

England's breeding seabirds: A review of the status of their breeding sites and suggested measures for their recovery

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Figure 1: Terns in flight on Coquet by Wesley Davies

Executive Summary

- England supports internationally significant populations of breeding seabirds including more than 50% of the UK population of 6 species.
- Recent assessments are that breeding seabirds in the UK have not achieved Good Environmental Status (GES), with many species in decline and widespread breeding failures becoming more frequent.
- Through interviews with site managers and site knowledge holders this review gathered information on the current state of England's natural breeding seabird sites. We believe this is the first time such a review of the pressures impacting on breeding seabirds across England has been carried out.

- We looked at 24 species of breeding seabird that regularly breed in England and gathered information from 123 sites (and 222 subsites). Although the scope of the review excludes urban sites taken together, these sites support the vast majority of England's breeding seabirds.
- We gathered information on the current and predicted pressures negatively impacting on or limiting breeding seabird populations at these sites, mainly through discussion with site managers
- We estimate that there are approximately 450,000 pairs of seabirds currently breeding in England, but the results of the latest 'Seabirds Count' JNCC survey are eagerly awaited to confirm numbers and recent trends
- We identified 22 'Priority Sites', which support the majority of England's breeding seabirds and where conservation actions, which are required to ensure protection or recovery, would therefore have the greatest impact
- We identified the most important pressures negatively impacting on England's breeding seabirds at a site, regional, and national level. These were (in order of importance): disturbance, habitat loss, predation, invasive species, reduction in food, and the impacts of climate change. Note that the assessments were carried out before the widespread and serious impacts of Avian Influenza were recorded in 2022.
- We highlight the importance of soft coast habitats for breeding seabirds in England and how these are particularly threatened by disturbance, predation, and habitat loss.
- We present recommendations for conservation actions to protect and enhance breeding seabird populations in England at a site, regional, and national level.
- We propose a five-year Breeding Seabird Recovery Plan to address the current pressures, halt current population declines, and provide a platform for the long-term recovery of England's breeding seabirds, at an estimated cost of £10.7 M of additional spend.
- This five-year Breeding Seabird Recovery Plan includes:
 - A programme of soft coast habitat creation and enhancement around the South and East coast building climate change resilience and adaptation which can provide habitat for an additional 30,000 pairs of gulls and terns.
 - The restoration of the Isles of Scilly through the removal of invasive brown rats
 - Enhanced biosecurity for offshore islands such as Lundy and Coquet which can see sustained population increases on these safe nesting areas
- We estimate that the proposed Breeding Seabird Recovery Plan could halt and reverse the current and predicted declines in breeding seabird populations in England and provide a platform for the recovery of England's breeding seabirds from a current estimated 450,000 pairs to a minimum of 500,000 pairs by 2050.

- We emphasise the need to strategically incorporate the needs of England’s breeding seabirds into wider land and coastal management policies

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2. Introduction

The UK holds internationally important populations of seabirds, but a recent UK Government-led assessment of the state of the UK’s seas concluded that breeding seabirds had not achieved ‘Good Environmental Status’ (GES) as defined by the UK Marine Strategy (Mitchell *et al*/2020). Over a third of species assessed had experienced declines in breeding abundance of 20–30% or more since the early 1990s and the proportion of species experiencing widespread and frequent breeding failures has increased in the last decade (Pearce-Higgins 2021).

This is therefore a timely opportunity to complete a rapid audit of the status England’s seabird colonies, the pressures facing them, interventions to maintain and restore them, and the opportunities to create and develop new ones. This information has been collated to inform the England Seabird Conservation Strategy (ESCS) which is currently in preparation by DEFRA/Natural England (NE), and due to be completed in 2023, and other conservation programmes such as the 25 Year Environment Plan, Local Nature Recovery Strategies, SSSI condition recovery and species conservation.

This review has been carried out as part of the Natural England - RSPB Action for Birds in England (AfBiE) programme.

Following data collection, the authors reviewed the information gathered from site managers on pressures affecting breeding seabird populations at sites and the intervention actions required to protect and enhance seabird populations on these sites and used this information to draft site-specific recommendations for each site. These are detailed in the regional site data tables in Annex: Regional Site Data Tables.

The aims of this review are:

- 1) to identify the main pressures currently negatively impacting on populations of breeding seabirds in England
- 2) to identify site-specific recommendations for actions to protect and enhance breeding seabird populations at each major breeding site
- 3) to identify the most important and most urgent actions required at a national and regional level to halt population declines, protect and enhance breeding sites, and allow populations of England's breeding seabirds to recover. These actions are collated and summarised in a proposed and costed five –year 'Breeding Seabird Recovery Plan'.

Further work to develop and deliver these actions and develop longer term strategic opportunities will be developed through the AfBiE project over the next 3 years.

The review is presented in two parts. This report, which summaries findings and the conclusions we draw from them, and the information on species, sites, pressures and remedial interventions required which are presented as a separate series of data tables and which are intended to be periodically reviewed as a live audit of ongoing management priorities and opportunities.

3. Methods

3.1. Species included in review

This review assessed 24 species of seabird that regularly breed in England (based on the past 20 years): northern fulmar (*Fulmarus glacialis*, hereafter 'fulmar'), Manx shearwater (*Puffinus puffinus*), European storm petrel (*Hydrobates pelagicus*, hereafter 'storm petrel'), northern gannet (*Morus bassanus*, hereafter 'gannet'), great cormorant (*Phalacrocorax carbo*, hereafter 'cormorant'), European shag (*Gulosus aristotelis*, hereafter 'shag'), black-legged kittiwake (*Rissa tridactyla*, hereafter 'kittiwake'), European herring gull (*Larus argentatus*, hereafter 'herring gull'), lesser black-backed gull (*Larus fuscus*), great black-backed gull (*Larus marinus*), black-headed gull (*Chroicocephalus ridibundus*), Mediterranean gull (*Larus melanocephalus*), common gull (*Larus canus*), yellow-legged gull (*Larus michahellis*), roseate tern (*Sterna dougallii*), little tern (*Sternula albifrons*), Sandwich tern (*Thalasseus sandvicensis*), common tern (*Sterna hirundo*), Arctic tern (*Sterna paradisaea*), Atlantic puffin (*Fratercula arctica*, hereafter 'puffin'), common guillemot (*Uria aalge*, hereafter 'guillemot'), razorbill (*Alca torda*), black guillemot (*Cephus grille*), and common eider (*Somateria mollissima*, hereafter 'eider').

However, it should be noted that yellow-legged gull has always been an extremely rare breeder in England, has only bred regularly at one site (Poole Harbour) and may not have bred in England since 2018.

These species are listed in Table 1, along with their conservation status according to BoCC5 (Stanbury *et al*, 2021), which covers bird species of conservation concern in the UK, Channel Islands, and Isle of Man, as well the European and Global IUCN Red List of species threatened with extinction. The only duck included was eider, which is a regular coastal breeder in Northumberland and Cumbria. Although very small numbers of red-breasted mergansers breed on the coast in Cumbria, the breeding population is otherwise dispersed and entirely freshwater-based and this species has therefore been excluded from this assessment. For the rest of this report, the term 'seabird' refers to species included in this list.

In terms of UK importance, England holds over 50% of the UK's breeding population of seven of these species: lesser black-backed gull, black-headed gull, Mediterranean gull, yellow-legged gull, roseate tern, little tern, and Sandwich tern. These species are highlighted in Table 1. In an international context, England supports about 36% of the breeding populations of the *graellsii* race of lesser black-backed gull; 5% of the world's Sandwich terns; 3% of the world's little terns; and 5% of the world's shags

Five out of the twenty-four species are on the UK red List (BoCC5): shag, kittiwake, herring gull, roseate tern, and puffin. Eighteen of the twenty-four species are on the UK amber list (BoCC5): fulmar, Manx shearwater, storm petrel, gannet, lesser black-backed gull, great black-backed gull, black-headed gull, Mediterranean gull, common gull, yellow-legged gull, little tern, Sandwich tern, common tern, Arctic tern, guillemot, razorbill, black guillemot, and eider. In addition, Stanbury *et al* (2021) assessed species against red list criteria for extinction risk in Great Britain, and classed kittiwake as 'Critically Endangered'; herring gull, great black-backed gull, yellow-legged gull, roseate tern, shag and eider as 'Endangered'; black-headed gull and little tern as 'Vulnerable' and common tern as 'Near Threatened' with extinction in Great Britain. These assessments show the seriousness of the issues facing seabirds in the United Kingdom and in England. Furthermore, puffin and eider are classed as 'Endangered' and kittiwake as 'Vulnerable' on the European Red List, and puffin and kittiwake are also classed as 'Vulnerable' on the Global Red List. Eider is also classed as 'Near Threatened' on the Global Red List and subject to a AEWA management plan. The need for concerted conservation action is clear for these species.

Table 1. Species included in this review along with their most recent conservation status. Shaded species names indicate that England holds over 50% of the UK's breeding population of this species.

Species		Conservation Status		
Common name	Scientific name	BoCC5 (2021)*	European Red List (2021)***	IUCN Global Red List (2021)***
Fulmar	<i>Fulmarus glacialis</i>	Amber	Least Concern	Least Concern
Manx shearwater	<i>Puffinus puffinus</i>	Amber	Least Concern	Least Concern
Storm petrel	<i>Hydrobates pelagicus</i>	Amber	Least Concern	Least Concern
Gannet	<i>Morus bassanus</i>	Amber	Least Concern	Least Concern
Cormorant	<i>Phalacrocorax carbo</i>	Green	Least Concern	Least Concern
Shag	<i>Gulosus aristotelis</i>	Red	Least Concern	Least Concern
Kittiwake	<i>Rissa tridactyla</i>	Red	Vulnerable	Vulnerable
Herring gull	<i>Larus argentatus</i>	Red	Least Concern	Least Concern
Lesser black-backed gull	<i>Larus fuscus</i>	Amber	Least Concern	Least Concern
Great black-backed gull	<i>Larus marinus</i>	Amber	Least Concern	Least Concern

Black-headed gull	<i>Chroicocephalus ridibundus</i>	Amber	Least Concern	Least Concern
Mediterranean gull	<i>Larus melanocephalus</i>	Amber	Least Concern	Least Concern
Common gull	<i>Larus canus</i>	Amber	Least Concern	Least Concern
Yellow-legged gull	<i>Larus michahellis</i>	Amber	Least Concern	Least Concern
Roseate tern	<i>Sterna dougallii</i>	Red	Least Concern	Least Concern
Little tern	<i>Sternula albifrons</i>	Amber	Least Concern	Least Concern
Sandwich tern	<i>Thalasseus sandvicensis</i>	Amber	Least Concern	Least Concern
Common tern	<i>Sterna hirundo</i>	Amber	Least Concern	Least Concern
Arctic tern	<i>Sterna paradisaea</i>	Amber	Least Concern	Least Concern
Puffin	<i>Fratercula arctica</i>	Red	Endangered	Vulnerable
Guillemot	<i>Uria aalge</i>	Amber	Least Concern	Least Concern
Razorbill	<i>Alca torda</i>	Amber	Least Concern	Least Concern
Black guillemot	<i>Cephus grille</i>	Amber	Least Concern	Least Concern
Eider	<i>Somateria mollissima</i>	Amber	Endangered	Near Threatened

*Stanbury et al (2021) BoCC5: The fifth review of Birds of Conservation Concern (BoCC5) in the UK, Channel Islands and Isle of Man

**BirdLife International (2021) European Red List of Birds

***IUCN Red List www.iucnredlist.org

3.2 Sites included in review

Sites included in this review were:

- Sites of Special Scientific Interest (SSSIs) in England that have breeding seabirds as designated features of interest
- Special Protection Areas (SPAs) in England that have breeding seabirds as qualifying features
- Any other sites in England of regional significance for breeding seabirds, including inland sites but excluding urban sites
- Sites in England which held important numbers of breeding seabirds in the past (1960-2000), even if these are no longer present.
- Sites in England with the potential to support important numbers of breeding seabirds in the future where this information was available

Urban sites (e.g., roof-nesting gulls) were not included unless they formed part of, or were linked to, one of the site types listed above.

Sites were defined based on functional linkage of the breeding seabird populations they support – in some cases this meant that a site was defined as part of an existing SPA, and in others it meant combining two or more SPAs into one site.

An initial list of sites was drawn from Brown (unpublished). Sites in southwest England were drawn from Porter *et al* (2010).

Information was collated on the designation status of each site (e.g., SSSI, SPA) and on land ownership and management of each site.

In total, 123 sites were included for assessment in this review. Several of the larger sites with multiple different landowners/managers were also divided into subsites based on these administrative differences, resulting in a total of 222 subsites. For example, the North Norfolk

Coast SPA is a site that covers a large area, with separate seabird colonies managed by different organisations (e.g., Blakeney Point is managed by the National Trust, Scolt Head Island is managed by Natural England, Titchwell is managed by the RSPB). Other large sites that are largely managed as one unit were not divided into subsites. For example, the Isles of Scilly comprises multiple islands, but is largely under single ownership and management, and as such is listed as one site. Information on ownership and management across the full list of sites and subsites can be found in the Annex: Regional Site Data Tables.

Sites were categorised into six different regions according to their geographical location. These were:

- The Northern North Sea (Northumberland to Yorkshire): 15 sites, 26 subsites
- The Southern North Sea (Humber to Thames): 28 sites, 66 subsites
- The English Channel (Kent to West Dorset): 17 sites, 26 subsites
- The Southwest, Bristol Channel and the Celtic Sea: 19 sites, 20 subsites
- The Irish Sea: 13 sites, 51 subsites
- Inland sites: 31 sites, 33 subsites

Sites were also classified as being made up primarily of one of four broad habitat types: offshore islands, mainland cliffs, soft coasts, and inland sites. Several colonies are associated with man-made habitats, but we have chosen to not classify these as a distinct habitat type as these are usually man-made features within or associated with one of the wider natural habitat types described above. For example, rafts are regularly part of the inland lowland habitat; and piers and pontoons in harbours and docks are associated with soft coast habitats.

