, red grouse *Lagopus lagopus* and meadow pipit *Anthus pratensis*; and subsequently led to increases in breeding numbers (≥ 14%/year) of lapwing, curlew, golden plover and red grouse, all of which declined in the absence of predator control (≥ 17%/year).

There was no significant effect of predator culling for any wader species. Predator culling reduced the abundance of fox by 43% and carrion crow by 78%.

Seabirds frequently nest on the ground where they are vulnerable to predation from both animals and other birds. A before-and-after study in New Zealand found an increase in a New Zealand fairy tern *Sterna nereis davisae* population following intensive trapping of invasive mammals (Wilson and Hansen, 2001) whilst a similar study in Canada found increases in common tern fledgling success following gull control (Guillemette and Brousseau, 2001).

For avian predators on islands, six before-and-after studies from North America (Morris *et al.,* 1980; Morris *et al.,* 1992; Roby *et al.,* 2002), Australia (Priddel and Carlile, 1995) and Europe (Finney *et al*., 2003; Paracuellos and Nevado, 2010) found that controlling avian predators led to increased population sizes of target species (Finney *et al.,* 2003; Paracuellos and Nevado, 2010), reduced mortality (Priddel and Carlile, 1995) or increased reproductive success (Morris *et al.,* 1980; Roby *et al.,* 2002) in seabirds on islands. Conversely a UK study at a former gravel pit in Kent, found that the number of common terns and black-headed gulls *Chroicocephalus ridibundus* declined on gravel islands despite the attempted control of large gulls (Akers and Allcorn, 2006).

Where traps are used to control predator numbers consideration should be given to the use of automatic trap checking systems. Although these will not increase the efficacy of the trap itself, monitoring traps with technology can help reduce unnecessary trap visits, leading to efficiencies in resource use and enable real time response which in turn improves the overall sustainability of control programmes (Martin, 2021).

It should be noted that removing or controlling predators in an area may create a vacuum effect that can draw in more, or different, predators from surrounding areas resulting in an ongoing effort to maintain the benefits of predator control in the long-term.

The geographical extent within which predator management can occur is often limited due to a variety of factors, including ecological complexities, landownership and access, legislative constraints, and the difficulty of implementing and maintaining large-scale control programmes (Menon *et* *al.,* 2025). That being said, there are a few initiatives that are looking to do just that; including the Waterlife Recovery East project which looks to control American mink throughout East Anglia, and New Zealand's Predator Free 2050 campaign. Although the control of predators along large swathes of the UK coastline seems unlikely to be achievable in the short to medium term, this should not be ruled out in the longer-term through coordinated, landscape-scale conservation efforts which could be delivered through programmes such as the government-funded Environmental Land Management schemes (BASC, 2025).

3.3.2 Habitat management to reduce predation

Alongside predation, changes to habitat can also cause declines in bird numbers, and the two are often interlinked. For example, broader habitat or environmental change may result in increased predator numbers or prey vulnerability. In some circumstances, predation becomes the proximate cause of a species decline while habitat change may be the ultimate cause.

In principle, birds and their nests could be made less vulnerable to predation by managing habitat so that birds are better hidden from predators or are in locations less favoured by predators. In open areas, for example, it is often considered beneficial to remove trees to get rid of perch sites for avian predators. In degraded or simplified habitats, restoration efforts that introduce habitat complexity (heterogeneity) and increase refuge availability can significantly reduce the vulnerability of prey to predators (Lennox *et al.,* 2025).

Some habitat and land-use changes may also constrain a species' ability to compensate for losses to predation. For example, if deteriorating habitat quality shortens the breeding season, birds that would otherwise be well adapted for high levels of predation might have less time for a second nesting attempt if the first is lost to predation. Improvements to habitat could therefore improve a populations ability to produce a second brood, increasing resilience to predation.

One of the most successful habitat modification methods is the creation of areas of cover or other refuges which result in predators being less likely to detect the target species. Cover and refuge methods may include the provision of tall ground cover or shrubs. For example, previous studies show that common guillemots nesting in areas with artificial cover installed over the cliff tops produced twice as many eggs (Parish and Paine 1996). The RSPB (2023) also suggested that providing an appropriate level of vegetation in front or around Atlantic puffin burrows, could aid in protecting pufflings and potentially reducing levels of kleptoparasitism (whereby the predator steals/competes for the prey of the individual) from gulls. However, scrub management has also been proposed as a potential method to increase puffin nesting as large amounts of vegetation may prevent access to or visibility of burrows and could increase predation by mammalian predators such as rats (Outer Dowsing, 2025).

