ABERDEEN HARBOUR
EXPANSION PROJECT
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Volume 2:
Environmental
Statement

CHAPTER 14: MARINE ORNITHOLOGY

14. MARINE ORNITHOLOGY

14.1 Introduction

This chapter presents an overview of the potential effects of the construction and operation of the proposed Aberdeen Harbour Expansion Project (AHEP) at Nigg Bay (hereafter referred to as 'the development) on marine birds. In the context of this ES, marine birds are those, which depend mainly on the sea, beyond the tide-line, for their food (Strategic Environmental Assessment (SEA) 5). Chapter 11: Terrestrial Ecology focuses on those birds that utilise the shoreline and terrestrial habitats.

Effects on species that are designated features of Special Protection Areas (SPAs) or Ramsar sites, and are present at the development site are, assessed in support of Volume 4: the Habitats Regulations Appraisal (HRA), and supporting information is provided on nature conservation designations in Chapter 10: Nature Conservation.

The project description used for the purposes of this assessment is presented in Chapter 3: Description of the Development.

This chapter is supported by the following supporting technical appendices:

- Appendix 6-B: Hydrodynamic Modelling and Coastal Processes Assessment;
- Appendix –D: Sediment Plume Modelling;
- Appendix 11-C: Breeding Bird Surveys between April and July 2014;
- Appendix 11-E: Wintering Bird Survey (September 2014 to April 2015);
- Appendix 13-B: Underwater Noise Impact Study;
- Appendix 14-A: Marine Ornithology Vantage Point Survey Report; and
- Appendix 14-B: Marine Ornithology, Supporting Information.

In addition, this chapter is supported by the following chapters:

- Chapter 7: Marine Water and Sediment Quality;
- Chapter 10: Nature Conservation;
- Chapter 12: Benthic Ecology; and
- Chapter 13: Fish and Shellfish Ecology.

14.2 Policy, Legislation and Guidance

This section outlines the policy, legislation and guidance that are relevant to the assessment of potential impacts on marine ornithology. Policy, legislation and guidance applicable to the wider project can be found in Chapter 4: Planning and Legislation. Further advice in relation to the development, its perceived effects and the scope of issues to be addressed, has been sought through consultation with both statutory and non-statutory authorities (Section 14.3).

International, European and national policy, and guidance relevant to the proposed development in terms of nature conservation are listed below.

14.2.1 International

- The Conservation of Natural Habitats and of Wild Flora and fauna EC Directive (92/43);
- The Conservation of Wild Birds and their Habitats EC Directive (2009/147/EC);
- United Nations Convention on Biological Diversity 1992 (the Rio Convention);
- The Convention on the Conservation of European Wildlife and Natural Habitats 1979 (the Bern Convention);
- Convention for the Protection of the Marine Environment of the north-east Atlantic 1992, (the OSPAR Convention);
- European Council Directive 2008/56/EC Establishing a Framework for Community Action in the Field of Marine Environmental Policy, (MSFD); and
- European Council Directive 2000/60/EC Establishing a Framework for Community Action in the Field of Water Policy (WFD).

14.2.2 National

- The Conservation (Natural Habitats, &c.) (Scotland) Regulations 1994 (as amended);
- The Nature Conservation (Scotland) Act 2004;
- Wildlife and Natural Environment (Scotland) Act 2011;
- UK Post-2010 Biodiversity Framework (the successor to, Biodiversity: UK Action Plan 1994);
- Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (as amended);
- The Wildlife and Countryside Act 1981 (as amended) (WCA);
- UK Marine Policy Statement (MPS) Defra, 2011;
- The Marine Strategy Regulations 2010 (the Marine Strategy Regulations);
- Conservation of Habitat and Species Regulations 2010 (as amended);
- The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011; and
- The Marine Works (Environmental Impact Assessment) (Amendment) Regulations 2011.

14.2.3 Guidance

- Scottish Natural Heritage (SNH) Guidance on Habitats Regulations Appraisal of Plans (David Tyldesley and Associates, 2015), (as amended);
- A Review of the Potential Impacts of Marine Aggregate Extraction on Seabirds (Cook and Burton, 2010);
- The Protection of European Protected Species from Injury and Disturbance (JNCC, 2011);
- The Protection of Marine European Protected Species from injury and disturbance: Guidance for Scottish Inshore Waters (Marine Scotland, 2014).

- Scottish Planning Policy 2014Planning Advice Note (PAN) 60: Planning for Natural Heritage;
- UK Biodiversity Action Plan (UK BAP);
- Scottish Biodiversity List;
- Seabird foraging ranges as a preliminary tool for identifying candidate Marine Protected Areas (Thaxter et al., 2012);
- Natura 2000 in UK Offshore Waters: Advice to support the implementation of the EC Habitats and Birds Directives in UK offshore waters (Johnston et al., 2002); and
- Guidelines for Ecological Impact Assessment in Britain and Ireland: Marine and Coastal (IEEM (now CIEEM), 2010).

All wild birds in the UK are protected under international and national law. Further legislative information can be found in ES Volume 4: Habitats Regulations Appraisal and Chapter 10: Nature Conservation.

14.3 Consultation

Table 14.1 presents the consultation that has been undertaken to date in respect of the conduct and scope of the assessment of potential effects on marine birds. This incorporates responses to the EIA Scoping Opinion (Appendix 1-D) and the updated Scoping Report 2014 (Appendix 1-E).

Table 14.1: Scoping response from stakeholders

Consultee	Date	Summary of Consultation	Where addressed in ES
RSPB Scotland	4 September 2013	The ES should consider impacts on eiders using the area and consequently any potential negative effect on the Ythan Estuary, Sands of Forvie and Meikle Loch SPA.	Individual species accounts – which have drawn on additional data from Wetland Bird Survey (WeBS) and JNCC to provide wider contextual information.
		Nigg Bay is a regular roost for passage and wintering waders, gulls and terns (also from the Ythan Estuary, Sands of Forvie and Meikjle Loch SPA). There is an occasional sand martin colony and other breeding birds along the beach which should be considered during construction phase.	Within the Baseline (Section 14.5) and Impact Assessment (Section14.6). Breeding sand martins are addressed within Chapter 11: Terrestrial Ecology.
		Within Greyhope Bay the following species are of concern: eiders roost offshore here and a regular roost for Sandwich terns, oystercatchers, purple sandpipers and other waders.	One of the vantage points was set up to record all bird and marine mammal activity within Greyhope Bay, however Greyhope Bay is outside of the project area and any impacts on this area will be temporary and limited to the construction period.
		Within the south breakwater there are regular non breeding congregations of eiders, gulls, shags, cormorants, goosanders and waders such as curlew, redshank, oystercatcher and purple sandpiper. Up to 80 goosanders are regularly recorded within the harbour boundary.	Vantage point survey designed to record species using Nigg Bay. The wintering bird survey also recorded birds that use Nigg Bay.

Table 14.1: Scoping response from stakeholders continued

Consultee	Date	Summary of Consultation	Where addressed in ES
RSPB Scotland Continued	4 September 2013	The ES must explore options for mitigating potential impacts on birds, as well as compensatory or enhancement measures. This could include creation of suitable areas for tern breeding.	Impacts Section (14.6) and Mitigation Section (0).
Scottish Natural Heritage (SNH)	20 August 2013	The potential effect on displacement of protected species and birds should be considered in the EIA. The survey methodology needs to be refined * (*Refined methodology can be found in Appendix 14-B).	An approved survey methodology was agreed subsequent to SNH initial response - see Appendix 14-B: Marine Ornithology, Supporting Information; for the survey methodology email dated 24 April 2014.

In addition to the EIA scoping responses, consultation with the statutory stakeholders has been ongoing, to refine and agree the site-specific survey methodology (see ES Appendix 14-B: Marine Ornithology Supporting Information). The agreed survey methodology is outlined in Section 14.4.

14.4 Methodology

This section describes the methods used to characterise bird populations both temporally and spatially and to categorise usage within and around the project area. The methods used to evaluate the significance of identified effects are also presented here.

14.4.1 Literature Review

A literature review was conducted to provide baseline information on the distribution and usage of the area by marine birds. Regional information has been incorporated to cover the wider Aberdeenshire coastline and to provide seasonal and geographical context.

Data sources used to inform the baseline are presented in Table 14.2. Further data sources used in the preparation of this document are credited within the text.

Table 14.2: Data sources used to inform the literature review

Data Source	Type of Information
EnviroCentre Wintering Bird Survey 2014 to 2015	Survey concentrating on shore based birds using WeBS methodology.
North East Scotland Biological Records Centre NESBReC	Incidental data gathered over several years – data not collected following any set methodology – information used to contextualise.
European Offshore Wind Deployment Centre Environment Statement 2012	Contextual information.
SPA citations	Contextual information.
Ramsar Information Sheets	Contextual information.

Note:
* "Data were supplied by the Wetland Bird Survey (WeBS), a partnership between the British Trust for Ornithology, the Royal Society for the Protection of Birds and the Joint Nature Conservation Committee (the last on behalf of the statutory nature conservation bodies: Natural England, Natural Resources Wales and Scottish Natural Heritage and the Department of the Environment Northern Ireland) in association with the Wildfowl and Wetlands Trust"

Table 14.2: Data sources used to inform the literature review continued

Data Source	Type of Information
JNCC Wintering Duck Aerial Surveys 2003/07	Contextual information, GIS referenced data, but limited in geographical scope to Aberdeen Bay covering the project area and coast line to the north up to the Cruden Bay. No information south of the project area. Some limited data on incidental marine mammal sightings.
* WeBS Counts five Year Data Sets up to: • 2013/14 for Nigg Bay and Girdle Ness, Montrose Basin SPA and Ythan Estuary SPA; • 2009/10 Dee Mouth to Don Mouth; • 2008/09 Nigg Bay to Cove Bay.	Monthly peak counts over a five year block period for waterbirds (wildfowl and shorebirds). No data on seabirds. five WeBS sectors chosen representing the project area, and areas immediately to the north and south of the project area, and two SPAs identified in correspondence with SNH (Appendix 14A) as having key feature species (eider duck)
Note: * "Data were supplied by the Wetland Bird Survey (WeBS), a partnership between the British Trust for Ornithology, the Royal Society for the Protection of Birds and the Joint Nature Conservation Committee (the last on behalf of the statutory nature conservation bodies: Natural England, Natural Resources Wales and Scottish Natural Heritage and the Department of the Environment Northern Ireland) in association with the Wildfowl and Wetlands Trust"	

14.4.2 Site-Specific Survey Methodology

In addition to the literature review a site-specific Vantage Point (VP) survey was also undertaken to collect detailed information on marine birds using Nigg Bay. The survey methodology was agreed by SNH and was based on 12 months observational data collection conducted between June 2014 and May 2015. The survey consisted of four VPs in total with two specifically focussed on birds (VP1 and VP2) and two focusing specifically on marine mammals (VP3 and VP4). The VPs were selected to ensure full coverage of Nigg Bay, including areas directly offshore from the bay and the offshore areas to the north and south (Figure 14.1)

The aim of the VP survey was to characterise the presence, abundance, seasonality and behaviour of birds within the proposed project area. All species recorded from the VP survey work are discussed in Section 14.5.3 with further detail within ES Appendix 14-A: Marine Ornithology Vantage Point Survey Report.

In addition to the VP surveys, 163 ad-hoc counts were undertaken over the same 12 month period. Each ad-hoc count was approximately 20 minute duration, and although untimed and unstandardised they provide useful additional context. Whilst the surveyor was on transit to the VP surveys, wader walk-overs were undertaken as an opportunistic survey of the shorebirds using the shore of Nigg Bay.

Full details of the methodology and results can be found in Appendix 14-B: Marine Ornithology Supporting Information.

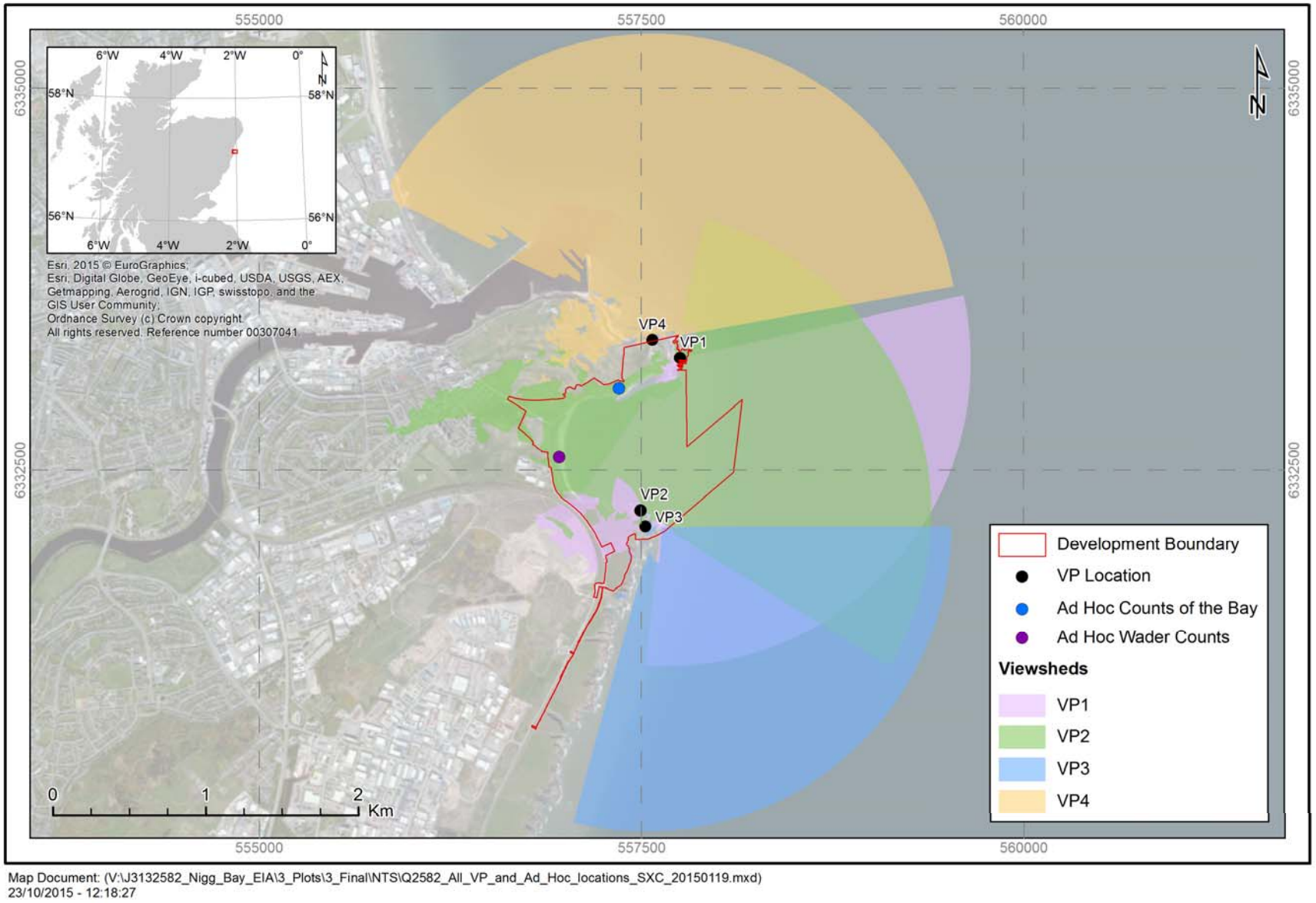

Figure 14.1: Extent of the vantage point survey (VP1 and VP2 specifically for birds)

14.4.3 Scope of the Assessment

The scope of the assessment has been determined through consultation with statutory and non-statutory consultees. Table 14.1 provides an overview of consultee responses. For the purposes of this assessment marine birds are considered separately to the onshore populations which are assessed in Chapter 11: Terrestrial Ecology. Reference has been made to the ES Appendix 11-B: Breeding Bird Survey 2014 and ES Appendix 11-E: Wintering Bird Survey 2014-2015 respectively undertaken as part of the terrestrial ecology technical studies, but which also provide context to and support the EIA throughout this chapter.

14.4.4 Impact Assessment Methodology

This section explains the approach to identifying the key marine bird receptors, identifying impacts and impact pathways, defining effect magnitude and receptor value and evaluating the significance of effects. The approach follows the general impact assessment methodology presented in Chapter 5: Environmental Impact Assessment Process, including the magnitude and value factors but uses tailored definitions to address relevant aspects of bird ecology. The magnitude of impacts also considers the outputs of the sediment and underwater noise modelling (Appendix 7-D: Sediment Plume Modelling and Appendix 13-B: Underwater Noise Impact Study respectively) and supports quantitative assessment of the impacts of the project on marine birds.

The impact assessment process starts with the identification of the impacts that are predicted to arise from the construction and operation of the scheme, based on the project description (Chapter 3: Description of the Development). Potential pathways through which those impacts are transmitted to marine bird receptors are also identified.

Table 14.3 presents the potential construction and operational activities, pathways and effects upon marine birds.

