

Conservation and Management Advice

YTHAN ESTUARY, SANDS OF FORVIE & MEIKLE LOCH SPA

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This document provides advice to Public Authorities and stakeholders about the activities that may affect the protected features of the Ythan Estuary, Sands of Forvie and Meikle Loch Special Protection Area (SPA). It provides advice from Scottish Natural Heritage (SNH) (operating under the name of and hereinafter referred to as NatureScot) under Regulation 33(2) of the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland) to other relevant authorities on the Conservation Objectives for the Ythan Estuary, Sands of Forvie and Meikle Loch SPA. It also provides advice on activities/operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species for which the site has been designated. It covers a range of activities and developments but is not exhaustive. It focuses on where there is a risk to achieving the Conservation Objectives. The paper does not attempt to cover all possible future activities or eventualities (e.g. as a result of accidents), and does not consider cumulative effects.

Further information on marine protected areas and management is available at -

<https://www.gov.scot/policies/marine-environment/marine-protected-areas/>

For the full range of MPA site documents and more on the fascinating range of marine life to be found in Scotland's seas, please visit -

www.nature.scot/mpas or <https://jncc.gov.uk/advice/marine-protected-areas/>

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Contents

1	OVERVIEW OF DOCUMENT	4
2	INTRODUCTION	4
2.1	Purpose statement	4
2.2	Conservation benefits	4
2.3	Wider benefits	5
2.4	Contribution to policy commitments	6
3	ROLES	7
4	PROTECTED FEATURES AND STATUS	7
5	SETTING CONSERVATION OBJECTIVES	8
5.1	Background	8
5.2	Relationship between feature condition and Conservation Objectives	9
5.3	Conservation priorities	9
5.4	Overlapping Protected Areas	10
6	FEATURE SENSITIVITY	10
6.1	Terns (Sandwich, little, common terns) (breeding)	10
6.2	Pink-footed goose (non-breeding)	10
6.3	Common eider (non-breeding)	11
6.4	Common redshank (non-breeding)	11
6.5	Lapwing (non-breeding)	11
7	MANAGEMENT	11
7.1	Conservation Measures	11
7.2	Advice to support management	12
7.3	Best Practice	13
8	RESEARCH AND SURVEY	26
ANNEX 1. THE YTHAN ESTUARY, SANDS OF FORVIE AND MEIKLE LOCH SPA CONSERVATION OBJECTIVES		27
ANNEX 2. SUPPORTING INFORMATION		50
	Factors determining the potential for feature recovery.	50
ANNEX 3: GLOSSARY FOR CONSERVATION OBJECTIVES AND REFERENCES		54
	Glossary	54
	References	55

1 Overview of document

This document provides details of the Conservation and Management Advice for the Ythan Estuary, Sands of Forvie and Meikle Loch Special Protection Area (SPA) and it is divided into eight main sections. The introduction in section 2 gives an overview of the Ythan Estuary, Sands of Forvie and Meikle Loch SPA and its contribution in terms of conservation and wider benefits. Section 3 provides an overview of the roles of the various bodies involved with advising, regulating and managing the marine protected area. Section 4 describes the protected features and their condition, and section 5 introduces the Conservation Objectives for the site. Section 6 describes the threats and pressures to which the protected features are sensitive, and section 7 provides the management advice for these activities. Section 8 identifies what further research and surveys may be required to increase our understanding of how the protected features utilise the marine protected area.

Annex 1 sets out the Ythan Estuary, Sands of Forvie and Meikle Loch SPA Conservation Objectives. Annex 2 provides supporting information relating to the protected features.

Throughout this document the term Special Protection Area (SPA) is used in relation to the site name, e.g. Ythan Estuary, Sands of Forvie and Meikle Loch SPA or in discussion of the specific legislation relating to the site. Otherwise the term Marine Protected Area (MPA) is used when discussing the MPA network generally. The term *qualifying features* is used in the Conservation Objectives to refer to those Annex 1 and regularly occurring migratory bird species that the Ythan Estuary, Sands of Forvie and Meikle Loch SPA has specifically been designated to protect. Within the wider document text, the term *protected features* is used to refer both to these specific site features and more generally to species or habitats protected through MPA designations.

2 Introduction

2.1 Purpose statement

The Ythan Estuary, Sands of Forvie and Meikle Loch SPA has been designated to protect seven species: breeding terns (Sandwich, little and common tern), wintering pink-footed geese, wintering waterfowl (eider) and waders (redshank and lapwing), and their supporting habitats. By doing so it contributes to the UK and OSPAR MPA networks, the conservation of the wider marine environment around Scotland, and progress towards Good Environmental Status within the North-East Atlantic marine region.

The main purpose of the Ythan Estuary, Sands of Forvie and Meikle Loch SPA is to contribute to the [Favourable Conservation Status](#) of the protected features in the Atlantic Biogeographic Region. The Conservation Objectives form the framework for establishing appropriate management measures and assessing all future plans and projects that have the potential to affect the protected features of the MPA.

2.2 Conservation benefits

The conservation benefits for the Ythan Estuary, Sands of Forvie and Meikle Loch SPA are:

- Protecting over 7% (up to 1125 pairs) of Sandwich tern and around 2% (up to 41 pairs) of little tern GB breeding populations. This SPA has the largest breeding colonies of both these species in Scotland. This SPA also protects around 2% (up to 265 pairs) of the common tern GB breeding population. All three of these tern species are Annex 1 rare and vulnerable species.

- Protecting over 9% of the Eastern Greenland/Iceland/UK biogeographic population of wintering pink-footed geese, 2% of the GB population of wintering eiders, and around 1% of GB population of wintering redshank and lapwing.
- Protecting a nationally important wintering assemblage of over 20,000 individuals of waterfowl and waders.
- Protecting the diverse intertidal and marine habitats that support a diversity of fish, and invertebrates, where the wintering qualifying features can forage, moult and roost, and where the breeding tern qualifying features can safely breed, forage and rest.

2.3 Wider benefits

The protected features of the Ythan Estuary, Sands of Forvie and Meikle Loch SPA contribute to ecosystem services locally and across the wider marine and estuarine ecosystems. We describe these ecosystem services in terms of their functions and the natural resources they comprise, which can in turn lead to benefits for people. Consequently, achieving the Conservation Objectives will also enable continuation of these wider benefits.

Figure 1 illustrates how the protected features of the Ythan Estuary, Sands of Forvie and Meikle Loch SPA contribute to benefits for people. There can be many complex interactions and dependencies amongst the protected features, their functions, associated natural resources and the benefits we gain from them.

The protected features together, especially when taken within the context of the whole MPA and/or local ecosystem, contribute to certain functions (e.g. biomass production and nutrient cycling) more than others. The contributions made by the protected features to these functions are fundamental to the continued supply of natural resources and benefits associated with this MPA, and to the long-term health of the protected features themselves.

In terms of resources, the MPA is a complex site which has resulted in the development of diverse intertidal and marine habitats that support a variety of natural resources. The River Ythan has a long, narrow estuary with the Sands of Forvie lying on the north bank, covering a complex area of sand dunes, shingle, saltmarsh, mudflats, sandbanks and other coastal habitats. The MPA also consists of marine waters, including relatively shallow waters, with sandy sediments dominating the seabed. The seas off this coastline support a wide diversity of invertebrates including shellfish and a wide range of pelagic and demersal fish species (including juveniles), as well as bird species which use the intertidal, coastal and nearshore environments.

The seascapes and wildlife within the MPA provide opportunities for tourism, recreation and wildlife watching (particularly bird watching), all of which encourage local jobs and businesses. Fisheries and supporting businesses from local communities within and around the MPA use and benefit from the wildlife and the area's fish and shellfish resources. Wildfowling is also undertaken within the MPA in line with the law of the foreshore and attracts visitors across the winter months. The MPA is valued by the local community. The overlapping Forvie National Nature Reserve (NNR) is well-used by locals and visitors alike. The complexity of the habitats and waters around this MPA, create a unique coastal environment and a sense of place. Further benefits relating to health and well-being, food and nutrition also arise from the site's natural resources, resulting in a place where communities and visitors can spend time connecting with and enjoying nature.

The benefits that arise from the functions and natural resources of the MPA are typically small in the context of the whole of Scotland, but some are of greater importance for this MPA and the people that use it. There is potential for benefits to be enhanced by improving the quantity or quality (health) of the protected features themselves.

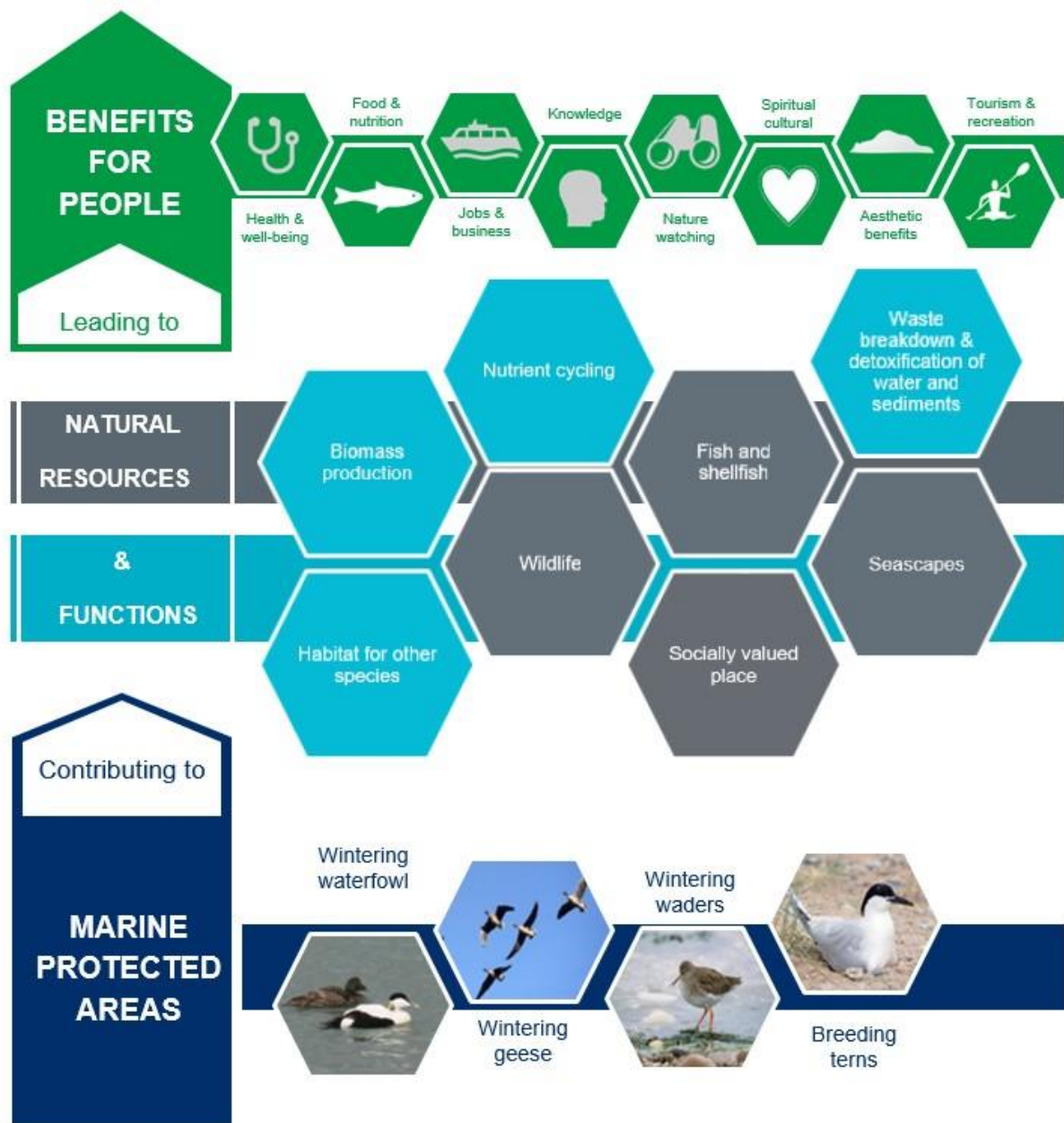


Figure 1. Benefits to people associated with marine protected features of the Ythan Estuary, Sands of Forvie and Meikle Loch SPA.

2.4 Contribution to policy commitments

Managing this MPA to maintain the protected features in favourable condition, will ensure the continued provision of the benefits above as well as the site's contribution to:

- An ecologically coherent network of MPAs which are well managed under the OSPAR convention and national legislation.
- Achieving Favourable Conservation Status for the protected features in the Atlantic Biogeographic Region.
- Progress towards achieving Good Environmental Status in relation to maintaining biological diversity, and ensuring marine food web abundance and diversity.
- Making a significant contribution to the protection, enhancement and health of the marine area under the National Marine Plan.

- Restoring marine and coastal ecosystems and increasing the environmental status of our seas under the Scottish Biodiversity Strategy.
- Helping to adapt to climate change under The Scottish Climate Change Adaptation Programme.

3 Roles

This document provides advice for the Ythan Estuary, Sands of Forvie and Meikle Loch SPA in relation to activities that may affect the protected features. More detailed advice can be provided to public authorities to inform their decision making as required. In doing this, our aim is to ensure the Conservation Objectives for the protected features are met.

The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland) (the “Habitats Regulations”) under Regulation 33(2), make special provisions for the protection of European marine sites, requiring SNH (now referred to as NatureScot) to advise other relevant authorities of the Conservation Objectives for a site, and also of the operations which may cause deterioration of the habitats or species, or disturbance of species protected in the SPA.

It is the role of the relevant and competent authorities¹ to ensure that the activities they regulate, permit or license do not hinder the achievement of the Conservation Objectives of the Ythan Estuary, Sands of Forvie and Meikle Loch SPA. The management advice in this document is provided to assist authorities in managing the activities outlined in Table 2, section 7, and undertaking Habitats Regulations Appraisals of plans and projects.

Stakeholders can provide additional evidence to support the development of management including local knowledge of the environment and of activities. This will contribute to the development of well-designed and effective management measures.

4 Protected features and status

The Ythan Estuary, Sands of Forvie and Meikle Loch SPA has been selected to become part of the UK’s SPA network, contributing to Scotland’s MPA network, which in turn has been established to help conserve and recover a range of Scotland’s important marine habitats, wildlife, geology and landforms.

The protected features of the Ythan Estuary, Sands of Forvie and Meikle Loch SPA are protected within the SPA throughout the year, irrespective of the season for which they qualified as a protected feature.

Table 1 provides a summary of the protected features within the MPA, their condition within the site (where known). Condition assessment is based on either the latest NatureScot [Site Condition Monitoring](#) or, for where it is available and appropriate, on the latest five year mean count from the Forvie National Nature Reserve (NNR), which overlaps entirely with the Ythan Estuary, Sands of Forvie and Meikle Loch SPA.

¹ A relevant authority is a body or authority that has a function in relation to land or waters within or adjacent to the site (Regulation 5) and include: a nature conservation body; a local authority; water undertakers; a navigation authority; a harbour authority; a lighthouse authority; a river purification board (SEPA); a district salmon fishery board; and a local fisheries committee. All relevant authorities are competent authorities. A competent authority is defined in Regulation 6 as “any Minister, government department, public or statutory undertaker, public body of any description or person holding a public office”. In the context of a plan or project, the competent authority is the authority with the power or duty to determine whether or not the proposal can proceed.

