Morven North Offshore Wind Array Project

Habitats Regulations Appraisal

Volume 3, Chapter 2: Compensation and Evidence Plan

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1 Background and Introduction

1.1 Introduction

1.1.1.1 This document provides the proposed ornithological compensation measures for the Morven North Offshore Wind Array Project (hereafter 'Morven North') and Morven South Offshore Wind Array Project (hereafter 'Morven South'), should Scottish Ministers conclude this is required as a result of being unable to rule out in-combination Adverse Effects on Integrity (AEOI) for qualifying features of Special Protection Areas (SPAs) with connectivity to Morven North and/or Morven South. The compensation proposals account for those SPAs and qualifying features where an AEOI could not be ruled out based on the Applicant's assessment presented in the Reports to Inform the Appropriate Assessments (RIAAs) for both Morven North and Morven South. Further, the compensation proposals also include, on a without prejudice basis, provision for any additional SPAs (and qualifying features) where there is the risk of AEOI based on the decisions reached by competent authorities (e.g. the Scottish Ministers) as part of the Appropriate Assessments for previous offshore wind developments.

1.1.1.2 The development of these proposals began at an early stage in the Morven North and Morven South planning process, prior to the completion of the impact assessment. Hence it was necessary to make some initial predictions about the species and designated sites which could potentially be impacted, in order to ensure all appropriate compensation requirements were given due consideration. Following completion of the impact assessments some of the initial measures and species originally included could be removed. However, for completeness the original documentation, some of which was discussed with stakeholders, is included in appended documents.

1.1.1.3 The process of reaching the final list of proposed compensation measures was as follows:

1. An initial long list of species at potential risk of impacts was compiled with an accompanying list of measures with the potential to address the potential impacts. This is discussed in Section 2 and Volume 3, Annex 2.1: Compensation Stakeholder Consultation of the Habitats Regulation Appraisal (HRA);
2. As the results of the baseline surveys and impact assessment became available the long list of species and measures was refined to a short-list for further consideration (discussed in Section 3);
3. Ecological evidence in support of the short-listed measures was collated and field surveys conducted as appropriate. From this the final proposed compensation measures were selected. These are discussed in Sections 4 and 5.

1.1.1.4 A summary of actions taken by Morven North and Morven South to secure the compensation measures (e.g. landowner agreements) and options for adaptive management are also discussed.

1.2 Legislative and policy context

1.2.1.1 Consideration has been given to the following guidance on compensation:

- Scottish Government's Update to the 2020 Offshore Wind Policy Statement: Scotland's Offshore Wind Ambition (2026);
- Scottish Government's Draft Updated Sectoral Marine Plan for Offshore Wind Energy (2025);
- Scottish Government's Framework to Evaluate Ornithological Compensatory Measures for Offshore Wind – Process Guidance Note for Developers (Scottish Government, 2023a);
- Department for Environment, Food and Rural Affairs (Defra) Guidance on "Habitats regulations assessments: protecting a European site" (Defra 2021, updated 2023);
- Defra "Best Practice Guidance for developing compensatory measures in relation to Marine Protected Areas" 2021 (Draft) (Defra, 2021);
- Defra Consultation on policies to inform updated guidance for Marine Protected Area (MPA) assessments (Defra, 2024);

- Defra Policy Paper "Environmental Compensatory Measures Reforms for Offshore Wind: policy background and proposed compensation hierarchy" (February 2026);
- European Commission (EC) 2018 "Managing Natura 2000 Sites" (European Commission, 2018),

1.2.1.2 Legislation for compensation for offshore wind development in the United Kingdom (UK), and separately for Scotland, is currently under revision following a period of consultation which ended in September 2025.

1.2.1.3 The current legislation, which remains in force until the above consultation and any subsequent revisions are announced, is the Conservation of Habitats and Species Regulations 2017 and the Conservation of Offshore Marine Habitats and Species Regulations 2017. Under these regulations compensation is required when a plan or project is approved despite having an adverse effect on the integrity of a European site (Special Area of Conservation or Special Protection Area). Compensation should be delivered in advance of the predicted impact and measures should be 'like-for-like', providing equivalent compensation to the impact (Defra 2026[1]).

1.2.1.4 The new proposals have widened the scope of measures which can be secured to compensate for effects on the National Site Network (NSN). While the preference for 'like-for-like' measures remains (typically referred at as Teir 1, i.e. those that directly compensate the impacted species at the impacted site) Defra[1] now propose the mechanism by which there is an increasing acceptance of measures under Tier 2 (ecologically similar features) and Tier 3 (wider measures of benefit to the UK Marine Protected Area network). The full guidance will be published in May when the statutory instrument comes into force. The Marine Recovery Fund forms part of the package of strategic compensation measures and contributions to the fund will allow developers to meet their compensation requirements. This developing guidance has also been considered:

- Defra 2025 Consultation: offshore wind environmental compensatory measures reforms;
- APBMer 2025: Strategic Compensation Policy for Offshore Wind Strategic Environmental Assessment Environmental Report. Report prepared for the Scottish Government.

1.2.1.5 It should be noted that the new proposals (above) retain a hierarchical approach under three tiers:

1. Tier 1: Measures that directly benefit the impacted feature at the impacted site or elsewhere in the protected site/ Marine Protected Area (MPA) network;
2. Tier 2: Measures that benefit ecologically similar features or groups of features;
3. Tier 3: Measures that benefit the protected site or MPA network more broadly, such as by addressing systemic or large-scale pressures.

1.2.1.6 Developers will be expected to work through the tiers in order, with a strong preference for Tier 1 measures, hence this Compensation and Evidence Plan is focussed on compensation options that qualify as Tier 1 measures. However the proposals allow more flexibility towards wider strategic measures within tiers 2 and 3, for example if they can be demonstrated to deliver greater ecological benefits to the NSN overall, and therefore allowance for this has also been incorporated in this Compensation and Evidence Plan. Thus, while the approach outlined has not yet been ratified, the Applicant considered it prudent to develop compensation deliverables that meet Tier 1 criteria, but with a view to wider measures where these represent appropriate alternatives or supplements to the overall package of measures.

1.2.1.7 A significant development in the delivery of strategic measures that could be delivered under Tier 2 and Tier 3 is the establishment of a marine recovery fund (MRF) for Scotland under the Marine

[1] https://www.gov.uk/government/publications/environmental-compensatory-measures-reforms-for-offshore-wind-policy-background-and-proposed-compensation-hierarchy/environmental-compensatory-measures-reforms-for-offshore-wind-policy-background-and-proposed-compensation-hierarchy#contents

Recovery Fund Regulations 2025 which came into force in December 2025. While this enables the UK Secretary of State to delegate powers to the Scottish Ministers to establish a MRF in Scotland, this is expected to be operational later in 2026. At present the advice from Scottish Government[2] is that:

1.2.1.8 "until the Scottish MRF and Scotland's portfolio of compensatory measures are operational, offshore wind developers will be expected to identify other appropriate measures to deliver the necessary compensation for their projects."

1.2.1.9 Therefore, the Applicant has developed a compensation measure that can be delivered for Morven North and Morven South.

1.3 Consultation

1.3.1.1 The approach to consultation for Morven North and Morven South is set out in Morven North and Morven South HRA Derogation Report Volume 3, Annex 2.1: Compensation Stakeholder Consultation of the HRA for all issues related to ornithological compensation. A summary of the issues raised during these consultation activities is presented in Table 1.1, together with how these issues have been considered in the production of this document. Full details of these consultations are presented within Derogation Report Volume 3, Annex 2.1: Compensation Stakeholder Consultation of the HRA.

1.3.1.2 In addition to the engagement set out below, several attempts were made to consult with the Royal Society for the Protection of Birds (RSPB) via email correspondence offering time for meetings to discuss the development of the compensation measures. However in all cases, these offers were not taken up.

Table 1.1: Summary of key consultation issues raised during consultation activities undertaken for Morven North and Morven South of relevance to ornithological compensation.

Date	Consultee and type of consultation	Summary of issue(s) raised	Applicant's response to issue raised and, if applicable, where considered in this chapter
06 June 2024	NatureScot and Marine Directorate – Licensing Operations Team (MD-LOT) (online meeting)	Update on proposed approach and supporting report for identifying offshore island locations suitable for predator eradication as potential Habitats Regulations compensation.	Identification of the offshore island selection process suitable for predator eradication is presented in Volume 3, Annex 2.3: Assessment of Offshore Islands Potentially Suitable for Predator Eradications Report of the HRA.
27 June 2024	NatureScot and MD-LOT (Email correspondence)	NatureScot noted that rat removal on the Isle of Rum could aid seabirds, but the island's size and rugged terrain make eradication difficult and costly.	Feasibility and implications of rat eradication on selected islands, including Isle of Rum, is presented in Volume 3, Annex 2.3: Assessment of Offshore Islands Potentially Suitable for Predator Eradications Report of the HRA, with further details about the island selection set out in Section 4 below.
		NatureScot reported puffin numbers are very low with no recent records, and any link to rat predation is unclear.	

[2] https://www.gov.scot/publications/scottish-marine-recovery-fund-guidance/pages/referencing-the-fund-in-consent-applications/

Date	Consultee and type of consultation	Summary of issue(s) raised	Applicant's response to issue raised and, if applicable, where considered in this chapter
03 February 2025	National Trust (Email correspondence, letter received)	The Applicant contacted the National Trust for Scotland regarding the potential for Sheep Island (Northern Ireland) for compensatory measures as part of derogation proposals linked to the offshore wind farm project.	The island selection process is presented in Section 4 below.
		National Trust highlighted that access for pre-eradication surveys was recently refused for another developer and indicated the same decision would apply to both Morven North and Morven South.	
05 March 2025	NatureScot and MD-LOT (online meeting)	NatureScot acknowledged the potential benefits of predator eradication but emphasized the necessity of comprehensive surveys, biosecurity planning, and monitoring; encouraged early engagement on shortlisted islands and complementary measures such as seagrass restoration and marine litter removal.	A description of the surveys completed to date, biosecurity planning, and monitoring is set out in Section 4 of this report with further details provided in Volume 3, Annex 2.5: Island Screening Report: Muck and Volume 3, Annex 2.6: Pre-eradication Field Study Report: Muck and proposed monitoring in Volume, Chapter 3: Outline Compensation Implementation, Monitoring and Adaptive Management Plan (CIMAMP) of the HRA.
16 May 2025	NatureScot (Email correspondence)	NatureScot welcomed the strong scope and early data collection but stressed assessing predator access and confirming seabird predation, recommending high-resolution imagery in June surveys and considering stable isotope analysis, with timing critical for results.	The Applicant took account of stakeholder feedback, with regards to Morven North and Morven South, when undertaking surveys to support island rat eradication (see Section 4 of this report) with further details about the survey methodologies set out in Volume 3, Annex 2.5: Island Screening Report: Muck and Volume 3, Annex 2.6: Pre-eradication Field Study Report: Muck of the HRA
		NatureScot noted that previous eradication projects are not directly comparable, stressing the need for stronger evidence of effectiveness and site-specific validation of rat predation impacts, particularly for cliff-nesting species.	
19 May 2025	NatureScot (Email correspondence)	The Applicant consulted NatureScot for any seagrass or similar habitat restoration projects around the Scottish coastline that have not yet	Short list measures for seagrass restoration (and other measures) is presented in section 3.6 of this report.

Date	Consultee and type of consultation	Summary of issue(s) raised	Applicant's response to issue raised and, if applicable, where considered in this chapter
		secured funding, particularly those previously considered by SMEEF (Scottish Marine Environmental Enhancement Fund) but not progressed.	
		NatureScot confirmed they are currently exploring more seagrass restoration projects but do not have a list of active projects available to share.	
28 May 2025	NatureScot and MD-LOT (online meeting)	Updates on predicted impacts and proposed compensation, with discussion of islands short-listed for potential rat eradication and other measures considered in the long listing process.	Long and short listing of measures has been set out in Sections 2 and 3 of this report, which included feedback from stakeholders. Additionally a description of the island selection for predator eradication and surveys undertaken is presented in Section 4 of this report with further details about the survey in Volume 3, Annex 2.5: Island Screening Report: Muck and Volum3 3, Annex 2.6: Pre-eradication Field Study Report: Muck of the HRA.
		NatureScot supported predator eradication but stressed the need for evidence on rat predation and habitat accessibility, requesting robust site-specific data to justify compensation.	
16 and 27 October, and 9 December 2025	RSPB (Email correspondence)	The Applicant consulted the RSPB to request a meeting to discuss proposed compensation measures for key seabird species.	Offers of meetings/workshops were not taken up by RSPB.
28 October 2025	NatureScot and MD-LOT (online meeting)	Further updates on progress of rat eradication and on a measure being developed for gannet.	Advice provided has been incorporated into Sections 4 and 5 of this document.
		NatureScot emphasized the importance of integrating site-specific habitat data and a holistic approach rather than relying solely on modelling for compensation estimates.	
		NatureScot highlighted challenges in predicting seabird population recovery and advised using adaptive management alongside reasonable, evidence-based estimates.	
		NatureScot supported focusing on Muck as the primary project led measure while exploring Rum	

Date	Consultee and type of consultation	Summary of issue(s) raised	Applicant's response to issue raised and, if applicable, where considered in this chapter
		as a strategic opportunity through government led initiatives.	
		NatureScot considered the proposal regarding gannet compensation as promising but noted difficulties in quantifying benefits. They acknowledged its ecological importance and agreed to review the measure further.	
02 December 2025	NatureScot (Email correspondence)	NatureScot agreed the gannet measure has potential benefits.	Due to the current commercial sensitivity further detail on the gannet compensation measure will be submitted during the determination phase. document.
		NatureScot emphasized that the relatively small compensation requirement for gannet (152–245 birds per year) supports the measure's proportionality.	

1.4 Summary of impacts

1.4.1 Report to Inform the Appropriate Assessment

1.4.1.1 The Morven North and Morven South RIAAs present full details of the predicted impacts, which are not reproduced here.

Morven North

1.4.1.2 Based on information presented within Part 3 of the RIAA, it is considered that Morven North alone will not lead to an Adverse Effect on Integrity (AEOI) on any of the 24 SPAs considered. However, a potential AEOI was identified at four SPAs and for three qualifying species as a result of disturbance and displacement and/or collision during the operation and maintenance phase of Morven North when considered in-combination with other plans and projects:

- Forth Islands SPA;
  - Guillemot (*Uria aalge*) and seabird assemblage (with regards to guillemot);
- St Abb's Head to Fast Castle SPA
  - Kittiwake (*Rissa tridactyla*), razorbill (*Alca torda*) and seabird assemblage (with regards to kittiwake and razorbill);
- Troup, Pennan and Lion's Heads SPA;
  - Guillemot and seabird assemblage (with regards to guillemot);
- Outer Firth of Forth and St Andrew's Bay Complex SPA;
  - kittiwake, guillemot and breeding seabird assemblage (with regards to kittiwake and guillemot).