Table 14.3: Predicted impacts and associated pathways for effects on marine birds

Activity	Pathway	Receptor	Description of Effect
Construction			
General construction	Increased levels of in-air noise and visual disturbance	Species	Disturbance and displacement of species for species that use the area for feeding and /or loafing, rafting
Capital dredging	Temporary Increases in suspended sediment concentrations (SSCs) due to dredging	Diving species	Impairment of ability of visual feeders to forage and temporary displacement from habitat
	Release of sediment contaminants	Prey	Impacts on prey availability for diving species
	Changes to prey availability i.e. changes in fish and benthic populations from: • Seabed disturbance; • Raised sediment plumes; • Sediment deposition.	Prey	Reduction in prey species for sea-ducks and divers and weakening of foraging ability especially if birds are in moult

Table 14.3: Predicted impacts and associated pathways for effects on marine birds continued

Activity	Pathway	Receptor	Description of Effect
Construction Continued			
Increased vessel activity	Accidental spills of oil and fuels etc. into the marine environment during construction	Habitats, species and prey	Accidental releases of pollutants during construction Aggregations of birds rafting/loafing area of moult
	Collision between species and vessels	Birds in moult	Mortality or physical injury due to collisions
	Vessel presence	Species	Disturbance and/or displacement due to vessel noise and presence
Operation			
Infrastructure foundations and scour material	Footprint on the seabed and physical structures	Habitats and prey	Reduction in extent of original feeding/ loafing habitat
	Changes to prey availability i.e. changes in fish and benthic populations	Prey	Change in prey resource
Increase in vessel presence	Increased levels of in-air noise and visual disturbance	Species	Disturbance and/or displacement due to vessel noise and presence

14.4.5 Effect Magnitude

Effect magnitude is categorised as severe, major, medium, low or negligible based on the definitions presented in Table 14.4 and are based on the factors identified in Chapter 5: Environmental Impact Assessment Process.

Table 14.4: Categories of magnitude of effect and definition (based on Percival et al. (1999))

Effect Category	Definition
Severe	Total loss or major alteration to key elements or features of the baseline conditions meaning that the character or attributes of the site post-development will be fundamentally altered and may be altogether lost. Guide value: > 80% of population or habitat lost.
Major	A major alteration to the key elements or features of the baseline conditions resulting in a fundamental change in the composition or attributes post-development. Guide value: 20% to 80% of population or habitat lost.
Moderate	Loss or alteration of one or more key elements or features of the baseline conditions such that there will be a partial change of baseline character attributes post construction. Guide value: 5% to 20% of population or habitat lost.
Minor	Minor shift from baseline conditions, with any change discernible and the underlying character and attributes post-development similar to baseline conditions. Guide value: 1% to 5% of population or habitat lost.
Negligible	Very slight change from baseline conditions seen, with any change barely distinguishable comprising a ‘no change’ situation. Guide value: < 1% of population or habitat lost.

14.4.5.1 Receptor Value

For the purposes of this assessment, receptor value (Table 14.5) is based upon the conservation value of individual species with reference made to their association with SPAs as identified in Chapter 10: Nature Conservation and Volume 4: Habitats Regulations Appraisal (HRA). In addition, to provide consistency across the terrestrial and marine assessments reference has been made to the Red,

Amber and Green lists of Birds of Conservation Concern (BoCC) which provides a mechanism to gauge conservation importance for species not afforded protection under international or national legislation.

Table 14.5: Categories of receptor value and associated criteria

Value	Definition
Very high	Internationally important species: Annex 1 feature or in Schedule 4.1 and Schedule 4.2 of the Birds Directive. A qualifying feature species of SPAs, Ramsar sites
High	Bird species that contribute towards the integrity of an SPA, Ramsar site. Includes species that are of international or national importance, for example those whose population estimates exceed 1% of national or international populations
Medium	Species designated under national legislation or subject to UK or Scottish biodiversity action plans and covered under Red List of Birds of Conservation Concern (BoCC) Red list species of Birds of Conservation Concern
Low	Amber list species of Birds of Conservation Concern
Negligible	Species is not a feature of any nature conservation designation, Green listed species of Birds of Conservation Concern

Nigg Bay is not within any national or international designation for birds. The site does support numbers of SPA feature birds, but not at threshold values to be significant. These species also utilise the wider coastline along this stretch of east Scotland and therefore in this assessment all SPA feature birds are assigned a value of 'high'.

The assessment in this chapter also considers the determination of the likelihood of the effect occurring, and in this regard it is necessary to establish the frequency and seasonality of each species or species group taken forward for further assessment in Section 14.6. The assessment will include the predicted sphere of construction and operational influences of the proposed project. Section 14.5 provides the findings of a data review and site specific survey data of bird ecology within and around Nigg Bay, Table 14.8, Table 14.9 and Table 14.10 summarise the usage and seasonal presence of the species known to use the area and therefore are scoped into this assessment.

Drawing upon this review and the site specific observations, the criteria used to determine the likelihood of species presence, and which are used here to inform the impact statements (Section 14.6) of this chapter, are presented in Table 14.6. It should be noted that unlike any other ecological receptors, marine bird species, with the exception of the annual moult of some species (sea-duck and auk species), are highly mobile and are likely to utilise an area much larger than that of the immediate development area, or even the wider study area, as shown in Figure 14.1.

Table 14.6: Likelihood classification

Likelihood Classification	Criteria
Certain	Species is present or uses the study area all year round based on the available literature and has been regularly recorded (i.e. every month or nearly every month) during the site specific surveys.
Near certain	Species is present at least seasonally based on the available literature and has been recorded occasionally or often (i.e. over one or a few months) during the site specific surveys.
Probable	Species has not necessarily been recorded during the site specific surveys but is known to occur in the area based on the available literature.
Unlikely	Species is not generally known in the area but can theoretically occur as it lies within its natural range.
Extremely unlikely	Species is not known in the area based on the available literature and the study area lies outside its natural range.

14.4.5.2 Evaluating the Significance of the Effect

The significance of predicted effects prior to the application of any mitigation is defined by combining the effect magnitude and receptor value criteria and is derived from the effect significance matrix presented in Table 14.7.

Table 14.7: Significance of effect

Magnitude of Effect	Nature Conservation Value, Socio-economic Value or Heritage and Cultural Value				
	Negligible	Low	Medium	High	Very High
Negligible	Negligible	Negligible	Negligible	Negligible	Minor
Minor	Negligible	Minor	Minor	Minor	Moderate
Moderate	Minor	Minor	Moderate	Moderate	Major
Major	Minor	Moderate	Moderate	Major	Major
Severe	Moderate	Major	Major	Major	Major

The likelihood of the effect actually occurring (as described above) has been used to contextualise impact significance and to provide a measure of risk. In this chapter, likelihood has been applied on the basis of the expected presence of the marine bird species in question from literature and/or empirical observation. The timing of the impact-producing factor has also been considered within measure of likelihood and reflects the periodicity of the sensitivity of potential marine bird receptors for example, during the breeding season, during the post-breeding moult, or on passage migration.

Finally, a level of certainty based upon the availability and quality of data sources used to underpin the assessment conclusions has been assigned as defined below:

i. **High Certainty:** criteria affecting the assessment are well understood and documented. Literature and data available to quantify predictions. Information/data have very comprehensive spatial coverage/resolution; effects have been modelled;

ii. **Medium Certainty:** criteria affecting assessment reasonably well understood with some supporting evidence. The assessment may not be fully quantifiable and the information/data available might not fully incorporate the area of interest; and

iii. **Low Certainty:** criteria affecting assessment poorly understood and not documented. Predictions are made on expert interpretation using little or no quantitative data. Spatial coverage may only partly encompass area of interest.

A residual effect assessment is also included to address any proposed monitoring or mitigation measures to reduce the effect.

14.4.6 Cumulative Effect Assessment Methodology

Potential cumulative effects on birds have been identified and assessed following the methodologies presented in Chapter 5: Environmental Impact Assessment Process. Relevant projects and activities taken forward for cumulative effect assessment on marine birds are identified in Section 14.8.

14.5 Baseline

14.5.1 Introduction

This section describes the baseline coastal and marine ornithological conditions based on the findings of the desktop study and the site specific surveys, and provides an overview of the data and relative importance of the project area. Further detail on the methods and findings of the site specific VP survey is presented in Appendix 14-A: Marine Ornithology Vantage Point Survey Report.

The 12 months VP survey was designed to inform the numbers, seasonality and behaviour of birds likely to be impacted by the development. There are no designations either international or national covering the development area directly, for which birds are a designated species; however, there are several SPAs and dSPAs along the coast for some key species as identified in Section 14.5.3.

Marine birds have been classified into two groups: coastal or littoral; and open sea or pelagic. The littoral populations breed along the coast collecting food from the open sea, intertidal and inland areas and include the wading birds, sea-ducks, terns, some species of gulls, cormorant and shag. Pelagic birds breed along the coast collecting food from the open ocean spending longer durations in open sea. This group includes auks, northern gannet *Morus bassanus* (hereafter referred to as gannet) and tubenoses (fulmar and shearwaters) and some species of gull. During the breeding season pelagic species will spend more time in coastal waters – the true definition of pelagic describes their non-breeding season distribution.

14.5.2 Regional Context

The UK lies on some of the major migratory flyways of the east Atlantic for a large number of waterbirds, which are attracted to the mild winter climate and the estuarine and wetland habitats (DECC, 2009).

Marine bird distribution along the east coast of Scotland is described here in order to provide a regional context for marine birds that may utilise Nigg Bay. Within the SEA 5, review of divers, grebes and sea-duck distribution and abundance, these species are discussed as being present along much of the east coast of Scotland from the Orkney Islands to the Lothian and border coast. Divers, grebes and sea-duck are primarily inshore species, typically wintering in sandy bays or estuaries (Barton and Pollock, 2004).

Many east coast of Scotland locations hold internationally or nationally important bird numbers, with the major Firths of Moray and Forth holding significant numbers of 12 out of the 13 species of diver, grebes and sea-duck that the SEA review assessed (Barton and Pollock, 2004). Whooper swan *Cygnus cygnus*; mute swan *Cygnus olor*; pink-footed goose *Anser brachrhynchus*; greylag goose, *Anser anser* and barnacle goose *Branta leucopsis,* occur in internationally important numbers at coastal sites along the wider east coast of Scotland (Barton and Pollock, 2004a).

The Moray Firth is known to be important throughout the year for great cormorant *Phalacrocorax carbo* (hereafter referred to as cormorant), European shag *Phalacrocorax aristoelis* (hereafter referred to as shag). Troup, Pennan and Lion's Heads SPA is designated for herring gull *Larus argentatus*; black-legged kittiwake *Rissa tridactyla* (hereafter referred to as kittiwake), common guillemot *Uria aalge* (hereafter referred to as guillemot), and razorbill *Alca torda* (Stone et al., 1995) with the Inner Moray Firth being the most important wintering site for sea-duck in Britain. The sheltered nature of the firths within the Moray Basin and their saltmarshes make this an important area for breeding waders and other waterfowl (Craddock and Stroud, 1996). The wider east coast of Scotland region also contains extensive areas of intertidal sands and mud-flats, which provide important feeding areas for breeding waterfowl (Craddock and Stroud, 1996).

The Firth of Forth is known to be an important area for auks for most of the year. Higher densities of auk can be found at the Forth during the breeding season as well as other east coast of Scotland breeding sites such as Fowlsheugh SPA and Buchan Ness to Collieston Coast SPA with moulting activity occurring throughout this area. During the winter season the area is used by common eider *Somateria mollissima* (hereafter referred to as eider), and gulls (particularly herring gull, and great black-backed gull *Larus marinus*). Kittiwakes and tern species are abundant in the spring and summer (common *Sterna hirundo*; Arctic *Sterna paradisaea* and Sandwich *Thalasseus sandvicensis*). In late summer early autumn, skua species are known to pass through the wider east coast of Scotland/western North Sea area. Shags and cormorants were found in the Firth of Forth throughout the year (Stone et al., 1995).

The wider Aberdeenshire coast holds internationally important numbers of eider (with both Ythan Estuary, Sands of Forvie and Meikle Loch SPA and Montrose Basin SPA designated Natura 2000 sites)as well as regularly holding nationally important numbers of red-throated diver *Gavia stellata* and common scoter *Melanitta nigra* (Barton and Pollock, 2004). The Loch of Strathbeg, which is found on the Aberdeenshire coast is internationally important for whooper swans, pink-footed geese and barnacle geese from the Svalbard breeding population in autumn and winter. The area around the Ythan Estuary and Meikle Loch also holds internationally important numbers of pink-footed geese (Barton and Pollock, 2004a).

A similar regional pattern and bird distribution has also been noted in The European Offshore Wind Deployment Centre (EOWDC) ES (AOWFL, 2011).

14.5.3 Site-specific Survey Results

The VP surveys recorded a total of 35 species with key species for the area discussed in further detail below.

The species sighted have been grouped as below:

- Pelagic species: this group of birds includes skuas, gulls (kittiwake and great black-backed), tubenoses, gannet, and auks; and
- Coastal species: incorporates the waders and wildfowl sea-ducks, cormorant, shag, terns and all other common gull species.

14.5.3.1 Pelagic Species

In this section the group of pelagic birds (Table 14.8) includes truly pelagic species (away from their breeding colonies) including skuas, two species of which breed in Scotland (great skua *Stercorarius skua* and Arctic skua *Stercorarius parasiticus*) although the designated SPAs for these species are too distant to show any breeding season connectivity with the project. These birds disperse widely away from their breeding sites.

Pelagic species tend to be wide ranging in their distribution with ranges that extend significant distances and are able to exploit a wide range of habitats, therefore these species are likely to be less sensitive to disturbance from shipping and fluctuations in prey availability at any singular location. Kittiwake are more constrained in their choice of prey species than other pelagic birds and as such may be more sensitive to changes in their prey species (sandeel) and are not as wide ranging in their foraging activity as other pelagic species (Furness and Tasker, 2000; as referenced in Cook and Burton, 2010). Species which dive for their prey such as guillemot and gannet which are pursuit feeders are likely to be dependent upon water clarity for feeding and therefore are likely to be sensitive to increases in turbidity (Cook and Burton, 2010). Species that forage closer to the coast such as razorbill and guillemot are likely to be more sensitive to disturbance from shipping activity than other pelagic species. Pelagic birds such as guillemot, which spend a lot of time swimming, may be more susceptible to oiling from spills in areas such as busy shipping lanes (Cook and Burton, 2010).

The great black-backed gull is the largest and most maritime of the four Larus gulls that breed regularly in the UK (JNCC, 2012). They are largely absent from southern and western coasts of the North Sea (Cramp and Simmons, 1983; as referenced in JNCC, 2012) especially during the breeding season (JNCC, 2012). Outside the breeding season, great black-backed gulls range widely in the seas around northern Europe, especially inshore waters around the North Sea (Stone et al., 1995). Gull species been shown to be attracted to areas with increased shipping activity (Garthe and Hüppop 1999; Skov and Durinck 2001; Christensen et al., 2003, referenced in Cook and Burton, 2010). Gull species are generally less affected by disturbance (Camphuysen 1989; Williams et al., 1994; Furness and Tasker 2000; Garthe and Hüppop 2004; King et al., 2009, referenced in Cook and Burton, 2010).

Table 14.8: Pelagic bird species recorded at Nigg Bay during the site specific vantage point surveys

Species	Numbers if Recorded and Peak Month	Seasonal Presence	Usage of Study Area
Black-legged kittiwake *Rissa tridactyla*	Common. Recorded in September and October as the birds congregated ahead of migration away from breeding areas	Spring, summer and autumn with small numbers present offshore during the winter	Large roosts of several thousand birds form in Aberdeen harbour, using the breakwaters. Breeds in small numbers on cliffs to the south of the site.
Great black-backed gull *Larus marinus*	Common	All year round	Listed as occurring in the SEA 5 area (covers eastern Scotland up the Shetland Islands) in important numbers. The closest SPA to the project is along the northern coast of the Moray Firth.
Pomarine skua *Stercorarius pomarinus*	Uncommon	Autumn (one record in spring)	Offshore.
Arctic skua *Stercorarius parasiticus*	Regular	Summer and autumn	Offshore.
Great skua *Stercorarius skua*	Regular	Summer and autumn	Offshore.
Northern Fulmar *Fulmarus glacialis*	Common offshore	Spring, summer and autumn	Small numbers breed on cliffs to south of site, regularly feeds in outer areas of Nigg Bay.
Sooty shearwater *Puffinus griseus*	Uncommon offshore	Autumn	Passing through.
Manx shearwater *Puffinus puffinus*	Regular offshore	Spring, summer and autumn	Occasionally feeds in outer areas of Nigg Bay.
Northern gannet *Morus bassanus*	Common offshore	Spring, summer and autumn	Regularly feeds in outer areas of Nigg Bay.
Atlantic Puffin *Fratercula arctica*	Regular	Spring and summer	Offshore.
Black guillemot *Cepphus grille*	Very rare breeder on coasts south of site.	Summer and autumn	Areas to south of Nigg Bay, little usage of the bay itself.
Razorbill *Alca torda*	Common	All year round	Forage in outer areas of Nigg Bay. Breeds in small numbers on cliffs to the south of the site.
Little auk *Alle alle*	Uncommon	Winter	Offshore.
Common guillemot *Uria aalge*	Common	All year round	Forage in outer areas of Nigg Bay. Breeds in small numbers on cliffs to the south of the site.