Table 1. Protected features and condition for the Ythan Estuary, Sands of Forvie and Meikle Loch SPA.

Feature condition refers to the condition of the protected feature at a site level. Broader conservation status is the overall conservation status of the feature within the UK and Europe. No assessment on the condition of the feature at the Marine Atlantic Biogeographic Region scale is available.

Protected Feature	Feature condition at site	Assessment year	Broader conservation status	
			UK ²	European region ³
Sandwich tern (breeding)	Favourable Maintained	2021	Amber	Least Concern
Little tern (breeding)	Favourable Maintained	2021	Amber	Depleted
Common tern (breeding)	Favourable recovered	2021	Amber	Least Concern
Pink-footed goose (non-breeding)	Favourable Maintained	2012	Amber	Least Concern
Common eider (non-breeding)	Unfavourable declining	2021	Amber	Endangered
Common redshank (non-breeding)	Favourable Maintained	2021	Amber	Vulnerable
Lapwing (non-breeding)	Unfavourable declining	2021	Red	Vulnerable

5 Setting Conservation Objectives

5.1 Background

Under Regulation 33(2) of the Habitats Regulations, NatureScot have responsibility for providing the Conservation Objectives for European marine sites in Scottish territorial waters. These site-level Conservation Objectives seek to define the contribution that each SPA should make to achieving Favourable Conservation Status for the protected features. They provide the framework for the setting of site conservation measures (management) and for the Habitats Regulations Appraisal of projects and plans.

The Conservation Objectives for the Ythan Estuary, Sands of Forvie and Meikle Loch SPA are provided in Annex 1.

² Based on Birds of Conservation Concern 5 (BoCC5), for further details on definitions see Stanbury *et al.* 2021.

³ Based on BirdLife International, 2021.

5.2 Relationship between feature condition and Conservation Objectives

The Conservation Objectives seek to *maintain* protected SPA features where evidence exists that it is in favourable condition in the site, or where there is uncertainty concerning the assessed condition of a feature (see section 4) but no reason to suspect deterioration in condition since site selection. Where evidence exists that a feature is declining and/or damaged and therefore not in a favourable condition in the site, the Conservation Objectives will seek to *restore* the protected feature.

The following protected features are in favourable condition at the Ythan Estuary, Sands of Forvie and Meikle Loch SPA: little tern, Sandwich tern, common tern, pink-footed goose, and redshank. Therefore, the Conservation Objectives seek to *maintain* this condition.

The following protected features are in unfavourable condition: eider and lapwing.

Non-breeding eiders have declined by 48% from 1860 individuals (1998 citation) to 967 individuals (mean 2015-2020). Reasons for the decline in the wintering population of eiders at Ythan Estuary, Sands of Forvie and Meikle Loch SPA are not fully understood. The breeding population of eiders has experienced a decline, which may have a subsequent effect on the wintering population. Pressures within the breeding season include predation and recreational disturbance (mainly from walkers and dogs). Previously, even within a separately fenced off area for eiders, fox predation was noted as being a pressure. However, now almost all eiders nest within the electrified fenced-off tern colony, which has better protection from mammalian predators. Disturbance of the roosting population of eiders has been noted at the site, which may subsequently deter the eiders from breeding at the site. Equally, pressures within the non-breeding period can have a subsequent effect on the following breeding season. Should eiders not be able to maintain good body condition over the winter period, they may choose to skip breeding. The condition of the main prey resource for eider, blue mussels, within the SPA is not known, but pressures on prey resources within the SPA may be contributing towards a decline in both the wintering and breeding populations of eider. The condition of eiders at the Ythan Estuary, Sands of Forvie and Meikle Loch SPA is therefore considered to be unfavourable and consequently, the Conservation Objectives seek to *restore* favourable condition where on-site remedies can influence this.

Lapwings at Ythan Estuary, Sands of Forvie and Meikle Loch SPA have decreased from 2542 individuals (winter mean peak from 1991-1996), to an average of 1228 individuals counted between 2015-2019. Reasons for the decline at the site are not fully understood but may relate to disturbance due to recreation or changes in the food supply in surrounding fields. Pressures in their breeding season outwith the SPA may also be having a subsequent effect on their wintering populations. The condition of lapwing at the Ythan Estuary, Sands of Forvie and Meikle Loch SPA is therefore considered to be unfavourable and consequently, the Conservation Objectives seek to *restore* favourable condition where on-site remedies can influence this.

5.3 Conservation priorities

On the rare occasion where the need to favour the management of one protected feature of a site over another, conservation priority will be given to the most important species/habitats to take action for and/or the most important or urgent measures to be taken.

For the Ythan Estuary, Sands of Forvie and Meikle Loch SPA, Sandwich tern, little tern and common tern are Annex 1 species and considered rare and vulnerable. The conservation requirements for Annex 1 species should take precedence over the regularly occurring migratory species (pink-footed geese, eider, lapwing and redshank). There are currently no apparent management conflicts between the protected features.

5.4 Overlapping Protected Areas

The following protected areas overlap with the Ythan Estuary, Sands of Forvie and Meikle Loch SPA:

- Buchan Ness to Collieston Coast SPA and Special Area of Conservation (SAC)
- Sands of Forvie SAC
- Ythan Estuary and Meikle Loch Ramsar site
- Sands of Forvie and Ythan Estuary Site of Special Scientific Interest (SSSI)

Conservation measures in the overlapping protected areas need to ensure the Conservation Objectives of each protected site are met. There are no apparent management conflicts between the protected features of the overlapping protected areas. No additional conservation objectives are related to the Ramsar site since the protected features are the same. Site information for the sites overlapping the Ythan Estuary, Sands of Forvie and Meikle Loch SPA, including the Conservation Objectives, are available on [SiteLink](#).

6 Feature sensitivity

The following section provides an overview of the pressures associated with human activities that are most relevant to the protected features. Further information on feature sensitivity for the marine protected features will be made available on Marine Scotland's [Feature Activity Sensitivity Tool \(FeAST\)](#)⁴. The information in FeAST will reflect our current understanding of the interactions between activities, pressures and marine protected features. It highlights that activities can give rise to a range of pressures, which the protected features may be sensitive to. Our assessment of sensitivity is based on a feature's tolerance (response to change) and its ability to recover.

6.1 Terns (*Sandwich, little, common terns*) (breeding)

Terns can be directly impacted by collision with artificial structures above and below water. Terns are also assessed as being sensitive to introduction of microbial pathogens. Terns are highly vulnerable to depletion of food-fish stocks, either due to climate change (Arnott & Ruxton, 2002), industry (Furness, 2002), construction (Perrow *et al.* 2011), or effects on their prey habitats. Tern species can be impacted by predation at the colony from either mammalian or avian predators. Terns may also be susceptible to disease, such as avian flu ([APHA](#)). Terns can be directly impacted by disturbance from a variety of activities. Disturbance is thought to have a greater impact on these species when on land at their nesting sites (Ratcliffe *et al.* 2008), compared to when they are foraging in the surrounding waters (Goodship & Furness, 2019). Terns may also be sensitive to changes in water turbidity, which impacts on their ability to forage (Brenninkmeijer *et al.* 2002). Changes in the mobile coastal dune habitat may also impact on availability of breeding habitat for tern colonies.

6.2 Pink-footed goose (*non-breeding*)

Pink-footed geese wintering in the UK are hunted across their flyway, and they are a quarry species in the open season in Scotland and England. The effects of wildfowling on their UK wintering population is currently not known (Humphreys *et al.* 2015). Changes in agricultural practice can affect food availability for pink-footed geese, and disturbance during winter can also disrupt their ability to forage (e.g. being scared off fields where they are feeding). Pink-footed geese have been assessed as being sensitive to human disturbance, including disturbance as a result of hunting activity (Goodship & Furness, 2019). The species is also susceptible to avian flu ([APHA](#)) so may be threatened by outbreaks of the virus.

⁴ <http://www.marine.scotland.gov.uk/feast/>

6.3 Common eider (non-breeding)

Eider are sensitive to mortality through collisions with marine developments and physical structures (e.g. Dierschke & Garthe, 2006; Larsen & Guillemette, 2007), entanglement as bycatch (Mendel *et al.* 2008; Žydelis *et al.* 2013) particularly near the seabed (Bradbury *et al.* 2017) and exposure to pollutants (Carboneras *et al.* 2017), including oil spills (Mendel *et al.* 2008). Eider may also be susceptible to disease, including avian flu ([APHA](#)). Eider are also sensitive to physical disturbance including displacement by built structures (Furness *et al.* 2013) and are frequently recorded taking evasive flights in association with vessel movements (Jarret *et al.* 2018). The level to which eider can become habituated to vessel movements is uncertain (Garthe & Hüppop, 2004; Schwemmer *et al.* 2011; Larsen & Laubek, 2005). The impact of some of these pressures may be greatest during their flightless moult period between July and mid-September, when large flocks aggregate in favoured locations and it is difficult for them to move away (Waltho & Coulson, 2015). Eider populations are also vulnerable to changes in availability of favoured bivalve prey (Cervencel *et al.* 2015; Mendel *et al.* 2008). (See also *Horse mussel bed sensitivity assessment in FeAST*). Studies in the Wadden Sea showed that eider can switch to a secondary prey source (surf clams), when blue mussel and common cockle numbers were severely reduced and eiders will move between foraging areas in response to prey depletion (Camphuysen *et al.* 2002). However, the ability to switch prey successfully may be limited. Loss of body condition and mortality are associated with loss of prey resources (Camphuysen *et al.* 2002; Beukema, 1993; Laursen *et al.* 2009).

6.4 Common redshank (non-breeding)

Redshank are sensitive to habitat loss and degradation, (e.g. through land reclamation, development, agricultural intensification, encroachment of grasses such as *Spartina* on mudflats etc.) (del Hoyo *et al.* 1996), and growth of macro algae (*Ulvae spp.*) on mudflats due to eutrophication. The species is also threatened by disturbance on intertidal mudflats from construction work and recreation activities on land (Burton *et al.* 2002a, b), as well as from watercraft along the shoreline (Goodship & Furness, 2019). The species is also susceptible to avian influenza so may be threatened by future outbreaks of the virus (Melville & Shortridge, 2006).

6.5 Lapwing (non-breeding)

Some countries still hunt lapwing (BirdLife International, 2020), which may have a subsequent effect on their UK wintering population. This species is sensitive to habitat loss and degradation due to changes in agricultural practice and coastline changes, which can cause a subsequent change in their optimal foraging habitats. Lapwings are also vulnerable to oil pollution and disease, such as avian botulism (Hubalek *et al.* 2005; Grishanov, 2006). Lapwing may also be sensitive to short-term cold weather events, which can impact on adult survival. They may also be susceptible to predation (BirdLife International, 2020). Lapwing are sensitive to disturbance, both from human disturbance at the shore and from watercraft along a shoreline (Goodship & Furness, 2019).

7 Management

7.1 Conservation Measures

The following conservation measures are currently in place for the Ythan Estuary, Sands of Forvie and Meikle Loch SPA:

- The Habitats Regulations require all plans or projects that may have an effect on the protected features of a SPA to be assessed against the Conservation Objectives for that site. This process is known as a Habitats Regulations Appraisal (HRA). An HRA is a statutory procedure that ensures the integrity of the site is maintained. It also provides an opportunity to consider appropriate mitigation that can reduce impacts,

avoid adverse effects and permit plans or projects to proceed, having taken full account of the protected features of an SPA.

Other relevant measures include:

- Forvie [National Nature Reserve \(NNR\) Management Plan](#) 2014 identified a number of management tasks relevant to the protected features of the Ythan Estuary, Sands of Forvie and Meikle Loch SPA, which includes:
 - Working in partnership with Scottish Environment Protection Agency (SEPA) and others to contribute to the monitoring of the estuary in relation to water quality.
 - Management in place to protect breeding terns. This includes erecting electric fences annually around the colonies with boundary fences around the tern sanctuary and information provided to the public as to what the fences are for to minimise human disturbance where possible. Control of predators around the tern colonies (foxes and corvids) also takes place. Regular patrols by NNR staff take place.
 - Management to protect the breeding (SSSI) eider population, which directly contributes to the SPA wintering population.
 - The catchment is a Nitrate Vulnerable Zone (NVZ) and SEPA monitors macro algal growth on the estuarine mudflats. The associated Action Plan for the NVZ introduced limits on the amount and timing of nitrogen fertilizer inputs (organic and inorganic) in the catchment. This has particular relevance to protected features such as redshank, which rely on the estuarine mudflats for foraging.
- The Sands of Forvie and the Ythan Estuary SSSI, which directly overlaps with the Ythan Estuary, Sands of Forvie and Meikle Loch SPA, has an Operations Requiring Consent (ORC) list that contains 28 operations which must be consented from NatureScot before being carried out.

7.2 Advice to support management

Table 2 provides NatureScot's advice on management for activities where we consider this may be necessary to achieve the Conservation Objectives for the protected features. The advice is focused on the activities that cause an effect (a pressure) that a feature is sensitive to. Pressures can be physical (e.g. abrasion of the seabed), chemical (e.g. introduction of pollutants) or biological (e.g. removal of prey resources). Different activities may cause the same pressure, e.g. fishing using bottom gears and aggregate dredging both cause abrasion which can damage the surface of the seabed.

Our advice takes a risk-based approach, i.e. we are focusing on providing advice where we believe there is a risk to achieving the Conservation Objectives. We have identified risks to achieving the Conservation Objectives where there is an overlap between protected features and activities associated with pressures that the features are sensitive to. We have provided management advice to support public authorities and others in managing these risks. Our advice is based on existing data and information on protected features and relevant activities, and our understanding of the relationships between the features and activities. We have identified a range of management advice:

- management to remove or avoid pressures;
- management to reduce or limit pressures; or
- no additional management required.

For our advice on fisheries management we have also stated where we think this should be 'considered.' This term is included to highlight that an issue exists, but circumstances mean that a specific recommendation for action cannot or need not be made at this point. However, there is sufficient cause to make fishery managers aware of the issue and for them to consider if a fishery management measure may be helpful in achieving Conservation

Objectives – particularly where there may be a synergy between the benefits of management actions for the fishery and the Conservation Objectives for the feature. The term ‘recommended’ highlights that an issue of fishery-feature interaction exists, there is a reasonable evidence base and a specific recommendation can be made/ justified.

New or other activities not identified within the table would need to be considered on a case-by-case basis.

We recognise that stakeholders can provide local environmental knowledge and more detailed information on activities, including in relation to intensity, frequency and methods. This additional information will help public authorities and others develop more specific management, focussed on the interaction between features and activities. If new information becomes available our management advice may be revised. Where management measures are required, the development of these would be undertaken through discussion with the relevant stakeholders.

Table 2 describes the activities that are considered capable of affecting the protected features. Activities that are considered not likely to affect the protected features (other than insignificantly) are listed in Table 3. Spatial data relating to the location and extent of the marine-based activities listed can be accessed on [Marine Scotland's National Marine Plan Interactive](#) (where available).