Habitat management may also be undertaken to indirectly control predator numbers. Specifically, habitat management may be used to reduce edge effects and actions may also be undertaken to reduce high populations of other typical prey species for predators, such as voles and rabbits, to indirectly reduce predator numbers (Kortland, 2006).

Across Europe habitat management measures have not always resulted in widespread reversal of the declines in breeding birds (McMahon *et al.,* 2024). This is likely because declines are due to multiple interacting factors, including habitat loss/degradation, climate change and food availability in addition to predation pressure. As already mentioned, removal of only one of these pressures, although likely to provide some benefit, will not necessarily result in major increases in bird breeding success (BASC, 2025).

As with other predator control measures the scale at which habitat management can be delivered is often limited due to the diverse range of stakeholders that need to be on board with delivery – regulators, policy makers, famers and landowners, conservationists, and local communities (BASC, 2025).

3.3.3 Diversionary/Supplementary feeding

Diversionary feeding is defined as "the use of food to divert the activity or behaviour of a target species from an action that causes a negative impact, without the intention of increasing the density of the target population" (Kubasiewicz *et al.,* 2016).

Although the provision of an alternative food source to decrease the number of prey killed seems logical, there are few cases where it has been proven to work successfully (Graham *et al*., 2005; Jimenez and Conover 2001). In the UK a trial to reduce hen harrier *Circus cyaneus* predation on red grouse chicks at Langholm Moor found that whilst hen harriers delivered 86% fewer grouse chicks to their nests when provided with supplementary food, grouse chick mortality remained high – possibly because other predators then took the grouse chicks (Redpath *et al.,* 2001).

There is also a risk that predator breeding success and density might also be improved by supplementary feeding, leading to a worsening of the problem in the long-term (Reynolds and Tapper, 1996). This is most likely if additional food sources are abundant at a time when natural food availability might normally be a limiting factor for predators, for example during the winter. Diversionary feeding of red kite in Scotland reduced predation on lapwing chicks without boosting populations of the predators themselves.

Interestingly, it has been suggested there may also be merit in providing supplementary food to the prey species rather than the predator (Quinn and Cresswell 2004) if it could be shown to reduce vulnerability of the prey – for example by reducing foraging time/effort.

3.3.4 Conditioned Taste Aversion

Another potential method to reduce predation is to provide a bait that resembles the prey, but which is dosed with a noxious chemical to make the animal sick. Over time, the predator will be conditioned to stop taking the prey in the belief it will make them ill. This method has been shown to reduce predation on bird's eggs by corvids (Avery and Decker, 1994) and mammals (Conover, 1990) in the wild in the US.

However, some species can detect the chemicals and avoid the baits (Massei *et al.,* 2003a) and there can be a marked difference in response between individuals of the same predator species (Massei *et al.,* 2003b). It can also be difficult to exclude non-target mammals, and the method is only really practicable where predator numbers are low as each individual predator needs to be conditioned – as such it is not deliverable alone at the scale necessary to make it of interest as a compensation measure for OW.

3.3.5 Intraguild Predation

Recently there has been an increasing interest in the role of intraguild predation (predators eating or competing with other predators) on predator-prey relationships. In theory, larger, more-dominant predators can reduce the number of smaller predators – through direct predation, competition, and avoidance behaviour. As smaller predators are often more efficient predators of small prey, the presence of more dominant predators may reduce overall predation on smaller prey species. This is being looked at in the Cairngorms Connect Predator Project, and there is evidence supporting this theory from around the world (Prugh *et al.,* 2009). However, it is unclear how applicable this could be to UK ecosystems.

It appears likely the greatest potential for intraguild predation in the UK is within predatory bird assemblages as these are more complete than the mammalian predator assemblage within which the larger, more dominant predators are now extinct in the UK. Goshawks *Accipiter gentilis* are known to reduce common buzzard *Buteo buteo* density and breeding success as well as preying on corvids (Sergio and Hiraldo, 2008), while it has been suggested that the White-tailed eagle *Haliaeetus albicilla* could have a controlling effect on American mink (Salo *et al*., 2008).