For each site, population estimates of breeding seabirds were obtained from the most recent available sources, and the proportion of England's breeding population of each species was estimated for each site. For some sites, the available population estimates date back to Seabird 2000, and recent population trends are uncertain. However, the available data does allow for a general overview of trends. The results of the JNCC's Seabird Count data (for the period 2015-2021), when they become available, can be used to update these estimates.

Together, the sites included in this review hold the majority of England's breeding seabirds. With the exception of herring gull and lesser black-backed gull, we estimate these sites hold over 90% of the breeding populations of the species included in this review. Herring gull and lesser black-backed gull are widespread and widely dispersed in England and often nest in non-colonial urban locations that are not included in this review (Burnell, 2021). For the most localised species, such as Manx shearwater, storm petrel, gannet, roseate tern, Sandwich tern, black guillemot and puffin, we estimate that 100 % or close to 100% of England's breeding population is included in these sites.

3.3 Priority Sites

From the full list of 123 sites and 222 subsites, we identified 22 'Priority Sites', based on the estimated numbers and proportions of England's breeding seabirds that they hold. Sites were identified as Priority Sites if they supported over 10,000 breeding pairs of breeding seabirds (all species combined) and/or if they supported over 10% of England's breeding population of any one seabird species. Sites were classified as Priority Sites if these population thresholds had been exceeded at any point since the Seabird 2000 counts. These areas are shown in

Table 2 and Figure 2. Together, these 22 areas support over 70% of England's breeding seabirds. They should therefore be considered as priorities for conservation action, and priority was given to these areas when collecting data. Table 2 also shows which of these sites hold over 50% of England's breeding population for any of these species.



Figure 2: Map of the Priority Sites which support the majority of England's breeding seabirds

This table also highlights sites that are amongst the top five most important breeding sites in England (by breeding population size) for each species. For example, the Isles of Scilly supports more than 10,000 pairs of breeding seabirds and it is also the most important site in England (by breeding population) for storm petrel, shag, and great black-backed gull, the second most important site for Manx shearwater, and also a top five site for fulmar and razorbill.

The suite of priority sites supports the full range of English seabirds, with representation from all habitat types and geographical areas and therefore targeting conservation effort at these sites could represent an effective strategy to recover England's seabirds.

It should also be noted that several of these sites are of international importance for breeding seabirds. For example, Bowland Fells may be the largest lesser black-backed gull colony in the world, and the Flamborough and Filey Coast SPA supports the largest colony of kittiwakes in the North Atlantic.

Table 2 also shows that the majority of England's Priority Sites for breeding seabirds are soft coast sites (14 out of the 22, 64%).

Table 2. Priority Sites in England for breeding seabirds identified as either supporting either 1) more than 10,000 pairs of breeding seabirds 2) more than 10% of England's breeding population for any one species and/or 3) sites that are amongst the top five most important breeding sites in England (by breeding population size) for each species. The main habitat types and the designation(s) that apply to these sites are also shown.

Site name	Site Designation(s)	Habitat	Criteria for inclusion as Priority Site	Additional importance (*top 5 site in England,)
Alde-Ore Estuary	SPA, SSSI	Soft coast	>10,000 pairs breeding seabirds >10% England breeding population lesser black-backed gull †	Lesser black-backed gull †*
Belmont and Stocks Reservoirs, West Pennine Moors	SSSI	Inland	>10,000 pairs breeding seabirds >10% England breeding population black-headed gull	Black-headed gull
Bowland Fells	SPA, SSSI	Inland	>10,000 pairs breeding seabirds >10% England breeding population lesser black-backed gull †	Lesser black-backed gull † Herring gull
Chichester, Langstone and Pagham Harbours	SPA, SSSI	Soft coast	> 10,000 pairs breeding seabirds >50% England breeding population Mediterranean gull †	Mediterranean gull * †
Coquet Island	SPA, SSSI	Offshore island	>10,000 pairs breeding seabirds >50% England breeding population roseate tern † >10% England breeding population Sandwich tern † >10% England breeding population common tern >10% England breeding population Arctic tern >10% England breeding population puffin >10% England breeding population eider	Roseate tern * † Sandwich tern * † Common tern * Arctic tern Puffin Eider

Dungeness, Romney Marsh and Rye Bay	SPA, SSSI	Soft coast	>10% England breeding population Mediterranean gull † >10% England breeding population common tern	Mediterranean gull * † Cormorant * Common tern
East Norfolk/Suffolk-Winterton to Minsmere	SPA, SSSI	Soft coast	>10% England breeding population little tern †	Little tern * † Common tern Sandwich tern
Hamford Water and Essex Estuaries: Blackwater, Colne, Crouch and Roach Estuaries	SPA, SSSI	Soft coast	>10,000 pairs breeding seabirds >10% England breeding population Mediterranean gull †	Mediterranean gull * † Black-headed gull * †
Farne Islands	SPA, SSSI	Offshore islands (archipelago)	>10,000 pairs breeding seabirds >50% England breeding population Puffin >10% England breeding population shag >10% England breeding population Sandwich tern † >10% England breeding population Arctic tern >10% England breeding population guillemot >10% England breeding population eider	Guillemot * Puffin * Shag * Eider * Sandwich tern* † Cormorant * Fulmar Kittiwake Arctic tern Fulmar
Flamborough and Filey Coast	SPA, SSSI	Mainland cliffs	>10,000 pairs breeding seabirds >50% England breeding population gannet >50% England breeding population guillemot >10% England breeding population kittiwake >10% England breeding population puffin	Gannet * Fulmar * Kittiwake * Guillemot Razorbill Puffin
Isles of Scilly	SPA, SSSI	Offshore islands (archipelago)	>10,000 pairs breeding seabirds >50% England breeding population shag	Storm petrel * Manx shearwater * Shag *

			<p>>50% England breeding population great black-backed gull</p> <p>>10% England breeding population Manx shearwater</p> <p>>10% England breeding population lesser black-backed gull †</p>	<p>Fulmar *</p> <p>Razorbill *</p> <p>Great black-backed gull *</p> <p>Lesser black-backed gull †</p> <p>Puffin</p>
Lundy	SSSI	Offshore island	<p>>10,000 pairs breeding seabirds</p> <p>>50% England breeding population Manx shearwater</p> <p>>10% England breeding population razorbill</p>	<p>Storm petrel *</p> <p>Manx shearwater *</p> <p>Razorbill *</p> <p>Guillemot</p> <p>Puffin</p>
Medway Estuary & The Swale	SPA, SSSI	Soft coast	<p>>10% England breeding population Mediterranean gull †</p>	<p>Mediterranean gull * †</p>
Morecambe Bay and Duddon Estuary	SPA, SSSI	Soft coast	<p>>10,000 pairs breeding seabirds</p> <p>>10% England breeding population eider</p>	<p>Sandwich tern* †</p> <p>Great black-backed gull * †</p> <p>Lesser black-backed gull †</p> <p>Herring gull</p> <p>Eider</p>
North Norfolk Coast and The Wash	SPA, SSSI	Soft coast	<p>>10,000 pairs breeding seabirds</p> <p>>10% England breeding population Mediterranean gull †</p> <p>>10% England breeding population Sandwich tern †</p> <p>>10% England breeding population common tern</p> <p>>10% England breeding population little tern †</p>	<p>Little tern * †</p> <p>Sandwich tern * †</p> <p>Common tern</p> <p>Mediterranean gull</p> <p>Black headed gull</p>
Northumbria coast, Lindisfarne and Beadnell Bay	SPA, SSSI	Soft coast	<p>>50% England breeding population Arctic tern</p>	<p>Arctic tern</p> <p>Eider</p>

Poole Harbour	SPA, SSSI	Soft coast	>10,000 pairs breeding seabirds >50% England breeding population yellow-legged gull † >10% England breeding population Mediterranean gull †	Black-headed gull * † Mediterranean gull * † Yellow-legged gull * †
Ribble Estuary	SPA, SSSI	Soft coast	>10,000 pairs breeding seabirds	Black-headed gull * † Lesser black-backed gull * † Herring gull *
Solent	SPA, SSSI	Soft coast	>10,000 pairs breeding seabirds >10% England breeding population common tern	Black-headed gull * † Mediterranean gull † Common tern
Solway Firth	SPA, SSSI	Soft coast	>10,000 pairs breeding seabirds	Lesser black-backed gull † Herring gull
St Bees Head	SSSI	Mainland cliffs	>10,000 pairs breeding seabirds >50% England breeding population black guillemot > 10% England breeding population guillemot	Black guillemot* Guillemot Razorbill
Teesmouth and Cleveland Coast	SPA, SSSI	Soft coast	>10% England breeding population common tern	Common tern Little tern †

* Amongst the top five most important breeding sites in England (by breeding population size) for this species

† Species for which England supports more than 50% of the UK's breeding population

The Dee Estuary (SPA and SSSI), which is shared between Wales and England, is not included despite supporting a large little tern colony in Wales, as there is limited seabird interest in the English part of the site.

3.4 Data collection

For each site, information was collected through discussion with site managers, wardens and conservation officers from the organisations involved in the management of the sites (e.g., The RSPB, National Trust, The Wildlife Trusts, Natural England etc). The people providing this information can be considered the best possible sources of information on the specific issues affecting these sites, because of their familiarity with the site, its management, and its breeding bird populations. The majority of the information was gathered via phone or email, but site visits were also made to the Isles of Scilly, the Severn Estuary, Morecambe Bay and Duddon Estuary, the Solent, Langstone and Chichester Harbour, Pagham Harbour, Rye/Dungeness, Medway Estuary, the Swale, Essex Estuaries, North Norfolk, the Wash, the Humber, Flamborough, and Lindisfarne. Some information was also gathered from the literature.

For each site/subsite, information was gathered on the following, where possible:

- Historical, current and potential numbers of breeding seabirds.
- Reasons for changes in numbers of breeding seabirds, particularly declines
- Issues currently negatively affecting populations of breeding seabirds on site
- Issues predicted to negatively affect populations of breeding seabirds on site in future
- Intervention actions required in order to protect and enhance breeding populations of seabirds on site

A lot of the information gathered was necessarily subjective, being based on the opinions of the site managers, area conservation officers and others. However, useful quantitative data being largely lacking for these issues, it was deemed that the expert judgement provided by the site managers most familiar with the sites, and their issues, constitutes the best available evidence on issues affecting England's breeding seabirds.

The information gathered primarily relates to terrestrial issues affecting breeding seabirds at their breeding sites. Offshore issues (e.g., impacts of fisheries, bycatch, offshore development proposals etc) were not included. However, because food availability during the breeding season is critical to seabird productivity and because changes in food availability can sometimes be observed by site managers, this was included.

Given limited time and resources, it was not possible to collect all of the above information for every site in as much detail as we would have liked. Priority was given to collecting information on the Priority Sites. In addition, the resulting database (Annex: Regional Site Data Tables) is to be viewed as a living document that can be updated whenever new information becomes available (e.g., when the JNCC's recent Seabird Count survey data is published).

3.5 Pressures

In order to facilitate the analysis and understanding of the information collected from site managers, the various issues described as negatively affecting breeding seabird populations were categorised into the following defined 'pressures'. These pressures and their definitions are based on those used by Natural England (Perez-Dominguez *et al* 2016; Kober *et al. unpublished*) and were chosen to facilitate comparison of the results of this review with other

work being done on seabird conservation in England, such as the England Seabird Conservation Strategy (currently in preparation by Natural England/Defra).

It should be noted that these categories are not mutually exclusive (for example, 'reduction in habitat' and 'climate change' may, in some cases, effectively be the same pressure).

Table 3. Pressure definitions

Pressures	Definition
Disturbance	Any disturbance caused by anthropogenic activities that results in displacement or impacts on breeding success. This generally refers to visual disturbance, although noise disturbance is an issue at some sites (e.g., personalised motorised watercraft at the Flamborough and Filey Coast SPA).
Removal	Deliberate, targeted removal of the species through human activities. This includes illegal activity such as killing of adults and egg collection as well as licenced activities such as egg harvesting, and species control (e.g., control of large gulls)
Predation/competition	Impacts of predation by, or competition with, native species.
Invasive species	Presence of invasive species. This mainly refers to the impacts of invasive mammalian predators (such as rats, cats, and mink) on offshore islands where they are not native.
Reduction in habitat	Includes both reduction in extent of habitat (e.g., as a consequence of erosion or regular inundation of nesting habitat) and reduction in quality of habitat (e.g., as a consequence of extensive unmanaged vegetation growth).
Reduction in food	Reduced availability of food during the breeding season evident at the breeding site.
Sea level rise	Sea level rise caused by climate change (linked to habitat loss – see above)
Increased frequency and severity of storms	Increased frequency and severity of storms related to climate change
Pathogens	Impacts of disease (e.g., botulism or avian influenza).

The fact that a pressure is not listed for a specific site does not mean that this pressure does not exist at this site. It may exist at a low level and be having impacts that are secondary to other pressures and therefore not be considered to be seriously impacting on the viability of the breeding colony, or clear evidence for the existence of the pressure at the site may be lacking. The inclusion of a pressure for a particular site is an indication that site managers believe this pressure exists at the site and that it is having a negative impact on populations of breeding seabirds at the site. The results therefore give a good overview of what site managers believe to be the most important pressures currently affecting breeding seabirds at these sites. Combined, these results give us a good indication of the prevalence of these pressures at seabird breeding sites in England, and the vulnerability of England's breeding seabirds to these pressures.