7.3 Best Practice

In our management advice for activities in Table 2 we refer to the development, adoption or use of ‘best practice’ as a way of managing interactions between activities and the features. Best practice is taken to mean approaches or procedures that are developed and accepted by regulators and relevant stakeholders as being an effective way of dealing with an interaction between a habitat or species and the pressures created by an activity. Much of this best practice is already being implemented by sectors and regulators, e.g. pre-application discussions between developers and regulators, the Scottish Marine Wildlife Watching Code, Scottish Outdoor Access Code, and Technical Standards for Scottish Finfish Aquaculture.

Table 2. NatureScot’s advice to support management for the Ythan Estuary, Sands of Forvie and Meikle Loch SPA for activities which are considered capable of affecting the protected features.

The text under the ‘Advice to support management’ columns provides NatureScot’s management advice for the features in relation to the activities (further details about the terminology used are provided in section 7.2). Where a cell is coloured grey this indicates that management is already in place, this includes where there are existing regulatory requirements for new proposals. Cells are also coloured grey where it is considered there is no additional management required to achieve the Conservation Objectives. An * has been used to highlight those activities to which the advice under ‘*Boat use associated with both commercial and recreational activities*’ also applies. For some activities, the pressures associated with new proposals are considered unlikely to affect some the features either because these activities do not occur in the same locations as the features or the pressure is unlikely to be at levels that can affect the features (see also Table 3). In these cases, we have not provided advice however, where regulated; this does not exempt new plans or projects related to these activities undergoing a Habitats Regulations Appraisal (HRA).

Activities considered capable of affecting the protected features	Advice to support management			
	Terns (Sandwich, little and common tern)	Common eider	Pink-footed goose	Waders (redshank and lapwing)
Aircraft (helicopters)	Reduce or limit pressures (disturbance) associated with low-flying helicopter movement.	<i>Pressure unlikely to affect this feature.</i>	<i>Pressure unlikely to affect this feature.</i>	<i>Pressure unlikely to affect these features.</i>
Boat use associated with both commercial and recreational activities.	Reduce or limit pressures (disturbance) associated with new boat use during commercial and recreational activities through effective mitigation such as: <ul style="list-style-type: none"> following the Scottish Marine Wildlife Watching Code (SMWWC). seasonal and/or spatial restrictions to avoid sensitive time periods for those protected features 	Reduce or limit pressures (disturbance) associated with new boat use during commercial and recreational activities through effective mitigation such as: <ul style="list-style-type: none"> following the Scottish Marine Wildlife Watching Code (SMWWC). seasonal and/or spatial restrictions to avoid sensitive time periods for those protected features 	<i>Pressure unlikely to affect this feature.</i>	<i>Pressure unlikely to affect these features.</i>

Activities considered capable of affecting the protected features	Advice to support management			
	Terns (Sandwich, little and common tern)	Common eider	Pink-footed goose	Waders (redshank and lapwing)
	<p>most susceptible to disturbance and/or;</p> <ul style="list-style-type: none"> production of vessel management plans associated with activities that require a marine licence. This may include agreed routes and for boats, potential seasonal speed restrictions. 	<p>most susceptible to disturbance and/or;</p> <ul style="list-style-type: none"> production of vessel management plans associated with activities that require a marine licence. This may include agreed routes and for boats, potential seasonal speed restrictions. 		
Cables and pipelines*	<p>No additional management for existing cables and pipelines.</p> <p>Reduce or limit pressures (disturbance) associated with new construction works on sub-tidal areas through effective seasonal and temporal mitigation.</p>	<p>No additional management for existing cables and pipelines.</p> <p>Reduce or limit pressures (disturbance) associated with new construction works on sub-tidal areas through effective seasonal and temporal mitigation.</p>	<p>No additional management for existing cables and pipelines.</p> <p>Reduce or limit pressures (disturbance) associated with new construction works on inter-tidal areas through effective seasonal and temporal mitigation.</p>	<p>No additional management for existing cables and pipelines.</p> <p>Reduce or limit pressures (disturbance) associated with new construction works on inter-tidal areas through effective seasonal and temporal mitigation.</p>
Coastal development - (coastal protection and flood defence)	<p>Reduce or limit pressures (disturbance, loss of prey-supporting habitat) associated with new coastal development or for repair and maintenance of existing defences through effective seasonal and temporal</p>	<p>Reduce or limit pressures (disturbance, loss of prey-supporting habitat) associated with new coastal development or for repair and maintenance of existing defences through effective seasonal and temporal</p>	<p>Reduce or limit pressures (disturbance, loss of prey-supporting habitat) associated with new coastal development or for repair and maintenance of existing defences through effective seasonal and temporal</p>	<p>Reduce or limit pressures (disturbance, loss of prey-supporting habitat) associated with new coastal development or for repair and maintenance of existing defences through effective seasonal and</p>

Activities considered capable of affecting the protected features	Advice to support management			
	Terns (Sandwich, little and common tern)	Common eider	Pink-footed goose	Waders (redshank and lapwing)
	mitigation.	mitigation.	mitigation.	temporal mitigation.
Discharges – industrial, agricultural and sewage	<i>Pressure unlikely to affect these features.</i>	No additional management for agricultural discharges within the Nitrate Vulnerable Zone (NVZ) – <i>existing management in place</i>	No additional management for agricultural discharges within the Nitrate Vulnerable Zone (NVZ) – <i>existing management in place</i>	No additional management for agricultural discharges within the Nitrate Vulnerable Zone (NVZ) – <i>existing management in place</i>
Dredging/ extraction of material* (inc. maintenance dredging and capital dredging)	<p>No additional management for existing maintenance dredging (ports and harbours).</p> <p>Reduce or limit pressures (disturbance, damage of supporting habitat) associated with new capital dredging projects and associated maintenance dredging through appropriate mitigation such as:</p> <ul style="list-style-type: none"> • spatial limitations to avoid damaging supporting habitat within foraging dive ranges of protected features and/or; • seasonal 	<p>No additional management for existing maintenance dredging (ports and harbours).</p> <p>Reduce or limit pressures (disturbance, damage of supporting habitat) associated with new capital dredging projects and associated maintenance dredging through appropriate mitigation such as:</p> <ul style="list-style-type: none"> • spatial limitations to avoid damaging supporting habitat within foraging dive ranges of protected features and/or; • seasonal 	<p>No additional management for existing maintenance dredging (ports and harbours).</p> <p>Reduce or limit pressures (disturbance, damage of supporting habitat) associated with new capital dredging projects and associated maintenance dredging through appropriate mitigation such as:</p> <ul style="list-style-type: none"> • spatial limitations to avoid damaging supporting habitat and/or; • seasonal restrictions. 	<p>No additional management for existing maintenance dredging (ports and harbours).</p> <p>Reduce or limit pressures (disturbance, damage of supporting habitat) associated with new capital dredging projects and associated maintenance dredging through appropriate mitigation such as:</p> <ul style="list-style-type: none"> • spatial limitations to avoid damaging supporting habitat and/or; • seasonal restrictions.

Activities considered capable of affecting the protected features	Advice to support management			
	Terns (Sandwich, little and common tern)	Common eider	Pink-footed goose	Waders (redshank and lapwing)
	restrictions.	restrictions.		
Fishing - demersal mobile/active gear (inc. mechanical trawls and benthic trawls)*	<p>Whilst we have limited understanding about the extent of interactions between benthic fisheries and prey supporting habitat within the site, we recommend that a principal objective of the management of the relevant fisheries should be to ensure that the fishing activity does not cause such disturbance to the benthic habitats that it adversely affects the abundance and availability of prey.</p> <p>Reduce or limit pressures (removal of prey species and abrasion of prey-supporting habitat) associated with fishing that has the potential to damage seabed habitat (in particular, sandeel habitat).</p>	<p>Whilst we have limited understanding about the extent of interactions between benthic fisheries and prey supporting habitat, we recommend that a principal objective of the management of the relevant fisheries should be to ensure that the fishing activity does not cause such damage to the benthic habitats that it adversely affects the availability of prey to bottom-feeding seaducks.</p> <p>The prey of seaducks are benthic species (particularly molluscs but also other marine invertebrates) which are associated with habitats within the site. Consideration of site-based management to avoid adverse impact on prey availability may be appropriate, particularly for</p>	<i>Pressures unlikely to affect this feature.</i>	<i>Pressures unlikely to affect these features.</i>

Activities considered capable of affecting the protected features	Advice to support management			
	Terns (Sandwich, little and common tern)	Common eider	Pink-footed goose	Waders (redshank and lapwing)
		blue mussels.		
Fishing – hydraulic dredge*	<p>Hydraulic dredging has the potential to cause significant disturbance to the sediment habitats that support the prey species of the protected features, particularly for sandeel. We recommend that a principal objective of the management of the relevant fisheries should be to ensure that the fishing activity does not cause such disturbance to the benthic habitats that it adversely affects the abundance and availability of prey.</p> <p>Remove or avoid pressures (removal of prey species and disturbance of prey-supporting habitat) associated with hydraulic fishing that has the potential to damage seabed habitat (in particular, sandeel habitat).</p>	<p>Hydraulic dredging has the potential to cause significant disturbance to the sediment habitats that support the prey species of the protected features. We recommend that a principal objective of the management of the relevant fisheries should be to ensure that the fishing activity does not cause such disturbance to the benthic habitats that it adversely affects the abundance and availability of prey of bottom-feeding eider.</p> <p>Remove or avoid pressures (removal of prey species and disturbance of prey-supporting habitat) associated with hydraulic fishing that has the potential to damage seabed habitat.</p>	<i>Pressures unlikely to affect this feature.</i>	<i>Pressures unlikely to affect these features.</i>

Activities considered capable of affecting the protected features	Advice to support management			
	Terns (Sandwich, little and common tern)	Common eider	Pink-footed goose	Waders (redshank and lapwing)
Fishing – static gear	<i>Pressures unlikely to affect this feature.</i>	Remove or avoid pressures (entanglement) associated with the use of all static nets. Spatial exclusion of static nets in areas identified as being important for eider (as identified from habitat and dive depth preferences) is recommended.	<i>Pressures unlikely to affect this feature.</i>	<i>Pressures unlikely to affect these features.</i>
Fishing – tractor dredging of shellfish	Remove or avoid pressures (disturbance) associated with tractor dredging of shellfish – <i>existing management in place.</i>	Remove or avoid pressures (disturbance and loss of prey) associated with tractor dredging of shellfish - <i>existing management in place.</i>	Remove or avoid pressures (disturbance) associated with tractor dredging of shellfish - <i>existing management in place.</i>	Remove or avoid pressures (disturbance and loss of prey) associated with tractor dredging of shellfish - <i>existing management in place.</i>
Fishing – hand gathering of mussels and oysters	Reduce or limit pressures (disturbance) associated with hand-harvesting of mussels and oysters should be considered.	Reduce or limit pressures (disturbance and loss of prey) associated with hand-harvesting of mussels and oysters should be considered.	Reduce or limit pressures (disturbance) associated with hand-harvesting of mussels and oysters should be considered.	Reduce or limit pressures (disturbance) associated with hand-harvesting of mussels and oysters should be considered.

Activities considered capable of affecting the protected features	Advice to support management			
	Terns (Sandwich, little and common tern)	Common eider	Pink-footed goose	Waders (redshank and lapwing)
Fishing – intertidal (bait digging)	<i>Pressures unlikely to affect these features.</i>	<p>No additional management for bait collecting by foot with the current levels.</p> <p>Reduce or limit pressures (loss of prey) associated with new commercial or non-commercial harvesting of shellfish should be considered.</p>	<p>No additional management for bait collecting by foot with the current levels.</p> <p>Reduce or limit pressures (disturbance) associated with new commercial or non-commercial harvesting of shellfish should be considered.</p>	<p>No additional management for bait collecting by foot with the current levels.</p> <p>Reduce or limit pressures (disturbance, loss of prey) associated with new commercial or non-commercial harvesting of shellfish should be considered.</p>
Fishing – pelagic*	<p>Remove or avoid pressures (removal of key prey species) associated with fishing for sandeels. There is no current targeted sandeel fishery within the SPA, this position should be retained.</p> <p>Pelagic fishing for herring/sprat may occur within or around the SPA. We recommend that a principle objective of the management of the fishery should be ensuring that the fishing activity does not</p>	<i>Pressure unlikely to affect this feature.</i>	<i>Pressure unlikely to affect this feature.</i>	<i>Pressure unlikely to affect these features.</i>

Activities considered capable of affecting the protected features	Advice to support management			
	Terns (Sandwich, little and common tern)	Common eider	Pink-footed goose	Waders (redshank and lapwing)
	prevent or disrupt the availability of prey species for terns, i.e. it should be considered as part of a broader ecosystem-based approach to management of this fishery.			
Marine deposit sites	Reduce or limit pressures (disturbance, smothering of prey supporting habitat, changes in water clarity) associated with new disposal sites within or adjacent to the SPA.	Reduce or limit pressures (disturbance, smothering of prey supporting habitat, changes in water clarity) associated with new disposal sites within or adjacent to the SPA.	<i>Pressure unlikely to affect this features.</i>	<i>Pressure unlikely to affect these features.</i>
Moorings	Reduce or limit pressures (disturbance, risk of pollution) associated with moorings within the SPA. <i>Management in place where no moorings permitted within the estuary itself.</i>			
Ports and harbours	No additional management for established activities at harbours within the SPA. Reduce or limit pressures (disturbance, displacement, loss or damage to prey-supporting habitat) associated with new development proposals or expansion of ports and harbours within or adjacent to the SPA. Appropriate mitigation may include: <ul style="list-style-type: none"> • spatial limitations to avoid damaging supporting habitat of the protected features and/or; • seasonal restrictions during construction to avoid periods when birds are present. 			
Renewable energy – offshore wind	No additional management required for the European Offshore Wind Deployment Centre in Aberdeen Bay providing consented project specific mitigation measures are deployed. Reduce or limit pressures (disturbance, displacement, collision) for any new wind proposals through effective mitigation measures.			