At present, too little is known about the relative importance of the different predators, and their interactions, to develop practical predator management strategies based around intraguild predation. However, as the numbers of some predatory species increase, it is important to be aware that the potential exists for some top predators to be beneficial to some of their prey species due to their effect on more efficient lower predators.

3.3.6 Deterrents

Deterrents may be auditory, visual, or chemical depending on the target species and location.

Auditory deterrents

Some organisations, such as the RSPB, have trialled ultrasonic deterrents such as 'catwatch' units which emit a high-pitched sound (normally above 20 kHz) when a movement sensor is activated. Two randomised, replicated and controlled trials in the UK (Nelson *et al.,* 2006) found the use of ultrasonic cat deterrents reduced cat visits by 32% in 63 gardens across an 18-week trial and also reduced the duration of visits but had no effect on predation over 96 gardens in a 33-week trial.

Visual deterrents

Most of the visual deterrents used to date focus on reduction of pressures from avian predators – such as bamboo canes to reduce predation by gulls on ground-nesting birds (Boothby *et al.,* 2019) or laser-hazing (where laser beams are pointed at avian predators to discourage predation on prey species). These are considered in more detail in OWIC SCS Report Number 01, Reducing Pressures from Avian Predators: A Potential Strategic Compensation Measure (OWIC, 2025).

3.3.7 Warning prey of approaching predators

Warning prey of the approach of predators would allow them to take avoiding action – although this is likely only practical for domestic predators such as cats. Evidence for the efficacy of this measure is mixed with some studies (e.g. Woods *et al.,* 2003) finding no effect of bells on bird predation rates whilst experimental studies by others (Ruxton *et al.,* 2002) showed bells reduced bird predation by about half. An RSPB study testing both bells and electronic sonic devices that emit an audible beep every seven seconds reduced bird kills by 41% and 51% respectively (Nelson *et al.,* 2005).

As cats receive most, or all, of their food from their owners, making them less effective killers is unlikely to impact on their welfare or survival. However, this is unlikely to be the case with wild predators.

4 Conclusions

Given that both mammalian predator eradication on islands, and predator control and exclusion on inshore islands, mainland sites, or on parts of larger islands are already approved as strategic compensation measures for seabirds in the UK and there is considerable scientific evidence of the effectiveness of both these methods as a means of controlling/eliminating predator numbers (and thereby increasing breeding success in seabirds) it is not recommended that any further work to test or trial additional techniques be taken forward under the SCS project. It should be noted however that there are already limitations to the use of rodenticides in the UK and, whilst there is currently a process in place to allow the use of SGARs for island eradication for breeding seabirds, this is seen as an ongoing risk to the delivery of this measure.

Although there are some additional control measures for which evidence of effectiveness is either lacking or less robust, the literature suggests these need to be considered on a species and location specific basis. Many of the control measures would also be difficult to deliver at the scale required to be considered as strategic measures. As such, these are not seen as a priority for additional work at this time, in relation to mammalian predators. These measures could be explored through avenues outside the SCS project.

It is noted that a number of the control methods are more suited to avian predators and recommendations for work in this area have been outlined in a separate report created by the SCS project in relation to reducing the pressures from avian predators – OWEC SCS Report No. 01 (OWIC, 2025).

The different control methodologies outlined in this review, their relative efficacy and recommendations for further work are summarised in Table 4.1.

Table 4.1: Summary table of predator control methods, predator species, efficacy of the measures and recommendations for further work

Predator control type	Control Method	Predator Species	Efficacy	Recommendation
Predator eradication on island sites	Poisoning	Rodents	84%improved nest survival 70% increase in post breeding population size 75% higher hatching success	Already very effective, no further work recommended
	Trapping/ shooting	Non-native mammals		
	Trapping/ hunting	Cats		
	Trapping/ relocation	Native mammals		
Predator exclusion	Fencing	All terrestrial mammals	Effective at reducing predation (changes in productivity can vary, based on underlying pressures on colony)	Already effective, lots of existing guidance on design. No further work recommended
	Nest enclosures/ covers		Mixed results, more promising for avian predators	No further work recommended
Predator Control	Reducing numbers (culling)	Foxes, crows, gulls	Increased density and fledgling success of breeding birds and reduced mortality	Allready effective. No further work recommended
	Habitat management		Results highly variable and specific to both species and habitat type	Too location specific. No further work recommended
	Diversionary feeding		Few cases where proven to be effective	No further work recommended
	Conditioned taste aversion	Mammals, corvids	Only practicable where predator numbers are low	No further work recommended
	Intraguild predation	Birds	Unlcear how aplicable it will be to UK	No further work recommended
	Deterrents	Avian predators	More relevant to avian predators	No further work recommended
	Prey warning systems	Cats	Only practical for domestic predators	No further work recommended