3.6 Recommendations

Following data collection, the authors reviewed the information gathered from site managers on pressures affecting breeding seabird populations at sites and intervention actions required to protect and enhance seabird populations on site and used this information to draft site-specific recommendations for each site. These are detailed in the regional site data tables.

The authors also reviewed all of the collated information and site-specific recommendations in order to summarise the key recommendations for the recovery and enhancement of England's breeding seabird populations at a regional and national level. Key recommendations are discussed in Chapter 5 by pressure and by habitat type. Chapter 6 then summarises the key recommendations at a regional and national level and puts forward a proposed five-year 'Breeding Seabird Recovery Plan' for England.

4. Results

The full results of the information gathered for each site and subsite are given in Regional Site Data Tables in the Annex. The database is divided into regional tables containing all of the information gathered for each site in each region. These include details of each site's designation status, key habitat types, seabird species supported, and most recently available breeding population size of those species, as well as the information gathered from site managers as to the pressures affecting breeding seabird populations at each site, the pressures they predict will impact on populations in future, and what intervention actions were recommended to protect and enhance populations at an individual site level. These tables are neither complete nor comprehensive but seek to pool the information that is currently available. It is intended that this database will be a 'living document', with information added and updated as it becomes available. For example, it is anticipated that population sizes will be updated in the near future when the results of the JNCC Seabird Count surveys become available (anticipated August 2023). The version provided is the version dated 28/2/2022, and the results it contains are summarised here.

The authors reviewed the results and the recommended site-level intervention actions and based on these drafted some general recommendations for the protection and enhancement of England's breeding seabird populations – these are given in Chapter 5 (Recommendations).

The results are presented here by pressure. For each pressure, the number of sites affected, and the number of sites of each habitat type affected are given.

We have also linked pressures to individual species, but it was not possible to assign pressures to specific numbers of birds. Our approach has been to attribute the pressure such that if a pressure is recorded as impacting on a site with a breeding population of 50 pairs, then we assume that 50 pairs of that species are potentially impacted by that pressure. This will not always be the case- for example the 50 pairs could be on part of the site not impacted by the specific pressure- but this does provide an indication of the conflicts between pressures and species. It should also be noted that there are uncertainties surrounding current breeding population sizes for some species, given the lack of available census data since Seabird 2000. Once the most recent Seabird Count data becomes available, these population sizes and proportions affected will be updated. However, it is possible to draw broad conclusions about the approximate proportions of each species' breeding population potentially affected, and these are therefore presented within broad categories: more than 75%, between 50 and 75%, between 25 and 50%, and between 0 and 25%.

Table 4. Percentages of sites and sites by region currently affected by each pressure.

Pressure	Percentage of sites affected						
	Total sites	Northern North Sea sites	Southern North Sea sites	English Channel sites	Southwest sites	Irish Sea sites	Inland sites
Disturbance	76.4%	80%	100%	82.4%	100%	84.6%	32.3%
Reduction in habitat	52%	33.3%	92.9%	58.8%	10.5%	92.3%	29%
Predation	56.1%	40%	92.9%	58.8%	5.3%	92.3%	45.2%
Invasive species	6.5%	13.3%	0%	0%	21.1%	0%	0%
Reduction in food	12.2%	66.7%	0%	11.8%	10.5%	7.7%	0%
Sea level rise	29.3%	26.7%	64.3%	41.2%	5.3%	46.2%	0%
Increased frequency and severity of storms	3.3%	13.3%	0%	0%	5.3%	0%	3.2%
Pathogens	0.8%	0%	0%	0%	5.3%	0%	0%
Removal	11.4%	13.3%	7.1%	11.8%	0%	15.4%	19.4%

Table 5. Percentages of sites of each habitat type currently affected by each pressure.

Pressure	Percentage of sites of each habitat type affected			
	Offshore Islands	Mainland Cliffs	Soft Coasts	Inland
Disturbance	93.3%	80.6%	96.2 %	32.3%
Reduction in habitat	26.7%	3.2%	98.1%	29%
Predation	13.3%	12.9%	96.2%	45.2%
Invasive species	40.0%	0%	0%	14.3%
Reduction in food	26.7%	35.5%	1.9%	0%
Sea level rise	20.0%	0%	64.2%	0%
Increased frequency and severity of storms	20.0%	0%	0%	3.2%
Pathogens	6.7%	0%	0%	0%
Removal	6.7%	0%	13.2%	19.4%

4.1. Disturbance

Disturbance was the most widely reported pressure currently impacting on seabird breeding sites, with 76.4% of sites reported as being affected (see Table 4). If inland sites are excluded, this percentage increases to 89% of sites, indicating that this is particularly an issue for coastal sites. This pressure also clearly has the biggest impact on soft coast sites, with 96.2% of soft coast sites currently affected (see Table 5). It is therefore unsurprising that species nesting in soft coast habitats are amongst those most affected by disturbance, although this is not exclusively the case, and all habitat types are affected to some extent.

In terms of impacts on species, disturbance is currently potentially impacting on sites supporting over 75% of the England's breeding population for 15 species: gannet, shag, Mediterranean gull, black-headed gull, lesser black-backed gull, Sandwich tern, common tern, Arctic tern, roseate tern, little tern, guillemot, razorbill, black guillemot, puffin, and eider. Between 50 and 75% of England's breeding population of fulmar was also estimated to be affected by reduction in habitat.

Table 6. Species currently most potentially affected by disturbance

Proportion of England's breeding population on sites affected by disturbance	Species
> 75%	Gannet
	Shag
	Mediterranean gull*
	Black-headed gull*
	Lesser black-backed gull*
	Sandwich tern*
	Roseate tern*
	Common tern
	Arctic tern
	Little tern*
	Guillemot
	Razorbill
	Black guillemot
	Puffin
	Eider
50-75%	Fulmar
25-50%	Cormorant
	Kittiwake

* species for which England supports over 50% of the UK's breeding population

Disturbance was also one of the pressures that site managers predicted would increase in future. Obviously, there is uncertainty surrounding any of these predictions, but there is concern that disturbance is a growing problem, and that the impact of disturbance will grow if protective measures are not put in place. Although already a widespread pressure, both the level of disturbance and the impact of disturbance that is expected to grow significantly.

4.2. Reduction in habitat

Reduction in habitat was the next most commonly reported pressure, reported as currently impacting on breeding seabird populations at 52% of all sites (see Table 4). It is particularly a problem at soft coast sites, where this percentage increases to 98.1% (see Table 5). Impacts of sea level rise and the increased frequency and severity of storms are often associated with reduction in habitat, but the results for these are given separately (in section 4.6 and 4.7 respectively).

Over 75% of the England's breeding population was estimated to be currently affected by reduction in habitat for nine species: Mediterranean gull, black-headed gull, common gull, lesser black-backed gull, Sandwich tern, roseate tern, common tern, Arctic tern, and little tern. Between 50 and 75% of England's breeding population of herring gull was also estimated to be affected by reduction in habitat.

Table 7. Species currently most potentially affected by reduction in habitat

Proportion of England's breeding population on sites affected by reduction in habitat	Species
>75%	Mediterranean gull*
	Black-headed gull*
	Common gull
	Lesser black-backed gull*
	Sandwich tern*
	Roseate tern*
	Common tern
	Arctic tern
	Little tern*
50-75%	Herring gull
25-50%	Cormorant

* species for which England supports over 50% of the UK's breeding population

4.3 Predation

Predation (which includes competition and displacement by other species) was reported as currently impacting on breeding seabird populations at 56.1% of all sites. Again, this is particularly a problem at soft coast sites, where the percentage increases to 96.2% (see Table 5), and fox and badger the most widely reported predators.

Over 75% of the England's breeding population was estimated to be currently affected by predation for 12 species: Mediterranean gull, black-headed gull, common gull, lesser black-backed gull, herring gull, Sandwich tern, roseate tern, common tern, Arctic tern, little tern, black guillemot, and eider.

Table 8. Species currently most potentially affected by predation

Proportion of England's breeding population on sites affected by predation	Species
>75%	Mediterranean gull*
	Black-headed gull*
	Common gull
	Lesser black-backed gull*
	Herring gull
	Sandwich tern*
	Roseate tern*
	Common tern
	Arctic tern
	Little tern*
	Black guillemot
	Eider

* species for which England supports over 50% of the UK's breeding population

4.4. Invasive Species

Invasive species were reported as currently impacting on breeding seabird populations at only 6.5% all sites (see Table 4), but this is clearly one of the most important pressures when it comes to offshore islands, where 40% of sites are reported to be affected (see Table 5). This means it is particularly important for certain species, such as burrow nesting seabirds which are largely confined to this habitat type. For example, we estimate that 100% of England's breeding populations of storm petrels and Manx shearwaters are affected by this pressure, as they nest exclusively on offshore islands. Over 75% of the England's breeding population was also estimated to be currently affected for shag, roseate tern, and puffin (see Table 9). Between 50 and 75% of England's breeding population was estimated to be affected by invasive species for Arctic tern, razorbill and eider. These impacts occur largely through predation, so these results can be considered alongside the results for predation (section 4.3.).

Table 9. Species currently most potentially affected by invasive species

Proportion of England's breeding population on sites affected by invasive species	Species
>75%	Manx shearwater
	Storm petrel
	Shag
	Roseate tern*
	Puffin
50-75%	Arctic tern
	Razorbill
	Eider
25-50%	Common tern
	Guillemot

* species for which England supports over 50% of the UK's breeding population

4.5. Reduction in food

Reduction in food was reported to be affecting breeding populations at 12.2% of sites (increases to 26.7% and 35.5% when looking at offshore islands and mainland cliffs individually), almost entirely relating to kittiwake. It is estimated to be impacting on sites supporting over 75% of the breeding population of kittiwake.

Table 10. Species currently most potentially affected by reduction in food

Proportion of England's breeding population on sites affected by reduction in food	Species
>75%	Kittiwake

4.6. Sea level rise

Sea level rise was reported to be affecting breeding populations at 29 % of sites, with this percentage increasing to 64.2% for soft coast sites.

Sites supporting over 75% of England's breeding population of little tern, and between 50 and 75% of England's breeding population of Mediterranean gull, black-headed gull, and Sandwich tern were estimated to be currently affected by sea level rise. Unsurprisingly, these are all species that breed in soft coast habitats.

Table 11. Species currently most potentially affected by sea level rise

Proportion of England's breeding population on sites affected by sea level rise	Species
>75%	Little tern*
50-75%	Mediterranean gull*
	Black-headed gull*
	Sandwich tern*
25-50%	Arctic tern

* species for which England supports over 50% of the UK's breeding population

The impacts of sea level rise are predicted to increase, and while there is uncertainty surrounding these predictions, these results show that sea level rise is predicted to impact on far higher proportions of several species in future (see Table 12). The impacts and predicted impacts are discussed in more detail in sections 5.1.2.

Table 12. Species predicted to be most potentially affected by sea level rise

Proportion of England's breeding population on sites predicted to be affected by sea level rise in future	Species
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>75%	Shag
	Mediterranean gull*
	Black-headed gull*
	Sandwich tern*
	Little tern*
25-50%	Lesser black-backed gull
	Arctic tern

* species for which England supports over 50% of the UK's breeding population

4.7. Increased frequency and severity of storms

Increased frequency and severity of storms was reported to be currently affecting breeding populations at 3 % of sites and is estimated to be currently impacting sites supporting over 75% of the breeding population of shag.

Table 13. Species currently most potentially affected by increased frequency and severity of storms

Proportion of England's breeding population on sites affected by increased frequency and severity of storms	Species
>75%	Shag

4.8. Pathogens

Pathogens were reported to be currently affecting breeding populations at 0.8 % of sites. This was a pressure recorded almost exclusively in relation to breeding populations of lesser black-backed gull and herring gull, and almost exclusively in relation to botulism. Note that the assessments were carried out before the widespread and serious impacts of Avian Influenza were recorded in 2022.

4.9. Removal

Removal (i.e. legal or illegal take of adults or eggs) was reported to be currently affecting breeding populations at 11.4 % of sites. This pressure was recorded only for certain species. This includes licensed removal of eggs of black-headed gulls unlicensed removal of eggs of Mediterranean gull and illegal egg collection of little tern. Up to 25% of England's breeding populations of lesser black-backed gull, herring gull and cormorant were estimated to be on sites affected by removal. Note that some of this 'removal' was licensed removal of very small numbers of gulls in mixed species colonies. Furthermore, some of this information was collected prior to recent changes to General Licences, which may affect exposure to this this pressure for herring and lesser black-backed gull

5. Discussion

5.1. Pressures

5.1.1. Disturbance

Disturbance was the pressure most commonly reported as currently impacting on seabird breeding populations in England, with 76.4% of sites and 90.9% of priority sites affected. Soft coast sites are particularly affected, due to their accessibility and popularity as places for recreation, but all habitat types were affected to some extent.

A review of the Site Improvement Plans (SIPs) created as part of the IPENS (Improvement Programme for England's Natura 2000 Sites) in 2014 and 2015 showed that 100% of SIPs for English SPAs where breeding seabirds were qualifying features listed disturbance as an issue (Natural England, 2015a, Jones, unpublished).

The results of this review show that site managers clearly see disturbance as a growing issue. Overall, visitor numbers to coastal sites are predicted to increase, and there are concerns that climate change may also further exacerbate future levels of recreational disturbance at coastal sites (Natural England and RSPB 2020). Species that nest on sandy or shingle habitats (soft coasts) are particularly at risk from increasing pressures of recreational disturbance and development. Further reductions in the extent of available habitat for these species (see section 5.1.2) are likely to result in increased impacts of disturbance (Miles and Richardson 2018).