Activities considered capable of affecting the protected features	Advice to support management			
	Terns (Sandwich, little and common tern)	Common eider	Pink-footed goose	Waders (redshank and lapwing)
Seaweed harvesting	<p>Reduce or limit pressures (disturbance) associated with new seaweed harvesting developments.</p> <p>Remove or avoid pressures (disturbance, removal of prey supporting habitat) associated with mechanical harvesting of seaweed (in particular, of kelp).</p>	<p>Reduce or limit pressures (disturbance) associated with new seaweed harvesting developments.</p> <p>Remove or avoid pressures (disturbance, removal of prey supporting habitat) associated with mechanical harvesting of seaweed (in particular, of kelp).</p>	<p>Reduce or limit pressures associated with new seaweed harvesting developments.</p> <p>Remove or avoid pressures (disturbance) associated with mechanical harvesting of seaweed (in particular, of kelp).</p>	<p>Reduce or limit pressures (disturbance) associated with new seaweed harvesting developments.</p> <p>Remove or avoid pressures (disturbance, removal of prey supporting habitat) associated with mechanical harvesting of seaweed (in particular, of kelp).</p>
Tourism & recreation (e.g. sea kayaking, diving, angling, bird watching, walking, jet-skiing, wind surfing, kite surfing)	<p>No additional management for existing recreational activities (includes walking, kayaking, angling, diving) providing the Scottish Marine Wildlife Watching Code (SMWWC) is followed by water-borne recreational users and the Scottish Outdoor Access Code (SOAC) is followed by access takers.</p> <p>Reduce or limit pressures (disturbance) of protected features from jet-skiing and angling, especially in areas</p>	<p>No additional management for existing recreational activities (includes walking, kayaking, angling, diving) providing the SMWWC is followed by water-borne recreational users and the SOAC is followed by access takers.</p> <p>Reduce or limit pressures (disturbance) of eider from jet-skiing, wind surfing and kite surfing.</p> <p>Reduce or limit pressures (disturbance) where an</p>	<p>No additional management for existing recreational activities (includes walking) providing the SOAC is followed by access takers.</p> <p>Reduce or limit pressures (disturbance) where an increase in recreational activities demonstrates there is evidence of impacts at particular locations and/or if there is a major increase in intensity of these pursuits within the SPA.</p>	<p>No additional management for existing recreational activities (includes walking, kayaking, anging) providing the SMWWC is followed by water-borne recreational users and the SOAC is followed by access takers.</p> <p>Reduce or limit pressures (disturbance) of protected features from jet-skiing and angling.</p> <p>Reduce or limit pressures (disturbance) where an</p>

Activities considered capable of affecting the protected features	Advice to support management			
	Terns (Sandwich, little and common tern)	Common eider	Pink-footed goose	Waders (redshank and lapwing)
	<p>close to the ternery.</p> <p>Reduce or limit pressures (disturbance) where an increase in recreational activities demonstrates there is evidence of impacts at particular locations and/or if there is a major increase in intensity of these pursuits within the SPA. There would be potential for some zonation of measures across the site given that breeding terns exhibit behavioural sensitivity to disturbance at nest sites.</p>	<p>increase in recreational activities demonstrates there is evidence of impacts at particular locations and/or if there is a major increase in intensity of these pursuits within the SPA. There would be potential for some zonation of measures across the site.</p>		<p>increase in recreational activities demonstrates there is evidence of impacts at particular locations and/or if there is a major increase in intensity of these pursuits within the SPA. There would be potential for some zonation of measures across the site given that waders exhibit behavioural sensitivity to disturbance.</p>
Wildfowling	Reduce or limit pressures (disturbance) associated with wildfowling.	Reduce or limit pressures (disturbance) associated with wildfowling.	Reduce or limit pressures (quarry mortality and disturbance) associated with wildfowling.	Reduce or limit pressures (disturbance) associated with wildfowling.
Wildlife tours	No additional management for existing wildlife tours providing the Scottish Marine Wildlife Watching Code is followed by Wildlife tour operators. The <u>SMWWC</u> should be	No additional management for existing wildlife tours providing the Scottish Marine Wildlife Watching Code is followed by Wildlife tour operators. The <u>SMWWC</u> should be	<i>Pressure unlikely to affect this feature.</i>	<i>Pressure unlikely to affect these features.</i>

Activities considered capable of affecting the protected features	Advice to support management			
	Terns (Sandwich, little and common tern)	Common eider	Pink-footed goose	Waders (redshank and lapwing)
	<p>followed by water-borne recreational users.</p> <p>Reduce or limit pressures (disturbance) associated with an increase in wildlife tour operators if in the future there is evidence of impacts at particular locations and/or if there is an increase in intensity of these pursuits within the SPA. There would be potential for some zonation of measures across the site given breeding terns exhibit behavioural sensitivity to disturbance at their nest sites.</p>	<p>followed by water-borne recreational users.</p> <p>Reduce or limit pressures (disturbance) associated with an increase in wildlife tour operators if in the future there is evidence of impacts at particular locations and/or if there is an increase in intensity of these pursuits within the SPA. There would be potential for some zonation of measures across the site.</p>		

Table 3. Activities that are considered not likely to affect the protected features (other than insignificantly) ⁵

Activity	Comments
Anchorage & moorings	Beyond pressures associated with the vessel traffic (covered in Table 2), we are not aware of any further pressures that have the potential to cause an adverse effect on the protected features.
Fishing – static gear – Creels (including lobster, crabs and <i>Nephrops</i>).	Fishing using creels is widespread throughout the SPA. Whilst there is the potential for entanglement for eider, the occurrence is thought to be rare and therefore we consider this method poses a low risk to the protected features. Pressures associated with the vessel traffic from this pressure is covered under Table 2.
Fishing – mobile gear – line fishing (including jigging)	Pelagic and bottom-set long-line fisheries are largely restricted to offshore waters and therefore at present pose a low risk to the protected features. Pressures associated with the vessel traffic from this pressure is covered under Table 2.

⁵ Only the specific examples of activities listed in the table have been excluded, rather than the broad activity types. New plans or projects will still need to be considered by the relevant competent authority (see Annex 1 for further details).

8 Research and survey

We recognise that there are still important gaps in our understanding and knowledge of the features of this site. We will identify research and survey projects to inform our understanding of these aspects. The knowledge gaps identified below are not a commitment to undertake this work. However, by highlighting these gaps we hope to inform future discussions with parties interested in undertaking research in this site and/or on these features, to help direct research and improve understanding of monitoring needs. The following list of research and survey needs is not prioritised and is not exhaustive.

- Establish adequate baseline information for supporting habitats and prey species and gain an understanding of which prey items are the most important at a local scale within the SPA for all marine protected features.
- Additional research is required to better understand the relationships between the impact of dredging and benthic trawling on supporting habitats, their ability to support suitable prey and any consequential effect this may have on the protected features. This is particularly relevant to benthic feeding eider.
- Knowledge of turnover of the wintering population and relationships with other protected areas are required to ensure the wider network of sites functions effectively for those non-breeding protected features.
- Better understanding of the interchange between the breeding and wintering eider population at the site and the possible dispersal to other areas.
- Better understanding of the implications of avian flu on the protected features within the SPA and beyond.
- Mapped distribution of high tide roosts of the wader and goose protected features along the SPA's coastline.
- Research required on Sandwich tern and little tern adult diet, as information we have on these species' diets is based on chick diet.
- Support research into the condition of the mussel beds within the site, which has particular relevance for eider.
- Gain a better understanding of the amount of wildfowling occurring within and adjacent to the SPA and assess the potential effects of this on the SPA protected features, particularly on pink-footed geese as a quarry species.
- Quantitative information required on disturbance distances (e.g. alert distance, flight initiation distance) for Sandwich and little terns, on the shore, or while foraging, as well as at their breeding sites.
- Establish a marine bird monitoring programme that informs changes in species populations and distributions at a site and SPA network level, and which may include monitoring of the supporting prey, habitats and processes within the SPA.

Annex 1. The Ythan Estuary, Sands of Forvie and Meikle Loch SPA Conservation Objectives

The box below provides the high-level Conservation Objective statements for the Ythan Estuary, Sands of Forvie and Meikle Loch SPA.

The full Conservation Objectives, which includes site-specific advice and information on the qualifying features that form part of this SPA, are provided in the tables that follow. The site-specific advice and information provides more detail in relation to each of the high level Conservation Objective statements for each feature, e.g. detail on the seasonal timings and what the supporting habitats and prey are for the qualifying features.

Information is also provided below on how minor changes to features should be considered and the influence of environmental change on features, particular in relation to climate change. Temporary impacts on the qualifying features resulting from plans or projects can only be permitted where there is certainty that the features will be able to quickly recover. Further details on the potential for each qualifying feature to recover are described in more detail in Annex 2 '*Factors determining the potential of features to recover*'.

A definition of the terms used is in the Glossary (Annex 3).

Ythan Estuary, Sands of Forvie and Meikle Loch SPA
<p>Qualifying features:</p> <ul style="list-style-type: none"> • Sandwich tern (<i>Sterna sandvicensis</i>) • Common tern (<i>Sterna hirundo</i>) • Little tern (<i>Sterna albifrons</i>) • Pink-footed goose (<i>Anser brachyrhynchus</i>) • Common eider (<i>Somateria mollissima mollissima</i>) • Lapwing (<i>Vanellus vanellus</i>) • Redshank (<i>Tringa tetanus</i>)
<p>The Ythan Estuary, Sands of Forvie and Meikle Loch SPA also supports:</p> <ul style="list-style-type: none"> • Non-breeding waterfowl assemblage
<p>1. To ensure that the qualifying features of the Ythan Estuary, Sands of Forvie and Meikle Loch SPA are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status.</p> <p>2. To ensure that the integrity of the Ythan Estuary, Sands of Forvie and Meikle Loch SPA is restored in the context of environmental changes by meeting objectives 2a, 2b and 2c for each qualifying feature:</p> <p>2a. The populations of the qualifying features are viable components of the site.</p> <p>2b. The distributions of the qualifying features throughout the site are maintained, or where appropriate restored, by avoiding significant disturbance of the species.</p> <p>2c. The supporting habitats and processes relevant to qualifying features and their prey resources are maintained, or where appropriate restored, at the Ythan Estuary, Sands of Forvie and Meikle Loch SPA.</p>

1. To ensure that the qualifying features of the Ythan Estuary, Sands of Forvie and Meikle Loch SPA are in favourable condition and make an appropriate contribution to achieving Favourable Conservation Status.

Achieving FCS is defined in terms of the natural range and population of the species and the extent of habitat necessary for long-term maintenance of populations. There is an important role for all protected sites in the UK in defining, achieving and maintaining FCS for any habitat or species. Achieving FCS requires that each parameter is either stable or increasing, exceeds the relevant reference value and has good prospects of continuing to do so in the foreseeable future (JNCC, 2018). Favourable Conservation Status (FCS) is assessed across the Marine Atlantic Biogeographic Region with individual SPAs and SPA networks contributing to FCS.

The conservation status will be taken as 'favourable' when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats;
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future;
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis;

When carrying out appraisals of plans and projects against these Conservation Objectives, it is not necessary to understand the status of the qualifying features within each individual SPA in this Biogeographic Region. The focus of the appraisal should be to understand whether the integrity of the Ythan Estuary, Sands of Forvie and Meikle Loch SPA would be maintained. If this is the case, then its contribution to FCS across the qualifying features' biogeographic range will be met. Similarly, when determining whether management measures may be required to ensure that the Conservation Objectives for this SPA are achieved, the focus should be on maintaining the contribution that it makes to FCS. Further advice on how these appraisals should be focussed in relation to maintaining site integrity is provided by Conservation Objective 2 (including parts a, b and c). If broader information (status, trends) on the qualifying features is available, it should be used to provide context to the site-based appraisal.

Note '*Appropriate*' within this part of the Conservation Objectives is included to indicate that the contribution to FCS varies from site to site, and feature to feature.

2. To ensure that the integrity of the Ythan Estuary, Sands of Forvie and Meikle Loch SPA is restored in the context of environmental changes by meeting objectives 2a, 2b and 2c for each qualifying feature:

This objective recognises that eider and lapwing are in unfavourable condition at the Ythan Estuary, Sands of Forvie and Meikle Loch SPA and consequently site integrity is compromised.

For Ythan Estuary, Sands of Forvie and Meikle Loch SPA, when carrying out appraisals of plans or projects, the focus of the appraisal should be to understand the impact of the plan or project on site integrity. For qualifying features that are in favourable condition this means maintaining that condition. For eider and lapwing that are in unfavourable condition, it means ensuring that the plan or project does not prevent or reduce the potential for recovery. The expectation is not for the plan or project to restore site integrity. Should the plan or project compromise the ability of the qualifying features to recover (e.g. result in a further decline or accelerate the rate of decline, or prevent a recovery from occurring), then the Ythan Estuary, Sands of Forvie and Meikle Loch SPA will not make an appropriate contribution to achieving FCS across the Atlantic Biogeographic Region. Similarly, when determining whether management measures are required to meet the Conservation Objectives, the focus is on ensuring the conditions are appropriate to support recovery and subsequently restore site integrity. Further advice on how these appraisals should be focussed in relation to site integrity is provided in 2a, b and c.

The non-breeding waterfowl assemblage is not considered further in the Conservation Objectives as each qualifying feature and 'named qualifier' of the assemblage are addressed individually.

Temporary impacts on these objectives resulting from plans or projects can only be permitted where there is a high degree of certainty that the features will be able to quickly recover from the impact and that impacts do not prevent the ability of unfavourable features to fully recover in the long-term.

Environmental changes

This Conservation Objective recognises that the qualifying features are part of a complex, dynamic and multi-dimensional environment. Birds depend on environmental conditions (for example water movement, up-wellings and prevailing weather) which vary over time and space. Consequently, the qualifying features are exposed to a wide range of drivers of change. 'Environmental changes' for the purpose of these Conservation Objectives means any change to the qualifying features reflecting both natural population dynamics and also broader environmental changes (i.e. those related to climate change and environmental variability, management of which is beyond the scope of the SPA). The impact of human activities on the SPA that can be managed will not be considered as part of the broader context of environmental change (i.e. where required they should be managed).

Some site-level changes are natural and are not a direct result of human influences (e.g. population fluctuations arising from factors such as

variable breeding success, weather conditions across the wintering range / shifts, or changes in prey availability resulting from variability in environmental factors processes such as temperature). Changes in the qualifying features' distribution and use of the site, which are brought about by entirely natural drivers, directly or indirectly, are normally considered compatible with the SPA's Conservation Objectives.

There may also be historical human influences that have now ceased but have modified and continue to drive change within the site. It is also recognised that climate change pressures could affect the qualifying features within the site. These changes cannot be prevented, so the Conservation Objectives seek at a site level to take account of them and where possible, improve the qualifying species' resilience to environmental change when considering future plans or projects. The magnitude of the future impacts will depend on the nature, scale, duration and intensity of the activity and the qualifying features tolerance and ability to recover from such an impact.

Additionally, management of human activities at a wider scale (i.e. regional, Scotland, or the area covered by an international agreement such as the OSPAR convention or the AEWA treaty) may also affect the qualifying features associated with this site (either by making a positive contribution or having a negative impact). Wider scale impacts may affect the ability of the qualifying features to recover from site level changes, and therefore additional precaution over the impacts of any future human activities may be necessary.

An assessment of whether a change is natural or anthropogenic, or a combination of both, will need to be looked at on a case-by-case basis.

In relation to Ythan Estuary, Sands of Forvie and Meikle Loch SPA and its qualifying features, the following effects of environmental change (climate change) are relevant. These effects should be taken into account when considering plans and projects as additional pressures may reduce the qualifying features' resilience to climate change, and conversely climate change impacts may start to hinder their ability to recover from human activities.