1.4.1.3 A summary of estimated project alone impact mortalities (number of breeding adults) apportioned to Special Protected Areas (SPAs) with connectivity to Morven North and therefore required for compensation is provided in Table 1.2. Please note that the impacts provided are rounded to one decimal point. All underlying calculations use non-rounded numbers and therefore totals may not match totals derived from constituent rounded numbers.

1.4.1.4 AEOI conclusions have been reached for the Outer Firth of Forth and St Andrew's Bay Complex SPA. This SPA is designated to protect seas areas used by birds from adjacent breeding colonies. AEOI conclusions reached for the Outer Firth of Forth and St Andrew's Bay Complex SPA are therefore a result of AEOI conclusions on adjacent SPAs. For Morven North this therefore relates to guillemot at the Forth Islands SPA and kittiwake at the St Abb's Head to Fast Castle SPA.

Table 1.2: Summary of compensation measures required based on conclusions of the Morven North RIAA (figures are Applicant's precautionary approach)

SPA	Species	Number of mortalities (annual)
Forth Islands	Guillemot	11
St. Abb's Head to Fast Castle	Kittiwake	0.5
	Razorbill	0.2
Troup, Pennan and Lion's Head	Guillemot	9.9
Summed across SPAs	Kittiwake	0.5
	Guillemot	21
	Razorbill	0.2

Morven South

1.4.1.5 Based on the information presented within Part 3 of the RIAA, it is considered that Morven South alone will not lead to an AEOI on any of the 21 SPAs considered. However, a potential AEOI was identified at four SPAs and for three qualifying species as a result of disturbance and displacement and/or collision during the operation and maintenance phase of Morven South when considered in-combination with other plans and projects:

- Forth Islands SPA;
  - Guillemot and seabird assemblage (with regards to guillemot);
- St Abb's Head to Fast Castle SPA
  - Kittiwake, razorbill and seabird assemblage (with regards to kittiwake and razorbill);
- Troup, Pennan and Lion's Heads SPA;
  - Guillemot and seabird assemblage (with regards to guillemot);
- Outer Firth of Forth and St Andrew's Bay Complex SPA;
  - Kittiwake, guillemot and breeding seabird assemblage (with regards to kittiwake and guillemot).

1.4.1.6 A summary of estimated project alone impact mortalities (number of breeding adults) apportioned to SPAs with connectivity to Morven South and therefore of potential relevance to compensation is provided in Table 1.3. Please note that the impacts provided are rounded to one decimal point. All

underlying calculations use non-rounded numbers and therefore totals may not match totals derived from constituent rounded numbers.

1.4.1.7 AEOI conclusions have been reached for the Outer Firth of Forth and St Andrew's Bay Complex SPA. This SPA is designated to protect seas areas used by birds from adjacent breeding colonies. AEOI conclusions reached for the Outer Firth of Forth and St Andrew's Bay Complex SPA are therefore a result of AEOI conclusions on adjacent SPAs. For Morven South this therefore relates to guillemot at the Forth Islands SPA and kittiwake at the St Abb's Head to Fast Castle SPA.

Table 1.3: Summary of compensation measures required based on conclusions of the Morven South RIAA (figures are Applicant's precautionary approach)

SPA	Species	Number of mortalities (annual)
Forth Islands	Guillemot	4.3
St. Abb's Head to Fast Castle	Kittiwake	0.2
	Razorbill	0.1
Troup, Pennan and Lion's Head	Guillemot	3.9
Summed across SPAs	Kittiwake	0.2
	Guillemot	8.1
	Razorbill	0.1

1.4.2 Morven North and Morven South – Without Prejudice impacts

1.4.2.1 While the impacts presented above (Table 1.2 and Table 1.3) are based on the conclusions of the Morven North RIAA and Morven South RIAA, this document and the wider Habitats Regulations Derogation Case has taken consideration of previous consent decisions made on other offshore wind farm projects. Based on these previous consent decisions, mortality estimates have been presented for a wider range of SPAs and qualifying features on a "without prejudice" basis. These impact numbers are set out in Table 1.4 for Morven North and Table 1.5 for Morven South (including the required compensation based on the conclusions of the Morven North and Morven South RIAAs) with annual mortalities presented both for the Applicant's precautionary position (low) and NatureScot's more precautionary position (high). The combined totals across Morven North and Morven South are provided in Table 1.6. Please note that the impacts provided are rounded to one decimal point. All underlying calculations use non-rounded numbers and therefore totals may not match totals derived from constituent rounded numbers.

1.4.3 Conservation Objectives

1.4.3.1 Since the potential collision and displacement impacts of Morven North and Morven South all result in predictions of elevated mortality (of the named SPA seabird populations), the conservation objectives which the proposed measures are intended to address relate to ensuring the maintenance of the seabird qualifying features as viable components of the SPAs, specifically:

1. To ensure that the qualifying features of the SPA are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status, and
2. To ensure that the integrity of the SPA is restored in the context of environmental changes by meeting objectives 2a, 2b and 2c for each qualifying feature:

2a. The populations of the qualifying features are viable components of the SPA (note objectives 2b and 2c are not considered relevant here as they relate to supporting habitats and distributions within the SPAs themselves, which will not be affected by Morven North and Morven South).

1.4.3.2 The same form of conservation objective applies to all the SPAs listed in Table 1.2 to Table 1.5 (i.e. all SPAs and qualifying features based on the RIAA conclusions and those considered on a "without prejudice" basis).

Table 1.4: Summary of impacts due to Morven North on seabird species from Special Protected Areas for which compensation may be required (based on previous consent decisions). The mortality estimates refer to the Applicant's precautionary position (Low) and NatureScot's more precautionary position (High) which includes additional levels of precaution

SPA	Species	Number of mortalities (annual)	
		Low	High
Buchan Ness to Collieston Coast	Kittiwake (*Rissa tridactyla*)	1.4	3.2
	Guillemot (*Uria aalge*)	14.0	54.6
East Caithness Cliffs	Kittiwake	0.6	1.6
	Razorbill (*Alca torda*)	1.5	5.4
Forth Islands	Kittiwake	0.4	0.9
	Guillemot	11.0	39.8
	Razorbill (*Alca torda*)	0.4	1.7
	Puffin (*Fratercula arctica*)	2.5	10.6
	Gannet (*Morus bassanus*)	7.1	13.6
Fowlsheugh	Kittiwake	2.8	6.2
	Guillemot	37.5	155.4
	Razorbill	0.9	4.1
Hermaness, Saxa Vord and Valla Field	Gannet	0.3	1.0
North Caithness Cliffs	Kittiwake	0.1	0.3
St. Abb's Head to Fast Castle	Kittiwake	0.5	1.1
	Guillemot	19.1	68.7
	Razorbill	0.2	0.8
Troup, Pennan and Lion's Head	Kittiwake	0.6	1.4
	Guillemot	9.9	35.7
Flamborough and Filey Coast	Kittiwake	1.0	2.3
	Razorbill	1.2	4.3
Summed across SPAs	Kittiwake	7.5	17.0
	Guillemot	91.6	354.2
	Razorbill	4.2	16.3

SPA	Species	Number of mortalities (annual)	
		Low	High
	Puffin	2.5	10.6
	Gannet	7.4	14.6

Table 1.5: Summary of impacts due to Morven South on seabird species from Special Protected Areas for which compensation may be required (based on previous consent decisions). The mortality estimates refer to the Applicant's precautionary position (Low) and NatureScot's more precautionary position (High) which includes additional levels of precaution

SPA	Species	Number of mortalities (annual)	
		Low	High
Buchan Ness to Collieston Coast	Kittiwake	0.3	0.7
	Guillemot	4.8	17.2
East Caithness Cliffs	Kittiwake	0.2	0.7
	Razorbill	0.7	2.5
Forth Islands	Kittiwake	0.1	0.3
	Guillemot	4.3	15.5
	Razorbill	0.2	0.7
	Puffin	0.7	2.7
	Gannet	4.8	9.6
Fowlsheugh	Kittiwake	0.5	1.2
	Guillemot	11.3	53
	Razorbill	0.3	1.1
Hermaness, Saxa Vord and Valla Field	Gannet	0.1	0.5
St. Abb's Head to Fast Castle	Kittiwake	0.2	0.4
	Guillemot	7.4	26.7
	Razorbill	0.1	0.3
Troup, Pennan and Lion's Head	Kittiwake	0.2	0.4
	Guillemot	3.9	13.9
Flamborough and Filey Coast	Kittiwake	0.4	1.1
	Razorbill	0.6	2.0
Summed across SPAs	Kittiwake	1.8	4.9
	Guillemot	31.6	126.2
	Razorbill	1.8	6.7
	Puffin	0.7	2.7

SPA	Species	Number of mortalities (annual)	
		Low	High
	Gannet	4.9	10.2

Table 1.6: Summary of impacts due to Morven North and Morven South on seabird species from Special Protected Areas for which compensation may be required (based on previous consent decisions). The mortality estimates refer to the Applicant's precautionary position (Low) and NatureScot's more precautionary position (High) which includes additional levels of precaution

SPA	Species	Number of mortalities (annual)	
		Low	High
Summed across SPAs	Kittiwake	9.1	21.7
	Guillemot	123.3	480.5
	Razorbill	5.9	23.1
	Puffin	3.2	13.3
	Gannet	12.3	24.5

2 Long listing compensation options baseline characterisation

2.1.1.1 The first stages in developing compensation proposals for Morven North and Morven South were to compile a list of the species for which compensation was considered likely to be required and to review recent Scottish offshore wind farm cases and guidance to identify potential options. This process is detailed in Volume 3, Annex 2.1: Compensation Stakeholder Consultation of the HRA and summarised below.

2.1.1.2 Two recent Offshore Wind Farm (OWF) applications were reviewed with respect to their compensation submissions; Green Volt and Ossian. Between them these projects identified gannet, kittiwake, guillemot, razorbill and puffin as qualifying features of SPAs for which AEOI could not be ruled out in-combination with other plans and projects. To offset predicted impacts Green Volt proposed drainage management above breeding sites at East Caithness Cliffs SPA, disturbance reduction to Troup, Pennan and Lion's Head SPA and tree mallow removal in the Forth Islands SPA, while Ossian proposed control of introduced mink in proximity to breeding seabird colonies and reduction of seabird bycatch by fishing vessels in Portuguese waters.

2.1.1.3 The long list of compensation measures for Morven North and Morven South was developed through a review of the available evidence presented in the reviews conducted by Furness *et al.* (2013), Furness (2021) and Pizzolla *et al.* (2024). Furness *et al.* (2013) produced the first list of potential compensation measures in a UK context, and this formed the basis for the current review. Furness (2021) reviewed the measures and refined the list on the basis of further evidence and Pizzolla *et al.* (2024) gave consideration to measures that could be suitable as strategic compensation.

2.1.1.4 To reach an initial long list of options for each species the Furness (2021) refinement was applied to the Furness *et al.* (2013) conclusions. Thus, consideration was given to the efficacy of each proposed measure for each species in relation to past evidence of success for the focal, and similar, species (with more weight given to the former), the feasibility and practicality of delivering the measure and whether the measure could be implemented at the SPAs where AEOI was anticipated. Compensation measures were given an initial score for each category (low/medium/high) then further refined using Furness (2021) and Pizzolla *et al.* (2024) to arrive at species-specific long lists. Some measures are more suitable as either project led or collaborative (with other wind farms), while others would require a strategic lead (e.g. government initiatives). While the latter are beyond the scope of developers to deliver, for completeness they were retained at the long listing stage. It should also be noted that, while the UK sandeel fishery was closed in 2024, it is uncertain if this is available to be considered as a compensation measure. It should be noted that Scottish Ministers have confirmed that closure of the sandeel fishery in Scottish waters could be proposed as a compensation measure for future offshore wind farm developments[3].

2.1.1.5 Since the predicted impacts were all considered to be ones that would increase mortality, compensation options under consideration were all aimed at either reducing other existing sources of mortality, improving productivity, or both to varying degrees.

2.1.1.6 Measures intended to *primarily* reduce existing mortality were:

- closure of commercial fisheries (partially or fully);
- eradication or exclusion of introduced mammalian predators at breeding colonies;
- fishery bycatch reduction;
- reduction of harvesting of adult birds;
- management of sources of avian predation.

[3] https://www.parliament.scot/chamber-and-committees/questions-and-answers/question?ref=S6W-24369

2.1.1.7 Measures intended to *primarily* improve productivity were:

- provision of additional nesting spaces, either on artificial structures or at natural sites;
- reduced disturbance at breeding colonies (e.g. from tourist and dive boats);
- reduction of legal harvest of chicks (where permitted).

2.1.1.8 Measures intended to improve habitat quality and thereby build resilience in seabird populations (e.g. by improving both survival and productivity) were:

- seagrass restoration;
- provision of MPAs;
- modification of fishing gear to reduce habitat degradation (e.g. scallop fishing gear);
- seaweed farming.

2.1.1.9 Table 2.1 lists the measures against the five key species for which potential compensation may be required.

Table 2.1: Summary of long list of potential compensation measures for Morven North and Morven South

Compensation Measure	Kittiwake	Guillemot	Razorbill	Puffin	Gannet
Closure of sprat fisheries in UK waters	Y	Y	Y	Y	N
Provision of artificial structures	Y	Y	Y	N	Y
Mink eradication	Y	N	N	N	N
Feral cat eradication	Y	N	N	N	N
Rat eradication	Y	Y	Y	Y	N
Fencing out foxes from colonies	Y	N	N	N	N
Exclusion of great skuas	Y	N	N	N	N
Establish new colonies at suitable natural sites	Y	Y	Y	Y	Y
Seagrass restoration and recovery.	Y	Y	N	N	Y
Disturbance from dive boats	Y	N	N	N	N
Switch scallop fishery gear	Y	Y	Y	Y	N
Marine Protected Areas	Y	Y	Y	Y	N
Closure of sprat fisheries in wintering areas	N	Y	Y	N	N
End harvest of chicks	N	N	N	N	Y
Reduce bycatch in fisheries	N	N	Y	N	Y
Reduce harvesting off West Africa	N	N	N	N	Y
Manage white-tailed eagles in proximity to gannet colonies	N	N	N	N	Y
Reduce fishing pressure on pelagic fish near gannet colonies	N	N	N	N	Y
Seaweed farming	N	N	N	N	Y

2.1.1.10 In addition to the measures listed above for the species of greatest concern, measures to improve the conservation status of other seabird species (i.e. species not impacted by Morven North and Morven South or those where an AEOI was excluded), could offer non like-for-like compensation options for the key species, should these be required. Hence, these compensation options are ones that would be classed as wider measures for the key species (i.e. measures that would fall within Tiers 2 and 3 in the proposed compensation regime; see Section 1.2) and are listed in Table 2.2. These additional measures and the species for which they could compensate were derived from Furness *et al.* (2013) and Furness (2021). Measures which have already been proposed for the key species (Table 2.1) are identified with shading (e.g. fishery closure or bycatch reduction), since these would not represent strictly additional measures but rather offer benefits that would extend to non-target species, thereby increasing the overall contribution of the measure to seabird resilience more generally.