Important breeding colonies for auk species are widespread across the Scottish mainland and islands (Stone et al., 1995; referenced in Cook and Burton, 2010). Other species have extensive foraging ranges (Thaxter et al., 2012) including gannets. Tubenose species, such as fulmar and shearwaters, are wide ranging pelagic species and although fulmar nest locally, they have no particular association with the development area. Auk species, in particular guillemot and razorbill, do associate with the development area. After the young have fledged their breeding colonies, both they and adults are flightless while undergoing their annual moult; the nearest SPA breeding colonies are Fowlsheugh

SPA (23 km) and Buchan Ness to Collieston Coast SPA (23 km). No significant rafts of these species were recorded in the development area.

14.5.3.2 Coastal Species

This assemblage of birds (Table 14.9) includes those that have been identified through VP surveys to have a major presence in the project and wider study areas. The waterfowl component of this group of birds potentially spend more time in the water than do other types of birds in this group such as gulls and terns), yet are restricted spatially to the inshore waters close to land. Some species may also have a greater vulnerability in that they use the area for their annual moult, making them temporally flightless.

Table 14.9: Coastal bird species recorded at Nigg Bay during the site specific vantage point surveys

Species	Numbers if Recorded and Peak Month	Seasonal Presence	Usage of Study Area
Whooper swan *Cygnus cygnus*	Recorded most autumn and winter months	Winter visitor	Recorded passing headland.
Pink-footed goose *Anser brachyrhynchus*	Recorded most autumn and winter months	Winter visitor	Use of site restricted to shelter during harsh weather.
Eurasian wigeon *Anas penelope*	Recorded most autumn and winter months	Spring and autumn passage	Widespread distribution on coastal and inland waters, no particular use of Nigg Bay.
Eurasian teal *Anas crecca*	Recorded most autumn and winter months	Spring and autumn passage	Widespread distribution on coastal and inland waters, no particular use of Nigg Bay.
Eider *Somateria mollissima*	WeBS data peak June, VP data peak August. Secondary peak in December, clear connectivity with nearby SPAs, all year presence, peak numbers in Nigg Bay recorded in low thousands.	Presence all year round, peak summer post breeding period, and mid-winter	Present in large numbers down the entire east coast. Spend most of the time in the water. Use of Nigg Bay for feeding on benthic prey items on the seabed and roosting, some evidence of night time roosting on the beach – until disturbed by dog walkers.
Long-tailed duck *Clangula hyemalis*	Peak numbers from VP recorded in April. Low numbers recorded in WeBS sectors showing winter bias, but 1 flock of 37 recorded from north of the study area in July.	Wintering species with peak counts in spring	Majority of records are birds passing the headland, small groups have been recorded in amongst larger flocks of eider. Use of bay for feeding on benthic prey items on the seabed.
Common scoter *Melanitta nigra*	Peak number of 800 June (ad-hoc survey) is exceptional, and is higher than any recorded from WeBS data.	Peak numbers May to July. Completely absent (October to April)	Summer aggregation in Aberdeen Harbour for birds in moult. Birds maybe using Girdle Ness area when displaced from preferred moulting grounds around Blackdog. The use of Nigg Bay for foraging for benthic prey items on the seabed is seasonal. Large summer flock of birds off Aberdeen Harbour, clearly also use Nigg Bay when disturbed. Likely connectivity with SPAs down east coast.
Velvet scoter *Melanitta fusca*	Not recorded from any VPs. Recorded in low numbers in ad hoc survey from May to July. Relatively large flock (60) recorded in WeBS sector Dee Mouth to Don Mouth in September. Not recorded in any other sector or any other month.	Occasional presence early summer	Individuals will associate with the more numerous common scoter.

Table 14.9: Coastal bird species recorded at Nigg Bay during the site specific vantage point surveys continued

Species	Numbers if Recorded and Peak Month	Seasonal Presence	Usage of Study Area
Common goldeneye *Bucephala clangula*	Recorded in VP and ad hoc surveys mid-summer and late autumn in low numbers	Occasional presence in late autumn	Limited use of the bay, very seasonal although has year-long presence in the Ythan Estuary SPA.
Red-breasted merganser *Mergus serrator*	Only two records from VP one in June, the other September. WeBS data suggests more of a winter and spring presence.	Records would suggest that birds are present as passage migrants.	Limited use of Nigg Bay – VP records of birds passing through.
Goosander *Mergus merganser*	WeBS data peaks in August correspond with data recorded from VP survey.	Present in low numbers in late summer.	Limited use of Nigg Bay – VP records of birds passing through.
Red-throated diver *Gavia stellata*	Peak numbers recorded in April, May and October. There is a presence all year round, although numbers in absolute terms are low, they are significant in SPA context.	Spring and autumn migration, low numbers present year round.	Low usage of Nigg Bay year round, most sightings are of birds passing the headland. Small groups associate with eiders. In spring small groups use the bay for resting and feeding (underwater pursuit of small marine fish). Terrestrial breeding bird survey recorded species loafing within Nigg Bay. Common winter visitor to the east coast of Scotland.
Common gull *Larus canus*	Common- winter peak of 2400. Most abundant species recorded in wintering bird surveys.	All year round	Large roosts in Nigg Bay (up to 2,400 birds) during winter and spring (large roost seen in winter time). Species is highly mobile and does not feed in the Nigg Bay area.
Sandwich tern *Thalasseus sandvicensis*	Common	Spring, summer and autumn	Offshore, roosts and crèches of young on the rocky shore in Greyhope Bay. Known to breed along Aberdeenshire coast. Records from wintering bird survey suggest that a proportion of the east coast breeding population roost in Nigg Bay prior to arrival on breeding grounds.
Common tern *Sterna hirundo*	Common	Spring, summer and autumn	Offshore, roosts and crèches of young on the rocky shore in Greyhope Bay.
Arctic tern *Sterna paradisaea*	Common	Spring, summer and autumn	Offshore, roosts and crèches of young on the rocky shore in Greyhope Bay.
Black-headed gull *Chroicocephalus ridibundus*	Common, peak from wintering bird survey in September.	Autumn, winter and spring	Small northward passage in spring, likely congregation ahead of migration.

Table 14.9: Coastal bird species recorded at Nigg Bay during the site specific vantage point surveys continued

Species	Numbers if Recorded and Peak Month	Seasonal Presence	Usage of Study Area
Lesser black-backed gull *Larus fuscus*	Common	Spring and summer	Listed as occurring in the SEA 5 area (covers eastern Scotland up the Shetland Islands) in important numbers. This species is known to breed in the Firth of Forth.
Herring gull *Larus argentatus*	Common. Recorded on all wintering bird surveys in low numbers with a peak in September.	All year round	Breeds on the roof of the sewage treatment works.
Cormorant *Phalacrocorax carbo*	Common all year round	All year round	Pass through Nigg Bay between day and night time roosts. The closest SPA's for breeding cormorant are located in the Firth of Forth and Moray Firth.
Shag *Phalocrocorax auritus*	Common	All year round	Regularly feeds in outer areas of Nigg Bay. This species has been recorded at Fowlsheugh SPA which is located along the coast south of the project site.

The coastal group of birds also includes waders and wildfowl (those shorebirds which frequent intertidal areas on the foreshore (sandy or rocky) for foraging and which tend to roost above the high water mark). Most of these shorebird species are seasonal in their distribution, being present as passage migrants. Table 14.10 presents a list of shorebirds recorded during the site wader walk-over surveys.

Table 14.10: Shorebirds recorded from wader walk-over survey

Species	Numbers if Recorded and Peak Month	Seasonal Presence	Usage of Study Area
Eurasian oystercatcher *Haematopus ostralegus*	Peak number in October	All year round	Use of rocky foreshore and beach area.
European golden plover *Pluvialis apricaria*	Recorded only in ad hoc survey in 2 months total of 3 birds	Passage migrant	Use of rocky foreshore and beach area.
Northern lapwing *Vanellus vanellus*	1 record only from ad hoc survey - July	Passage migrant	Use of beach area, and grass areas inland.
Common ringed plover *Charadrius hiaticula*	Total of 6 birds recorded in months March, June and July	Present in low numbers for months of the year	One pair recorded to nest on Nigg Bay foreshore.
Whimbrel *Numenius phaeopus*	Total of 3 birds recorded 2 in July and one in May	Passage migrant	Use of rocky foreshore and beach area.
Eurasian curlew *Numenius arquata*	19 recorded in February and similar number in January	Predominantly late winter, early spring, but present in lower numbers all year round	Use of rocky foreshore and beach area.
Ruddy turnstone *Arenaria interpres*	26 recorded in April, 12 in October	Predominantly spring and autumn passage migrant, low numbers in winter	Use of rocky foreshore and beach area.
Sanderling *Calidris alba*	1 recorded in August, Nigg Bay WeBS data also only recorded in August although more numerous in coast line sector between the Dee and Don estuaries where appears to be a regular winter visitor	Autumn passage migrant	Use of beach area.
Dunlin *Calidris alpina*	2 recorded in August and May, WeBS data shows species predominantly a winter visitor	Winter and passage migrant in spring and summer	Use of beach area.
Purple sandpiper *Calidris maritima*	88 recorded in ad hoc survey in April- WeBS record as autumn, winter and spring peak number in January present outside summer months widespread along coastline	Spring and autumn migrant. Absent in summer months	Use of rocky foreshore.

Table 14.10: Shorebirds recorded from wader walk-over survey continued

Species	Numbers if Recorded and Peak Month	Seasonal Presence	Usage of Study Area
Common sandpiper *Actitus hypoleucos*	Recorded in 3 months in ad hoc surveys only, 4 birds in total	Passage migrant, summer visitor	Use of rocky foreshore and beach area.
Common redshank *Tringa totanus*	15 recorded in April	Present all year round outside of breeding season (May to June), main peak in spring	Use of rocky foreshore and beach area.

Drivers, ducks and grebes are those species likely to be present and utilising the existing bay for significant periods of time, informed through data collated regionally.

14.5.4 Overview of Key Species

For each species within the section below, data on populations and trends is presented, with contextual information provided from WeBS counts, which presents monthly peak counts recorded over a 5 year period. Connectivity to SPAs has been discussed within Volume 4: Habitats Regulations Appraisal.

Ducks and Divers

Common Eider *Somateria mollissima*

Conservation

The conservation status of eider is shown in Table 14.11. There are no SPAs for breeding eider in the UK. There are eight SPAs for non-breeding populations, four of which are on the east coast of Scotland. The SPAs for non-breeding eider within the wider regional area with regards to the Nigg Bay population are: the Firth of Forth SPA, Firth of Tay and Eden Estuary SPA, Montrose Basin SPA and Ythan Estuary, Sands of Forvie and Meikle Loch SPA.

Table 14.11: Conservation status of Eider

UK Breeding Population	UK Winter Population	BoCC Status*	IUCN Status**	Annex 1
27,000	63,000	AMBER	LC	ROMS***

Notes:
Population estimates are taken from Musgrove et al., 2013. Annex 1 refers to the bird's status on the Birds Directive. ROMS are not listed on Annex 1, but are regularly occurring migratory species for which SPAs can be designated. Breeding populations are given in pairs, wintering populations in individuals
* Birds of Conservation concern (BOCC)
** International Union for Conservation of Nature (IUCN)
*** Regularly occurring migratory species

Spatial and Temporal Distribution

The eider is found in northern Europe and is also resident in the UK, with local birds making some relatively small scale seasonal and post breeding movements. Its population trend in the UK is unknown but its extent is widespread across the coasts of northern and western Europe, North America. It breeds in the Arctic and northern temperate regions (BirdLife International, 2015) reflected

in an IUCN status of least concern. In the UK it has amber status in the BoCC criteria due to over 50% of the wintering population being concentrated in 10 or fewer locations.

Eider breed at the Ythan Estuary, and birds ringed as pulli (very young chicks), are regularly seen at the Nigg Bay site (personal observations of Mark Lewis) (although none have been noted during the 12 month survey - Appendix 14-A: Marine Ornithology Vantage Point Survey Report). Some of these birds disperse to Aberdeen Bay (the stretch of coast from Cruden Bay in the north to Nigg Bay in the south) after breeding. The east coast population is reasonably sedentary, and in winter aggregate in the Firths of Forth and Tay, (Wernham et al., 2002). As such is it extremely likely that the survey site contains birds that breed locally and winter in one of the non-breeding SPAs.

The VP surveys recorded the largest number of eider around Nigg Bay during summer months, peaking with counts of 749 birds from the VP surveys and 903 birds from the ad hoc counts. Numbers decreased rapidly through the autumn to an early winter population of around 100 birds, and the population remained at this level through to February. After decreasing further through March and April, numbers began to increase in May with the arrival of males from breeding areas.

Distribution trends identified from the VP surveys are consistent with the rest of the east coast of Scotland population, which largely winters in the Firths of Forth and Tay. The birds that pass through the site can be linked to some degree with non-breeding SPAs for eider. In total, the suite of non-breeding SPAs comprise 22,223 birds, with January maxima totalling 9,023 birds, equalling 0.5% of the biogeographic population, and 11.5% of the UK population. The four east coast Scotland SPAs hold 13,475 birds (Stroud et al., 2001). The maximum counts of birds using the survey site are expressed as proportions of the relevant thresholds, national populations and SPA populations in Table 14.12.

Table 14.12: Maximum Counts of Eider Expressed as Percentages of the Relevant Thresholds, National Populations and SPA Populations

		Biogeographic SPA Threshold	UK Breeding Population	UK Winter Population	Ythan SPA	Montrose Basin SPA	Firth of Forth SPA	Firth of Tay SPA	East Coast SPAs Total
SPA/National Population		**20,000**	**27,000**	**63,000**	**1,778**	**1,794**	**7,887**	**2,061**	**13,520**
VP Maximum	**749**	3.75	2.77	1.19	42.13	41.75	9.50	36.34	5.54
Ad hoc Maximum	**903**	4.52	3.34	1.43	50.79	50.33	11.45	43.81	6.68

Seasonal trends are mirrored quite closely with the WeBS data shown in Table 14.13 and the data gathered in support of the EOWDC (AOWFL, 2011), even though the timeframe differs from the VP survey undertaken in support of the Aberdeen Harbour Expansion Project. The most frequently recorded sea-duck species within the Aberdeen OWF surveys were eider and common scoter, both of which were recorded in relatively large numbers at Nigg Bay, particularly during the summer months.

Table 14.13: Five Year Peak Monthly Counts of Eider (WeBS data*)

WeBS Sector	Nigg Bay and Girdle Ness	Ythan Estuary SPA	Montrose Basin SPA	Nigg Bay to Cove Bay	Dee Mouth to Don Mouth
June	1783	3079	1208	171	183
July	1015	2059	1983	156	50
August	1427	880	1580	217	172
September	322	1020	1619	227	170
October	218	1509	1832	80	67
November	630	1430	1216	95	16
December	1417	1630	1395	104	50
January	417	1570	845	154	47
February	461	1033	1099	172	23
March	275	867	1016	115	46
April	283	1528	1322	254	89
May	174	2945	1586	183	42

Note:
Nigg Bay and Girdle Ness, Ythan Estuary SPA, and Montrose Bay SPA 5 year period covers period 2009/2014. Nigg Bay to Cove Bay and Dee Mouth to Don Mouth 5 year period covers period 2004/2009.
* "Data were supplied by the Wetland Bird Survey (WeBS), a partnership between the British Trust for Ornithology, the Royal Society for the Protection of Birds and the Joint Nature Conservation Committee (the last on behalf of the statutory nature conservation bodies: Natural England, Natural Resources Wales and Scottish Natural Heritage and the Department of the Environment Northern Ireland) in association with the Wildfowl and Wetlands Trust"

Data from other sites and wider east coast confirm the widespread distribution of eider down the east coast of Scotland. This is further demonstrated from the aerial survey work undertaken by the JNCC. Given this widespread distribution, eider can be considered of regional importance along this coastline and of local importance within Nigg Bay itself (Figure 14.2) and (Figure 14.3) respectively.