Seabird colonies need to be protected from disturbance through guidance, codes of practice and even bylaws which guide public access and activities on sea and land. Fencing and signage can be effective. For beach-nesting species this is one of the highest priority issues. Best practice approaches need to be developed, with guidance codes of practice and bylaws as required. Specific guidance is needed to address specific user groups e.g., beach goers, dog walkers, paddleboarders, kayakers, wind surfers. Ideally, the management of all of the key sites for breeding seabirds in England should be supported by wardens or rangers focused on local engagement and enabling community engagement with species conservation. Increased management of little tern colonies in the form of wardening, temporary fencing, and efforts to raise awareness has resulted in reduced recreational disturbance at colonies (Natural England and RSPB 2020; Babcock and Booth 2020).

Several 'coastal bird awareness' projects have been established in recent years funded through development mitigation funding secured for the purpose of reducing disturbance impacts on birds but to date these are having uncertain benefits to breeding seabirds. For example, the Solent Bird Aware project does not look to protect breeding birds even though breeding little tern, Sandwich tern and common tern are all features of the Solent SPA over which the scheme operates, and more widely to date there is little monitoring of, and therefore demonstration of the benefit being provided by, these schemes. However, there is clearly the potential for new schemes to be funded by development mitigation or net gain and be tied to clearer bird outcomes.

Beach wardening even when following best practice advice on engagement, fencing and signage, will only be effective if supported by policies and laws that discourage activities impacting on coastal wildlife. There is a need for a strategic approach to the management of activities on the coast which includes zonation of activities and tighter regulation and enforcement.

The impact of the England Coast Path (ECP) is also uncertain. Although the approach in establishment has been to site the trail away from existing nesting areas and use restrictions to exclude access to the margins where there is nesting, supported by infrastructure e.g., fencing, the efficacy of this approach in securing areas to allow (re)colonisation is untested. The ECP and access partnerships that are being set up offer an opportunity to manage disturbance, adding further mitigation where necessary. Part of the ECP project is evaluating the success of measures in keeping people out of sensitive areas, which will then feedback to improve existing stretches. However, it needs to be recognised that in a dynamic coastal environment, managing access may need to occur before the birds establish, to allow them to track habitat availability, rather than be reactionary as the presence of disturbance can be a bar on adoption of suitable habitat.

This is a big area of future investment – ultimately seabirds and particularly beach-nesting birds will need to share the coast with local communities, and therefore engagement, education, and beach wardening empowerment of local communities is critical to their future. This needs development and management at the strategic level for example through AONB partnerships and Local Nature Recovery Strategies, and at site specific level by engaging and empowering key local communities in species support. Since 2013, the Flamborough Head European Marine Site (EMS) Management Scheme has been monitoring the frequency and impacts of recreational activities around the site. Volunteers record disturbance events around the Flamborough to Filey stretch of coastline, this data is then used to inform and support management of the Flamborough Head EMS. Over the years this research has helped to identify a number of activities that have the potential to disturb the natural behaviour of the breeding seabird colony. Thanks to the data collected, the Management Scheme has been able to work with various user groups to establish a number of voluntary codes of conduct. This model could be replicated elsewhere. Elsewhere the Wash and North Norfolk Coastal Partnership are developing ideas for strategic zonation of sections of the coastline – and hopefully this will be supported by stakeholders and developed further over the coming years.

5.1.2. Reduction in habitat and sea level rise

'Reduction in habitat' was the second most widely reported pressure impacting on seabird breeding populations in England, found to be currently affecting 52% of sites, and 98% of soft coast sites.

Since World War II, England has lost 15% of saltmarsh (around 5904 ha), 18% of sand dunes (2668 ha) and 50% of shingle habitat (5,023ha). (Miles and Richardson 2018). These losses have been due largely to build development and land claim, but in the future the main threat to coastal habitats is from climate change and sea level rise. Without action, we anticipate losing a further 5000ha of protected intertidal habitat by 2060, and a much greater area of habitat will no longer be able to function as safe nesting and roosting habitat because of high tides and flooding at critical times (Miles and Richardson 2018). Within the next 30 years, areas supporting 100,000 breeding seabirds could be lost.

Furthermore, the quality of existing coastal habitat is poor. In England, 57% of SAC-designated saltmarsh, 76% of coastal vegetated shingle, and 66% of sand dunes were assessed as being of unfavourable condition in 2013 and many SSSIs have also been assessed as being in unfavourable condition as a result of coastal squeeze or inappropriate coastal management (Miles and Richardson 2018). A review of the Site Improvement Plans (SIPs) created as part of the IPENS (Improvement Programme for England's Natura 2000 Sites) in 2014 and 2015 showed that 97% of SIPs for English SPAs where breeding seabirds

were qualifying features listed reduction in the extent or quality of habitat as an issue (Natural England; 2015a; Jones, *unpublished*). The IPENS Coastal Management Theme Plan (Natural England; 2015b) concluded that the overall status of England's intertidal habitats 'bad-deteriorating'.

Sea level rise due to climate change has already led to the loss of intertidal habitat in England – mean sea level around the UK has risen by approximately 17 cm since the start of the 20th century (Lawton *et al*; 2010; Fung *et al* 2018; Met Office 2021). Climate predictions show that sea levels around the UK will continue to rise, under all emissions scenarios, until at least the year 2100. Increases in sea level rise are difficult to predict, due to the possibility of differing emissions scenarios, differing rates of erosion, differing polar melt predictions and differences between locations. Loss of coastal habitat due to sea level rise is likely to be greatest in southern and eastern England (MCCIP 2020). Rising sea levels mean that more intertidal habitat will be lost, and the risk of intermittent flooding of nest sites is also increased (Natural England 2015c; Pearce-Higgins 2021).

Species that nest on sand and shingle habitats, such as terns and gulls, are particularly at risk, as large areas of these types of habitats can be lost rapidly with only minor increases in sea level (Johnston *et al* 2021). Many current nesting sites for terns are likely to become unsuitable, and important low-lying islands and beaches are particularly vulnerable to being lost within the next 10 years. Predictions of future shorelines using geographic information systems and predicted sea level rise scenarios are needed to identify which low-lying seabird colonies are at the highest risk and should be prioritised for habitat protection and creation work. Many of these species are already under stress from the impacts of disturbance and predation. Further loss of habitat may force these species to nest in less suitable areas where they may be at higher risk of disturbance or flooding (Miles and Richardson 2018).

Little terns are particularly at risk because they tend to nest just above the high-water mark. For example, of the 24 coastal and estuarine SPAs in England where little tern is a qualifying feature, Natural England have identified coastal habitat loss as being an issue at 22 (92%) of them (Miles and Richardson 2018). Furthermore, 13 of the 24 have been ranked as amongst the SPAs most vulnerable to climate change effects. These most vulnerable SPAs include the North Norfolk Coast, Chichester and Langstone Harbours, The Solent, and the Essex Estuaries which, combined, support over 50 % of the UK's breeding population of little tern (Miles and Richardson 2018).

Climate envelope modelling suggests that Britain's climate will become increasingly suitable for more southerly-distributed seabirds such as little, roseate and Sandwich terns. However, the status of terns as a group, and little terns in particular, are likely to be more affected by climate change through the effects of sea level rise, increased storminess, increased coastal erosion and the flooding of breeding colonies (Ausden *et al* 2015a).

In summary, large areas of habitat have been lost, much of what remains is in poor condition and there are further predicted losses of area and quality of coastal habitat. This is already impacting on breeding seabirds, but it is expected that this impact will grow significantly.

In recognition of the need to identify how coastal habitats must be strategically managed in order to secure favourable condition, Natural England published a Coastal Theme Plan to address the key issues affecting the Natura 2000 network, part of the improvement Programme for England's Natura 2000 sites (IPENS) (Natural England 2015b). The theme plan identifies 58 Natura 2000 sites that are affected by coastal squeeze and 34 sites affected by or at risk from inappropriate coastal management. These sites are identified in the regional tables.

Habitat restoration and habitat creation are the key recommendations for dealing with these pressures. Lawton *et al* (2010) highlighted the need to improve the quality of existing wildlife sites, increase the size of sites, and increase the number of sites. Habitat restoration can be very effective in the short term, but it will be increasingly important to look for opportunities to create new habitat for breeding seabirds, particularly those that nest on soft coasts, as sea level rise make these habitats less available. Coastal realignment schemes allow the shoreline to shift naturally, creating new intertidal habitats. New habitats can be created at higher levels or further inland, for example through the use of dredged materials to create islands or banks (Ausden *et al* 2018; Babcock and Booth 2020; Mitchell *et al* 2020). Planning, designing, and creating new habitats can take several years, so the sooner these projects are set in motion, the better (Babcock and Booth 2020). It should be noted though that where land has been historically reclaimed from saltmarsh the combined impacts of cessation of sediment supply, loss of soils to agriculture, and rising sea levels mean that where realignment occurs the resultant habitat may be at a lower effective tidal level than when it was reclaimed. While this may satisfy habitat recreation targets, creation of suitable conditions for breeding seabirds and waders may entail additional activity such as land raising or will rely on post-realignment sediment deposition which takes time. The RSPB's Sustainable Shores Project (Miles and Richardson 2018) identified a considerable area of land that is potentially suitable for intertidal habitat creation around England's coasts – the majority of these areas are in East Anglia and the southeast of the country. The National Habitat Compensation Programme (NHCP) in England, led by the Environment Agency, is vital in this regard.

While immediate threats to tern colonies need to be addressed through targeted management of current colonies to ensure available nesting habitat and protection from human impacts and predation, to improve productivity of the most important current colonies. Opportunities to create new safe nesting areas for colonies to replace those likely to be lost through climate change or other adverse impacts need to be explored if longer term interventions are to be secured when they are needed.

5.1.3. Predation and Invasive Species

This review found that predation (which includes competition and displacement by other species) was reported as currently impacting on breeding seabird populations at 56% of all sites and 96.2% of soft coast sites. Populations of native predators such as foxes (*Vulpes vulpes*) and badgers (*Meles meles*) have increased in England during the past two decades and some native predator populations have also recovered from previously low levels (e.g., otters (*Lutra lutra*), marsh harriers (*Circus aeruginosus*)). In the UK overall population densities for many generalist predators are now amongst the highest in Europe and are recognised as being a particular pressure for ground-nesting seabirds (Roos *et al* 2018)

Breeding seabirds often nest in dense colonies, and reductions in available habitat have resulted in more concentrated and less mobile colonies. This results in seabird colonies being very attractive 'honey pot' sites for predators.

In addition to predation from native predators, seabird species are also vulnerable to predation from invasive mammalian predators, particularly (although not exclusively) on offshore islands. Dias (2019) identified invasive species as one of the top three threats to the world's seabirds. European hedgehogs (*Erinaceus europaeus*), for example, are not native to any of England's offshore islands, whilst brown rat (*Rattus norvegicus*), domestic cat (*Felis catus*) and American mink (*Neogale vison*) are not native to the United Kingdom and can cause devastation at seabird colonies whether on the mainland or on offshore islands. The key

species in England are brown rat, feral cat and American mink. Brown rat arrived much later around 1728 via shipping from present day Russia. The American mink was introduced into the UK in 1929 and following release or escape from fur farms spread rapidly around the UK except the more remote islands, profoundly damaging ground-nesting birds, and small mammal populations such as water voles. Although absent from our key islands they always present a threat to these sites, but of much more concern is the impact of American mink on mainland seabird (and breeding wader) colonies.

On the Isles of Scilly, the most widespread and impactful species is the brown rat which occurs throughout the archipelago, and which is particularly associated with predation of burrow nesting species (except for the islands of St Agnes and Gugh since eradication in 2014). Feral cats and hedgehogs are also present on inhabited islands – and although the impact of hedgehogs on seabirds is currently uncertain, feral cats are thought to be predated Storm petrels on St Agnes and Gugh and may be impacting on other islands.

The importance of predator management at seabird colonies has grown in the past two decades and is now one of the most critical, widely used and probably best developed management activities. Predators can be lethally controlled or excluded from seabird nesting areas using predator-proof fencing. As a protected species, badger cannot be removed for conservation reasons even though there is legal provision to do so for development or livestock health reasons. Usually, the most effective management uses a combination of lethal control and predator-proof fencing (Babcock and Booth 2020). The use of predator proof fences has been critical to protect colonies from mammals and has been supported by various methods such as diversionary feeding and use of aero lasers to deter avian predators. The development of smart live capture cage traps which alert the trapper to captured animals is improving the efficiency and the scale of mink trapping and can be developed to create and maintain mink-free wetland landscapes, as is being carried out in East Anglia by Waterlife Recovery East where effective trapping is being carried out across an area the size of Wales (Tony Martin pers comm).

For any effective predator management strategy to work, it is essential to gather the evidence confirming which species, and often individuals, are involved, so that the most effective methods are deployed. This can be done through careful observation but also the use of trail cameras. When creating and designing new habitats, the ease with which new areas can be kept predator-free (e.g., islands in lagoons) should be considered important. Most soft coast sites require ongoing predator management.

The need to manage invasive species on offshore islands applies to relatively few sites in England, but these sites do hold some of England's largest seabird aggregations (e.g., Lundy and the Farne Islands) or have the potential to be restored to key sites (the Isles of Scilly).

The eradication of all invasive predators from offshore islands where seabirds nest should be a priority. In addition, seabird islands need to have measure in place to protect them from invasion (or reinvasion) through biosecurity provision. Removal of brown rats from as much of the Scillies archipelago as possible and then to maintain them as rat free through robust biosecurity measures could be a transformative intervention for England's seabirds.