- **All qualifying features** - Under climate change, sea temperatures are predicted to increase, sea levels will rise and there could be increases in the frequency of stormy conditions. Any of these factors could cause changes in bird abundance and distribution at the SPA due to changes in prey (species, availability and distribution), both in marine waters and in intertidal areas. The Ythan Estuary, Sands of Forvie and Meikle Loch SPA contains large areas of important inter-tidal habitats which many of the qualifying features use. Relative sea level rises at the Ythan Estuary, Sands of Forvie and Meikle Loch SPA are occurring, which could affect the extent, composition and species diversity in these intertidal areas, including habitat such as saltmarsh. It is also possible that climate change may result in effects at their breeding grounds or in other parts of the overall wintering range which could have subsequent effects on their wintering populations and distributions.
- **Terns (*Sandwich, little and common tern*):** Tern populations in the UK are highly susceptible to climatic fluctuations or change (Russell *et al.* 2015). Due to their high reliance on sandeels, tern species are vulnerable to any changes in the distribution and abundance in sandeel populations, which may come about as a result of climate change. Severe weather events can also have consequential effects on breeding terns. Little terns may be affected by sea level rise or increases in storminess as it has been noted that on Ythan Estuary, Sands of Forvie and Meikle Loch SPA where clutches outside the protected ternery have been lost to high tides

or to windblown sand (SNH, 2012). Bad weather with heavy rain and chilling wind can cause chick losses at tern colonies (Everett, 1980). The changing dune system at the Ythan Estuary, Sands of Forvie and Meikle Loch SPA can lead to loss or gain of suitable tern nesting habitat from year to year.

- **Pink-footed geese:** There is some evidence for climate change affecting these species (e.g. Prop *et al.* 2015; Clausen *et al.* 2018), with potential effects on migration and breeding timings, distribution and interactions with other species, although future impacts are unknown.
- **Wader species (lapwing and redshank):** Wintering waders in the UK have shifted their distribution eastward since the mid-1980s, with a shift in mean winter temperature (Boere & Stroud, 2006). Wader species are particularly sensitive to changes in coastal environments as a result of climate change (Maclean *et al.* 2008; Rehfish & Austin, 2006). Annual adult survival rates of lapwings are significantly correlated with winter air temperatures (Peach *et al.* 1994). Macro algal blooms at the Ythan Estuary, Sands of Forvie and Meikle Loch SPA on the estuarine mudflats increase with eutrophication and sunny periods of weather in late summer, which has subsequent effects on the waders prey resource.
- **Common eider:** Rising winter temperatures have been identified as a driver for declines in the mussel stocks that common eider feed on in the Wadden Sea (Nehls *et al.* 2006).

2a. The populations of the qualifying features are viable components of the site.

This objective seeks to specifically protect the qualifying features from **significant** mortality, injury or removal that can lead to a long-term decline of the feature(s) within the site. It protects the features from significant risk of incidental killing and injury from activities both within and outwith the site. Impacts and effects are considered 'significant' where they could result in a permanent or long-term reduction or continued decline in the population and consequently, reduction in the contribution the Ythan Estuary, Sands of Forvie and Meikle Loch SPA makes to the maintenance of the qualifying features in their natural range in the UK. It should be ensured that the qualifying features are protected from anthropogenic pressures that could lead to a significant long-term decline in numbers using the site. Ensuring the capacity of the Ythan Estuary, Sands of Forvie and Meikle Loch SPA to support all the essential behaviours and activities required to support viable populations of the qualifying features in the relevant season(s) are addressed by Conservation Objectives 2b and 2c.

At a site level, the population is considered to be viable if the species can carry out their life cycle functions relevant to the season(s) they are present, irrespective of dependencies such as immigration. In the Ythan Estuary, Sands of Forvie and Meikle Loch SPA, this means that overwinter survival should not significantly decrease for non-breeding birds and birds that have overwintered on this site should have good enough body condition to be able to migrate to their breeding grounds and breed successfully.

When assessing the effects of any plan or project consideration should also be given to whether impacts outwith the SPA could affect achievement of this Conservation Objective. This Conservation Objective is considered to be met if the conditions to support all the species' essential behaviours and activities within the site are in place. This includes:

- avoiding effects within and outwith the site that could prevent or reduce the ability of the populations of qualifying features to recover.
- avoiding effects within and outwith the site that could lead to a permanent reduction in the populations of qualifying features through mortality, injury, or impacts caused by disturbance, displacement, barrier effects or reduction in mobile prey resources.
- maintaining the species' ability to use all areas of importance within the site (to be considered under Conservation Objective 2b)
- maintaining access to, and availability of, supporting habitats and prey within the site (to be considered under Conservation Objective 2c).

Where known, the populations of the qualifying features should be maintained at or above site reference populations, as detailed below. The site reference population may be revised from the baseline at designation where a) there is evidence to show that a population's size has significantly changed as a result of natural factors or management measures and has been stable at or above a new level over a considerable period (generally equivalent to at least one generation length for the given species) and/or b) to reflect any wider strategic objectives for the species (e.g. national or international species action plan). Where there is evidence to show that a qualifying feature has historically been more abundant than the stated minimum target and current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account.

All qualifying features are protected throughout the whole site, throughout the year. This means that irrespective of the season for which they are designated, the qualifying features are protected during both their breeding and non-breeding seasons when using the SPA.

Temporary short-term changes in the populations due to human activity may be considered not to compromise the Conservation Objectives within the site provided it can be demonstrated that the populations of any affected qualifying features can fully recover. Factors limiting the recovery of the qualifying features include: the average generation times, population growth rates, availability of prey and the timing and duration of the activity around vulnerable stages of their life cycles such as during moulting or chick-rearing period.

Direct mortality can arise from: collision (above and underwater); entanglement (incidental bycatch); predation, flooding events, disease, and pollution. Indirect mortality can arise from loss of or damage to prey or prey-supporting habitats (e.g. through harvesting; physical removal of or damage to seabed; nutrient enrichment; changes to water temperature, salinity, or flows; introduction of invasive non-native species (INNS); pollution; modification of intertidal or coastal habitat). Indirect mortality can arise from reduced ability to capture or access prey arising from e.g. increased water turbidity or displacement from foraging areas.

For all species, the site-specific information includes a reference population that is considered the most appropriate for assessments of plans and projects. Where this is based on the citation population at classification or recent surveys, the reference population is rounded using standard procedures (Stroud *et al.* 2001). Where contemporary data exists this should be taken into account.

Feature	Site-specific advice	Site-specific information
Sandwich tern	<p>Maintain the population of breeding Sandwich tern at a stable or increasing trend relative to the site reference population.</p> <p>and</p> <p>Ensure breeding Sandwich terns are not at significant risk from injury or mortality.</p>	<p>The site reference population for Sandwich tern at the Ythan Estuary, Sands of Forvie and Meikle Loch SPA is 600 pairs (5 year mean 1989-1993). The most recent site condition monitoring count showed that this population is stable (642 pairs, 4 year mean between 2009-2012), with the latest annual count being 1,031 nests in 2022 and most recent 5-year mean (2018-2022) being around 990 pairs (Short, 2022). Sandwich terns in the UK as a whole have remained stable over the period 1986-2019 (JNCC, 2021).</p>
Little tern	<p>Maintain the population of breeding little tern at a stable or increasing trend relative to the site reference population.</p> <p>and</p> <p>Ensure breeding little terns are not at significant risk from injury or mortality.</p>	<p>The site reference population for little tern at the Ythan Estuary, Sands of Forvie and Meikle Loch SPA is 26 pairs (5 year mean 1989-1993). The latest site condition monitoring count showed this population is stable at around 31 pairs (5 year mean 2008-2012). The most recent annual count was 10 nests in 2022, with the latest 5-year mean (2018-2022) being 24 pairs (Short, 2022). From 2015-2020 little terns failed to produce any fledged young in five of the six years. It is thought the cause of this failure was related to both cold and wet weather combined with predation from other bird species. However, in 2022 17 little terns fledged. Little terns in the UK have decreased by 42% over the period 1986-2019 (JNCC, 2021).</p>
Common tern	<p>Maintain the population of breeding common tern at a stable or increasing trend relative to the site reference population.</p> <p>and</p> <p>Ensure breeding common terns are not at significant risk from injury or mortality.</p>	<p>The site reference population for common tern at Ythan Estuary, Sands of Forvie and Meikle Loch SPA is 144 pairs (5 year mean 1989-1993). The latest site condition monitoring count showed this population had declined to around 25 pairs (highest estimate between 2003-2012). However, the most recent count of common terns was 107 nests in 2022 and the latest 5-year average was 206 nests (2018-2022) (Short, 2022). Terns have fluctuated greatly over the years.</p> <p>Common tern numbers in the UK as a whole have remained largely stable (1986-2019), although the Scottish trend shows a decline of around 50% in 2019 from the baseline 1986 (JNCC, 2021).</p>

<p>Pink-footed goose</p>	<p>Maintain the population of non-breeding pink-footed goose at a stable or increasing trend relative to the site reference population.</p> <p>and</p> <p>Ensure non-breeding pink-footed geese can move safely between the site and important areas of functionally linked land outwith the site.</p>	<p>The site reference population for pink-footed goose at the Ythan Estuary, Sands of Forvie and Meikle Loch SPA is 17, 200 individuals (5 year mean of peak 1988/89 to 1992/93), representing 9% of the Eastern Greenland/Iceland/UK biogeographic overwintering population. The latest site condition monitoring counts of pink-footed geese at this SPA showed the numbers have increased slightly to 18,200 individuals (mean from 2008/09-2012). The UK-wide trend shows that wintering pink-footed geese have increased by 400% between 1980/81-2016/17 (Frost <i>et al.</i> 2018). Regular goose counts take place for pink-footed geese as part of the Goose and Swan Monitoring Programme (Brides <i>et al.</i> 2019).</p> <p>Pink-footed geese are mobile species which migrate on a daily basis between feeding grounds and roost sites. Adjacent fields (outwith the Ythan Estuary, Sands of Forvie and Meikle Loch SPA), within the catchment of the Ythan are used by pink-footed geese for important wintering foraging. When assessing the effects of any plan or project consideration should therefore also be given to whether impacts on the population whilst outwith the SPA could affect achievement of this Conservation Objective. Maintaining safe connectivity between these sites is important to ensure utilisation of the most optimal habitats. Barriers to movement may reduce the usable habitat for this species and cause the use of sub-optimal foraging or roosting areas.</p>
<p>Common eider</p>	<p>Ensure the population of eider has the ability to recover to the site reference population.</p> <p>and</p> <p>Ensure eider are not at significant risk from injury or mortality.</p> <p>and</p> <p>Ensure eider can move safely between the site and other functionally linked marine areas outwith the site.</p>	<p>The site reference population for non-breeding eiders at Ythan Estuary, Sands of Forvie and Meikle Loch SPA is 1860 individuals (1998 citation), representing around 2% of the GB population. The most recent site condition monitoring assessment showed that this number has decreased to 967 individuals (mean value between 2015-2020). This local decline reflects a wider decline in eider numbers in both Scotland and the UK, with this species experiencing a decline of around 23% since at least 1980/81 (Frost <i>et al.</i> 2018).</p> <p>Some of the non-breeding eider will contribute to the breeding population of eider within the SPA. Therefore, when assessing the effects of any plan or project consideration should also be given to whether impacts on the breeding population of eiders in the SPA could affect achievement of this Conservation Objective.</p> <p>Eiders may use other waters outwith the SPA during their wintering period. Maintaining safe connectivity between these functionally linked sites is important.</p>

		<p>When assessing the effects of any plan or project consideration should therefore also be given to whether impacts on the population whilst outwith the SPA could affect achievement of this Conservation Objective.</p> <p>Reasons for the decline in the wintering population of eiders at Ythan Estuary, Sands of Forvie and Meikle Loch SPA are not fully understood. Pressures within the breeding season include predation and recreational disturbance (mainly from walkers and dogs). Pressures within the non-breeding period can have a subsequent effect on the following breeding season. Should eiders not be able to maintain good body condition over the winter period, they may choose to skip breeding. The condition of the main prey resource for eider, blue mussels, within the SPA is not known, but effects on prey resources within the SPA may be contributing towards a decline in both the wintering and breeding populations of eider.</p>
Northern lapwing	<p>Ensure the population of non-breeding lapwing has the ability to recover to the site reference population.</p> <p>and</p> <p>Ensure lapwing can move safely between the site and important areas of functionally linked land outwith the site.</p>	<p>The site reference population for lapwing at the Ythan Estuary, Sands of Forvie and Meikle Loch SPA is 2542 individuals (winter mean peak from 1991-1996), representing 0.2% of the GB wintering population. The latest site condition monitoring for lapwing at this SPA was a mean of 2677 individuals (mean of peak 2008-2012). However, more recent counts have shown a distinct decrease of lapwing at the site with an average of 1228 individuals counted between 2015-2019. The UK-wide trend shows that lapwing numbers have increased overall in their long-term trend by around 223% between 1980/81-2016/17, though their short-term trend also shows a 23% decline (2005/06-2016/17) (Frost <i>et al.</i> 2018).</p> <p>Lapwing are mobile species which migrate on a daily basis between feeding grounds and roost sites. Adjacent fields (outwith the Ythan Estuary, Sands of Forvie and Meikle Loch SPA), are used by lapwing for important wintering foraging. When assessing the effects of any plan or project consideration should therefore also be given to whether impacts on the population whilst outwith the SPA could affect achievement of this Conservation Objective. Maintaining safe connectivity between these sites is important to ensure utilisation of the most optimal habitats.</p> <p>Reasons for the decline at the SPA are not fully understood but may relate to disturbance due to recreation or changes in the food supply outwith the site. Pressures in their breeding season outwith the SPA may also be having a</p>

		subsequent effect on their wintering populations.
Common redshank	Maintain the population of non-breeding redshank at a stable or increasing trend relative to the site reference population.	The site reference population for redshank at the Ythan Estuary, Sands of Forvie and Meikle Loch SPA is 1149 individuals (mean of peak between 1993/94-1997/98), representing 1% of the GB wintering population (at time of 1998 citation). The latest site condition monitoring shows that redshank numbers have remained stable with 1671 being the 5 year average from 2008-2012. The most recent counts demonstrate the population has remained stable with 1743 counted (5-year mean 2015-2019). The UK-wide trend shows that redshank numbers have remained relatively stable (around 9% decrease) in their long-term (1980/81-2016/17), but have shown a short-term (2005/06-2016/17) decline of 13% (Frost <i>et al.</i> 2018).

2b. The distribution of the qualifying features is maintained, or where appropriate restored, throughout the site by avoiding significant disturbance of the qualifying features.

This objective seeks to ensure that the qualifying features can continue to use and access all areas within the Ythan Estuary, Sands of Forvie and Meikle Loch SPA used for breeding, feeding, moulting, roosting, loafing, shelter and other maintenance activities. This objective also recognises however, that the populations of wintering lapwing and eider using the Ythan Estuary, Sands of Forvie and Meikle Loch SPA are in unfavourable condition and that this may, in part, be due to disturbance at the site causing declines at the SPA.

Changes in the distribution of the qualifying features are most likely to be brought about through disturbance, therefore this objective relates to avoiding significant disturbance. Disturbance associated with human activity may take a variety of forms including: noise, light, sound, vibration, trampling, presence of people, animals and structures, as well as displacement and barrier effects on the species. The type of disturbance, its duration and the area over which the qualifying features are likely to be affected are important considerations in any appraisal of disturbance. Changes in distribution may also result from shifts in prey distributions; this is considered under objective 2c. Changes in distribution may also result from shifting habitat types (for example mobile dune systems), which is considered under objective 2 in environmental change.

Disturbance can, for example, result in changes to feeding or roosting behaviour, increased energy expenditure due to increased time spent moving to avoid stressors, abandonment of nest sites and desertion of supporting habitat (both within or outside the protected area where appropriate). This may affect successful chick rearing in the subsequent breeding season (related to poor winter condition of adult birds), feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance may also lead to risk of predation of eggs or chicks for those breeding qualifying species such as terns.

