PINE MARTENS BOUNCE BACK

The Two Moors Pine Marten Project



Habitats Regulations Assessment (HRA) Stage 2: Appropriate Assessment

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Two Moors Pine Marten Reintroduction Project

Introduction

This document forms the appropriate assessment component of the Habitats Regulations Assessment. This assessment is in response to Natural England regarding the Two Moors Project, HRA, Stage 1: Screening Assessment of February 2023. A full introduction to the project may be found within the screening assessment report. The HRA screening assessment was undertaken on all European nature conservation sites within a 20km radius of the Proposed Release Regions (PRR) of the Two moors Pine Marten Project. In addition, all Sites of Special Scientific Interest (SSSI) within 10km of PRRs were screened.

The response from Natural England specified appropriate assessment of the following:

<u>SACs</u> identified as having the potential to be impacted by the project:

- Exmoor and Quantock Oakwoods SAC
- Hestercombe House SAC
- South Dartmoor Woods SAC
- South Hams SAC
- Dartmoor SAC (features only listed within Dendles wood SSSI)

<u>21 SSSIs</u> were identified as having the potential to be impacted by the project. These 21 sites support notable populations of dormice, important bat roosts or rare woodland bird assemblages. The majority of these are within SACs and summarised below under those headings. Note: species listed within SSSI citations may not be designated features within the overlapping SAC but the assessment and the residual adverse effect applies to those species.

Natural England was particularly concerned about the <u>potential predation</u> by Pine Martens on:

- Barbastelle and Bechstein's bats and breeding woodland birds (such as pied flycatcher) within the **Exmoor and Quantock Oakwoods SAC**.
- Breeding woodland birds (such as pied flycatcher) within the South Dartmoor Woods SAC
- Lesser Horseshoe bats within the Hestercombe House SAC
- Greater Horseshoe bats (and other bat species within the South Hams SAC.
- Breeding woodland birds and Barbastelle bats within the **Dartmoor SAC (features only listed** within **Dendles wood SSSI** which is the only woodland element of the Dartmoor SAC)

SSSIs not already included in above SACs

Concern that the application might have the following adverse effects on the SSSIs:

Predation by Pine Martens on, (or competition for prey, in the case of raptors) with:

- Breeding Goshawk, breeding Honey Buzzard and the raptor assemblage of the Haldon Forest SSSI.
- Nightjar of the Haldon Forest SSSI
- Breeding woodland birds at Stoke Woods SSSI

While the HRA Screening and the NE response did not include Beer Quarry and Caves SAC as its designated sites are outside the PRR+20km zone, this has been included within this appropriate assessment due to the main associated maternity roost lying within the PRR+20 zone and the connectivity to other roosts being good.

To justify the conclusions reached in this assessment, the known ecology of pine marten together with their probable activity post-release were considered. Please also see the screening assessment report for a full account. In summary, whilst assessing potential risk of impact to the species listed within this document, the hunting and feeding strategy of pine marten are considered along with its rarity in the landscape, even when at carrying capacity. Where species are uncommon or also exist at low densities, the probability of predation by pine marten will be low due to the pine marten's generalist and opportunistic feeding strategy, eating what is seasonal, abundant and easily available. As seen in dietary studies, species such as dormice, are only a significant component where they occur more frequently (see dormouse section 2.7).

All species listed below co-evolved with pine marten, many with anti-predator strategies such as multiple broods and behaviours such as egg covering seen in many bird species, frequent movement of roosts as seen in woodland bats, avoidance of areas frequented by pine marten (such as food sources) seen in small mammals (for references see relevant sections in Part Two: Evidence by theme and Addendum, this report).

Pine marten territories and home ranges relate to habitat quality and food abundance as well as access to shelter for resting and denning. There is minimal overlapping in territories, resulting in a low density of individuals in the landscape. Habitat suitability mapping suggest Devon's habitat could support roughly 120 individuals.

Releases are planned to take place over two years, into two potential release regions (PRR) one each on Dartmoor and Exmoor. Best practice suggests releasing animals into the core of these areas give maximum opportunity for post- release dispersal. Based on post-release monitoring of animals in Wales (McNicol et al., 2021) the first year this distance is predicted to be approximately 9km from the release site (mean of 8.7km), primarily within the first two weeks of release.

The distance of the conservation feature from the PRR may be considered when determining risk, however, the long-term aim of the project is for pine marten to disperse rapidly throughout the PRR and buffers wherever habitat allows and as such, the conclusion of residual risk made here are based on that assumption as there is no phase where there is increased risk to the release area through higher population density.

For reference, a table of SSSI and their distances to the PRRs are given in the screening report and reproduced within the SSSI section on page 38 of this report for ease.

Mitigation measures are outlined within each section. Reactive mitigation places a greater emphasis on monitoring the pine marten via radio-tracking, GPS and camera trapping because of the greater likelihood of this providing information on potential adverse effects on SACs, in the context of the extremely large number of target species within the project area. This identification of pine marten presence over a wide area, followed by high intensity deployment in risk situations, will be employed where appropriate. See individual sections.

Summary findings

- Six SACs (including Beer Quarry and Caves) were assessed. The only relevant component of the Dartmoor SAC is Dendles Wood SSSI. 21 SSSIs including several that lay outside SACs were also included.
- Habitat features were not considered to be at risk. However, benefits to habitats may
 occur through improved natural regeneration of woodland habitat through increased
 seed dispersal of fruiting species, and reduced tree damage and consumption of tree
 seed through a reduction in grey squirrel numbers. Reduction of grey squirrel population
 will also reduce predation pressure by that species on other woodland species, allowing
 greater diversity within woodland ecosystems.

- The primary species focus was on bats (specifically greater and lesser horseshoe bats, and woodland species, Barbastelle and Bechstein's bats), woodland birds and raptors. Dormice were also included within some of the SSSI citations.
- Pine marten were not considered to cause any residual adverse effect on woodland birds and (non-bat) mammals at a population level, in a natural situation. The generalist feeding habits of the pine marten mean greater predation of the common species, since they will prey on the most abundant food source. Rare, opportunist predation of these species will not cause adverse population level effects.
- Prey competition between pine marten and raptors was not considered likely to cause any residual adverse effect on the specified raptor species or the raptor assemblage. This is due to the compensatory effect of predation on the prey population and habitat partitioning.
- Benefits to some species of concern may come about through predator mediated competition and potentially predator protection. Changing predation pressure on woodland birds (via pine marten predation of grey squirrel, corvids and great spotted woodpecker) may benefit other species.
- The main risk of negative impact to species of concern is in human mediated environments where species are using anthropogenic structures in replacement of natural features - such as bat roosts in buildings and nest boxes for birds. Pine marten (and other predators) may learn associations of prey with nest boxes. Large bat roosts, while unlikely to be found by pine marten, carry a moderate risk of predation and disturbance due to the proportion of a local population that may be using an individual roost, mediated by the accessibility of the feature to pine martens. Mitigation measures for these circumstances may be proactive or reactive, depending on circumstances or outcomes of monitoring.

A summary of features associated with the protected areas and their assessment can be found in Table 1.

Table 1. Summary table of conservation features considered for appropriate assessment. * Included as specifically requested by NE. Species rated green or least concern are not included unless they are a listed feature of an SAC or SSSI. Some species may benefit from the presence of pine marten and actions to maximise these benefits are suggested. + Beer Quarry and Caves SAC falls outside the PRR buffer zone but the maternity roost integral to the functioning of the SAC lies within it. Conservation status for birds: BOCC 5 assessment at European and global level. Mammals: English Red list. PRR = Potential Release Region. Release Area = Priority Area within PRR selected for release sites.

Conservation feature	Component if noted		SAC & individual SSSI where not part of a wider SAC	Mitigation and actions to maximise benefit Actions to maximise benefit are NOT presented as	Residual adverse effect
				mitigation measures.	If mitigation
		itus			undertaken, are you
		Sta			sure that no
					adverse effect on
					the integrity of the
					site will occur.
Breeding	Pied flycatcher		South Dartmoor Woods SAC	Mitigation:	Yes
(woodland) bird	Ficedula		Exmoor and Quantock	Trial nest box mitigation (including external and	
assemblage:	hypoleuca		Oakwoods SAC	internal baffles) to understand nestbox occupancy	
			Dartmoor SAC	effects. If effects are low, then deploy proactively	
				within Release Area and reactively beyond Release	
				Area. If effects are moderate to high, then deploy	
				reactively where signs of predation are occurring.	
		er		How to maximise benefit:	Yes
		qu		Provide woodland management advice to	
		∢		landowners encouraging varied woodland habitat	
				structure, including open woodland habitats,	
				retention of ivy and creation of veteran tree	
				features including cavities, fungal decay, and nest	
				holes.	
				Seek opportunities to connect and de-fragment	
				woodlands through woodland creation to increase	
				woodland area and reduce fragmentation effects.	

Wood warbler		South Dartmoor Woods SAC	How to maximise benefit:	Yes
Phylloscopus		Exmoor and Quantock	Provide woodland management advice to	
sibilatrix		Oakwoods SAC	landowners encouraging varied woodland habitat	
		Dartmoor SAC	structure, including development of more open	
	p	Stoke Woods SSSI	woodland understoreys (suitable to the woodland	
	Re		type) in a proportion of woodland.	
			Seek opportunities to create, connect and de-	
			fragment woodlands through woodland creation to	
			reduce edge effect which otherwise benefits pine	
			marten predation of wood warbler.	
Redstart		South Dartmoor Woods SAC	How to maximise benefit:	Yes
Phoenicurus	er	Exmoor and Quantock	Provide woodland management advice to	
phoenicurus	np	Oakwoods SAC	landowners encouraging varied woodland habitat	
	A	Dartmoor SAC	structure, including increasing deadwood and	
			levels of low-level woodland cover.	
Lesser spotted		South Dartmoor Woods SAC	How to maximise benefit:	Yes
woodpecker		Exmoor and Quantock	Provide woodland management advice to	
Dendrocopus		Oakwoods SAC	landowners encouraging varied woodland habitat	
minor		Stoke Woods SSSI	structure, including open woodland habitats,	
	pa		retention of deadwood, particularly smaller	
	Ř		standing deadwood trees and branches, and	
			increased number of mature trees.	
			Seek opportunities to connect and de-fragment	
			woodlands through woodland creation to increase	
			woodland area and reduce fragmentation effects.	
Merlin <i>Falco</i>		Exmoor and Quantock	How to maximise benefit:	Yes
columbaris		Oakwoods SAC	Provide woodland and heathland management	
	ed		advice to landowners encouraging varied habitat	
	ž		structure, including increasing areas of open	
			ground with adjacent woodland suitable for nesting	
			merlin.	

	Tawny owl Strix aluco	Amber	Exmoor and Quantock Oakwoods SAC Stoke Woods SSSI	Mitigation (reactive): Explore mitigation measures to tawny owl nestboxes reactively due to low level of risk and low numbers of nestboxes in landscape.	Yes
Nightjar Caprimulgus europaeus	n/a	Amber	South Dartmoor Woods SAC Exmoor and Quantock Oakwoods SAC Haldon Forest SSSI Stoke Woods SSSI	How to maximise benefit: Provide woodland and heathland management advice to landowners encouraging varied habitat structure, including increasing areas of open ground suitable for nesting nightjar.	Yes Also see monitoring plan in Addendum
Assemblage of breeding birds of prey:	Honey buzzard Pernis apivorus	Amber	Haldon Forest SSSI (not confirmed breeding since 1995)		Yes
	Goshawk Accipiter gentilis	*Not listed	Haldon Forest SSSI		Yes
	Sparrowhawk Accipiter nisus	Amber	Haldon Forest SSSI		Yes
	Kestrel Falco tinnunculus	Amber	Haldon Forest SSSI	Mitigation (reactive): Explore mitigation measures to barn owl nest boxes (which are occasionally used by kestrel) reactively due to low level of risk.	Yes

Dormouse Muscardinus avellanarius	n/a	Vulnerable (Eng)	Exmoor and Quantock Oakwoods SAC South Dartmoor Woods SAC Haldon Forest SSSI Ladies Wood SSSI	Mitigation (proactive): Providing proactive advice to dormouse monitoring volunteers (via Peoples Trust for Endangered Species) of the importance of positioning nestboxes within dense understorey for predator protection and the need to firmly secure nestbox lids and ensure nest boxes are of robust construction.	Yes
Also see acc	companying docun	nent 'Asses	sment to inform HRA Pine Marte	ens and Bats' including flow chart of monitoring and m	itigation strategy
All bat species	General			Mitigation (proactive): Pine marten den boxes will be installed in areas away from known bat colonies to provide alternative denning sites to limit competition for bat roosting sites.	Yes
Barbastelle bat Barbastella barbastellus	Tree roosts	ulnerable (Eng)	Exmoor and Quantock Oakwoods SAC Dartmoor SAC	Mitigation (reactive): Where monitoring identifies pine marten near <u>high</u> <u>value roost</u> , examine if practical to use bespoke deterrents (climbing baffles/anti-climb sheeting, mesh tubes, entrance hole reducers) – deploy reactively where suitable. Consider pine marten translocation as last resort – see flow chart of monitoring and mitigation.	Yes
		>		How to maximise benefit (bat habitat): Provide woodland management advice to landowners encouraging retention of tree features favourable to bats.	n/a

Bechstein's bat Myotis bechsteinii	Tree roosts		Exmoor and Quantock Oakwoods SAC	Mitigation (reactive): Where monitoring identifies pine marten near <u>high</u> <u>value roost</u> , examine if practical to use bespoke deterrents (climbing baffles/anti-climb sheeting, mesh tubes, entrance hole reducers) – deploy reactively where suitable. Consider translocation as last resort– see flow chart of monitoring and	Yes
				mitigation.	
				How to maximise benefit (bat habitat):	n/a
		()		Provide woodland management advice to	
		Eng		landowners encouraging retention of tree features	
) u		favourable to bats.	
	General	cer	⁺ Beer Quarry and Caves SAC	Mitigation (proactive):	Yes
		con		Monitoring using trail cameras will target the	
		ist e		pinch-point area where pine martens may move to	
		Lea		the east of the Exe Estuary. If activity is detected in	
				this area, then the following mitigation approaches	
				should be followed as there is good connectivity	
				from there to the Beer Quarry and Caves SAC and	
				associated roosts.	
	Underground			Mitigation (reactive):	Yes
	roosts			Where monitoring identifies pine marten near <u>high</u>	
				value roost examine if practical to use bespoke	
				mitigation – deploy reactively where suitable.	
				Consider translocation as last resort- see flow chart	
				of monitoring and mitigation.	

	Tree roosts			Mitigation (reactive): Where monitoring identifies pine marten near <u>high</u> <u>value roost</u> , examine if necessary/practical to use deterrents (climbing baffles/anti-climb sheeting, mesh tubes, entrance hole reducers) – deploy reactively where suitable. Consider translocation as last resort– see flow chart of monitoring and mitigation. How to maximise benefit (bat habitat):	Yes n/a
				Provide woodland management advice to landowners encouraging retention of tree features favourable to bats.	
Greater horseshoe bat Rhinolophus ferrumequinum	Building roosts		South Hams SAC Hestercombe House SSSI	Mitigation (proactive): Bespoke mitigation of <u>high value roosts</u> within PRRs and 20km buffer to prevent access by pine marten. Consider translocation as last resort – see flow chart of monitoring and mitigation.	Yes
		.east concern (Eng)		Mitigation (reactive): Where monitoring identifies pine marten near <u>moderate value roost</u> examine if appropriate or practical to use bespoke mitigation – deploy reactively where suitable. Consider translocation as last resort – see flow chart of monitoring and mitigation.	Yes
	Underground roosts		South Hams SAC Napp's Cave SSSI Potters Wood SSSI Torbryan Caves SSSI	Mitigation (reactive): Where monitoring identifies pine marten near <u>high</u> <u>value roost</u> examine if practical to use bespoke mitigation – deploy reactively where suitable. Consider translocation as last resort – see flow chart of monitoring and mitigation.	Yes

General	⁺ Beer Quarry and Caves SAC	Mitigation (proactive): Monitoring using trail cameras will target the pinch-point area where pine martens may move to the east of the Exe Estuary. If activity is detected in this area, then the following mitigation approaches should be followed as there is good connectivity from there to the Beer Quarry and Caves SAC and associated roosts.	Yes
Building roosts		Mitigation (proactive – following movement into East Devon): Bespoke mitigation of <u>high value roosts</u> within PRRs and 20km buffer and other key SAC roosts to prevent access by pine marten. Consider translocation as last resort – see flow chart of monitoring and mitigation.	Yes
		Mitigation (reactive): Where monitoring identifies pine marten near <u>moderate value roost</u> examine if appropriate to use bespoke mitigation – deploy reactively where suitable. Consider translocation as last resort – see flow chart of monitoring and mitigation.	Yes
Underground roosts		Mitigation (reactive): Where monitoring identifies pine marten near <u>high</u> <u>value roost</u> examine if practical to use bespoke mitigation – deploy reactively where suitable. Consider translocation as last resort – see flow chart of monitoring and mitigation.	Yes

Lesser horseshoe bat Rhinolophus hipposideros	Building roosts		Hestercombe House SAC South Hams SAC	Mitigation (proactive): Bespoke mitigation of <u>high value roosts</u> within PRRs and 20km buffer to prevent access by pine marten. Consider translocation as last resort – see flow chart of monitoring and mitigation. Mitigation (reactive):	Yes
		Eng)		Where monitoring identifies pine marten near <u>moderate value roost</u> examine if appropriate to use bespoke mitigation – deploy reactively where suitable. Consider translocation as last resort – see flow chart of monitoring and mitigation.	
	Underground roosts	Least concern (South Hams SAC Napp's Cave SSSI Torbryan Caves SSSI	Mitigation (reactive): Where monitoring identifies pine marten near <u>high</u> <u>value roost</u> examine if practical to use bespoke mitigation – deploy reactively where suitable. Consider translocation as last resort – see flow chart of monitoring and mitigation.	Yes
	General		⁺ Beer Quarry and Caves SAC	Mitigation: Monitoring using trail cameras should target the pinch-point area where pine martens may move to the east of the Exe Estuary. If activity is detected in this area, then building roosts should be defended as there is good connectivity from there to the Beer Quarry and Caves SAC and associated roosts.	Yes

Building roosts	Mitigation (proactive – following movement into East Devon): Bespoke mitigation of <u>high value roosts</u> within PRRs and 20km buffer and other key SAC roosts to prevent access by pine marten. Consider translocation as last resort – see flow chart of monitoring and mitigation.	Yes
	Mitigation (reactive): Where monitoring identifies pine marten near <u>moderate value roost</u> examine if appropriate to use bespoke mitigation – deploy reactively where suitable. Consider translocation as last resort – see flow chart of monitoring and mitigation.	Yes
Underground roosts	Mitigation (reactive): Where monitoring identifies pine marten near <u>high</u> <u>value roost</u> examine if practical to use bespoke mitigation – deploy reactively where suitable. Consider translocation as last resort – see flow chart of monitoring and mitigation.	Yes

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Habitats Regulations Assessment Appropriate Assessment

This HRA is split into two sections:

- Part One describes the impact of the project on the Qualifying Features and Conservation Objectives of SACs and SSSIs within the Screening Area
- Part Two provides the evidence that informs the impacts described in Part One

Part One: Impact on Qualifying Features and Conservation Objectives

Special Areas of Conservation

Conservation Objectives

The following table shows the Conservation Objectives of the six SACs assessed.

Conservation Objective	SAC
The extent and distribution of qualifying natural	Dartmoor
habitats and habitats of qualifying species	Exmoor and Quantock Oakwoods
	South Hams
The extent and distribution of the habitats of	Beer Quarry and Caves
qualifying species	Hestercombe House
The extent and distribution of qualifying natural habitats	South Dartmoor Woods
The structure and function (including typical	Dartmoor
species) of qualifying natural habitats	Exmoor and Quantock Oakwoods
	South Dartmoor Woods
	South Hams
The structure and function of the habitats of	Beer Quarry and Caves
qualifying species	Dartmoor
	Hestercombe House
	Exmoor and Quantock Oakwoods
	South Hams
The supporting processes on which qualifying	Dartmoor
natural habitats and the habitats of qualifying	Exmoor and Quantock Oakwoods
species rely	South hams
The supporting processes on which the habitats	Beer Quarry and Caves
of qualifying species rely	Hestercombe House
The supporting processes on which qualifying	South Dartmoor Woods
natural habitats rely	
The populations of qualifying species	Beer Quarry and Caves
	Dartmoor
	Hestercombe House
	Exmoor and Quantock Oakwoods
	South Hams
The distribution of qualifying species within the	Beer Quarry and Caves
site	Dartmoor
	Hestercombe House
	Exmoor and Quantock Oakwoods
	South Hams

The only Conservation Objective likely to be negatively impacted by the project is the '**populations of qualifying species**' objective. This objective is dealt with through the individual qualifying features below. All Conservation Objectives may be positively impacted by the project either directly through return of pine martens and/or indirectly through other project activities, particularly the provision of landowner advice and support on habitat management.

Timing

Pine martens would be released during the early autumn of the project release years (2024 and 2025). Wild pine martens will be trapped in Scotland at various sites to minimise impact on any one

donor site. All animals would be checked by a wildlife vet and fitted with a radio collar, followed directly by translocation to Dartmoor/Exmoor, three to five days within a soft release pen to reduce stress prior to final wild release. A maximum of four martens can be transported at a time and a maximum of eight martens at a time could be within soft release pens followed by a break for cleaning. This means that the translocation process is likely to last a number of weeks dependent upon trapping success. The release period is therefore likely to last as much as two months. Pine martens in previous reintroductions have undergone a dispersal phase during the first two weeks after release followed by a settlement phase after that, where they will establish territories. Occasionally martens released early that initially establish territories can be displaced by subsequently released martens. Therefore, released martens may be expected to have settled into territories by late Autumn and up until this point may be more mobile as they seek unoccupied good quality habitat. The release process described above, which by necessity would create a series of phased small releases over two months, means population density is unlikely to exceed natural carrying capacity. Indeed, as pine martens are arriving into a landscape with no resident martens, there will be less population pressure to limit territory size through competition and so population density would be expected to be well below carrying capacity.

Therefore, risks that are examined below are considered as a **<u>permanent and ongoing risk</u>** as there is no phase where there is increased risk to the release area through higher population density.

Bats

A separate expert assessment has been carried out to inform this HRA around the potential impact of this project on bats. The results have informed this assessment and the report is included within the submission to Natural England, including a flow chart of monitoring and mitigation. Summaries of relevant sections have been included within this report where it provides clarity.

Habitats

While potential impact on habitats were screened out for this HRA, potential benefits on habitat have been included within this assessment as this is a key objective of the project. Where opportunities to maximise benefits are highlighted, these activities are planned within the project lifetime and would not be practical or appropriate to deliver prior to release of pine martens.

Beer Quarry and Caves SAC

Species - risks

Feature		Risk		Risk prior	Proposed mitigation	Residual Bisk	Residual adverse
				mitigation		MISK	If mitigation
	Nature	Likelihood	Severity				undertaken, are you sure that no adverse effect on the integrity of the site will occur.
All bats	 Provide alternative denning opportunities 				Pine marten den boxes will be proactively installed in areas away from known bat colonies to provide alternative denning sites to limit competition for bat roosting sites.	Low	Yes
All bats	•Movement and connectivity to roosts	Low	Moderate	Moderate	Proactive monitoring using trail cameras will target the pinch-point area where pine martens may move to the east of the Exe Estuary. If activity is detected in this area, then the following mitigation approaches should be followed as there is good connectivity from there to the Beer Quarry and Caves SAC and associated roosts.	Low	Yes
Lesser horseshoe bat Rhinolophus hipposideros – cave roosting	• Predation Disturbance	Low	Moderate	Moderate	Where monitoring identifies pine marten near <u>high value roost</u> examine if practical to use bespoke mitigation – deploy reactively where suitable. Consider translocation as last resort – see flow chart of monitoring and mitigation.	Low	Yes
Lesser horseshoe bat Rhinolophus hipposideros – building roosting	Predation Disturbance	Low	Moderate	Moderate	Bespoke proactive (following movement into East Devon) mitigation of <u>high value roosts</u> within PRRs and 20km buffer to prevent access by pine marten. Consider translocation as last resort – see flow chart of monitoring and mitigation.	Low	Yes

					Where monitoring identifies pine marten near <u>moderate value roost</u> examine if appropriate or practical to use bespoke mitigation – deploy reactively where suitable. Consider translocation as last resort – see flow chart of monitoring and mitigation.		
Greater horseshoe bat Rhinolophus ferrumequinum – cave roosting	 Predation Disturbance 	Low	Moderate	Moderate	Where monitoring identifies pine marten near <u>high value roost</u> examine if practical to use bespoke mitigation – deploy reactively where suitable. Consider translocation as last resort – see flow chart of monitoring and mitigation.	Low	Yes
Greater horseshoe bat Rhinolophus ferrumequinum – building roosting	 Predation Disturbance 	Low	Moderate	Moderate	Bespoke proactive (following movement into East Devon) mitigation of <u>high value roosts</u> within PRRs and 20km buffer to prevent access by pine marten. Consider translocation as last resort – see flow chart of monitoring and mitigation. Where monitoring identifies pine marten near <u>moderate value roost</u> examine if appropriate or practical to use bespoke mitigation – deploy reactively where suitable. Consider translocation as last resort – see flow chart of monitoring and mitigation.	Low	Yes
Bechstein's Bat <i>Myotis</i> <i>bechsteinii</i> – cave roosting	 Predation Disturbance 	Low	Moderate	Low	Where monitoring identifies pine marten near <u>high value roost</u> , examine if practical to use bespoke deterrents (climbing baffles/anti-climb sheeting, mesh tubes, entrance hole reducers) – deploy reactively where suitable. Consider pine marten translocation as last resort – see flow chart of monitoring and mitigation.	Low	Yes

Bechstein's Bat Myotis	 Predation 	Low	Moderate	Low	Where monitoring identifies pine marten	Low	Yes
<i>bechsteinii</i> – tree	 Competition 				near high value roost, examine if practical to		
roosting	(cavity roost				use bespoke deterrents (climbing		
	sites)				baffles/anti-climb sheeting, mesh tubes,		
					entrance hole reducers) – deploy reactively		
					where suitable. Consider pine marten		
					translocation as last resort – see flow chart		
					of monitoring and mitigation.		

Use of the site by Pine martens

Modelling suggests that the conductivity of the landscape between the PRR and the site is good. However, it should be noted that the model could not account of the connectivity gap caused by the River Exe and Exe Estuary. Therefore, the only plausible regions of connectivity are around the upper reaches of the river, where it is either swimmable or bridges are available (Topsham and the outskirts of Exeter). Given this lack of connectivity, and the presence of only a small number of sites (excluding the cliff caves, about which little is known), the likelihood of use is considered **low**.

Impact on designated feature

There is potential for pine martens to prey on horseshoe bats in building roosts, or to cause colonies to abandon the site, resulting in a **moderate** impact. For underground sites, the probability of significant effects is **low** owing to the elevated and inaccessible positions of bats in most of the systems. There is potential for a greater impact on bats in smaller sea cliff caves, but these are thought to accommodate few individuals.

Pine martens may prey upon Bechstein's bats opportunistically and may also compete for den sites. However, availability of alternative roosting sites is likely to be high, as is alternative prey availability for pine martens. Overall impact on bats is considered likely to be **low**.