Table 2.2: Compensation measures for seabird species where AEOI (alone and in-combination) was excluded for Morven North and Morven South (measures from Furness *et al.* 2013 and Furness 2021). Measures with grey shading are those identified in Table 2.1 which have the potential to deliver wider benefits

Compensation Measure	Red-throated diver	Fulmar	Manx shearwater	European storm petrel	Leach's petrel	Arctic skua	Great skua	Lesser black-backed gull	Herring gull	Great black-backed gull	Sandwich tern	Common tern	Arctic tern
Nesting rafts at breeding lochs	Y												
Closure of sandeel (*Ammodytidae* spp.) and Sprat (*Sprattus sprattus*) fisheries close to wintering areas	Y												
Closure of sandeel and sprat fisheries close to breeding areas	Y		Y			Y	Y				Y	Y	Y
Reducing disturbance by vessel activity	Y												
Reducing the depletion of forage fish stocks by industrial fisheries		Y											
Reducing bycatch		Y											
Reducing plastic pollution in the North Atlantic		Y											
Artificial nesting structures	Y			Y									
Provision of supplementary food to breeding pairs						Y							
Exclusion of great skuas from buffer zones around colonies						Y							
Reduction of fishery bycatch							Y						
Mink eradication								Y	Y	Y	Y	Y	

Compensation Measure	Red-throated diver	Fulmar	Manx shearwater	European storm petrel	Leach's petrel	Arctic skua	Great skua	Lesser black-backed gull	Herring gull	Great black-backed gull	Sandwich tern	Common tern	Arctic tern
Fencing out foxes from colonies								Y	Y	Y	Y	Y	
End culling (of large gulls)								Y	Y	Y			
Rat eradication			Y	Y	Y			Y	Y	Y	Y	Y	
Stoat control/eradication											Y	Y	
Flood control at colonies											Y		
Provision of nest platforms												Y	
Exclusion of large gulls												Y	
Tern terraces												Y	Y

2.1.1.11 The long-listed measures were then subject to further scrutiny for each species in order to arrive at a short-list of preferred options. For each measure the short-listing process assessed the evidence for the effectiveness of the measure as well as the feasibility of delivery.

3 Short-list

3.1.1.1 Each of the measures listed in Table 2.1 and Table 2.2 was subjected to scrutiny with respect to the level of evidence for effectiveness and feasibility. This was conducted from the perspective of identifying measures that would be suitable as project led options as separate from strategic ones.

3.1.1.2 Consideration was also given to measures which could potentially deliver benefits for multiple species, both target species (gannet, kittiwake, auks) and other seabird species (as listed in Table 2.2). All being equal, a measure which would benefit multiple species was given higher priority than one that would benefit a single species.

3.1.1.3 Table 3.1 gives an overview of the Red Amber Green (RAG) rating given to each measure for each species. Justification for these ratings is provided below.

Table 3.1: Red Amber Green rating of long list of like-for-like potential compensation measures for Morven North and Morven South. Note that blank cells do not necessarily indicate the measure would not provide any benefit, but simply that there is an absence of evidence for efficacy (e.g. seagrass restoration for razorbill and puffin)

Compensation Measure	Kittiwake	Guillemot	Razorbill	Puffin	Gannet
Closure of sprat fisheries in UK waters					
Provision of artificial breeding structures					
Mink eradication					
Feral cat eradication					
Rat eradication					
Fencing out foxes from colonies					
Exclusion of great skuas					
Establish new colonies at suitable natural sites					
Seagrass restoration and recovery.					
Disturbance from dive boats					
Switch scallop fishery gear					
Marine Protected Areas					
Closure of sprat fisheries in wintering areas					
End harvest of chicks					
Reduce bycatch in fisheries					
Reduce harvesting off West Africa					
Manage white-tailed eagles in proximity to gannet colonies					
Reduce fishing pressure on pelagic fish near gannet colonies					
Seaweed farming					

3.2 Fishery closures

3.2.1.1 Most of the evidence on the relationship between forage fish prey stocks and seabird population status has focused on sandeels (Furness 2021). This reflects the long-term data available from seabird colonies such as the Isle of May and the preferred fish prey of kittiwake, guillemot, razorbill and puffin studied at this site. Much of this evidence was used to support the closure of the sandeel fisheries in UK waters.. In some locations sprat form a significant part of local breeding seabird diets, such as kittiwake in south-east England and in the upper Firth of Forth (Furness 2021). Local no-take zones could potentially benefit these breeding colonies. Other species which would be expected to benefit from more widespread reductions in sprat catches would include red-throated divers (*Gavia stellata*), Manx shearwater (*Puffinus puffinus*), common tern (*Sterna hirundo*), Arctic tern (*Sterna paradisaea*), Sandwich tern (*Thalasseus sandvicensis*), and Arctic skua (*Stercorarius parasiticus*).

3.2.1.2 Such fishery management is beyond the scope of wind farm developers and requires Government led initiatives and as such falls within the strategic options (see paragraph 2.1.1.4). This was discussed as an option with NatureScot and the Scottish Government Marine Directorate Licensing Operations Team (MD-LOT) (Table 1.1), following which it was concluded that, while it may have a place among wider measures and strategic efforts, at present fishery management would not be retained on the short-list of compensation measures for Morven North and Morven South. It is therefore not considered any further as a project led option. However, there may be options for this to be included as a strategic measure under wider measures (see Section 8).

3.3 Invasive mammal control, exclusion or eradication

3.3.1.1 Predation of birds by invasive mammals is a well-established threat to many species and there are numerous examples worldwide and in the UK of how effective their removal can be as a conservation tool (Stanbury *et al.* 2017). With respect to seabirds, this typically relates to rats, cats and other predatory mammal species becoming established on islands to which they were previously absent. The magnitude of impact on breeding seabirds depends on the species of mammal and the seabird breeding habits. Burrow nesting species such as puffin and Manx shearwater are particularly vulnerable to smaller mammals such as rats and stoats. Cliff-nesting species may be less vulnerable, although there is increasing awareness that rats, in particular, can scale steep cliffs in search of prey (see Section 4.5), restricting nesting opportunities to only the most inaccessible locations.

3.3.1.2 The overlap of seabird breeding species and predatory invasive mammals is highly variable, therefore the benefits of measures to reduce, exclude or remove invasive mammals are dependent on the site selected. Furthermore, breeding habitat choice can vary at different locations, with consequent variations in vulnerability to predation. For example, puffin often nest in burrows (on top of sea stacks for example) but will also nest in cracks in cliffs and boulder fields. Guillemot nest at high densities on cliff ledges when available, but will also nest in boulder fields if ledges are limited. It is therefore not appropriate to state that any particular species is always vulnerable to predation by a particular mammal species, as this is highly site dependent.

3.3.1.3 Stanbury *et al.* (2017) provided a very valuable review of UK islands and produced a priority list of sites for mammal eradication. This was informed by the seabird species present, the mammal species present, evidence of impacts, the feasibility of conducting a successful eradication campaign and the risk of reinvasions occurring. There is therefore existing literature from which to develop compensation.

3.3.1.4 It is clear that some form of invasive mammal control has the potential to deliver seabird compensation and that site selection offers opportunities to select species and the scale to correspond to a project's predicted impacts. For these reasons invasive mammal control or eradication was retained on the short-list of compensation measures for Morven North and Morven South.

3.4 Establishment of new breeding colonies at natural or artificial sites

3.4.1.1 There are numerous examples of kittiwake colonies becoming established on non-natural cliff analogues in both onshore and offshore locations, such as the sides of warehouse buildings, along bridges and on offshore oil and gas (O&G) platforms (Coulson 2011, Christensen-Dalsgaard *et al.* 2019). As well as these opportunistic examples, bespoke structures have been constructed to provide nesting spaces, which in recent years have included ones intended as compensation for wind farm impacts (e.g. for Norfolk Vanguard and Hornsea 3, among several others). In recognition of the potential, this is also a measure in Defra's library of strategic compensation measures, specifically for kittiwake[4]. It is clear therefore that artificial structures can provide additional or enhanced nesting opportunities for kittiwake in locations where these are limiting range expansion, such as regions lacking cliffs.

3.4.1.2 Guillemot and razorbill have occasionally been recorded nesting on offshore O&G platforms (e.g. Outer Dowsing, 2025) and there is one example of an extension to a natural site built to permit close observation of breeding (Hentati-Sundberg *et al.*, 2011). However, there is generally less evidence that auks will utilise artificial structures for breeding.

3.4.1.3 It is less apparent how much benefit the provision of artificial nesting structures would be around Scottish coasts where cliffs suitable for nesting are much more widespread than in parts of England where kittiwake nest on artificial structures and it is the Applicant's understanding that this measure is not currently supported by NatureScot. Similarly, it is unclear whether it would be possible to encourage kittiwake to nest at unoccupied natural sites in Scotland that are apparently already suitable (i.e. at sites where it is thought kittiwake could, but currently don't nest), given how widespread this species already is around Scotland. Decoys and colony playback have been used with some success to encourage seabirds to create new colonies, although this has not always proved successful and even when it has, it can take several years before pairs are attracted. These uncertainties apply to all the species for which compensation may be required. For these reasons establishment of new breeding colonies at natural or artificial sites in Scotland has not been retained on the short-list of compensation measures for Morven North and Morven South.

3.5 Reduction of avian predation

3.5.1.1 There is some evidence for specific forms of avian predation of particular seabird species by specific birds: white-tailed eagles have affected gannet colonies in Norway (Barrett 2008, Pettex *et al.,* 2015) predominantly through harassment and great skua and large gulls will prey upon breeding auks and other seabirds such as kittiwake (Votier 2004). However, it is uncertain how much impact these depredations have, and the predatory species themselves often have less than favourable conservation status, so any controls on these species would need to avoid negatively impacting them. At present it is not considered that reducing avian predation represents a realistic option for seabird compensation and therefore it has not been retained on the short-list of compensation measures for Morven North and Morven South.

3.6 Seagrass restoration

3.6.1.1 Restoring lost areas of seagrass, expanding existing ones, or both, can benefit seabirds which forage on fish which use such habitat as nursery areas. This includes most of the species for which compensation may be required for Morven North and Morven South, although the extent to which each species would benefit is uncertain due to the challenge of monitoring this measure and consequent benefits to seabirds. Although there is likely to be general agreement that seagrass restoration would be beneficial to the ecosystem as a whole, and by extension seabirds, there is little

[4] https://www.gov.uk/guidance/offshore-wind-development-library-of-strategic-compensatory-measures

evidence with which to predict the scale of response (e.g. improvement in productivity per hectare of seagrass) nor the timescale for observing such effects. Thus, while seagrass (and similar) habitat restoration and enhancement would deliver ecosystem benefits, it is difficult to see how this could be applied as project led compensation. This was discussed as an option with NatureScot and MD-LOT (Table 1.1), following which it was concluded that, while it may have a place among wider measures and strategic efforts, at present seagrass restoration would not be retained on the short-list of compensation measures for Morven North and Morven South. However, there may be options for this to be included as a strategic measure under wider measures (Section 8).

3.7 Bycatch reduction and fishery gear modification

3.7.1.1 The extent of accidental or inadvertent capture of seabirds by fishery gear is highly uncertain but also expected to be highly variable across species and fisheries. Pizzolla *et al.* (2024) reviewed the evidence for bycatch in a Scottish context and stated that, while it undoubtedly does affect the species for which compensation may be required, and there is a good deal of uncertainty about the magnitude of mortality which occurs, it is likely to be quite modest and challenging to address due to a range of factors (e.g. the origins of the fleets involved, the locations of the fishery effort, existing mitigation efforts; Kingston *et al.* 2023). This was discussed as an option with NatureScot and MD-LOT (Table 1.1), following which it was concluded that, while it may have a place among wider measures and strategic efforts, at present fishery bycatch reduction would not be retained on the short-list of compensation measures for Morven North and Morven South. However, there may be options for this to be included as a strategic measure under wider measures (Section 8).

3.8 Reduction of harvesting (of gannet) off West Africa

3.8.1.1 There is some indication that wintering gannet are subject to harvesting in the seas off West Africa, although it is unclear where harvest replaces accidental bycatch and records are very limited for this fishery (Grémillet *et al.* 2020). While this potentially represents a significant source of mortality on gannet, international efforts would be required across governments to enact control efforts and those are clearly beyond the scope of project led measures. For these reasons targeting the harvest of gannet has not been retained on the short-list of compensation measures for Morven North and Morven South.

3.9 Reduction of legal harvesting of chicks

3.9.1.1 Gannet chicks are subject to a cultural harvest on Sula Sgeir each year, of up to 2,000 chicks. There is some evidence that losses at this colony are offset by elevated immigration from elsewhere, thereby extending the range of effect to other Scottish gannet colonies (Trinder 2016). Ending this harvest and also those that take place in the Faroes and Iceland, which form part of the North Atlantic gannet metapopulation, would be a very effective means to remove other sources of mortality (Furness 2021). However, the cultural sensitivities attached to these harvests places these options beyond the scope of project led measures. For this reason reducing the legal harvests of gannet has not been retained on the short-list of compensation measures for Morven North and Morven South.

3.10 Seaweed farming

3.10.1.1 Some seabird species collect seaweed from the sea to construct their nests. Increasingly, plastic waste is also collected for this purpose and becomes incorporated into their nests: O'Hanlon *et al.* (2019) reported the presence of such plastic in gannet nests at 28 out of 29 colonies, with almost half of all nests (46%) containing plastic. Adults or chicks can become entangled in this plastic leading to the death of the individual. Estimates of the percentage of annual seabird mortality which may result from plastic entanglement range from 1.3% to 7.5% (Camphuysen 2001, Votier *et al*., 2011 and Rodríguez *et al*. 2013). Furness and Furness (2025) proposed seaweed farming in the vicinity of gannet colonies as a means of reducing plastic levels, by increasing its presence relative to plastic. They suggest this could potentially have additional benefits as nursery areas for fish and carbon

sequestration. However, as a compensation measure this remains untested and its effects difficult to quantify. This was discussed as an option with NatureScot and MD-LOT (Table 1.1), following which it was concluded that, while it may have a place among strategic efforts, at present for the reasons outlined here, seaweed farming would not be retained on the short-list of compensation measures for Morven North and Morven South.

3.11 Reduction of disturbance at colonies

3.11.1.1 Colony productivity may be affected by human sources of disturbance, for example if the disturbance is sufficient to cause adults to flush from their nests leaving eggs and chick vulnerable to predation. Pizzolla *et al.* (2024) reported there was limited evidence of colony disturbance, with the presence of dive boats at St. Abbs Head the only example found, which is reported to have minor effects on kittiwake and guillemot (Beale and Monaghan 2004, Diele and White 2018). A voluntary code of conduct for such vessels, in place during the most sensitive period of the breeding season, could readily address this effect, although measuring the benefits would be challenging. This was discussed as an option with NatureScot and MD-LOT (Table 1.1), where it was concluded that it may have a place among wider measures and strategic efforts. Therefore, this measure is retained as one of a possible wider suite of conservation efforts that could be deployed if required (Section 8).