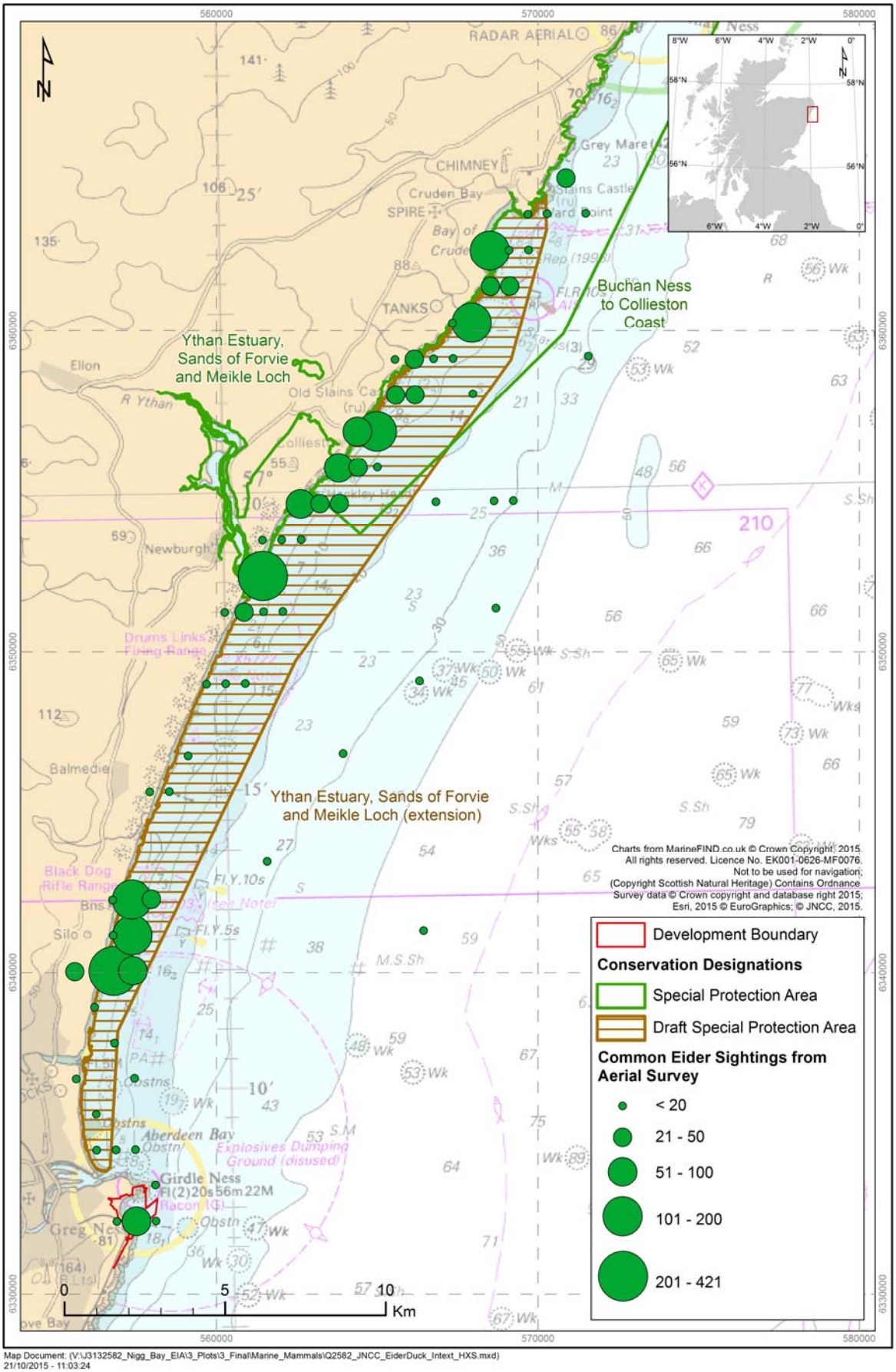

Figure 14.2: Collective aerial data showing distribution of Eider taken from surveys undertaken over five winters (2003 to 2007)
(Source: kind permission of JNCC)

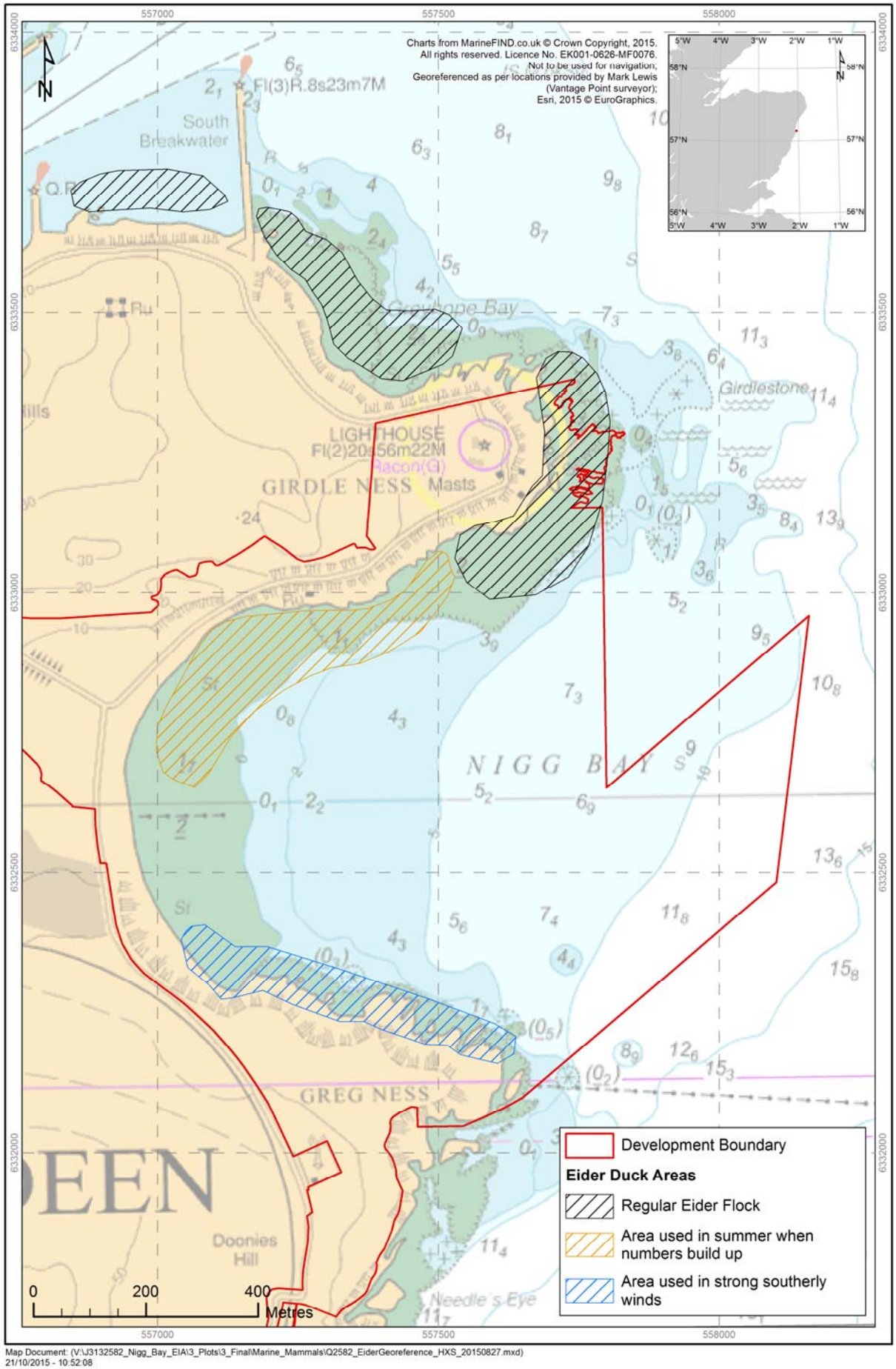

Figure 14.3: Eider distribution at Nigg Bay and the immediate surrounding area

It is thought that spatial use of the site is weather dependent to some degree, with birds moving between Nigg Bay, Greyhope Bay, and frequently Aberdeen Harbour itself, depending on the strength and direction of the wind (note that this is anecdotal, rather than being based upon any evidence collected during the surveys (personal observations of Mark Lewis)). Other species such as red-throated diver and long-tailed duck can often be found with aggregations of eider until their numbers are at sufficient quantity for them to form an aggregation of their own.

Sensitivity/Use

Eider use Nigg Bay and the wider area for feeding, roosting and moulting. The largest roost flocks are generally found on the water, but some birds roost on the rocky shores on the north and south sides of Nigg Bay. Given their presence on the water it is likely that eider are of high risk of displacement and disturbance due to the presence of vessels or construction activities. Occasionally, relatively large numbers are seen roosting on the beach – these roosts tend to be seen in early mornings, and it is likely that beach roosting birds are frequently disturbed by activities such as dog walking and bait digging.

Eider feed by diving in shallow waters up to 12 m depth and typically within 1 km of the shore (Larsen and Guillemette 2000; Merke and Mosbech 2008, referenced in Cook and Burton, 2010). Eider target crustaceans and molluscs, with mussels being the favoured prey (BirdLife International, 2015). The maximum foraging range of an eider is 80 km (Thaxter et al., 2012).

The distribution of diving duck species such as eider have been shown to be influenced by the availability of prey in intertidal and marine environments (Guillemette and Himmelman, 1996; Larsen and Guillemette, 2000; Lacroix et al., 2005; Kaiser et al., 2006; Zydelis et al., 2006 referenced in Cook and Burton, 2010). This sensitivity will be considered in terms of loss of prey items but also the predicted changes in turbidity which will influence the ability to forage effectively. Eider are often unable to switch to foraging in alternative habitats (Garthe and Hüppop 2004; King et al., 2009, referenced in Cook and Burton, 2010), although as referenced in Chapter 12: Benthic Ecology and Chapter 13: Fish and Shellfish Ecology the seabed habitats in Nigg Bay broadly reflect those found across the wider region. A reduction in food availability has been linked to major mortality (Camphuysen et al., 2002, referenced in Cook and Burton, 2010).

Red-throated Diver *Gavia stellata*

Conservation

The conservation status of red-throated diver is shown in Table 14.14. There are 10 SPAs for breeding red-throated diver in the UK. The SPAs for breeding red-throated diver within the wider regional area with regards to the Nigg Bay population are: Caithness and Sutherland Peatlands SPA, Fouls SPA, Hermaness, Saxa Vord and Valla Field SPA, Hoy SPA, Orkney Mainland Moors SPA, Otterswick and Graveland SPA, and Ronas Hill – North Roe and Tingon SPA. There are well documented spring and autumn passages of red-throated diver along the east coast of Scotland (Forrester et al., 2007), and although these movements almost certainly contain birds that have bred further north than the UK, it is assumed that UK breeders are involved as well.

The SPAs for non-breeding red-throated diver within the wider regional area with regards to the Nigg Bay population are: Firth of Forth SPA and Outer Thames Estuary SPA. A recent estimate for the

latter (Goodship et al., 2015) has suggested that the population could be as high as 14,161 (83% of the total wintering population in Britain).

Table 14.14: Conservation status of Red-throated diver

UK Breeding Population	UK Winter Population	BoCC Status	IUCN Status	Annex 1
1,300	17,000	AMBER	LC	Annex 1

Note:
Population estimates are taken from Musgrove et al., 2013. Annex 1 refers to the birds status on the Birds Directive. ROMS are not listed on annex 1, but are regularly occurring migratory species for which SPAs can be designated. Breeding populations are given in pairs, wintering populations in individuals

Spatial and Temporal Distribution

The red-throated diver is a rare breeding bird in the UK, but is a reasonably common winter visitor around UK coasts, especially in the east. Winter aggregations of red-throated diver are thought to comprise some UK breeders as well as birds originating in Greenland, Iceland and Scandinavia. The breeding population fluctuates but has shown no long-term change between 1980 and 2005 (Mavor et al., 2008). This species mainly breeds in the Arctic regions of the northern hemisphere, but also breeds as far south as Scotland, and winters along the Pacific and Atlantic coasts (the range of which includes the whole of the UK) and as far south as the Caribbean and south east China.

The VP surveys recorded small numbers of red-throated diver at the site throughout the 12 month period, with peak counts during the spring and autumn coinciding with the species main migration periods. The birds comprising these peak counts are considered to be both UK breeders and those that breed at more northerly latitudes. The largest counts coincided with the peak period of spring passage, in April and May.

Distribution trends identified from the VP surveys are consistent with the rest of the east coast of Scotland population. The species distribution was found to be fairly even along the east coast of the UK as a whole (JNCC, 2001). Of the 13 UK SPAs that list red-throated diver as an interest feature, seven terrestrial SPAs, two wholly marine SPAs, and one SPA with a marine component are considered to be likely to show connectivity with Nigg Bay. The seven terrestrial sites are designated for breeding populations, and the three others for wintering aggregations. The maximum counts of birds using the survey site are expressed as proportions of the relevant thresholds, national populations and SPA populations for wintering SPAs in Table 14.15 and for breeding SPAs in Table 14.16.

Table 14.15: Maximum counts of Red-throated Diver Expressed as percentages of the relevant thresholds, national populations and non-breeding SPA populations

		Biogeographic SPA Threshold	UK Breeding Population	UK Winter Population	Firth of Forth SPA	Liverpool Bay SPA	Outer Thames Estuary SPA
SPA/National Population		750	1,300	17,000	88	922	6,466
VP Maximum	**9**	1.20	0.69	0.05	10.23	0.98	0.14
Ad hoc Maximum	**34**	4.53	2.62	0.20	38.64	3.69	0.53

Table 14.16: Maximum counts of Red-throated diver, expressed as percentages of the populations of breeding SPA populations

		Caithness and Sutherland Peatlands SPA	Foula SPA	Hermaness, Saxa Vord and Valla Field SPA	Hoy SPA	Orkney Mainland Moors SPA	Otterswick and Graveland SPA	Ronas Hill SPA	East coast SPAs Total
SPA/National Population		**89**	**11**	**28**	**56**	**15**	**27**	**50**	**276**
VP Maximum	**9**	10.11	81.82	32.14	16.07	60.00	33.33	18.00	3.26
Ad hoc Maximum	**34**	38.20	309.09	121.43	60.71	226.67	125.93	68.00	12.32

Seasonal trends are mirrored between the WeBS data shown in Table 14.17, and the data gathered in support of the EOWDC ES (AOWFL, 2011) even though the timeframe differs from the VP survey undertaken in support of the Aberdeen Harbour Expansion Project. The red-throated diver was the only species of diver frequently recorded during the AOWL surveys, with peak numbers recorded during the winter and spring (AOWFL, 2011).

Table 14.17: Five year peak monthly counts of Red-throated diver (WeBS Data*)

WeBS Sector	Nigg Bay and Girdle Ness	Ythan Estuary SPA	Montrose Basin SPA	Nigg Bay to Cove Bay	Dee Mouth to Don Mouth
June	0	0	0	0	3
July	0	0	0	0	8
August	0	0	0	0	9
September	2	1	14	6	11
October	1	0	1	3	8
November	1	0	0	1	2

Table 14.17: Five year peak monthly counts of Red-throated diver (WeBS Data*) continued

WeBS Sector	Nigg Bay and Girdle Ness	Ythan Estuary SPA	Montrose Basin SPA	Nigg Bay to Cove Bay	Dee Mouth to Don Mouth
December	0	0	0	3	2
January	7	0	0	3	8
February	12	0	1	2	14
March	1	0	0	1	3
April	8	0	0	3	34
May	5	0	0	0	10

Notes:
Nigg Bay and Girdle Ness, Ythan Estuary SPA, and Montrose Bay SPA 5 year period covers period 2009/2014. Nigg Bay to Cove Bay and Dee Mouth to Don Mouth 5 year period covers period 2004/2009
* "Data were supplied by the Wetland Bird Survey (WeBS), a partnership between the British Trust for Ornithology, the Royal Society for the Protection of Birds and the Joint Nature Conservation Committee (the last on behalf of the statutory nature conservation bodies: Natural England, Natural Resources Wales and Scottish Natural Heritage and the Department of the Environment Northern Ireland) in association with the Wildfowl and Wetlands Trust"

Data from other sites and wider east coast confirm the widespread distribution of red-throated diver down the east coast of Scotland. This is further demonstrated from the aerial survey work undertaken by the JNCC (Figure 14.4).

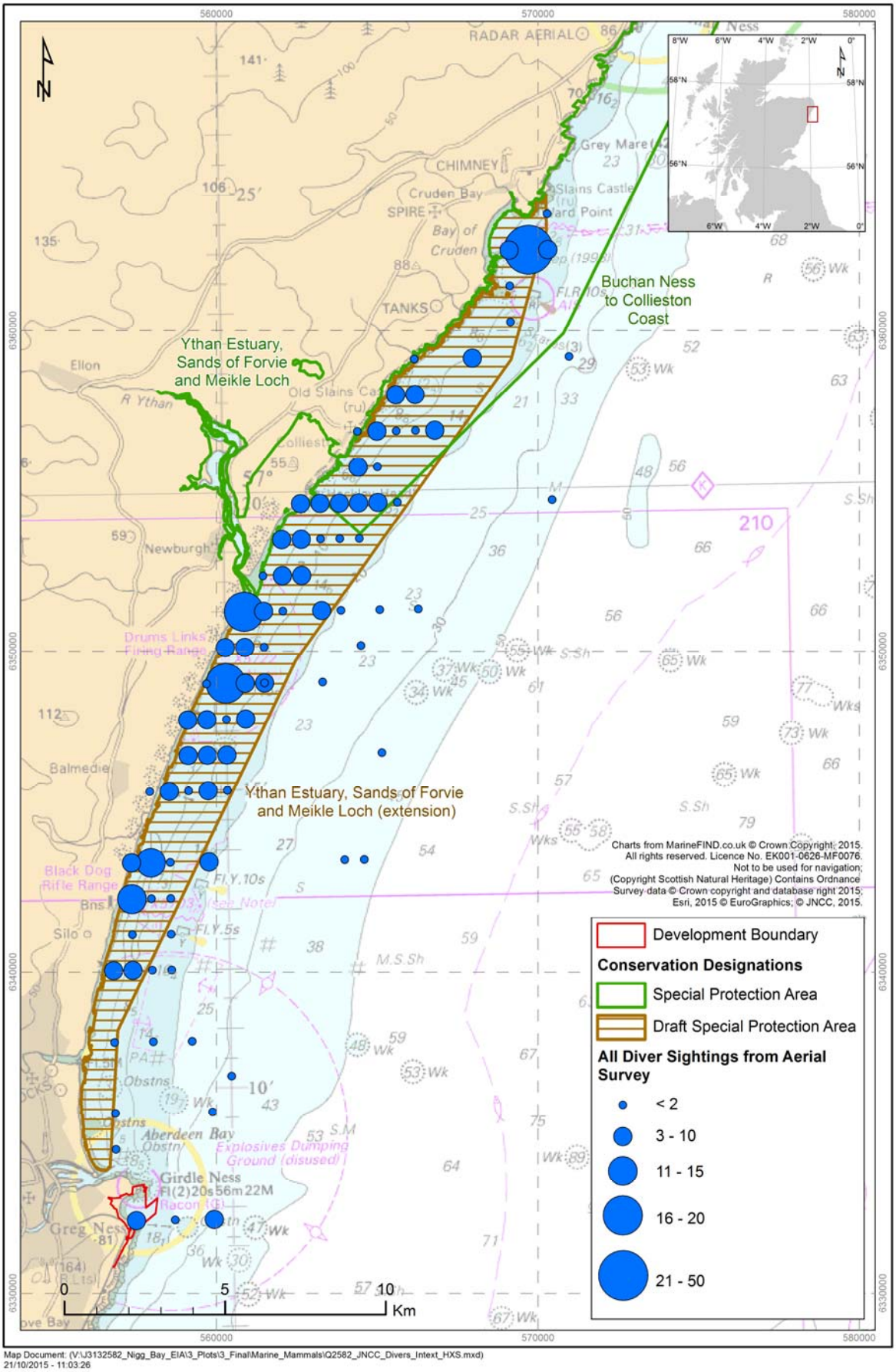

Figure 14.4: Collective aerial data showing distribution of red-throated diver and diver species taken from surveys undertaken over five winters (2003 to 2007)
(Source: kind permission of JNCC)

The majority of red-throated diver records from the site are of birds passing the headland, or of small groups of birds associating with flocks of eider. As such, the distribution of the eider flocks they associate with largely drives the distribution of common scoter actively using the site. In spring and less frequently autumn, small flocks use Nigg bay for resting and feeding. The population of red-throated diver using Nigg Bay can be described as being of local importance.