5 References

Akers P and Allcorn RI (2006). Re-profiling islands in a gravel pit to improve nesting conditions for terns *Sterna* and small gulls *Larus* at Dungeness RSPB reserve, Kent, England. *Conservation Evidence* 3: 96-98

Amaral J, Almeida S, Sequeira M and Neves V (2010). Black rat *Rattus rattus* eradication by trapping allows recovery of breeding roseate tern *Sterna dougallii* and common tern *S. hirundo* populations on Feno Islet, the Azores, Portugal. *Conservation Evidence* 7; 16–20

Avery ML and Decker DG (1994). Responses of captive fish crows to eggs treated with chemical repellents. *Journal of Wildlife Management* 58: 261-266

Babcock M and Booth V (2020). Tern Conservation best practice: Anti-predator fencing. Developed as part of the project Improving the conservation prospects of the priority species
roseate tern throughout its range in the UK and Ireland LIFE14 NAT/UK/000394

BASC (2025). Cooperation and trust: Key ingredients for successful habitat management. Available at: https://basc.org.uk/cooperation-and-trust-key-ingredients-for-successful-habitat-management/. Accessed June 2025.

Birdlife International (2008). *State of the world's birds: Indicators for our changing world*. Birdlife International

Blackburn TM, Cassey P, Duncan RP, Evans KL and Gaston KJ (2004). Avian extinction and mammalian introductions on oceanic islands. *Science* 305: 1955-1958

Boothby C, Redfern C, Schroeder J, (2019) An evaluation of canes as a management technique to reduce predation by gulls of ground-nesting seabirds. *Ibis* 161, 453-458.

Bryd GV, Bailey EP and Stahl W (1997). Restoration of island populations of black oystercatchers and pigeon guillemots by removing introduced foxes. *Colonial Waterbirds* 253-260

Burness GP and Morris RD (1992). Shelters decrease gull predation on chicks at a common tern colony. *Journal of Field Ornithology* 63: 186-189

Burns B, Innes J and Day T. (2012). 'The use and potential of pest-proof fencing for ecosystem restoration and fauna conservation in New Zealand. *Fencing for conservation* 10: 65-90

Conover MR (1990). Reducing mammalian predation on eggs by using conditioned taste aversion to deceive predators. *Journal of Wildlife Management* 54: 360-365

Cooper J and Fourie A (1991). Improved breeding success of great-winged petrels *Pterodrama macroptera* following control of feral cats *Felis catis* at subantarctic Marion Island. *Bird Conservation International* 1; 171-175

Cote IM and Sutherland WJ (1997). The effectiveness of removing predators to protect bird populations. *Conservation Biology* 11: 395-405

Cruz J and Cruz F (1996). Conservation of the dark-rumped petrel *Pterodroma phaeopygia* of the Galapagos Islands, 1982-1991. *Bird Conservation International* 6; 23-32

Dalrymple SA (2023). Predator exclusion fencing improves productivity at a mixed colony of Herring Gulls *Larus argentatus*, Lesser Black-backed Gulls *L. fuscus* and Great Black-backed Gulls *L marinus*. Seabird 35

De L. Brooke M, Bonnaud E, Dilley BJ, Flint EN, Holmes ND, Jones HP, Provost P, Rocamora G, Ryan PG, Surman C and Buxton RT (2017). Seabird population changes following mammal eradications on islands. *Animal Conservation* 21(1): 3-12

Dickman CR 2012. *Fences or Ferals? Benefits and Costs of Conservation Fencing in Australia in Somers, M.J. & Hayward, M.W.* (eds) Fencing for Conservation: Restriction of Evolutionary Potential or a Riposte to Threatening Processes? Springer, New York.