3.12 Summary of short-listed measures

3.12.1.1 The compensation measures retained as project led options from the long list for Morven North and Morven South are:

- Invasive mammal control, exclusion or eradication.
- A compensation measure for gannet (this was discussed with NatureScot and MD-LOT pre-application, NatureScot advised there was value in pursuing the measure. Further detail on this measure will be provided during the determination phase due to commercial sensitivity).

3.12.1.2 The only measure retained as potential components of a wider suite, potentially in collaboration with other developers is:

- Reduction of disturbance at colonies.

3.12.1.3 Measures that may be delivered strategically and to which Morven North and Morven South could contribute are:

- Fishery management or closure.
- Seagrass restoration.

3.12.1.4 Of the above measures, invasive mammal control, with a specific emphasis on rats (for reasons set out below) is considered to have the best chance of successfully delivering the required levels of compensation for Morven North and Morven South in relation to kittiwake and auks. Further consideration of this measure is provided in the following section.

4 Rat eradication

4.1.1.1 Eradication of invasive and non-native mammal predators from seabird islands has been demonstrated globally to be highly effective at restoring populations of particular seabird species. The suitability and effectiveness vary depending on the seabird and mammal species present and the habitat type. Typically, predation is on eggs and chicks, although in some cases adults may also be affected. The presence of predatory mammals, as well as reducing productivity through predation, may restrict seabird nesting to areas which are inaccessible to mammals thereby limiting expansion opportunities. The most successful eradication campaigns are typically complete eradication of predators from an island (or island group) with measures put in place to prevent and/or quickly address reinvasion should it occur. Once an island is cleared of a predatory species it should remain free, subject to maintenance of such measures. For the purposes of the current wind farm compensation proposal, the biosecurity measures would be maintained for the lifetime of Morven North and Morven South as a minimum (35 years).

4.1.1.2 The identification of suitable sites also needs to account for the scale of compensation required (i.e. number of predicted mortalities and any scaling applied as per guidance) in order that selected site(s) offer sufficient potential for seabird population expansion to meet these requirements. The steps taken to identify the suitable site for predator eradication and define the potential benefit to seabird populations is set out in the following sections:

- Section 4.2 summarises the initial site selection process via a desk based review of available information, reducing a long list of candidates derived from Stanbury *et al.* (2017) to a smaller number that warranted further consideration (full details set out in Volume 3, Annex 2.2: Long list of Species And Compensation Options and Annex 2.3: Assessment of Offshore Island Potentially Suitable for Predator Eradications Report of the HRA);
- Section 4.3 provides a summary of the theoretical scope for population expansion following rat eradication for the most promising island; this was estimated using a comparative population growth method (full details set out in Volume 3, Annex 2.4: Predator Eradication Modelling Report of the HRA);
- Section 4.4 and 4.5 provide a summary of the site visits of the selected island group to collect site specific information prior to eradication (full details set out in Volume 3, Annex 2.5: Island Screening Report: Muck and Volume 3, Annex 2.6: Pre-eradication Field Study Report: Muck of the HRA).
- The Compensation Implementation, Monitoring and Adaptive Management Plan (Volume 3, Chapter 3: Outline CIMAMP of the HRA) provides outline details of the implementation for and delivery of the rat eradication campaign.

4.2 Island selection

4.2.1.1 As a first step in identifying a suitable location to undertake invasive mammal control to compensate for potential impacts on seabirds at Morven North and Morven South the review and supporting information produced by Stanbury *et al.* (2017) was consulted. The criteria considered during the island short-listing process were:

- The invasive mammal species present,;
- The presence of seabird SPAs (part or all of the island);
- The qualifying (seabird) features of those SPAs;
- Island size;
- The presence and number of permanent human residents;
- The presence and type of agriculture.

4.2.1.2 For each criterion a score was given so that islands could be placed in rank order for each and then each criterion was given a weighting so that an overall score could be determined. Full methods and results are presented in detail in Volume 3, Annex 2.3: Assessment of Offshore Island Potentially Suitable for Predator Eradications Report of the HRA.

4.2.1.3 Islands with rats, SPAs for seabird species expected to be potentially impacted by Morven North and Morven South, smaller human populations and no agriculture were scored more highly as these all indicate higher likelihoods of successful eradication and seabird benefits and lower biosecurity risks (i.e. of rat reinvasion). Each criterion was also given a weighting which reflected the relative importance of each criterion in determining overall island scores. The highest weights were given to the predator score and seabird presence score. The scoring and weighting system is outlined in Table 4.1. For each island a score was obtained for each criterion, the islands were then ranked by the score (highest to lowest) with ties given equal ranking, and the rank multiplied by the criterion weight. The sum of the weighted ranks for an island gave its final overall score, which was used to derive the final rank order of islands.

Table 4.1: Criteria scores and weighting used to rank islands for suitability as candidates for invasive mammal eradication

Criterion	Factors considered and scoring	Weighting	Notes
Invasive mammal species	• Brown rat (0.7) • American mink (0.1) • Feral cat (0.2) • Black rat (NA)	0.25	Rat eradication has the most supporting evidence for benefits; limited evidence that cats affect breeding seabirds; American mink are primarily a concern for ground nesting species rather than the seabirds of particular concern here; black rat are not present on any islands under consideration (Furness *et al.* 2013, Furness 2021).
Breeding seabird species' responses to eradication	• Species with strong evidence of strong response (3) • Species with weak evidence or a weak effect (or colony specific) (2)	0.25	Score summed across species present in the Seabird Monitoring Programme (SMP) database[5].
Human population size	• Islands ranked in reverse order of population	0.2	The presence of people introduces biosecurity risks
Island size	• Islands ranked in reverse order of size	0.15	Predator eradication is easier and more likely to succeed on smaller islands
Agriculture	• Agriculture present (0) • Agriculture absent (1)	0.1	The type of agriculture, when present was also considered following the initial screening
SPA for seabirds	• Seabird SPA present (1) • Seabird SPA absent (0)	0.05	Relatively low weight since identification of suitable islands considered more important than presence of SPA.

4.2.1.4 The individual weighted criteria, the overall score and the rank order of islands is provided in Table 4.2.

[5] https://app.bto.org/seabirds/public/index.jsp

Table 4.2: Island scores for each criterion, overall weighted score and rank order (highest to lowest). Note that 'agriculture presence' is used to refer to intensive arable farming rather than small livestock holdings

Island	Predator	Seabirds present	Human population	Island size	Agriculture presence	SPA	Overall summed Score	Rank (highest to lowest)
Housay, Out Skerries	5.5	5.75	3.4	3.9	0	0	18.55	33
Rum	5.5	7.75	4.4	0.6	0	0.05	18.3	32
Muck	5.5	5	3.8	3	0	0	17.3	31
Sheep Island, Northern Ireland	2.25	5	4.8	4.95	0.1	0	17.1	30
Bruray, Out Skerries	2.25	5	4.2	4.5	0	0	15.95	29
Inchmarnock	5.25	1.25	4.8	3.6	0	0	14.9	28
Colonsay and Oronsay	5.5	6.5	1.6	1.05	0	0.05	14.7	26
Hellisay, Sound of Barra	2.25	3.5	4.8	4.05	0.1	0	14.7	26
Stronsay	5.5	6.5	1.2	1.5	0	0	14.7	25
Grunay off Bruray, Out Skerries	2.25	2.5	4.8	4.8	0.1	0	14.45	24
Boreray, North Uist	2.25	3.5	4.8	3.75	0.1	0	14.4	23
South Havra, Shetland	0.25	4.5	4.8	4.35	0.1	0	14	22
Rousay	5.5	5.75	1.4	1.2	0	0.05	13.9	21
Gairsay	5.5	0.25	4.6	3.45	0	0	13.8	20
Fair Isle	0.25	7.75	3	2.7	0	0.05	13.75	19
Foula	0.25	7.75	3.6	1.95	0	0.05	13.6	18
Egilsay, Orkney	5.5	1.25	4	2.85	0	0	13.6	17
Flotta	5.5	3.5	2.4	2.1	0	0	13.5	16
Hoy	5.5	6.5	1	0.3	0	0.05	13.35	15
Tiree	5.5	6.5	0.4	0.75	0	0	13.15	14
Unst	5.5	6.5	0.6	0.45	0	0.05	13.1	13
Guns Island, Northern Ireland	2.25	1.25	4.8	4.65	0.1	0	13.05	12
Sandray, south of Vatersay	2.25	2	4.8	3.3	0.1	0	12.45	11

Island	Predator	Seabirds present	Human population	Island size	Agriculture presence	SPA	Overall summed Score	Rank (highest to lowest)
Gighay, Sound of Barra	2.25	0.75	4.8	4.2	0.1	0	12.1	10
Taransay, Harris	2.25	2.5	4.8	1.8	0.1	0	11.45	9
Eigg, Small Isles	2.25	3.5	2.2	1.65	0	0	9.6	8
Papa Westray	0.25	4.75	1.8	2.4	0	0.05	9.25	7
Vatersay	2.25	2.5	1.8	2.25	0	0	8.8	6
East Burra, Shetland	2.25	0.75	2.6	3.15	0	0	8.75	5
Fetlar	0.25	3.25	3.2	1.35	0	0.05	8.1	4
North Ronaldsay	0.25	2.25	2.8	2.55	0	0	7.85	3
Westray	0.25	5.75	0.8	0.9	0	0.05	7.75	2
Yell	0.25	0.25	0.2	0.15	0	0	0.85	1

4.2.1.5 The highest ranked islands were then subject to qualitative consideration to further refine the list of candidates. Note that the various islands of the Out Skerries archipelago (Shetland; Housay, Bruray and Grunay) were considered collectively at this stage. Each island is considered in the following sections and summarised in Table 1.10.

4.2.2 Out Skerries

4.2.2.1 There is some agriculture on the Out Skerries (Housay) and an indication that seabird numbers have declined significantly[5]. Many Shetland seabird colonies underwent declines following the collapse of the sandeel stock (Furness and Tasker, 2000) and these stocks are still considered to be below their previous levels (Furness 2021). The lowered prey densities could limit population recovery due to removal of predation, therefore these islands were not retained for Morven North and Morven South compensation.

4.2.3 Rum

4.2.3.1 Rum is a relatively large island, owned and managed by NatureScot as a National Nature Reserve (NNR). The high parts of the island are very important for Manx shearwater, with comparatively little of the coast suitable for cliff-nesting seabirds. Complete eradication of rats from the island would be a very large project, however there may be scope to target seabird colonies with exclusion fencing and conduct eradication within smaller areas. This island was retained for further investigation.

4.2.4 Muck

4.2.4.1 Muck is a medium sized island with a moderate human population (approx. 30). All the key species (except gannet) breed or have bred on the island (and sub-islands) in the past, although numbers are in decline. There is a small amount of mixed agriculture which may raise biosecurity concerns. This island was retained for further investigation.

4.2.5 Sheep Island, Northern Ireland

4.2.5.1 Sheep Island is very small, however it has hosted all the key seabirds (except gannet) and is known to have rats. There is interest in attempting a rat eradication on the island[6], although this is likely to prove logistically challenging due to inaccessibility. Nonetheless, the island was retained for further investigation.

4.2.6 Inchmarnock

4.2.6.1 This island was previously inhabited and farmed but now has only livestock. There is no evidence that any of the key species breed on Inchmarnock, which may reflect an apparent absence of suitable cliff habitat. This island was not retained for further investigation.

4.2.7 Colonsay and Oronsay

4.2.7.1 Colonsay and Oronsay are treated here as a single island since they are connected at low tide. All the key seabirds (except gannet) breed on the islands, and most have undergone declines over the last 20 years. However, the islands have a moderate human population (over 100) and are quite large (over 5,000ha) with mixed agriculture distributed across both islands. A rat eradication would be very challenging, due to the size, human population and varied land use. These islands were not retained for further investigation.

4.2.8 Hellisay, Sound of Barra

4.2.8.1 Although Hellisay does not have any human residents or agriculture, simplifying some aspects of an eradication campaign, it also does not have any of the key seabird species breeding, and this is not thought to be related to the presence of rats. Therefore, this island was not retained for further investigation.

4.2.9 Stronsay

4.2.9.1 Stronsay is a large island in Orkney with over 300 residents and widespread mixed farming. While both rats and key seabird species (except gannet) are present, the size, human population and extensive agriculture mean a rat eradication would be very challenging. This island was not retained for further investigation.

4.2.10 Boreray, North Uist

4.2.10.1 Boreray appears to have no human residents or agriculture at present, although livestock have been grazed there in the past. However, it also has limited records that any of the key seabird species breed there. Therefore, this island was not retained for further investigation.

4.2.11 South Havra, Shetland

4.2.11.1 South Havra is no longer inhabited or farmed. There are past records of feral cat although rats are unconfirmed, and also some of the key seabirds breed there (e.g. puffin and kittiwake). It is unclear if the island could deliver the necessary scale of compensation for Morven North and Morven South, however due to its small size and relatively easy access (which would facilitate an eradication campaign) the island was retained for further investigation.

[6] https://biosecurityforlife.org.uk/blog/2022-05-20-guest-blog-project-partners-national-trust

4.2.12 Rousay

4.2.12.1 Rousay is comparatively large (nearly 5,000ha), with a human population of over 200 and widespread mixed agriculture. While all the key seabirds are also present (except gannet), there would be considerable challenges in attempting an island wide eradication of rats. However, there is scope for erection of exclusion fencing and localised control of rats and feral cats, and therefore this island was retained for further investigation.

Table 4.3: Summary information and retention decision for highest ranked islands. Shaded rows indicated islands retained for further consideration

Island	Rank (highest to lowest)	Predators	Key seabirds	Human population (approx.)	Size (ha)	Agriculture	Retain ?
Out Skerries (Housay, Bruray, Grunary)	33, 29, 24	Brown rat Feral cat	Guillemot, razorbill, kittiwake, puffin	50, 24, 0	177, 64, 35	Crofting	No
Rum	32	Brown rat	Guillemot, razorbill, kittiwake, puffin, Manx shearwater	22	>10,000	Livestock	Yes
Muck	31	Brown rat	Guillemot, razorbill, kittiwake, puffin	27	628	Mixed	Yes
Sheep Island, Northern Ireland	30	Brown rat	Guillemot, razorbill, puffin	0	4	None	Yes
Inchmarnock	28	Brown rat American mink	-	0	266	None currently, although livestock in recent past	No
Colonsay and Oronsay	26	Brown rat Feral cat	Guillemot, razorbill, kittiwake, puffin	132	>5,000	Crofting, rough grazing	No
Hellisay, Sound of Barra	26	Brown rat	-	0	158	None	No
Stronsay	25	Brown rat Feral cat	Guillemot, razorbill, kittiwake, puffin	349	>3,000	Mixed	No
Boreray, North Uist	23	Brown rat	-	0	259	None	No
South Havra, Shetland	22	Feral cats	Puffin, kittiwake	0	66	None	Yes

Island	Rank (highest to lowest)	Predators	Key seabirds	Human population (approx.)	Size (ha)	Agriculture	Retain ?
Rousay	21	Brown rat Feral cat	Guillemot, razorbill, kittiwake, puffin	216	>4,000	Mixed	Yes

4.2.12.2 The methods used to refine the selection of islands were discussed at a meeting with NatureScot (May 2025; Table 1.1). To explore the feasibility of rat eradication for the seabird populations of the retained islands (Rum, Muck, Sheep Island, South Havra and Rousay) the Applicant contacted landowners. The National Trust (the landowner for Sheep Island) responded stating that their focus was on strategic compensation and they were not looking to engage on project led compensation. The Applicant visited the other four islands in April 2025. Initial feedback from the South Havra landowners was that there were no mammalian predators on the island. There was a mixed reception from Rousay landowners with some supportive of an eradication programme, whilst others were less so. The Applicant was also aware of another Scotwind developer (West of Orkney) progressing this location to deliver compensation.