Overall, the risk of significant impacts on designated features of the SAC is considered **low**. However, monitoring using trail cameras should target the pinchpoint area where pine martens may move to the east of the Exe Estuary. If activity is detected in this area, then building roosts should be defended as there is good connectivity from there to the Beer Quarry and Caves SAC and associated roosts.

Dartmoor SAC (Dendles wood SSSI component) Dendles Wood SSSI

Species - risks

Feature Ris		Risk	Risk		Proposed mitigation	Residual	Residual adverse
	Nature	Likelihood	Severity	prior to mitigatio n		Risk	effect If mitigation undertaken, are you sure that <i>no</i> adverse effect on the integrity of the site will occur.
Assemblage of breeding woodland birds (favourable condition) including:	 Predation Competition (nesting spaces) 	Low- moderate (largely abundance- related)	Low, pine marten predation and competition likely to be compensatory	Low		Low	Yes
Pied flycatcher Ficedula hypoleuca	• Predation	Low (natural nesting)	Low, pine marten predation likely to be compensatory	Low		Low	Yes
		Moderate (nestbox nesting)	Moderate, although pine marten predation likely to be partly compensatory	Moderate	Trial nest box mitigation (including external and internal baffles) to understand nestbox occupancy effects. If effects are low, then deploy proactively within Release Area and reactively beyond Release Area. If effects are moderate to high, then deploy reactively where signs of predation are occurring.	Low	Yes
Wood warbler Phylloscopus sibilatrix	•Predation	Low	Low, pine marten predation likely to be compensatory	Low		Low	Yes

Redstart Phoenicurus phoenicurus	● Predation	Low	Low, pine marten predation and competition likely to be compensatory	Low		Low	Yes
Buzzard Buteo buteo	 Predation Competition (prey and nesting spaces) 	Low	Low	Low		Low	Yes
Barbastelle bat Barbastella barbastellus - maternity colony utilising a range of tree roosts (not a feature but key species recognised since designation)	 Predation Competition (cavity roost sites) 	Low	Moderate	Low	Where monitoring identifies pine marten near <u>high value roost</u> , examine if practical to use bespoke deterrents (climbing baffles/anti-climb sheeting, mesh tubes, entrance hole reducers) – deploy reactively where suitable. Consider pine marten translocation as last resort – see flow chart of monitoring and mitigation.	Low	Yes

This 50.4 ha upland oakwood is located 8km from the closest PRR. It has a breeding colony of barbastelle bats. Pine martens may prey upon barbastelle bats opportunistically and may also compete for den sites. However, availability of alternative sites is likely to be high, as is alternative prey availability for pine martens. Overall impact on bats is considered likely to be **Low**.

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Feature	Benefit	How to maximise benefits
Woodland bird assemblage	 Predator-mediated competition (predation of other competitors of woodland birds for food and nesting opportunities) Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on woodland birds, notably grey squirrel, corvids, raptors and great spotted woodpecker) 	 Project staff to provide landowner advice around woodland management, use of pesticides and enhancement of complementary habitats (e.g. grasslands around woodlands) to facilitate landscape- scale changes that support woodland birds. Woodland management advice to include a range of requirements of different species, including methods for long-term creation of tree cavity nesting opportunities.
Pied flycatcher <i>Ficedula hypoleuca</i>	 Predator-mediated competition (predation of competitors of pied flycatcher for nesting opportunities) Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on pied flycatcher, notably small mammals, great spotted woodpecker and grey squirrel) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including open woodland habitats, retention of ivy and creation of veteran tree features including cavities, fungal decay and nest holes. Seek opportunities to connect and de-fragment woodlands through woodland creation to increase woodland area and reduce fragmentation effects.
Wood warbler <i>Phylloscopus sibilatrix</i>	 Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on wood warbler, notably jay, other corvids, great spotted woodpecker and rodents) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including development of more open woodland understoreys (suitable to the woodland type) in a proportion of woodland.

		 Seek opportunities to create, connect and de-fragment woodlands through woodland creation to reduce edge effect which otherwise benefits pine marten predation of wood warbler.
Common redstart Phoenicurus phoenicurus	 Grey squirrel predation (predator of redstart) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including increasing deadwood and levels of low-level woodland cover.

Habitats - benefits

Feature	Benefit	How to maximise benefits
 Ancient upland oak woodland (favourable condition) 	 Predator-mediated competition Predator protection hypothesis Trophic cascades Seed dispersal (including rowan Sorbus aucuparia, bramble Rubus fruticosus and bilberry Vaccinium myrtillus) Grey squirrel predation 	 Provide more suitable habitat (better) – through advising/supporting landowners to enhance woodland management Increase habitat availability (bigger, joined, more) – through new woodland planting, natural regeneration and complementary habitats

Exmoor and Quantock Oakwoods SAC

Species-risks

Feature	Risk			Risk prior	Proposed mitigation	Residual	Residual adverse
	Nature	Likelihood	Severity	to mitigation		Risk	effect If mitigation undertaken, are you sure that <i>no</i> adverse effect on the integrity of the site will occur.
All bats	 Provide alternative denning opportunities 				Pine marten den boxes will be proactively installed in areas away from known bat colonies to provide alternative denning sites to limit competition for bat roosting sites.	Low	Yes
Barbastelle bat Barbastella barbastellus - maternity colony utilising a range of tree roosts in the oak woodland	 Predation Competition (cavity roost sites) 	Low	Moderate	Low	Where monitoring identifies pine marten near <u>high value roost</u> , examine if practical to use bespoke deterrents (climbing baffles/anti-climb sheeting, mesh tubes, entrance hole reducers) – deploy reactively where suitable. Consider pine marten translocation as last resort – see flow chart of monitoring and mitigation.	Low	Yes
Bechstein's Bat <i>Myotis</i> bechsteinii – also supported by woodland	 Predation Competition (cavity roost sites) 	Low	Moderate	Low	Where monitoring identifies pine marten near <u>high value roost</u> , examine if practical to use bespoke deterrents (climbing baffles/anti-climb sheeting, mesh tubes, entrance hole reducers) – deploy reactively where suitable. Consider pine marten translocation as last resort – see flow chart of monitoring and mitigation.	Low	Yes

Bats: summary from expert assessment:

Potential use of site by pine martens This SAC has suitable habitat close to several PRRs and therefore potential for use by pine martens is **High**.

Impact on designated feature

Pine martens will forage throughout the SAC's designated habitat which supports a wide variety of potential prey species. Pine martens may prey upon both barbastelle and Bechstein's bats opportunistically and may also compete for den sites. However, availability of alternative sites is likely to be high, as is alternative prey availability for pine martens. Overall impact on bats is considered likely to be **Low**.

Habitats-benefits

Feature	Benefit	How to maximise benefits		
 Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae). (Alder woodland on floodplains) - Annex I (Habitats Directive) priority habitat Old sessile oak woods with <i>llex</i> and <i>Blechnum</i> in the British Isles. (Western acidic oak woodland) 	 Predator-mediated competition Predator protection hypothesis Trophic cascades Seed dispersal Grey squirrel predation 	 Enhance habitat condition (better) – through advising/supporting landowners to enhance woodland management Increase habitat availability (bigger, joined, more) – through new woodland planting, natural regeneration and complementary 		
		habitats		

Hestercombe House SAC

Species - risks

Feature	Risk			Risk prior	Proposed mitigation	Residual	Residual adverse
	Nature	Likelihood	Severity	to mitigation		Risk	effect If mitigation undertaken, are you sure that <i>no</i> adverse effect on the integrity of the site will occur.
All bats	 Provide alternative denning opportunities 				Pine marten den boxes will be proactively installed in areas away from known bat colonies to provide alternative denning sites to limit competition for bat roosting sites.	Low	Yes
Lesser horseshoe bat Rhinolophus	•Predation	Low	Moderate	Moderate	Bespoke proactive mitigation of <u>high value</u> <u>roosts</u> within PRRs and 20km buffer to prevent access by pine marten. Consider	Low	Yes

hipposideros –building	•Competition	translocation as last resort – see flow chart	
roosts	(use of	of monitoring and mitigation.	
	building	Where monitoring identifies pine marten	
	roost for	near moderate value roost examine if	
	denning)	appropriate to use bespoke mitigation –	
	 Disturbance 	deploy reactively where suitable. Consider	
		translocation as last resort – see flow chart	
		of monitoring and mitigation.	

Potential use of site use by pine martens

There is some potential for pine martens to use the building, though the maintenance of the grounds and high amounts of anthropogenic disturbance around the building means that the overall probability is **Low**.

Impact on designated feature

There is potential for pine martens to prey on lesser horseshoe bats, or to cause the colony to abandon the site owing to disturbance. Impact on the designated features is therefore considered to be **Moderate**.

South Dartmoor Woods SAC

Species – risks

Feature	Risk			Risk prior	Proposed mitigation	Residual	Residual adverse
	Nature	Likelihood	Severity	to mitigation		Risk	effect If mitigation undertaken, are you sure that <i>no</i> adverse effect on the integrity of the site will occur.
Nightjar Caprimulgus europaeus	• Predation	Low	Low, pine marten predation and competition likely to be compensatory	Low		Low	Yes
Assemblage of breeding	 Predation 	Low- moderate	Low, pine marten	Low		Low	Yes

woodland birds	 Competition 	(largely	predation and				
including:	(nesting	abundance-	competition				
	spaces)	related)	likely to be				
Dia di fluccatale au		1	compensatory	1		1	
Pied flycatcher	 Predation 	Low (natural	Low, pine	LOW		LOW	Yes
псеции пуротецки		nesting)	narten				
			likely to be				
			compensatory				
		Moderate	Moderate	Moderate	Trial nest hoy mitigation (including external	Low	νος
		(nesthox	although nine	Woderate	and internal baffles) to understand	LOW	163
		nesting)	marten		nestbox occupancy effects. If effects are		
		11000118/	predation		low, then deploy proactively within		
			likely to be		Release Area and reactively beyond		
			partly		Release Area. If effects are moderate to		
			compensatory		high, then deploy reactively where signs of		
					predation are occurring.		
Wood warbler	 Predation 	Low	Low, pine	Low		Low	Yes
Phylloscopus			marten				
sibilatrix			predation				
			likely to be				
			compensatory				
Redstart Phoenicurus	 Predation 	Low	Low, pine	Low		Low	Yes
pnoenicurus			marten				
			predation and				
			likely to be				
			compensatory				
All bats	●Provide		compensatory		Pine marten den boxes will be proactively	Low	Yes
	alternative				installed in areas away from known bat	-	
	denning				colonies to provide alternative denning		
	opportunities				sites to limit competition for bat roosting		
					sites.		
Barbastelle bat	 Predation 	Low	Moderate	Low	Where monitoring identifies pine marten	Low	Yes
Barbastella					near <u>high value roost</u> , examine if practical		
barbastellus -					to use bespoke deterrents (climbing		

maternity colony	•Competition	baffles/anti-climb sheeting, mesh tubes,	
utilising a range of tree	(cavity roost	entrance hole reducers) – deploy	
roosts (not a feature	sites)	reactively where suitable. Consider pine	
but key species		marten translocation as last resort – see	
recognised since		flow chart of monitoring and mitigation.	
designation)			

Not included in assessment as not notified as qualifying feature of SAC.

Species-benefits

Feature	Benefit	How to maximise benefits		
2.17 Nightjar Caprimulgus europaeus	 Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on nightjar, notably magpie, jay, raptors and grey squirrel) 	 Provide woodland and heathland management advice to landowners encouraging varied habitat structure, including increasing areas of open ground suitable for nesting nightjar. 		
2.12 Pied flycatcher <i>Ficedula hypoleuca</i>	 Predator-mediated competition (predation of competitors of pied flycatcher for nesting opportunities) Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on pied flycatcher, notably small mammals, great spotted woodpecker and grey squirrel) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including open woodland habitats, retention of ivy and creation of veteran tree features including cavities, fungal decay and nest holes. Seek opportunities to connect and de-fragment woodlands through woodland creation to increase woodland area and reduce fragmentation effects. 		
2.10 Wood warbler <i>Phylloscopus sibilatrix</i>	 Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on wood warbler, 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including development of more open woodland understoreys (suitable to 		

	notably jay, other corvids, great spotted woodpecker and rodents)	 the woodland type) in a proportion of woodland. Seek opportunities to create, connect and de-fragment woodlands through woodland creation to reduce edge effect which otherwise benefits pine marten predation of wood warblar.
2.13 Common redstart <i>Phoenicurus phoenicurus</i>	 Grey squirrel predation (predator of redstart) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including increasing deadwood and levels of low-level woodland cover.

Habitats - benefits

Feature	Benefit	How to maximise benefits
• Old sessile oak woods with <i>llex</i> and <i>Blechnum</i> in the British Isles. (Western acidic oak woodland)	 Predator-mediated competition Predator protection hypothesis Trophic cascades Seed dispersal (including rowan Sorbus aucuparia, bramble Rubus fruticosus and bilberry Vaccinium myrtillus) Grey squirrel predation 	 Provide more suitable habitat (better) – through advising/supporting landowners to enhance woodland management Increase habitat availability (bigger, joined, more) – through new woodland planting, natural regeneration and complementary habitats
• European dry heaths	 Seed dispersal (particularly bilberry Vaccinium myrtillus) near woodland 	 Heath is not a key habitat of pine marten but adjacent woodland enhancement may offer opportunities for greater interaction

South Hams SAC

Species – risks

Feature	Risk			Risk prior	Proposed mitigation	Residual	Residual adverse
	Nature	Likelihood	Severity	to mitigation		Risk	effect If mitigation undertaken, are you sure that <i>no</i> adverse effect on the integrity of the site will occur.
All bats	 Provide alternative denning opportunities 				Pine marten den boxes will be proactively installed in areas away from known bat colonies to provide alternative denning sites to limit competition for bat roosting sites.	Low	Yes
Greater horseshoe bat Rhinolophus ferrumequinum – building roosting	 Predation Disturbance 	Low	Moderate	Moderate	Bespoke proactive mitigation of <u>high value</u> <u>roosts</u> within PRRs and 20km buffer to prevent access by pine marten. Consider translocation as last resort – see flow chart of monitoring and mitigation. Where monitoring identifies pine marten near <u>moderate value roost</u> examine if appropriate or practical to use bespoke mitigation – deploy reactively where suitable. Consider translocation as last resort – see flow chart of monitoring and mitigation.	Low	Yes
Greater horseshoe bat Rhinolophus ferrumequinum – cave roosting	Predation Disturbance	Moderate	Moderate	Moderate	Where monitoring identifies pine marten near <u>high value roost</u> examine if practical to use bespoke mitigation – deploy reactively where suitable. Consider translocation as last resort – see flow chart of monitoring and mitigation.	Low	Yes
Lesser horseshoe bat Rhinolophus hipposideros – cave roosting	• Predation Disturbance	Moderate	Moderate	Moderate	Where monitoring identifies pine marten near <u>high value roost</u> examine if practical to use bespoke mitigation – deploy reactively where suitable. Consider translocation as last	Low	Yes

	resort – see flow chart of monitoring and	
	mitigation.	

Use of the site by Pine martens

The proximity and connectivity to the PRR means that the likelihood of use of many of the component sites of the SAC by pine martens is **moderate** for underground sites given the large number of accessible small caves and adits associated with the main sites (potentially high if there are large numbers of bats in accessible positions close to entrances). For building roosts, the likelihood of use is considered **low** for because of the very low numbers of sites (n=3) compared with the availability of other potentially suitable buildings in the landscape. There are a small number of additional key sites in buildings outside the SAC, but these include fewer than 80 individuals each (see Figure 4) and the assessment is not changed by the inclusion of these locations.

Impact on designated feature

There is potential for pine martens to prey on horseshoe bats, or to cause colonies to abandon roosts in buildings owing to site disturbance, resulting in a **moderate** impact. For underground sites, pine martens are unlikely to cause significant predation in the maternity season, due to the inaccessible locations of animals, but there is **moderate** potential for impact on hibernating animals roosting in accessible positions close to entrances. Overall, the risk of impacts on designated features of the SAC is considered **moderate**.

Cumulative Effects

Very large-scale woodland management works, particularly clear-fell operations, could have the potential for creating a cumulative effect as available habitat would be reduced increasing likelihood of encounter between woodland species. This project has contacted woodland stakeholders and Forestry Commission to understand if any such works are planned, but no such works are currently planned. In recent times the only occurrence of forestry operations at a large enough scale to create a potential cumulative effect have been where disease risk has necessitated removal of multiple blocks of plantation woodland across the country e.g. European larch, Sweet chestnut (due to *Phytopthera ramorum*) and Ash (due to *Hymenoscyphus* (formerly *Chalara*) *fraxinea*). The majority of these blocks have since been replanted or are recovering through natural regeneration. The current trend is for an increase in woodland cover which will mitigate any future large-scale operations.

While some initial localised increase in recreational pressure through wildlife photography and amateur naturalists may occur, this is likely to be low-level and niche, with those taking part generally aware of wider wildlife impacts and so unlikely to cause significant impacts to SAC qualifying features or conservation objectives. As pine martens recover across their former range, any increase will dissipate as opportunities to encounter martens across a wider area increase. Where this coincides with other opportunities for increased recreational pressure through other projects then cumulative effects could be seen but is considered very unlikely.
Sites of Special Scientific Interest

Summary of SSSI sites with distance from PRR

Designated Site	Distance from PRR	Feature Listed
Barle Valley SSSI	2km	Woodland Birds
Beer Quarry & Caves SSSI	Just outside buffer	Cave roosting bats
Bovey Valley Woodlands SSSI	Within PRR	Woodland Birds Dormice
Buckfastleigh Caves SSSI	Within PRR	Cave roosting bats
Bulkamore Iron Mine SSSI	Within PRR	Cave roosting bats
Chudleigh Caves and Woods SSSI	Within PRR	Cave roosting Bats
Dendles Wood SSSI	8km	Tree roosting bats, Woodland birds
Haldon Forest SSSI	Within PRR	Dormice
Haytor and Smallacombe Iron Mines SSSI	Within PRR	Cave roosting bats
Hembury Woods SSSI	Within PRR	Cave roosting bats
Hestercombe House SSSI	1.3km	Building roosting bats
Holne Wood SSSI	Within PRR	Woodland birds
Lady Wood and Viaduct Meadow SSSI	1.7km	Dormice
Napp's Cave SSSI	13.6km	Cave roosting bats
North Exmoor SSSI	0.6km	Woodland birds
Potters Wood SSSI	Within PRR	Cave roosting Bats
Sampford Spinney SSSI	4.4km	Woodland birds
Stoke Wood SSSI	3km	Woodland birds
The Quantocks SSSI	Within PRR	Woodland birds

Two Moors Project HRA Appropriate Assessment as amended in February 2024

Teign Valley Woods SSSI	Within PRR	Woodland birds
Torbryan Caves SSSI	1km	Cave Roosting bats
Watersmeet SSSI	Within PRR	Woodland birds
West Exmoor Coast and Woods SSSI	3.1km	Woodland birds
Yarner Wood and Trendlebere Down SSSI	Within PRR	Woodland birds

Barle Valley SSSI (part of Exmoor and Quantock Oakwoods SAC)

Species-risks

Feature	Risk		Risk prior	Proposed mitigation	Residual	Residual	
	Nature	Likelihood	Severity	to mitigation		Risk	adverse effect If mitigation undertaken, are you sure that <i>no</i> adverse effect on the integrity of the site will occur.
Assemblage of breeding woodland birds (favourable condition) including:	 Predation Competition (nesting spaces) 	Low- moderate (largely abundance- related)	Low, pine marten predation and competition likely to be compensatory	Low		Low	Yes
Pied flycatcher Ficedula hypoleuca	• Predation	Low (natural nesting)	Low, pine marten predation likely to be compensatory	Low		Low	Yes
		Low (nestbox nesting)	Moderate, although pine marten	Moderate	Trial nest box mitigation (including external and internal baffles) to understand nestbox occupancy effects. If effects are low, then	Low	Yes

			predation likely to be partly compensatory		deploy proactively within Release Area and reactively beyond Release Area. If effects are moderate to high, then deploy reactively where signs of predation are occurring.		
Wood warbler Phylloscopus sibilatrix	•Predation	Low	Low, pine marten predation likely to be compensatory	Low		Low	Yes
Redstart Phoenicurus phoenicurus	•Predation	Low	Low, pine marten predation and competition likely to be compensatory	Low		Low	Yes
Dormouse <i>Muscardinus</i> <i>avellanarius</i>	• Predation	Low, particularly where there is dense woodland understorey to enable predator detection and avoidance	Low	Low	Providing proactive advice to dormouse monitoring volunteers (via Peoples Trust for Endangered Species) of the importance of positioning nestboxes within dense understorey for predator protection and the need to firmly secure nestbox lids and ensure nest boxes are of robust construction.	Low	Yes

Feature	Benefit	How to maximise benefits
Nightjar Caprimulgus europaeus	 Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on nightjar, notably magpie, jay, raptors and grey squirrel) 	 Provide woodland and heathland management advice to landowners encouraging varied habitat structure, including increasing areas of open ground suitable for nesting nightjar.

Woodland bird assemblage	 Predator-mediated competition (predation of other competitors of woodland birds for food and nesting opportunities) Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on woodland birds, notably grey squirrel, corvids, raptors and great spotted woodpecker) 	 Project staff to provide landowner advice around woodland management, use of pesticides and enhancement of complementary habitats (e.g. grasslands around woodlands) to facilitate landscape- scale changes that support woodland birds. Woodland management advice to include a range of requirements of different species, including methods for long-term creation of tree cavity nesting opportunities.
Pied Flycatcher <i>Ficedula hypoleuca</i>	 Predator-mediated competition (predation of competitors of pied flycatcher for nesting opportunities) Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on pied flycatcher, notably small mammals, great spotted woodpecker and grey squirrel) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including open woodland habitats, retention of ivy and creation of veteran tree features including cavities, fungal decay and nest holes. Seek opportunities to connect and de-fragment woodlands through woodland creation to increase woodland area and reduce fragmentation effects.
Wood warbler <i>Phylloscopus sibilatrix</i>	 Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on wood warbler, notably jay, other corvids, great spotted woodpecker and rodents) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including development of more open woodland understoreys (suitable to the woodland type) in a proportion of woodland. Seek opportunities to create, connect and de-fragment woodlands through woodland creation to reduce edge effect which otherwise

		benefits pine marten predation of wood warbler.
Common redstart Phoenicurus phoenicurus	 Grey squirrel predation (predator of redstart) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including increasing deadwood and levels of low-level woodland cover.
Dormouse Muscardinus avellanarius	 Grey squirrel predation (predator of dormice and significant competitor of dormouse for hazelnuts) 	 Provide more suitable habitat (better) – through advising/supporting landowners to enhance woodland management Increase habitat availability (bigger, joined, more) – through new woodland planting, natural regeneration and complementary habitats

Habitats- benefits

Feature	Benefit	How to maximise benefits
 Ancient upland sessile oak woodland (unfavourable condition – largely recovering) 	 Predator-mediated competition Predator protection hypothesis Trophic cascades Seed dispersal (including rowan Sorbus aucuparia, bramble Rubus fruticosus and bilberry Vaccinium myrtillus) Grey squirrel predation 	 Provide more suitable habitat (better) – through advising/supporting landowners to enhance woodland management Increase habitat availability (bigger, joined, more) – through new woodland planting, natural regeneration and complementary habitats

Bovey Valley Woodlands SSSI (part of South Dartmoor Woods SAC)

Feature		Risk		Risk prior to mitigation	Proposed mitigation	Residual Risk	Residual adverse effect If mitigation undertaken, are you sure that <i>no</i> adverse effect on the integrity of the site will occur.
	Nature	Likelihood	Severity				
Assemblage of breeding woodland birds (favourable condition) including:	 Predation Competition (nesting spaces) 	Low-moderate (largely abundance- related)	Low, pine marten predation and competition likely to be compensatory	Low		Low	Yes
Pied flycatcher Ficedula hypoleuca	• Predation	Low (natural nesting)	Low, pine marten predation likely to be compensatory	Low		Low	Yes
		Low (nestbox nesting)	Moderate, although pine marten predation likely to be partly compensatory	Moderate	Trial nest box mitigation (including external and internal baffles) to understand nestbox occupancy effects. If effects are low, then deploy proactively within Release Area and reactively beyond Release Area. If effects are moderate to high, then deploy reactively where signs of predation are occurring.	Low	Yes
Wood warbler Phylloscopus sibilatrix	•Predation	Low	Low, pine marten predation likely to be compensatory	Low		Low	Yes
Redstart Phoenicurus phoenicurus	 Predation 	Low	Low, pine marten	Low		Low	Yes

			predation and competition likely to be compensatory				
Lesser spotted woodpecker Dendrocopus minor	• Predation	Low	Low, pine marten predation likely to be compensatory	Low		Low	Yes
Buzzard Buteo buteo	 Predation Competition (prey and nesting spaces) 	Low	Low	Low		Low	Yes
Grey heron Ardea cinerea	PredationCompetition (prey)	Low	Low, pine marten predation likely to be compensatory	Low		Low	Yes
Dormouse Muscardinus avellanarius	•Predation	Low, particularly where there is dense woodland understorey to enable predator detection and avoidance	Low	Low	Providing proactive advice to dormouse monitoring volunteers (via Peoples Trust for Endangered Species) of the importance of positioning nestboxes within dense understorey for predator protection and the need to firmly secure nestbox lids and ensure nest boxes are of robust construction.	Low	Yes
Barbastelle bat Barbastella barbastellus - maternity colony utilising a range of tree roosts (not a feature but key species	 Predation Competition (cavity roost sites) 	Low	Moderate	Low	Where monitoring identifies pine marten near <u>high value roost</u> , examine if practical to use bespoke deterrents (climbing baffles/anti-climb sheeting, mesh tubes, entrance hole reducers) – deploy reactively where suitable. Consider pine marten	Low	Yes

recognised since			translocation as last resort – see flow chart	
designation)			of monitoring and mitigation.	

Feature	Benefit	How to maximise benefits
Nightjar Caprimulgus europaeus	 Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on nightjar, notably magpie, jay, raptors and grey squirrel) 	 Provide woodland and heathland management advice to landowners encouraging varied habitat structure, including increasing areas of open ground suitable for nesting nightjar.
Woodland bird assemblage	 Predator-mediated competition (predation of other competitors of woodland birds for food and nesting opportunities) Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on woodland birds, notably grey squirrel, corvids, raptors and great spotted woodpecker) 	 Project staff to provide landowner advice around woodland management, use of pesticides and enhancement of complementary habitats (e.g. grasslands around woodlands) to facilitate landscape- scale changes that support woodland birds. Woodland management advice to include a range of requirements of different species, including methods for long-term creation of tree cavity nesting opportunities.
Pied Flycatcher <i>Ficedula hypoleuca</i>	 Predator-mediated competition (predation of competitors of pied flycatcher for nesting opportunities) Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on pied flycatcher, notably small mammals, great spotted woodpecker and grey squirrel) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including open woodland habitats, retention of ivy and creation of veteran tree features including cavities, fungal decay and nestholes. Seek opportunities to connect and de-fragment woodlands through woodland creation to increase

		woodland area and reduce fragmentation effects.
Wood warbler <i>Phylloscopus sibilatrix</i>	 Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on wood warbler, notably jay, other corvids, great spotted woodpecker and rodents) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including development of more open woodland understoreys (suitable to the woodland type) in a proportion of woodland. Seek opportunities to create, connect and de-fragment woodlands through woodland creation to reduce edge effect which otherwise benefits pine marten predation of wood warbler.
Common redstart Phoenicurus phoenicurus	 Grey squirrel predation (predator of redstart) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including increasing deadwood and levels of low-level woodland cover.
Lesser spotted woodpecker <i>Dendrocopus minor</i>	 Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on lesser spotted woodpecker, notably great spotted woodpecker and grey squirrel) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including open woodland habitats, retention of deadwood, particularly smaller standing deadwood trees and branches, and increased number of mature trees. Seek opportunities to connect and de-fragment woodlands through woodland creation to increase woodland area and reduce fragmentation effects.