Sensitivity/Use

Red-throated divers are notably highly sensitive to the disturbance associated with shipping traffic (Kube, 1996, Garthe and Hüppop 2004; King et al., 2009 referenced in Cook and Burton, 2010). Consequently, they are likely to avoid areas associated with shipping activity (Cook and Burton, 2010). This species is highly vulnerable to the effects of oil pollution (Camphuysen, 1989; Williams et al., 1994 referenced in Cook and Burton, 2010). However, this sensitivity may be offset by their tendency to avoid areas with heavy shipping (Kube, 1996 referenced in Cook and Burton, 2010).

Red-throated divers are a diving species that specialises in foraging on fish (Cook and Burton, 2010), with herring being a key prey species (Guse et al., 2009 referenced in Cook and Burton, 2010). Therefore this species may also be sensitive to activities that negatively affect herring populations, such as increases in sediment deposition through dredging/disturbance of the seabed.

Velvet Scoter *Melanitta fusca*

Conservation

There are no SPAs for breeding velvet scoter in the UK and four for non-breeding, three of which are located on the east coast of Scotland: Firth of Tay and Eden Estuary SPA, Firth of Forth SPA and Moray Firth SPA. The conservation status for velvet scoter is presented in Table 14.18.

Table 14.18: Conservation status of Velvet scoter

UK Breeding Population	UK Winter Population	BoCC Status	IUCN Status	Annex 1
0	2,500	AMBER	LC	ROMS

Note:
Population estimates are taken from Musgrove et al., 2013. Annex 1 refers to the birds status on the Birds Directive. ROMS are not listed on annex 1, but are regularly occurring migratory species for which SPAs can be designated. Breeding populations are given in pairs, wintering populations in individuals

Spatial and Temporal Distribution

This species breeds in Scandinavia and western Siberia and winters mostly in the Baltic Sea and along the coasts of western Europe accounting for the vast majority of the global population (Delany and Scott, 2006 referenced in BirdLife International, 2015). With a small population wintering in the Black Sea and Caucasus having bred in Turkey, Armenia, Georgia and Turkmenistan (Kear, 2005 referenced in BirdLife International, 2015).

The VP surveys recorded no velvet scoter around Nigg Bay; however, the ad-hoc survey recorded the species in May to July with a peak monthly maximum of 5 birds in May and June. This species was absent from all other months.

Seasonal trends and distribution for sites closest to Nigg Bay are mirrored in the WeBS data shown in Table 14.19.

Table 14.19: Five year peak monthly counts of Velvet scoter (WeBS Data*)

WeBS Sector	Nigg Bay and Girdle Ness	Ythan Estuary SPA	Montrose Basin SPA	Nigg Bay to Cove Bay	Dee Mouth to Don Mouth
June	0	0	0	0	0
July	0	0	0	0	0
August	0	0	0	0	0
September	0	0	0	0	60
October	0	0	0	0	0
November	0	0	0	0	0
December	0	0	0	0	0
January	0	0	0	0	0
February	0	0	0	0	0
March	0	0	0	0	0
April	0	0	0	0	0
May	0	0	0	0	0

Notes:
Nigg Bay and Girdle Ness, Ythan Estuary SPA, and Montrose Bay SPA 5 year period covers period 2009/2014. Nigg Bay to Cove Bay and Dee Mouth to Don Mouth 5 year period covers period 2004/2009
* "Data were supplied by the Wetland Bird Survey (WeBS), a partnership between the British Trust for Ornithology, the Royal Society for the Protection of Birds and the Joint Nature Conservation Committee (the last on behalf of the statutory nature conservation bodies: Natural England, Natural Resources Wales and Scottish Natural Heritage and the Department of the Environment Northern Ireland) in association with the Wildfowl and Wetlands Trust"

Sensitivity/Use

The diet of the velvet scoter consists predominantly of molluscs, as well as crustaceans, worms, echinoderms (del Hoyo et al., 1992), amphipods, isopods (Kear, 2005), small fish, and (in freshwater habitats) adult and larval insects (del Hoyo et al., 1992). The species may also consume plant material on its breeding grounds (del Hoyo et al., 1992) (e.g. leaves and shoots) (Flint et al., 1984) (all referenced in BirdLife International, 2015).

The main threat to the moulting and wintering concentrations is that they are very susceptible to oil spills and other marine pollutants (Gorski et al., 1977, del Hoyo et al., 1992, Kear, 2005, UICN France, 2011). The species is also susceptible to the effects of commercial exploitation of marine benthic organisms and shellfish (Kear, 2005), it is threatened by drowning in fishing nets (del Hoyo et al., 1992, Kear, 2005), and is sensitive to disturbance from wind farms (wind turbines) (Garthe and Huppop, 2004) (all referenced in BirdLife International, 2015) as well as to general shipping activity.

Common Scoter *Melanitta nigra*

Conservation

The conservation status of common scoter is shown in Table 14.20. The SPA for breeding common scoter within the wider regional area with regards to the Nigg Bay population is the Caithness and Sutherland Peatlands SPA.

The SPAs for non-breeding common scoter within the wider regional area with regards to the Nigg Bay population are: the Firth of Forth SPA, the Firth of Tay and Eden Estuary SPA, and the Moray and Nairn Coast SPA. Entirely marine SPAs in Carmarthen Bay and Liverpool Bay also list common scoter as interest features.

Table 14.20: Conservation status of Common scoter

UK Breeding Population	UK Winter Population	BoCC Status	IUCN Status	Annex 1
52	100,000	RED	LC	ROMS

Note:
Population estimates are taken from Musgrove et al., 2013. Annex 1 refers to the birds status on the Birds Directive. ROMS are not listed on Annex 1, but are regularly occurring migratory species for which SPAs can be designated. Breeding populations are given in pairs, wintering populations in individuals

The moulting flock of common scoter in Aberdeen Bay can number as many as 4,750 birds (Forrester et al., 2007) and as such must contain birds that do not originate from UK breeding areas – i.e. those originating in European breeding areas. However, despite the fact that little is known about the movements of UK breeding birds, it is assumed that they use the same UK wintering and moult flocks as the European birds. With moult flocks also present on the west coast of Scotland, it is likely that the birds breeding at eastern SPAs use the east coast moult flocks, and those breeding at the west coast SPA use west coast moult aggregations. However, recent research has shown that these birds could be overwintering as far away as Morocco (WWT, 2015).

Spatial and Temporal Distribution

The common scoter is a rare breeding bird in the UK, with all birds breeding in Scotland (Balmer et al., 2013). It is more common in the winter, with influx of birds from Icelandic and Scandinavian populations (Wernham et al., 2002). There are also summer aggregations of moulting birds, including one to the north of the survey area in Aberdeen Bay (Forrester et al., 2007). Its population trend in the UK is unknown but its extent is widespread across the coasts of northern and western Europe, North America, eastern Siberia and southern Greenland and breeds in the Arctic and northern temperate regions (BirdLife International, 2015).

The VP surveys recorded a distinct peak in numbers of common scoter using Nigg Bay in summer, coinciding with the annual build-up of birds aggregating to moult in Aberdeen Bay. Dispersal of some of these moulting birds (possibly a result of boats being present in the area) resulted in an unprecedented flock of 800 birds using the site for 6 days in late June and early July. It is likely that the birds that aggregate in moult flocks to the north of the site contain birds bred in the UK, and that these moult flocks comprise some proportion of the populations designated as wintering SPAs for this species.

Distribution trends identified from the VP surveys are consistent with the rest of the east coast of Scotland population. Most of the UK winter population tends to be found in a few large flocks off the mouths of major estuaries, and for the east coast of Scotland sites include Moray Firth, Firth of Forth and St Andrew's Bay/Eden Estuary (Barton and Pollock, 2004). The birds that pass through the site can be linked to some degree with the UK wintering SPAs of the Firth of Forth SPA, the Firth of Tay and Eden Estuary SPA, and the Moray and Nairn Coast SPA. In total, the suite of non-breeding SPAs

comprise 8,793 birds, with January maxima totalling 3,422 birds, equalling 0.2% of the biogeographic population and 12.4% of the UK population. The three relevant east coast Scottish SPAs comprise a total population of 4,628 birds (Stroud et al., 2001). The maximum counts of birds using the survey site are expressed as proportions of the relevant thresholds, national populations and SPA populations in Table 14.21.

Table 14.21: Maximum counts of Common scoter expressed as percentages of the relevant thresholds, national populations and SPA populations

		Biogeographic SPA Threshold br	Biogeographic SPA Threshold Non br	UK Breeding Population	UK Winter Population	Moray and Nairn Coast	Firth of Forth SPA	Firth of Tay SPA	East Coast SPAs Total
SPA/National Population		**5,300**	**16,000**	**52**	**100,000**	**531**	**2,653**	**1,444**	**4,628**
VP Maximum	**84**	1.58	0.53	161.54	0.08	15.82	3.17	5.82	1.82
Ad hoc Maximum	**800**	15.09	5.00	1538.4	0.80	150.66	30.15	55.40	17.29

Seasonal trends are mirrored with the WeBS data shown in Table 14.22, and the data gathered in support of The European Offshore Wind Deployment Centre (EOWDC) ES (AOWFL, 2011), even though the timeframe differs from the VP survey undertaken in support of the Aberdeen Harbour Expansion Project. The most frequently recorded sea-duck species within the Aberdeen OWF surveys were common eider and common scoter, both of which were recorded in relatively large numbers at Nigg Bay, particularly during the summer months.

Table 14.22: Five year peak monthly counts of Common scoter (WeBS data*)

WeBS Sector	Nigg Bay and Girdle Ness	Ythan Estuary SPA	Montrose Basin SPA	Nigg Bay to Cove Bay	Dee Mouth to Don Mouth
June	25	0	0	0	15
July	0	0	0	0	6
August	0	0	0	0	56
September	0	0	200	0	188
October	0	0	0	0	18
November	0	0	1	0	7
December	0	0	0	1	3
January	0	0	0	0	0
February	0	0	6	2	0
March	0	0	0	0	2

Table 14.22: Five year peak monthly counts of Common scoter (WeBS data*) continued

WeBS Sector	Nigg Bay and Girdle Ness	Ythan Estuary SPA	Montrose Basin SPA	Nigg Bay to Cove Bay	Dee Mouth to Don Mouth
April	0	0	0	0	34
May	0	0	0	0	9

Note:
Nigg Bay and Girdle Ness, Ythan Estuary SPA, and Montrose Bay SPA five year period covers period 2009/2014. Nigg Bay to Cove Bay and Dee Mouth to Don Mouth five year period covers period 2004/2009
* "Data were supplied by the Wetland Bird Survey (WeBS), a partnership between the British Trust for Ornithology, the Royal Society for the Protection of Birds and the Joint Nature Conservation Committee (the last on behalf of the statutory nature conservation bodies: Natural England, Natural Resources Wales and Scottish Natural Heritage and the Department of the Environment Northern Ireland) in association with the Wildfowl and Wetlands Trust"

Data from other sites and wider east coast confirm the widespread distribution of common scoter along the east coast of Scotland. This is further demonstrated from the aerial survey work undertaken by the JNCC ((Figure 14.5). The population of common scoter using Nigg Bay can be described as being of local importance.

The majority of common scoter records from the site are of birds passing the headland, or of small groups of birds associating with flocks of eider. As such the distribution of the eider flocks they associate with largely drives the distribution of common scoter actively using the site. Common scoter will occasionally roost with flocks of eider using Nigg Bay, but have never been observed to roost out of the water.

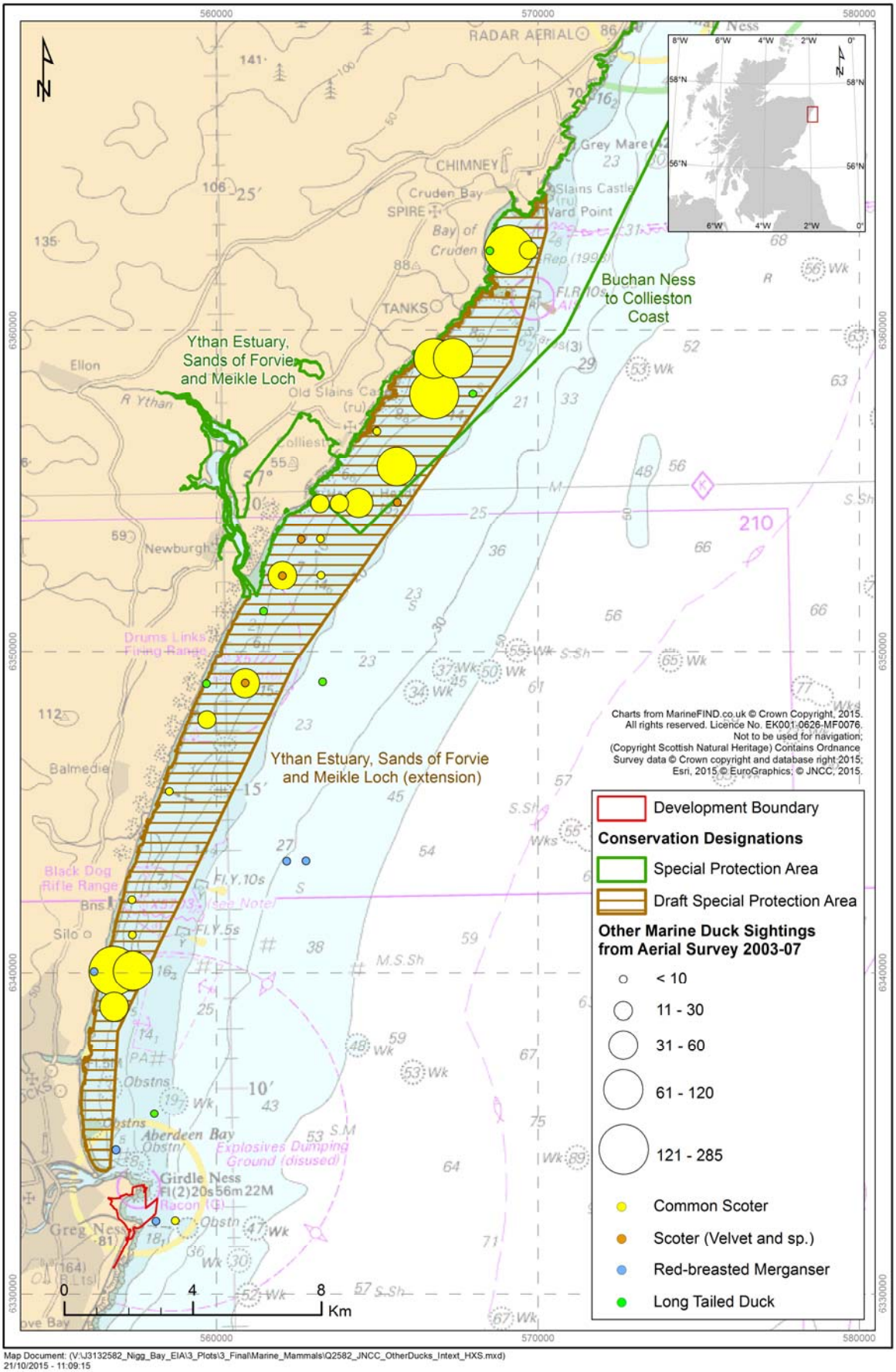

Figure 14.5: Collective aerial data showing distribution of marine ducks (other than eider) taken from surveys undertaken for five winters (2003 to 2007)

(Source: kind permission of JNCC)

Sensitivity/Use

Common Scoter is a diving species that typically feeds in water that is 7 m to 18 m deep, usually within 10 km of the shore (Seys et al., 2001; Kaiser et al., 2006 referenced in Cook and Burton, 2010). The common scoter specialises in foraging on shellfish, particularly bivalves (Kaiser et al., 2006 referenced in Cook and Burton, 2010).