5.1.4. Reduction in food

This proved to be a difficult pressure to assess as issues tend to be apparent only during the chick rearing phase of the breeding cycle at closely monitored sites. In general, this was not

reported as a widespread issue at seabird colonies. The exception was in connection with kittiwakes where most contacts from sites with kittiwakes assumed that lack of food was the principle driver for declining numbers or poor productivity rather than other pressures affecting terrestrial site condition. However, as this issue is an 'at sea' issue rather than an aspect of breeding site condition, it is not really within the scope of this study to fully assess and discuss it. We have recorded reduction in food as a key factor for most kittiwake sites, but we are aware that this pressure has not been assessed consistently for all species and sites.

On the basis of the reports, reduction in food is impacting on sites supporting over 75% of the England population of kittiwake.

Food availability is a critical aspect of seabird breeding ecology. For kittiwakes, lack of food is thought to be driving widespread declines, with reductions in sandeels linked to decreased breeding success (Frederiksen *et al* 2007). Reductions in availability and quality of prey have also been linked to decreased breeding success in many other seabird species, including puffin, razorbill, guillemot, and shag (Wanless *et al* 2005; Wanless *et al* 2018; Pearce-Higgins 2021). For herring and lesser black-backed gulls, which have both experienced major declines, the reasons for these declines are largely unknown, however, for some sites such as the South Walney colony, maximum populations were considered to be dependent on the super abundance of food supplied by nearby landfill sites and the closure of these sites has been implicated in the decline of some colonies as predicted by Sibley and McCleery (1983a, b). On islands such as Lundy, with recovering seabird populations after the removal of rats, lesser black-backed gull and herring gull have not recovered which again implies that something other than terrestrial site condition is limiting their population. Fewer fishery discards may also be affecting fulmar with a reduction in food explaining some declines. It is possible that food availability is currently a factor affecting more sites and more of England's breeding seabirds than were identified by this study, but that it is not quantifiable at the site without more targeted research.

For most species though (apart from those listed above) food availability is not thought to be currently the most limiting factor on populations, but it may be important at a local level, where it may undermine the effectiveness of terrestrial-based management measures such as habitat creation and predator control. For example, this has been raised as an issue for Dungeness SPA and for some species on the Isles of Scilly SPA.

The lesser sandeel (*Ammodytes marinus*) plays a pivotal role in the North Sea food web, serving as a vital link between primary productivity (plankton) and top predators such as seabirds (Wanless *et al* 2018). Many seabird species rely heavily on sandeels during the breeding season, including kittiwakes, terns, guillemot, razorbill, and puffin (Wanless *et al* 2018). Sandeels are also the focus of the largest single-species commercial fishery in the North Sea (Dunn 2021). Reducing sandeel mortality caused by commercial fisheries has been shown to allow sandeel populations to recover in following years and have positive impacts on breeding seabird populations (Daunt *et al* 2008).

The current Danish-led North Sea sandeel fishery is currently the only active fishery for sandeel in UK waters and forms the largest single-species fishery in the North Sea. It is currently largely limited to the Dogger Bank, a massive sandbank in the central southern North Sea straddling the Exclusive Economic Zones (EEZs) of the UK, the Netherlands and Germany, although the fishery extends to waters off eastern Scotland (Dunn 2021). The announcement by Defra that bylaws are being established effective from June 2022 to regulate bottom trawling on the Dogger Bank may lead to improved regulation and management of this resource (Defra 2022).

Climate change is also affecting fish species and therefore the availability of food to seabirds, and these impacts may increase in the future. The effects of climate warming on food supply is the principal mechanism by which climate change is thought to be affecting seabird populations (Pearce-Higgins 2021). Increasing sea temperatures disrupt marine food webs and affect the size, abundance, species availability and quality of fish prey for breeding seabirds (Mitchell *et al* 2020; IPCC 2022). Future impacts are difficult to predict, but there is a very real possibility that climate change could lead to serious food shortages in future. Recent mass mortality of seabirds in the North Sea has been linked to a shortage of food, although the reasons for this are not fully understood (Fullick *et al* 2022, SeaPop 2022).

Whilst the designation of a series of offshore SPAs is welcomed (e.g., The Outer Thames Estuary, The Outer Wash, The Solent and Dorset Coast) observers commented that little effort is going into monitoring prey fish in these areas or monitoring or managing activities that may impact on them.

Further studies of seabird diet and chick provisioning during the breeding season are vital to inform future action.

More effort should also be made to better understand the fisheries-prey interactions for sandeels and other forage fish species like European sprat (*Sprattus sprattus*), European anchovy (*Engraulis encrasicolus*) and Atlantic herring (*Clupea harengus*) and dependencies for seabirds in English waters other than the North Sea. Monitoring of marine food webs and particularly of forage fisheries is important.

Fisheries, particularly sandeel fisheries, need to be managed in a sustainable way. Although catch limits for commercial fisheries are set annually in accordance with independent advice provided by the International Council for the Exploration of the Sea (ICES), the needs of seabirds, cetaceans and other marine wildlife are not adequately catered for in setting levels of commercial exploitation of sandeels. There is therefore insufficient sandeel 'set-aside' for the wider ecosystem (Dunn 2021). There is a need to improve the management of fisheries to account for the needs of seabirds through the appropriate jurisdictions (UK government and UK devolved governments) and international agreements (post-Brexit mechanisms). The sustainable management of fisheries is particularly important in light of the potential future impacts of climate change (Dunn 2021).

5.1.5. Increased frequency and severity of storms

Extreme weather is another consequence of climate change that can impact on breeding seabirds, particularly increased frequency and severity of storm events. High winds and heavy rainfall during the breeding season can destroy nests, chill eggs, kill nestlings, and reduce the foraging efficiency of adult birds, and has led to widespread breeding failure in some cases (Mitchell *et al* 2020, Johnston *et al*, 2021). Extreme weather can also lead to storm swells that flood nesting sites on soft coasts, and even wash away nests on cliffs, whilst high levels of rainfall can flood burrows for species such as puffin and Manx shearwater (Johnston *et al* 2021). High temperatures can also lead to eggs and nestlings overheating (Pearce-Higgins 2021). Winter storms can affect the over-winter survival of breeding adults. Increased winter rainfall may also lead to increased cliff erosion, reducing the availability of nest sites (Morecroft and Speakma, 2015).

As with most pressures linked to climate change, these issues are predicted to increase (Lawton *et al* 2010; Morecroft and Speakma, 2015 Pearce-Higgins 2021).

The key recommendation is to build resilience through habitat restoration and creation and reducing other pressures on breeding seabirds wherever possible.

5.1.6. Pathogens

Mass mortality of large gulls during the breeding season has been linked to botulism poisoning of adult birds feeding on refuse tips. This is believed to have impacted herring, great black-backed and lesser black-backed gulls in SW England and S Wales from the 1970s into the early 1990s. Black plastic bags which were introduced as a method of waste disposal in 1972 were ideal for the proliferation of the poisonous bacterium (Rock, 2005). Traditional gull colonies such as Steep Holm in the Bristol Channel were badly affected by botulism with numbers plummeting from 8000 pairs in the early 1970s to just 800 pairs in 1990s. In contrast urban colonies appeared less affected by botulism and continued to grow through this period. For example, in Bristol the population grew from 100 pairs to 1000 pairs in the early 1990s and although some botulitic gulls were recorded in Bristol at this time, numbers were low compared with the traditional natural colonies. Since the 1990s with botulism stabilised at low levels, numbers of herring and lesser black backed gulls have recovered with over 1000 pairs on Steep Holm and 3500 pairs on Flatholm – but are unlikely to recover to pre-botulism levels because of changes to refuse and discard management. More generally, outbreaks of botulism could reoccur (although perhaps less likely given changes to landfill management), with uncertain impact on gull populations in the future.

There is growing concern that disease and parasitism may pose threats to seabird populations, with concentrations of breeding birds at colonies particularly vulnerable (Mitchell *et al* 2020; Hakkinen *et al* 2022). Climate change may exacerbate these threats (Hakkinen *et al* 2022).

Avian Influenza outbreaks in wild birds have increased in incidence and severity in recent years and this has been linked to climate change, with future further increases predicted (Mu *et al* 2014, Verhagen *et al* 2021, Banyard *et al* 2022). Formerly considered a seasonal virus primarily affecting non-breeding aggregations, the virus has increasingly been linked to summer mortality events in recent years and the concentration of large numbers of birds into a limited number of high-density colonies means that breeding seabirds offer the virus a high-transmission environment. Avian influenza has been confirmed in a growing number of seabird species in recent years and has been confirmed as cause of death in seabirds breeding in the UK in the summers of 2021 and 2022 (Banyard *et al* 2022, Gov.uk 2022), and currently is causing mass mortality at major seabird colonies (June 2022). Understanding the extent and impacts of this and other disease outbreaks within our seabird populations will require more monitoring and surveillance than is currently carried out (Miller 2022, Walton 2022). The rapidly evolving situation with AI will require urgent review and the development and implementation of an action plan for colony management next year which seeks to minimise the impacts of AI.

Other pathogens have been linked to breeding season mortality in recent years including botulism and Bisgaard in terns (Duff *et al* 2021) and viral duck enteritis in eider in the Irish Sea in 1992 (C. Raven pers comm).

The key recommendation though is to build resilience in the population through habitat restoration and creation, creating more safe nesting sites and where possible allowing for reduced density in breeding colonies to lower transmission risk.

5.1.7. Removal

Historically 'removal' of seabirds through the harvesting of adults and eggs suppressed seabird numbers until the early 20th century when seabirds and seabird colonies were protected. However, for species like gulls and cormorants, licenced and unlicensed nest destruction, take of eggs, and killing of adults has continued, and for gulls this has included large scale culling. The growth in the number of herring and lesser black-backed gulls in the Forest of Bowland colony during the 1950s and 1960s to 24740 pairs in 1978 led to a programme of controlling adults which reduced the colony to 9480 pairs in 1982 ostensibly to prevent contamination of domestic water supply (Brown and Grice 2005). On the Farne islands 16000 nests with a mixed gull colony were destroyed between 1985 and 1990 reducing the population from 5287 pairs in 1974 to just 913 pairs in 1981. Many large gulls have been killed under General License in urban areas, on airfields and at industrial sites where the gulls are considered a threat to health and safety.

Large gulls are a very important part of our seabird heritage, and England has supported spectacular and internationally important colonies of large gulls until recently. During Seabird 2000 England held 36% of the global population of the *graellsii* race of lesser black-backed gull (62,000 pairs). However, since then most colonies on natural coastal sites are in decline with huge losses at sites such as Orfordness and Walney Island. Recent survey and analysis (Burnell 2021) show that there has been a 38 % and 45 % decline in herring and lesser black-backed gulls respectively on natural sites since 2000, and the majority of the population of both species have shifted to urban sites. The current population estimates of natural nesting herring and lesser black-backed gulls are 17,573 and 34,320 AONs respectively which demonstrate how much these colonies have declined and, other than in Bowland, the colonies of 10,000s are now a thing of the past.

In some sites where large gulls co-exist with smaller gulls and terns, they compete for nesting space and/or predate eggs/chicks there is a need to manage the balance between these populations. The recovery of roseate tern on Coquet Island for example has been helped by the management of small number of large gulls, and other multi species seabird colonies benefit from a similar approach. Gull management can involve lethal and non-lethal methods, but for lethal methods a license is required from NE with evidence of the need along with reasons why non-lethal methods cannot be used. Whilst a strict evidence-based approach is welcomed, there is concern that the licensing of evidence based and targeted gull management at sites with other smaller vulnerable species has become more difficult, and this is to the disadvantage of other priority species. Also, there is concern that little is being done to manage for and restore some of the large herring gull and lesser black-backed gull colonies on natural sites. Given all these issues there is a need for a considered approach to large gull management through licensing. While the recent removal of these species from General Licences is welcomed (Gov.uk 2020), there is a need to carefully monitor all continued licences issued for these species, and the impacts this may have on populations. Linkage of licenced take in areas where large gulls are a threat with work to enhance populations on sites where they are desired would enable a sustainable approach to population management to be developed that would serve conservation needs. Where take can be limited to nest and eggs this can be expected to facilitate redistribution as birds will be more likely to seek out secure nesting areas in future seasons facilitating adoption of safe nesting areas and limit the long-term impact of take on the population as a whole.

As cormorants feed exclusively on fish this has led to conflicts with angling and fisheries. They can be killed under license where serious damage to fisheries can be demonstrated and the demand for control continues to grow. As with large gulls, no doubt many cormorants are killed illegally and is suspected in the proximity of various inland colonies. Sadly, illegal egg

collection remains an issue for rarer species such as little tern and roseate tern. For little terns, incidents of egg collection are still an annual issue at certain targeted colonies. The only remaining breeding site for roseate terns in the UK, Coquet Island, was raided by egg collectors 12 years ago. Since then, strict protection measures have been in place.

A key recommendation is increased vigilance over poorly justified or illegal control of large gulls and cormorants, particularly at certain sites. Efforts need to be made to protect colonies of gulls to increase productivity and numbers at natural sites, and large-scale culls must be a thing of the past. However, we recognise the need to manage the gull in some mixed colonies, as well as at some non-natural sites.

We therefore propose a refreshed approach to large gull management which 1) identifies the important large colonies for restoration and 2) mixed colony sites where gull numbers warrant management and where licensed control of a small number of individuals may be appropriate to maximise conservation outcomes for all species in the assemblage.

Black-headed gulls are subject to licenced commercial harvest at a small number of sites, though unlicenced take of both this species and Mediterranean Gull is also believed to occur. Licenced take of black-headed gull eggs is managed to ensure sustainability of resource; however, this has been difficult to ensure in recent years due to increasing sea levels and loss of habitat reducing productivity, and it is likely that if this practise is to continue in the future, then a strategy to ensure ongoing sustainability of harvest will need to be enacted.