'Significant disturbance' should be interpreted to mean disturbance that affects the integrity of the site through alteration of the distribution of the qualifying features such that recovery cannot be expected or effects can be considered long term. It is expected that significant disturbance will lead to more than a transient effect on the distribution of the qualifying features. It may result in the following types of effect:

- Contributes to the long-term decline in the use of the site by the qualifying features.
- Changes to the distribution of the qualifying features on a continuing or sustained basis.
- Changes to the qualifying features behaviour such that it reduces the ability of the species to survive, breed or rear their young.

There are two main ways in which the qualifying features' continued access to suitable resources could be restricted and distribution affected and this is where assessments should be focussed:

1. Large scale physical barriers, or;
2. Significant disturbance which alters their distribution within the site or disrupts important behaviours.

Temporary short-term disturbances may be considered not to compromise the Conservation Objectives within the site provided it can be demonstrated that the population can fully recover with a high degree of certainty. Factors limiting the recovery of the qualifying features include the timing, frequency and duration of the activity around vulnerable stages of their life cycle such as during moulting or chick-feeding period.

All qualifying features are protected throughout the whole site, throughout the year. Some locations within the Ythan Estuary, Sands of Forvie and Meikle Loch SPA will be more, or less, important than others for individual species. Distributions within the site may also change over time in response to a range of abiotic and biotic factors (e.g. changes in abundance or quality of prey resources at particular locations, numbers of each qualifying feature within the site as a whole, seasonal fluctuations or trends in prevailing weather conditions etc.). In some cases detailed bespoke surveys of bird numbers and distributions, to determine qualifying features' current usage of particular locations within a proposals area of influence, may be required to complete the necessary assessments.

Direct displacement/redistribution of the qualifying features can arise from: barriers to movement to and between foraging and breeding or roosting locations; and visual disturbance (e.g. associated with marine or terrestrial activities). Indirect displacement/redistribution can arise from loss of or damage to prey or prey-supporting habitats (e.g. through harvesting; physical removal of or damage to seabed; nutrient enrichment; changes to water temperature, salinity, or flows; introduction of invasive non-native species; predatory mammals; pollution (e.g. light, noise, chemical)).

For breeding terns: Disturbance to foraging birds may reduce the time spent feeding or cause them to move to different areas that are less energetically profitable. Disturbance that creates an avoidance response or disrupts/reduces incubation, chick-rearing, foraging or resting behaviour can also put increased energetic demands on birds during an already energetically expensive season. Ensuring safe movement within and between the breeding colony and those areas used for foraging, roosting and other maintenance behaviours (see also 2c) is important to meet the energetic demands required to achieve or maintain body condition needed to support migration and successful breeding and for subsequent winter survival,. Barriers to movement may reduce access to preferred foraging habitat and cause sub-optimal foraging.

For all wader and waterfowl qualifying features: Disturbance to foraging birds may reduce the time spent feeding or cause them to move to different areas that are less energetically profitable. Disturbance that creates an avoidance response or disrupts/reduces roosting behaviour can also put increased energetic demands on birds. Ensuring safe movement within and between areas used for foraging, roosting and other maintenance behaviours (see also 2c) is important to meet the energetic demands required for winter survival and to achieve or maintain body condition needed to support subsequent migration and successful breeding. Barriers to movement may reduce access to preferred foraging habitat and cause sub-optimal foraging.

Feature	Site-specific advice	Site-specific information
Sandwich tern	<p>Ensure Sandwich tern continue to have access to and can utilise all optimal habitats suitable for all relevant aspects of their life cycle associated with the site.</p> <p>and</p> <p>Avoid significant disturbance to Sandwich tern and ensure individuals can move safely between these areas within the site.</p>	<p>Sandwich terns are a migratory species, moving from their Scottish breeding grounds to their wintering grounds around the coasts of Central Asia, Africa and South America. Their main breeding season at Ythan Estuary, Sands of Forvie and Meikle Loch SPA is from mid-March to mid-August, but are still present along the coast at Forvie into September.</p> <p>Sandwich terns prefer to nest on sandy substrate in dunes or in other vegetated habitats (Eglington & Perrow, 2014), or will nest on raised, open un-vegetated sand, gravel, mud or bare coral substrates (del Hoyo <i>et al.</i> 1996). At Ythan Estuary, Sands of Forvie and Meikle Loch SPA they are known to nest amongst the black-headed gull colony among the marram tussocks in the dunes, near the mouth of the estuary.</p> <p>At the Ythan Estuary, Sands of Forvie and Meikle Loch SPA, Sandwich terns will use marine waters along the coastline, predominantly those waters stretching from Aberdeen Bay to Cruden Bay. Breeding Sandwich terns typically forage in inshore waters, with a mean maximum foraging range of 34+/- 23km being recorded, though they may forage up to 80km (Woodward <i>et al.</i> 2019). Sandwich terns have been observed foraging in waters up to 50m deep (Steinen, 2006), though more typical offshore feeding areas are within depths of <15m deep (Perrow <i>et al.</i> 2011). Key habitats for Sandwich terns include inshore shallow marine waters such as bays, inlets and outflows, gullies, shoals, reefs and sandbanks as well as open waters (Eglington & Perrow, 2014). Sandwich terns may snatch at prey from the sea surface as well as being able to fully plunge and immerse themselves to capture prey, initiated from a height of up to 40m (Eglington & Perrow, 2014). Whilst dive depths are not well known it is thought to be around 1.5m below to surface (Eglington & Perrow, 2014), and tend only to last a few seconds.</p>

<p>Little tern</p>	<p>Ensure little tern continue to have access to and can utilise all optimal habitats suitable for all relevant aspects of their life cycle associated with the site.</p> <p>and</p> <p>Avoid significant disturbance to little tern and ensure individuals can move safely between these areas within the site.</p>	<p>Little terns are migratory, moving from their breeding grounds in Scotland to their wintering grounds in Western and South Africa. They are present at Ythan Estuary, Sands of Forvie and Meikle Loch SPA for their breeding season from mid-April to the end of August.</p> <p>Little terns prefer linear strips of un-vegetated (less than 15%) bare shingle, shell beach or sand to nest on, with nests being just above the normal tide or flood limits. They may also nest on dry mudflats in grassy areas (BirdLife International, 2020). At the Ythan Estuary, Sands of Forvie and Meikle Loch SPA typically the preferred areas for little tern nesting are on the foreshore and raised beach pebbles which have been exposed within the mobile dune complex north of the Ythan Estuary. The little terns will nest alongside other tern species such as Arctic terns.</p> <p>In the breeding period they can forage in both freshwater and marine waters. At Ythan Estuary, Sands of Forvie and Meikle Loch SPA no freshwater locations within the SPA are used, but little terns feed immediately offshore to their colony, encompassing coastal waters between Balmedie and Collieston. Breeding little terns forage in shallow waters, less than 1m deep, in close proximity to their colonies, typically within 2.5km seaward and 4km along the shoreline (Parsons <i>et al.</i> 2015), with a maximum range of 5km (Woodward <i>et al.</i> 2019). Some foraging may occur right in the breaking shoreline (Davies 1981; Allcorn <i>et al.</i> 2003). They often feed over the advancing tideline but can also forage in brackish lagoons and saltmarsh creeks (BirdLife International, 2020). Little terns feed singly or in small flocks, sometimes in mixed flocks with other terns (Snow & Perrins, 1998). Little terns tends to forage from a height of 4-8m and will plunge dive from a hover and will dip into the water or partly immerse to catch prey at the water surface (Dunnet <i>et al.</i> 1990; Cabot & Nisbet, 2013).</p>
<p>Common tern</p>	<p>Ensure common tern continue to have access to and can utilise all optimal habitats suitable for all relevant aspects of their life cycle associated with the site.</p> <p>and</p>	<p>Common terns are migratory, moving from their breeding grounds in the Ythan Estuary, Sands of Forvie and Meikle Loch SPA and their wintering grounds along the west coast of tropical Africa. They are present at the Ythan Estuary, Sands of Forvie and Meikle Loch SPA between mid-April to mid-September.</p> <p>Common terns prefer flat rock surfaces or open shingle and sand on upper beaches or vegetated inter-dune areas in which to nest (Snow & Perrins, 1998). At Ythan Estuary, Sands of Forvie and Meikle Loch SPA common terns nest among</p>

	<p>Avoid significant disturbance to common tern and ensure individuals can move safely between these areas within the site.</p>	<p>marram tussocks and bare sand and gravel, near the mouth of the estuary. Common terns at this SPA prefer to nest within the black-headed gull colony.</p> <p>Common terns forage over the open sea, in nearshore waters and along edges of sandy or rocky shores, tidal flats, over tide rips or drift lines, and may also forage within infralittoral reef kelp beds (Eglington & Perrow, 2014; Kelly, 2005). They may switch between foraging between freshwater and marine environments depending on the conditions. Their mean maximum foraging range in the breeding period is 18+/-8.9km (Woodward <i>et al.</i> 2019), though distances of up to 37km have been recorded. Common terns have been known to kleptoparasitise, stealing fish from Arctic terns, or other common terns. Common terns will plunge dive from around 1-6m and may dip under the surface to catch prey, though will not completely submerge (Eglington & Perrow, 2014).</p>
Pink-footed goose	<p>Ensure pink-footed geese continue to have access to and can utilise all optimal habitats suitable for all relevant aspects of their life cycle associated with the site.</p> <p>and</p> <p>Avoid significant disturbance to pink-footed and ensure individuals can move safely between these areas within the site.</p>	<p>Pink-footed geese migrate from their breeding grounds in Iceland or Greenland to winter within the UK, including on estuaries such as the Ythan Estuary, Sands of Forvie and Meikle Loch SPA. Pink-footed geese arrive at the SPA in September and depart in April. There is considerable movement through the site in autumn and spring with the Ythan estuary used as an important staging ground for birds wintering further south and east, as well as a wintering ground and refuge from cold weather events. Numbers of geese peak in the late winter/early spring period.</p> <p>Pink-footed geese roost at the Ythan Estuary, Sands of Forvie and Meikle Loch SPA on inter-tidal estuarine areas throughout the autumn and winter. Important roost site locations within the SPA include the upper Ythan estuary, where the majority of the pink-footed geese roost, as well as on Meikle Loch and Little Loch. A few birds occasionally roost on the small lochs within Forvie. The roost site location may depend upon the level of disturbance present within the season, including disturbance from wildfowling. Geese may also use areas of saltmarsh (Kear 2005) in estuaries (del Hoyo <i>et al.</i> 1992) and on flat agricultural land (del Hoyo <i>et al.</i> 1992). In Scotland, favoured winter daytime roosting sites include estuarine mudflats, lochs and reservoirs (Madge & Burn, 1988). The pink-footed geese will also use parts of the SPA to forage, particularly on the upper estuary.</p>
Common eider	<p>Ensure eider continue to have access to and can utilise all optimal</p>	<p>Eiders are present throughout the year at the Ythan Estuary, Sands of Forvie and Meikle Loch SPA. Their non-breeding season is from September to mid-April, with</p>

	<p>habitats suitable for all relevant aspects of their life cycle associated with the site.</p> <p>and</p> <p>Avoid significant disturbance to eider and ensure individuals can move safely between these areas within the site.</p>	<p>their flightless moult period being from July to mid-September.</p> <p>In the non-breeding season, eiders use shallow, sheltered bays at the Ythan Estuary, Sands of Forvie and Meikle Loch SPA for foraging, moulting and roosting. Eiders prefer to moult in sheltered waters free from disturbance (Waltho & Coulson, 2015). Foraging is largely restricted to waters less than 10m deep (Woodward & Humphreys, 2018), although dive depths of 60m have been identified when in pursuit of prey (Waltho & Coulson, 2015). Roost locations are not known within the SPA but may include offshore locations as well as ashore when sheltering from prevailing weather (Cramp & Simmons, 2004). In the Ythan Estuary, Sands of Forvie and Meikle Loch SPA eiders foraging locations will include the mussel beds in the lower part of the estuary.</p>
Northern lapwing	<p>Ensure lapwing continue to have access to and can utilise all optimal habitats suitable for all relevant aspects of their life cycle associated with the site.</p> <p>and</p> <p>Avoid significant disturbance to lapwing and ensure individuals can move safely between these areas within the site.</p>	<p>Lapwings in Scotland are partially migratory with some non-breeding birds being from the Scottish breeding population and others being migrants from Fennoscandia. Lapwings are present at the Ythan Estuary, Sands of Forvie and Meikle Loch SPA during their non-breeding season from August to March. There are a few locally breeding lapwing in neighbouring fields which may (in very small numbers) contribute to the wintering population.</p> <p>Lapwing's preferred roosting habitats within the Ythan Estuary, Sands of Forvie and Meikle Loch SPA are predominantly on the estuary, on mud and sand, shingle and saltmarsh.</p>
Common redshank	<p>Ensure redshank continue to have access to and can utilise all optimal habitats suitable for all relevant aspects of their life cycle associated with the site.</p> <p>and</p> <p>Avoid significant disturbance to redshank and ensure individuals can move safely between these areas</p>	<p>Redshank have their non-breeding period from August to April at the Ythan Estuary, Sands of Forvie and Meikle Loch SPA. Most redshank wintering at Ythan Estuary, Sands of Forvie and Meikle Loch SPA will be Icelandic breeding birds, with a small proportion from Scandinavian and UK breeding populations. A small number of redshank will be present at the Ythan Estuary, Sands of Forvie and Meikle Loch SPA throughout the year.</p> <p>At the Ythan Estuary, Sands of Forvie and Meikle Loch SPA important feeding and roosting areas for redshank are on the estuarine mudflats, with high tide roosts on adjacent shingle areas. If the mudflats are consumed with macro algal blooms due to eutrophication, these areas are less suitable for redshank foraging at Ythan</p>

	within the site.	Estuary, Sands of Forvie and Meikle Loch SPA. In winter redshank use the coast extensively, occupying rocky, muddy and sandy beaches, saltmarshes, tidal mudflats, saline and freshwater coastal lagoons, and tidal estuaries (del Hoyo <i>et al.</i> 1996).
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2c. The supporting habitats and processes relevant to the qualifying features and their prey/food resources are maintained or where appropriate, restored at the Ythan Estuary, Sands of Forvie and Meikle Loch SPA.

This objective seeks to restore the current extent, quality and distribution of supporting habitats within the site as well as ensure a sufficient food supply within the site. It also recognises however, that the populations of wintering lapwing and eider using the Ythan Estuary, Sands of Forvie and Meikle Loch SPA are in unfavourable condition and that this may, in part, be due to a reduction in prey causing declines at the SPA.

The qualifying features require suitable habitat for breeding (tern species), shelter, roosting, foraging, loafing, moulting and other maintenance activities. The variety, quality, abundance and availability of food resources on which the qualifying features depend is important for ensuring adult fitness, survival and breeding success (including for over-wintering species). The supply of food resources is supported by environmental processes.

In the marine environment, supporting habitats refer to the characteristics of the seabed and water column relevant to their use by the qualifying features. Supporting processes relates to wider oceanographic processes such as up-wellings, tidal flows, hydrological movements which may be necessary for the habitat, and thus affects nutrient cycling and prey distribution.