4.2.12.3 The initial feedback from landowners on Muck and Rum was extremely positive (see Section 6). Therefore, the Applicant focussed next steps on these locations. As Muck is considered more appropriate for project led compensation, mainly due to its size and terrain, population models were developed that provide a form of counterfactual prediction for future growth to help understand how Muck seabird populations may respond to a rat eradication programme. The results are summarised in the following section.

4.3 Population modelling of potential benefits of rat eradication on Muck

4.3.1.1 A key uncertainty when planning a predator eradication is how much benefit will result from the removal of the predator in terms of population growth in the hitherto impacted species. To provide some guidance on this for the current suite of seabirds predicted to be impacted by Morven North and Morven South, the seabird population growth trends on islands where rat eradication was conducted were compared with those from nearby islands which did not have rats. By subtracting the growth rate from the 'control' islands (those which lacked rats) from that seen on the eradication island, the net growth rate, accounting for local trends, could be obtained. While this can provide a useful guide for how seabird populations may respond to the removal of rats it is important to remember that this cannot account for site specific factors such as habitat availability and quality (which are discussed in Sections 4.4 and 4.5). Full details of the modelling undertaken is presented in Volume 3, Annex 2.4: Predator Eradication Modelling Report of the HRA.

4.3.1.2 The species and islands for which this comparison was undertaken were:

- Guillemot: Lundy (eradication) compared to Skomer and Skokholm (rats not present);
- Razorbill: Lundy (eradication) compared to Skomer and Skokholm (rats not present) and Canna (eradication) compared to Ceann a Mhara (rats not present);
- Puffin: Lundy (eradication) compared to Skomer and Skokholm (rats not present).

4.3.1.3 On Lundy, both guillemot and razorbill had stable populations prior to the eradication followed by very strong increases thereafter. It is thought that this reflected range expansion by nesting birds into areas that previously would have been readily accessible to rats (St. Pierre *et al.* 2023) such as boulder fields.

4.3.1.4 There have been other UK islands at which rat eradication has been conducted (e.g. Canna and Ramsey) which were also considered for this comparative analysis, however while these eradication

campaigns are considered successful, the guillemot and razorbill populations have not responded as those on Lundy did.

4.3.1.5 The rat eradication on Ramsey Island was primarily conducted for the benefit of Manx shearwaters (numbers of which have increased 5-fold since; Bell *et al.* 2019). The guillemot population was already growing from a low point prior to the eradication, and this growth has continued since, albeit at a decreasing rate (possibly indicating space limitations). This suggests that rats were probably not a constraint on guillemot population growth, either due to their nest sites being inaccessible (e.g. on cliff ledges) or perhaps due to a preference for the rats to prey upon Manx shearwater. A similar pattern was seen with razorbill, with strong growth prior to the eradication and a plateau since, for which similar factors may have applied.

4.3.1.6 The rat eradication on Canna, was also primarily intended to benefit Manx shearwater and was completed in 2006. For most seabirds monitored, there has been a halt in the declines seen prior to 2006, which represents an improved status in itself, but only one or two species (e.g. puffin and razorbill) have shown evidence of clear increases since, with most recovering to a small extent or remaining stable (Luxmoore *et al.* 2019). It is unclear why there has not been a more pronounced recovery in some breeding seabird numbers. However, many of the areas used by auks are on low cliffs and boulder fields at the base of long scarp slopes on the northern side of the island, so these may potentially be at risk from flooding following periods of heavy rain (as occurred in some of the years following the eradication, Luxmoore *et al.* 2019). Furthermore, such areas are typically considered less suitable, particularly for guillemot (I. Cain pers. comm), which tend to show a preference for cliff ledges, so this may be constraining growth. Food may also have been locally limiting in the years after the eradication, manifesting as low individual return rates (i.e. birds failing to attempt to breed), high nest failure rates and low chick weights (Bob Swann, pers. comm.). The situation appeared to be improving subsequently (in the years up until around 2020), and it was noted that food availability had improved, with “very high” return rates of adult birds and high levels of productivity resulting in the study colony beginning to recover (Bob Swann pers. comm.). However, highly pathogenic avian influenza (HPAI) also seems to have affected Canna and may have resulted in some years of reduced breeding success. Overall, therefore, while population increases would have been expected, the cessation of the previous declines, which if extended could have resulted in extirpation for many species (e.g. the razorbill low point was estimated at 40 pairs in 2005) still indicates that the scheme should be considered successful. Nonetheless, the Canna example provides an illustration that there are multiple drivers of seabird population dynamics and that removal of one negative pressure (rat predation) does not automatically result in population growth, even if it can halt declines and safeguard the affected populations. Thus, the measure of success of a rat eradication should not be based on the strength of subsequent population growth, but also in terms of change to past trajectories and the probable alternative outlook if rats are not removed.

4.3.1 Estimated benefits for guillemot – Lundy compared to Skomer and Skokholm

4.3.1.1 Prior to the rat eradication, the guillemot population on Lundy had a long-term growth rate of 0.4% (1981 to 2000). Following the eradication the growth rate was 7.9% (2004-2023).

4.3.1.2 The equivalent growth rates on Skomer were 5.0% (1985 to 2003) and 3.9% (2004 to 2023) and on Skokholm were 2.9% (1987 to 2003) and 1.8% (2004 to 2022) (note the slightly different spans of years reflect data availability in the SMP).

4.3.1.3 Therefore, focussing on the growth rates in the period following the rat eradication on Lundy (i.e. after 2004), the net growth rates (Lundy rate minus Skomer/Skokholm rates) were 4.0% and 6.1% respectively. Thus, by accounting for the rates of growth seen on nearby rat-free islands, growth of between 4% and 6.1% is what could be attributed to the removal of rats (under ideal conditions). To translate these growth rates into projected population sizes a starting population of guillemot for Muck (319, taken from Inger *et al.* 2023) was multiplied by the net growth rates for a span of 35 years (Table 4.4).

Table 4.4: Projected population size increase of guillemots on Muck (from a starting population size of 319 individuals in year 0, not shown) and projected annual increase (individuals) as a result of rat eradication based on evidence from Lundy, Skomer and Skokholm

Year	Muck population (individuals)						Net additional birds on Muck per year	
	Lundy rate (7.9%)		Skomer rate (3.9%)		Skokholm rate (1.8%)		Lundy less Skomer	Lundy less Skokholm
	N	Addition/ year	N	Addition/ year	N	Addition /year		
1	344	25	331	12	325	6	13	19
2	372	27	344	13	331	6	14	21
3	401	29	357	13	337	6	16	23
4	433	32	371	14	343	6	18	26
5	467	34	386	15	349	6	19	28
20	1,470	108	681	25	457	8	83	100
25	2,155	158	822	31	500	9	127	149
35	4,626	340	1,201	45	599	11	295	329

4.3.1.4 To obtain the potential benefit in terms of the number of additional breeding adult guillemots per year on Muck, following a rat eradication, the additional number of birds per year (no. at *t*+1 minus no. at *t*) obtained from a population growing at the Skomer and Skokholm post-Lundy eradication rates were subtracted from the equivalent number obtained using the Lundy rate ('Net additional birds on Muck per year' in Table 4.4). This output was selected as it is comparable to the predicted potential impacts which are expressed as mortalities per year.

4.3.1.5 Thus, in the first year following an eradication the method predicts between 13 and 19 additional breeding adults in the Muck population would be attributed to the removal of rats. By year 20 this figure increases to between 83 and 100 and by year 35 the additional birds per year would be between 295 and 329, equating to 198 to 220 pairs (using a ratio of 0.67 pairs:individuals; Harris 1989).

4.3.1.6 It is important to note that these projected values do not account for local conditions and habitat availability and can only offer a guide as to what might happen following a rat eradication. However, it is equally important to note that this between-island comparison approach is just one way of considering the potential population benefits. Records of the guillemot population on Muck are sporadic, but there appears to have been a significant decline from 1,073 reported guillemot in 1986 (Dobson and Dobson 1986) to 377 in 2001 (SMP), 420 in 2018 (Burnell *et al.* 2023) and 319 in 2021 (Inger *et al.* 2023). Across the whole period this represents a decline of 3.4%, and just between the last two counts a decline of 8.8%. Compared with these rates of decline, growth at the rate seen on Lundy (7.9%) would mean a comparative 35 year population of between 4,850 and 4,930 (i.e. comparing the decline in the population extrapolated from the current trend with the growth predicted by the Lundy growth rate) and, perhaps more importantly, would be a reversal of the current long-term downward trend.

4.3.2 Estimated benefits for razorbill – Lundy compared to Skomer and Skokholm

4.3.2.1 Prior to the rat eradication, the razorbill population on Lundy had a long-term growth rate of -0.02% (1981 to 2000). Following the eradication the growth rate was 8.2% (2004 to 2023).

4.3.2.2 The equivalent growth rates on Skomer were 10.0% (1985 to 2003) and 4.3% (2004 to 2023) and on Skokholm were 6.2% (1987 to 2003) and 5.9% (2004 to 2022) (note the slightly different spans of years reflect data availability in the SMP).

4.3.2.3 Therefore, focussing on the growth rates in the period following the rat eradication on Lundy, the net growth rates (Lundy rate minus Skomer/Skokholm rates) were 3.9% and 2.3% respectively. Thus, by accounting for the rates of growth seen on nearby rat-free islands, growth of between 2.3% and 3.9% is what could be attributed to the removal of rats. To translate these growth rates into projected population sizes a starting population of razorbill for Muck (51, taken from Inger *et al.* 2023) was multiplied by the net growth rates for a span of 35 years (Table 4.5).

Table 4.5: Projected population size increase of razorbills on Muck (from a starting population size of 51 individuals in year 0, not shown) and projected annual increase (individuals) as a result of rat eradication based on evidence from Lundy, Skomer and Skokholm

Year	Muck population						Net additional birds on Muck per year	
	Lundy rate (8.2%)		Skomer rate (4.3%)		Skokholm rate (5.9%)		Lundy less Skomer	Lundy less Skokholm
	N	Addition/year	N	Addition/year	N	Addition/year		
1	55	4	53	2	54	3	2	1
2	60	5	55	2	57	3	3	2
3	65	5	58	3	61	4	2	1
4	70	5	60	2	64	3	3	2
5	76	6	63	3	68	4	3	2
20	248	19	118	5	161	9	14	10
25	369	28	145	6	215	12	22	16
35	815	62	221	9	381	21	53	41

4.3.2.4 To obtain the potential benefit in terms of the number of additional breeding adult razorbills per year on Muck following a rat eradication, the additional number of birds per year (no. at *t*+1 minus no. at *t*) obtained from a population growing at the Skomer and Skokholm post-Lundy eradication rates were subtracted from the equivalent number obtained using the Lundy rate ('Net additional birds on Muck per year' in Table 4.5). This output was selected as it is comparable to the predicted potential impacts which are expressed as mortalities per year.

4.3.2.5 Thus, in the first year following an eradication the method predicts between 1 and 2 additional breeding adults in the Muck population would be attributed to the removal of rats. By year 20 this figure increases to between 10 and 14 and by year 35 the additional birds per year would be between 41 and 53, equating to 27 to 36 pairs (using a ratio of 0.67 pairs:individuals; Harris, 1989).

4.3.2.6 It is important to note that these projected values do not account for local conditions and habitat availability and can only offer a guide as to what might happen following a rat eradication. However, it is equally important to note that this between island comparison approach is just one way of considering the potential population benefits. Records of the razorbill population on Muck are sporadic, but there appears to have been a significant decline from 246 reported in 1986 (Dobson and Dobson 1986) to 136 in 2001 (SMP), 40 in 2018 (Burnell *et al.* 2023) and 51 in 2021 (Inger *et al.* 2023). Across the whole period this represents a decline of 4.4%. Compared with these rates of

decline, growth at the rate seen on Lundy (8.2%) would mean a comparative 35 year population of 855 (i.e. comparing the decline in population extrapolated from the current trend with the growth predicted by the Lundy growth rate) and, perhaps more importantly, would be a reversal of the current long-term downward trend. Furthermore, Morven North and Morven South are investigating options for delivering the eradication in advance of the predicted impacts, in which case the time to achieve any given compensation target would be reduced.

4.3.3 Estimated benefits for razorbill – Canna compared to Ceann a Mhara (Tiree)

4.3.3.1 Immediately following the rat eradication on Canna in 2005 the razorbill population increased substantially (although the immediate effect is slightly uncertain due to what is considered to have been an undercount in 2005). For the next 10 years (up to 2015) there was no evidence of long-term growth. However, since then the population has recovered, increasing 3-fold to around 900 individuals in 2021 before declining a little to around 600 in the most recent counts (thought to be due to HPAI, B. Swann pers. comm.).

4.3.3.2 Two rat-free colonies were considered for comparison with these trends: Ceann a Mhara (Tiree) and Mingulay and Berneray. Unfortunately, on review of the counts from the latter there was evidence of very large inter-annual fluctuations of +/-30-40%. These are not considered to be true reflections of that population and it is most probable that they are the result of partial counts in some years (the SMP does not make this apparent). Consequently, these data were not considered suitable for further assessment. The Ceann a Mhara colony has declined over the period of interest (2005 to the present) from over 400 to fewer than 250 individuals. Thus, there is limited additional insight to be gained from detailed consideration of modelling the Muck population using the Canna growth rate discounted by that from Ceann a Mhara (though this has been presented in Volume 3, Annex 2.4: Predator Eradication Modelling Report of the HRA). Instead, the average growth rate of the Canna razorbill population following the eradication (1.081 between 2004 and 2021, spanning the period between the last count prior to the eradication and the year before HPAI) can be used to estimate the Muck population size. Thus, from a starting point of 51 individuals, the population that could be obtained within 5 years is 75 (1.081^{5} x 51), within 13 years is 140 (1.081^{13} x 51), within 25 years is 358 (1.081^{25} x 51) and after 35 years is 780 (1.081^{35} x 51) (Table 4.6).