DIISE. (2015). *The Database of Island Invasive Species Eradications,* developed by Island Conservation, Coastal Conservation Action Laboratory UCSC, IUCN

SSC Invasive Species Specialist Group, University of Auckland, and Landcare Research New Zealand. Available at: http://diise.islandconservation.org Accessed January 2025

Finney SK, Harris MP, Keller LF, Elston DA, Monaghan P and Wanless S (2003). Reducing the density of breeding gulls influences the pattern of recruitment of immature Atlantic puffins *Fratercula arctica* to a breeding colony. *Journal of Applied Ecology* 40: 545-552

Fletcher K, Aebischer NJ, Baines D, Foster R and Hoodless AN (2010). Changes in breeding success and abundance of ground-nesting moorland birds in relation to the experimental deployment of legal predator control. *Journal of Applied Ecology* 47; 263–272.

Gibbons DW, Amar A, Anderson GOA, Bolton M, Bradbury RB, Easton MA, Evans AD, Grant MC, Gregory RD, Hilton GM, Hirons GJM, Hughes J, Johnstone I, Newbery P, Peach WJ, Ratcliffe N, Smith KW, Summers RW, Walton P and Wilson JD (2007). *The Predation of Wild Birds in the UK: A review of its conservation impact and management*. RSPB Research Report no 23, RSPB, Sandy

Graham K, Beckermann AP, and Thirsgood S (2005). Human predator-prey conflicts: ecological correlates, prey losses and patterns of management. *Biological Conservation* 122: 159-171

Guillemette M and Brousseau P (2001). Does culling predatory gulls enhance the productivity of breeding common terns? *Journal of Applied Ecology* 38; 1–8

HM Government (2012). *Marine Strategy Part One: UK Initial Assessment and Good Environmental Status*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69632/pb13860-marine-strategy-part1-20121220.pdf Accessed January 2025

HM Government (2015). *Marine Strategy Part Three: Uk Programme of Measures.* Available at: https://www.gov.uk/government/publications/marine-strategy-part-three-uk-programme-of-measures Accessed January 2025

Howald G, Donlan C, Galvan JP, Russell JC, Parkes J, Samaniego A, Wang Y, Veitch D, Genovesi P, Pascal M, Saunders A and Tershy B (2007). Invasive rodent eradication on islands. *Conservation Biology* 21: 1258-1268

Hughes BJ, Martin GR, and Reynolds SJ (2008). Cats and seabirds: effects of feral domestic cat *Felis silvestris catus* eradication on the population of sooty terns *Onychoprion fuscata* on Ascension Island, South Atlantic. *Ibis* 150; 122–131.

Igual JM, Forero MG, Gomez T, Orueta JF and Oro D (2006) Rat control and breeding performance in Cory's shearwater (*Calonectris diomedea*): effects of poisoning effort and habitat features. *Animal Conservation* 9; 59–65.

Isaksson D, Wallander J and Larsson M (2007). Managing predation on ground-nesting birds: the effectiveness of nest enclosures. *Biological Conservation* 136: 136-142

Isles of Scilly Wildlife Trust (2023). Isles of Scilly Seabird Recovery Project: saving Scilly's seabirds. Available at: https://www.ios-wildlifetrust.org.uk/our-projects/isles-scilly-seabird-recovery-project. Accessed January 2025.

Jimenez JE and Conover MR (2001). Ecological approaches to reduce predation on ground-nesting gamebirds and their nests. *Wilson Society Bulletin* 29: 62-69

Johnson M and Oring LW (2002). Are nest enclosures an effective tool in plover conservation? *Waterbirds* 25: 184-190

Keitt BS and Tershy BR (2003). Cat eradication significantly decreases shearwater mortality. *Animal Conservation* 6; 307–308

Kubasiewicz LM, Bunnefeld N, Tulloch AIT, Quine CP, and Park KJ (2016) Diversionary feeding: An effective management strategy for conservation conflict? *Biodiversity and Conservation* 25(1), 1–22.

Landmark Trust (2017). Seabird Success! Super news for seabird numbers on Lundy. Available at: https://www.landmarktrust.org.uk/lundyisland/news-and-events/latest-news/seabird-success/. Accessed May 2025.