In the terrestrial environment, supporting habitats refer to the characteristics of the intertidal, shore, mudflat and dune areas relevant to their use by the qualifying features. Supporting processes relates to wider processes such as wind affecting dune formation, nutrient movements flowing into and within the SPA, the hydrology of water across the mudflats, and factors affecting vegetation formation, all of which will influence the habitat types and prey distribution available for the qualifying features.

Maintenance of prey species and their supporting habitats is important to maintain the conditions required to support the qualifying features populations.

Temporary short-term changes in supporting habitat and/or food resources due to human activity may be considered not to compromise the Conservation Objectives within the site provided it can be demonstrated with a high degree of certainty that the populations of any affected qualifying features can fully recover. The species-specific information includes a summary of available information on food resources and where known, the distribution of the key supporting habitats and associated processes within the Ythan Estuary, Sands of Forvie and Meikle Loch SPA.

The overall water body condition status relevant to Ythan Estuary, Sands of Forvie and Meikle Loch SPA was assessed as “High” (in 2020) for the majority of the marine waters (Cruden Aby to the Don Estuary), with a section closer to Aberdeen (Don Estuary to Souter Head, Aberdeen) being assessed as “Good”. The Ythan Estuary section was assessed as “Moderate” water quality⁶. Meikle Loch was not assessed in this process. The assessment includes consideration of water chemistry, pollutants, the physical condition of the water body, plant and animal communities, including plankton, and the risk from invasive non-native species.

There is currently insufficient information to provide quantitative advice on the environmental processes associated with the supporting habitats and prey of the qualifying features at Ythan Estuary, Sands of Forvie and Meikle Loch SPA.

Feature	Site-specific advice	Site-specific information
Sandwich tern	<p>Maintain the extent and distribution of the supporting habitats for Sandwich tern within the site.</p> <p>and</p> <p>Maintain the variety and abundance of food resources and the condition of supporting habitats and associated processes.</p> <p>and</p> <p>Existing water quality should be maintained and any increase in nutrients, turbidity or contaminants where this could reduce supporting habitats and/or prey, should be avoided.</p>	<p>Sandwich terns require suitable habitat for breeding, foraging, bathing, and other maintenance activities within this SPA. Sandwich terns require suitable habitat for nesting such as sandy substrates, dunes, or other bare substrates. Sandwich terns forage in nearshore waters, such as shallow bays, inlets and outflows, gullies, shoals, reefs and sandbanks, as well as open water (Eglington & Perrow, 2014). As with other tern species, they may forage within infralittoral reef kelp beds (Kelly, 2005).</p> <p>Sandwich terns feed on a variety of marine prey, including: larval fish, sandeels, clupeids, gadoids as well as invertebrates such as squid, shrimp, crustaceans. Other prey items such as insects, worms and nestlings from other shorebirds have also been recorded as prey items (Eglington & Perrow, 2014). Adult birds increase the prey size item throughout the breeding season, as the chick grows and develops with sizes ranging from 1cm-25cm (Eglington & Perrow, 2014).</p> <p>The key supporting processes for Sandwich tern within the marine environment at Ythan Estuary, Sands of Forvie and Meikle Loch SPA are water quality (nutrients and turbidity), tidal cycles, and water flow. As with the other tern species, tides are important for Sandwich terns with higher fishing success and increased diving rates being noted during low tide, when the water is shallower and thus fish are more easily available (Eglington & Perrow, 2014). Sandwich terns will also preferentially feed during a flooding tidal state, presumably due to these tides being favourable for concentrating shoaling fish in inshore waters (Eglington & Perrow, 2014).</p>

⁶ <https://www.sepa.org.uk/data-visualisation/water-classification-hub/>

		<p>Observations of Sandwich terns feeding at Ythan estuary also showed that wind speed and wave amplitude influences capture rate, with higher wind speed and larger wave amplitude decreasing capture rates as the terns find it more difficult to locate their prey (Taylor, 1983). Sandwich terns appear to favour water with sandy bottoms (Cabot & Nisbet, 2013). The edges of gullies and fronts are likely to be especially important (Stienen, 2006), probably because stronger currents increase the availability of prey in these areas (Eglington & Perrow, 2014).</p> <p>Supporting processes within the terrestrial environment at Ythan Estuary, Sands of Forvie and Meikle Loch SPA are not well understood but will relate to those processes that affect the formation and suitability of breeding habitat for Sandwich terns.</p>
Little tern	<p>Maintain the extent and distribution of the supporting habitats for little tern within the site.</p> <p>and</p> <p>Maintain the variety and abundance of food resources and the condition of supporting habitats and associated processes.</p> <p>and</p> <p>Existing water quality should be maintained and any increase in nutrients, turbidity or contaminants where this could reduce supporting habitats and/or prey, should be avoided.</p>	<p>Little terns require suitable habitat for breeding, foraging, bathing, and other maintenance activities within this SPA. Little terns will require suitable habitat for nesting such as unvegetated bare shingle, shell beach or sand. They may also nest on dry mudflats in grassy areas. Little terns forage in nearshore, shallow waters close to their breeding colony (Parsons <i>et al.</i> 2015), preferring channels and lagoons for foraging, rather than deeper marine habitats (Bertolero <i>et al.</i> 2005). They often feed over the advancing tideline but also forage in brackish lagoons and saltmarsh creeks (BirdLife International, 2020).</p> <p>Little terns predominantly prey on small fish (marine and freshwater) including sandeels, roach, rudd, carp, perch, herring and sprat, as well as invertebrates such as shrimps, crustaceans (usually 3-6cm long), insects, annelid worms and molluscs (del Hoyo <i>et al.</i> 1996). Little terns tends to forage from a height of 4-8m and will plunge dive from a hover and will dip into the water or partly immerse to catch prey at the water surface (Cabot & Nisbet, 2013). Full immersion is not thought to take place in little terns and it has been proposed that most prey are within 30cm from the surface (Eglington & Perrow, 2014).</p> <p>They key supporting processes for little tern at Ythan Estuary, Sands of Forvie and Meikle Loch SPA within the marine environment are water quality (nutrients and turbidity), tidal cycles, and water flow. Little Terns have shown to preferentially feed in entrance channels and main lagoon channels with strong currents (Paiva <i>et al.</i></p>

		<p>2007). Areas of strong currents may increase prey availability for them rather than deeper marine habitats (Eglington & Perrow, 2014). Patterns of foraging may be related to tidal patterns (Eglington & Perrow, 2014), with little terns forage preferentially at low tide as more prey becomes available (Paiva <i>et al.</i> 2007). The foraging success of little terns is affected by water turbidity (Brenninkmeijer <i>et al.</i> 2002), although evidence is conflicting on this. Some studies have shown that they avoid foraging in areas where turbidity is increased as a result of shipping traffic (Pavia <i>et al.</i> 2007). Whereas others have noted that turbid waters may be an essential prerequisite for this shallow diving species, as it brings their small fish prey closer to the surface where they can be reached (Eglington & Perrow, 2014). Perrow <i>et al.</i> (2008) found a clear relationship between greater turbidity and increased fish catches, which was attributed to fish moving closer to the surface to feed amongst the plankton. Wave height is also known to affect little tern foraging. At high wave heights, little terns concentrate their activity in the surf line closer to the colony (Howe, 2003).</p> <p>Supporting processes within the terrestrial environment at Ythan Estuary, Sands of Forvie and Meikle Loch SPA are not well understood but will relate to those processes that affect the formation and suitability of breeding habitat for little tern.</p>
Common tern	<p>Maintain the extent and distribution of the supporting habitats for common tern within the site.</p> <p>and</p> <p>Maintain the variety and abundance of food resources and the condition of supporting habitats and associated processes.</p> <p>and</p> <p>Existing water quality should be maintained and any increase in</p>	<p>Common terns require suitable habitat for breeding, foraging, bathing, and other maintenance activities within this SPA. Common terns forage over the open sea, in nearshore waters and along edges of sandy or rocky shores, tidal flats, over tide rips or drift lines, and may also forage within infralittoral reef kelp beds (Eglington & Perrow, 2014; Kelly, 2005). They may switch between foraging between freshwater and marine environments depending on the conditions.</p> <p>Common terns predominantly prey on marine fish, especially sandeels, clupeids (especially herring and sprat), whiting, saithe, as well as crustaceans (especially planktonic species such as prawn and shrimp), molluscs (e.g. small squid), and insects (e.g. Chironomidae) (del Hoyo <i>et al.</i> 1992). Fish prey taken are typically between 5-15cm long. During the chick-rearing period the adults can only normally carry back one fish at a time. Adult terns will continue to feed their chicks a short period of time after they have fledged and the fledged chicks will accompany the</p>

	<p>nutrients, turbidity or contaminants where this could reduce supporting habitats and/or prey, should be avoided.</p>	<p>adults on foraging trips. Common terns have been known to kleptoparasitise, stealing fish from Arctic terns, or other common terns. Common terns will plunge dive from around 1-6m and may dip under the surface to catch prey, though will not completely submerge (Eglington & Perrow, 2014).</p> <p>The key supporting processes for terns at Ythan Estuary, Sands of Forvie and Meikle Loch SPA are water quality (nutrients and turbidity), tidal cycles, and water flow. Small-scale physical processes are thought to be especially important in directly influencing prey availability and hence foraging areas used. Common terns appear to prefer areas of high water flow velocity, in both shallow areas and in areas of around 15–20 m depth (Schwemmer <i>et al.</i> 2009). Common terns are also known to forage further from their colony at high tide, due to reduced prey availability at this time (Schwemmer <i>et al.</i> 2009). The weather can also influence foraging distribution, as birds may choose to use more sheltered freshwater habitats in high winds or storms, thus resulting in temporal variation in distribution (Eglington & Perrow, 2014). High windspeed (more than 6 m-s), has resulted in common terns having a lower foraging rate (Frank, 1992). Observations of common terns feeding at Ythan estuary also showed that wind speed and wave amplitude influences capture rate, with higher wind speed and larger wave amplitude decreasing capture rates as the terns find it more difficult to locate their prey (Taylor, 1983).</p> <p>Supporting processes within the terrestrial environment at Ythan Estuary, Sands of Forvie and Meikle Loch SPA for common tern are not well understood but will relate to those processes that affect the formation and suitability of breeding habitat for common tern.</p>
<p>Pink-footed goose</p>	<p>Maintain the extent and distribution of the supporting habitats for pink-footed geese within the site.</p> <p>and</p> <p>Maintain the variety and abundance of food resources and the condition of supporting habitats and</p>	<p>Pink-footed geese use the Ythan Estuary, Sands of Forvie and Meikle Loch SPA primarily as a roosting site, especially using the estuary and the freshwater lochs. Pink-footed geese may also feed within the Ythan Estuary, Sands of Forvie and Meikle Loch SPA. Access to autumn and winter stubbles and grass pasture outwith the SPA provide additional feeding opportunities for the geese.</p> <p>Pink-footed geese are herbivorous and opportunistic foragers. Cereal grains, stubble fields, pasture grasses and potatoes are all important food sources for this species, whilst saltmarsh is also grazed. Clover and common meadow-grass are</p>

	<p>associated processes.</p>	<p>particularly important for this species. When feeding and roosting within adjacent farmland, pink-footed geese require large and open fields to allow for early detection of predators. Key roosting and foraging sites should be kept free from obstructions which may impair line-of-sight for this species.</p> <p>Supporting processes at Ythan Estuary, Sands of Forvie and Meikle Loch SPA for pink-footed geese are not well understood but will relate to those processes that affect the formation and suitability of foraging habitat. The geese prefer short sward heights and may have difficulty feeding if the vegetation is too tall.</p>
<p>Common eider</p>	<p>Maintain or enhance the extent and distribution of the supporting habitats for eider within the site.</p> <p>and</p> <p>Ensure the variety and abundance of food resources and the condition of supporting habitats and associated processes have the ability to recover.</p> <p>and</p> <p>Existing water quality should be maintained any increase in nutrients, turbidity or contaminants where this could reduce supporting habitats and/or prey, should be avoided.</p>	<p>Eider require suitable habitat within the SPA for foraging, loafing, moulting and roosting. In Scotland, eiders occur in sheltered bays with rocky, stony or hard substrates associated with their main prey items. Foraging in these habitats occurs on the seabed (down to 10m depth). Open waters are also used potentially for loafing, moulting and roosting.</p> <p>Eiders have a wide variety of prey items. Their principal food resource is benthic bivalves, in particular blue mussels, and other species such as the common cockles, razor clams and clams. They also take shore crabs other marine invertebrates, including gastropods, and fish (Woodward & Humphreys, 2018; Waltho & Coulson, 2015).</p> <p>Eider dive from the surface to pluck their prey from the seabed and typically feed in water depths of under 10m. They prefer areas where there are high abundances of benthic molluscs and actively select particular sizes of their preferred prey (Nehls & Ketzenberg, 2002). Eiders may be attracted to artificial structures that support mussel populations (Heubeck & Mellor, 2013; Cervencel <i>et al.</i> 2015).</p> <p>Benthic habitats capable of supporting the principal bivalve and/or gastropod prey species of eider may be relatively extensive in area within the SPA and the prey distributions and abundance within suitable habitats will vary both spatially and temporally. However some areas within accessible foraging depths are likely to more consistently support relatively higher biomass of benthic prey. The mussel beds have been mapped at the Ythan Estuary, Sands of Forvie and Meikle Loch SPA, although the condition of these beds is not known.</p>

		<p>The key supporting processes for eiders at Ythan Estuary, Sands of Forvie and Meikle Loch SPA are water quality (nutrients and turbidity), tidal cycles, and water flow. Eiders exhibit increased feeding activity at low tide when mussel beds are more accessible and in the morning and towards dusk. In Scotland, greater numbers were observed during ebb tides on an exposed west-facing coast and during slack tides and in mornings and evenings in a strongly tidal area (Robbins, 2011; 2012). Eider appear to be unable to feed in currents faster than ~1.2 m s⁻¹ (Heath <i>et al.</i> 2010). High turbidity may also affect eiders, potentially by limiting their visibility (Dickson & Smith, 2013), or reducing growth of mussel prey (Nehls, 2000). The causal links between eider numbers and water turbidity however are unclear.</p>
Northern lapwing	<p>Maintain or enhance the extent and distribution of the supporting habitats for lapwing within the site.</p> <p>and</p> <p>Ensure the variety and abundance of food resources and the condition of supporting habitats and associated processes have the ability to recover.</p> <p>and</p> <p>Existing water quality should be maintained any increase in nutrients, turbidity or contaminants where this could reduce supporting habitats and/or prey, should be avoided.</p>	<p>Lapwing use the inter-tidal and coastal areas of the Ythan Estuary, Sands of Forvie and Meikle Loch SPA primarily for roosting, with potentially some foraging. Lapwing preferred roosting habitats include mud and sand, shingle and saltmarsh.</p> <p>Lapwings at Ythan Estuary, Sands of Forvie and Meikle Loch SPA may also forage at the site, but it's thought most foraging will occur on adjacent farmland. Diet may consist of adult and larval insects (e.g. beetles, ants, Diptera, crickets, grasshoppers, dragonflies, mayflies, and Lepidoptera), spiders, snails, earthworms, frogs) (Urban <i>et al.</i> 1986; del Hoyo <i>et al.</i> 1996).</p> <p>Supporting processes for lapwing at Ythan Estuary, Sands of Forvie and Meikle Loch SPA are not well understood but may relate to nutrient movements flowing into and within the SPA and the subsequent effects this has on their prey habitat.</p>
Common redshank	<p>Maintain the extent and distribution of the supporting habitats for common tern within the site.</p>	<p>Redshank use the Ythan Estuary, Sands of Forvie and Meikle Loch SPA for foraging and roosting. Important feeding areas are on muddy substrates on the estuary with high tide roosts on adjacent areas.</p>

	<p>and</p> <p>Maintain the variety and abundance of food resources and the condition of supporting habitats and associated processes.</p> <p>and</p> <p>Existing water quality should be maintained and any increase in nutrients, turbidity or contaminants where this could reduce supporting habitats and/or prey, should be avoided.</p>	<p>During the non-breeding season redshanks take insects, spiders and annelid worms, as well as molluscs, crustaceans (especially amphipods) and occasionally small fish and tadpoles (del Hoyo <i>et al.</i> 1996).</p> <p>Supporting processes for lapwing at Ythan Estuary, Sands of Forvie and Meikle Loch SPA are not well understood but may relate to nutrient movements flowing into and within the SPA and the subsequent effects this has on their prey habitat.</p>
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Annex 2. Supporting information

Factors determining the potential for feature recovery.