Table 4.6: Projected population size increase of razorbills on Muck (from a starting population size of 51 individuals in year 0, not shown) and projected annual increase (individuals) as a result of rat eradication based on evidence from Canna.

	Canna growth rate	
Years	Projected Muck population size (indiv.)	Additional birds per annum
1	55	4
2	60	4
3	64	5
4	70	5
5	75	6
13	140	11
25	358	27
35	780	59

4.3.4 Estimated benefits for puffin – Lundy compared to Skomer and Skokholm

4.3.4.1 Prior to the rat eradication, the puffin population on Lundy had a long-term growth rate of -11.4% (1981 to 2000). Following the eradication the growth rate was 34.2% (2004 to 2023).

4.3.4.2 The equivalent growth rates on Skomer were 1.6% (1988 to 2003) and 3.3% (2004 to 2023) and on Skokholm were 1.3% (1986 to 2003) and 3.7% (2004 to 2019) (note the slightly different spans of years reflect data availability in the SMP).

4.3.4.3 Therefore, focussing on the growth rates in the period following the rat eradication on Lundy, the net growth rates (Lundy rate minus Skomer/Skokholm rates) were 30.9% and 30.5% respectively. Thus, by accounting for the rates of growth seen on nearby rat-free islands, growth of between 30.5% and 30.9% is what could be attributed to the removal of rats. To translate these growth rates into projected population sizes a starting population of puffin for Muck (19, taken from Inger *et al.* 2023) was multiplied by the net growth rates for a span of 35 years (Table 4.7).

Table 4.7: Projected population size increase of puffin on Muck (from a starting population size of 19 individuals in year 0, not shown) and projected annual increase (individuals) as a result of rat eradication based on evidence from Lundy, Skomer and Skokholm

Year	Muck population						Net additional birds on Muck per year	
	Lundy rate (34.2%)		Skomer rate (3.3%)		Skokholm rate (3.7%)		Lundy less Skomer	Lundy less Skokholm
	N	Addition/ year	N	Addition/ year	N	Addition/ year		
1	25	6	20	1	20	1	5	5
2	34	9	20	1	20	1	8	8
3	46	12	21	1	21	1	11	11

Year	Muck population						Net additional birds on Muck per year	
	Lundy rate (34.2%)		Skomer rate (3.3%)		Skokholm rate (3.7%)		Lundy less Skomer	Lundy less Skokholm
	N	Addition/ year	N	Addition/ year	N	Addition/ year		
4	62	16	22	1	22	1	15	15
5	83	21	22	1	23	1	20	20
20	6,807	1,734	36	1	39	1	1,733	1,733
25	29,616	7,545	43	1	47	2	7,544	7,543
35	560,587	142,822	59	2	68	2	142,820	142,820

4.3.4.4 To obtain the potential benefit in terms of the number of additional breeding adult puffin per year on Muck following a rat eradication, the additional number of birds per year (no. at *t*+1 minus no. at *t*) obtained from a population growing at the Skomer and Skokholm post-Lundy eradication rates were subtracted from the equivalent number obtained using the Lundy rate ('Net additional birds on Muck per year' in Table 4.7). This output was selected as it is comparable to the predicted potential impacts which are expressed as mortalities per year.

4.3.4.5 Thus, in the first year following an eradication the method predicts 5 additional breeding adults in the Muck population would be attributed to the removal of rats. By year 20 this figure increases to 1,733 and by year 35 the additional birds per year would be 142,820.

4.3.4.6 It is important to note that these projected values do not account for local conditions and habitat availability and can only offer a guide as to what might happen following a rat eradication, and that given the very high growth rate seen on Lundy and the absence of any density dependence in the modelled population growth, the projections are unrealistic for the longer projection periods when habitat limitations would restrict growth (habitat availability on the Isle of Muck are considered separately in Section 4.4 below). However, it is equally important to note that this between island comparison approach is just one way of considering the potential population benefits. Records of the puffin population on Muck are sporadic, but there appears to have been a significant decline from 254 reported in 1986 (Dobson and Dobson 1986) to 222 in 2001 (SMP), 100 in 2018 (Burnell *et al.* 2023) and 19 in 2021 (Inger *et al.* 2023) (note these have been converted from Apparently Occupied Burrows, AOB, to individual adults). Across the whole period this represents a decline of 5.3%, against which growth at the rate seen on Lundy (34.2%) would result in a considerable improvement in the population status and, perhaps more importantly, would be a reversal of the current long-term downward trend. Furthermore, Morven North and Morven South are investigating options for delivering the eradication in advance of the predicted impacts, in which case the time to achieve any given compensation target would be reduced.

4.3.5 Summary of projected benefits in relation to compensation targets

4.3.5.1 In Section 1.4 the potential predicted impacts from Morven North and Morven South are presented. The summed total annual mortalities (Table 1.6) for the species for which rat eradication is proposed to compensate (rounded to the nearest integer) are 123 to 480 guillemot, 6 to 23 razorbill, 3 to 13 puffin and 9 to 22 kittiwake.

4.3.5.2 The number of years following eradication required to offset these impacts, defined as the point at which this many additional birds would be added to the population each year (as the net value: Lundy minus Skomer or Skokholm) are presented in Table 4.8.

4.3.5.3 The modelling indicates that razorbill impacts at Morven North would be fully compensated under even NatureScot's more precautionary scenario within 22 years and for Morven South impact by year 12. For Morven North and Morven South combined the maximum impact would be compensated by year 26. For puffin, the models suggest that the combined Morven North and Morven South impact estimates using NatureScot's more precautionary scenario would be fully compensated within 5 years. For guillemot, with the largest impact across all species, the modelling indicates that the Applicant's precautionary position impact would be compensated after 19, 7 and 23 years for Morven North, Morven South and both combined respectively. NatureScot's more precautionary impact levels would be compensated for Morven South after 23 years, but would take more than 35 years for Morven North alone and for the combined impact (although space and other factors permitting, the populations, and hence conservation benefits, would be expected to continue to grow beyond the 35 year life spans of Morven North and Morven South).

4.3.5.4 However, it is important to note that these model predictions are provided as a guide and should not be considered as accurate projections for how the seabird populations will actually respond following rat removal. Regular monitoring of the colonies to estimate population size will be critical to determining the success of the campaign and identifying the need for adaptive measures, if required.

Table 4.8: Estimated period taken for Muck projected populations to reach compensation targets based on estimated impacts and assuming net growth (i.e. accounting for other influences on population growth). The mortality estimates refer to the Applicant's precautionary position (Low) and NatureScot's position (High) which includes additional levels of precaution

Project	Number of mortalities	Guillemot		Razorbill		Puffin	
		Impact	No. years to offset impact	Impact	No. years to offset impact	Impact	No. years to offset impact
Morvern North	Low	91.6	19	4.2	9	2.5	2
	High	354.2	>35	16.3	22	10.6	3
Morven South	Low	31.6	7	1.8	2	0.7	2
	High	126.2	23	6.7	12	2.7	2
Morven North & Morven South	Low	123.3	23	5.9	12	3.2	2
	High	480.5	>35	23.1	26	13.3	4

4.3.5.5 As noted above, the modelled growth as presented is based on assumptions about the transferability of observed post-eradication population expansion, which vary from site to site. By subtracting the population trend from nearby rat-free islands and thereby attempting to account for other influences on population growth, these projections also adopt a precautionary approach. If the observed negative trend on Muck (-3.4% to -8.8%) is maintained (i.e. as might be expected in the absence of rat eradication) it could be argued that a more realistic comparison would be between a population heading for extinction (e.g. zero) and one increasing at 7.9% (as seen on Lundy). Under this scenario the maximum combined impact (480), delivered as additional birds compared with the initial population of 319 (i.e. a target of 799), would be attained by year 13.

4.3.5.6 Furthermore, the predicted benefits for other species, both those modelled above and others for which benefits would be expected, would comfortably exceed the sum of their species-specific predicted impacts and the 'excess' could be seen as providing Tier 2 compensation for guillemot.

Indeed, given the wider benefits expected from a rat eradication on Muck, it could be argued that an appropriate way to view the potential benefits for seabirds would be to consider the overall sum of the predicted number that would be gained against the sum of the predicted impacts at Morven North and Morven South. In that context it is clear that the benefit of the proposed measure far exceeds the predicted potential impacts from Morven North and Morven South thereby making a very strong case for pursuing this as a suitable project led compensation measure.

4.3.5.7 While kittiwake is among the key species for which compensation is expected to be required, no comparative modelling was undertaken for this species as there is limited evidence for the extent to which their populations recover from rat eradications. However, although kittiwake nests are typically considered less accessible to rats (i.e. located on small ledges on steep cliffs), infra-red camera footage of cliffs on the neighbouring island of Rum recorded rats on what would previously have been considered inaccessible cliffs (see Section 4.5). Therefore, rats may still be restricting available habitat for kittiwake. In addition, the kittiwake population was historically much higher on Muck than the 20 individuals recorded in 2025, with 140 pairs reported in the 1980s (Dobson and Dobson 1986), which also suggests that the presence of rats may be suppressing the population. Therefore, this species is still expected to benefit from rat eradication, and this would be expected to be sufficient to deliver the modest compensation required (9 to 22; Table 1.6). Notably, observations following rat eradications have found that non-target seabird species (i.e. not the species primarily expected to benefit) also increase in numbers following an eradication (Saunier *et al*. 2024) and other studies have found that smaller colonies, such as that currently on Muck, tend to recover more rapidly than larger ones (Brooke *et al*. 2017).

Other species

4.3.5.8 The above has focussed on the key species predicted to be impacted by Morven North and Morven South and for which rat eradication would be expected to halt further population decline and permit expansion (guillemot, razorbill and puffin). However, other species which have been recorded on Muck and which would also be expected to benefit to varying degrees include Arctic tern, Sandwich tern (*Sterna sandvicensis*), shag (*Gulosus aristotelis*), black guillemot (*Cepphus grylle*), common gull (*Larus canus*), herring gull (*Larus argentatus*), lesser black-backed gull (*Larus fuscus*) and great black-backed gull (*Larus marinus*). No attempt has been made to model the potential responses of these species to rat eradication as there are either no reliable data sources available, the species are currently absent (so the first step would require a recolonisation event) or they are not predicted to be at risk of impact from Morven North of Morven South.

4.3.6 Summary of population modelling

4.3.6.1 The population modelling presented in this section provides a useful guide to the potential population trends that could be observed following a rat eradication on the island of Muck. It indicates that, given favourable circumstances, seabird population growth could rapidly address much of the required Tier 1 compensation (e.g. for razorbill and puffin at least) although compensation for guillemot might require some consideration under Tier 2.

4.3.6.2 To investigate how feasible a rat eradication would be on Muck, how much effect rats may currently be having on seabirds and the scope for population expansion, a range of site visits, investigations and surveys were conducted during 2025. These are reported on in Volume 3, Annex 2.5: Island Screening Report: Muck and Volume 3, Annex 2.6: Pre-eradication Field Study Report: Muck of the HRA and summarised below.

4.4 Isle of Muck surveys

4.4.1.1 To determine if a rat eradication on the Isle of Muck (which includes the main island of Muck itself plus Lamb Island, Horse Island and Eagamol) could deliver the levels of compensation required by Moven North and Morven South, two survey campaigns were conducted. The first undertook preliminary surveys for invasive predators, counted breeding seabirds and reviewed the amount of

currently unoccupied seabird breeding habitat (Volume 3, Annex 2.5: Island Screening Report: Muck of the HRA). The second was focussed on collecting detailed information about rats, including their distributions, dietary composition and Deoxyribonucleic Acid (DNA) profiles (Volume 3, Annex 2.6: Pre-eradication Field Study Report: Muck of the HRA). The results of both are summarised below.

4.4.2 Muck screening surveys

4.4.2.1 The preliminary survey was designed to provide answers to three questions:

1. Is site access approved and supported?
2. Are the key seabird species (auks and kittiwake) and invasive predators present?
3. Is there suitable seabird breeding habitat available and how likely are birds to use it?

4.4.2.2 The preliminary survey was conducted between 09 and 13 June 2025 and included the main island of Muck itself, Eilean Aird nan Uan (Lamb Island), plus the two main islets of Eilean nan Each (Horse Island) and Eagamol. Lamb Island is connected to the main island at low tide, Horse Island is approximately 200m from Lamb Island and Eagamol is just over 100m from Horse Island (Figure 4.1).

Figure 4.1: Isle of Muck

4.4.3 Is site access approved and supported?

4.4.3.1 The Isle of Muck is the most southerly of the small isles group off the west coast of Scotland, which includes Rum, Canna (and the adjoining Sanday) and Eigg. It is approximately 8km from the mainland and is privately owned with a resident population of around 30. Discussions were held with the landowners, leaseholders and members of the community, all of whom were supportive of measures to reduce the impacts of rats whose effects extend beyond those on the seabirds (i.e. hygiene and livelihoods). Further details of the discussions with the landowners are provided in Section 6.

4.4.4 Are the key seabird species and invasive predators present?

4.4.4.1 The seabird surveys were conducted during mid-June, undertaken primarily from a vessel, supplemented by vantage point watches from suitable locations. All surveys followed standard methods (Walsh *et al.* 1995; Gilbert *et al.,* 2011). Although the coverage of the surveys may have varied, accounting for some of the changes observed, it is apparent that breeding seabird numbers on Muck have declined considerably in the last 40 years (Table 4.9).

4.4.4.2 The most recent previous seabird survey was undertaken in May 2021 and recorded 319 guillemot, 51 razorbill, 19 puffin (all individuals) and 4 kittiwake (AON, apparently occupied nests). Similar numbers of razorbill (32) and puffin (22) were found in 2025, although kittiwake numbers were slightly higher (11 AON) and guillemot numbers had further declined to 179. However, given the difference in timing of the two surveys these differences may be accounted for by the 2025 surveys overlapping with early departures of breeding individuals.

4.4.4.3 It should also be noted that since the 2025 population counts are only available in this submission it was not considered appropriate to use these as the basis for the population modelling, and hence the 2021 counts (Inger *et al*. 2022) were used as the initial population sizes (Section 4.3).

Table 4.9: Seabird counts for Muck. Count units indicated

Species	1986 Dobson & Dobson (1986)	2001 Mitchell *et al*. 2004	2018 Burnell *et al*. 2023	2021 Inger *et al*. 2022	2025 This report
Guillemot (Ind.)	1,073	397	420	319	179
Razorbill (Ind.)	246	136	40	51	32
Puffin (Ind.)	254	111	50	19	22
Kittiwake (AON)	140	67	24	4	11

4.4.4.4 Guillemot and razorbill were recorded at highest densities in areas with the steepest cliffs, with localised peak densities of guillemot of up to 16 pairs/m^2, while razorbill were primarily seen in much smaller numbers and as individuals or pairs near guillemots, with occasional pairs seen in cracks near cliff tops.

4.4.4.5 Puffin were only recorded on Horse Island, with 22 individuals seen standing in burrow entrances (although nesting was not confirmed).

4.4.4.6 Only 11 kittiwake AON were recorded, on the southern side of Muck and no information was collected on their potential breeding status.