Dormouse Muscardinus avellanarius	Grey squirrel predation (predator of	 Provide more suitable habitat
	dormice and significant competitor of	(better) – through
	dormouse for hazelnuts)	advising/supporting landowners to enhance woodland management
		 Increase habitat availability (bigger, joined, more) – through new
		woodland planting, natural
		regeneration and complementary
		habitats

Habitats- benefits

Feature	Benefit	How to maximise benefits
 Semi-natural broadleaved woodland (favourable condition) 	 Predator-mediated competition Predator protection hypothesis Trophic cascades Seed dispersal (including rowan Sorbus aucuparia, bramble Rubus fruticosus and bilberry Vaccinium myrtillus) Grey squirrel predation 	 Provide more suitable habitat (better) – through advising/supporting landowners to enhance woodland management Increase habitat availability (bigger, joined, more) – through new woodland planting, natural regeneration and complementary habitats

Buckfastleigh Caves SSSI (Part of South Hams SAC)

Feature	Risk			Risk prior	Proposed mitigation	Residual	Residual adverse
	Nature	Likelihood	Severity	to mitigation		Risk	effect If mitigation undertaken, are you sure that <i>no</i> adverse effect on the integrity of the site will occur.
All bats	 Provide alternative 				Pine marten den boxes will be proactively installed in areas away from known bat colonies	Low	Yes

	denning opportunities				to provide alternative denning sites to limit competition for bat roosting sites.		
Greater horseshoe bat Rhinolophus ferrumequinum – summer nursery building roost	Predation Disturbance	Low	Moderate	Moderate	Bespoke proactive mitigation of high valueroostswithin PRRs and 20km buffer to preventaccess by pine marten. Consider translocationas last resort – see flow chart of monitoring andmitigation.Where monitoring identifies pine marten nearmoderate value roostexamine if appropriate orpractical to use bespoke mitigation – deployreactivelywhere suitable. Considertranslocation as last resort – see flow chart ofmonitoring and mitigation.	Low	Yes
Greater horseshoe bat Rhinolophus ferrumequinum – winter cave roost	PredationDisturbance	Moderate	Moderate	Moderate	Where monitoring identifies pine marten near <u>high value roost</u> examine if practical to use bespoke mitigation – deploy reactively where suitable. Consider translocation as last resort – see flow chart of monitoring and mitigation.	Low	Yes

Bulkamore Iron Mine SSSI (part of South Hams SAC)

Feature		Risk		Risk prior	Proposed mitigation	Residual	Residual
	Nature	Likelihood	Severity	to mitigation		Risk	adverse effect If mitigation undertaken, are you sure that <i>no</i> adverse effect on the integrity of the site will occur.
All bats	 Provide alternative denning opportunities 				Pine marten den boxes will be proactively installed in areas away from known bat colonies to provide alternative denning sites to limit competition for bat roosting sites.	Low	Yes
Greater horseshoe bat Rhinolophus	PredationDisturbance	Moderate	Moderate	Moderate	Where monitoring identifies pine marten near <u>high value roost</u> examine if practical to use bespoke mitigation – deploy reactively	Low	Yes

ferrumequinum –					where suitable. Consider translocation as last		
winter cave roost					resort – see flow chart of monitoring and		
					mitigation.		
Lesser horseshoe bat	 Predation 	Moderate	Moderate	Moderate	Where monitoring identifies pine marten	Low	Yes
Rhinolophus	 Disturbance 				near high value roost examine if practical to		
hipposideros – cave					use bespoke mitigation – deploy reactively		
roosting					where suitable. Consider translocation as last		
					resort – see flow chart of monitoring and		
					mitigation.		
Natterer's bat Myotis	 Predation 	Low	Low	Low	Where monitoring identifies pine marten	Low	Yes
<i>nattereri –</i> cave	 Disturbance 				near high value roost examine if practical to		
roosting					use bespoke mitigation – deploy reactively		
					where suitable. Consider translocation as last		
					resort – see flow chart of monitoring and		
					mitigation.		
Barbastelle bat	 Predation 	Low	Low	Low	Where monitoring identifies pine marten	Low	Yes
Barbastella	 Disturbance 				near high value roost examine if practical to		
barbastellus – cave					use bespoke mitigation – deploy reactively		
roosting					where suitable. Consider translocation as last		
					resort – see flow chart of monitoring and		
					mitigation.		
Myotis bechsteinii –	 Predation 	Low	Low	Low	Where monitoring identifies pine marten	Low	Yes
cave roosting	 Disturbance 				near high value roost examine if practical to		
					use bespoke mitigation – deploy reactively		
					where suitable. Consider translocation as last		
					resort – see flow chart of monitoring and		
					mitigation.		

Bats: summary from expert assessment:

This is part of the South Hams SAC and hibernating greater and lesser horseshoe bats, as well as a large number of hibernating Natterer's bats (Myotis nattereri) are features of the site. Because Natterer's bats tend to hibernate in small crevices, the impacts on this species are likely to be low owing to inaccessibility. The impacts for lesser horseshoe bats will be similar to those for greater horseshoe bats (see South Hams SAC). The potential for impact is **Moderate**.

Chudleigh Caves and Woods SSSI (part of South Hams SAC)

Species – risks

Feature	Risk			Risk prior	Proposed mitigation	Residual	Residual adverse
	Nature	Likelihood	Severity	to mitigation		Risk	effect If mitigation undertaken, are you sure that <i>no</i> adverse effect on the integrity of the site will occur.
All bats	 Provide alternative denning opportunities 				Pine marten den boxes will be proactively installed in areas away from known bat colonies to provide alternative denning sites to limit competition for bat roosting sites.	Low	Yes
Greater horseshoe bat Rhinolophus ferrumequinum – winter cave roost	 Predation Disturbance 	Moderate	Moderate	Moderate	Where monitoring identifies pine marten near <u>high value roost</u> examine if practical to use bespoke mitigation – deploy reactively where suitable. Consider translocation as last resort – see flow chart of monitoring and mitigation.	Low	Yes
Assemblage of breeding woodland birds (favourable condition) including:	 Predation Competition (nesting spaces) 	Low- moderate (largely abundance- related)	Low, pine marten predation and competition likely to be compensatory	Low		Low	Yes
Buzzard Buteo buteo	 Predation Competition (prey and nesting spaces) 	Low	Low	Low		Low	Yes
Raven Corvus corax	• Predation	Low	Low	Low		Low	Yes

Bats: summary from expert assessment:

This is part of the South Hams SAC and Hibernating greater horseshoe bats are the key relevant feature of the designation. The potential for impact is **Moderate**.

Species – benefits

Feature	Benefit	How to maximise benefits
Woodland bird assemblage	 Predator-mediated competition (predation of other competitors of woodland birds for food and nesting opportunities) Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on woodland birds, notably grey squirrel, corvids, raptors and great spotted woodpecker) 	 Project staff to provide landowner advice around woodland management, use of pesticides and enhancement of complementary habitats (e.g. grasslands around woodlands) to facilitate landscape- scale changes that support woodland birds. Woodland management advice to include a range of requirements of different species, including methods for long-term creation of tree cavity nesting opportunities.

Haldon Forest SSSI

Feature	Risk		Risk prior	Proposed mitigation	Residual	Residual	
	Nature	Likelihood	Severity	to mitigation		Risk	adverse effect If mitigation undertaken, are you sure that <i>no</i> adverse effect on the integrity of the site will occur.
Honey buzzard <i>Pernis</i> <i>apivorus</i> (unfavourable condition – no change)	● Predation	Low	Low	Low		Low	Yes

Goshawk Accipiter gentilis (favourable condition)	 Predation Competition (prey and nesting spaces) 	Low	Low	Low	Low	Yes
Nightjar <i>Caprimulgus europaeus</i> (unfavourable condition – declining)	Predation	Low	Low, pine marten predation and competition likely to be compensatory	Low	Low	Yes
Assemblage of breeding woodland birds (favourable condition) including:	 Predation Competition (nesting spaces) 	Low- moderate (largely abundance- related)	Low, pine marten predation and competition likely to be compensatory	Low	Low	Yes
Crossbill <i>Luxia</i> curvirostra	 Predation 	Low	Low	Low	Low	Yes
Siskin Carduelis spinus	 Predation 	Low	Low	Low	Low	Yes
Assemblage of breeding birds of prey (favourable condition) including:	PredationCompetition	Low	Low	Low	Low	Yes
Buzzard <i>Buteo buteo</i>	 Predation Competition (prey and nesting spaces) 	Low	Low	Low	Low	Yes
Hobby Falco subbuteo	PredationCompetition (prey and	Low	Low	Low	Low	Yes

	nesting spaces)						
Sparrowhawk Accipiter nisus	 Predation 	Low	Low	Low		Low	Yes
Kestrel Falco tinnunculus	PredationCompetition	Low (natural nesting)	Low	Low		Low	Yes
	(prey)	Low- moderate (nestbox nesting) - low numbers of boxes reduces risk	Low	Low	Explore mitigation measures to barn owl nest boxes (which are occasionally used by kestrel) reactively due to low level of risk.	Low	Yes
Dormouse <i>Muscardinus</i> <i>avellanarius</i>	•Predation	Low, particularly where there is dense woodland understorey to enable predator detection and avoidance	Low	Low	Providing proactive advice to dormouse monitoring volunteers (via Peoples Trust for Endangered Species) of the importance of positioning nestboxes within dense understorey for predator protection and the need to firmly secure nestbox lids and ensure nest boxes are of robust construction.	Low	Yes

Feature	Benefit	How to maximise benefits
Nightjar <i>Caprimulgus europaeus</i>	 Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on nightjar, notably magpie, jay, raptors and grey squirrel) 	 Provide woodland and heathland management advice to landowners encouraging varied habitat structure, including increasing areas of open ground suitable for nesting nightjar.

Woodland bird assemblage	 Predator-mediated competition (predation of other competitors of woodland birds for food and nesting opportunities) Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on woodland birds, notably grey squirrel, corvids, raptors and great spotted woodpecker) 	 Project staff to provide landowner advice around woodland management, use of pesticides and enhancement of complementary habitats (e.g. grasslands around woodlands) to facilitate landscape- scale changes that support woodland birds. Woodland management advice to include a range of requirements of different species, including methods for long-term creation of tree cavity nesting opportunities.
Dormouse <i>Muscardinus avellanarius</i>	 Grey squirrel predation (predator of dormice and significant competitor of dormouse for hazelnuts) 	 Provide more suitable habitat (better) – through advising/supporting landowners to enhance woodland management Increase habitat availability (bigger, joined, more) – through new woodland planting, natural regeneration and complementary habitats

Habitats- benefits

Feature	Benefit	How to maximise benefits
Lowland dry heath	 Seed dispersal (particularly bilberry vaccinium myrtillus and cowberry Vaccinium vitisidaea) near woodland 	 Heath is not a key habitat of pine marten but adjacent woodland enhancement may offer opportunities for greater interaction

Haytor and Smallacombe Iron Mines SSSI (part of South Hams SAC)

Species – risks

Feature	Feature Risk Risk price		Risk prior	Proposed mitigation	Residual	Residual	
	Nature	Likelihood	Severity	to mitigation		Risk	adverse effect If mitigation undertaken, are you sure that <i>no</i> adverse effect on the integrity of the site will occur.
All bats	 Provide alternative denning opportunities 				Pine marten den boxes will be proactively installed in areas away from known bat colonies to provide alternative denning sites to limit competition for bat roosting sites.	Low	Yes
Greater horseshoe bat Rhinolophus ferrumequinum – winter cave roost	 Predation Disturbance 	Moderate	Moderate	Moderate	Where monitoring identifies pine marten near <u>high value roost</u> examine if practical to use bespoke mitigation – deploy reactively where suitable. Consider translocation as last resort – see flow chart of monitoring and mitigation.	Low	Yes

Bats: summary from expert assessment:

The site is a 2.5ha mine network located within one of the PRRs. It is a component of the South Hams SAC (Section 3.1.3) noted for its use by hibernating greater horseshoe bats. The potential for impact is **Moderate**.

Hembury Woods SSSI (part of South Dartmoor Woods SAC)

Feature		Risk		Risk prior	Proposed mitigation	Residual	Residual
	Nature	Likelihood	Severity	to mitigation		Risk	adverse effect If mitigation undertaken, are you sure that <i>no</i> adverse effect on the integrity of the site will occur.

All bats	 Provide 				Pine marten den boxes will be proactively	Low	Yes
	alternative				installed in areas away from known bat		
	denning				colonies to provide alternative denning sites		
	opportunities				to limit competition for bat roosting sites.		
Greater horseshoe bat	 Predation 	Moderate	Moderate	Moderate	Where monitoring identifies pine marten	Low	Yes
Rhinolophus	 Disturbance 				near high value roost examine if practical to		
<i>ferrumequinum</i> – cave					use bespoke mitigation – deploy reactively		
roosting					where suitable. Consider translocation as last		
					resort – see flow chart of monitoring and		
					mitigation.		
Lesser horseshoe bat	 Predation 	Moderate	Moderate	Moderate	Where monitoring identifies pine marten	Low	Yes
Rhinolophus	 Disturbance 				near high value roost examine if practical to		
hipposideros – cave					use bespoke mitigation – deploy reactively		
roosting					where suitable. Consider translocation as last		
					resort – see flow chart of monitoring and		
					mitigation.		

Bats: summary from expert assessment:

Hembury Woods is a 124ha semi-natural oak woodland conjoined to a valley of alder wood and unimproved grassland. It is located within one of the PRRs. Two mining adits are used as winter roosts by greater horseshoe bats and lesser horseshoe bats. The potential for impact is **Moderate**.

Habitats-benefits

Feature	Benefit	How to maximise benefits
 Semi-natural oak woodland (favourable condition) Valley alder woodland (favourable condition) 	 Predator-mediated competition Predator protection hypothesis Trophic cascades Seed dispersal Grey squirrel predation 	 Provide more suitable habitat (better) – through advising/supporting landowners to enhance woodland management Increase habitat availability (bigger, joined, more) – through new woodland planting, natural regeneration and complementary habitats

Hestercombe House SSSI (Hestercombe House SAC)

Feature		Risk		Risk prior	Risk prior Proposed mitigation		Residual
	Nature	Likelihood	Severity	to mitigation		Risk	adverse effect If mitigation undertaken, are you sure that <i>no</i> adverse effect on the integrity of the site will occur.
All bats	 Provide alternative denning opportunities 				Pine marten den boxes will be proactively installed in areas away from known bat colonies to provide alternative denning sites to limit competition for bat roosting sites.	Low	Yes
Lesser horseshoe bat <i>Rhinolophus</i> <i>hipposideros</i> –building roosts (unfavourable condition – recovering)	 Predation Competition (use of building roost for denning) Disturbance 	Low	Moderate	Moderate	Bespoke proactive mitigation of <u>high value</u> <u>roosts</u> within PRRs and 20km buffer to prevent access by pine marten. Consider translocation as last resort – see flow chart of monitoring and mitigation. Where monitoring identifies pine marten near <u>moderate value roost</u> examine if appropriate to use bespoke mitigation – deploy reactively where suitable. Consider translocation as last resort – see flow chart of monitoring and mitigation.	Low	Yes
Greater horseshoe bat <i>Rhinolophus</i> <i>ferrumequinum</i> – building roosts (unfavourable condition – recovering)	 Predation Disturbance 	Low	Moderate	Moderate	Bespoke proactive mitigation of <u>high value</u> <u>roosts</u> within PRRs and 20km buffer to prevent access by pine marten. Consider translocation as last resort – see flow chart of monitoring and mitigation. Where monitoring identifies pine marten near <u>moderate value roost</u> examine if appropriate or practical to use bespoke mitigation – deploy reactively where suitable. Consider translocation as last resort – see flow chart of monitoring and mitigation.	Low	Yes

Bats: summary from expert assessment:

This SSSI is located 1.3km from the closest PRR and holds a significant lesser horseshoe maternity roost and hibernaculum. The potential for impacts is **Moderate**.

Holne Woodlands SSSI (part of South Dartmoor Woods SAC)

Feature		Risk		Risk prior	Proposed mitigation	Residual	Residual
	Nature	Likelihood	Severity	to mitigation		Risk	adverse effect If mitigation undertaken, are you sure that <i>no</i> adverse effect on the integrity of the site will occur.
Assemblage of breeding woodland birds (favourable condition) including:	 Predation Competition (nesting spaces) 	Low- moderate (largely abundance- related)	Low, pine marten predation and competition likely to be compensatory	Low		Low	Yes
Pied flycatcher Ficedula hypoleuca	• Predation	Low (natural nesting)	Low, pine marten predation likely to be compensatory	Low		Low	Yes
		Low (nestbox nesting)	Moderate, although pine marten predation likely to be partly compensatory	Moderate	Trial nest box mitigation (including external and internal baffles) to understand nestbox occupancy effects. If effects are low, then deploy proactively within Release Area and reactively beyond Release Area. If effects are moderate to high, then deploy reactively where signs of predation are occurring.	Low	Yes
Wood warbler Phylloscopus sibilatrix	 Predation 	Low	Low, pine marten predation	Low		Low	Yes

			likely to be compensatory				
Redstart Phoenicurus phoenicurus	•Predation	Low	Low, pine marten predation and competition likely to be compensatory	Low		Low	Yes
Buzzard <i>Buteo buteo</i>	 Predation Competition (prey and nesting spaces) 	Low	Low	Low		Low	Yes
Raven Corvus corax	 Predation 	Low	Low	Low		Low	Yes
Great spotted woodpecker <i>Dendrocopus major</i>	 Predation Competition (nesting spaces) 	Low- moderate (largely abundance- related)	Low (pine marten predation and competition likely to be partly compensatory -unlikely to have population- level effect)	Low		Low- moderate	Yes

Feature	Benefit	How to maximise benefits		
Woodland bird assemblage	 Predator-mediated competition (predation of other competitors of woodland birds for food and nesting opportunities) Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on woodland birds, notably grey squirrel, corvids, raptors and great spotted woodpecker) 	 Project staff to provide landowner advice around woodland management, use of pesticides and enhancement of complementary habitats (e.g. grasslands around woodlands) to facilitate landscape- scale changes that support woodland birds. Woodland management advice to include a range of requirements of different species, including methods for long-term creation of tree cavity nesting opportunities. 		
Pied flycatcher <i>Ficedula hypoleuca</i>	 Predator-mediated competition (predation of competitors of pied flycatcher for nesting opportunities) Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on pied flycatcher, notably small mammals, great spotted woodpecker and grey squirrel) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including open woodland habitats, retention of ivy and creation of veteran tree features including cavities, fungal decay and nestholes. Seek opportunities to connect and de-fragment woodlands through woodland creation to increase woodland area and reduce fragmentation effects. 		
Wood warbler <i>Phylloscopus sibilatrix</i>	 Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on wood warbler, notably jay, other corvids, great spotted woodpecker and rodents) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including development of more open woodland understoreys (suitable to the woodland type) in a proportion of woodland. 		

		 Seek opportunities to create, connect and de-fragment woodlands through woodland creation to reduce edge effect which otherwise benefits pine marten predation of wood warbler.
Common redstart Phoenicurus phoenicurus	 Grey squirrel predation (predator of redstart) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including increasing deadwood and levels of low-level woodland cover.

Habitats - benefits

Feature	Benefit	How to maximise benefits
 Ancient semi-natural oak woodland (favourable condition) Valley alder woodland (favourable condition) 	 Predator-mediated competition Predator protection hypothesis Trophic cascades Seed dispersal Grey squirrel predation 	 Provide more suitable habitat (better) – through advising/supporting landowners to enhance woodland management Increase habitat availability (bigger, joined, more) – through new woodland planting, natural regeneration and complementary
		habitats

Lady's Wood and Viaduct Meadow SSSI

Feature		Risk		Risk prior	Proposed mitigation	Residual	Residual
	Nature	Likelihood	Severity	to		Risk	adverse effect
	itature	Lincentood	Sevency	mitigation			If mitigation
				U U			undertaken, are
							you sure that no
							adverse effect on
							the integrity of the
							site will occur.

Dormouse	 Predation 	Low,	Low	Low	Providing proactive advice to dormouse	Low	Yes
Muscardinus		particularly			monitoring volunteers (via Peoples Trust for		
avellanarius		where there			Endangered Species) of the importance of		
		is dense			positioning nestboxes within dense		
		woodland			understorey for predator protection and the		
		understorey			need to firmly secure nestbox lids and		
		to enable			ensure nest boxes are of robust		
		predator			construction.		
		detection					
		and					
		avoidance					

Feature	Benefit	How to maximise benefits
Dormouse Muscardinus avellanarius	 Grey squirrel predation (predator of dormice and significant competitor of dormouse for hazelnuts) 	 Provide more suitable habitat (better) – through advising/supporting landowners to enhance woodland management Increase habitat availability (bigger, joined, more) – through new woodland planting, natural regeneration and complementary habitats

Habitats- benefits

Feature	Benefit	How to maximise benefits
• Upland oak woodland (favourable condition)	 Predator-mediated competition Predator protection hypothesis Trophic cascades Seed dispersal Grey squirrel predation 	 Provide more suitable habitat (better) – through advising/supporting landowners to enhance woodland management Increase habitat availability (bigger, joined, more) – through new woodland planting, natural regeneration and complementary habitats

Napp's Cave SSSI

Feature		Risk		Risk prior	Risk prior Proposed mitigation		Residual
	Nature	Likelihood	Severity	to mitigation		Risk	adverse effect If mitigation undertaken, are you sure that <i>no</i> adverse effect on the integrity of the site will occur.
All bats	 Provide alternative denning opportunities 				Pine marten den boxes will be proactively installed in areas away from known bat colonies to provide alternative denning sites to limit competition for bat roosting sites.	Low	Yes
Greater horseshoe bat Rhinolophus ferrumequinum – cave roosting	 Predation Disturbance 	Moderate	Moderate	Moderate	Where monitoring identifies pine marten near <u>high value roost</u> examine if practical to use bespoke mitigation – deploy reactively where suitable. Consider translocation as last resort – see flow chart of monitoring and mitigation.	Low	Yes
Lesser horseshoe bat Rhinolophus	PredationDisturbance	Moderate	Moderate	Moderate	Where monitoring identifies pine marten near <u>high value roost</u> examine if practical to	Low	Yes

hipposideros – cave				use bespoke mitigation – deploy reactively		
roosting		where suitable. Consider translocation as last				
				resort – see flow chart of monitoring and		
				mitigation.		

Bats: summary from expert assessment:

Napp's Cave is 13.6km from the closest PRRs. While designated for geological interests, the site is also a hibernation roost for greater and lesser horseshoe bats. The potential for impact is **Moderate**.

North Exmoor SSSI (part of Exmoor and Quantock Woodlands SAC)

Feature		Risk		Risk prior	Proposed mitigation	Residual	Residual
	Nature	Likelihood	Severity	to mitigation		Risk	adverse effect If mitigation undertaken, are you sure that <i>no</i> adverse effect on the integrity of the site will occur.
Assemblage of breeding woodland birds (favourable condition) including:	 Predation Competition (nesting spaces) 	Low- moderate (largely abundance- related)	Low, pine marten predation and competition likely to be compensatory	Low		Low	Yes
Pied flycatcher Ficedula hypoleuca	• Predation	Low (natural nesting)	Low, pine marten predation likely to be compensatory	Low		Low	Yes
		Low (nestbox nesting)	Moderate, although pine marten predation likely to be	Moderate	Trial nest box mitigation (including external and internal baffles) to understand nestbox occupancy effects. If effects are low, then deploy proactively within Release Area and reactively beyond Release Area. If effects are	Low	Yes

			partly		moderate to high, then deploy reactively		
			compensatory		where signs of predation are occurring.		
Wood warbler Phylloscopus sibilatrix	•Predation	Low	Low, pine marten predation likely to be compensatory	Low		Low	Yes
Redstart Phoenicurus phoenicurus	● Predation	Low	Low, pine marten predation and competition likely to be compensatory	Low		Low	Yes
Buzzard Buteo buteo	 Predation Competition (prey and nesting spaces) 	Low	Low	Low		Low	Yes
Raven Corvus corax	 Predation 	Low	Low	Low		Low	Yes
Great spotted woodpecker Dendrocopus major	 Predation Competition (nesting spaces) 	Low- moderate (largely abundance- related)	Low (pine marten predation and competition likely to be partly compensatory -unlikely to have population- level effect)	Low		Low- moderate	Yes
Redpoll Acanthis flammea	● Predation	Low	Low, pine marten predation and competition likely to be	Low		Low	Yes

			partly compensatory			
Nightjar Cagrimulgus europaeus	•Predation	Low	Low, pine marten predation and competition likely to be compensatory	Low	Low	Yes
Stonechat Saxicola torquata	 Predation 	Low	Low	Low	Low	Yes
Whinchat S. rubestra	 Predation 	Low	Low	Low	Low	Yes
Merlin Falco columbaris	 Predation Competition (prey) 	Low	Low	Low	Low	Yes

Feature	Benefit	How to maximise benefits
Woodland bird assemblage	 Predator-mediated competition (predation of other competitors of woodland birds for food and nesting opportunities) Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on woodland birds, notably grey squirrel, corvids, raptors and great spotted woodpecker) 	 Project staff to provide landowner advice around woodland management, use of pesticides and enhancement of complementary habitats (e.g. grasslands around woodlands) to facilitate landscape- scale changes that support woodland birds. Woodland management advice to include a range of requirements of different species, including methods for long-term creation of tree cavity nesting opportunities.

Pied flycatcher <i>Ficedula hypoleuca</i>	 Predator-mediated competition (predation of competitors of pied flycatcher for nesting opportunities) Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on pied flycatcher, notably small mammals, great spotted woodpecker and grey squirrel) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including open woodland habitats, retention of ivy and creation of veteran tree features including cavities, fungal decay and nest holes. Seek opportunities to connect and de-fragment woodlands through woodland creation to increase woodland area and reduce fragmentation effects.
Wood warbler <i>Phylloscopus sibilatrix</i>	 Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on wood warbler, notably jay, other corvids, great spotted woodpecker and rodents) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including development of more open woodland understoreys (suitable to the woodland type) in a proportion of woodland. Seek opportunities to create, connect and de-fragment woodlands through woodland creation to reduce edge effect which otherwise benefits pine marten predation of wood warbler.
Common redstart Phoenicurus phoenicurus	 Grey squirrel predation (predator of redstart) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including increasing deadwood and levels of low-level woodland cover.
Lesser redpoll Acanthis flammea	 Grey squirrel predation (predator of redpoll) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including open woodland areas, woodland restoration through

		planting and natural regeneration to include birch and scrub.
Nightjar Caprimulgus europaeus	 Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on nightjar, notably magpie, jay, raptors and grey squirrel) 	 Provide woodland and heathland management advice to landowners encouraging varied habitat structure, including increasing areas of open ground suitable for nesting nightjar.
Merlin Falco columbarius	 Predator protection hypothesis, trophic cascades (predation of other predators that may have a larger impact on merlin, notably corvids) 	 Provide woodland and heathland management advice to landowners encouraging varied habitat structure, including increasing areas of open ground with adjacent woodland suitable for nesting merlin.