Lennox RJ, Kambestad M, Berhe S, Birnie-Gauvin K, Cooke SJ, Dahlmo LS, Eldøy, SH, Davidsen JG, Hanssen EM, Sortland LK, Shea D, Nilsen CI, Skoglund H, Velle G, Hellström G, Lundberg P, Junge C, Ferter K and Wiik Vollset K (2025). The role of habitat in predator–prey dynamics with applications to restoration. *Restoration Ecology* 33: e14354

Lock J (2006). Eradication of brown rats *Rattus norvegicus* and black rats *Rattus rattus* to restore breeding seabird populations on Lundy Island, Devon, England. *Conservation Evidence* 3; 111–113.

MacArthur Green / Royal Haskoning DHV (2022). Norfolk Projects Offshore Wind Farms – Lesser black-backed gull Implementation and Monitoring Plan. Available at https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010087/EN010087-002993-The%20Norfolk%20Projects%20Lesser%20Black-Backed%20Gull%20Implementation%20and%20Monitoring%20Plan%20.pdf Accessed May 2025

Malpas LR, Kennerley RJ, Hirons GJM, Sheldon RD, Ausden M, Gilbert JC, Smart J (2013). The use of predator exclusion fencing as a management tool improves the breeding success of waders on lowland wet grassland. *Journal for Nature Conservation* 21: 37-47

Martin AR (2021). Reliability and effective use of electronic trap monitoring systems based on cellular networks. *Biological Invasions* 24: 1247-1251

McMahon BJ, Doyle S, Mougeot F and Arroyo B (2024). The decline of ground nesting birds in Europe: Do we need to manage predation in addition to habitat? *Global Ecology and Conservation*: 55, id e03213

Menon V, Giljohann K, Pascoe J, Wintle B, Robley A, Town-Hopkinson L and Hradsky B (2025). Managing multiple threats: Evaluating the efficacy of broad-scale introduced predator management in improving native mammal resilience to fire. *Biological Conservation*: 301, 110847

Massei G, Lyon A and Cowan DP (2003a). Potential compounds for induction conditioned taste aversion in ferrets. *New Zealand Journal of Zoology* 30: 95-100

Massei G, Lyon A and Cowan DP (2003b). Levamisole can induce conditioned taste aversion in foxes. *Wildlife Research* 30: 633-637

Miller CJ, Young LC, VanderWerf EA, Smith DG, Kennedy R, Takahama TK, Liesemeyer BR and Leong H (2010). 'The Kaena Point Natural Area Reserve Ecosystem Restoration Project: A Predator Exclusion Fence.' *In Proceedings of the Vertebrate Pest Conference* (Vol. 24, No. 24)

Mitchell I, Thomas S, Bambini L, Varnham K, Phillips R, Singleton G, Douse A, Foster S, Kershaw M, McCulloch N, Murphy M and Hawkridge J, (2018). *Invasive mammal presence on island seabird colonies.* UK Marine Online Assessment Tool, available at: https://moat.cefas.co.uk/biodiversity-food-webs-and-marine-protected-areas/birds/invasive-mammals/ Accessed January 2025

Morris RD, Kirkham UR, and Chardine JW (1980). Management of a declining common tern colony. *Journal of Wildlife Management* 48: 21-245

Morris H, Blokpoel H and Tessier GD (1992). Management efforts for the conservation of common tern *Sterna hiruno* colonies in the Great Lakes: two case histories. *Biological Conservation* 60: 7-14

Moseby KR and Read JL (2006). The efficacy of feral cat, fox, and rabbit exclusion fence designs for threatened species protection. *Biological Conservation* 127: 429-437

Murphy RK, Michaud IM, Prescott DR, Ivan JS, Anderson BJ & French-Pombier ML (2003) Predation on adult piping plovers at predator enclosure cages. *Waterbirds* 26: 150–155.

Nelson SH, Evans AD and Bradbury RB (2005). The efficacy of collar-mounted devices in reducing the rate of predation of wildlife by domestic cats. *Applied Animal Behavioural Science* 94: 273-285

Nelson SH, Evans AD and Bradbury RB (2006). The efficacy of an ultrasonic cat deterrent. *Applied Animal Behavioural Science* 96: 83-91

Neuman KK, Page GW, Stenzel LE, Warriner JC & Warriner JS (2004) Effect of mammalian predator management on snowy plover breeding success. *Waterbirds* 27: 257–263.