4.4.4.7 No formal surveys were conducted for the presence of invasive mammal predators during the Muck screening survey (June 2025) however the residents discussed their presence, and dead rats were

observed in traps set by land managers during the survey. Signs of their presence was also noted from observations of rat runs, droppings and burrows.

4.4.5 Is there suitable seabird breeding habitat available and how likely are birds to use it?

4.4.5.1 Suitable habitat for breeding seabirds includes cliffs and boulder fields for guillemot, razorbill and kittiwake and sloping areas of vegetated soil for puffin within which to burrow (although boulder fields and cracks in cliffs may also be used).

4.4.5.2 Potential habitat observable from a vessel was visually assessed as being either unoccupied or partially occupied (with space for additional birds) and matching known guillemot and/or razorbill, puffin and kittiwake breeding preferences (including height above high tide and splash zone, presence of existing colony, orientation of feature, protection from adverse weather, width and incline of ledge, depth of crevices etc). A detailed photographic record was collected, including currently occupied ledges and cliffs, and is presented in Volume 3, Annex 2.5: Island Screening Report: Muck of the HRA. To estimate distance in the images either an accompanying length was obtained at the time using a laser range-finder, or the presence of objects of known size (e.g. a seabird) was used. In the manner the length and depth of ledges could be estimated from the imagery. A qualitative assessment of habitat suitability was made based on expert knowledge, with scores of poor, moderate and good applied.

4.4.5.3 Later survey visits (03, 12 and 15 August 2025) following the departure of most seabirds permitted the capture of images from above using a drone, thereby enhancing the vessel based results and also providing coverage of the top of the offshore islands (Horse Island and Eagamol) which could offer opportunities for puffin burrows.

4.4.5.4 Following image analysis it was estimated that there were the following areas of good quality unoccupied ledge and boulder field habitat suitable for guillemot and razorbill (Volume 3, Annex 2.5: Island Screening Report: Muck of the HRA):

- Muck - 51.8m^2;
- Horse Island – 274.8m^2;
- Eagamol – 186.9m^2.

4.4.5.5 In total these areas amount to an estimated 513.5m^2 of potentially suitable, good quality and unoccupied breeding habitat for guillemot and razorbill across the Muck island group (Volume 3, Annex 2.5: Island Screening Report: Muck of the HRA). Guillemot nesting density varies in different habitats and can be as high as 60 pairs/m^2 (Harris and Birkhead 1985). The habitats on Muck are more varied and a density of around 20 pairs/m^2 is probably a more reasonable upper target, while the existing peak density was estimated to be 16/m^2. A density of 16 to 20 breeding pairs/m^2 suggests that around 8,200 to 10,300 breeding pairs of guillemot and razorbill could potentially be supported on Muck. Razorbill nesting densities are less well estimated due to a tendency to be more concealed (e.g. under boulders and in cracks) but it is likely that they would utilise some of the same areas as guillemot, so the estimated total probably reflects the combined total for both species that could be accommodated. It is also important to note that these figures relate only to the most highly scored areas of habitat, and that additional areas may also be suitable, further increasing the potential for population expansion.

4.4.5.6 Drone footage of the grassy slopes on Horse Island and Eagamol yielded area estimates of 3,785m^2 and 2,127m^2 respectively that were deemed potentially suitable and unoccupied puffin habitat; 5,912m^2 in total. This could support between 296 and 4,316 puffin burrows (burrow density in the range 0.05 to 0.73/m^2; Luxmoore *et al.,* 2024). It should be noted that these estimates represent probable upper limits since factors such as soil depth and presence of stones cannot be determined from aerial images but will limit the amount of suitable area.

4.4.5.7 No attempt was made to estimate the potentially suitable kittiwake nesting habitat, but given the very low numbers recorded in recent surveys and the small predicted impacts that may require compensation (9 to 22 from Table 1.6) it is considered reasonable to expect that even a modest increase in kittiwake pairs would achieve required levels of compensation. Historically, kittiwake numbers have been higher, with 140 AON reported in the mid-1980s (Dobson and Dobson 1986) and 67 in 2001 (Mitchell *et al*. 2004). Therefore, there is scope for kittiwake numbers to increase, and experience from other rat eradication schemes has shown that population growth in one species can encourage increases in other species (Saunier *et al*. 2024).

4.4.5.8 Therefore, there appears to be sufficient suitable habitat for guillemot, razorbill, puffin and kittiwake to achieve considerably larger populations than would be required to compensate for potential impacts at Morven North and Morven South. It is difficult to predict the likelihood of the species to expand into these areas, but the presence of existing populations is likely to be a critical factor, so conducting the eradication before the populations decline much further is likely to be important. It is also beneficial that much of the seabird breeding habitat is on the uninhabited islets of Eagamol and Horse Island, which will therefore be subject to minimal human disturbance and also reduced risk from rat recolonisation. There are potential measures that can be taken to encourage colonisation into areas, such as placing decoys and broadcasting colony calls. These would probably be best considered as adaptive management options should colonisation occur less quickly than anticipated.

4.5 Muck pre-eradication survey

4.5.1.1 Having established the presence of the species of seabird for which compensation is anticipated, the presence of invasive rats and establishing that the required level of compensation could be delivered (through the modelling and survey work), the next phase was to conduct a detailed survey across the islands to collect information on the rat population. This survey was conducted between 31 July and 21 August 2025 and was designed to collect data on the abundance, distribution, diet and genetic profile of the rats on Muck. Full details of this pre-eradication field survey is presented in Volume 3, Annex 2.6: Pre-eradication Field Study Report: Muck of the HRA but is summarised below.

4.5.1.2 To estimate abundance and distribution three trap lines were set up in different parts of the main island of Muck, intended to provide a range of results. Two lines were placed in proximity to areas used by breeding seabirds, and one was placed in the harbour area. Each line had a pair of lethal snap traps placed inside a locked box at 30m intervals. One of each trap pair was baited with peanut butter the other with chocolate spread. Traps were placed alongside linear features or existing runs to maximise trapping rates. Following trap placement, the traps were left unset for 1 night followed by 16 nights of live trapping. Due to the challenges of landing on Horse Island and Eagamol during the pre-eradication survey, it was not possible to conduct trapping on those sites.

4.5.1.3 Because rats vary in their response to novel items lethal trapping alone may not provide a complete picture of rat presence. Therefore, three additional, non-lethal, recording measures were used:

- 30 ink tunnels (lengths of plastic tunnel with a central ink pad and recording pads on either side, baited with peanut butter) were deployed in proximity to the trap lines to record activity;
- 30 chocolate flavoured wax blocks were pegged out in proximity to the trap lines to record animal presence by the tooth marks;
- 20 camera traps distributed along the trap lines and in nearby locations considered likely to harbour rats.

4.5.1.4 Seven thermal drone flights were conducted at night to record heat signatures (night-time operation also minimises the risk of interactions with birds in flight). Video footage from the flights was captured and could be analysed to identify the likely species observed, based on image and movement characteristics (e.g. size is used to distinguish from mice). Importantly, these included flights over Horse Island and Eagamol (which could not be trapped due to access challenges during the survey).

4.5.1.5 Trapped rats were measured, sexed and aged. As well as rats caught on the three trap lines set out above, land managers from Gallanach Lodge provided rats caught as part of their activities which were subject to the same analysis as those collected on trap lines as follows (see Volume 3, Annex 2.6: Pre-eradication Field Study Report: Muck of the HRA for full details of analysis and results:

- A 2cm tail sample was taken from 20 rats and preserved in ethanol for testing of genetic resistance to rodenticide (which will inform eradication methods).
- Stomach contents were reviewed on the day of capture for any obvious origins then frozen for later analysis.
- Complete whiskers (including the follicle) were removed for stable isotope analysis. Rat whiskers take approximately 8 weeks to grow, so analysis along the whisker provides a history of the animal's diet over the 8 weeks prior to being caught. Terrestrial, coastal and marine food sources have different ratios of carbon and nitrogen isotopes which can be detected in the animal's tissues.
- In addition, micro-satellite markers were collected for storage. These may prove useful in future to establish the historical linkages between the Muck population and other rat populations in the region, thereby indicating the source of origin (e.g. mainland, nearby island etc.).

4.5.1.6 Over the 16 nights of trapping, the traps along the three traplines caught 4, 6 and 13 rats respectively, giving an Incidence of Abundance (IoA), calculated as catches/available trap nights) between 0.5 and 1.64. Only one wax block (from 30 deployed) had evidence of rat teeth marks and two of the 30 ink tunnels recorded rat footprints. There were 332 distinct camera trap records of rats, most of which (253) were around the harbour area, followed by Lamb Island (61).

4.5.1.7 Rats were observed in the thermal drone imagery at each of the main seabird areas (Camus Mor, south main island, Horse Island and Eagamol). This included several rats seen in areas historically used by puffin on Horse Island and Eagamol. Since the only rat species caught on Muck itself was brown rat it seems reasonable to assume the rats observed on Horse Island and Eagamol are also this species and not black rat. Of the rats observed on Eagamol, estimation of body length from ground truthed pixel counts indicated the presence of juvenile individuals, strongly indicative of a breeding rat population on Eagamol. This is of particular significance since Eagamol will be potentially of best suitability for breeding seabirds, in particular razorbill and guillemot.

4.5.1.8 The only other mammals recorded during the surveys were wood mouse (*Apodemus sylvaticus*), field vole (*Microtus agrestis*) and pygmy shrew (Sorex minutus). No evidence of otter (*Lutra lutra*), mink (*Neogale vision*), rabbit (*Oryctolagus cuniculus*), stoat (*Mustela erminea*), weasel (*Mustela nivalis*) or hedgehog (*Erinaceus europaeus*) was found, and of these, only otter has been recorded in the past.

4.5.1.9 The diet analyses found little direct evidence of predation on seabirds, with only one feather recorded from 45 samples. However, 17 of these came from rats caught by land managers in the vicinity of grain feed provided for gamebirds (almost all of which had grain recorded in their stomachs). The feather was recorded in a rat caught on the Lamb Island trap line, but as this is not adjacent to a seabird breeding area and the trapping was conducted after most seabirds had departed, this was most likely a terrestrial bird feather. It should be noted however that the surveys on Muck were undertaken in early August when many of the seabirds had left the colonies.

4.5.1.10 Analysis of the whiskers found no significant differences between the base and tips in any sample. The overlap of terrestrial, littoral and marine isotopes with the whisker samples indicated a primarily littoral diet (e.g. coastal molluscs). Overall the stable isotope analysis indicated that the rats had a varied diet (which is to be expected in a generalist species) but that rats caught on the traplines had a more littoral based diet and rats caught in proximity to buildings by land managers near the grain feed had a predominantly terrestrial signature (further evidenced by the predominance of grain in these rat's stomachs).

4.5.1.11 There was no indication of rodenticide resistance among tested rat samples. Such resistance can be seen in populations with long exposure to rodenticides. This is encouraging, but further testing will be required prior to an eradication campaign to ensure the appropriate rodenticides are selected.

4.5.1.12 Between 7 and 31 July 2025, a similar set of surveys was undertaken around the south coast of the Isle of Rum with identical scopes as those set out above for Muck (i.e. lethal trap lines, non-lethal camera traps, ink tunnels and wax blocks, drone surveys and laboratory analysis of captured rats). These surveys were conducted three weeks earlier in the breeding season than those on Muck (which commenced immediately afterwards, on 31 July) and therefore there was a greater potential of obtaining evidence of interactions with seabirds. The results of these surveys included thermal images of rats moving around on steep cliffs which might otherwise have been considered inaccessible to rats (Figure 4.2). It is thought this movement is facilitated by the presence of patches of vegetation which link up ledges on these cliffs.

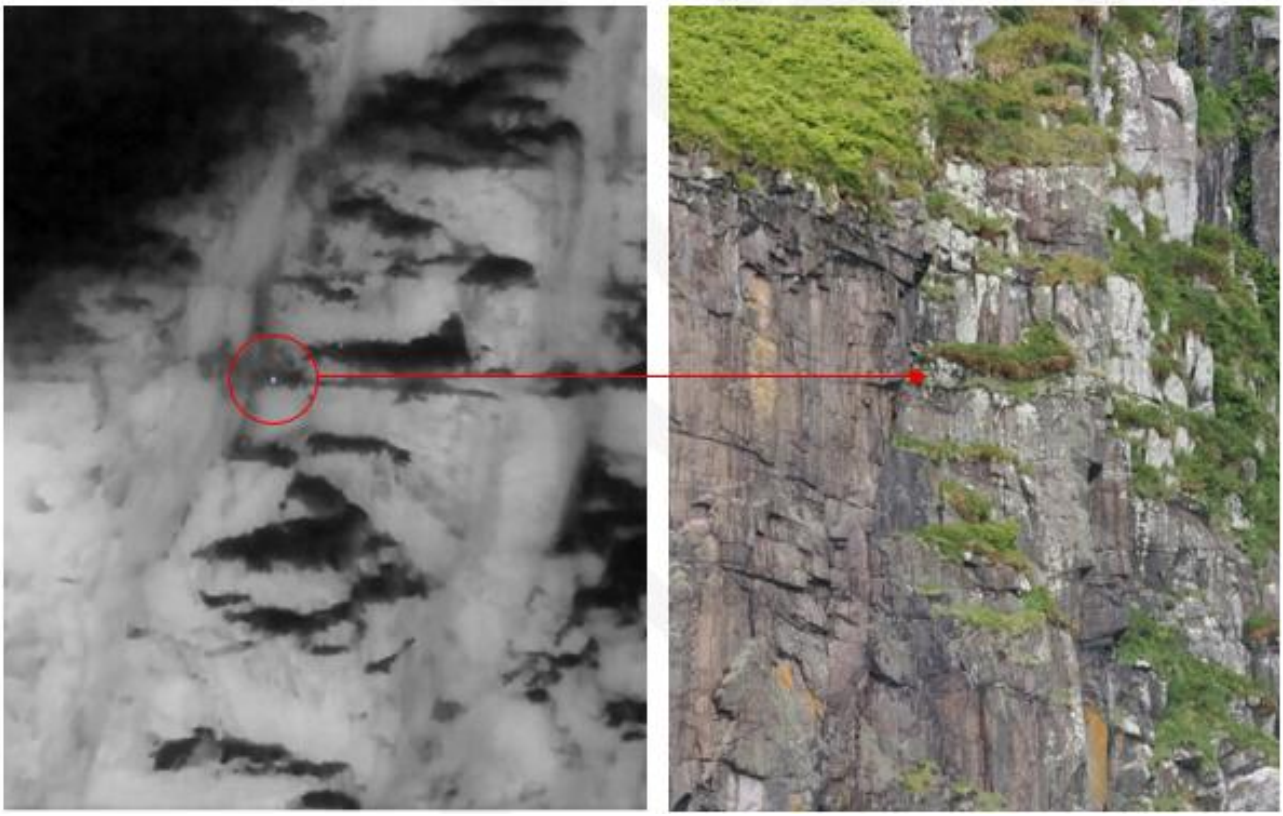

Figure 4.2. The location of a rat observed during a thermal UAV survey of cliffs on the south coast of Rum (left), compared to daytime imagery (right) of the same area of cliffs, June 2025. Red arrow indicates what would be the approximate location of the rat in the daytime imagery.