Habitats- benefits

Feature	Benefit	How to maximise benefits
 Ancient semi-natural oak woodland Wet woodland (unfavourable condition – recovering) 	 Predator-mediated competition Predator protection hypothesis Trophic cascades Seed dispersal (including rowan Sorbus aucuparia) Grey squirrel predation 	 Provide more suitable habitat (better) – through advising/supporting landowners to enhance woodland management Increase habitat availability (bigger, joined, more) – through new woodland planting, natural regeneration and complementary habitats
Lowland and upland heaths	• Seed dispersal (including bilberry vaccinium myrtillus, crowberry Empetrum nigrum and cranberry Vaccinium oxycoccus) near woodland	•

Potters Wood SSSI

Species – risks

Feature		Risk		Risk prior	Proposed mitigation	Residual	Residual
	Nature	Likelihood	Severity	to mitigation		Risk	adverse effect If mitigation undertaken, are you sure that <i>no</i> adverse effect on the integrity of the site will occur.
All bats	 Provide alternative denning opportunities 				Pine marten den boxes will be proactively installed in areas away from known bat colonies to provide alternative denning sites to limit competition for bat roosting sites.	Low	Yes
Greater horseshoe bat Rhinolophus ferrumequinum – cave roosting	 Predation Disturbance 	Moderate	Moderate	Moderate	Where monitoring identifies pine marten near <u>high value roost</u> examine if practical to use bespoke mitigation – deploy reactively where suitable. Consider translocation as last resort – see flow chart of monitoring and mitigation.	Low	Yes

Sampford Spiney SSSI (part of South Dartmoor Woods SAC)

Feature		Risk		Risk prior	Proposed mitigation	Residual	Residual
	Nature	Likelihood	Severity	to mitigation		Risk	adverse effect If mitigation undertaken, are you sure that <i>no</i> adverse effect on the integrity of the site will occur.
Assemblage of breeding woodland birds (unfavourable condition - recovering) including:	 Predation Competition (nesting spaces) 	Low- moderate (largely abundance- related)	Low, pine marten predation and competition likely to be compensatory	Low		Low	Yes

Wood warbler	 Predation 	Low	Low, pine	Low	Low	Yes
Phylloscopus			marten			
sibilatrix			predation			
			likely to be			
			compensatory			
Redstart Phoenicurus	 Predation 	Low	Low, pine	Low	Low	Yes
phoenicurus			marten			
			predation and			
			competition			
			likely to be			
			compensatory			
Buzzard Buteo buteo	 Predation 	Low	Low	Low	Low	Yes
	 Competition 					
	(prey and					
	nesting					
	spaces)					

Feature	Benefit	How to maximise benefits
Woodland bird assemblage	 Predator-mediated competition (predation of other competitors of woodland birds for food and nesting opportunities) Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on woodland birds, notably grey squirrel, corvids, raptors and great spotted woodpecker) 	 Project staff to provide landowner advice around woodland management, use of pesticides and enhancement of complementary habitats (e.g. grasslands around woodlands) to facilitate landscape- scale changes that support woodland birds. Woodland management advice to include a range of requirements of different species, including methods for long-term creation of tree cavity nesting opportunities.

Wood warbler <i>Phylloscopus sibilatrix</i>	 Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on wood warbler, notably jay, other corvids, great spotted woodpecker and rodents) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including development of more open woodland understoreys (suitable to the woodland type) in a proportion of woodland. Seek opportunities to create, connect and de-fragment woodlands through woodland creation to reduce edge effect which otherwise benefits pine marten predation of wood warbler.
Common redstart Phoenicurus phoenicurus	 Grey squirrel predation (predator of redstart) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including increasing deadwood and levels of low-level woodland cover.

Habitats - benefits

Feature	Benefit	How to maximise benefits
 Ancient upland oak woodland (unfavourable condition – recovering) Upland mixed ashwoods (favourable condition) Lowland beech and yew woodland (unfavourable condition – recovering) Wet woodland (favourable condition) 	 Predator-mediated competition Predator protection hypothesis Trophic cascades Seed dispersal (including rowan Sorbus aucuparia) Grey squirrel predation 	 Provide more suitable habitat (better) – through advising/supporting landowners to enhance woodland management Increase habitat availability (bigger, joined, more) – through new woodland planting, natural regeneration and complementary habitats

Stoke Woods SSSI

Feature		Risk		Risk prior	Proposed mitigation	Residual	Residual
	Nature	Likelihood	Severity	to mitigation		Risk	adverse effect If mitigation undertaken, are you sure that <i>no</i> adverse effect on the integrity of the site will occur.
Assemblage of breeding woodland birds (unfavourable condition - recovering) including:	 Predation Competition (nesting spaces) 	Low- moderate (largely abundance- related)	Low, pine marten predation and competition likely to be compensatory	Low		Low	Yes
Wood warbler Phylloscopus sibilatrix	• Predation	Low	Low, pine marten predation likely to be compensatory	Low		Low	Yes
Buzzard Buteo buteo	 Predation Competition (prey and nesting spaces) 	Low	Low	Low		Low	Yes
Tawny owl Strix aluco	PredationCompetition	Low (natural nesting)	Low	Low		Low	Yes
	(prey)	Low- moderate (nestbox nesting) – low numbers of boxes reduces risk	Low	Low	Explore mitigation measures to tawny owl nestboxes reactively due to low level of risk and low numbers of nestboxes in landscape.	Low	Yes

Great spotted	 Predation 	Low-	Low (pine	Low	Low-	Yes
woodpecker	 Competition 	moderate	marten		moderate	
Dendrocopos major	(nesting	(largely	predation and			
, ,	spaces)	abundance-	competition			
	spaces,	related)	likely to be			
		,	partly			
			compensatory			
			-unlikely to			
			have			
			population-			
			level effect)			
Green woodnecker	Predation	Low	Low (nine	Low	Low	Ves
Picus viridis	- reaction	2011	marten	2011	2011	105
			nredation and			
			competition			
			likely to be			
			nartly			
			compensatory			
			-unlikely to			
			have			
			nonulation			
			level effect)			
Lesser spotted	• Prodution	Low		Low		Voc
woodpockor Druobatas	Freudtion		norton	LOW	LOW	163
minor			nredation			
mmor			likely to be			
			compensatory			
Nightingolo Luccinia	• Due de tie e	Low	Low	Low	Low	Voc
Nightingale Luscinia	•Predation	LOW	LOW	LOW	LOW	res
megarnynchos						

Feature	Benefit	How to maximise benefits
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Woodland bird assemblage	 Predator-mediated competition (predation of other competitors of woodland birds for food and nesting opportunities) Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on woodland birds, notably grey squirrel, corvids, raptors and great spotted woodpecker) 	 Project staff to provide landowner advice around woodland management, use of pesticides and enhancement of complementary habitats (e.g. grasslands around woodlands) to facilitate landscape- scale changes that support woodland birds. Woodland management advice to include a range of requirements of different species, including methods for long-term creation of tree cavity nesting opportunities.
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Wood warbler <i>Phylloscopus sibilatrix</i>	 Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on wood warbler, notably jay, other corvids, great spotted woodpecker and rodents) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including development of more open woodland understoreys (suitable to the woodland type) in a proportion of woodland. Seek opportunities to create, connect and de-fragment woodlands through woodland creation to reduce edge effect which otherwise benefits pine marten predation of wood warbler.
European green woodpecker <i>Picus viridis</i>	Grey squirrel predation (predator of green woodpecker)	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including closed canopy woodlands, orchards and wood pasture. Provide advice to landowners to encourage complementary open habitats – ant-rich dry grasslands.

Lesser spotted woodpecker Dendrocopus minor	 Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on lesser spotted woodpecker, notably great spotted woodpecker and grey squirrel) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including open woodland habitats, retention of deadwood, particularly smaller standing deadwood trees and branches, and increased number of mature trees. Seek opportunities to connect and de-fragment woodlands through woodland creation to increase woodland area and reduce fragmentation effects.

Habitats - benefits

Feature	Benefit	How to maximise benefits
• Ancient semi-natural woodland	 Predator-mediated competition Predator protection hypothesis Trophic cascades Seed dispersal (including rowan Sorbus aucuparia) Grey squirrel predation 	 Provide more suitable habitat (better) – through advising/supporting landowners to enhance woodland management Increase habitat availability (bigger, joined, more) – through new woodland planting, natural regeneration and complementary habitats

Teign Valley Woods SSSI (part of South Dartmoor Woods SAC)

Feature		Risk		Risk prior	Proposed mitigation	Residual	Residual
	Nature	Likelihood	Severity	to mitigation		Risk	adverse effect If mitigation undertaken, are you sure that <i>no</i> adverse effect on

							the integrity of the
							site will occur.
Assemblage of	 Predation 	Low-	Low, pine	Low		Low	Yes
breeding	 Competition 	moderate	marten				
woodland birds	(nesting	(largely	predation and				
(favourable condition)	spaces)	abundance-	competition				
including:		related)	likely to be				
			compensatory				
Pied flycatcher	 Predation 	Low (natural	Low, pine	Low		Low	Yes
Ficedula hypoleuca		nesting)	marten				
			predation				
			likely to be				
			compensatory				
		Low (nestbox	Moderate,	Moderate	Trial nest box mitigation (including external	Low	Yes
		nesting)	although pine		and internal baffles) to understand nestbox		
			marten		occupancy effects. If effects are low, then		
			predation		deploy proactively within Release Area and		
			likely to be		reactively beyond Release Area. If effects are		
			partly		moderate to high, then deploy reactively		
			compensatory		where signs of predation are occurring.		
Redstart Phoenicurus	 Predation 	Low	Low, pine	Low		Low	Yes
phoenicurus			marten				
			predation and				
			competition				
			likely to be				
			compensatory				

Species-benefits

Feature	Benefit	How to maximise benefits		
Woodland bird assemblage	 Predator-mediated competition (predation of other competitors of woodland birds for food and nesting opportunities) Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on woodland birds, notably grey squirrel, corvids, raptors and great spotted woodpecker) 	 Project staff to provide landowner advice around woodland management, use of pesticides and enhancement of complementary habitats (e.g. grasslands around woodlands) to facilitate landscape- scale changes that support woodland birds. Woodland management advice to include a range of requirements of different species, including methods for long-term creation of tree cavity nesting opportunities. 		
Pied Flycatcher <i>Ficedula hypoleuca</i>	 Predator-mediated competition (predation of competitors of pied flycatcher for nesting opportunities) Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on pied flycatcher, notably small mammals, great spotted woodpecker and grey squirrel) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including open woodland habitats, retention of ivy and creation of veteran tree features including cavities, fungal decay and nestholes. Seek opportunities to connect and de-fragment woodlands through woodland creation to increase woodland area and reduce fragmentation effects. 		
Common redstart Phoenicurus phoenicurus	 Grey squirrel predation (predator of redstart) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including increasing deadwood and levels of low-level woodland cover. 		

Habitats- benefits

Feature	Benefit	How to maximise benefits
 Upland oak woodland (favourable condition) Upland mixed ashwoods (unfavourable condition declining) 	 Predator-mediated competition Predator protection hypothesis Trophic cascades Seed dispersal (including bilberry <i>Vaccinium myrtillus</i>) Grey squirrel predation 	 Provide more suitable habitat (better) – through advising/supporting landowners to enhance woodland management Increase habitat availability (bigger, joined, more) – through new woodland planting, natural regeneration and complementary habitats
 Sub-alpine dwarf-shrub heath (unfavourable condition – declining) 	 Seed dispersal (including bilberry vaccinium myrtillus) near woodland 	•

The Quantocks SSSI (part of Exmoor and Quantock Oakwoods SAC)

Feature	Risk			Risk prior Proposed mitigation	Residual	Residual	
	Nature	Likelihood	Severity	to mitigation		Risk	adverse effect If mitigation undertaken, are you sure that <i>no</i> adverse effect on the integrity of the site will occur.
Assemblage of breeding woodland birds including:	 Predation Competition (nesting spaces) 	Low- moderate (largely abundance- related)	Low, pine marten predation and competition likely to be compensatory	Low		Low	Yes
Pied Flycatcher Ficedula hypoleuca	 Predation 	Low (natural nesting)	Low, pine marten	Low		Low	Yes

			predation likely to be				
			compensatory				
		Low (nestbox nesting)	Moderate, although pine marten predation likely to be partly compensatory	Moderate	Trial nest box mitigation (including external and internal baffles) to understand nestbox occupancy effects. If effects are low, then deploy proactively within Release Area and reactively beyond Release Area. If effects are moderate to high, then deploy reactively where signs of predation are occurring.	Low	Yes
Raven Corvus corex	Predation	Low	Low	Low		Low	Yes
Nightjar Caprimulgus europaeus	• Predation	Low	Low, pine marten predation and competition likely to be compensatory	Low		Low	Yes
Grasshopper Warbler Locustella naevia	 Predation 	Low	Low	Low		Low	Yes
Assemblage of raptors	PredationCompetition	Low	Low	Low		Low	Yes

Species-benefits

Feature	Benefit	How to maximise benefits		
Woodland bird assemblage	 Predator-mediated competition (predation of other competitors of woodland birds for food and nesting opportunities) Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on woodland birds, notably grey squirrel, corvids, raptors and great spotted woodpecker) 	 Project staff to provide landowner advice around woodland management, use of pesticides and enhancement of complementary habitats (e.g. grasslands around woodlands) to facilitate landscape- scale changes that support woodland birds. Woodland management advice to include a range of requirements of different species, including methods for long-term creation of tree cavity nesting opportunities. 		
Pied Flycatcher <i>Ficedula hypoleuca</i>	 Predator-mediated competition (predation of competitors of pied flycatcher for nesting opportunities) Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on pied flycatcher, notably small mammals, great spotted woodpecker and grey squirrel) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including open woodland habitats, retention of ivy and creation of veteran tree features including cavities, fungal decay and nestholes. Seek opportunities to connect and de-fragment woodlands through woodland creation to increase woodland area and reduce fragmentation effects. 		
Nightjar Caprimulgus europaeus	 Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on nightjar, notably magpie, jay, raptors and grey squirrel) 	 Provide woodland and heathland management advice to landowners encouraging varied habitat structure, including increasing areas of open ground suitable for nesting nightjar. 		

	На	bitats-	benefits
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Feature	Benefit	How to maximise benefits
 Upland oak woodland (favourable condition) Lowland mixed deciduous ash/wych elm woodland (unfavourable condition – recovering) Wet alder woodland (unfavourable condition – no change) 	 Predator-mediated competition Predator protection hypothesis Trophic cascades Seed dispersal (including rowan sorbus aucuparia, bilberry Vaccinium myrtillus) Grey squirrel predation 	 Provide more suitable habitat (better) – through advising/supporting landowners to enhance woodland management Increase habitat availability (bigger, joined, more) – through new woodland planting, natural regeneration and complementary habitats
 Lowland dry heath (unfavourable condition – declining) 	 Seed dispersal (including bilberry vaccinium myrtillus) near woodland 	•

Torbryan Caves SSSI

Feature		Risk	Risk		Risk prior Proposed mitigation		Residual
	Nature	Likelihood	Severity	to mitigation		Risk	adverse effect If mitigation undertaken, are you sure that <i>no</i> adverse effect on the integrity of the site will occur.
All bats	 Provide 				Pine marten den boxes will be proactively	Low	Yes
	alternative				installed in areas away from known bat		
	denning				colonies to provide alternative denning sites		
	opportunities				to limit competition for bat roosting sites.		
Greater horseshoe bat	 Predation 	Moderate	Moderate	Moderate	Where monitoring identifies pine marten	Low	Yes
Rhinolophus	 Disturbance 				near <u>high value roost</u> examine if practical to		
<i>ferrumequinum</i> – cave					use bespoke mitigation – deploy reactively		
roosting					where suitable. Consider translocation as last		

					resort – see flow chart of monitoring and mitigation.		
Lesser horseshoe bat Rhinolophus hipposideros – cave roosting	 Predation Disturbance 	Moderate	Moderate	Moderate	Where monitoring identifies pine marten near <u>high value roost</u> examine if practical to use bespoke mitigation – deploy reactively where suitable. Consider translocation as last resort – see flow chart of monitoring and mitigation.	Low	Yes

Bats: summary from expert assessment:

This 19ha cave system is designated for its geological interest, but it is also noted as hibernation roost for greater horseshoe, lesser horseshoe, and longeared bats. The site is located 1km away from a PRR. The potential for impact is **Moderate**.

Watersmeet SSSI (part of Exmoor and Quantocks Oakwoods SAC)

Feature		Risk		Risk prior	Proposed mitigation	Residual	Residual
	Nature	Likelihood	Severity	to mitigation		Risk	adverse effect If mitigation undertaken, are you sure that <i>no</i> adverse effect on the integrity of the site will occur.
Assemblage of breeding woodland birds (unfavourable condition – recovering) including:	 Predation Competition (nesting spaces) 	Low- moderate (largely abundance- related)	Low, pine marten predation and competition likely to be compensatory	Low		Low	Yes
Pied Flycatcher Ficedula hypoleuca	•Predation	Low (natural nesting)	Low, pine marten predation likely to be compensatory	Low		Low	Yes

		Low (nestbox nesting)	Moderate, although pine marten predation likely to be partly compensatory	Moderate	Trial nest box mitigation (including external and internal baffles) to understand nestbox occupancy effects. If effects are low, then deploy proactively within Release Area and reactively beyond Release Area. If effects are moderate to high, then deploy reactively where signs of predation are occurring.	Low	Yes
Raven <i>Corvus corex</i>	 Predation 	Low	Low	Low		Low	Yes
Redstart Phoenicurus phoenicurus	•Predation	Low	Low, pine marten predation and competition likely to be compensatory	Low		Low	Yes
Buzzard Buteo buteo	 Predation Competition (prey and nesting spaces) 	Low	Low	Low		Low	Yes
Tawny owl Strix aluco	PredationCompetition	Low (natural nesting)	Low	Low		Low	Yes
	(prey)	Low- moderate (nestbox nesting) – low numbers of boxes reduces risk	Low	Low	Explore mitigation measures to tawny owl nestboxes reactively due to low level of risk and low numbers of nestboxes in landscape.	Low	Yes
Great spotted woodpecker <i>Dendrocopos major</i>	 Predation Competition (nesting spaces) 	Low- moderate (largely abundance- related)	Low (pine marten predation and competition likely to be partly compensatory	Low		Low- moderate	Yes

			-unlikely to have population- level effect)			
Lesser spotted woodpecker <i>Dryobates</i> <i>minor</i>	•Predation	Low	Low, pine marten predation likely to be compensatory	Low	Low	Yes
Green woodpecker <i>Picus viridis</i>	•Predation	Low	Low (pine marten predation and competition likely to be partly compensatory -unlikely to have population- level effect)	Low	Low	Yes

Species-benefits

Feature	Benefit	How to maximise benefits
Woodland bird assemblage	 Predator-mediated competition (predation of other competitors of woodland birds for food and nesting opportunities) Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on woodland birds, notably grey squirrel, corvids, raptors and great spotted woodpecker) 	 Project staff to provide landowner advice around woodland management, use of pesticides and enhancement of complementary habitats (e.g. grasslands around woodlands) to facilitate landscape- scale changes that support woodland birds. Woodland management advice to include a range of requirements of different species, including methods for long-term creation of tree cavity nesting opportunities.
Pied Flycatcher <i>Ficedula hypoleuca</i>	 Predator-mediated competition (predation of competitors of pied flycatcher for nesting opportunities) Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on pied flycatcher, notably small mammals, great spotted woodpecker and grey squirrel) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including open woodland habitats, retention of ivy and creation of veteran tree features including cavities, fungal decay and nest holes. Seek opportunities to connect and de-fragment woodlands through woodland creation to increase woodland area and reduce fragmentation effects.
Lesser spotted woodpecker <i>Dendrocopus minor</i>	 Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on lesser spotted woodpecker, notably great spotted woodpecker and grey squirrel) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including open woodland habitats, retention of deadwood, particularly smaller standing deadwood trees and branches, and increased number of mature trees.

		 Seek opportunities to connect and de-fragment woodlands through woodland creation to increase woodland area and reduce fragmentation effects.
Common redstart Phoenicurus phoenicurus	 Grey squirrel predation (predator of redstart) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including increasing deadwood and levels of low-level woodland cover.
European green woodpecker <i>Picus viridis</i>	 Grey squirrel predation (predator of green woodpecker) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including closed canopy woodlands, orchards and wood pasture. Provide advice to landowners to encourage complementary open habitats – ant-rich dry grasslands.

Habitats - benefits

Feature	Benefit	How to maximise benefits
 Upland oak woodland (unfavourable condition – no change) Wet alder woodland (unfavourable condition – recovering) 	 Predator-mediated competition Predator protection hypothesis Trophic cascades Seed dispersal (including rowan sorbus aucuparia, bilberry Vaccinium myrtillus) Grey squirrel predation 	 Provide more suitable habitat (better) – through advising/supporting landowners to enhance woodland management Increase habitat availability (bigger, joined, more) – through new woodland planting, natural regeneration and complementary
		habitats

 Subalpine dwarf-shrub heath (unfavourable condition – recovering) 	 Seed dispersal (including bilberry vaccinium myrtillus) near woodland 	•

West Exmoor Coast and Woods SSSI (part of Exmoor and Quantock Oakwoods SAC)

Feature		Risk		Risk prior	Proposed mitigation	Residual	Residual
	Nature	Likelihood	Severity	to mitigation		Risk	adverse effect If mitigation undertaken, are you sure that <i>no</i> adverse effect on the integrity of the site will occur.
Assemblage of breeding woodland birds (favourable condition) including:	 Predation Competition (nesting spaces) 	Low- moderate (largely abundance- related)	Low, pine marten predation and competition likely to be compensatory	Low		Low	Yes
Pied Flycatcher Ficedula hypoleuca	• Predation	Low (natural nesting)	Low, pine marten predation likely to be compensatory	Low		Low	Yes
		Low (nestbox nesting)	Moderate, although pine marten predation likely to be partly compensatory	Moderate	Trial nest box mitigation (including external and internal baffles) to understand nestbox occupancy effects. If effects are low, then deploy proactively within Release Area and reactively beyond Release Area. If effects are moderate to high, then deploy reactively where signs of predation are occurring.	Low	Yes
Redstart Phoenicurus phoenicurus	• Predation	Low	Low, pine marten predation and	Low		Low	Yes

			competition likely to be compensatory			
Lesser spotted woodpecker Dryobates minor	• Predation	Low	Low, pine marten predation likely to be compensatory	Low	Low	Yes
Wood warbler Phylloscopus sibilatrix	•Predation	Low	Low, pine marten predation likely to be compensatory	Low	Low	Yes
Peregrine Falco perigrinus	PredationCompetition (prey)	Low	Low	Low	Low	Yes

Species- benefits

Feature	Benefit	How to maximise benefits
Woodland bird assemblage	 Predator-mediated competition (predation of other competitors of woodland birds for food and nesting opportunities) Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on woodland birds, notably grey squirrel, corvids, raptors and great spotted woodpecker) 	 Project staff to provide landowner advice around woodland management, use of pesticides and enhancement of complementary habitats (e.g. grasslands around woodlands) to facilitate landscape- scale changes that support woodland birds. Woodland management advice to include a range of requirements of different species, including methods for long-term creation of tree cavity nesting opportunities.

Pied Flycatcher <i>Ficedula hypoleuca</i>	 Predator-mediated competition (predation of competitors of pied flycatcher for nesting opportunities) Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on pied flycatcher, notably small mammals, great spotted woodpecker and grey squirrel) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including open woodland habitats, retention of ivy and creation of veteran tree features including cavities, fungal decay and nestholes. Seek opportunities to connect and de-fragment woodlands through woodland creation to increase woodland area and reduce fragmentation effects.
Lesser spotted woodpecker Dendrocopus minor	 Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on lesser spotted woodpecker, notably great spotted woodpecker and grey squirrel) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including open woodland habitats, retention of deadwood, particularly smaller standing deadwood trees and branches, and increased number of mature trees. Seek opportunities to connect and de-fragment woodlands through woodland creation to increase woodland area and reduce fragmentation effects.

Wood warbler <i>Phylloscopus sibilatrix</i>	 Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on wood warbler, notably jay, other corvids, great spotted woodpecker and rodents) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including development of more open woodland understoreys (suitable to the woodland type) in a proportion of woodland. Seek opportunities to create, connect and de-fragment woodlands through woodland creation to reduce edge effect which otherwise benefits pine marten predation of wood warbler.
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Habitats - benefits

Feature	Benefit	How to maximise benefits
 Upland oak woodland Wet alder woodland 	 Predator-mediated competition Predator protection hypothesis Trophic cascades Seed dispersal (including rowan sorbus aucuparia, bilberry Vaccinium myrtillus) Grey squirrel predation 	 Provide more suitable habitat (better) – through advising/supporting landowners to enhance woodland management Increase habitat availability (bigger, joined, more) – through new woodland planting, natural regeneration and complementary habitats
Subalpine dwarf-shrub heath	 Seed dispersal (including bilberry vaccinium myrtillus) near woodland 	•

Yarner Wood & Trendlebere Down SSSI (part of South Dartmoor Woods SAC

Feature		Risk		Risk prior	Proposed mitigation	Residual	Residual
	Nature	Likelihood	Severity	to mitigation		Risk	adverse effect If mitigation undertaken, are you sure that no adverse effect on the integrity of the site will occur.
Assemblage of breeding woodland birds (favourable condition) including:	 Predation Competition (nesting spaces) 	Low-moderate (largely abundance- related)	Low, pine marten predation and competition likely to be compensatory	Low		Low	Yes
Pied Flycatcher Ficedula hypoleuca	•Predation	Low (natural nesting)	Low, pine marten predation likely to be compensatory	Low		Low	Yes
		Low (nestbox nesting)	Moderate, although pine marten predation likely to be partly compensatory	Moderate	Trial nest box mitigation (including external and internal baffles) to understand nestbox occupancy effects. If effects are low, then deploy proactively within Release Area and reactively beyond Release Area. If effects are moderate to high, then deploy reactively where signs of predation are occurring.	Low	Yes
Redstart Phoenicurus phoenicurus	• Predation	Low	Low, pine marten predation and competition likely to be compensatory	Low		Low	Yes
Wood warbler Phylloscopus sibilatrix	 Predation 	Low	Low, pine marten predation	Low		Low	Yes

			likely to be compensatory				
Wintering hen harrier Circus cyaneus	 Predation Competition (prey) 	Low	Low	Low		Low	Yes
Dormouse <i>Muscardinus</i> <i>avellarinus</i>	Predation	Low, particularly where there is dense woodland understorey to enable predator detection and avoidance	Low	Low	Providing proactive advice to dormouse monitoring volunteers (via Peoples Trust for Endangered Species) of the importance of positioning nestboxes within dense understorey for predator protection and the need to firmly secure nestbox lids and ensure nest boxes are of robust construction.	Low	Yes
All bats	 Provide alternative denning opportunities 				Pine marten den boxes will be proactively installed in areas away from known bat colonies to provide alternative denning sites to limit competition for bat roosting sites.	Low	Yes
Barbastelle bat Barbastella barbastellus - maternity colony utilising a range of tree roosts (not a feature but key species recognised since designation)	 Predation Competition (cavity roost sites) 	Low	Moderate	Low	Where monitoring identifies pine marten near <u>high value roost</u> , examine if practical to use bespoke deterrents (climbing baffles/anti-climb sheeting, mesh tubes, entrance hole reducers) – deploy reactively where suitable. Consider pine marten translocation as last resort – see flow chart of monitoring and mitigation.	Low	Yes

Species-benefits

Feature	Benefit	How to maximise benefits		
Woodland bird assemblage	 Predator-mediated competition (predation of other competitors of woodland birds for food and nesting opportunities) Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on woodland birds, notably grey squirrel, corvids, raptors and great spotted woodpecker) 	 Project staff to provide landowner advice around woodland management, use of pesticides and enhancement of complementary habitats (e.g. grasslands around woodlands) to facilitate landscape- scale changes that support woodland birds. Woodland management advice to include a range of requirements of different species, including methods for long-term creation of tree cavity nesting opportunities. 		
Pied Flycatcher Ficedula hypoleuca	 Predator-mediated competition (predation of competitors of pied flycatcher for nesting opportunities) Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on pied flycatcher, notably small mammals, great spotted woodpecker and grey squirrel) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including open woodland habitats, retention of ivy and creation of veteran tree features including cavities, fungal decay and nestholes. Seek opportunities to connect and de-fragment woodlands through woodland creation to increase woodland area and reduce fragmentation effects. 		
Common redstart Phoenicurus phoenicurus	 Grey squirrel predation (predator of redstart) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including increasing deadwood and levels of low-level woodland cover. 		