Feature	Factors determining the potential for future recovery
Sandwich tern	<p>Estimated generation length is 8.5 years (Bird <i>et al.</i> 2020) with a maximum lifespan recorded as 30.8 years. Age at first breeding is thought to be 2-3 years old (Bird <i>et al.</i> 2020). Younger birds tend to arrive later at breeding colonies (as evidenced by ringing data) and therefore tend to lay eggs later in the season. Clutch size is 1-2 eggs, incubation is 21-29 days and chick rearing is 28-20 days (Snow & Perrins, 1998). Adult survival rates have been estimated at 0.872 (Bird <i>et al.</i> 2020) and average productivity as 0.702 (Horswill & Robinson, 2015). As a long-lived seabird species, the adult will balance parental investment into their current breeding attempt with their own need to survive, and future reproductive attempts.</p> <p>Sandwich tern is a migratory species found in Europe, Africa, western Asia, and the southern Americas. European breeding populations migrate to the coasts of western and southern Africa, and from the south Red Sea to north-west India and Sri Lanka (BirdLife International, 2020). Pressures in these wintering grounds or during passage could limit potential for populations to recover from impacts arising in breeding areas. Tern species show a low degree of site faithfulness from one breeding season to the next and in response to predation, disturbance or habitat change the tern colony may move to another site (Ratcliffe, 2004).</p> <p>Sandwich tern food resources are often unpredictably in time and space, which may explain why there is variation in specific foraging locations between years and colonies (Eglington & Perrow, 2014). As with other terns, their numbers tend to fluctuate and have frequent changes of site, which sometimes make trends difficult to ascertain (Snow & Perrins, 1998). Compared to other tern species, Sandwich terns can forage further afield (Woodward <i>et al.</i> 2019), which may mean they are potentially more resilient to changes in prey abundances in water close to the colony. Sandwich terns are still able to forage in wind speeds up to 55-80km/hr (Eglington & Perrow, 2014), though transported food back to the colony has been found to be lower in both very high winds and in very low wind speeds (Stienen <i>et al.</i> 2000).</p>
Little tern	<p>Estimated generation length is 9.6 years and maximum longevity is around 24 years (Bird <i>et al.</i> 2020). Age at first breeding is thought to be around 3 years old (Bird <i>et al.</i> 2020). Clutch size is 1-3 eggs (Snow & Perrins 1998) and little terns have the ability to re-lay a clutch if the first one fails, although the re-lay clutch size will be lower as clutch size in terns decreases with the time it is laid in the season (Everett, 1980). Incubation period is 18-22 days from mid-May and chick-rearing period is 19-20 days from early June (Snow & Perrins, 1998). Adult survival rates have been estimated at 0.899 (Bird <i>et al.</i> 2020). Average productivity has been noted as 0.518 (Horswill & Robinson, 2015), though breeding success of little terns at Ythan Estuary, Sands of Forvie and Meikle Loch SPA between 2009 and 2013 averaged 0.94 chicks fledged per pair. As a long-lived seabird species, the adult will balance parental investment into their current breeding attempt with their own need to survive, and future reproductive attempts.</p> <p>Little tern colonies are scattered along the coasts and inland parts of Europe,</p>

	<p>parts of Africa, much of western, central and the extreme east and south of Asia, and in northern parts of Australasia. Migratory individuals expand the range to include most of the coast of Africa, the Arabian Peninsula, the western coast of India and most of the waters of south-east Asia and Australasia, including New Zealand (BirdLife International, 2020). Little terns are a migratory species: western European breeding populations are thought to winter in West Africa and as far down as South Africa (Snow & Perrins, 1998). Pressures in these wintering grounds could limit potential for populations to recover from impacts arising in breeding areas. When leaving their breeding grounds in northern Europe, little terns will travel first to their moulting grounds where they form large roosts before heading further southwards (Tavecchia <i>et al.</i> 2006). During this moulting period they may be more vulnerable. Tern species show a low degree of site faithfulness from one breeding season to the next and in response to predation, disturbance or habitat change the tern colony may move to another site (Ratcliffe, 2004).</p> <p>Of all the tern species, little terns have the most inshore distribution (BirdLife International, 2019). Little terns rely on abundant food supplied close to the colony in order to provision their chicks and within the top 30cm of the water column, thus they are considered to have a relatively specialised habitat requirement (Eglington & Perrow, 2014). Breeding is thought to be timed to coincide with the peak fish abundance (Perrow <i>et al.</i> 2006).</p>
Common tern	<p>Estimated generation length is 10.4 years and maximum longevity is around 34 years (Bird <i>et al.</i> 2020). Age at first breeding is thought to be around 3 years old (Bird <i>et al.</i> 2020). Clutch size is 1-3 eggs and common terns have the ability to re-lay a clutch if the first one fails (Snow & Perrins, 1998). Adult survival rates have been estimated at 0.885 (Bird <i>et al.</i> 2020) and average productivity is 0.764 (Horwssill & Robinson, 2015). First year survival for young increases with fledging mass (Ludwigs & Becker, 2002). Local productivity rates have been reported to decrease due to predation (Nisbet & Welton 1984; Becker 1995; Mavor <i>et al.</i> 2008), but increase with nesting density (Becker, 1995). Productivity also depends on parental age or quality (Nisbet & Cam, 2002; Arnold <i>et al.</i> 2006). Any effect on adult mortality can potentially have serious effects on breeding numbers. As a long-lived seabird species, the adult will balance parental investment into their current breeding attempt with their own need to survive, and future reproductive attempts.</p> <p>Common tern has a circumpolar distribution and can be found breeding in most of Europe, Asia and North America except the extreme north and south. It winters further south, along the coasts and inland South America, along the coast of Africa excluding the north, along parts of the Arabian Peninsula and the whole coast of India, and throughout much of south-east Asia and Australasia (excluding New Zealand) (BirdLife International, 2020). Most British-breeding common terns winter along the west coast of tropical Africa north of the Equator. Pressures in these wintering grounds (e.g. human disturbance and pollution of inland breeding lakes), especially during their flightless moult period at their wintering grounds, could limit potential for populations to recover from impacts arising in wintering areas.</p> <p>Terns may return to the same nesting area each year, but they are also known for changing nesting areas completely, such that some areas which are occupied with terns one year may have very few the following year, possibly related to variable food resources (Eglington & Perrow, 2014). Common terns are a generalist and opportunistic feeders and have a wider prey base than other tern species (Eglington & Perrow, 2014), demonstrating plasticity in foraging</p>

	<p>which potentially makes them more resilient to change should one prey resource become unavailable.</p>
Pink-footed goose (non-breeding)	<p>Pink-footed goose estimated generation length is 11.7 years and maximum longevity is around 34 years (Bird <i>et al.</i> 2020), although average lifespan is recorded as being 8 years. Shooting in autumn and winter accounts for the majority of mortality in pink-footed geese and may be influencing this average lifespan figure. Females first breed at 3 years with a clutch size typically of 4-5 eggs. They will only have one brood, and so do not have the ability to re-lay should something interrupt their breeding season. Adult survival rate has been recorded as 0.81 with juvenile survival recorded as 0.78. As for other species with apparently high adult survival rates, relatively large impacts on population trends may arise from changes to adult survival.</p> <p>Pressures at their breeding grounds in Iceland or Greenland, or during their migration may have subsequent effects on the wintering population.</p> <p>Pink-footed geese rely on being able to travel safely between roosting areas and feeding areas during winter. It means that should impacts on their inland feeding sites occur it could have a subsequent effect on their wintering population at their roosting site, and vice versa. Disturbance to feeding or roosting during non-breeding period may reduce fitness and have consequences for the subsequent migration back to their breeding grounds.</p>
Common eider	<p>Eiders have a relatively long generation length estimated at 11.2 years and a maximum longevity of around 38 years (Bird <i>et al.</i> 2020). Females first breed at 3 years with a clutch size typically of 4-6 eggs (Cramp & Simmons, 2004). Adult survival rates from older studies are highly variable, but have been estimated as 0.872 (Bird <i>et al.</i> 2020), with annual productivity being 0.379 (Horswill & Robinson, 2015). The critical factor for the long-term survival of the species appears to be the survival rate of young ducklings (Waltho & Coulson, 2015) and both disease outbreaks and poor breeding female condition have been associated with mass mortality in this species (BirdLife International, 2020).</p> <p>Eider are dispersive partial migrants, resident year round in Scotland. The non-breeding season extends from September to mid-April during which period large flocks may form. Males start to assemble from June or early July and are joined by post-breeding females 3-4 weeks later forming aggregations during the flightless post-breeding moult period between July to mid-September (Cramp & Simmons, 2004). Eider are especially vulnerable to disturbance at sea during this period. Flightless young ducklings also form crèches at sea, guarded by females. Males are not involved with rearing chicks.</p> <p>Eider nest on the ground in loose colonies usually in areas free of mammalian predators (Waltho & Coulson, 2015), including coastal islands and islets along low-lying rocky coasts, on coastal shores and spits, on islets in brackish and freshwater lagoons, coastal lakes and rivers or on tundra pools (BirdLife International, 2020). Pressures in these breeding grounds (e.g. human disturbance and depredation by introduced mammals) could limit potential for populations to recover from impacts arising at sea.</p>
Northern Lapwing	<p>Lapwings have a generation length of 6.2 years and a maximum longevity of 24 years (Bird <i>et al.</i> 2020). Females first breed at 2 years old. Adult survival rate is 0.79. Short-term cold weather impacts reduces adult survival in lapwings. Productivity varies depending on the study colony, but productivity of 0.46 fledglings per pair is not unusual, which is low productivity. Poor and reduced breeding attempts due to agricultural intensification, predation and chick</p>

	<p>mortality are thought to be the main causes of poor lapwing productivity, and therefore of population decline.</p> <p>Pressures at breeding grounds, or during their migration if coming from the Fennoscandia population to Scotland, may have subsequent effects on the wintering population. This is coupled with short-term cold weather impacts reducing adult survival.</p> <p>Lapwings exhibit high site fidelity, which may limit individual ability to adapt to changes within wintering areas and hence potential for population recovery from perturbations.</p> <p>Lapwings are sensitive to disturbance and so disturbance and possible subsequent displacement from roosts from recreational activities may reduce winter survival and fitness to breed.</p>
Redshank	<p>Redshank have a generation length of 5 years and a maximum longevity of 27 years (Bird <i>et al.</i> 2020). Age at first breeding is 1 and they will only have one brood, and so do not have the ability to re-lay should something interrupt their breeding season. Adult survival rate is estimated as 0.79 with juvenile (first year) survival estimated as 0.43.</p> <p>Pressures at breeding grounds, or during their migration if coming to their Scottish wintering grounds from a non-local population, may have subsequent effects on the wintering population.</p> <p>Redshank are sensitive to disturbance and so disturbance and possible subsequent displacement from roosts or foraging areas due to recreational activities may reduce winter survival and subsequent fitness to breed.</p>

Annex 3: Glossary for Conservation Objectives and References

Glossary

Conservation Objective term	Definition
Distribution	The “distribution” is how the qualifying feature is spread out within the site.
Favourable condition	This refers to the assessed condition of a feature through Site Condition Monitoring. Features considered to be in favourable condition for the purposes of these Conservation Objectives are those that have an assessed condition of either: <ul style="list-style-type: none"> • Favourable Declining - The attribute targets set for the natural feature have been met, but evidence suggests that its condition will worsen unless remedial action is taken. • Favourable Maintained - the attribute targets set for the natural features have been met, and the natural feature is likely to be secure on the site under present conditions. • Favourable Recovered - the condition of the natural feature has recovered from a previous unfavourable condition, and attribute targets are now being met.
Generation length	Generation length is “the average age of parents of the current cohort”. Generation length therefore reflects the turnover rate of breeding individuals in a population (IUCN, 2019).
Maintain	Where a qualifying feature of the SPA is assessed as being in favourable condition the conservation objective is ‘maintain’. This means that the various attributes of the feature should be kept at that favourable level. This can include increasing/improving condition as well, but not a permanent decline.
Marine birds	This term encompasses true seabirds and waterfowl (seaducks, divers, and grebes).
Metapopulation	A group of connected populations of a species within a defined area, where the individual populations may interact with one another.
Restore	Where a qualifying feature of the SPA is assessed as being in unfavourable condition the conservation objective is ‘restore’. This means that the various attributes of the feature should be returned to the favourable level by increasing/improving condition.
Site integrity	The integrity of a site is defined in general terms as the coherence of its ecological structures and function, across its whole area, which enables it to sustain the habitat, complex of habitats and and/or the levels of populations of the species for which it was designated.
Site reference population	This refers to the estimated population figure for the site and should be used to form the basis of carrying out HRAs. In most cases, the site reference population will be the baseline population (figure at designation). However, where recent surveys show a population to have increased or stayed stable, the current population is considered the most appropriate population figure to use for HRA’s.
Supporting habitats and processes	This includes the following environmental conditions (but is not limited to) which are important for maintaining/restoring the protected features, e.g. hydrography and supporting water currents, chemical water quality parameters, suspended sediment levels, radionuclide levels.

Conservation Objective term	Definition
Unfavourable condition	<p>This refers to the assessed condition of a feature through Site Condition Monitoring. Features considered to be in unfavourable condition for the purposes of these Conservation Objectives are those that have an assessed condition of either:</p> <ul style="list-style-type: none"> • Unfavourable recovering - One or more of the attribute targets have not been met on the site, but management measures are in place to improve the condition. • Unfavourable no change - One or more of the attribute targets have not been met, and recovery is unlikely under the present management and activity on the site. • Unfavourable declining - One or more of the attribute targets have not been met, evidence suggests that condition will worsen unless remedial action is taken.
Waterfowl	Encompasses seaducks, grebes and divers.

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