The distribution of diving duck species have been shown to be influenced by the availability of prey in intertidal and marine environments (Guillemette and Himmelman 1996; Larsen and Guillemette 2000; Lacroix et al., 2005; Kaiser et al., 2006; Zydelis et al., 2006 referenced in Cook and Burton, 2010). This sensitivity will be considered in terms of loss of prey items but also changes in turbidity which may influence the ability to forage effectively. Common scoter are inflexible in their habitat use (Garthe and Hüppop 2004; King et al., 2009, referenced in Cook and Burton, 2010) and are thus also likely to be sensitive to any loss of prey and through the deposition of sediment. The common scoter is notably sensitive to disturbance, often flushed at distances in excess of 1 km from large vessels, as well as showing sensitivity to oil pollution (Garthe and Hüppop 2004; Kaiser et al., 2006; King et al,. 2009; Camphuysen, 1989; Williams et al., 1994; Banks et al., 2008 referenced in Cook and Burton, 2010).

As the behaviour of UK breeding common scoter is poorly known, linking the Nigg Bay birds to a specific wintering SPA population is not possible. As such, it would be precautionary to use the east coast Scotland SPAs as well as the individual site totals when assessing any potential impacts the proposed development might have on non-breeding birds. Potential effects on UK breeding populations should be assessed against the population breeding within the Caithness and Sutherland Peatlands SPA.

Red-breasted Merganser *Merganser serrator*

Conservation

There are no SPAs for breeding red-breasted merganser in the UK and 15 for non-breeding. The conservation status for red-breasted merganser is presented in Table 14.23.

Table 14.23: Conservation Status of Red-breasted Merganser

UK Breeding Population	UK Winter Population	BoCC Status	IUCN Status	Annex 1
2,400	9,000	GREEN	LC	ROMS

Note:
Population estimates are taken from Musgrove et al., 2013. Annex 1 refers to the birds status on the Birds Directive. ROMS are not listed on Annex 1, but are regularly occurring migratory species for which SPAs can be designated. Breeding populations are given in pairs, wintering populations in individuals

Spatial and Temporal Distribution

This species is widespread across much of the northern hemisphere. Its breeding range includes most of the northern North America, Iceland, and much of northern Eurasia south to the United Kingdom, parts of Eastern Europe, northeast China and northern Japan. Its wintering grounds expand its range to include the Atlantic and Pacific coasts of North America, areas of central Europe and the Mediterranean, the Black Sea, the southern Caspian Sea, the southern coast of Iran and Pakistan, the eastern coast of China, and the coasts of Korea and Japan (BirdLife International, 2015).

The VP surveys recorded a peak monthly maximum of 1 bird in June and September with the ad hoc survey recording no birds. This species was absent from all other months.

Seasonal trends and distribution for sites closest to Nigg Bay are mirrored in the WeBS data shown in Table 14.24.

Table 14.24: Five Year Peak Monthly Counts of Red-breasted Merganser (WeBS Data*)

WeBS Sector	Nigg Bay and Girdle Ness	Ythan Estuary SPA	Montrose Basin SPA	Nigg Bay to Cove Bay	Dee Mouth to Don Mouth
June	0	13	192	-	0
July	0	4	137	-	4
August	0	3	45	-	17
September	0	32	51	-	2
October	0	70	22	-	0
November	0	48	29	-	3
December	1	30	24	-	1
January	9	37	41	-	7
February	1	65	21	-	4
March	3	52	61	-	4
April	9	48	75	-	9
May	0	24	38	-	1

Notes:
Nigg Bay and Girdle Ness, Ythan Estuary SPA, and Montrose Bay SPA 5 year period covers period 2009/2014. Nigg Bay to Cove Bay and Dee Mouth to Don Mouth 5 year period covers period 2004/2009
* "Data were supplied by the Wetland Bird Survey (WeBS), a partnership between the British Trust for Ornithology, the Royal Society for the Protection of Birds and the Joint Nature Conservation Committee (the last on behalf of the statutory nature conservation bodies: Natural England, Natural Resources Wales and Scottish Natural Heritage and the Department of the Environment Northern Ireland) in association with the Wildfowl and Wetlands Trust"

Data from other sites and the wider east coast confirm the distribution of red-breasted merganser down the east coast of Scotland. This is further demonstrated from the aerial survey work undertaken by the JNCC (Figure 14.5).

Sensitivity/Use

The diet of the red-breasted merganser consists predominantly of small, shoaling marine or freshwater fish (del Hoyo et al., 1992), as well as small amounts of plant material (del Hoyo et al., 1992) and aquatic invertebrates (del Hoyo et al., 1992) such as crustaceans (e.g. shrimps and crayfish) (Johnsgard, 1978), worms and insects (Kear, 2005b) (all referenced in BirdLife International, 2015).

The main threats to this species include shooting, fishing and fish farmers who accuse it of depleting fish stocks (del Hoyo et al., 1992, Kear, 2005b). It is also threatened by accidental entanglement and drowning in fishing nets (Kear, 2005b) (all referenced in BirdLife International, 2015).

Goosander *Mergus merganser*

Conservation

There are no SPAs for breeding goosander in the UK and 2 for non-breeding, both of which are on the east coast of Scotland: Firth of Tay and Eden Estuary SPA and Moray Firth SPA. The conservation status for goosander is presented in Table 14.25.

Table 14.25: Conservation status of Goosander

UK Breeding Population	UK Winter Population	BoCC Status	IUCN Status	Annex 1
3,500	12,000	GREEN	LC	ROMS

Note:
Population estimates are taken from Musgrove et al., 2013. Annex 1 refers to the birds status on the Birds Directive. ROMS are not listed on Annex 1, but are regularly occurring migratory species for which SPAs can be designated. Breeding populations are given in pairs, wintering populations in individuals

Spatial and Temporal Distribution

This species is widespread across much of the northern hemisphere with the exception of Africa, with breeding areas extending across much of Europe, Asia and North America. Its wintering range is fairly broad, encompassing the western cost of Europe extending into central and south-eastern Europe, and central Asia, and the eastern coast of China as well as Korea and Japan (BirdLife International, 2015).

The VP surveys recorded a peak monthly maximum of 3 birds in August with the ad hoc survey recording a peak monthly maximum of 1 bird in April. This species was absent from all other months.

Seasonal trends and distribution for sites closest to Nigg Bay are mirrored in the WeBS data shown in Table 14.26 below.

Table 14.26: Five year peak monthly counts of Goosander (WeBS Data*)

WeBS Sector	Nigg Bay and Girdle Ness	Ythan Estuary SPA	Montrose Basin SPA	Nigg Bay to Cove Bay	Dee Mouth to Don Mouth
June	18	0	90	0	0
July	47	2	167	0	0
August	67	8	137	0	0
September	2	2	47	0	0
October	0	0	47	0	0
November	0	6	1	0	1
December	0	1	4	0	0
January	2	0	7	0	0
February	0	0	7	0	0
March	2	1	70	0	0
April	0	2	4	0	0
May	2	0	21	0	0

Note:
Nigg Bay and Girdle Ness, Ythan Estuary SPA, and Montrose Bay SPA 5 year period covers period 2009/2014. Nigg Bay to Cove Bay and Dee Mouth to Don Mouth 5 year period covers period 2004/2009
* “Data were supplied by the Wetland Bird Survey (WeBS), a partnership between the British Trust for Ornithology, the Royal Society for the Protection of Birds and the Joint Nature Conservation Committee (the last on behalf of the statutory nature conservation bodies: Natural England, Natural Resources Wales and Scottish Natural Heritage and the Department of the Environment Northern Ireland) in association with the Wildfowl and Wetlands Trust”

Sensitivity/Use

The diet of the goosander consists predominantly of fish (del Hoyo et al., 1992) less than 10 cm long (Kear, 2005b), but may also include aquatic invertebrates (such as molluscs, crustaceans, worms, and adult and larval insects), amphibians, small mammals and birds (del Hoyo et al., 1992) (all referenced in BirdLife International, 2015).

The main threat to this species is occasional drowning in freshwater fishing nets with mesh sizes greater than 5 cm (Quan et al. 2002) (all referenced in BirdLife International, 2015).

Long-tailed duck *Clangula hyemalis*

Conservation

The conservation status of long-tailed duck is shown in Table 14.27. Globally there has been a dramatic decline in the wintering population in the Baltic Sea and its IUCN status is vulnerable. This species does not breed here therefore there are no SPAs for breeding long-tailed duck in the UK. There are 3 SPAs designated for aggregations of non-breeding long-tailed duck in UK waters: the Firth of Forth SPA, Firth of Tay and Eden Estuary SPA, and the Moray and Nairn Coast SPA. Long-tailed duck winter aggregations are generally very site faithful (possibly due to specific habitat requirements) (Forrester et al., 2007). However, it is possible that the birds comprising the spring aggregations may come from one of the non-breeding SPAs in the UK. There is no knowledge of where these spring birds come from, however it is though that species movements are largely northward in eastern Scotland, which would suggest an origin south of the project site.

Table 14.27: Conservation status of Long-tailed duck

UK Breeding Population	UK Winter Population	BoCC Status	IUCN Status	Annex 1
0	11,000	GREEN	Vulnerable	ROMS

Note:
Population estimates are taken from Musgrove et al., 2013. Annex 1 refers to the birds status on the Birds Directive. ROMS are not listed on Annex 1, but are regularly occurring migratory species for which SPAs can be designated. Breeding populations are given in pairs, wintering populations in individuals

Spatial and Temporal Distribution

The long-tailed duck is a regular non-breeding visitor to UK waters, with most UK birds wintering on northern and eastern Scottish coasts (Balmer et al., 2013). Some wintering birds linger into spring. In Nigg Bay, counts of long-tailed duck are highest in spring, with displaying birds sometimes present to late May. Its population trend in the UK is unknown. Its range is circumpolar and it breeds across the arctic coasts of North America, Europe and Asia and winters at sea as far south as the UK, South Carolina and Washington in the United States and Korea (del Hoyo et al., 1992 referenced in BirdLife International, 2015).

Very small numbers of long-tailed duck were noted during the 12 month period, with the small autumn increase in sightings reflecting a) the arrival of non-breeding birds from northern Fennoscandinavia and north-west Russia (Wernham et al., 2002) and b) the largely site faithful nature of this species on its UK wintering sites. A small aggregation occurred in April (as with other years, M Lewis pers. obs.) before returning to low numbers in May.

Patterns of occurrence identified from the VP surveys are consistent with the rest of the east coast of Scotland population. Of the UK wintering population, the Firth of Forth SPA, the Firth of Tay and Eden Estuary SPA, and the Moray and Nairn Coast SPA are considered to have potential connectivity with birds using the survey site. These 3 SPAs hold a total population of 1,553 birds, with a January maximum of 796. These totals comprise less than 0.1% of the biogeographic population and 3.5% of the UK wintering population. The maximum counts of birds using the survey site are expressed as proportions of the relevant thresholds, national populations and SPA populations in Table 14.28.

Table 14.28: Maximum counts of Long-tailed duck expressed as percentages of the relevant thresholds, national populations and SPA populations

		Biogeographic SPA Threshold	UK Winter Population	Montrose Basin SPA	Firth of Forth SPA	Firth of Tay and Eden Estuary SPA	East coast SPAs Total
SPA/National Population		1,500	11,000	277	716	560	1,553
VP Maximum	**25**	1.67	0.23	9.03	3.49	4.46	1.61
Ad hoc Maximum	**27**	1.80	0.25	9.75	3.77	4.82	1.74

Seasonal trends are mirrored with the WeBS data shown in Table 14.29. Species are largely found in the winter and early to mid-spring however the WeBS results record a higher number of birds occurring in January and February (although this is at a different site to Nigg Bay) with the VP results recording a higher number in April.

Table 14.29: Five year peak monthly counts of Long-tailed duck (WeBS Data*)

WeBS Sector	Nigg Bay and Girdle Ness	Ythan Estuary SPA	Montrose Basin SPA	Nigg Bay to Cove Bay	Dee Mouth to Don Mouth
June	0	0	0	0	0
July	0	0	0	0	37
August	0	0	0	0	0
September	0	1	0	0	0
October	0	0	0	0	0
November	0	2	1	0	0
December	0	14	1	0	0
January	2	36	2	0	6
February	0	34	2	1	8
March	1	11	4	0	2
April	1	10	0	0	12
May	0	0	0	0	8

Notes:
Nigg Bay and Girdle Ness, Ythan Estuary SPA, and Montrose Bay SPA 5 year period covers period 2009/2014. Nigg Bay to Cove Bay and Dee Mouth to Don Mouth 5 year period covers period 2004/2009
* "Data were supplied by the Wetland Bird Survey (WeBS), a partnership between the British Trust for Ornithology, the Royal Society for the Protection of Birds and the Joint Nature Conservation Committee (the last on behalf of the statutory nature conservation bodies: Natural England, Natural Resources Wales and Scottish Natural Heritage and the Department of the Environment Northern Ireland) in association with the Wildfowl and Wetlands Trust"

Data from Table 14.29 confirms the presence of long-tailed duck down the east coast of Scotland, specifically the eastern and northern coasts of Scotland, with large concentrations limited to the east coast Firths of Scotland with smaller flocks distributed around other British and Irish coasts. This is further demonstrated from the aerial survey work undertaken by the JNCC (Figure 14.5) as well as other sources including JNCC (2001) and Cook and Burton (2010). The majority of long-tailed duck records from the site are of birds passing the headland, or of small groups of birds associating with flocks of common eider. The population of long-tailed duck using Nigg Bay can be described as being of local importance.

Sensitivity/Use

Long-tailed duck are largely site faithful to their UK wintering sites (possibly due to specific habitat requirements) (Forrester et al., 2007). The distribution of the eider flocks (that long-tailed duck associate with) largely drives the distribution of long-tailed duck actively using Nigg Bay.

The long-tailed duck is a diving species and an opportunistic, generalist forager (Bustnes and Systad 2001; Zydelis and Ruskyte 2005; Ross and Luckenbach 2009 referenced in Cook and Burton, 2010), feeding on polychaetes and amphipods; however, they may switch to spawning fish in the late winter (Jamieson et al., 2001; Ross and Luckenbach 2009 referenced in Cook and Burton, 2010). This species is therefore likely to be less sensitive to localised effects; however, the species may also show more sensitivity to indirect effects such as the deposition of sediment from plumes, which can affect prey species at a wider spatial scale (Cook and Burton, 2010). This species is sensitive to oil pollution (Camphuysen 1989; Williams et al., 1994 referenced in Cook and Burton, 2010).

Scottish birds have been shown to move on a daily basis up to 12 km from feeding areas inshore to nighttime roost sites in much deeper waters (Hope Jones, 1979; referenced in JNCC, 2001).

The distribution and foraging behaviour of long-tailed ducks suggests that their sensitivity and vulnerability is likely to be low.

Goldeneye *Bucephala clanga*

Conservation

There are no SPAs for breeding goldeneye in the UK and 15 for non-breeding goldeneye. The conservation status for goldeneye is presented in Table 14.30.

Table 14.30: Conservation status of Goldeneye

UK Breeding Population	UK Winter Population	BoCC Status	IUCN Status	Annex 1
200	27,000	AMBER	LC	ROMS

Note:
Population estimates are taken from Musgrove et al., 2013. Annex 1 refers to the birds status on the Birds Directive. ROMS are not listed on Annex 1, but are regularly occurring migratory species for which SPAs can be designated. Breeding populations are given in pairs, wintering populations in individuals

Spatial and Temporal Distribution

This species is widespread across much of the northern hemisphere with the exception of Africa, with breeding areas extending across much of Asia and northern North America. Its wintering range is equally broad, encompassing the coast of northern Europe including inland United Kingdom, south-eastern Europe, central Asia, the coasts of eastern China, Korea, Japan and the Kamchatkha Peninsula (Russia), the Pacific coast of Canada and the Alaskan coast and inland USA (del Hoyo et al., 1992 referenced in BirdLife International, 2015).

The VP surveys recorded goldeneye around Nigg Bay during early summer and autumn, with a peak monthly maximum of eight birds in June with the ad hoc survey recording a peak monthly maximum of 11 birds in October. This species was largely absent from all other months.

Seasonal trends and distribution for sites closest to Nigg Bay are mirrored in the WeBS data shown in Table 14.31.