Wood warbler <i>Phylloscopus sibilatrix</i>	 Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on wood warbler, notably jay, other corvids, great spotted woodpecker and rodents) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including development of more open woodland understoreys (suitable to the woodland type) in a proportion of woodland. Seek opportunities to create, connect and de-fragment woodlands through woodland creation to reduce edge effect which otherwise benefits pine marten predation of wood warbler.
Dormouse Muscardinus avellanarius	 Grey squirrel predation (predator of dormice and significant competitor of dormouse for hazelnuts) 	 Provide more suitable habitat (better) – through advising/supporting landowners to enhance woodland management Increase habitat availability (bigger, joined, more) – through new woodland planting, natural regeneration and complementary habitats

Habitats - benefits

Feature	Benefit	How to maximise benefits	
 Upland ancient oak woodland Wet alder woodland 	 Predator-mediated competition Predator protection hypothesis Trophic cascades Seed dispersal (including rowan Sorbus aucuparia, bilberry Vaccinium myrtillus) Grey squirrel predation 	 Provide more suitable habitat (better) – through advising/supporting landowners to enhance woodland management Increase habitat availability (bigger, joined, more) – through new woodland planting, natural regeneration and complementary habitats 	

Subalpine dwarf-shrub heath	 Seed dispersal (including bilberry vaccinium myrtillus) near woodland 	•	

Part Two: Evidence by theme

Forest of Dean studies

Many of the themes pertinent to this study have previously been thoroughly investigated by the Forest of Dean Pine Marten Reintroduction Project through their HRA and Feasibility Study. We have reproduced the relevant main points for each theme in this study but for further detail please see those reports¹. The HRA only studied greater and lesser horseshoe bats and is not publicly available². With thanks to the authors of these two reports.

1 Habitat

1.1 General

1.1.1 Forest of Dean Feasibility Study

1.1.1.1 The importance of predation

Predation is a key component of a healthy ecosystem, and the reintroduction of a native predator can have profound positive impacts for ecosystem restoration. Indeed, with increasing density and diversity of generalist predators, comes increasing prey population stability. In particular, generalist predators, such as pine martens, can have a stabilising effect on prey populations that reduces large fluctuations. This is because generalist predators are most likely to eat what is most common, and this can have an important balancing effect on ecosystems.

1.1.1.2 Impacts of lack of predation

There are numerous examples where a lack of predation has let terrestrial herbivore populations grow without control, this means plants cannot escape herbivory, and plant survival is much reduced. Indeed, a lack of predation has led to what has been described as 'Ecological Meltdown'. This balancing of the ecosystem by predators is an important ecological function. Indeed, the suppression and control of predators has been shown to promote the success of invasive species.

1.1.1.3 Co-evolution of native species

Every native species has lived and evolved alongside European pine marten for over a million years. Indeed, it is thought that pine martens were once the UK's second most numerous carnivore. This evolutionary history means that pine martens are a fundamental missing piece of our natural heritage, and their potential importance within ecological communities should not be understated.

1.1.1.4 Predator-mediated competition

Anti-predator strategies come in a range of different forms. Examples include camouflage, herding, vigilance, nest-site selection, foraging-site selection, flight patterns, etc. Any species investing resources in anti-predator strategies, or decreasing resource intake to lower predation risk, is at a competitive disadvantage if predation risk is not present. For instance, when a predator is not present a species which invests in a low number of highly protected young will lose out to a competitor which produces high numbers of at-risk young. Hence, if two species are in competition, the balance of competition may change due to the presence or absence of a predator.

1.1.1.5 Predator protection hypothesis

This may be best described as 'the predator of my predator is my friend'. For instance, firecrests (*Regulus ignicapilla*) are not a common component of goshawk (*Accipiter gentilis*) diet. Firecrests have been found to be more likely to nest near a goshawk nest, as the goshawk will provide protection against other predators, such as jays (*Garrulus glandarius*). This has been observed for a variety of species.

1.1.1.6 Trophic cascades

When a predator is removed from an ecosystem, prey populations may inflate, and prey behaviour may change. This may have a variety of further effects on the species that the prey influence at lower trophic levels, which is known as a trophic cascade. Trophic cascades can have widespread implications for a variety of species. Trophic cascades are thought to be common occurrences, however detailed knowledge of an ecosystem is required to show and record their effects.

1.2 Suppression or extirpation of grey squirrels

1.2.1 Forest of Dean Feasibility Study

1.2.1.1 Reintroducing native predators can decrease the impacts of invasive non-native species

Pine marten are thought to have a controlling influence on grey squirrel (Sciurus carolinensis) populations. The first evidence for this comes from central Ireland, where pine martens have been recolonising their former range following legal protection. Pine martens have been shown to have clear impacts on grey squirrel populations in areas they have recolonised. More recent evidence has now shown that the grey squirrel has been extirpated from six counties in central Ireland. Also, during a recent camera trap study in Northern Ireland, grey squirrels and pine martens were never both found at the same camera trap location.

1.2.1.2 Mechanism of interaction between grey squirrel and pine marten

The mechanism for interaction has not yet been determined. It is likely to be partially due to direct predation, but it may also be caused by non-lethal, non-consumptive effects associated with the landscape of fear. To speculate, grey squirrels may increase their vigilance and decrease their foraging time when pine martens are present in an area. Also, pine martens may need to reach a specific density to cause grey squirrel extirpation, alternatively pine marten may cause a highly localised reduction in grey squirrel numbers in areas where pine marten are resident.

1.2.1.3 Key difference between Ireland and Great Britain

Ireland and Northern Ireland differ ecologically in some key respects from mainland Britain. In particular, voles (Arvicolinae) are usually a key component of pine marten diet, but there are no vole species native to Ireland. This has led to suggestions that pine marten may predate more heavily on squirrels in Ireland than in mainland Britain. However, recent results from studies in Scotland reveal that pine martens are having the same effect on squirrels there, suppressing grey squirrel populations and allowing reds to recover. As a result, it appears that the effect of pine martens on squirrels may not be dependent on the assemblage of small mammals available as prey.

1.2.1.4 Predatory extirpation of non-native species

The extirpation of a species by a predator is a rare event. Usually, the co-evolutionary history between species means an evolutionary arms race has developed which stops one species gaining a significant advantage over the other. However, extirpation may occur when there is a lack of co-evolutionary history. Grey squirrels have no experience of a marten-like predator in their native range in North America, making them vulnerable to population extirpation.

1.2.1.5 Benefits to red squirrels

The reduction in grey squirrel populations in Ireland has greatly benefited red squirrel conservation status. The impact of pine marten predation on red squirrels does not impact red squirrel population success due to their historical evolution alongside each other. Hence, when pine marten come back into an area, red squirrels seem to thrive. This is a good example of the differing effects of compensatory vs additive predation. Also see <u>1.2.2.2</u>

1.2.1.6 Grey squirrel- nest predator and ecosystem modification

A variety of species may benefit from grey squirrel extirpation. For instance, grey squirrels may be an important nest predator of birds, with potential subsequent impacts on bird populations. Hawfinch (Coccothraustes coccothraustes) and lesser spotted woodpecker (*Dryobates minor*) are negatively associated with grey squirrel density. This may not be directly through predation but could be ecosystem modification by grey squirrels resulting in poorer quality habitat for the species.

1.2.1.7 Competition for food

Grey squirrels are thought to be in competition with a range of species due to the food resources they consume. The release of resources currently consumed by grey squirrels may have a range of positive implications for native biodiversity.

1.2.2 Additional evidence

1.2.2.1 Mechanism of interaction between grey squirrel and pine marten

Pine martens have been shown to reduce grey squirrel population and range^{3,4} through multiple mechanisms: direct predation of grey squirrel females and juveniles in spring⁵; non-lethal effects of a predator in the landscape changing the behaviour of grey squirrels (reducing feeding and breeding efficacy while increasing range)⁶

1.2.2.2 Benefits to red squirrels

Red squirrel occurs in pine marten diet at low levels but its population is positively correlated with connectivity with pine martens, with the opposite being true of grey squirrel populations. Decreased grey squirrel population reduces risk of contact between species and subsequent transmission of Squirrel Pox Virus (SQPV), to which red squirrel is vulnerable. Additionally, SQPV prevalence is reduced in controlled grey squirrel populations including those controlled through predation, presumably as population stress makes remaining grey squirrels vulnerable to effects of SQPV, so further reducing probability of transmission to red squirrels.⁷,⁸.

Red squirrel has been absent from the project area since the 1940s (Exmoor since the 1950s) but there is current interest in reintroductions of this native species.

1.2.2.3 Trophic cascades

The squirrel example of a trophic cascade effect may be indicative of other trophic cascades that occur as pine martens recover, but which are difficult to study. Understanding of trophic cascades is very limited, with little empirical data due to the complexity of ecosystem responses to reintroduced species⁹.

1.3 Seed dispersal

1.3.1 Pine marten frugivory

Fruit represents an important component of pine marten diet during summer, autumn and winter both in terms of frequency of occurrence in scats but also biomass. A study in Northern Ireland has shown that in autumn fruit can represent over 80% of diet (by frequency and biomass). Annually, fruit intake represents 30-47% of annual diet (by frequency of occurrence) in studies in Scotland, Ireland, Northern Ireland and Italy but this is lower (5-15%) in studies in Poland and Sweden.¹⁰

1.3.2 Ecological role in seed dispersal

Carnivorous mammals are the main mammalian frugivores and seed dispersers in temperate climate regions. They are considered long-distance seed dispersers due to their large territory sizes, meaning they fulfil a different ecological role from resident (non-migrating) passerine birds which have relatively smaller dispersal distances. A study in NW Spain identified that pine martens had a maximum seed dispersal distance of 1233m from the maternal tree where home range was 0.5-

1.5km².¹¹ UK home range is more typically 5-25km² so pine martens may present substantially greater seed dispersal distances in the UK¹². As ground flora and understorey species frequently rely on endozoochory for seed dispersal, pine martens are key dispersal vectors for these components of woodlands.¹³

Carnivore seed dispersers (inc pine marten) may also play a role in providing resilience against climate change¹⁴

1.3.3 Preference of fruit species

Fruit preference of pine marten is primarily based on abundance and accessibility within the environment. However, effort is often concentrated on a similar group of species across Europe, probably as they coincide with suitable pine marten habitat and are found within multiple habitat types, particularly those associated with acid soils. Bilberry *Vaccinium myrtillus*, rowan *Sorbus aucuparia* and blackberry *Rubus fruticosus* produce large volumes of fruit and can be abundant on acid habitats so represent frequent components of pine marten diet¹⁵, ¹⁶. A wide range of other fruit may be consumed such as cowberry *Vaccinium vitis-idaea*, bog whortleberry *Vaccinium uliginosum*, crowberry *Empetrum hermaphroditum*, and common juniper *Juniperus communis*. As mushroom species also occur in pine marten diet (e.g. *Rhizopogon rubescens*), they may play a role in dispersal of spores too.¹⁷

1.4 Conclusions

Restoring the broad guild of native, co-evolved predators is key to restoring woodland ecosystems and supporting conservation of woodland species, as predators fulfil a wide range of natural functions and can tackle non-native species. Of SSSIs screened into this assessment, half of relevant assessed habitats are in unfavourable condition, with many of those species identified within citations and conservation objectives in decline, some critically so. Restoring natural processes is key and therefore returning missing components of these processes is essential to enable recovery. Ensuring that landscapes can support pine marten and the wide range of other woodland species is critical to this and can be managed through management advice and in some instances project support.

Actions:

- Provide suitable habitat across release regions (fulfils Lawton's 'better' component) through advising/supporting landowners to enhance woodland management across PRRs, particularly to provide more complex variety of structure within woodlands to provide habitat and resilience for a range of species.
- Increase habitat availability and connectivity (fulfils Lawton's 'bigger',' joined', and 'more' components) through new woodland planting, natural regeneration and complementary habitats (e.g. vole-rich grasslands). This can be through advice, supporting access to other schemes and also through direct support where targeted effort is required.

2 Species

2.1 Bats

2.1.1 Forest of Dean HRA

2.1.1.1 Status of horseshoe bats

In the UK, the greater and lesser horseshoe bat populations are doing well. Since 1999, the Bat Conservation Trust report that a population index of greater horseshoe bats has increased 145 – 163%, while for lesser horseshoe bats a population index has increased 80 – 158%. In the latest regional review of British mammals, carried out by the mammal society in 2020, both species were assessed against the IUCN red list criteria and were categorised as least concern, the report stating

"A reduction in population size has not been observed, inferred, estimated or suspected for this species, and there is no evidence of a contraction of the geographical range over the last 20 years".

2.1.1.2 Interaction between horseshoe bats and pine marten

Greater and lesser horseshoe bats live alongside pine martens across much of their range, supplying widespread opportunities for interaction between the species. Predation by pine martens on bats is broadly rare. A review of 17 studies, totalling 18210 scats investigated, showed three with bats (0.02% of diet). This is supported by two reviews of pine marten diet which found that the consumption of bats by pine marten was also low (0.01%), or not mentioned. For both greater and lesser horseshoe bats, predation is not listed as a threat within their IUCN red list assessments.

2.1.1.3 Winter (underground) roost interactions

- a. Pine marten predation within international guidance. Within international guidance covering the geographic area where pine martens and horseshoe bats interact (Europe), no mention of protecting roosts (winter or summer) from disturbance or predation by pine martens is made. This includes the European Commission's Action Plan for the Conservation of All Bat Species in the European Union, and the UNEP/EUROBATS publication Protecting and managing underground sites for bats. Both papers conclude the main threats to underground sites are from excessive human disturbance and/or unsympathetic modification of site features.
- b. Use of underground sites for denning. Pine martens will use underground sites for denning particularly in extensive periods of cold weather and heavy snow or when there is a lack of suitable above ground arboreal den sites.
- c. Bat predation in underground roosts. There are two examples of pine martens eating bats within an underground roost. One in a large bat roost in Neitoperek, Poland. It was unknown whether this was predominantly scavenging or predation. The roost was healthy and expanding. Another example is from a cave system in Slovakia where skeletal remains of pine martens were found to be associated with the remains of bats. Due to the presence of the remains of other mammals, birds, and frogs in the same location the cave was presumed to be used as a food reserve by martens. Predation only results in detrimental impacts on populations in specific circumstances. This is dependent on a variety of factors, such as the proportion of the breeding population impacted by predation, whether predators selected for individuals less able to contribute to populations (i.e. old/sick/weak) and whether the populations can compensate for losses. In both cases there is no evidence to suggest that martens were having a detrimental impact on populations of bats.
- d. Conservation Objectives threat from pine martens. Lesser horseshoe bat conservation objectives for Ireland lists pine martens as a threat to summer roosts, but not to winter roosts.
- e. Conclusions of Forest of Dean HRA. For winter roosts, there are no examples of significant impacts on either the population of each of the qualifying features or the distribution of the qualifying features where pine martens currently interact.

2.1.1.4 Summer (building) roost interactions

a. Pine marten predation within international guidance. Within international guidance covering the area where pine martens and horseshoe bats interact (Europe), no mention of protecting roosts (winter or summer) from disturbance or predation by pine martens is made. This includes the European Commission's Action Plan for the Conservation of All Bat Species in the European Union, and the UNEP/EUROBATS – Protection of overground roosts for bats.

- b. Use of buildings for denning. Pine martens will use sub optimal den sites like buildings when there is a scarcity of suitable arboreal sites.
- c. Bat predation and disturbance in summer roosts. Lesser horseshoe bat conservation objectives for Ireland lists pine martens as a threat to summer roosts, but not to winter roosts. In Ireland, pine martens disturbed two lesser horseshoe bat roosts within buildings, causing the roosts to become deserted. Pine martens were thought to be utilising these buildings as denning/resting sites, no predation was observed. Where pine marten entry to the roost was prevented, the roost returned. This would have impacted the distribution of the qualifying features within the site. The LHB population in western Ireland shows increases across both short and long time frames, while living alongside a high-density pine marten population.
- d. Conclusions of Forest of Dean HRA. For summer roosts, there are no examples of impacts on the population of the qualifying features. There is an example of an impact on the distribution of the qualifying features within the site.

2.1.1.5 Distribution of the qualifying features within the site

- a. Likelihood of impact. Impacts have been observed in a single country (Ireland) and single type of summer roost (building), but not observed elsewhere.
- b. Preference for natural denning features. Pine martens are specialists of old growth forests and utilise the structures these habitats provide for den sites. They preferentially choose den sites in arboreal features such as cavities or structures like bird nests or squirrel dreys when available. A literature review of 1,241 pine marten resting or denning sites shows no buildings were used in the Netherlands, Poland, or Scandinavia. Natural den sites in these locations were used instead. This included a study of Den sites in Bialowieza National Park in Poland using radio tracking data from 14 animals found that over 95% were arboreal features. Hence, building use has not been observed in areas with high levels of suitable pine marten den sites.
- Use of buildings for denning. Buildings are only used as denning or resting sites when there is C. a lack of natural denning/resting sites. Natural denning/resting sites for pine marten are most frequently found in old broadleaved woodlands. In Scotland, less than 5% of woodland cover is broadleaves >60 years old. Few opportunities for natural denning sites in Scotland has led to suboptimal alternatives being used instead, such as buildings. A similar situation occurs in Ireland, where less than 5% of woodland cover is broadleaves >50 years old. Similarly, areas lacking old growth woodlands has led to pine martens using buildings as den or resting sites. Two recent studies carried out in Northern Ireland are relevant here. The first looked at pine marten denning behaviour across two distinct landscapes, one a highly human-modified landscape with limited tree cover and the other a semi-natural, wooded landscape. The conclusions of this study showed that pine martens are highly adaptable to human modified landscapes and can survive in low numbers in areas with low habitat suitability by utilising buildings and underground sites for denning. However, where oldgrowth forested habitats were present, with an abundance of arboreal features, this was the preferred habitat chosen for denning and they almost exclusively used arboreal features and rarely left the forest. The second study looked at current and predicted occupancy rates of habitats across a large geographic area. The results showed that pine martens strongly avoided human settlements and areas of human inhabitation. Hence, building use is driven by low levels of suitable pine marten den sites.

d. Conclusions of Forest of Dean HRA. There is an example of an impact on the distribution of the qualifying features within the site in an area with a low level of suitable pine marten den sites. There are no examples of impacts on the distribution of the qualifying features within the site in areas with high levels of suitable pine marten den sites.

2.1.2 Forest of Dean Feasibility Study

2.1.2.1 Risk assessment for bats

Туре	Likelihood	Potential impact	Risk (Out of 5)	
Large building roost	Medium ^{&}	High		4
Medium building roost	Medium ^{&}	Medium		3
Small building roost	Medium ^{&}	Low		2
Cave/mine roost	Low*	Low-High	<mark>2</mark> -	<mark>4</mark> †
Forest roosting bats	Low	Low		1

Roost size determines potential impact on the population, either through disturbance or predation. Roost type determines likelihood of interaction.

*but dependent on distance to the cave entrance.

«Potentially dependent on availability of alternative den sites.

[†]Awaiting more detailed review of available evidence.

2.1.3 Stakeholder concern

Concerns raised at stakeholder workshops and via feedback forms were the direct predation of bats within roosts (especially maternity roosts) by pine marten and disturbance of roosts. The concern over the lack of knowledge of the whereabouts of woodland bat roosts, notably barbastelle and Bechstein's, meant any impacts were unlikely to be known about. The impact of a small number of barbastelle roost predation events could potentially have a large effect. The ability to make modifications to roosts in buildings to mitigate impacts, ameliorated concern.

2.1.4 Expert assessment to inform HRA – bats and pine martens

In recognition of the concern from stakeholders and the limited information regarding the interaction between pine marten and woodland bats (Bechstein's and Barbastelle bats), the Two Moors Project partnership employed expert consultants to carry out an assessment to inform this HRA regarding bats and pine martens. This HRA has applied these conclusions to all designated features for bats including some that were not examined within the report.

2.1.5 Assessment and mitigation of roosts

This HRA has identified the approach to be taken for categories of roosts (see below), however detailed assessments of individual roosts have not been possible at this stage due to the number of roosts. During the next phase, subject to consents, expert contractors (Vincent Wildlife Trust) will be employed to carry out site visits to individual roosts to determine category of roost, need, practicality and method of mitigation, designs and costs of mitigation and landowner consent. Where proactive mitigation is to be installed prior to pine marten release, the contractors will seek appropriate licences/permissions and install mitigation. The majority of this work is expected to proceed between January and July 2024, although some works may go ahead the following season where appropriate (i.e. due to distance from release area in year one). Reactive mitigation will be carried out by landowners, bat roost volunteers and/or the project team as appropriate to each site. Expert advice will be provided by Vincent Wildlife Trust for reactive works.

2.1.6 Beer Quarry and Caves SAC

A bespoke approach has been identified for the Beer Quarry and Caves SAC, which is separated from the Potential Release Regions by breaks in habitat connectivity around Exeter and the Exe Estuary – described as a pinch point. This pinch point provides some protection, but if bridged by pine

martens, good connectivity east to the roosts associated with the SAC would increase risk. Therefore, proactive monitoring of this pinch point to understand if pine marten have bridged the area, would enable a trigger for further mitigation to be progressed, some proactively at that point. In addition, sightings/reports of pine marten east of the pinch point would also trigger the mitigation for Beer Quarry and Caves SAC.

A monitoring plan is being developed for the project during autumn 2023, which will identify how the pinch point area will be monitored.

2.2 Greater Horseshoe Bat (*Rhinolophus ferrumequinum*)

Туре	Species	Likelihood	Potential	Moderating	Opportunity
	(type of use)	of use	Impact	factors	for defence
					against pine
					martens
Large building	Greater horseshoe	Low	Moderate	Distance to	High
roost	(breeding)			suitable habitat	
				for pine martens	
				Availability of	
				alternative	
				denning sites	
Medium	Greater horseshoe	Low	Moderate	Distance to	High
building roost	(breeding)			suitable habitat	
				for pine martens	
				Availability of	
				alternative	
				denning sites	
Small building	Greater horseshoe	Medium	Very low	Distance to	High (but
roost	(breeding)			suitable habitat	potentially
				for pine martens	expensive
				Availability of	owing to
				alternative	large number
				denning sites	of sites)
Cave/mine/adit	Greater horseshoe	Moderate	Moderate	Pine martens	Low
	(hibernation; some			unlikely to range	
	breeding)			far from	
				entrance, but	
				horseshoe bats in	
				Devon frequently	
				found roosting at	
				low heights and	
				near entrances	

2.2.1 Summa	ary of risks to	Greater	horseshoe k	bat roosts	from pine	martens
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2.2.2 Conclusions

Feature	Risk		Proposed mitigation	Residual	
	Nature	Likelihood	Severity		Risk
All bats	 Provide alternative denning opportunities 			Pine marten den boxes will be proactively installed in areas away from known bat colonies	Low

				denning sites to limit	
				competition for bat	
				roosting sites.	
Greater horseshoe bat	 Predation 	Low	Moderate	Bespoke proactive	Low
Rhinolophus	 Disturbance 			mitigation of high value	
ferrumequinum –				roosts within PRRs and	
building roosting				20km buffer to prevent	
				access by pine marten.	
				Consider translocation as	
				last resort – see flow chart	
				of monitoring and	
				mitigation.	
				Where monitoring	
				identifies pine marten	
				near moderate value roost	
				examine if appropriate or	
				practical to use bespoke	
				mitigation – deploy	
				reactively where suitable.	
				Consider translocation as	
				last resort – see flow chart	
				of monitoring and	
				mitigation.	
Greater horseshoe bat	 Predation 	Moderate	Moderate	Where monitoring	Low
Rhinolophus	 Disturbance 			identifies pine marten	
<i>ferrumequinum</i> – cave				near <u>high value roost</u>	
roosting				examine if practical to use	
				bespoke mitigation –	
				deploy reactively where	
				suitable. Consider	
				translocation as last resort	
				– see flow chart of	
				monitoring and mitigation.	

2.3 Lesser Horseshoe Bat (*Rhinolophus hipposideros*)

2.3.1 Summary of risks to Lesser horseshoe bat roosts from pine martens

Туре	Species (type of use)	Likelihood of use	Potential Impact ^a	Moderating factors	Opportunity for defence against pine martens
Large building roost	Lesser horseshoe (breeding)	Low	Moderate	Distance to suitable habitat for pine martens Availability of alternative denning sites	High
Medium building roost	Lesser horseshoe (breeding, possibly hibernation)	Low	Moderate	Distance to suitable habitat for pine martens Availability of alternative denning sites	High

Small building roost	Lesser horseshoe (breeding, possibly hibernation)	Medium	Very low	Distance to suitable habitat for pine martens Availability of alternative denning sites	High (but potentially expensive owing to large number of sites)
Cave/mine/adit	Lesser horseshoe (hibernation)	Moderate	Moderate	Pine martens unlikely to range far from entrance, but horseshoe bats in Devon frequently found roosting at low heights and near entrances	Low

2.3.2 Conclusions

Feature		Risk Propo		Proposed mitigation	Residual
	Nature	Likelihood	Severity		Risk
All bats	 Provide alternative denning opportunities 			Pine marten den boxes will be proactively installed in areas away from known bat colonies to provide alternative denning sites to limit	Low
				roosting sites.	
Lesser horseshoe bat <i>Rhinolophus</i> <i>hipposideros</i> – building roosting	 Predation Disturbance 	Low	Moderate	Bespoke proactive mitigation of <u>high value</u> <u>roosts</u> within PRRs and 20km buffer to prevent access by pine marten. Consider translocation as last resort – see flow chart of monitoring and mitigation. Where monitoring identifies pine marten near <u>moderate value roost</u> examine if appropriate or practical to use bespoke mitigation – deploy reactively where suitable. Consider translocation as last resort – see flow chart of monitoring and mitigation	Low

Lesser horseshoe bat	 Predation 	Low	Moderate	Where monitoring	Low
Rhinolophus	Disturbance			identifies pine marten	
hipposideros – cave				near <u>high value roost</u>	
roosting				examine if practical to use	
				bespoke mitigation –	
				deploy reactively where	
				suitable. Consider	
				translocation as last resort	
				 see flow chart of 	
				monitoring and mitigation.	