Newton I (1993). Predation and the limitation of bird numbers. *Current Ornithology* 11: 143-198

Newton I (1998). *Population Limitations in Birds*. Academic Press, London

Niehaus AC, Ruthrauff DR & McCaffery BJ (2004) Response of predators to western sandpiper nest enclosures. *Waterbirds* 27: 79–82

Nogales M, Martin A, Tershy BR, Donlan CJ, Veitch D, Puerta N, Wood B and Alonso J (2004). A review of feral cat eradication on islands. *Conservation Biology* 18: 310-319

Nordström M (2003). Introduced predator in Baltic Sea archipelagos: variable effects of feral mink on bird and small mammal populations. *Annales Universitatis Turkuensis*. Sarja – Ser All Osa – Yom. 158

Outer Dowsing (2025) https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010130/EN010130-001613-7.7.5%20Predator%20Control%20Evidence%20Base%20and%20Roadmap.pdf Accessed January 2025

OWIC (2025). *Reducing Pressures from Avian Predators: A Potential Strategic Compensation Measure*. OWEC SCS Report No. 01. A report produced by OWIC for the OWEC Strategic Compensation Studies (SCS) project.

Ozaki S, Carter H, Chaplow JS, Dodd BA, Potter ED, M. Pereira G, Sleep D, Toon B, and Walker LA (2023). *Second generation anticoagulant rodenticide residues in barn owls 2022*. UKCEH contract report to the Campaign for Responsible Rodenticide Use (CRRU) UK, pp. 26

Paracuellos M and Nevado J (2010). Culling yellow-legged gulls *Larus michahellis* benefits Audouin's gulls *Larus andouinii* at a small and remote colony. *Bird Study* 57: 26-30

Parrish R (2005). Pacific rat *Rattus exulans* eradication by poison-baiting from the Chickens Islands, New Zealand. *Conservation Evidence* 2; 74–75

Peck DR, Faulquier L, Pinet P, Jaquemet S and Le Corre M (2008). Feral cat diet and impact on sooty terns at Juan de Nova Island, Mozambique Channel. *Animal Conservation* 11; 65–74

Priddel D and Carlile N (1995). Mortality of adult Gould's petrels *Pterodroma leucoptera leucoptera* at the nesting site on Cabbage Tree Island, New South Wales. *Emu* 95: 259-264

Prugh LR, Stoner JC, Epps CW, Bean WT, Ripple WJ, Laliberte AS, Brashares JS (2009). The rise of the Mesopredator. *Bioscience* 59: 779-791

Quinn JL and Cresswell W (2004). Predator hunting behaviour and prey vulnerability. *Journal of Animal Ecology* 73: 143-154

Ratcliffe N, Mitch I, Varnham K, Verboven N and Higson P (2009). How to prioritize rat management for the benefit of petrels: a case study of the UK, Channel Islands, and Isle of Man. *Ibis* 151; 699–708.

Ratcliffe N, Bell M, Pelembe T, Boyle D, Benjamin R, White R, Godley B, Stevenson J and Sanders S (2010). The eradication of feral cats from Ascension Island and its subsequent recolonization by seabirds. *Oryx* 44, 20–29

Redpath S, Thirsgood S and Leckie FM (2001). Does supplementary feeding reduce predation of red grouse by hen harriers? *Journal of Applied Ecology* 38: 1157-1168

Regher HM, Rodway MS, Lemon MJF and Hipfner JM (2007). Recovery of the Ancient Murrelet *Synthliboramphus antiquus* colony on Langara Island, British Columbia, following eradication of invasive rats. *Marine Ornithology* 35; 137–144.

Reynolds JC and Tapper SC (1996). Control of mammalian predators in game management and conservation. *Mammal Review* 26: 127-156

Roby DD, Collis K, Lyons DE, Craig DP, Adkins JY, Myers AM, and Suryan RM (2002). Effects of colony relocation on diet and productivity of Caspian terns. *Journal of Wildlife Management* 66: 662-673

Rodriguez C, Torres R and Drummond H (2006). Eradicating introduced animals from a forested topical island. *Biological Conservation* 130: 98-105

RSPB (2023). *The conservationist's dilemma - an update on the science, policy and practice of the impact of predators on wild birds*. Available at: https://community.rspb.org.uk/ourwork/b/actionfornature/posts/the-conservationist-s-dilemma---an-update-on-the-science-policy-and-practice-of-the-impact-of-predators-on-wild-birds-10 Accessed February 2025