Protection from illegal egg collectors requires high levels of surveillance. Roseate tern eggs on Coquet Island are protected by 24-hour staffing (the island is never left unattended), a high-quality CCTV system dedicated to species protection, and by having Police Operational Orders in place to fast-track responses from the police. For little terns, 24-hour protection and surveillance are required at those colonies where egg collection remains an issue.

5.2. Habitat types

5.2.1. Offshore islands

The 10,000+ islands of the UK represent 5% of the land area but they support 80% of our seabirds, including the entire populations of species such as Manx shearwater and storm petrel along with significant populations of other species (Thomas *et al* 2017). England has relatively few of these islands, but those few offshore islands are amongst the most important sites for seabirds in England, the UK and NW Europe – The Farne Islands archipelago and Coquet Island in Northumberland, and the Isles of Scilly archipelago and Lundy Island in South West England. Together these islands hold all of England's Manx shearwater, storm petrel, roseate tern and most of England's shag, arctic tern, and puffin. The key threat to breeding seabirds on offshore islands is from invasive mammalian predators – which have impacted on seabird populations around the world through predation of seabird eggs, chicks and breeding adults. The most prominent invasive species in England are brown rat, and feral cats.

Within England, a strategic approach to island restoration is required which combines the eradication of invasive predators and a vigilant approach to biosecurity to keep predator free islands free from predators over the longer term. Two of the most successful UK rat eradication projects have taken place in England – the eradication of brown and black rats from Lundy in 2002 and brown rat from St Agnes and Gugh Isles of Scilly in 2013. Both projects have resulted in (re) colonisation by storm petrels and rapid increases in the numbers of Manx shearwater – most notably on Lundy where there are now 5500 Apparently Occupied Nests (AONs)

compared with less than 300 AONs prior to the eradication (Booker and Price 2010; Brown et al 2011, Booker *et al* 2019). The Farne Islands and Coquet Island have remained free from invasive species (by luck rather than design) although the recent occurrence a rat on Coquet in 2019, highlights the ongoing threat of invasion and the need for heightened awareness and rapid response. A coordinated response to island biosecurity is currently being developed through the UK wide 'Biosecurity for LIFE' project which aims to establish a government-funded UK Seabird Island Biosecurity Programme. This programme would ensure that the effective preventative, early detection and rapid incursion response capabilities are developed across the UK's 42 seabird island SPAs. Within England, this project covers the Farne Islands, Coquet and Isles of Scilly SPAs and has recently been extended to cover Steephelm (within the Severn Estuary SPA but not designated for its seabirds) and Lundy (not SPA). It will be critical that this capability is maintained beyond the externally funded project life.

The outstanding action for England's seabirds on islands is to build on the success of the St Agnes and Gugh eradication, and remove invasive brown rats from Bryher, Tresco, St Martins and the associated islands on the Isles of Scilly. This would be of huge benefit to the whole assemblage of seabirds (including some of the most range restricted seabirds in England in Manx shearwater, storm petrel and roseate tern) and other species providing multiple safe nesting opportunities on a range of different islands. A feasibility assessment for the eradication of brown rats was produced in 2011 (Bell 2011) and updated by RSPB in 2017 (Varnham and St Pierre 2017) concluding that eradication was feasible but keeping the islands rat free would require robust biosecurity to prevent reinvasion. This would restore the whole archipelago with the exception of large, heavily populated St Marys, and which could start prolonged recovery of species like Manx shearwater and storm petrel to 'historic' levels and restore the English range of roseate tern. Over the longer term the restoration of St Marys should be considered and may become more feasible as new eradication methods are developed. Enhanced seabird populations are known to improve ecosystem function in adjacent waters and rats are known to impact on a broad suite of species as a result recovery of seabird islands would have wider benefits than for seabird conservation alone.

5.2.2. Mainland cliffs

Mainland cliffs provide important sites for seabird colonies particularly in the North East and the South West with scattered colonies elsewhere in England such as St Bees Head in Cumbria. Most notable is the Flamborough and Filey coast SPA which holds approximately 300,000 individual breeding seabirds (Lloyd *et al* 2020), including England's only gannet colony and the largest kittiwake colony.

There is outstanding information needed on pressures for this habitat and therefore the percentages in Table 4 and 5 may actually be higher. For this report, effort was concentrated on receiving this information at the priority areas including Bempton Cliffs at Flamborough Head and St Bees Head.

It is very clear that increased pressure on the coast is impacting seabirds on mainland cliffs. Water based recreation has caused disturbance issues at Flamborough, and there is a voluntary ban on recreational inshore fisheries at St Bees in response to disturbance and bycatch problems. On Portland, climbers have been an issue in the past and the increase in activities such as coasteering is thought to be impacting on some cliff nesting sites and at sites like St Bees Head climbing restrictions are in place to address issues.

In addition, erosion of cliffs may become a greater issue in the future due to climate change, particularly for softer cliffs in the south and southeast of England (Natural England 2020).

Since the cessation of seabird harvesting there is less need for active management of cliff nesting colonies as they are largely self-maintaining. However, monitoring of disturbance from land and sea at the most important colonies is recommended so that site-based actions can be developed to address issues. This is best developed at Flamborough and Filey SPA, where since 2013 the European Marine Site (EMS) Management Scheme has been monitoring the frequency and impact of recreational activities around the site to inform the management of the EMS. The management scheme works with user groups to reduce impacts e.g., agreeing closure of cliff top angling during the breeding season at Bempton RSPB reserve, establishing a personal code of conduct for personal watercraft such as jet skis) and initiating Operation Seabird – a campaign to address wildlife disturbance at a strategic scale. Further work on stakeholder and community engagement of this kind, together with potentially seasonal restrictions on climbing and coastering activities, may help to deal with disturbance issues (see <https://yorkshiremarinepartnership.org.uk>).

Where erosion or potential erosion is a problem (particularly for softer cliffs), care should be taken to manage the cliff tops and cliff slopes to minimise the impacts of erosion. No drainage should be installed on cliff slopes or cliff tops. Natural or semi-natural habitats on cliff tops and slopes are more likely to resist erosion. Where intensive agriculture is taking place on cliff tops, a buffer area reverted to semi-natural habitat can provide greater resilience and resistance to erosion.

Food supply and its impact on productivity are probably more significant drivers of population change than the management of cliff nesting sites. In the case of the major cliff nesting colonies in the North East, there is the clear connection with the availability of sand eels and the management of the Dogger Bank and other nearby fishing grounds. The spatial relationship between productive foraging areas and nesting colonies is a critical determinant of productivity. Work on auks and kittiwakes both demonstrate the critical relationships between food supply and productivity in the breeding period (mid-April to early August). In this period the birds are central point foragers making commuting flights between nesting sites and foraging areas which are both time consuming and energy depleting with implications for both adult energy balance and chick productivity. More work diet studies enabling the linking of good quality foraging grounds with potential and existing nesting areas and assessing the health of relevant fish stocks within proximity of nesting areas would help inform potential recovery at key colonies for cliff-nesting species.

Cliff-nesting species can occasionally benefit from provision of artificial nest sites, as has been the case with kittiwakes and the Gateshead kittiwake Tower. Further provision of artificial nest sites onshore and offshore at suitable locations close to good food supplies may benefit kittiwakes and potentially other cliff-nesting species in future (see section 5.2.5. Man-made habitats).

5.2.3. Soft coasts

The majority of the key sites (14 of these 22 sites: 64%) are soft coast sites.

Soft coast sites require a combination of short-term measures to support existing colonies through the management of disturbance, predation and habitat loss; and longer-term measures to create new safe opportunities for seabirds in the face of predicted coastal habitat change. Soft coasts are naturally dynamic and plans will need to allow for that.

The species for which England holds more than 50% of the UK population and has a particular responsibility for (little tern, Sandwich tern, roseate tern, Mediterranean gull, black-headed gull, lesser black-backed gull) are all associated with soft coast sites. Even roseate tern, which is currently confined to Coquet an offshore island, would require positive management of common tern colonies on the soft coast to enable recolonization of its former range which included a number of soft coast sites. This again emphasises the importance of soft coast management for seabirds in England.

Most of England's seabird colonies are associated with soft coast habitats in contrast to the pattern elsewhere in the UK where offshore islands and cliff sites predominate. Here seabirds are using a variety of shingle, sand dune, salt marsh and nearshore island habitats – where seabirds face complex and connected problems. The key long-term issues are sea level rise and coastal habitat change which present a major existential threat to many of the most important colonies. However, in the short term, most colonies are under the immediate and related threats of reduced areas of available habitat due to coastal erosion; increased breeding season flooding and storm effects linked to climate change impacts; exacerbated by the impact of human disturbance (both impacting existing colonies and preventing colonisation of accreting habitats); and predation by various birds and mammals. As a result, the existing colonies require immediate and ongoing management to minimise the impacts of disturbance and predation, whilst planning for the long-term security of seabird colonies through the creation of new sites to replace those likely to be modified or lost through coastal change. These issues are also impacting on other coastal breeding species such as ringed plover (*Charadrius hiaticula*), oystercatcher (*Haematopus ostralegus*), and redshank (*Tringa totanus*) (and no doubt contribute to the ongoing absence of Kentish plover (*Charadrius alexandrinus*) since its extinction as a UK breeding species) and on the availability of safe high tide roosts for non-breeding wildfowl and waders.

Not only is there less habitat overall, but that which remains is increasingly susceptible to summer flooding making it increasingly unsuitable for breeding. This assessment shows that many seabird colonies have already been significantly impacted by coastal habitat change. Since 2000, a major issue for soft coast seabird colonies is flooding during the breeding season. In 2017, for example, we estimated that 25% of the UK little tern nests were flooded out over one weekend of high spring tides. There are regular reports of even large seabird colonies regularly flooded out leading to zero productivity and colony abandonment e.g., losses of black-headed gull colonies in Poole Harbour, the Solent and in Essex.

Meanwhile the fewer remaining places above these highest tides come under increasing pressure from disturbance and predation effects. Although some new area of apparently suitable nesting habitat may be created through natural processes, these areas may still be heavily impacted by disturbance e.g., Gore Point at the western end of the North Norfolk SPA which is readily accessible from Hunstanton. In the case of Scroby Sands, an emerging sand bar off Great Yarmouth, the cycle of erosion and deposition occasionally creates potentially suitable nesting habitat for terns, but most often is still inundated at the highest tides, and regularly suffers from disturbance because of access via boats. Also, with more mixed species colonies being squeezed into limited space, the effects of interspecific competition and predation and impacts of unregulated tourism and recreation become more pronounced. These impacts are most pronounced on the smaller species e.g., gulls competitively excluding terns from potential breeding habitat and preying on tern eggs and chicks.

The smallest species little tern is particularly disadvantaged - as a pioneer species preferring to breed away from mixed colonies where human disturbance can be managed. Most little tern sites require active site protection throughout the breeding season to give them a chance

of co-existing with humans on our beaches. This can be highly intensive requiring 24-hour protection, fences, nest cages, diversionary feeding, aero lasers and even moving eggs over the highest tides, but the ideal is to create places where little terns can thrive without such high levels of effort. Although projects looking to protect little terns have been operating since the 1970s, the UK population has declined and a five-year Little Tern Recovery Project was launched in the UK in 2014, through the EU LIFE+ funding stream, designed to lay the foundations for a more coordinated, comprehensive, and strategic approach to UK little tern conservation. Overall, an estimated additional 1,785 chicks fledged as a result of the LIFE+ Little Tern Recovery Project, with a significant increase in productivity for smaller colonies. Those that survive their first few years are expected to recruit back into the UK and Irish population, benefitting from the legacy of protection, habitat restoration and creation measures established as part of the project. However, a simple population model indicates that even if the elevated breeding success levels achieved by the project were maintained, the projected population decline between 2020–2050 would only be slowed by 30 %, so more needs to be done to achieve population stabilisation. The project's beneficial impact has bought valuable time that can be used to further develop and deploy innovative solutions (Wilson *et al* 2020), but much more needs to be done to address decline and secure recovery.

These multiple pressures work together to create a challenging and increasingly hostile environment for nesting seabirds. Most of the recommendations from the colony audit relate to interventions to benefit seabirds on these soft coast sites. In the short term these include the ongoing protection of beach nesting little terns in various colonies such as Winterton (Norfolk) and Kessingland (Suffolk); the provision of measures to protect against mammalian predators particularly predator proof fences around the larger mixed colonies; and more robust enforcement of the legal protection from disturbance of Schedule 1 species. Medium term recommendations include island creation and recharge projects which provide more safe breeding areas above the highest tides. Examples include work currently in development at Langstone Harbour, West Sussex, Hodbarrow Lagoon, Cumbria and Horsey Island, Essex for breeding gulls and terns.

Long term recommendations relate to the creation of new alternative safe nesting sites for seabirds through managed realignments and regulated tidal exchange to create new areas of intertidal habitat in which seabird nesting islands are created, alongside a more ambitious larger scale programme of island creation and recharge particularly though the beneficial use of dredged material. Because of the intense pressure on the coast for recreation and development, safe seabird breeding sites need to be integrated into large multipurpose coastal management schemes – that create space for people and wildlife and manage coastal flood risk, provide benefits to fisheries and so on. This has been successfully achieved through recent habitat creation projects, for example at Wallasea Island, Essex where a 670ha complex of wetland habitats has been created on ex-arable land, which now supports gull and tern colonies (Ausden *et al* 2015b).