2.4 Bechstein's Bat (Myotis bechsteinii)

2.4.1 Summary of risks to Bechstein's bat roosts from pine martens

Туре	Species (type of use)	Likelihood of use	Potential Impact ^a	Moderating factors	Opportunity for defence against pine martens
Cave/mine/adit	small numbers of Bechstein's (hibernation)	Moderate	Moderate	Pine martens unlikely to range far from entrance	Low
Tree roosts	Bechstein's (breeding; possibly hibernation)	Low	Low	Availability of alternative denning sites Availability of tree features suitable for bat roosts and inaccessible to pine martens	Very low
Bat boxes	Bechstein's (breeding)	Low	Low	Availability of tree features suitable for bat roosts, and hence ability to use multiple roost locations	Medium

2.4.2 Conclusions

Feature		Risk		Proposed mitigation	Residual
	Nature	Likelihood	Severity		Risk
All bats	 Provide alternative denning opportunities 			Pine marten den boxes will be proactively installed in areas away from known bat colonies to provide alternative denning sites to limit competition for bat roosting sites.	Low
Bechstein's Bat Myotis	 Predation 	Low	Moderate	Where monitoring	Low
bechsteinii – cave	 Disturbance 			identifies pine marten	
roosting				near <u>high value roost</u> ,	

				examine if practical to use bespoke deterrents (climbing baffles/anti- climb sheeting, mesh tubes, entrance hole reducers) – deploy reactively where suitable. Consider pine marten translocation as last resort – see flow chart of monitoring and mitigation.	
Bechstein's Bat <i>Myotis</i> <i>bechsteinii</i> – tree roosting	 Predation Competition (cavity roost sites) 	Low	Moderate	Where monitoring identifies pine marten near <u>high value roost</u> , examine if practical to use bespoke deterrents (climbing baffles/anti- climb sheeting, mesh tubes, entrance hole reducers) – deploy reactively where suitable. Consider pine marten translocation as last resort – see flow chart of monitoring and mitigation.	Low
Bechstein's Bat <i>Myotis</i> <i>bechsteinii</i> – bat box roosting	• Predation	Low	Low	Explore mitigation measures to bat boxes reactively due to low level of risk and low numbers of bat boxes in landscape.	Low

2.5 Barbastelle Bat (Barbastella barbastellus)

2.5.1 Summary of risks to Greater horseshoe bat roosts from pine martens

Туре	Species (type of use)	Likelihood of use	Potential Impact	Moderating factors	Opportunity for defence against pine martens
Cave/mine/adit	small numbers of barbastelle (hibernation)	Moderate	Moderate	Pine martens unlikely to range far from entrance, but horseshoe bats in Devon frequently found roosting at low heights and near entrances	Low
Tree roosts	Barbastelle (breeding; hibernation)	Low	Low	Availability of alternative denning sites Availability of tree features suitable for bat	Very low

				roosts and inaccessible to pine martens	
Bat boxes	Barbastelle (breeding)	Low	Low	Availability of tree features suitable for bat roosts, and hence ability to use multiple roost locations	Medium

2.5.2 Conclusions

Feature	Risk			Proposed mitigation	Residual
	Nature	Likelihood	Severity		Risk
All bats	 Provide 			Pine marten den boxes	Low
	alternative			will be proactively	
	denning			installed in areas away	
	opportunities			from known bat colonies	
				to provide alternative	
				denning sites to limit	
				competition for bat	
				roosting sites.	
Barbastelle bat	 Predation 	Low	Moderate	Where monitoring	Low
Barbastella	 Competition 			identifies pine marten	
<i>barbastellus</i> – tree	(cavity roost			near <u>high value roost</u> ,	
roosts	sites)			examine if practical to use	
				bespoke deterrents	
				(climbing baffles/anti-	
				climb sheeting, mesh	
				tubes, entrance hole	
				reducers) – deploy	
				reactively where suitable.	
				Consider pine marten	
				translocation as last resort	
				 see flow chart of 	
				monitoring and mitigation.	
Barbastelle bat	 Predation 	Low	Moderate	Where monitoring	Low
Barbastella	 Disturbance 			identifies pine marten	
barbastellus – cave				near <u>high value roost</u> ,	
roosting				examine if practical to use	
				bespoke deterrents	
				(climbing baffles/anti-	
				climb sheeting, mesh	
				tubes, entrance hole	
				reducers) – deploy	
				reactively where suitable.	
				Consider pine marten	
				translocation as last resort	
				 see flow chart of 	
			ļ	monitoring and mitigation.	
Barbastelle bat	 Predation 	Low	Low	Explore mitigation	Low
Barbastella				measures to bat boxes	
<i>barbastellus</i> – bat box				reactively due to low level	
roosting	1				

		of risk and low numbers of	
		bat boxes in landscape.	

2.6 Natterer's Bat (Myotis nattereri)

2.6.1 Summary of risks to Natterer's bat roosts

The only roost where this species is identified is at Bulkamore Iron Mine SSSI. The expert assessment found that 'because Natterer's bats tend to hibernate in small crevices, the impacts on this species are likely to be low owing to inaccessibility'.

2.6.2 Conclusions

Feature	Risk		Proposed mitigation	Residual	
	Nature	Likelihood	Severity		Risk
All bats	 Provide alternative denning opportunities 			Pine marten den boxes will be proactively installed in areas away from known bat colonies to provide alternative denning sites to limit competition for bat roosting sites.	Low
Natterer's Bat (<i>Myotis</i> <i>nattereri</i>) – cave roosting	 Predation Disturbance 	Low	Low	Where monitoring identifies pine marten near <u>high value roost</u> examine if practical to use bespoke mitigation – deploy reactively where suitable. Consider translocation as last resort – see flow chart of monitoring and mitigation.	Low

2.7 Dormouse (Muscardinus avellanarius)

2.7.1 Forest of Dean Feasibility Study

2.7.1.1 Interaction between pine marten and dormouse

Extensive evidence of overlap between pine marten populations and hazel dormouse from Italy. There is also some evidence of overlap in other areas and overlap likely widespread across continental Europe.

Three studies found evidence of hazel dormouse predation by pine marten in Italy, Switzerland, and Germany. The frequency of occurrence of hazel dormouse within pine marten diet was 3.7%, 0.5%, and 1.6% respectively. However, five other studies where hazel dormouse were present found no evidence of predation by pine marten. Levels of predation are linked to the abundance of dormice in an area. Dormice populations within the study area in Italy are widespread, hence 3.7% is the highest level of predation that can be expected.

Hazel dormice are in direct competition with grey squirrels for hazelnuts, a primary food source. The impact of this competition may be significant, with an estimated 96% of hazelnuts eaten by grey squirrels. Hence, a reduction in grey squirrel numbers by pine marten may benefit hazel dormice.
2.7.1.2 Modern environmental differences

Dormouse boxes are a key difference between the modern environment and the environment in which the species co-evolved. However, as dormouse boxes are placed with entrances holes towards the tree, it would be assumed that a pine marten's head or arm entry would be severely restricted. The use of dormouse boxes in areas with pine martens is frequent and widespread, and their use is still actively encouraged by conservationists in these areas. If lids are properly secured, predation in dormouse boxes is not expected.

2.7.1.3 Levels of pine marten predation in comparison with other predators

Two key predators of dormice are foxes and feral cats. The frequency of occurrence of dormice in fox diet has been recorded as between 0.6-6.6% of diet, and for feral cats has been recorded as high as 9%. Other predators are known to include badgers, dogs, wild boar, and adders.

3.1.1.4 Risk assessment for other mammal species

Species	Potential impact	Likelihood	Risk (Out of 5)
Hazel Dormouse	Low	Medium	2

2.7.2 Additional information

2.7.2.1 Status of dormouse

Hazel dormouse is classified as Least Concern under the IUCN Red List with threats to dormice including built development, agriculture and forestry. Declines are seen in parts of its northern range (e.g. UK, Netherlands, Sweden, Germany, Denmark) due to habitat loss and fragmentation¹⁸. It is generally accepted that Mediterranean areas have the highest density of dormice where it is common and widespread¹⁹, although there are no standardised monitoring protocols across Europe for the species²⁰. Hazel dormice are associated with ancient woodland and have persisted in deforested areas where hedge networks are a key cultural part of the landscape, with southern Britain being a good example of this, with considerably greater range of dormouse than nearby areas of Europe²¹.

In the UK dormouse is classified as Vulnerable with uncertainty over causes of a 48% decline during 2005-2014 but decline in habitat quality is suspected²². The southwest population remained stable between 1998-2008 and Devon is considered a stronghold for the species in Britain due to its network of woodlands and hedges. There are over 100 recorded sites for dormouse in Devon although there is variation across the county with east Devon supporting particularly high concentrations. Greatest numbers of records appear within the Dartmoor PRR²³ at 0.02 per hectare. As a comparison, an Italian study of fragmented landscapes found mean density values within woodland fragments of 0.01 to 0.5 per hectare²⁴ – up to 25 times greater density.

2.7.2.2 Interaction with predators

Juškaitis (2023)²⁵ carried out a review of studies of predator dietary analysis in Europe where dormouse formed part of the diet. This showed that, while pine marten will certainly predate the species, dormice are also predated by at least 17 other species that occur in SW England, with owls hunting in and around woodlands (particularly tawny owl) being the major predators of dormice.

Predator Species	Number of sources containing information about Hazel Dormouse <i>Muscardinus avellanarius</i> recorded in the diets of
	particular predators.
Red fox Vulpes vulpes	15
Eurasian otter Lutra lutra	2
Pine marten Martes martes	7
Eurasian badger Meles meles	2

Stoat Mustela erminea	1
Least weasel Mustela nivalis	5
Western polecat Mustela putorius	1
American mink Neovison vison	2
Domestic cat Felis catus	8
Common barn owl Tyto alba	71
Tawny owl Strix aluco	102
Little owl Athene noctua	3
Northern long-eared owl Asio otus	47
Eurasian sparrowhawk Accipiter nisus	1
Eurasian buzzard Buteo buteo	2
Common raven Corvus corax	2
Common pheasant Phasianus colchicus	1
Adder Vipera berus	1

Adapted from Juškaitis (2023) – our emphasis on pine marten line.

This demonstrates the wide range of species predating on hazel dormouse and the relative impact of pine marten as being low. This suggests it is unlikely that the additional predation pressure of pine martens will cause any major impacts on dormouse populations.

2.7.2.3 Interaction with pine marten

The range of hazel dormouse and pine marten overlap heavily in Europe²⁶,²⁷. Greatest predation of dormice by pine marten occurs where dormouse species are abundant, particularly in parts of the Mediterranean, such as Italy, where edible dormouse *Glis glis* and garden dormouse *Eliomys quercinus* live in sympatry with hazel dormouse. Seasonally and collectively these can reach 10% of pine marten diet in these areas due to their high abundance and profitable size of edible dormouse in autumn. But this level of dormouse predation by pine marten is rare, particularly where there are only hazel dormouse populations.

Hazel dormouse is common in SW England, relative to other parts of the UK and therefore may seasonally become part of pine marten diet, but this may be considerably lower than in Mediterranean areas where dormouse density is considerably greater. Whilst both species occupy woodland habitat, the low densities of both pine marten and dormice in the landscape, coupled with the pine martens opportunistic feeding strategy of predating common and abundant prey, give a low likelihood of impact at a population level.

Where dense woodland understoreys exist, dormice are warned of mammalian predators (including pine marten) approaching through movements in foliage. This density also provides protection from birds of prey, particularly owls²⁸. Dormice will benefit from woodland management that promotes dense understorey growth and siting of nestboxes within such growth.

2.7.3 Stakeholder concern

Concerns from stakeholders were generally low over dormouse predation outside of nest boxes. Expert opinion countered concern over hibernating dormouse predation. Stakeholders (box monitors) felt that robust nest boxes securely fastened should be standard practice to reduce general predation from a range of species. Benefits of pine marten presence raised were reducing competition from grey squirrel plus broader project benefits of improved habitat.

2.7.4 Conclusions

Risk		Proposed mitigation	Residual	
Nature	Likelihood	Severity		Risk

Two Moors Project HRA Appropriate Assessment as amended in February 2024

 Predation 	Low, particularly	Low	 Providing advice to dormouse monitoring 	Low
	where there is		volunteers of the importance of positioning	
	dense woodland		nest boxes within dense understorey for	
	understorey to		predator protection and the need to firmly	
	enable predator		secure next box lids.	
	detection and		 Providing woodland management advice to 	
	avoidance		landowners encouraging varied woodland	
			habitat structure, including development of	
			dense understoreys (suitable to the woodland	
			type) in a proportion of woodland, will be	
			important both to provide protection to	
			dormice from predators but also providing	
			suitable habitat for many other species.	

Benefit	How to maximise benefits
 Grey squirrel predation (predator of dormice and significant competitor of dormouse for hazelnuts) 	 Provide more suitable habitat (better) – through advising/supporting landowners to enhance woodland management Increase habitat availability (bigger, joined, more) – through new woodland planting, natural regeneration and complementary habitats

2.8 Birds

2.8.1 Forest of Dean Feasibility Study

2.8.1.1 Diet – context of bird predation

Over 46 studies have investigated the diet of pine martens across continental Europe, with four studies of diet specifically within Scotland. Pine martens are a generalist omnivore, eating a wide range of different food species. They have been shown to have the broadest dietary niche of any British mustelid. Indeed, due to the niche breadth of the pine marten, and their preference for voles, counter-intuitively the mean mass of their mammalian prey (121g) is smaller than both weasels (201g) and stoats (508g). The broad groups eaten include small mammals (e.g. rodents), medium mammals (e.g. squirrels and rabbits), large mammals (e.g. deer and sheep as carrion), birds (e.g. corvids and passerines), plant material (e.g. berries) and invertebrates (e.g. beetles). The proportion of these different food groups within pine marten diet is highly variable between different locations, even within Scotland (see Table 1), as measured by the frequency of occurrence of food items in pine marten scat. When interpreting these data, it should be remembered that the frequency of occurrence of food items is biased towards small prey with a large proportion of recoverable remains.

Table 1. The proportion of different food groups within pine marten diet, based on the minimum and maximum frequency of occurrence in faecal samples taken from four study locations in Scotland, and the mean across Europe, and predicted proportions in the Forest of Dean based on latitude.

Species group	Min % (Scotland)	Mean % (Europe)	Max % (Scotland)
Small mammals	25	44	58
Medium & large mammals	2	7	12
Birds	11	14	22
Invertebrates	11	10	41
Plant material	3	19	33
Herptiles	0	*	10

*Not comparable

There is also variation in the types of food eaten in different seasons. The most commonly reported variation is the increase in berries eaten in the autumn. For instance, in a study in Scotland, consumption of plant material (predominantly berries) increased to 64% of diet in the autumn, in comparison to a year-round average of 32%, with a concurrent decrease in bird consumption (18% yearly average, 3-6% in autumn). The same study also showed an increase in small mammal consumption in the winter and spring (30% yearly average, 52% in winter and spring). There is large geographic variation between the proportion of different food groups in the diet, and this variation is also found in studies in Europe. Much of this variation is thought to be explained by the abundance and availability of a food type within the ecosystem, with the most common species and food groups more likely to be eaten.

Small mammals are frequently reported as the most common food group eaten. In continental Europe three genera of small mammals are commonly taken – *Apodemus, Microtus,* and *Myodes,* with the last of these the preferred species. In the UK these groups consist of the wood mouse (*Apodemus sylvaticus*) and yellow-necked mouse (*Apodemus flavicollis*), the field vole (*Microtus agrestis*), and the bank vole (*Myodes glareolus*). In Scotland the large majority (e.g. 77%) of small mammals taken are *Microtus* voles. This is somewhat unexpected as *Microtus* voles are specialists of grasslands, whereas Myodes are specialists of the forest habitats that pine martens require (see Caryl 2008 28 for possible explanations).

Within each food group a range of species may be taken. For instance, within the birds (Aves), common species found in woodland are often eaten such as wood pigeon, *Columba palumbus* (the most frequently eaten bird in a study in north Scotland), goldcrest (*Regulus regulus*), wren (*Troglodytes troglodytes*), thrushes (*Turdus spp*), tits (*Parus spp*), and jays (*Garrulus glandarius*). The fruiting species that are most commonly taken in Scotland are rowan (*Sorbus aucuparia*), and bilberry (*Vaccinium myrtillus*). However, other berries that are known to be eaten include cherries (Prunus spp), blackberries (*Rubus fruticosus*), and ivy berries (*Hedera helix*). The most commonly taken invertebrates are often beetles (*Coleoptra*), although other species that may be taken include wasps (Hymenoptera), which includes pollen taken from their nests.

Despite this variation in diet, pine martens tend to specialise on certain common species. For instance in a study in Scotland, 48.5% of yearly diet was made up of just three species; rowan berries (*Sorbus aucuparia*), bilberry (*Vaccinium myrtillus*), and Microtus voles.

In continental Europe, it is thought that the broad composition of a pine marten's diet can be predicted by the latitude of the population. If used to predict diet in the Forest of Dean, this would

result in a composition of small mammals – 56%, medium & large mammals - 7%, birds – 13%, invertebrates – 6%, plant material – 16%. However, this is likely to be inaccurate due to the influence of the maritime climate on the UK. This prediction is also likely to vary, in particular as vole numbers and availability are often highly variable. Interestingly, in times of low vole numbers pine martens will compensate by eating greater numbers of alternative prey. This may be a range of different foods, however in Poland on a similar latitude to the Forest of Dean there was a switch towards amphibians.

2.8.1.2 Competition for tree cavities

Tree cavities used by pine martens are often old black (Dryocopus martius) or green woodpecker (Picus viridis) nest chambers, and it is thought their use may be more common in managed woodland with fewer suitable natural cavities. Black woodpecker holes are oval and large (110-120mm × 80-110 mm), but the species is not found in the UK. However, greater spotted woodpecker (Dendrocopos major) and green woodpecker are found in the UK. Their nest holes are much smaller than D. martius (48-76mm for D. major, 44-57mm for P. viridis), but overlap with the smallest of holes that pine martens can fit through (45 – 58mm). Indeed, it has been reported that greater spotted woodpecker holes are too small for pine martens when initially created. However, woodpecker holes are often created in soft or decaying wood and hole degradation can be swift. Hence, woodpecker holes may quickly become large enough for pine martens. Indeed, this may be a reason that woodpeckers rarely reuse nest sites, preferring to create new holes each year. Greater spotted woodpeckers prefer trees with an average DBH of 58.9 cm, and investigation into other cavity nesting birds also shows a preference for trees >60cm DBH. Large standing dead trees are also important for cavity nesting birds. In old growth forest the removal of large standing dead wood can reduce hole density from 40/ha to 6-15/ha in deciduous stands and as low as 1/ha in coniferous stands.

2.8.2 Additional information

2.8.2.1 Prediction of diet composition in Devon and Somerset

Using Zalewski's (2004)²⁹ approach to predicting pine marten prey in Europe, composition of diet in Devon and Somerset, which sit at 50-51° latitude, would be as follows (with similar caveats to those for Forest of Dean):

- 51-53% small mammals
- 6-9% medium-large mammals
- 10-15% birds
- 3-8% other
- 5-10% invertebrates
- 16-18% plant material

2.8.2.2 Interaction between denning female pine marten and birds

Of birds predated by denning females in Galloway, 91% were small birds (up to and including blackbird *Turdus merula*) and 9% large birds based on quill diameter. A slightly higher spring and summer predation rate of birds and small mammals than the mixed sex wider population suggests both a shift away from carrion to avoid competition risk but also timing of breeding to take advantage of breeding season of prey. Birds and eggs in spring are an important source of energy for lactating pine marten females³⁰.

2.8.2.3 Predator protection hypothesis

As discussed in sections on grey squirrel, wood warbler, great spotted woodpecker and raptors, pine martens predate and compete with (for food and tree cavities) other bird predators. Any additional predation/competition of species of conservation concern by pine marten is likely mitigated (at least

to some extent) by this compensatory effect. Dietary analysis has shown pine marten to consume great spotted woodpecker, jay, corvids, falcons and grey squirrel (together with other small mammals which can also predate birds)³¹,³²,¹⁰.

2.8.2.4 Bird anti-predator strategies

Nests built on or near the ground, it could be argued, are the most vulnerable and least protected type of nest. However, multiple broods are a common strategy employed by many bird species to mitigate losses due to predation, weather etc. and muliti-brooded birds are less likely to be limited by predation. Nests built in cavities usually receive lower levels of predation because of the reduced predator access. The entrance hole size plays a part in inhibiting access to larger predators and this level of protection means cavity-nesters have greater nesting success. Behavioural strategies to reduce risk of predation, such as egg covering are seen in both cavity nesting and open nesting birds.

2.8.3 Stakeholder concern

General concerns raised by stakeholders were around woodland birds generally (see section 2.9.5) and predation of ground nesting birds more widely in the landscape. Capercaillie frequently being raised as an example where pine marten predation is an issue, with comparisons made with curlew and nightjar. There was some lack of understanding or confidence about the complex role of predators and the concept of predator-mediated competition among non-expert stakeholders. Groups where stakeholders had more expertise raised both risks and benefits but still had concerns where outcomes would be unknown.

2.9 Woodland bird assemblage

2.9.1 Status of woodland birds

Woodland bird assemblage as a term is not defined and is used variably to refer to a group of species of conservation concern that breed in UK woodlands. The list used by Natural England's Countryside Stewardship Scheme (e.g. Exmoor statement of priorities)³³ includes nine species. The table below provides current status for these species. Colouring of text denotes red or amber list birds of conservation concern³⁴, Figures in brackets show UK population trend.

Lesser spotted woodpecker (-97)*	Pied flycatcher (-56)	Marsh tit (-43)
Tree pipit (-15)	Spotted flycatcher (-68)	Lesser redpoll (+16)
Redstart (+2)	Wood warbler (-79)	Hawfinch (-76%)**

Population trends shown from 2022 Breeding Birds Survey long term trend (1995-2021) except *between 1967 and 2020³⁵ and **between 1968 and 2011³⁶

2.9.2 Pressures on woodland birds

Fuller et al (2005)³⁷ identify a series of pressures that are affecting a large suite of woodland bird species – those in bold are key pressures affecting most woodland birds:

- pressures on migrants during migration or in winter
- climate change on the breeding grounds
- reduction of invertebrates
- impacts of land use on woodland edges and on habitats outside woodland
- reduced management of lowland woodland
- intensified habitat modification by deer
- changing predation pressure (especially by grey squirrel, corvids and great spotted woodpecker)

These are explored in species sections below where a specific effect is seen, but it should be noted that all woodland birds are experiencing some or all of these.

2.9.3 Evidence from Forest of Dean bird monitoring

Monitoring at Nag's Head in the Forest of Dean³⁸ for a number of woodland bird species suggests that there has been no impact on bird populations that coincides with the arrival of pine martens in the Forest from 2019 onwards. There are some other trends worth noting:

- Birds requiring contiguous woodland cover and deadwood are declining.
- Birds associated with woodland edge are increasing.
- Birds of open woodlands and heath are stable but at very low numbers.

This reflects a pattern of woodland fragmentation at the landscape scale and a historic loss of heath and open woodland habitats.

2.9.4 Increasing availability of natural nest holes

Current woodland management is often focussed on production of straight homogeneous trees with no damage or disease. However damaged and diseased trees create opportunities for cavity nesting birds which are often lacking appropriate nesting sites due to modern forestry practice (see individual bird sections). Long term management of woodlands should include veteranisation of trees (where some deliberate damage is carried out on a proportion of trees to mimic natural damage)³⁹, creation of nest holes in trees with suitable internal cavities⁴⁰ and consider inoculating trees and woodlands with wood-decay fungi⁴¹ to increase internal cavity creation. These are generally long-term measures although there is increasing evidence that they are successful in providing opportunities for cavity nesting species⁴².

2.9.5 Stakeholder concern

Concern over predation of woodland birds was high among some stakeholders. This was generally due to a combination of awareness of the declining and vulnerable nature of many of the species and some lack of understanding of pine marten ecology and population densities. Feelings that pine martens would eat *all* the nesting birds when their population 'explodes' were expressed by some, particularly those who attended non bird-focussed workshops. The concepts of trophic cascades and predator-mediated competition were not generally known by non-expert stakeholders.

2.9.6 Conclusions

Risk		Proposed mitigation	Residual	
Nature	Likelihood	Severity		Risk
 Predation Competition (nesting spaces) 	Low-moderate (largely abundance- related)	Low, pine marten predation and competition likely to be compensatory		Low

Benefit	How to maximise benefits
 Predator-mediated competition (predation of other competitors of woodland birds for food and nesting opportunities) Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on woodland birds, notably grey squirrel, corvids, raptors and great spotted woodpecker) 	 Project staff to provide landowner advice around woodland management, use of pesticides and enhancement of complementary habitats (e.g. grasslands around woodlands) to facilitate landscape- scale changes that support woodland birds. Woodland management advice to include a range of requirements of different species, including methods

for long-term creation of tree cavity nesting opportunities.

2.10 Wood Warbler (Phylloscopus sibilatrix)

2.10.1 Status of wood warbler

Listed as Least Concern globally⁴³ and in Europe⁴⁴, with causes of decline unclear but linked to changing forestry management, including cessation of coppice management and woodland grazing and associated increases in woodland understorey⁴⁵. In the UK, wood warbler decreased by 79% between 1995 and 2021³⁴ and is on the Red List of Birds of Conservation Concern and classified as Vulnerable⁴⁶. Habitat loss, fragmentation, and degradation at wintering grounds in Africa are also likely to be a factor in declines of this species⁴⁷.

Devon holds 3-5% of the British population of wood warbler but has seen a 37% decrease in range between 1988 and 2011⁴⁸,⁴⁹.





2.10.2 Interaction with predators

Predation of wood warbler in the UK is predominantly carried out by birds, particularly Eurasian jay *Garrulus glandarius*, but also by common buzzard *Buteo buteo*, great spotted woodpecker *Dendrocopos major* and Eurasian sparrowhawk *Accipiter nisus*. Badger *Meles meles* and red fox *Vulpes vulpes* also predate these ground-nesting birds. Predation is not considered to be driving the decline of wood warbler⁵¹. Grey squirrel predates wood warbler but does not limit their numbers⁵².

2.10.3 Interaction with pine marten

Pine martens in Switzerland and Germany are effective nest predators of wood warblers in highly fragmented woodland landscapes with large edge effect due to their slower foraging behaviour along forest edges and hedges⁵³. The fragmented nature of woodlands in SW England may favour pine marten predation of wood warbler and other ground nesting species. However, predation by

reintroduced pine marten, which will take eggs as well as chicks, may be compensatory of chick predators such as jays and raptors and so may not lead to increased overall nest failures⁵⁴. Similar nest predation rates across Europe despite regional variation in dominant predator group (mammal or bird) supports this³⁵. Pine marten will also predate jay, other corvids, great spotted woodpecker and rodents, including grey squirrel, all of which will predate wood warbler, which may have a positive effect.

2.10.4 Evidence from Forest of Dean bird monitoring

Numbers of breeding wood warbler have been declining from a high of 22 singing males in 2007 (data from 2005) with particularly large decrease between 2015 (14 singing males) and 2017 (4 singing males) and have remained stable since then including since the arrival of pine marten in 2019³⁸.