Ruxton GD, Thomas S and Wright JW (2002). Bells reduce predation of wildlife in domestic cats (*Felis catus*). *Journal of the Zoological Society of London* 256: 81-83

Salo P, Nordstrom M, Thomson RK, Korpimaki E (2008). Risk induced by a native top predator reduces alien mink movements. *Journal of Animal Ecology* 77(6): 1092-1098

Scottish Rural Development Programme (2021). *Technical Note (TN742): Predator Control for Conservation.*

Sellarés de Pedro C (2021). *Plémont Seabird Reserve: Feasibility study report for a predator-exclusion fence.* Birds on the Edge. Available at https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010130/EN010130-001286-7.7.5%20Predator%20Control%20Evidence%20Base%20and%20Roadmap.pdf Accessed January 2025

Sergio F and Hiraldo F (2008). Intraguild predation in raptor assemblages: a review. *Ibis* 150 (Suppl 1): 132-145

Seto NW and Conant S (1996). The effects of rat (*Rattus rattus*) predation on the reproductive success of the Bonin petrel (*Pterodroma hypoleuca*) on Midway Atoll. *Colonial Waterbirds*; 253-260

Smart J and Ratcliffe N (2000). *Monitoring the effects of supplementary feeding as a means of reducing kestrel predation on little tern chicks at the Great Yarmouth colony*. RSPB report, Sandy UK

Smith DG, Shiinok, EK and VanderWerf EA (2006). Recovery of native species following rat eradication on Mokoli'i Island, O'ahu, Hawai'i. *Pacific Science* 60; 299–303

Smith RK, Pullin AS, Stewart GB and Sutherland WJ (2010). Effectiveness of predator removal for enhancing bird populations. *Conservation Biology* 24: 820-829

Stanbury A, Thomas S, Aegerter J, Brown A, Bullock D, Eaton M, Lock L, Luxmoore R, Roy S, Whitaker S and Oppel S (2017). Prioritising islands in the United Kingdom and crown dependencies for the eradication of invasive alien vertebrates and rodent biosecurity. *European Journal of Wildlife Research* 63: 1084-87

Tershy BR, Shen KW, Newton KM, Holmes ND & Croll DA (2015). The importance of islands for the protection of biological and linguistic diversity. *Bioscience* 65: 592–597.

Thomas S, Varnham K and Havery S (2017). *UK Rodent Eradication Best Practice Toolkit* (Version 4.0). RSPB, Sandy, Bedfordshire. Available at: https://biosecurityforlife.org.uk/resources/detail/uk-rodent-eradication-best-practice-toolkit. Accessed January 2025

White G and Hirons G, 2019. The predator exclusion fence manual. *Guidance on the use of predator exclusion fences to reduce mammalian predation on ground-nesting birds on RSPB reserves. RSPB Ecology.*

Williams DR, Pople RG, Showler DA, Dicks LV, Child MF, zu Ermgassen EKHJ and Sutherland WJ (2012) *Bird Conservation: Global evidence for the effects of interventions.* Exeter, Pelagic Publishing.

Wilson T and Hansen K (2005). Predator control to enhance breeding success of the New Zealand fairy tern *Sterna nereis davisae*, North Island, New Zealand. *Conservation Evidence* 2; 89

Woods M, McDonald RA, and Harris S (2003). Predation of wildlife by domestic cats *Felis catus* in Great Britain. *Mammal Review* 33: 174-188

WWF (2016). What is the sixth mass extinction and 'what can we do about it? [Available from https://www.worldwildlife.org/stories/what-is-the-sixth-mass-extinction-and-what-can-we-do-about-it] Accessed January 2025

Zino F, Oliveira P, King S, Buckle A, Biscoito M, Neves HC, and Vasconcelos A (2001). Conservation of Zino's petrel *Pterodroma madeira* in the archipelago of Madeira. *Oryx* 35; 128–136.

Zino F, Hounsome MV, Buckle AP and Biscoito M (2008). Was the removal of rabbits and house mice from Selvagem Grande beneficial to the breeding of Cory's shearwaters *Calonectris diomedea borealis*? *Oryx* 42; 151–154