Table 14.31: Five year peak monthly counts of Goldeneye (WeBS Data*)

WeBS Sector	Nigg Bay and Girdle Ness	Ythan Estuary SPA	Montrose Basin SPA	Nigg Bay to Cove Bay	Dee Mouth to Don Mouth
June	0	14	18	0	0
July	0	8	48	0	0
August	0	14	18	0	0
September	0	25	20	0	0
October	0	7	30	0	0
November	0	24	28	0	0
December	0	48	39	0	0
January	0	33	35	0	0
February	0	39	75	0	2
March	0	38	52	0	0
April	0	34	39	0	0
May	0	11	7	0	0

Notes:
Nigg Bay and Girdle Ness, Ythan Estuary SPA, and Montrose Bay SPA five year period covers period 2009/2014. Nigg Bay to Cove Bay and Dee Mouth to Don Mouth five year period covers period 2004/2009.
* "Data were supplied by the Wetland Bird Survey (WeBS), a partnership between the British Trust for Ornithology, the Royal Society for the Protection of Birds and the Joint Nature Conservation Committee (the last on behalf of the statutory nature conservation bodies: Natural England, Natural Resources Wales and Scottish Natural Heritage and the Department of the Environment Northern Ireland) in association with the Wildfowl and Wetlands Trust"

Sensitivity/Use

The species feeds predominantly on small invertebrates (including crabs and bivalves), small fish and some plant material (Campbell, 1986; Owen et al., 1986 referenced in JNCC, 2001). The Goldeneye has been shown to be strongly attracted to sewage outfalls and discharges of waste from breweries and food processing plants, especially in Scotland (Pounder, 1976; referenced in JNCC, 2001).

The main threat to the species in its wintering range is pollution, e.g. from coastal oil spills or other pollutants from sewage outfalls (del Hoyo et al., 1992 referenced in BirdLife, 2015).

Terns

Tern species are summer migrants to the wider Aberdeenshire coast (including the vicinity of Nigg Bay) and as such there is likely to be connectivity with SPAs for Sandwich, Arctic and common terns, which have been recorded foraging within Nigg Bay and roosting on the rocky foreshore.

Tern species plunge dive for their prey, and require clear water for foraging (Essink 1999, referenced in Cook and Burton, 2010). They may thus be particularly sensitive to turbidity and re-suspension of sediment (Cook and Burton, 2010). Tern species are generally tolerant of disturbance from activities such as shipping (Cook and Burton, 2010).

Sandwich tern *Thalasseus sandvicensis*

Conservation

There are 16 SPAs for breeding Sandwich tern in the UK and three for non-breeding, one of which is on the east coast of Scotland and is the Firth of Forth, as well being listed as a feature in the Ythan Estuary marine dSPA.

The conservation status for Sandwich tern is presented in Table 14.32.

Table 14.32: Conservation status of Sandwich tern

UK Breeding Population	UK Passage Population	BoCC Status*	IUCN Status**	Annex 1
14,000 pairs	42,000 individuals	AMBER	LC	Annex 1

Note:
Population estimates are taken from Musgrove et al., 2013. Annex 1 refers to the bird's status on the Birds Directive. ROMS are not listed on Annex 1, but are regularly occurring migratory species for which SPAs can be designated. Breeding populations are given in pairs, wintering populations in individuals
* Birds of Conservation concern (BOCC)
** International Union for Conservation of Nature (IUCN)

Spatial and Temporal Distribution

The Sandwich tern can be found in Europe, Africa, western Asia, and the southern Americas. It breeds seasonally on the coast of much of Europe, and overwintering from the Caspian, Black and Mediterranean Seas to the coasts of western and southern Africa, and from the south Red Sea to north-west India and Sri Lanka (BirdLife, 2015).

Sensitivity/Use

Sandwich Terns typically feed within 10 km of their breeding colonies (Furness and Tasker 2000), though may fly further where shallow offshore habitat is available (referenced in Cook and Burton, 2010).

Sandwich terns are sensitive to issues that affect their food supply and foraging ability. Consequently, they have been assessed as being moderately vulnerable to the effects upon benthos and fish communities, and highly vulnerable to increases in turbidity (referenced in Cook and Burton, 2010).

Arctic tern *Sterna paradisaea*

Conservation

There are 17 SPAs in the UK with Arctic tern as an interest feature, 1 of which is on the east coast of Scotland and is the Firth of Forth (there are also a number of sites in the Orkney Islands and northern England. The conservation status for Arctic tern is presented in Table 14.33.

Table 14.33: Conservation status of Arctic tern

UK Breeding Population	UK Winter Population	BoCC Status	IUCN Status	Annex 1
44,000 pairs	-	AMBER	LC	Annex 1
Note: Population estimates are taken from Musgrove et al., 2013. Annex 1 refers to the birds status on the Birds Directive. ROMS are not listed on Annex 1, but are regularly occurring migratory species for which SPAs can be designated. Breeding populations are given in pairs, wintering populations in individuals				

Spatial and Temporal Distribution

The Arctic Tern has a circumpolar range, breeding in the Arctic and subarctic regions of Europe, Asia and North America as far south as Brittany, France and Massachusetts (USA). It is a transequatorial migrant, and can be found wintering throughout the southern ocean to the edge of the Antarctic ice and the southern tips of South America and Africa (del Hoyo et al., 1996, as referenced in Cook and Burton, 2010).

Sensitivity/Use

Arctic Terns tend to feed further offshore than other tern species (Black and Diamond 2005), at distances of up to 30 km (Garthe 1997, (as reference in Cook and Burton, 2010). This species' diet consists predominantly of fish as well as crustaceans (especially planktonic species), molluscs, insects (e.g. caterpillars, Chironomidae) and earthworms (del Hoyo et al., 1996; as referenced in BirdLife, 2015).

Common tern *Sterna hirundo*

Conservation

There are 22 SPAs in the UK for breeding common tern, 4 of which are on the east coast of Scotland: the Firth of Forth Islands SPA, Ythan Estuary, Sands of Forvie and Meikle Loch SPA, Inner Moray Firth SPA and Cromarty Firth SPA.

The conservation status for common tern is presented in Table 14.34.

Table 14.34: Conservation status of Common tern

UK Breeding Population	UK Winter Population	BoCC Status	IUCN Status	Annex 1
12,300 pairs	-	AMBER	LC	Annex 1
Note: Population estimates are taken from Musgrove et al., 2013. Annex 1 refers to the birds status on the Birds Directive. ROMS are not listed on Annex 1, but are regularly occurring migratory species for which SPAs can be designated. Breeding populations are given in pairs, wi ntering populations in individuals				

Spatial and Temporal Distribution

The 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, being found along the coast and inland of 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) (del Hoyo et al., 1996, as referenced in BirdLife, 2015).

Sensitivity/Use

This species' diet consists of small fish and occasionally planktonic crustaceans and insects (del Hoyo et al., 1996, as referenced in BirdLife, 2015).

Common terns can be sensitive to issues affecting food availability and therefore any exposure to increased sedimentation and effects on benthos and fish communities could be significant. However, as vision plays an important role in their foraging capabilities, they are highly vulnerable to changes in turbidity (Cook and Burton, 2010).

Waders

Waders were counted during walk-over surveys (Table 14.35), conducted when the observer was in transit between VPs. In total, 36 walk-over counts were carried out, comprising six hours of effort. To supplement the data collected during the wader walk-over surveys, a total of 163 ad hoc counts of waders were conducted during the 12 month period, comprising approximately 54 hours and 40 minutes of additional effort (Table 14.36).

Table 14.35 shows that no waders were recorded in high numbers on the walk-over surveys. Here, the populations recorded are expressed as proportions of the 1% population thresholds used in non-breeding SPA selection. The non-breeding thresholds are used because no waders breed at the site, apart from very small numbers of ringed plovers (i.e. 1 pair or fewer, annually). The full dataset collected during wader walk-overs is shown in Appendix 2 of the Appendix 14-A: Marine Ornithology Vantage Point Survey Report.

Table 14.35: Maximum numbers of Waders recorded during walk-over surveys, related to the non-breeding SPA thresholds

Month	Oystercatcher	Ringed plover	Curlew	Turnstone	Whimbrel	Redshank	Sanderling
June	24	2	2	0	0	0	0
July	27	3	5	1	2	6	0
August	19	4	9	1	1	2	1
September	67	6	9	0	0	4	0
October	47	0	7	3	0	6	0
November	22	0	3	3	0	5	0
December	19	0	2	1	0	1	0
January	13	0	7	1	0	3	0

Table 14.35: Maximum numbers of Waders recorded during walk-over surveys, related to the non-breeding SPA thresholds continued

Month	Oystercatcher	Ringed plover	Curlew	Turnstone	Whimbrel	Redshank	Sanderling
February	15	1	14	2	0	1	0
March	15	2	4	1	0	1	0
April	11	2	1	6	0	8	0
May	15	2	1	0	0	0	0
SPA Threshold	**3600**	**290**	**1200**	**640**	**50**	**1200**	**230**
Maximum % of Threshold	**1.86**	**2.07**	**1.17**	**0.94**	**4.00**	**0.67**	**0.43**

Table 14.36: Maximum numbers of waders recorded during ad-hoc surveys, related to the non-breeding SPA thresholds

Month	Oystercatcher	Ringed plover	Sanderling	Purple sandpiper	Dunlin	Turnstone	Whimbrel	Curlew	Redshank	Greenshank	lapwing	golden plover	Common sandpiper
June	42	6	0	0	0	2	0	2	2	1	0	2	0
July	38	6	0	0	1	1	2	4	3	0	1	0	0
Aug	49	3	1	1	2	1	0	12	4	0	0	0	1
Sept	65	0	0	0	0	1	0	4	7	0	0	0	0
Oct	68	2	0	21	0	12	0	6	7	0	0	0	0
Nov	22	0	0	0	0	1	0	3	2	0	0	0	0
Dec	23	2	0	0	0	1	0	3	3	0	0	0	0
Jan	28	0	0	0	0	3	0	18	3	0	0	0	0
Feb	28	2	0	0	0	0	0	19	3	0	0	0	0
Mar	28	6	0	0	0	6	0	11	12	0	0	0	0
April	46	3	0	88	0	26	0	5	15	0	0	0	1
May	27	3	0	8	2	4	1	11	0	0	0	0	2
SPA Threshold	**3600**	**290**	**230**	**210**	**5300**	**640**	**50**	**1200**	**1200**	**na***	**20000**	**2500**	**na***
Maximum % of Threshold	**1.89**	**2.07**	**0.43**	**41.90**	**0.04**	**4.06**	**4.00**	**1.58**	**1.25**	**na**	**0.01**	**0.08**	**na**

Notes:

There are no known concentrations of international importance for either greenshank or common sandpiper in the UK.

The diversity of species and the maxima recorded during the ad hoc counts are larger than those recorded on the walk-over surveys, which would be expected given the level of effort involved with each, and the wider temporal spread of the ad-hoc counts over each month. However, for the key species of wader, the ad-hoc counts support the trends demonstrated by the walk-over data, and the fact that the populations recorded are not significant. Figure B1 to Figure B5 of Appendix 14-B: Marine Ornithology Supporting Information shows how the ad-hoc data back up the counts conducted on the

walk-over surveys. The WeBS data confirms this (Table B1 to Table B14 of Appendix 14-B: Marine Ornithology Supporting Information), following the same seasonal trends; it can be clearly demonstrated that the peak monthly populations in the designated SPAs are significantly (often an order of magnitude higher) than the coastal sectors to the immediate north and south of Nigg Bay, and Nigg Bay itself.

14.6 Assessment of Effects

The following impacts are assessed against bird populations on a regional rather than a site specific basis. Whilst it is acknowledged that the existing habitat within Nigg Bay will be permanently altered, the birds inhabiting Nigg Bay will also inhabit other areas along the Aberdeenshire coast and more widely afield.

14.6.1 Design Parameters Used in this Assessment

Table 14.37 presents the project metrics used to assess each of the predicted impacts of the construction and operation of the proposals, and are taken from Chapter 3: Description of the Development.

Table 14.37: Project metrics used in the assessment of impacts on marine ornithology

Description of Impacts	Project Metrics Considered in the Assessment of the Impact
Construction	
Disturbance and displacement due to marine construction activities	Capital dredging within Nigg Bay will be undertaken over a 19 month period using trailer suction hopper dredging and/or backhoe dredging methods with rock drilling and blasting. Up to 3 dredging vessels may be present at any one time. The construction period is 3 years, in which time vessel movements, together with associated movement of plant on land, will take place across the development site. Impact piling will be undertaken generating underwater and airborne noise.
Disturbance and displacement due to terrestrial construction activities	
Reduced prey availability for visual predators due to the presence of sediment plumes	Trailer suction hopper dredging will produce the greatest overspill quantities and largest sediment plumes. The dredging may be undertaken at any time over a 19 month period.
Accidental release of environmentally harmful substances	Accidental releases of pollutants during construction.
Increase in the risk of collision and changes to ambient light	The construction period is 3 years in which time vessel movements, together with associated movement of plant on land will take place across the project site.
Operation and Maintenance	
Loss of habitat	There will be a permanent loss of 212,118m^2 of seabed habitat within Nigg Bay as a result of the placement of the proposed harbour infrastructure on the seabed. Seabed depths within the site will be deepened to 9.0 m below Chart Datum and 10.5 m below Chart Datum.
Disturbance due operational activities.	The operational harbour will accommodate approximately 550 commercial vessels; 1,700 Platform Supply Vessel (PSV)/Offshore vessels; 40 Diving Support Vessel (DSV) and 33 cruise ships per year. The harbour and entrance channel is expected to be required to be dredged regularly.

Table 14.37: Project metrics used in the assessment of impacts on marine ornithology continued

Description of Impacts	Project Metrics Considered in the Assessment of the Impact
Operation and Maintenance Continued	
Water quality and accidental release of environmentally harmful substances	Water quality changes and increase in bio-availability of sediment contaminants. Accidental releases of pollutants during operation.
Increased turbidity during maintenance dredging	Seabed disturbances due to channel maintenance dredging.
Increase in the risk of collision and changes to ambient light	Additional vessels per annum. Potential impacts on breeding and wintering bird populations as a result of the terrestrial elements of the project, i.e. from dust, noise, vibration and lighting disturbance have been considered within Chapter 11: Terrestrial Ecology. Coastal and pelagic species have been considered in this chapter.

14.6.1.1 Sources of Impacts during Construction Phase

This section presents the assessment of the potential impacts that have been identified for the construction phase of the development. Effects from the construction phase on marine birds encompass disturbance effects as a result of general activity relating to construction of the breakwaters and quayside, as well as dredging activity and an increase in the number of vessels on site. Direct effects from dredging activity include increased suspended sediment concentrations, together with the release of any sediment contaminants into the wider environment. This assessment has considered a worst case of the construction activities occurring simultaneously.

Ports and harbours are generally located in or close to estuaries and bays that are important to bird populations. As such birds often co-exist with navigation, ports and harbour infrastructure (PIANC, 2005). Numerous strategies can be utilised to protect birds and their habitats, such as the development of mitigation and monitoring plans. However when considering new developments, the value of bird species poses a significant challenge. The value assigned to species within this assessment takes account of designated sites and the likely presence of species that are associated with SPAs along the east coast of Scotland and England. The assessment also takes into account the presence of migratory species whose habitat requirements at breeding and wintering grounds as well as stopover sites are vital to replenish energy reserves during migrations. Changes in bird numbers at one site could be a function of improvements or decline elsewhere or a result of changes (natural or man-made) at their breeding grounds, resulting in a change of behaviour or migration patterns. Concerns do arise regarding the piecemeal loss of habitat along migratory routes (PIANC, 2005).

Best practice for habitat management of ports is generally aimed at an ecosystem level. Any assessment of habitat will need to consider the use of the area in its entirety, for example the relationship between feeding and roosting: when roosting habitat is not in proximity to feeding habitats there will be a lower chance of these more isolated habitats being utilised by birds (PIANC, 2005). As such, taking the precautionary approach, equal weighting has been given to all use (breeding, roosting, feeding) of the site throughout the assessments.

Disturbance and Displacement Due to Marine Construction Activities

Disturbance and any subsequent displacement is relevant to any species present within the footprint of the development and who actively use the area for a key phase of their life cycle, which is when the birds will be at their most sensitive to this effect. Adverse effects of displacement may occur when birds are excluded from breeding, roosting and feeding habitats for significant periods of time.

Within the construction phase disturbance may occur due to the following activities:

- Vessel presence (dredgers and construction/support vessels);
- Construction activities (i.e., drilling, pilling, rock placement and general construction of breakwaters and harbour infrastructure); and
- Terrestrial activities occurring along the harbour edge.

This effect relates to disturbance to marine birds from the presence of construction vessels and plant activity, visual disturbance and noise and vibration during the construction phase. Typical vessels and their associated activities that will be present during construction include dredging vessels (backhoe, TSHD, split barge), general construction vessels (for intake and outlet diversions), jack-up barges (piling and drilling) as well as any associated support vessels and tugs for example.

The dredging within Nigg Bay may occur at any time (although not continuously) over a 19 month period and will be highly localised to within the dredge footprint. Dredging includes drilling and blasting activities for removing rock, and trailer suction hopper dredging for removal of the less consolidated sediment, and/or backhoe dredging for the removal of consolidated material and rock, with the potential for a split barge to be used for the disposal of dredged material. The backhoe dredger may also be used during the blasting activities for the removal of the rock material. Up to three dredging vessels may be present at any one time. This seabed dredging will disturb the seabed substrate and the benthic organisms living on it.

The construction period is 3 years, in which time heavy and light vessel movements, together with associated movement of plant on land will take place across the project site. A jack-up barge will be used for drilling and piling activities. The drilling consists of multiple movements of the barge to predetermined drilling locations where holes will be drilled in preparation for blasting charges to be inserted. Piling will take place over a 23 month period (although not continuously) with a jack–up barge being used. During the construction period several support vessels will also be utilised including tugs for manoeuvring other vessels into position.