2 10 5	Concl	lusions
2.10.5	CONCI	usions

Risk		Proposed mitigation	Residual	
Nature	Likelihood	Severity		Risk
• Predation	Low	Low, pine marten predation and competition likely to be compensatory		Low

Benefit	How to maximise benefits
 Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on wood warbler, notably jay, other corvids, great spotted woodpecker and rodents) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including development of more open woodland understoreys (suitable to the woodland type) in a proportion of woodland. Seek opportunities to create, connect and de-fragment woodlands through woodland creation to reduce edge effect which otherwise benefits pine marten predation of wood warbler.

2.11 Lesser Spotted Woodpecker (Dryobates minor)

2.11.1 Status of lesser spotted woodpecker

Lesser spotted woodpecker is listed globally as Least Concern⁵⁵ with decline due to losses of deciduous woodland, particularly river valley woodlands and old orchards. Habitat fragmentation is also a key factor due to the species' large home range - lesser spotted woodpeckers require at least 40ha of mature oak woodland with deadwood, which may be fragmented over maximum of 200ha^{56,57}.

In Britain the species is listed as Endangered and on the Red List due to its decline in population by 91% (1967-2020) and range by 41% (1968-2011)³⁵. The cause of decline is currently unclear with hypotheses covering weather, climate and phenological changes affecting nesting success, loss of open woodland habitat, loss of deadwood (particularly smaller standing deadwood trees and branches), competition and predation from great spotted woodpecker and grey squirrel – but there is little direct evidence for any of these. Nest/breeding success reductions appear to be due to food

shortages and starvation during the breeding season with some additional predation by great spotted woodpecker^{58,59}.

BTO Bird Atlas data⁵⁰Error! Bookmark not defined. suggests the south west of England is not a key a rea for this species in southern Britain. However, there are moderate declines but also some recovery in this region.



BTO Bird Atlas data for lesser spotted woodpecker⁵⁰

2.11.2 Interaction with predators

Greater spotted woodpeckers are the main predators of lesser spotted woodpeckers, but they also apply interspecific competition in relation to food resources and nesting tree selection²⁹, although it is unclear what level of impact this is having on lesser spotted woodpecker populations^{48,49,51}.

Lesser spotted woodpecker population decline is correlated with higher densities of grey squirrel dreys⁶⁰, suggesting grey squirrel predates and/or competes for tree cavities with this species. There is good evidence grey squirrel limit numbers of lesser spotted woodpecker⁵².

2.11.3 Interaction with pine marten

Although no evidence of predation of lesser spotted woodpecker by pine marten could be found, papers do refer to *Dryobates* species being predated without specifying which species. As pine marten predate other species of woodpeckers, it is reasonable to assume that they would predate lesser spotted woodpecker opportunistically, however, the small entrance hole selected by this species reduces risk of predation by pine marten. Whilst both species occupy woodland habitat, the low densities of both pine marten and lesser spotted woodpecker in the landscape, coupled with the pine martens opportunistic feeding strategy of predating common and abundant prey, give a low likelihood of impact at a population level.

The entrance to the cavity of lesser spotted woodpecker has the smallest diameter of woodpeckers in Europe at 30-35mm⁶¹. As pine martens have a minimum passable entrance size of 44mm, this severely restricts their ability to predate the nests/cavities of lesser spotted woodpeckers,

particularly when nest holes are recent. Conversely, the larger great spotted woodpecker is vulnerable to pine marten nest predation as its mean cavity entrance diameter is 46mm and over⁶² and they are more abundant. Therefore, pine marten may have a beneficial effect on lesser spotted woodpecker through predation of its main predators – both great spotted woodpecker and grey squirrel.

2.11.4 Evidence from Forest of Dean bird monitoring

Numbers of lesser spotted woodpecker have remained consistently low (1-3 birds recorded) between 2005 and 2022. 4 birds were recorded in 2007 and none in 2021. No noticeable effect has been seen due to arrival of pine marten in 2019³⁸.

2.11.5 Conclusions

Risk			Proposed mitigation	Residual
Nature	Likelihood	Severity		Risk
•Predation	Low	Low, pine marten predation and competition likely to be compensatory		Low

Benefit	How to maximise benefits
 Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on lesser spotted woodpecker, notably great spotted woodpecker and grey squirrel) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including open woodland habitats, retention of deadwood, particularly smaller standing deadwood trees and branches, and increased number of mature trees. Seek opportunities to connect and de- fragment woodlands through woodland creation to increase woodland area and reduce fragmentation effects.

2.12 Pied Flycatcher (Ficedula hypoleuca)

2.12.1 Status of pied flycatcher

Pied flycatcher are listed as Least Concern, with a key threat from climate change shifting peaks of invertebrate prey earlier causing a mismatch between food availability and needs of nestlings⁶³. It is on the Amber list of Birds of Conservation Concern 5 having previously been a Red List species, although its current decline of 43.4% remains close to the Red List threshold of -50%⁴⁶. Pied flycatcher shows a negative correlation with the number of rainy days in April, suggesting weather and climate changes may affect this species. Additionally, lower ivy and lichen cover and higher canopy cover are associated with declines of pied flycatcher, which feeds on invertebrates often taken from foliage and prefers horizontal visibility across a woodland⁶⁰.

Pied flycatcher naturally nest in holes within the living trunks of small trees and have an average nest hole entrance diameter of 3.5 - 4.6cm, although they will use holes of 1.5 - 15cm - often using holes made by woodpecker species⁶⁴.

BTO Bird Atlas data⁵⁰ shows Dartmoor and Exmoor as key areas for this species in southern Britain but with moderate declines.



BTO Bird Atlas data for pied flycatcher⁵⁰

2.12.2 Modern environmental differences

Nestboxes have been widely used for both monitoring and conservation of pied flycatcher for many decades, with approximately 3300 pied flycatcher nestboxes within the PRRs. Many of the interactions studied have looked at nestboxes rather than natural sites as these provide easier monitoring.

2.12.3 Interaction with predators

Small mammals (dormouse and mouse species) and great spotted woodpecker will predate natural nests of pied flycatcher in Europe, entering through the nest hole entrance and the latter enlarging entrance holes where necessary⁶⁴. Great spotted woodpecker predates pied flycatcher in nestboxes in Sweden⁶⁵. It is reported anecdotally that grey squirrel predate pied flycatcher in nestboxes – while evidence for this is limited, grey squirrel are key predators of songbirds using both open and cavity nests in North America and are likely to be impacting a range of birds in the UK⁶⁶. Grey squirrel will also use nestboxes as dreys, creating competition to pied flycatchers. They will also predate pied flycatcher but there is no evidence of this limiting numbers⁵².

Competition for nest holes could be a key success factor for pied flycatcher outside primeval woodlands due to a lack of these features in younger managed woodlands⁶⁴.

2.12.4 Interaction with pine marten

Pine marten are key predators of *Ficedula* species, including pied flycatcher, in Europe both in natural holes and nestboxes, although predation in natural holes is significantly lower than in nestboxes⁶⁷. Nest hole entrance size and the distance between hole entrance and bottom are key factors in pine marten predation ability⁶⁴ as where an entrance hole is too small for head entry pine marten will use arm entry to reach for nestlings. Pine marten will also enlarge holes. Pied flycatcher daytime activity may draw the attention of pine marten as long-lasting mobbing calls of pied flycatchers during daytime enables pine martens to locate nestboxes (and presumably natural nest holes)⁶⁸.

A study in Bialowieza National Park³² identified *Ficedula* species within pine marten diet, including pied flycatcher, combined species reaching 13% of diet while *Ficedula* make up 7.4% of the local bird population. However, this was a total of 4 individuals of three species, so impact on the pied flycatcher population would likely have been low.

Long-term monitoring of a nestbox scheme in Sweden⁶⁵ showed that when red fox numbers declined, pine marten populations increased with associated predation of pied flycatcher increasing significantly. However, this predation was unlikely to be the cause of pied flycatcher population declines as these occurred before red fox declines and after they recovered.

A Latvian study found that pine marten could predate up to 100% of pied flycatchers in nestboxes, using the nestbox as a search image. Martens usually remove the tops of nestboxes to enter them, so firmly securing nestbox lids is critical in areas where martens occur⁶⁸.

2.12.5 Forest of Dean Feasibility Study

Nest boxes may highlight the location of a nest in comparison to a cavity nest. Moving nest boxes reduces predation rates, indicating that pine martens do learn where nest boxes are and revisit them. Nest box holes are too small (28mm) for pine marten head entry (45mm+). However, pine marten arm entry is possible. Pine marten arm length is ~15cm, hence any nest within that distance may be at risk. In Poland, pine martens were responsible for 37% of nest predation events in natural cavities, and 78% of nest predation events in nest boxes where the predator was identified. Overall the predation rate by all predators was lower in natural cavities than in nest boxes (47% v 65% of nests). Interestingly, conservationists still use nest boxes significantly in this area. Using this single study, a nest in a natural cavity would have a 17% chance of being predated by a pine marten, while a nest in a box would have a 51% chance of being predated by a pine marten.

2.12.6 Mitigation of nestboxes

Mitigation of nestboxes is relatively straightforward and widely practiced in Europe. Several elements are required: (a) ensure nestbox is built well from hardwood and is not deteriorating, (b) secure lids firmly, (c) place baffle on entrance hole to increase distance to nest and (d) consider internal baffle to further increase distance to nest. These are all low cost and quick to deploy.

However, there is uncertainty around impact of mitigation on nestbox occupancy. Members of the Piedfly.net group are currently carrying out initial tests of approach with formal trials to take place in spring/summer 2024. Internal baffles may also restrict monitoring of nestboxes, so these will be examined to understand best design options.

2.12.7 Forest of Dean monitoring

Monitoring of pied flycatcher nestboxes in the Forest of Dean between 2016 and 2022⁶⁹ shows a decrease in pied flycatcher occupancy, even though the number of available boxes increased. However, this decline started prior to pine marten reintroduction so it is unlikely that pine marten predation is the critical factor. This is reflected in RSPB monitoring of the species which shows the species to be declining from a high of over 100 nests in boxes or singing males in 1991 to a low of 15 in 2013 with nesting broadly stable since this time³⁸. Numbers of birds fledged remained broadly stable although 2022 showed a reduction of 35% on the average over the previous 6 years – but it is unclear the reason for this. 2023 figures may help clarify if this is a stochastic event or longer term⁶⁹.

2.12.8 Stakeholder concern

Stakeholder concern was mainly focussed around predation of pied flycatchers using nest boxes since they are widely used and known to facilitate population increases where installed. Box modifications (such as those widely used in mainland Europe) to mitigate against predation ameliorated concern.

Nest box monitors could test occupancy and the intense monitoring of this species allows for detailed data collection of population trends.

2.12.9 Conclusions

Risk		Proposed mitigation	Residual	
Nature	Likelihood	Severity		Risk
● Predation	Low (natural nesting)	Low, pine marten predation likely to be compensatory		Low
	Moderate (nestbox nesting)	Moderate, although pine marten predation likely to be partly compensatory	•Trial nestbox mitigation to understand occupancy effects. If effects are low then deploy proactively across PRRs and reactively beyond PRRs. If effects are moderate to high then deploy reactively where signs of predation are occurring.	Low

Benefit	How to maximise benefits
 Predator-mediated competition (predation of competitors of pied flycatcher for nesting opportunities) Predator protection hypothesis, trophic cascades & grey squirrel predation (predation of other predators that may have a larger impact on pied flycatcher, notably small mammals, great spotted woodpecker and grey squirrel) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including open woodland habitats, retention of ivy and creation of veteran tree features including cavities, fungal decay and nestholes. Seek opportunities to connect and de- fragment woodlands through woodland creation to increase woodland area and reduce fragmentation effects.

2.13 Common redstart (Phoenicurus phoenicurus)

2.13.1 Status of common redstart

Listed as Least Concern on the IUCN Red List, there are a number of possible causes of international declines: rainfall patterns in the Sahel; intensified modern forestry practices reducing nest hole availability; interspecific nest-site competition; habitat degradation from pollution; and deliberate killing⁷⁰.

In the UK, common redstart are Amber listed following a decline of 21% in the last 10 years³⁴. As with all UK long-distance migrants, redstart decline suggests factors in wintering or migration areas. Reductions in deadwood, particularly dead limbs on trees, could be a factor in redstart decline in Britain. They are associated with ancient semi-natural woodland, where they show stability or increases in contrast with declines outside these sites. Redstart declines are also correlated with reductions in low-level woodland cover (below 2m)⁶⁰.

There is evidence that redstart have increased in numbers on Dartmoor since the late 1970s perhaps due to more diverse vegetation structure⁷¹. However, BTO Bird Atlas data suggests a moderate decline on Dartmoor while some recovery on Exmoor – both areas are important in southern Britain for this species⁵⁰.

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2.13.2 England and Wales Pine Marten Reinforcement Feasibility Study

This study⁷², carried out before the 2015 pine marten reintroduction/reinforcement in Mid-Wales found that:

The Redstart is associated with Atlantic oak woods but can also be present in well thinned upland conifers. It is a cavity nester but the cavities are probably too small [30-45mm] for a pine marten to be able to access birds, eggs or chicks. Redstarts also prefer territories with sparse vegetation and bare ground to enable them to access the ground invertebrates on which they feed. This is not the type of habitat preferred by pine martens, particularly when foraging, so there may be little overlap at the home range scale with these two species. The distribution of redstarts and pine martens overlaps across Europe, where redstart numbers have increased in recent years.

2.13.3 Interaction with predators

Redstart are predated by grey squirrel but with no evidence of limiting effect on their numbers⁵². No other evidence has been found around predator interaction with common redstart, including by pine marten.

2.13.4 Evidence from Forest of Dean bird monitoring

Numbers of common redstart have shown a slight increase from 7 singing males in 2004 to 13 in 2022. Numbers have remained stable since 2019 following pine marten reintroduction³⁸.

Risk		Proposed mitigation	Residual	
Nature	Likelihood	Severity		Risk
• Predation	Low	Low, pine marten predation and competition likely to be compensatory		Low

2.13.5 Conclusions

Benefit	How to maximise benefits
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Grey squirrel predation (predator of	• Provide woodland management advice
redstart)	to landowners encouraging varied
	woodland habitat structure, including
	increasing deadwood and levels of
	low-level woodland cover.

2.14 Great spotted woodpecker (Dendrocopos major)

2.14.1 Status of great spotted woodpecker

Great spotted woodpecker is listed as Least Concern on the IUCN Red List with threats including harsh winters, habitat fragmentation, air pollution damage to woodland and hybridization⁷³. However, in Britain great spotted woodpecker has increased its population by 137% (1995-2021)³⁴ with increased abundance across the UK⁵⁰. This increase has led to its increased predation of other woodland birds (see other bird sections).



BTO Bird Atlas data for great spotted woodpecker⁵⁰⁵⁰

2.14.2 Forest of Dean Feasibility Study

Tree cavities used by pine martens are often old black (Dryocopus martius) or green woodpecker (Picus viridis) nest chambers, and it is thought their use may be more common in managed woodland with fewer suitable natural cavities. Black woodpecker holes are oval and large (110-120mm × 80-110 mm), but the species is not found in the UK. However, greater spotted woodpecker (Dendrocopos major) and green woodpecker are found in the UK. Their nest holes are much smaller than D. martius (48-76mm for D. major, 44-57mm for P. viridis), but overlap with the smallest of holes that pine martens can fit through (45 – 58mm). Indeed, it has been reported that greater spotted woodpecker holes are too small for pine martens when initially created. However, woodpecker holes are often created in soft or decaying wood and hole degradation can be swift. Hence, woodpecker holes may quickly become large enough for pine martens. Indeed, this may be a reason that woodpeckers rarely reuse nest sites, preferring to create new holes each year. Greater spotted woodpeckers prefer trees with an average DBH of 58.9 cm, and investigation into other cavity nesting birds also shows a preference for trees >60cm DBH. Large standing dead trees are also important for cavity nesting birds. In old growth forest the removal of large standing dead wood can reduce hole density from 40/ha to 6-15/ha in deciduous stands and as low as 1/ha in coniferous stands.

2.14.3 Interaction with predators

Sparrowhawk and goshawk will both predate great spotted woodpecker⁷⁴, as will grey squirrel but without limiting numbers⁵². It is likely that other mustelids (stoats, weasels) would also predate great spotted woodpecker although no direct evidence of this has been found.

Dendrocopus species including great spotted woodpecker are found in pine marten diet in Europe^{75, 76, 17}. There is no evidence of a population level effect on great spotted woodpecker and many diet studies do not mention the species.

2.14.4 Conclusions

Risk			Proposed mitigation	Residual
Nature	Likelihood	Severity		Risk
 Predation 	Low-moderate	Low (pine marten		Low-
 Competition 	(largely	predation and		moderate
(nesting spaces)	abundance-	competition likely		
	related)	to be partly		
		compensatory -		
		unlikely to have		
		population-level		
		effect)		

2.15 Lesser redpoll (Acanthis cabaret)

2.15.1 Status of lesser redpoll

The lesser redpoll was only recently 'split' from the common redpoll (*A. flammea*) but there is now evidence that all redpolls should be treated as ecotypes of a single species⁷⁷. Common redpoll overwinters in the UK while lesser redpoll is resident and breeds in the UK.

While lesser redpoll is not on the IUCN Red List of threatened species, the common redpoll is listed as Least Concern, with threats including climate change, deforestation and recreational disturbance. Lesser redpoll, which favours young woodland, does feature on the British Birds of Conservation Concern Red List³⁴ having shown a 78% decline between 1966 and 1999 in Britain³⁷. Forestry clearance during the second world war led to increases in lesser redpolls' favoured birch as pioneers of young woodland. As slower growing species have outcompeted birch, and agricultural intensification has removed seeding plants from the landscape, lesser redpoll numbers have reduced⁷⁸. The reduction in conifer planting in southern Britain is also a possible factor³⁷. Lesser redpoll decline is also correlated to low lichen cover and bracken decline⁶⁰.

The PRRs hold key populations of this species in southern Britain⁵⁰

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2.15.2 Interaction with predators

Lesser redpoll are predated by grey squirrel but with no evidence of limiting effect on their numbers⁵². No evidence of predation by pine marten could be found.

2.15.3 Conclusions

Risk			Proposed mitigation	Residual
Nature	Likelihood	Severity		Risk
• Predation	Low	Low, pine marten predation and competition likely to be partly compensatory		Low

Benefit	How to maximise benefits
 Grey squirrel predation (predator of redpoll) 	•Provide woodland management advice to landowners encouraging varied woodland habitat structure, including open woodland areas, woodland restoration through planting and natural regeneration to include birch and scrub.

2.16 European green woodpecker (Picus viridis)

2.16.1 Status of green woodpecker

Green Woodpecker are listed as Least Concern due to threats of intensification of agriculture and forestry and loss of pasture to arable, with intensive forestry also leading to loss of nest sites⁷⁹.

In Britain green woodpecker increased by 97% between 1966-1999³⁷. While trends for the last 26 years have been stable, in the last 10 years this species has seen declines of 26% but is not on the Red or Amber lists³⁴. In south west England green woodpecker have shown some declines, particularly around the Dartmoor and Exmoor PRRs⁵⁰. Green woodpecker prefer higher spring temperatures, lower spring rainfall and drier sites so changes in climate may affect this species

positively or negatively locally. They are correlated with higher bramble cover and closed canopy woodland in more open (less wooded) landscapes⁶⁰.



BTO Bird Atlas data for green woodpecker⁵⁰

2.16.2 Forest of Dean Feasibility Study

Tree cavities used by pine martens are often old black (*Dryocopus martius*) or green woodpecker (*Picus viridis*) nest chambers, and it is thought their use may be more common in managed woodland with fewer suitable natural cavities. Black woodpecker holes are oval and large (110-120mm × 80-110 mm), but the species is not found in the UK. However, greater spotted woodpecker (*Dendrocopos major*) and green woodpecker are found in the UK. Their nest holes are much smaller than *D. martius* (48-76mm for *D. major*, 44-57mm for *P. viridis*), but overlap with the smallest of holes that pine martens can fit through (45 – 58mm).

2.16.3 Interaction with predators

Green woodpecker are predated by grey squirrel but with no evidence of limiting effect on their numbers⁵². There was no evidence found of pine marten predation, although as pine marten predate other woodpecker species and will use green woodpecker nestholes, it appears likely that they would predate green woodpecker.

Risk			Proposed mitigation	Residual
Nature	Likelihood	Severity		Risk
• Predation	Low	Low (pine marten predation and competition likely to be partly compensatory - unlikely to have		Low

2.16.4 Conclusions

population-level effect)		
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Benefit	How to maximise benefits
 Grey squirrel predation (predator of green woodpecker) 	 Provide woodland management advice to landowners encouraging varied woodland habitat structure, including closed canopy woodlands, orchards and wood pasture. Provide advice to landowners to encourage complementary open habitats – ant-rich dry grasslands.

2.17 Nightjar (Caprimulgus europaeus)

2.17.1 Status of nightjar

European nightjar is listed as Least Concern with threats including loss of insects due to pesticides, habitat loss and degradation, recreational disturbance, predation particularly of eggs and chicks, climate change and nitrogen pollution of habitats⁸⁰. In Britain, nightjar was Red Listed due to historic range contraction of over 50%. More recently it has moved onto the Amber List following increases in range and population due to large-scale heathland restoration⁸¹ and colonisation of recent clear fell areas⁸².



BTO Bird Atlas data for nightjar⁵⁰

2.17.2 Interaction with predators

Nightjars suffer predation from an extensive list of species including: magpie (*Pica pica*), jay (*Garrulus glandarius*), goshawk (Accipter gentilis), sparrowhawk (Accipter nisus), buzzard (Buteo buteo), hen harrier (Circus cyaneus), peregrine (Falco peregrinus), tawny owl (Strix aluco), barn owl (Tyto alba), long-eared owl (Asio otus), fox (Vulpes vulpes), grey squirrel (Neasciurus carolinensis), hedgehog (*Erinaceus europaeus*), weasel (*Mustela nivalis*), adder (Vipera berus) and domestic dog^{80,83}.

Pine marten will also predate nightjar⁸³, although they do not occur in dietary studies and with such a long list of predators, this is unlikely to be significant.

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2.17.3 Evidence from Forest of Dean bird monitoring

Nightjar numbers have remained broadly stable at just 2 churring males since 2018. The species was absent in 2004-5 and had peaks of 3-4 churring males during 2009-2017. The limiting factor for nightjar is considered to be availability of suitable open areas for breeding. No evidence of impact by pine marten on figures is seen³⁸.

2.17.3 Conclusions

Risk		Proposed mitigation	Residual	
Nature	Likelihood	Severity		Risk
•Predation	Low	Low, pine marten predation and competition likely to be compensatory		Low

Benefit	How to maximise benefits
 Predator protection hypothesis, trophic 	 Provide woodland and heathland
cascades & grey squirrel predation	management advice to landowners
(predation of other predators that may	encouraging varied habitat structure,
have a larger impact on nightjar, notably	including increasing areas of open
magpie, jay, raptors and grey squirrel)	ground suitable for nesting nightjar.

2.18 Crossbill (Luxia curvirostra)

2.18.1 Status of crossbill

Listed as Least concern on the IUCN Red List, crossbill face threats from forest fragmentation⁸⁴. The UK population is Green Listed and considered to be stable (3). Crossbills can breeding at any time during the winter and are are highly mobile, moving in response to conifer seed production⁸⁵. Bird Atlas data suggests the south west of England is not a key area for this species⁸⁶.





BTO Bird Atlas data for crossbill

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2.18.2 Interaction with predators

The crossbill is predated by sparrowhawk within conifer plantations, where it can be a key prey source of this raptor. Merlin may also predate crossbill as will corvids, taking advantage of the crossbill's conspicuous colouring and large numbers in Norway spruce seeding years⁸⁷, ⁸⁸. Arboreal mammals including red squirrel and pine marten will also predate crossbill in Scotland, but crossbills have evolved to select nestsites that minimise vistation by these predators⁸⁹.

2.18.3 Conclusions

Risk		Proposed mitigation	Residual	
Nature	Likelihood	Severity		Risk
 Predation 	Low	Low		Low

2.19 Siskin (Spinus spinus)

2.19.1 Status of siskin

Listed as Least concern globally⁹⁰ and in Europe and faces threats from irregular resource availability⁹¹, diseases spread at bird feeders and pesticide poisoning. In Britain, there are 445,000 breeding pairs of siskin (2016). The breeding population has increased by 33% (1995-2020) and its breeding range has increased by 166% (1968–72 to 2008–11)⁹².



BTO Bird Atlas data for siskin⁹³

2.19.2 Interaction with predators

Siskins face predation from cats⁹⁴ as well as from sparrowhawks⁸⁷. No evidence of predation by pine martens could be found.

2.19.3 Conclusions

Risk		Proposed mitigation	Residual	
Nature	Likelihood	Severity		Risk
 Predation 	Low	Low		Low

2.20 Stonechat (Saxicola rubicola)

2.20.1 Status of stonechat

Listed as Least Concern globally and in Europe and faces threats to loss of breeding habitat due to agricultural intensification⁹⁵. Stonechat have also suffered from grazing changes to breeding habitat and severe winters⁹⁶, ⁹⁷. Stonechat breeding population has increased significantly across Britain and Europe, and as such was recently moved from the amber to the green list⁹⁸, with Dartmoor one of the strongholds for the species (6). The UK breeding population has increased by 147% (1995-2020)⁹⁹.



BTO Bird Atlas data for stonechat¹⁰⁰

2.20.2 Interaction with predators

As a ground nesting bird of heathland and other open, rough country, they are likely subject to a variety of predators including fox, raptors and corvids. It is likely that other mustelids (stoats, weasels) would also predate stonechat although no direct evidence of this has been found. No evidence was found to suggest that predation limits numbers.

No evidence of predation by pine martens could be found. However, pine martens will predate jays, other corvids, and rodents, all of which may predate stonechats, which may have a positive effect.

2.20.3	Concl	usions	

Risk Proposed mitigation

Nature	Likelihood	Severity	Residual
			Risk
 Predation 	Low	Low	Low

2.21 Whinchat (Saxicola rubetra)

2.21.1 Status of whinchat

Whincat is listed as Least Concern globally¹⁰¹ and in Europe. The biggest threat to whinchat is mowing¹⁰², as well as the intensification of agriculture, habitat degradation and the intentional capture of birds on wintering grounds¹⁰³. However in the UK, whinchat numbers have been in serious decline since 1995 and the species is now Red Listed on the Birds of Conservation Concern 5 list. The UK breeding population has reduced by 57% (1995-2020), with a breeding range decline of 47.9% (1968-72 to 2008-11)¹⁰⁴. Whinchats are now largely confined to the British uplands. In Devon, whinchat are almost entirely confined to the uplands¹⁰⁵.



BTO Bird Atlas data for whinchat¹⁰⁶

2.21.2 Interaction with predators

Whinchats face predation from avian predators, such as buzzards, crows and magpies, as well as mammalian predators, including small rodents and mustelids, like stoats and weasels¹⁰⁷, ¹⁰⁸, ¹⁰⁹.

2.21.3 Interaction with pine marten

No pine marten predation of whinchat could be found, however, since other mustelid predation has been recorded, pine marten predation on whinchat could occur. However, predation by reintroduced pine marten, which will target eggs as well as chicks, may be compensatory of chick predators such as jays and raptors and so may not lead to increased overall nest failures⁵⁴. Pine marten will also predate other corvids and rodents, all of which will predate whinchat, which may have a positive effect.