4.5.1.13 These observations, while made on a different island, support the assumption that the rats on Muck would be able to access many of the areas which seabirds would otherwise use for nesting. Furthermore, analysis of a stomach sample from a rat caught on Rum above a section of cliffs where guillemot breed (Figure 4.3) returned a 99% probable match for guillemot DNA.

Figure 4.3. The location of a rat trapped in south-east Rum (red dot) which had guillemot DNA in its stomach sample. Ledges occupied by guillemot, approximately 100m from the trap site are indicted (yellow circle).

4.5.1.14 This is very strong evidence that brown rats are able to access seabird breeding areas and feed on seabirds, although it must be acknowledged that this may have been a scavenging event (albeit on remains within a breeding colony) rather than predation. Nonetheless, there does seem to be a clear indication that rats have the ability to eat eggs and young chicks and thereby suppress seabird populations.

4.6 Rat eradication on Muck: comparison of model predictions and survey findings

4.6.1.1 As discussed in Section 4.3, prior to the field surveys on Muck conducted over the summer of 2025, auk population data from UK locations where rat eradications were conducted and nearby locations that were rat-free were analysed and modelling of projected populations undertaken. The aim of this was to provide an initial guide, in the absence of site-based considerations, to how the seabird populations on Muck could respond to the removal of rats. The populations were projected using the net population growth rate (i.e. the rate to be expected due to rat removal alone) and this rate would be expected to include all sources of increase (immigration, productivity) and decrease (mortality and emigration). However, these factors will reflect site specific conditions and therefore may not be appropriate for Muck.

4.6.1.2 One of the most important considerations is the extent to which breeding space is limiting. The Muck screening surveys (Section 4.4) have provided a detailed assessment of the potential areas available for seabirds to utilise following rat removal. The area available for guillemot and razorbill, even using the precautionary end of the potential density range, suggests space for at least 8,200 breeding pairs, approaching double the model predicted total number of pairs of both species of approximately 3,600 (derived as 67% of the model projected year 35 figures of 4,626 and 815 individuals of each species respectively, adjusted to obtain pairs; Harris 1989).

4.6.1.3 Therefore, space for breeding auks, even if it is half that estimated from the surveys (i.e. 8 pairs/m^2) would still be sufficient for all the guillemot and razorbill predicted by the model. Or alternatively, this may indicate that the populations will grow faster than the analysis suggested, achieving compensation targets in a shorter period.

4.6.1.4 The survey derived estimates of space available for puffin exceeds the compensation requirements by a very large extent (predicted mortality: 3 to 13 individuals, most precautionary burrow density: 296). While there is less evidence that kittiwake will benefit from removal of rats it seems very likely that their population size and productivity will improve as a result, and given the kittiwake population

has been much higher in the past, almost any improvement is likely to exceed the predicted mortalities, which are very low (Table 1.6).

4.6.1.5 The two approaches therefore provide a good degree of independent support that removal of rats from Muck would permit recovery of the four target species' breeding populations. Using population modelling methods, not typically presented for this purpose in seabird compensation submissions, the potential post-eradication growth has been predicted, while the habitat surveys have determined that these recoveries would not become constrained by space limitations before the required levels of compensation could be achieved. This result does not take into account the wider benefits of removing rats from Muck, since they will also be having negative impacts on a wide range of terrestrial animal and plant species.

4.6.1.6 Although Muck is not designated as an SPA for breeding seabirds, it lies within a region of seabird SPAs and given the high degree of inter-connectedness between seabird colonies, growth of the seabird populations on Muck would generate recruits for those SPA colonies, thereby contributing to the overall coherence of the National Site Network.

4.6.1.7 An Outline Compensation Implementation, Monitoring and Adaptive Management Plan (Volume 3, Chapter 3: Outline CIMAMP of the HRA) has been prepared and provides an overview of how the rat eradication on Muck would be conducted, proposed monitoring, for both rat reinvasion and of the seabird populations and adaptive measures should they be required.

5 Gannet Compensation

5.1.1.1 The predicted impact on gannet from Morven North and Morven South is between 12.3 individuals (low) to 24.7 individuals (high; Table 1.6). This cannot be directly compensated (Tier 1) through the proposed rat eradication on Muck since gannet do not currently breed at this site and there are no historical records of gannet breeding here. While the wider benefits of the eradication could be considered as providing gannet compensation under Tier 2, the Applicant has also been developing options for a gannet specific compensation measure. Due to commercial sensitivity further detail on this measure will be submitted during the determination phase.

6 Landowner discussions

6.1 Muck

6.1.1.1 Muck is largely owned by the Isle of Muck Property Owning Partnership, with the community hall and small community renewable energy scheme being owned by the Isle of Muck Community Enterprise. The single-track road on the island is owned by the Highland Council. An exclusivity agreement is in place with the Isle of Muck Property Owning Partnership.

6.1.1.2 Table 6.1 below provides a summary of the key engagement and discussions with landowners and the local residents.

Table 6.1: Summary of key discussions during landowner consultations on Isle of Muck

Date	Type of communication	Summary of key points
17 January 2025	Letter	Letter sent to the landowners introducing Morven North and Morven South and informing landowners when the Applicant would be visiting the island for an introductory discussion.
15-16 April 2025	Site visit	The Applicant spent two days on Muck and met with landowners. Information was shared on Morven North and Morven South and the potential for a rat eradication programme to be undertaken on Muck as a seabird compensation measure. The Applicant also met with several local residents. Initial responses from landowners and residents were supportive as rats were considered to be a significant concern on the island, interfering with property and livestock. Local people highlighted how much seabird populations had declined in recent years. During this visit the Applicant discussed the next steps and proposals for undertaking boat-based seabird colony counts and habitat assessment survey around Muck in June 2025.
9-13 June 2025	Survey	Habitat Assessment and Restoration (HAR) spent 5 days on the island undertaking seabird colony counts (boat-based) and habitat assessment surveys. For this work a local vessel was used. As the HAR team were staying on the island they were also able to engage with locals on rat activity and seabird populations.
6 June 2025	Licences	Non-intrusive survey licences were issued to all landowners for follow up pre-eradication surveys planned for July and August 2025.
18 June 2025	Site visit	The Applicant visited Muck to allow landowners to discuss any outstanding issues before licences were signed.
22 July 2025	Leaflet	A leaflet was emailed to all island residents informing them of the community engagement event planned for 25 July 2025 in advance of the pre-eradication surveys being undertaken.
25 July 2025 (16:00-20:00)	Community Engagement Event	The Applicant held the community engagement event in the Muck Community Hall. Fifteen people (approximately half of the resident population of the island) attended. Information was provided by the Applicant on the pre-eradication surveys including rat trapping, drone surveys and trail cameras. One resident described how he had trapped more than 100 rats around his property over the last few months.

Date	Type of communication	Summary of key points
		Many residents described the significant declines to seabird populations over recent years. Some concerns were raised on whether the HAR surveys would impact other wildlife or pets. HAR were able to satisfy locals that traps were designed to target rats. All the residents that attended the community engagement event were supportive of a rat eradication programme.
31 July-21 August 2025	Pre-eradication surveys	The HAR team spent 3 weeks on the island undertaking pre-eradication surveys. During this time the team lived on the island engaging with residents and learning more about rat activity and declining seabird populations. The team also did a visit to the local school to talk to the school children about the surveys being undertaken.

7 Monitoring of compensation

7.1.1.1 The proposed compensation measures for Morven North and Morven South are a rat eradication campaign on the Isle of Muck and a gannet measure.

7.1 Muck rat eradication

7.1.1.1 Compensation monitoring following a rat eradication would be focussed on the seabird populations. Monitoring for signs of rat recolonisation is considered an essential part of the measure itself, rather than a measure of success in the outcome so is not strictly speaking considered part of the compensation monitoring. This will require ongoing monitoring and maintenance of traps at potential entry points (e.g. around the harbour) and the ability to rapidly respond to any detected incursions. These will be fully detailed in the final Compensation Implementation, Monitoring and Adaptive Management Plan which will be agreed with stakeholders post consent (see Chapter 3.2 for the Outline CIMAMP).

7.1.1.2 The status of the seabird populations will be monitored on an annual basis (for a period to be agreed with NatureScot and MD-LOT) following the completion of the rat removal, plus 1 or 2 years in advance of when this is conducted (to ensure a robust baseline). Monitoring will follow industry guidance, with additional effort to understand colony expansion into currently unoccupied sites. This will include fixed point photography and drone surveillance for locations that cannot be readily observed from a vessel or vantage point.

7.1.1.3 Collecting productivity data for auks is challenging due to the nature of their colonies, with guillemot in particular often forming dense groups, making eggs, pairs and chicks difficult to distinguish. Nonetheless, efforts will be made to initiate several plots (e.g. sections of cliff) that can be readily observed from suitable and safe vantage points to permit detailed counts to be made. These plots will provide a guide to the status and health of the populations and indicate how they are responding to removal of rats. There may be opportunities to undertake tagging work within accessible parts of the colonies. Depending on the nature of the tags used, this will enable an understanding of where the birds are foraging in the breeding season and potentially over the non-breeding season, if long-term geolocator tags are also fitted and can be retrieved. However, any such programme will need to be carefully considered to be confident that the scientific benefits justify the disturbance such activity can cause.

8 Adaptive management and strategic measures

8.1.1.1 A requirement of a compensation plan is to provide consideration of adaptive measures which could be taken if the proposed compensation either does not deliver to the agreed level, or not within agreed time periods, or both. The project led compensation proposed for Morven North and Morven South is to undertake a rat eradication campaign on the Isle of Muck with the aim of safeguarding the breeding seabird populations and allowing them to increase through expansion of their ranges, and the delivery of a compensation measure for gannet.

8.1.1.2 The rat eradication efforts themselves will include adaptive steps should the initial campaign fail to completely remove rats; those are considered separately from the compensation adaptive management measures proposed and are discussed in Chapter 3.2 for the Outline CIMAMP. Biosecurity measures will be put in place during the eradication implementation and will continue to the required duration, i.e. for the full 35 year operational lifetime of Morven North and Morven South to ensure that the rat-free status of the Isle of Muck is maintained. The long-term biosecurity protocols to be implemented post-eradication will be detailed in a Biosecurity Plan, in accordance with international best practice guidelines. These will include permanent monitoring stations equipped with wax blocks and trail cameras, effective waste management practices, and ongoing engagement with local stakeholders, such as cargo and passenger boat operators, to ensure their effectiveness.

8.1.1.3 The compensation adaptive management measures relate to the recovery of the seabird populations following the successful completion of the rat removal. While adaptive measures must, by their nature, adapt to the circumstances and cannot therefore be fully defined in advance, it is likely that they would include efforts to encourage recruitment to the islands, such as placement of decoys and broadcasting colony playback calls to draw birds in to investigate the site. Puffin nest in burrows in vegetated slopes and it is possible that following the removal of rats the vegetation may grow more vigorously and require cutting back to ensure sufficient space is available.

8.1.1.4 Morven North and Morven South also commissioned surveys of seabird numbers and rat activity on the nearby island of Rum. Rum is a much larger island (over 10,000ha) than Muck (over 500ha) and also has seabird species that would be expected to benefit from a rat removal programme, whether conducted across the island as a whole, or within fenced areas. However, the scale of undertaking is such that this is considered more appropriate to be delivered as government led strategic compensation (e.g. through the Marine Recovery Fund), to which Morven North and Morven South could potentially contribute if the primary compensation measures prove insufficient to meet the necessary levels of compensation.

8.1.1.5 Reducing disturbance to seabirds breeding at colonies was identified as a measure which could potentially be delivered by Morven North and Morven South in collaboration with other developers if required (Section 3.11). Therefore this will be revisited as a measure in the future should any of the preferred project alone options be deemed to not have met the required level of compensation.

8.1.1.6 A wider source of adaptive measures which may be available to Morven North and Morven South in later years will be strategic measures administered through the proposed Marine Recovery Fund (MRF). At this stage there only high-level details are available for how this might operate in terms of identifying projects, making contributions or delivering compensation. However, the intention is that projects requiring compensation either directly or as a means of adaptive management, will pay into the MRF and from this compensation of a scale not feasible for individual projects, or of a nature that requires government led action, will be delivered. Morven North and Morven South is committed to supporting the set up and implementation of the MRF.

8.1.1.7 It is likely that much of the compensation delivered under the MRF would fall under Tier 2 and 3 measures (i.e. ones which benefit seabirds and the marine environment more generally and therefore ecologically benefit the National Site Network overall), and these may include larger scale invasive mammal control and eradication campaigns (e.g. on larger islands, or groups of islands), habitat

restoration such as planting and expanding seagrass meadows (Section 3.6) and oyster beds, management or closure of commercial fisheries (Section 3.2), trials of seaweed farming as a means to reduce plastic collection for nesting material (Section 3.10), efforts to reduce disturbance to colonies caused by close approaching vessels such as dive boats (Section 3.11) and support for implementing widescale measures to reduce incidental seabird bycatch (Section 3.7).

9 Summary

9.1.1.1 To ensure Scottish Ministers have the information they need to inform their decision on the appropriateness of the proposed compensation measure, the following checklist (Table 9.1) provides a guide to the proposed compensation and how it addresses relevant guidance (Section 1.2).

Table 9.1: Summary compensation checklist with RAG colouring. Green criteria are considered to be addressed already, amber criteria will require external agreements (e.g. with Government) but these are expected to be forthcoming once consent for Morven North and Morven South is awarded.

Criteria	Muck rat eradication
Ecological benefits	Invasive mammal eradication (often including rats) from seabird breeding colonies has a proven track-record of improving the conservation status of seabirds.
Technically feasible	Similar island-wide rat eradication schemes have been conducted in the UK (and world-wide) and Muck does not present any unforeseen challenges.
Sustainable	With commitment to the biosecurity, long-term monitoring and production of an incursion response plan, the outcomes can be sustained as demonstrated by comparable projects in the UK.
Politically acceptable	Local and National Government support will be required as well as agreement from NatureScot
Legally acceptable	Will require a Critical Situation Permit from HSE to authorise the use of preferred rodenticides for 'open use', underpinned with a robust environmental/non-target species management plan. Landowner exclusivity agreement in place.
Socially acceptable	Positive support from all external landowners and stakeholders consulted to date. No reason at present to believe that eradication would not be acceptable to local stakeholders on Muck.
Environmentally acceptable	Supported with non-target species risk assessment and mitigation plan and following relevant license conditions for use of rodenticides.
Capacity	Suitably skilled contractors are available and will be appointed once plan approved.
Affordability	Sufficient resources to conduct and maintain the eradication will be part of the business case for Morven North and Morven South.
When will benefits occur	Seabird productivity should begin improving in the breeding season following completion of the rat removal.

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