There is also a need to create alternative places for people and particularly dog walkers to go as alternatives to sensitive breeding bird locations. This has been created through Suitable Alternative Natural Green Space (SANGS), mostly to reduce impact on heathlands, but around the Solent some coastal site measures are in place to provide alternative access to relieve pressure on more sensitive sites. Provisions include all new developments incorporating good quality greenspace, to give people an attractive daily dog walk in an urban environment, including areas for dogs off leads. It is anticipated that Net Gain Funding should similarly be

used to improve urban greenspaces for people and wildlife (greening urban areas is an objective in the 25-year Environment Plan).

5.2.4. Inland sites

Inland sites fall into two types – upland moorland and reservoirs with gull colonies e.g., the lesser black-backed and herring gull colonies in Bowland; and lowland freshwater wetlands with black-headed gull, common tern and cormorant. These inland sites can be significant in their own right and also provide important alternative sites for species being squeezed out of coastal sites by flooding and habitat change. For example, the Bowland colony is now the largest natural large gull colony in England, following the rapid decline of coastal colonies at Orfordness and on the Cumbrian coast.

On lowland lakes, reservoirs and gravel pits seabirds are largely restricted to inaccessible islands but vegetation growth and habitat change on islands is an issue. Over time there is a gradual loss of open habitats for nesting gulls and terns and gradual loss of tree nesting opportunities for cormorants, so these habitats need to be managed or replaced. The creation of special nesting areas using rafts for black-headed gulls and common terns has become important but to benefit a full suite of species special efforts need to be made to manage the competition for nesting space so that the late arriving common terns have space to nest. The potential expansion of freshwater wetlands through landscape scale projects may open up increasing opportunities for these species if the needs of nesting seabirds are designed into new wetlands e.g., islands with short vegetation for nesting seabirds. Large scale wetlands could even provide opportunities for colonising or recolonising species such as black tern (*Chlidonias niger*) or little gull (*Hydrocoloeus minutus*).

Persecution has been and remains an issue for large gulls and cormorants at some inland sites, but the scale and impacts are uncertain. Predator management at inland gull colonies is also an issue. The large gull colonies in the uplands may have developed because of more effective predator control, limiting predation of eggs and chicks, than at coastal sites where they have declined. At these sites ongoing predator control may be key to their future success.

5.2.5 Man-made habitats

Although not identified as a separate category, man-made habitats currently contribute significantly to supporting seabird colonies in England, and with increasing pressure on diminishing safe nesting natural habitats, the importance of man-made habitats could and should grow in the future. Buildings in coastal towns replicate mainland cliffs and predator free spaces, and offshore infrastructure provides some of the key attributes of offshore islands. Throughout our coastal and marine zone there is also opportunity for the creation of new sites through the establishment of seabird-friendly infrastructure such as gravel roofs on industrial buildings, adaptation of coastal infrastructure to support breeding and roosting seabirds e.g., kittiwake towers, and provision of nesting and roosting habitat on offshore infrastructure. This has been largely undeveloped in the UK but may be particularly relevant to some industrial areas and may shape the design of new offshore renewables infrastructure. Kittiwake have been particularly adept at utilising offshore infrastructure for nesting. The use of nesting rafts is widespread on inland sites for common tern and black-headed gull but needs to be developed further. In 2020, common tern and black-headed gulls were discovered nesting on

an industrial building beside Chichester Gravel Pits and if this proves successful, seabirds could be attracted to other similar sites.

5.3 Additional points

5.3.1. Monitoring and research

Monitoring of breeding seabird populations is essential to underpin the work highlighted in this report. At the national level, the results from the most recent Seabirds Count census are eagerly awaited to provide updates on population sizes and trends for England's breeding seabird species. Looking forward, it is imperative that a regular programme of seabird surveys is implemented nationally and long-term, to provide us with the necessary overview of population sizes and trends. This information is vital to enable us to work out the drivers of seabird population changes, positive or negative, and to inform conservation actions.

Regular, long-term monitoring is also necessary at the site level to provide information on local population size, site condition, the success or otherwise of conservation interventions and productivity. Site monitoring and seabird counts are often carried out by staff or volunteers, who also fulfil the roles of colony protection (e.g., tern colonies), habitat management, and community engagement. Many sites, however, do not have enough staff (or volunteers) to perform any of these tasks fully, and some sites have no staff or volunteers at all. This report does not assess monitoring coverage or the required additional funding to cover current and predicted future gaps in monitoring coverage. This should be considered by the ESCS.

Further research into the causes of seabird declines is also required if we are to fully understand the complex mechanisms operating and act effectively to prevent declines and encourage recovery. For example, studies of the foraging movements and behaviour of breeding seabirds, diet studies at colonies, and monitoring of fish prey stocks should all improve the evidence base and allow for more effective conservation action at breeding sites.

The information gathered also needs to be widely and publicly shared so that the knowledge and understanding of decision-makers, land managers, and communities is enhanced, and our breeding seabirds can benefit.

5.3.2 Coordination, networking, and support

A key point raised by site managers and others involved in seabird conservation is the value of coordination across individual sites and networking between sites.

Over the past decade, projects such as the Little Tern and Roseate Tern LIFE Recovery Projects have brought site managers together to share experiences and develop best practice approaches. This has been welcomed by site staff and has helped to develop more efficient and effective intervention measures, as well as providing support for site staff often working long hours on a pressurised site.

Area/regional coordination enables an overview of the pressures and issues being faced and helps coordinate responses to them. This can be illustrated by the Flamborough Management Scheme which coordinates monitoring and research across a large SPA and has initiated new schemes such as Operation Seabird to address issues of wildlife disturbance.

Networking between sites both within the UK and with similar practitioners in NW Europe, is also hugely beneficial to coordinate work and share best practice. Through the Roseate Tern

LIFE Project an Irish Sea network was established connecting seabird site managers and conservation staff between England, Wales, Northern Ireland the Republic of Ireland and the Isle of Man, providing a valuable forum to coordinate seabird work around the Irish Sea – taking a biogeographic approach rather than a site or country-based one. Establishing similar networks for the other biogeographic regions would also be useful: an English Channel Network for Southern England, France, and Belgium; a Southern North Sea Network for eastern England, The Netherlands, Germany, and Denmark: and a Northern North Sea Network with Denmark and Scandinavia.

This should be key part of the England Seabird Conservation Strategy as we go forward.

6. Summary of recommendations and Proposed Breeding Seabird Recovery Plan

6.1. Five-year Breeding Seabird Recovery Plan

Some pressures are clearly having significant negative impacts on breeding seabirds now and these require an immediate response to halt population declines and enable recovery. These include the provision of predator-proof fencing, signage and warden/ranger protection for soft coast-nesting terns and gulls. Other pressures are predicted to have negative impacts in the next 10 years. These still require urgent action to secure funding and consent and to adequately plan habitat restoration and creation works.

In the longer term, integration of the needs of seabirds into coastal adaptation programmes will be needed to address rising sea levels, habitat loss and colony abandonment. This will require early engagement with multi-agency planning teams and local communities and stakeholder consultation and funding, all of which can take a decade. With this in mind, we have developed a five-year plan encompassing recommendations that need to be acted on immediately to address both the short term and longer-term issues, all of which, taken together could have a transformative impact on England's breeding seabirds. Initial recommendations for this five-year Breeding Seabird Recovery Plan are outlined and costed here.

The five-year Breeding Seabird Recovery Plan aims to:

- Halt current declines in England's breeding seabird populations through the immediate implementation of urgent protective and restorative measures.
- Provide a platform for longer term seabird recovery
- Promote the recovery and enhancement of England's breeding seabird populations through wide-scale habitat restoration and creation.

The plan focuses on the Priority Sites, which support the majority of England's breeding seabirds, and where conservation interventions can have the greatest impact.

We estimate that over the next five years, this targeted plan could halt the current, and predicted, loss of safe nesting habitat and declining number of seabirds and facilitate an increase from the current estimated 450,000 pairs of breeding seabirds (excluding urban gulls) and provide a platform for recovery to a minimum of 500,000 pairs by 2050.

This plan includes some high-profile projects, such as:

- A programme of soft coast habitat creation and enhancement around the South and East coast building climate change resilience and adaptation which can provide habitat for an additional 30,000 pairs of gulls and terns.
- The restoration of the Isles of Scilly through the removal of invasive brown rats
- Enhanced biosecurity for offshore islands such as Lundy and Coquet to ensure sustained population increases on these safe nesting areas

The proposed habitat restoration and creation actions should be incorporated into a strategic approach to coastal planning (see 6.2) and will help to contribute to building the ecological resistance of our coastal habitats to climate change. They also contribute towards the nation's obligations to meet the conservation objectives of our SPAs and SSSIs.

6.2 Strategic and Policy Recommendations

Key to protecting and recovering England's breeding seabird populations will be integrating seabird site conservation into the implementation of wider land and coastal management policies, such as Shoreline Management Policies (SMPs) and the National Habitat Compensation Programme (NHCP). The objectives in the DEFRA 25-year Environment Plan are to restore protected sites to favourable condition, create/restore habitat outside protected sites, recover threatened species and achieve other social benefits including recreation (HM Government 2018). These will be delivered through the Nature Recovery Network (NRN) and Local Nature Recovery Strategies (LNRS). The NRN and LNRSs must deliver outcomes for breeding seabirds by protecting and managing existing sites and by creating new habitats that provide safe nesting sites. They should also develop and implement appropriate strategies for access and recreation which reduce the growing pressures on coastal sites of high ecological value. The NRN and LNRS should also direct new funding opportunities such as Biodiversity Net Gain to fund the key management measures identified in this report.

England also has a duty to take appropriate steps to manage SPAs and SSSIs in such a way as to avoid their deterioration and ensure that the conservation objectives of these sites are met. The majority of England's breeding seabirds are supported by sites that qualify as either SSSIs or SPAs (or both) and many are currently failing to achieve their conservation targets

Predicted changes to England's coastline due to erosion and climate change will require coastal management and adaptation strategies in order to protect human life and interests as well as important intertidal habitats from flooding and rising sea levels. Coastal and intertidal habitats support many species and provide valuable flood protection and social benefits (Natural England 2015). England will need to invest in coastal management and mitigation strategies over the coming decades, and habitat protection and the creation of new habitats will form vital parts of these schemes. These include Shoreline Management Plans (SMPs) and the National Habitat Compensation Programme (NHCP) led by the Environment Agency. Important habitat loss can be avoided, and important habitats created during the course of these schemes if they are planned strategically and collaboratively. We recommend that the needs of breeding seabirds be taken into account when implementing such programmes (Natural England 2015; Natural England 2020).

Our strategic and policy recommendations can be summarised as follows:

- Integrate seabird site conservation into the implementation of the DEFRA 25-Year Environment Plan, the Nature Recovery Network and the Local Nature Recovery Strategies.

- Identify and develop funding streams such as Biodiversity Net Gain to fund the programme of site management particularly where site pressures are linked to the consequences of development.
- Develop more robust strategies and policies to limit impacts of disturbance, particularly on nationally and internationally important sites for breeding seabirds.
- Increase investment in the management of existing nationally and internationally important seabird colonies to ensure delivery of favourable condition targets and drive population recovery.
- Ensure needs of breeding seabirds are built into wider programme of climate change mitigation and adaptation projects around the coast.
- Continually review potential population-level impacts of licenced control and evidence base for licenced take of large and small gull species and cormorants and revise if necessary.

6.3 Site Specific recommendations

The proposed five-year Breeding Seabird Recovery Plan for England includes the following site/area specific recommendations.

Northern North Sea

- Maintain robust biosecurity measures around the predator free islands of the Farne Islands and Coquet Island.
- Develop and maintain beach bird protection for open coast nesting little tern and arctic tern (and species like ringed plover) – particularly in Northumberland and Teeside.
- Maintain overview of threats and issues at the Flamborough to Filey SPA cliff nesting colonies through the European Marine Site Management Scheme.
- Assess threats at other key cliff nesting colonies in the region, particularly to minimise impacts of disturbance.

Southern North Sea

- Develop and maintain beach bird protection through engagement and education to protect open coast breeding little terns (and non-seabird species such as ringed plover) - the most important region for this action.
- Effective predator and people management for the major seabird colonies in the North Norfolk SPA such as Scolt Head Island and Blakeney Point.
- Enable the restoration of the gull and tern colonies at Alde-Ore SPA (in particular Orfordness) and Foulness SPA through effective habitat, predator and people management.
- Habitat (re)creation to secure predator free, disturbance free habitat above highest tides for terns and small gulls throughout area – particularly Hamford Water, the Blackwater and Colne Estuaries, the Swale and Medway Estuary. Develop beneficial use of dredged material as a regular resource for habitat replenishment
- Design seabird breeding habitat into large multipurpose coastal management schemes – that create space for people and wildlife, manage coastal flood risk, provide benefits to fisheries and recreation.

English Channel

- Habitat (re)creation of to secure predator free, disturbance free habitat above highest tides for terns and small gulls throughout area – particularly in the Solent and the South Coast harbours. Develop beneficial use of dredged material as a regular resource for

habitat replenishment and streamlined regulatory process for facilitating strategic benefits.

- Beach bird protection through engagement and education to protect open coast breeding little terns (and non-seabird species such as ringed plover).
- Habitat enhancement and creation for gulls and terns throughout Rye and Dungeness SPA through various mechanisms including gravel pit restoration, and enhanced predator management.

The Southwest, Bristol Channel and the Celtic Sea

- On the Isles of Scilly, maintain biosecurity measures to keep the St Agnes-Gugh-Annet complex and other predator free islands, e.g., Round island, predator free.
- Remove rats from Bryher, Treco, St Martins and the associated islands on the Isles of Scilly with follow up biosecurity to ensure islands remain rat free.
- Ensure biosecurity measures in place to protect predator-free Lundy and extend biosecurity provisions to develop a rodent-free Severn.