2.21.4 Conclusions

Risk		Proposed mitigation	Residual	
Nature	Likelihood	Severity		Risk

 Predation 	Low	Low	Low

2.22 Nightingale (Luscinia megarhynchos)

2.22.1 Status of nightingale

Nightingale is listed as Least Concern globally¹¹⁰ and in Europe. Threats to nightingale are degradation and loss of scrubby woodland habitat, changes in agriculture, climactic variations, and habitat modifications¹¹¹, ¹¹², ¹¹³, ¹¹⁴. Nightingales are Red Listed in the UK, with approximately 5550 territorial males left¹¹⁵, ¹¹⁶. The UK population has experienced a 48% decrease (1995-2020) and a 42.6% (1968-72 to 2008-11) range reduction¹¹¹. Nightingales no longer breed in Devon¹¹⁷.



BTO Bird Atlas data for nightingale¹¹⁸

2.22.2 Interaction with predators

Nightingale face predation from cats¹¹⁹, avian predators, including tawny owls¹²⁰, mammals, such as rats and foxes, although no evidence was found to suggest that predation limits numbers.

2.22.3 Interaction with pine martens

No evidence of predation by pine martens in the UK could be found. However, pine marten predation of nightingale has been reported in Czech Republic, but there is no evidence of the predation having a limiting effect on nightingale numbers¹²¹.

2.22.4 Conclusions

Risk		Proposed mitigation	Residual	
Nature	Likelihood	Severity		Risk
 Predation 	Low	Low		Low

2.23 Grasshopper Warbler (Locustella naevia)

2.23.1 Status of grasshopper warbler

Grasshopper warbler is listed as Least Concern globally and in Europe¹²². Threats faced are from the habitat loss in both its summer and winter ranges, caused by the intensification of agriculture, wetland drainage and scrub clearance¹²³, ¹²⁴. Grasshopper warbler is Red Listed in the UK, due to its contraction in range (-10% from 1968-72 to 2008-11) and rapid population decline between the mid-1960s and mid-1980s. The UK population is now stable with 12,000 territories (1995-2020)¹²⁵.



2.23.2 Interaction with predators

Grasshopper warblers face predation by small mammals, including common rat and wood mouse, red fox, jay and magpie¹²⁷. However, predation is not considered to be driving the decline of grasshopper warbler¹²⁵. There was no evidence found of pine marten predation of grasshopper warbler.

2.23.3 Conclusions

Risk		Proposed mitigation	Residual	
Nature	Likelihood	Severity		Risk
 Predation 	Low	Low		Low

2.24 Raptors

2.24.1 Status of raptors on Haldon

Haldon Forest is an important area for raptors with the assemblage a key part of the citation, however comprehensive monitoring records are not available. The following statement was provided by the ecology and wildlife ranger team at Haldon (June 2023 pers. comm.):

"Raptors in Haldon were historically monitored for several decades, however these records were mostly lost during an office move in the early 2000s. Anecdotally we can state the following:

- We have had at least six resident goshawk for many years, with an increase in the last few years to cover the majority of suitable habitat.
- Sparrowhawk have declined during the same period as the increase in goshawk
- Hobby have not been seen at Haldon for several years, but are suspected breeding in the landscape
- *Kestrel are known to breed adjacent restock sites in the Haldon area as are common buzzard.*
- We have not had honey buzzard confirmed present since 1995

We currently have projects ongoing to monitor goshawk and hobby as well as nightjar, and so can provide feedback on ongoing population sizes in the event of a pine marten release."

2.24.2 Interaction with pine marten

A number of studies report pine marten predation (interspecific and intraguild) of raptor species across Europe with owls, buzzard, and diurnal raptors specifically mentioned¹²⁸. However, raptors are rarely picked up in dietary studies and are unlikely to be a major part of pine marten diet.

Pine marten coexist in Europe with many vertebrate predators with this relationship being stable for both main predator guilds – generalist predators and rodent eaters - with partitioning of habitats and/or food resources being a key factor in this coexistence¹²⁹.

2.24.3 Conclusions

Risk		Proposed mitigation	Residual	
Nature	Likelihood	Severity		Risk
PredationCompetition	Low	Low		Low

2.25 Tawny owl (Strix aluco)

2.25.1 Status of tawny owl

This species is listed as Least Concern with threats including historic persecution, changes to woodland structure, pesticide use, traffic levels, and powerline collisions¹³⁰. In the UK tawny owl had increased by 40% between 1966-99³⁷ but has since been added to the Amber List due to a decline of 33% between 1995 and 2021.

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2.25.2 Interaction with predators

Tawny owl does occasionally appear in pine marten diet in Europe in low numbers⁷⁵. Pine marten is a regular predator of tawny owls using nest boxes in Sweden, usually taking eggs or young chicks, with martens using the nestbox as a search image. Predation leads tawny owls to seek a different nesting location within their territory in subsequent years as an adaptation strategy¹³¹. Adult tawny owl will drive off predators including fox, corvids and pine marten and is a reason mothers stay close to fledglings, which is the most likely time of predation in a Norwegian study¹³².

While both pine marten and tawny owls prey preferences of small mammals overlap heavily, there are a number of differences between selected prey by the different predators – e.g. tawny owls take heavier voles in all seasons that those taken by pine martens. But seasonally there were more variations with smaller differences in summer than in winter when martens take younger voles than tawny owls. These adaptations generally reflect differences of predation approach rather than avoiding competition. Both predators are able to shift diet onto a variety of small mammals¹³³.

2.25.3 Modern environmental differences

There is no formal nestbox scheme for tawny owls in the UK (although there is some ad hoc deployment of next boxes), but as suggested above, tawny owls will readily make use of nestboxes, although this increases their vulnerability to pine marten predation¹³¹.

Risk		Proposed mitigation	Residual	
Nature	Likelihood	Severity		Risk
PredationCompetition	Low (natural nesting)	Low		Low
(prey)	Low-moderate (nestbox nesting) – low numbers of boxes reduces risk	Low	•Explore mitigation measures to tawny owl nestboxes reactively due to low level of risk and low numbers of nestboxes in landscape.	Low

2.25.4 Conclusions

2.26 Barn owl (Tyto alba)

2.26.1 Status of barn owl

Barn owl is listed as Least Concern on the IUCN Red List of Threatened Species with threats around habitat loss and fragmentation, intensification of agriculture, urbanisation and road development. Historic agro-chemical use led to disastrous impacts on populations¹³⁴.

1995-2021 figures show barn owl number have increased in the UK by 185%, although there has been a decline of 26% over the last 10 years³⁴. While previously on the Amber List, barn owl is no longer on the list of Birds of Conservation Concern⁴⁶.

Traffic is a significant risk to barn owl – particularly on major roads. Other key risks include poisoning, built development, nestbox losses, drowning in water troughs, collisions with wires and wind turbines, and potentially climate change impacts¹³⁵.



2.26.2 Interaction with predators

Pine marten will predate barn owl chicks and eggs in nestboxes¹³⁶ although habitat separation means this is unlikely to be significant. While raptors as a group are seen within pine marten dietary analyses, no evidence has been found of barn owl, suggesting predation is not significant. Mitigation of nestboxes on individual trees is possible using cone baffles, but some trialling may be required to understand if nestboxes can be adapted e.g. using anti-climb sheeting and design changes (Barn Owl Trust pers.comm.).

2.26.3 Conclusions

Risk		Proposed mitigation	Residual	
Nature	Likelihood	Severity		Risk
PredationCompetition	Low (natural nesting)	Low		Low
(prey)	Low-moderate (nestbox nesting) - low numbers of boxes reduces risk	Low	•Explore mitigation measures to barn owl nestboxes reactively due to low level of risk.	Low

2.27 Northern goshawk (Accipiter gentilis)

2.27.1 Status of goshawk

Listed as Least Concern on the IUCN Red List, the goshawk suffered substantial historic declines from persecution, deforestation, pesticides and heavy metals, with forestry operations, wildfires, intensification of agriculture and forestry, and wind farm developments all current threats¹³⁷.

Goshawk is not on the lists of Birds of Conservation Concern⁴⁶, with populations increasing consistently since the 1970s, with the South West of England holding some of the largest concentrations³⁶.





BTO Bird Atlas data for goshawk⁵⁰

2.27.2 Forest of Dean Feasibility Study

No evidence of pine marten predation of goshawk could be found, but pine marten may be a nest predator of undefended nests. There was evidence of goshawk predation on pine marten. There may be an influence of pine marten on goshawk diet due to the potential impact on grey squirrels. Grey squirrels can be a major component of goshawk diet in the UK. In areas without grey squirrels, birds often dominate goshawk diet (e.g. 86 - 95% of diet), and the most common species taken are woodpigeon (*Columba palumbus*), crows (*Corvus corone*), rooks (*Corvus frugilegus*), and thrushes (*Turdus spp*).

2.27.3 Interaction with predators

Goshawk will suffer nest predation, hence their use of older trees in forests of high tree density for nest sites, as a response to nest predation risk¹³⁸. Predators of goshawk in Europe include corvids, large owl species and pine marten, with pine marten and buzzard also competing for nest sites¹³⁹. However, goshawk are probably less vulnerable to pine marten predation due to their large size¹³⁸.

Goshawk will compete with pine marten in Europe for many food resources including squirrel¹⁴⁰ and carrion¹⁴¹.

2.27.4 Conclusions

Risk		Proposed mitigation	Residual	
Nature	Likelihood	Severity		Risk

 Predation 	Low	Low	Low
 Competition 			
(prey and			
nesting spaces)			

2.28 Common or Eurasian buzzard (Buteo buteo)

2.28.1 Status of buzzard

Buzzard is listed as Least Concern, historically impacted by persecution and currently by poisoning through pesticides. Collisions with traffic, power lines and wind farms together with agricultural intensification and urban development leading to loss and fragmentation of habitat are key factors¹⁴².

Buzzards are Green Listed and have shown an 89% increase which is thought to be recovery following persecution³⁴. Buzzards feed along ecotones such as clear-felling along forest trails¹⁴³ so may benefit from fragmented woodland landscapes.



BTO Bird Atlas data for buzzard⁵⁰

2.28.2 Interaction with predators

Buzzard does occasionally appear in pine marten diet in Europe in low numbers⁷⁵ although buzzards probably have low vulnerability to pine marten predation due to their large size^{138,50} Buzzards and pine marten will compete for nest sites¹³⁸ and abundant prey items such as songbirds¹⁴⁴ and bank vole¹⁴⁵.

2.28.3 Conclusions

Risk		Proposed mitigation	Residual	
Nature	Likelihood	Severity		Risk
 Predation 	Low	Low		Low
 Competition 				
(prey and				
nesting spaces)				

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2.29 European honey buzzard (Pernis apivorus)

2.29.1 Status of honey buzzard

Honey Buzzard's Least Concern status is due to persecution particularly hunting on migration, but also collisions with power lines, traffic and wind farms. Historic deforestation in northern breeding grounds and current habitat loss and pesticide poisoning in Africa are all key factors in its status¹⁴⁶.

Honey Buzzard is Amber Listed in the UK, with a breeding population of only 33 pairs but an increase in distribution of 554.5% between 1968-2011. There is little evidence of the UK drivers of changes in numbers and distribution of honey-buzzard.

Honey-buzzard is a rare visitor to Haldon Forest, where an individual was seen between 1987-1995 but none have been recorded since¹⁴⁷.



BTO Bird Atlas data for honey buzzard⁵⁰

2.29.2 Interaction with predators

Pine marten and, in particular, goshawk are important predators of honey-buzzard - there is a negative correlation between the number of successful breeding pairs of goshawk and the number of successful breeding pairs of honey-buzzard¹⁴³. Predation risk forms an important factor in nest site selection with honey-buzzard selecting areas away from goshawk¹⁴⁸ and preferring spruce, which gives best cover, as nest trees¹³⁸.

2.29.3 Conclusions

Risk		Proposed mitigation	Residual	
Nature	Likelihood	Severity		Risk
 Predation 	Low	Low		Low

2.30 Merlin (Falco columbarius)

2.30.1 Status of merlin

Merlin's Least Concern status is due to historic exposure to pesticides and chemicals, collisions with man-made objects and agricultural intensification. The species is also predated by red fox¹⁴⁹.

Merlin are Red Listed in the UK - although they have shown a weak increase in their 25 year trend, they declined by 20% over the last 10 years³⁶. Reasons for declines are poorly understood but land-use change, prey population changes and climate change are all probable factors¹⁵⁰.

Merlin will nest on the ground in heather moorland but also increasingly in tall trees in mature conifer plantations – usually within 10m of woodland edge. They forage, particularly for passerines, over large areas of open moorland, grassland and peat-bogs and so are very much associated with uplands in the UK. Afforestation of their foraging habitats and forestry operations in conifer nesting habitats are both risk factors affecting merlin¹⁵¹.





2.30.2 Interaction with predators

Merlin is subject to intraguild predation by goshawk and peregrine (and other large birds of prey¹⁵²) – competing for prey species and subject to direct predation from these apex predators¹⁵³. However, a study in Northumberland, suggested that it is unlikely that intra-guild predation by goshawk has played an important role in Merlin population changes¹⁵⁰, although clearly Merlin behaviour and population changes may be at least in part a result of mesopredator suppression, due to the return of these apex predator species following historic declines¹⁵³¹⁵³.

When ground nesting, the species is subject to predation by fox, stoat, and a range of other terrestrial nest-raiding species and avian nest predators particularly corvids^{152,154}.

No evidence has been found in studies of pine marten dietary analyses of merlin, although raptors as a group occasionally are mentioned. Pine marten are not associated with open heathland but where merlin shift nesting preference to trees, opportunistic predation by pine marten is possible, although it is unlikely to have a population level effect.

2.30.3 Conclusions

Risk		Proposed mitigation	Residual	
Nature	Likelihood	Severity		Risk
 Predation 	Low	Low		Low
 Competition 				
(prey)				

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Benefit	How to maximise benefits
 Predator protection hypothesis, trophic cascades (predation of other predators that may have a larger impact on merlin, notably corvids) 	•Provide woodland and heathland management advice to landowners encouraging varied habitat structure, including increasing areas of open ground with adjacent woodland suitable for nesting merlin.

2.31 Eurasian hobby (Falco subbuteo)

2.31.1 Status of hobby

The hobby's Least Concern listing is caused by agricultural intensification, pesticide use, shooting, loss of old-growth forest, human disturbance and collisions with wind farms. Goshawk predation and competition for nest sites is also a factor in some areas¹⁵⁵. Removal of poplar belts in Europe (key nesting sites for hobby), removal of nests from pylons and agricultural changes affecting hirundine prey are all factors in decline of hobby¹⁵⁶.

Hobby are Green Listed in the UK and have seen an 8% decrease 1995-2021³⁴.



2.31.2 Interaction with predators

Hobby is predated by goshawk and pine marten in Europe¹⁵⁶ but the overlap of goshawk and hobby nesting habitat together with the expansion of goshawk populations across Europe and UK, mean goshawk is the key predator of hobby¹⁵⁷.

	~	
2.31.3	Concl	usions

Risk		Proposed mitigation	Residual	
Nature	Likelihood	Severity		Risk
 Predation 	Low	Low		Low

2.32 Common kestrel (Falco tinnunculus)

2.32.1 Status of kestrel

Listed as Least Concern on the IUCN Red List, threats include historic and current pesticides use, shooting, agricultural intensification, collisions with power lines, traffic and wind farms and loss of habitats. Kestel may also be predated by Northern goshawk limiting populations in some areas¹⁵⁸.

With a breeding UK population size of 31,000 pairs, kestrel is Amber listed due to a 42% decline 1995-2021 and its adverse status in Europe¹⁵⁹. The causes of its current declines are not understood¹⁶⁰. Kestrel numbers fluctuate in response to vole numbers and starvation is the largest cause of mortality. Traffic collisions, shooting, poisoning and disease are also key causes of death¹⁶⁰. This species is a habitat generalist and will nest in a range of places including using old nests of other species^{34,159}.



BTO Bird Atlas data for kestrel⁵⁰

2.32.2 Interaction with predators

The decline of kestrel in Northumberland has been attributed to an increased incidence of predation by goshawk¹⁵⁰. Pine marten is also a predator of kestrel nests in Europe¹⁶¹. Use by kestrel of twig nests made by corvids in trees near forest edges, creates a greater risk of predation by goshawk and pine marten as both species hunt along woodland edge¹⁶². Rodents are also a nest predator of kestrel and kestrel will compete for nest sites with a range of species including owls. As kestrel don't build their own nests, they will take advantage of nestboxes, which may place them at greater risk from pine marten¹⁶³.

No evidence has been found of kestrel within studies of pine marten dietary analyses, although raptors as a group occasionally are mentioned. Kestrel's ability to use multiple habitats and nesting opportunities means they are adaptable to predation risk although Northumberland demonstrates this is not always the case. Competition for food and nesting is also clearly a factor, although both are of abundant opportunity.

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2.32.3	Concl	usions
2.52.5	conci	usions

Risk		Proposed mitigation	Residual	
Nature	Likelihood	Severity		Risk
 Predation Competition (prey) 	Low (natural nesting)	Low		Low
	Low-moderate (nestbox nesting) - low numbers of boxes reduces risk	Low	•Explore mitigation measures to barn owl nestboxes (which are occasionally used by kestrel) reactively due to low level of risk.	Low

2.33 Eurasian sparrowhawk (Accipter nisus)

2.33.1 Status of sparrowhawk

Sparrowhawk is on the IUCN Red List under Least Concern, with historic declines due to persecution and pesticides, and trapping in some areas still ongoing. Habitat alteration and forest fires together with wind farm developments and lead shot poisoning are all current threats¹⁶⁴.

In the UK, sparrowhawk is Amber Listed due to a 25% population reduction between 1995-2020 to 31,000 pairs although range has expanded by 26%. While nesting success and distribution have risen (following historic collapse in figures due to organophosphate pesticides), recruitment particularly in Scotland has fallen, although reasons are unclear. Sparrowhawks are susceptible to trichomonosis but this has not been linked to the decline¹⁶⁵.



2.33.2 Interaction with predators

Sparrowhawks in Europe will select nesting sites in woodlands with high tree density as an adaptation to avoid goshawks and pine martens which, along with buzzards, are their main nest predators¹³⁸, ¹⁴³, ¹⁶⁶. While no evidence has been found of sparrowhawk within studies of pine marten dietary analyses, raptors as a group occasionally are mentioned. This suggests that sparrowhawk predation is opportunistic only.

2.33.3 Conclusions			
Risk	Proposed mitigation		
Nature	Likelihood	Severity	Residual Risk
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 Predation 	Low	Low	Low

2.34 Peregrine (Falco perigrinus)

2.34.1 Status of peregrine

Peregrines are listed as Least Concern on the IUCN Red List, with threats from persecution, egg collecting and shooting¹⁶⁷, ¹⁶⁸, ¹⁶⁹. Pesticides, such as organochlorin pesticides like DDT, played a key role in reducing the peregrine population in the UK during the 1950's and 1960's¹⁷⁰.

Peregrine is Green listed in the UK and has increased its breeding range by 186.1% (1968-72 to 2008-11)¹⁷¹. Whilst there has been an overall 46% decrease in the breeding population (1995-2020), numbers of breeding peregrine in recent years have increased¹⁷².

The greatest continuing threat in the UK is from illegal persecution, particularly on grouse moors¹⁷³.



BTO Bird Atlas data for peregrine¹⁷⁴

2.34.2 Interaction with predators

As an apex predator, Peregrine have few natural predators. Large birds of prey (golden eagle, whitetailed eagle, gyrfalcon) may occasionally predate peregrine although competition for prey and nesting sites would usually lead to displacement rather than predation¹⁷⁵. Nest site selection on cliffs usually provides protection from nest raiding although corvids and common rat may still predate eggs and chicks.

2.34.3 Interaction with pine martens

Pine marten predation of cliff-nesting peregrine nests has been reported anecdotally¹⁷⁶. This predation, however, is likely to be compensatory to other nest predation. Peregrine diet consists predominantly of birds, all year round, with the main prey species being pigeon¹⁷⁷. The overlap between these two species is therefore likely to be small.

2.34.4 Conclusions

Risk		Proposed mitigation	Residual	
Nature	Likelihood	Severity		Risk
 Predation 	Low	Low		Low
 Competition 				
(prey)				

2.35 Hen Harrier (Circus cyaneus)

2.35.1 Status of hen harrier

Listed as Least Concern on the IUCN Red List, hen harrier face threats from habitat changes and intensification of agriculture, burning of vegetation and persecution^{178, 179, 180.} Persecution continues to be main threat for hen harriers on grouse moors in the UK¹⁸¹.

In the UK, hen harrier is Red Listed due to the population decline, with only 545 breeding pairs remaining. The overall distribution has increased by 30.9% (1968-72 to 2008-11), however, whilst Wales have had an increase in distribution, Scotland have had marked losses¹⁸².

Hen harriers are no longer breeding in Devon, however, hen harriers do still visit Devon during the winter months¹⁸³. Hen harriers aggregate in communal roosts on the ground, in the winter¹⁸⁴.



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BTO Bird Atlas data for hen harrier¹⁸³

2.35.2 Interaction with predators

Hen harriers suffer nest predation from a variety of predators, including foxes, small rodents and avian predators, such as corvids^{185, 186}.

2.35.3 Interaction with pine marten

Some pine marten predation of hen harrier has been reported anecdotally although they do not occur in dietary studies and such predation is unlikely to be significant¹⁸⁷. However, predation by reintroduced pine marten, which will take eggs as well as chicks, may be compensatory of chick predators such as small mammals and corvids. Pine marten will also predate other corvids and rodents, all of which will predate hen harrier, which may have a positive effect.

2.35.4 Conclusions

Risk		Proposed mitigation	Residual	
Nature	Likelihood	Severity		Risk
 Predation 	Low	Low		Low
 Competition 				
(prey)				

2.36 Common raven (Corvus corax)

2.36.1 Status of raven

Raven has Least Concern status due to historic and some ongoing persecution. Threats from intensive agriculture, woodland loss, and human disturbance are additional factors¹⁸⁸.

Ravens are Green Listed in the UK with 10,000 breeding pairs: a population that has increased by 43% between 1995 and 2020 and a 60% increase in breeding range. Ravens will use a wide range of habitats with moorland, bogs and coastal habitats being key areas¹⁸⁹.



BTO Bird Atlas data for raven⁵⁰

2.36.2 Interaction with predators

Raven is predated by goshawk, other raptors, raven and pine marten in Bialowieza Forest in Poland¹⁹⁰. While no evidence has been found of raven within studies of pine marten dietary analyses, corvids as a group occasionally are mentioned. This suggests that raven predation is opportunistic only.

2.36.3 Conclusions

Risk		Proposed mitigation	Residual	
Nature	Likelihood	Severity		Risk
 Predation 	Low	Low		Low

2.37 Grey Heron (Ardera cinerea)

2.37.1 Status of grey heron

Grey herons are listed as Least Concern globally¹⁹¹ and in Europe¹⁹². Threats include hunting and trapping, marine and freshwater agriculture, pollution and logging¹⁹³.

The grey heron population in the UK has seen an overall long-term increase and is Green listed, with 13,000 breeding pairs¹⁹⁴. This long-term increase is most likely due to improving water quality, reduced persecution and an increasing number of suitable nesting and feeding sites¹⁹⁵.



BTO Bird Atlas data for grey heron¹⁹⁶

2.37.2 Interactions with predators

Grey herons have few natural predators, aided in part by their colonial living¹⁹⁷, but their chicks and eggs can be vulnerable to predation by foxes and crows (8). No evidence of grey heron predation by pine martens could be found. This suggests that grey heron predation is opportunistic only.

2.37.3 Interaction with pine marten

While competition prey between pine martens and grey herons may occur for small mammal and bird prey, there are some differences in the foraging behaviour and prey preferences between the two species. Grey heron diet is made up largely of fish, and their foraging tends to occur in aquatic habitat, only occasionally foraging in recently been harvested fields for rodents¹⁹⁸, ¹⁹⁹.

2.37.4 Conclusions

Risk			Proposed mitigation	Residual
Nature	Likelihood	Severity		Risk
 Predation Competition (prey) 	Low	Low, pine marten predation and competition likely to be partly compensatory		Low

2.38 Coastal seabird colonies

Razorbill (*Alca Tords*) and guillemot (*Uria aalge*) are features of West Exmoor Coast and Woods SSSI but were not discussed in the Two Moors HRA Screening Assessment Report. For completeness, it should be noted that MacPherson et al (2014)⁷² ruled out impacts on birds nesting on coastal cliffs and shores as these were habitats unlikely to be utilised by pine marten. No evidence has been

found of seabirds within studies of pine marten dietary analyses. However, where woodland habitat is immediately adjacent to coastal cliffs, it is possible some opportunistic predation of seabirds (particularly eggs) may occur.

2.38.1 Conclusions

Risk		Proposed mitigation	Residual	
Nature	Likelihood	Severity		Risk
 Predation 	Low	Low		Low

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¹⁹⁵ <u>https://www.bto.org/sites/default/files/bto_heronries_census_annual_summary_2022.pdf</u>

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¹⁹⁸ <u>https://birdfact.com/birds/grey-heron</u>

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Addendum

Response to NE regarding the SSSI component of the HRA

As part of this HRA, considerations were made to the features within relevant SSSIs, in particular regarding potential impacts on ground nesting birds of open heathland habitats which border woodlands. The project will undertake a baseline monitoring programme, designed to capture early indication of a predation issue which can be developed into a longer-term study if required.

It is beyond the scope of the Two Moors project to undertake detailed monitoring of a range of species and therefore monitoring will focus on the population of nightjar found at Yarner Woods and Trendlebere Downs SSSI (Trendlebere Downs), using these as a proxy for assessing impacts on other ground nesting birds.

Nightjar surveys will be undertaken initially in 2024 to 2026 following the standardised national survey guidance following established transects from previous surveys. If evidence indicates nightjar predation, the project will instigate a more detailed predation study. If a longer-term, more involved study becomes necessary, this would potentially require specialist input and skills to assist with project design and field work (e.g. nest finders) and there may be a need for additional equipment (nest cameras). At that stage, funding opportunities could be explored through Natural England or other bodies (e.g. Devon Birds)

As part of this assessment, the radio tracking and GPS data of the released pine marten will be used to investigate pine marten proximity to nightjar habitat during the first 6-9months of release (2024-25), or however long the radio collars remain active. Where possible, scat surveys will be undertaken as additional records of pine marten presence and offer potential for dietary studies at a later date. It should be stressed that scat detection is notoriously unreliable, so it is important to manage expectations from this method of survey. Post-release monitoring of pine marten using camera traps will also be employed, which can also provide information on pine marten location and potentially their use of the heath habitat adjacent to the woodland.

As a control, other sites will be included within the nightjar survey that fall outside the PRRs. East Devon Heaths with RSPB would be an appropriate comparison. However, it is acknowledged that many factors, including site specific factors, cause fluctuations in populations and proving a causal effect of pine marten predation, should it exist, will be difficult.

The project will investigate data collection on habitat changes and disturbance levels as possible contributory factors to changes in nightjar numbers.

Potential data sources:

- Historic survey data SCARABBS
- 2025 National survey planned as part of the East Dartmoor Landscape Recovery Project (ED LRP)
- Fine scale vegetation mapping produced as part of the ED LRP
- Natural England's long Term Monitoring Network repeat vegetation surveys undertaken at roughly 5-year intervals on Trendlebere Down
- Site management plans from the East Dartmoor NNR team



Flow chart of monitoring strategy with actions to be taken in response to identified risks

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