The Irish Sea

- Habitat creation to secure predator free, disturbance free habitat above the highest tides for terns and small gulls throughout area.
- Restoration of the Foulney-Walney colony complex for large gulls and terns through effective habitat, predator and people management.
- Development of effective mechanisms for creating safe nesting sites for gulls and terns in man-made, post-industrial and brownfield sites.
- Develop and maintain beach bird protection for open coast little tern (and other species like ringed plover).

Inland sites

- Development of effective designs and strategies for nesting rafts for common terns and black-headed gulls.
- Design of seabird islands and features into new freshwater wetlands.
- Effective management of licensing and illegal control of large gulls and cormorants including an effective strategy for management of large gull 'supercolony' in Bowland.

6.4 Estimated costs for the Breeding Seabird Recovery Plan

We estimate the costs of implementing the five-year Breeding Seabird Recovery Plan across the priority sites to be approximately £11million. These costs do not include current ongoing management actions that are already underway at many of England's breeding seabird sites but are the additional costs required to maintain existing sites in good condition whilst developing a programme to restore and create sites to support productive seabird colonies over the longer term

Details are given in Appendix 10.1 - Table 1.

These costs include:

- A programme of enhancement across the Priority sites to minimise current pressures, build resilience and adaptation. Estimated at £5.5 M (£2540k capital costs and £3020k staff costs.)
- Restoration of the Isles of Scilly. Estimated at £5M.
- Developing an England-wide programme of biosecurity to protect all predator-free islands. Estimated at £250,000.
- Programme management, policy links and funding. Estimated at £250,000.

7. Conclusions

England supports internationally important populations of seabirds, but they are under extreme pressure. This report highlights how widely the pressures of disturbance, habitat loss and predation are impacting on seabirds – particularly on the soft coast sites where they often operate in combination.

We eagerly await the outcome of the latest Seabird Count data to clarify current seabird numbers and trends, but there is expectation of declines in several species since the previous survey in 2000 (Mitchell *et al* 2004). With the current and predicted pressures operating at breeding sites, urgent action is required to halt the declines and put in place measures to support longer term recovery.

We recommend establishing a five-year Breeding Seabird Recovery Plan that would put in place urgent measures to halt declines and enable longer term recovery. The plan is particularly targeted at the top 22 Priority Sites that support the majority of England's seabirds. We estimate that this plan will cost £11M across the initial five years.

The impact of Avian Influenza on seabirds during 2022, since this assessment was carried out, has only increased the pressure on seabirds significantly impacting on the most important colonies of roseate tern and Sandwich tern in England particularly through adult mortality. The measures proposed through this Recovery Plan are now more urgently needed than ever to build resilience in these populations.

We also emphasise that the recovery of England's breeding seabirds will depend heavily on integrating the management of seabird breeding sites into wider land and coastal management policies (e.g., climate change mitigation and adaptation), to ensure that these internationally important sites are protected and managed to prevent further population declines and to fulfil their potential.

We hope that these recommendations will be developed as part of the and funded through the England Seabird Conservation Strategy process and the 25 Year Plan.

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10. Appendices

10.1. Tables listing important sites

Table 1. Costed programme for priority sites

Site	Current Pressures	Future Pressures	Key action	Designation	Additional costs required
Alde/Ore Estuary	Sea level rise, reduction in habitat predation, disturbance removal	Sea level rise predation disturbance reduction in habitat removal	Creation of new safe nesting areas, beach bird protection schemes: Lesser black-backed gull management plan in place. assessment of further options to restore multi species seabird colony.	SPA, SSSI	Funding available through windfarm mitigation funding for x years. Some additional costs related to SPA management rather than mitigation for losses
Belmont Reservoir					Minor costs maintenance of Belmont. Costs of restoration of Stocks res-island management and pred fencing
Bowland Fells	Removal predation disturbance	Removal predation disturbance	Productivity at the colony is very high due to the fact that the SPA is wardened and predator control is effective		
Coquet	INNS predation	INNS disturbance reduction in habitat storminess	Island biosecurity -Maintain predator free,	SPA, SSSI	Framework for biosecurity management included as a generic action. only new costs relate to minor maintenance and management of disturbance
Dungeness/Rye	Predation, reduction in habitat disturbance	Ppredation reduction in habitat disturbance sea level rise reduction in food	Creation of new safe nesting area, habitat creation rejuvenation.	SPA, SSSI	In need of major restoration programme. and dedicated staff resource to develop new opportunities and funding. habitat works, pred fencing, mink control

East Norfolk/Suffolk	Ddisturbance predation sea level rise	Disturbance predation sea level rise	Beach bird protection schemes	SPA, SSSI	Little tern protection under-resourced-needs increase in and security of funding, and improved infrastructure to support protection teams.
Essex Blackwater, Roach Estuaries Crouch	Sea level rise, reduction in habitat disturbance predation	Sea level rise predation disturbance reduction in habitat	Creation of new safe nesting areas, beach bird protection schemes	SPA, SSSI	Key issue is loss of habitat, but major restoration opportunities. Including with EA/MoD at Foulness. Need for staff time as above
Farne Islands	INNS disturbance predation	INNS predation disturbance storminess	Island biosecurity -Maintain predator free,	SPA, SSSI	Minor maintenance costs
Flamborough	Disturbance	Disturbance	Assess disturbance impacts	SPA, SSSI	Minor costs relate to maintenance and management of disturbance
Hamford Water	Sea level rise, reduction in habitat disturbance predation	Sea level rise predation disturbance reduction in habitat	Creation of new safe nesting areas, beach bird protection schemes: assessment of options	SPA, SSSI	Horsey Island project in place. Requirement for staff time and budget for technical assessments, licenses – shared with Essex Estuaries.
Isles of Scilly	INNS disturbance reduction in habitat storminess sea level rise	INNS disturbance reduction in habitat storminess sea level rise	Maintain St Agnes-Gugh-Annet predator free; removal of rats from other islands, increased biosecurity across archipelago; habitat management on some islands.	SPA, SSSI	Costs of eradication of rats from islands estimated at £6M. Costs of staff time to develop project proposal and secure funding from various sources £40/k year for 3 years. Post eradication biosecurity included in overall biosecurity costs.
Langstone and Chichester Harbour, Pagham Harbour	Sea level rise, reduction in habitat predation disturbance	Predation disturbance reduction in habitat sea level rise	Habitat creation beach, safe nesting habitat, beach nesting bird schemes.	SPA, SSSI	Urgent need for creation /enhancements of islands and creation of safe nesting habitats. Some being delivered by LOTE but need for more. Costs relate to staff costs and contractors, licenses.

Lundy	INNS disturbance	INNS disturbance	Maintain predator free	SSSI	Maintenance of biosecurity included in overall biosecurity costs. Minor additional management costs and minimising disturbance.
Medway Estuary & The Swale	Sea level rise, reduction in habitat disturbance predation removal	Sea level rise predation disturbance reduction in habitat	Creation of new safe nesting areas, beach bird protection schemes	SPA, SSSI	Urgent need of island enhancements – costs for staff management, licences, and contractor costs.
Minsmere/Walberswick	Reduction in habitat predation disturbance	Reduction in habitat disturbance predation sea level rise	Habitat rejuvenation, beach nesting bird schemes	SPA, SSSI	Minsmere scrape upgrade underway, but potential for further habitat works at Minsmere and other sites inc Benacre and Kessingland. Funding for staff time to develop new schemes. Potential for major funding as mitigation for impacts of Sizewell if it goes ahead.
Morecambe Bay Est	Sea level rise, reduction in habitat disturbance, predation removal	Sea level rise reduction in habitat disturbance predation removal	Creation of new safe nesting areas, beach bird protection schemes, restoration of Lesser black-backed gull colony	SPA, SSSI	Various staff costs – protection of nesting birds at key sites like S Walney, Foulney. Predator fencing and vegetation management.
N Norfolk Coast & The Wash	Sea level rise, reduction in habitat disturbance predation removal	Sea level rise predation disturbance reduction in habitat	Creation of new safe nesting areas, beach bird protection schemes: Increased wardening, protection of beach nesting birds supported by coastal zoning of public access	SPA, SSSI	Significant staff investment required to manage increasing disturbance impacts. Staff time and equipment for beach nesting birds. Disturbance mitigation strategy.
Northumberland Coast - Lindisfarne, Beadle Bay	Disturbance, predation sea level rise	Disturbance predation sea level rise	Create safe nesting habitat, beach nesting bird schemes.	SPA, SSSI	Support for beach nesting birds – current WADER LIFE project in place to in addition to this.

Poole Harbour	Sea level rise, reduction in habitat disturbance, predation removal	Sea level rise reduction in habitat disturbance predation removal	Creation of new safe nesting areas, stopping illegal egg collection	SPA, SSSI	Minor costs of maintaining key sites. Developing urban /man made opportunities
Ribble Estuary	Sea level rise, reduction in habitat disturbance predation removal	Sea level rise reduction in habitat disturbance predation removal	Creation of new safe nesting areas, beach bird protection schemes, Lesser black-backed gull management plan	SPA, SSSI	
Solent	Sea level rise, reduction in habitat disturbance predation	Sea level rise reduction in habitat disturbance predation	Creation of new safe nesting areas, beach bird protection schemes	SPA, SSSI	Staff time and costs of assessments, licences to develop new safe nesting areas particularly through beneficial use.
Solway Estuary	Sea level rise, reduction in habitat disturbance predation removal	Sea level rise reduction in habitat disturbance predation removal	Creation of new safe nesting areas, beach bird protection schemes	SPA, SSSI	
St Bees Head	Disturbance	Disturbance	Assess disturbance impacts		No significant costs. Minor maintenance costs relating to disturbance management
Tees	Disturbance, predation reduction in habitat removal	Sea level rise predation disturbance reduction in habitat	Beach nesting bird schemes, habitat creation	SPA, SSSI	Support for beach nesting birds protection and fencing/kit.

*Ranking for Key Species: 1>10,000 prs S2000 or more recently, 2>10%of England population, 3 top 5 site for any species in England

Table 2. Most important sites identified for each of the England's breeding seabird species

Species	England (S2000)	England as % UK total (S2000)	Revised estimate (where available)	Revised England as % UK total (indicative)	Top 5 sites by population (excluding sites <20 pairs)	>10 % England population	>50 % England population
Fulmar	6291	1.2			Flamborough, Berwick, Cayton Bay, Isles of Scilly Farne Islands.		
Manx shearwater	367	0.1	5504	4	Lundy Isles of Scilly	Lundy Isles of Scilly	Lundy
Storm Petrel	1475	5.7			Isles of Scilly Lundy	Isles of Scilly	Isles of Scilly
Gannet	2552	1.1	13392		Flamborough	Flamborough	Flamborough
Cormorant	2896	31.7			Marsden, Farne Islands, Lea Valley, Abberton, Dungeness/Rye.		
Shag	3863	13.4			Isles of Scilly Farne Islands Gerrans Bay	Isles of Scilly Farne Islands	Isles of Scilly
Mediterranean Gull**	108	98.1	2000	96	Langstone/Chich H, Swale/Medway, Rye/Dungeness, N Norfolk. Thames/Essex	Langstone/Chich H, Swale/Medway, Rye/Dungeness, Poole H. N Norfolk, Essex Estuaries	Langstone/Chich H
Black Headed Gull**	82728	60			Ribble, Hamford Water, Belmont Res, Poole H, Solent, (N Norfolk, Langstone H, Swale/Medway, Rye/Dungeness)	Ribble Hamford Water, Belmont Res	
Common Gull	44	0.1			N Norfolk (23)		
Lesser Black-backed Gull**	64208	56.4	34320 natural sites, 18767 coastal	?	Bowland Ribble Morecambe Bay Isles of Scilly	Bowland, Isles of Scilly, various sites on S2000 counts e.g., Orfordness	

Herring Gull	45365	37.8	17,573 natural sites, 17069 coastal	?	Ribble, Morecambe Bay, Solway, Orfordness.		
Great Black-backed Gull	1476	8.4			Isles of Scilly, Morecambe Bay, Loe Island, Great Mewstone, Lundy	Isles of Scilly	Isles of Scilly
Kittiwake	76281	20.1			Flamborough, Filey, Farne Islands, Cayton Bay, Scarborough	Flamborough	
Sandwich Tern**	9018	72.2			N Norfolk, Coquet Farne Islands, Morecambe Bay (Medway, Rye)	N Norfolk, Coquet Farne Islands.	
Roseate Tern**	36	64.3	130	98	Coquet	Coquet	Coquet
Common Tern	4676	38.9			Coquet, Tees, N Norfolk, Solent, Dungeness	Coquet, Tees, N Norfolk, Solent, Dungeness	
Arctic Tern	3602	6.8			Northumberland Coast, Farne Islands, Coquet	Northumberland Coast, Farne Islands, Coquet	Northumberland Coast
Little Tern**	1521	78.1	1100		N Norfolk, East Norfolk, (N Suffolk, Morecambe Bay, Tees, Langstone H, Northumberland)	N Norfolk, East Norfolk	
Guillemot	91986	6.5			Flamborough, Farne Islands, St Bees Head, Lundy, Exmoor	Flamborough, Farne Islands,	Flamborough
Razorbill	11144	5.9			Lundy, Exmoor, Isles of Scilly, St Bees Head, Farne Islands	Lundy	
Black Guillemot	7	<0.1			St Bees Head (7 AON)		St Bees Head
Puffin	75734	13			Farne Islands, Coquet, Flamborough, Lundy, Isles of Scilly	Farne Islands, Coquet, Flamborough	Farne Islands
Eider	3000				Coquet, Farne Islands, Northumberland, Morecambe Bay, Solway.	Farne Islands, Coquet, Morecambe Bay	

** species with > 50% of UK pop in England

11. Annex: Regional Site Data Tables

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