Cook and Burton (2010) undertook a systematic review of the effects of marine aggregate extraction (and associated shipping) on seabirds and coastal waterbirds (including waders) and their supporting habitat and prey. This review has been used to support the assessment in this chapter with further detail on sensitivities found within the baseline Section 14.5.

Construction vessels may lead to increased flushing of seabirds which can result in disturbance and ultimately displacement of bird species which may then result in a temporary loss of habitat, energetic costs associated with unnecessary flight and lowered reproductive output. Some species are typically more sensitive to vessel disturbance and include sea-duck, divers, shearwaters, grebes and terns,

which have been shown to actively avoid shipping lanes (Kube 1996; Mitschke et al., 2001; Kaiser 2004; Borberg et al., 2005 as referenced in Cook and Burton, 2010). Overwintering and passage migrant marine bird species may be particularly sensitive to disturbance whilst feeding, to maintain energy reserves for transit to breeding and wintering grounds. Any disturbance that requires birds to take flight reduces feeding time and increases energy expenditure.

It is feasible that some species of bird will be positively attracted to the development area, as a result of increased food availability as bottom sediments are stirred up, which in turn attract potential prey items of marine bird species (particularly gulls). Increased shipping in itself can attract birds especially if the vessels are slow moving, which is again most typically associated with gull species (Garthe and Hüppop 1999). Indeed, gulls have been shown to be attracted to areas with increased shipping activity (Garthe and Hüppop 1999; Skov and Durinck 2001; Christensen et al., 2003 as referenced in Cook and Burton, 2010).

The species known to utilise the area that are considered sensitive to disturbance from shipping activity (Cook and Burton, 2010) include common and velvet scoter, eider, red-throated diver, long-tailed duck, cormorant, shag, guillemot, razorbill and puffin.

Displacement has been identified as a key issue for offshore wind farms, in particular the cumulative effects of several together (Cook and Burton, 2010), therefore it can be assumed that if displacement occurs at multiple coastal and wind farm sites within the area of use by marine bird species utilising the Nigg Bay area, this may lead to a cumulative effect, as discussed within Section 14.8.

Previous studies suggest that some species such as red-throated diver and common scoter can tolerate small craft up to a distance of 100 m before taking flight, however these studies (Ruddock and Whitfield 2008 as referenced in Cook and Burton, 2010) relate to small pleasure craft, and in this instant the study in Liverpool Bay where common scoter were flushed from 2 km away by large vessels (Kaiser 2004 as referenced in Cook and Burton, 2010) is most likely to imitate the probable scenario in Nigg Bay. Although vessels used during construction and using the harbour once operational are likely to be slow moving, they are still expected to locally displace the more sensitive species referred to above.

Tern Species

Tern species are generally tolerant to shipping activity and therefore are likely to have a certain degree of tolerance to construction disturbance, however they are more constrained in terms of their feeding habits as most tern species forage within 10 km of the coast (Becker et al., 1993; Furness and Tasker 2000; Bertolero et al., 2005; Perrow et al., 2006; Rock et al., 2007 as referenced in Cook and Burton, 2010). Construction activity includes the dredging of the bay to 9 m below CD, and 10.5 m below CD in the approach channel and eastern quayside. As tern species are more tolerant to shipping activity, including that associated with construction, they could potentially still use the bay for feeding whilst construction occurs. The Ythan Estuary, Sands of Forvie and Meikle Loch SPA and its associated extension dSPA are within potential foraging range for tern species, as is much of the Aberdeenshire coastline, however this does not mean that these species will breed in close proximity to Nigg Bay or that they will exclusively target the bay. Therefore the effect magnitude is judged to be

negligible on a high value receptor. Effect significance for terns is therefore judged to be **minor adverse**, which is not significant in EIA terms.

Gulls, Tubenoses and Gannet

Gulls, tubenoses and gannet are known to be attracted to areas with increased shipping activity and have a low sensitivity. Dredging activity may attract gulls to an area as bottom sediments are stirred up, releasing benthic organisms into the water column where they can be preyed on by gulls (Tasker et al., 1986; Herron Baird 1990; Wiese and Montevecchi 2000 as referenced in Cook and Burton, 2010). Gull species are typically unaffected by disturbance and are flexible in their habitat use (Garthe and Hüppop 2004; King et al., 2009 as referenced in Cook and Burton, 2010). Herring gull has been considered further in Chapter 11: Terrestrial Ecology. Common gull are known to roost in large numbers during the winter and spring but do not feed in the area. Therefore, the effect magnitude is negligible. The receptor value is high for species such as herring gull, lesser black-backed gull and kittiwakes as they have 3, 1 and 3 SPAs respectively within their foraging range (Thaxter et al., 2012) of Nigg Bay, however they are generalist feeders and are able to exploit a variety of habitats. Fulmar and gannet are also judged to be high value receptors due to their connectivity to several SPAs. Other species of tubenose such as Manx shearwater are judged to be medium value receptors as there are no SPAs on the east coast of Scotland or England for these birds. Effect significance for gulls, tubenoses and gannet is therefore judged to be **negligible,** which is not significant in EIA terms.

Cormorant and Shag

Cormorant and shag are considered in Cook and Burton (2010) to have a high sensitivity to shipping (Camphuysen 1989; Williams et al., 1994) (including dredging), which may be compounded by a relative inflexibility in habitat use due to their short foraging range (Furness and Tasker 2000; Garthe and Hüppop 2004; King et al., 2009, referenced in Cook and Burton, 2010) with a mean maximum foraging range of 25 km and 14.5 km respectively (Thaxter et al., 2012). The SPAs designated for breeding birds are not within the foraging range of Nigg Bay. Although, most birds remain within a few miles of their breeding colonies there is evidence to suggest that shags undergo a partial migration and that some individual birds can travel significant distances. In a long term colour ringing programme of adults and chicks on the Isle of May (Firth of Forth SPA) 110 km away from the development area colour ringed adults have been observed at 29 locations, including Nigg Bay, along the East coast of Scotland and northern England (from 540 km north of the Isle of May to 355 km south). Numbers of individual colour ringed birds recorded at each of these locations is not given in this paper (Grist et al) and Nigg Bay is a particularly accessible part of this coastline for bird watchers from Aberdeen, therefore the importance of Nigg Bay may be overestimated in comparison with elsewhere along this stretch of coastline for shags. It is therefore likely that there is also a winter connectivity with the Firth of Tay and Eden Estuary SPA, Firth of Forth SPA and Inner Moray Firth SPA with the closest being 86 km away where these colour ringed birds have also been recorded.

Both species have been seen at Nigg Bay during the VP survey but their activity is generally of passing through the bay between day and night time roosts. Therefore, the effect magnitude is negligible, on a medium value receptor, and the effect significance for cormorant and shag is therefore judged to be **negligible,** which is not significant in EIA terms.

Auks

Auks have been discussed in Cook and Burton (2010) as having a high sensitivity to shipping. However species such as common guillemot are regularly recorded as feeding in the existing harbour at Aberdeen (Envirocentre, 2012) suggesting a high degree of habituation and tolerance. The auks using Nigg Bay will be impacted during construction and displaced from feeding areas but the impact will be temporary, with other similar foraging areas available along the coast. In light of the evidence of the tolerance of local populations to shipping disturbances, the magnitude of effect is thus considered to be minor on a high value receptor as although Nigg Bay is within foraging range of a number of breeding colonies along the wider east coast of Scotland, the birds will not exclusively use Nigg Bay. Therefore the effect significance for auk species are therefore judged to be **minor adverse,** which is not significant in EIA terms.

Sea-ducks and divers

It is likely that during periods of marine construction activity, sea-ducks and divers will be displaced from the development, and although the impact on any individual bird could be high, the effects are localised, temporary and will cease on completion of the construction. In particular, flocks of eider (and red-throated diver and long-tailed duck which sometimes associate with eider) are known to utilise both Nigg Bay, the Girdle Ness headland and Greyhope Bay (Figure 14.3). Sea-ducks, primarily eider, are also known to feed and loaf in the existing harbour (Envirocentre, 2012) (Figure 14.5), as well as the wider Aberdeenshire coastline (Figure 14.2). Therefore they may also utilise the Nigg Bay area post construction. Other species such as goosander are only present in low numbers in late summer and during the VP survey were recorded as passing through Nigg Bay. The magnitude of the effect on the sea-duck and diver population as a whole will be minor. They have been recorded at Nigg Bay during the VP survey and have been judged to be of high value due to being a feature of a number of SPAs. Therefore the effect significance for sea-ducks and divers is judged to be **minor adverse,** which is not significant in EIA terms.

Waders

The Old South Breakwater (OSBW) of the existing harbour is an important local roost for waders, particularly for purple sandpipers, and thus they are tolerant to general shipping activity, while the south breakwater of the existing harbour holds a small number of roosting waders. Nigg Bay does not appear to be an area of specific importance in terms of the wider region with waders being found along the Aberdeenshire coastline as further discussed within Chapter 11: Terrestrial Ecology. The species of birds that were surveyed as part of the wader walk-over are discussed in Section 14.5.3.2. Therefore the magnitude of the effect on waders is considered to be minor on a medium value receptor. Effect significance for wading birds is thus judged to be **minor adverse,** which is not significant in EIA terms.

Disturbance and Displacement due to Terrestrial Construction Activities

During the construction phase, some of the terrestrial construction activities will use plant that will be very close to the shore, or lifting/moving material over the water (such as cranes). This may have the potential to disturb marine birds using the shore.

The habitats within Nigg Bay are utilised by bird species at various stages for feeding, roosting, or breeding (also see Chapter 11: Terrestrial Ecology). The cliff fronts within sheltered coves located

south of the bay are considered particularly important local habitat, with colonies of sea birds nesting and sheltering. The site specific surveys (Appendix 11-C: Breeding Bird Surveys 2014 and Appendix 11-E: Wintering Bird Survey Winter 2014-2015)) did not record any unusual or unexpected birds, with many of the species being common and widespread passage birds or breeding birds that are characteristic of the Aberdeenshire coast. As a result, there is no local or regional concern over the status of breeding numbers within the survey area, or their conservation status. No WCA Schedule 1 species recorded at the project site were breeding there; these species occurred only during migrations or as part of over wintering populations.

In addition, the dedicated winter bird survey identified 12 species, and although 11 of these are afforded extra legal protection through their inclusion within Annex 1 or are included on the UKBAP or listed as Red or Amber Birds of Conservation Concern, none of the birds were described as unusual or unexpected birds, with many of the species being common, and widespread along the Aberdeenshire coast. As a result, there is no local or regional concern over the status of the overwintering species recorded within the survey area, or their conservation status.

Any effects on breeding and wintering birds are considered temporary and minor at a local level for direct effects associated with land based construction including disturbance. The assessment within this chapter evaluates the effect of terrestrial construction on marine birds.

Terns

In terms of terrestrial activities, tern species can be easily disturbed and in extreme cases will abandon their breeding colonies. The nearest reported such breeding sites are considered to be sufficiently distant from Nigg Bay (at least 5 km) so as not to be an issue. The exact locations of tern colonies are often confidential to protect them from human interference. Terns do display a relatively high tolerance to human activities in their foraging behaviour, therefore effect magnitude is considered to be negligible on a high value receptor, and the effect significance for terns is therefore judged to be **minor adverse,** which is not significant in EIA terms.

Gulls, Tubenoses and Gannet

Gulls, tubenoses and gannet are considered to be relatively tolerant of terrestrial construction activity. Therefore effect magnitude is considered to be negligible on a high value receptor for fulmar, gannet and kittiwake, and medium for other species and the effect significance for gulls, tubenoses and gannet is therefore judged to be **negligible,** which is not significant in EIA terms.

Cormorant and Shag

The recorded use of Nigg Bay by cormorant and shag during the VP surveys shows that these species pass through the area between day and night time roosts. Therefore in terms of terrestrial construction activities the effect magnitude is considered to be negligible on a medium value receptor, and the effect significance for cormorant and shag is therefore judged to be **negligible,** which is not significant in EIA terms.

Auks

Auk species have been recorded in the VP surveys as primarily using the outer areas of Nigg Bay for foraging with puffin recorded further offshore. Therefore the effect magnitude is considered to be

negligible on a high value receptor, and the effect significance for auks is therefore judged to be **negligible,** which is not significant in EIA terms.

Sea-ducks and Divers

Sea-duck and divers are sensitive to shipping and construction activities and are likely to be close to the coast when utilising Nigg Bay, (Figure 14.3) Therefore the effect magnitude is considered to be minor on a high value receptor, and the effect significance for sea-duck and divers is therefore judged to be **minor adverse,** which is not significant in EIA terms.

Waders

Waders are likely to be disturbed due to terrestrial construction activities when these are occurring, and will likely utilise the site if they are not. Waders will utilise a wide area in the course of their foraging activities along the Aberdeenshire coastline and therefore there is no concern over this effect on their conservation status. Effect magnitude is considered to be minor on a medium value receptor, and the effect significance for wading birds is therefore judged to be **minor adverse,** which is not significant in EIA terms.

Reduced Prey Availability for Visual Predators due to the Presence of Sediment Plumes

Marine bird species which are visual foragers in pursuit of fish are likely to be affected by an increase of turbidity making it harder to see its prey; however, species such as gannet have a large foraging range and feed on a variety of prey and therefore can switch between prey species or locations without impacting on their breeding success (Martin 1989; Furness and Tasker 2000; Hamer et al., 2000 as referenced in Cook and Burton, 2010). This ability to forage widely results in lower sensitivity to prey changes. Auks and divers are pursuit specialists too, and although their foraging ranges are not as wide as gannets, they are likely to be able to forage elsewhere locally. Cormorant feed on fish and shellfish and have been observed foraging at depths of up to 18 m (Gremillet et al., 2005; Roycroft et al., 2004 as referenced in Cook and Burton, 2010). They are not, as commonly believed; pursuit feeders (White et al., 2007 as referenced in Cook and Burton, 2010) so may be less sensitive to changes to turbidity in comparison to other diving species.

Increased Turbidity during Dredging

Increases in suspended sediment concentrations (SSCs) will occur as a result of the action of the dredger draghead or the backhoe dredging tool on the seabed, and also from any overspill from the dredger hopper. Suspended sediments will be transported from the point of release as sediment plumes via tidal currents, and will be subsequently deposited back to the seafloor during periods of reduced tidal and wave energy.

Peak concentrations of SSCs will be short-lived due the predominant sand component settling back to the seafloor very quickly and in close proximity to the initial disturbance. Finer sediment particles are likely to stay in suspension for longer periods and will be subject to gradual dilution and dispersion out of the area (Guillou and Chapalain, 2010).

At Nigg Bay, typical SSCs are in the range of 24 mg/l (outer embayment) to 144 mg/l (inner embayment) but increase to between 529 mg/l and 899 mg/l during high energy wave events (see Appendix 6-B: Hydrodynamic Modelling and Coastal Processes Assessment).

Greatest SSCs will be created during the trailer suction hopper dredging of the unconsolidated sediments. Appendix 7-D: Sediment Plume Modelling, assumes that the northern and southern breakwaters have been partially constructed and predicts that most sediment fractions disturbed by this dredging will remain within the embayment at Nigg Bay, settling rapidly back to the seafloor close to the point of disturbance. This is due to the comparatively lower current velocities and enhanced settling behind the partial breakwaters. Mud particles however, will remain in suspension for longer and will be transported outside of the bay via tidal currents. Dispersion will be mostly to the north towards the entrance of the River Dee following the dominant current movement.

Peak SSCs during TSHD overspill are predicted to be greater than 8,000 mg/l at the immediate dredging location. Coarse sediments are predicted to settle quickly, limiting the spatial extent of plumes, and SSC levels for coarse sediments are predicted to be indistinguishable from natural levels around some of the periphery of the Bay. Finer sediments will travel further, however peak SSCs during TSHD are not predicted to be greater than 100-200 mg/l north of Girdle Ness.In general, it is predicted that that the effects of the dredging will be largely limited to the construction area only.

The dredging at Nigg Bay is not forecast to affect any SPA in the locality (Appendix 7-D: Sediment Plume Modelling).

The impact will be intermittent, lasting for the duration of the capital dredge (19 months) only, and will be localised to within the study area but beyond the EIA boundary. Effects will relate to an increase in turbidity.

Sediment released at the disposal site during the construction and operational phases is not predicted to effect the Ythan Estuary and Sands of Forvie dSPA. Mud is the only sediment size that is predicted to leave the development area during the dredging and disposal process. During the duration of the TSHD operation mud sediment within natural variation is predicted to reach the south of the Ythan Estuary and Sands of Forvie dSPA.As such this mud is not likely to impact on the receptor species of this dSPA, Sandwich and little tern.

A significant increase in turbidity will reduce the visual ability of species that actively dive for or pursue their prey in the water by vision, including species such as gannet, terns and guillemot. As a result, water clarity may play an important role in the foraging success of these and other species.

If increased turbidity occurs during the breeding season, it may potentially affect those species that breed within foraging range of Nigg Bay and that are more susceptible to turbid conditions i.e. visual pursuit feeders. However, these effects are localised and do not extend to the wider vicinity of Nigg Bay or the Aberdeenshire coastline. It should be recognised that coastal areas can be naturally high in turbidity due to storm events mobilising sediments from the seabed and erosion of cliff faces (such as glacial tills experienced along areas of coastland like the Holderness coast in East Yorkshire). Coastal bird species are mobile enough in their foraging that they can avoid these areas of high turbidity.

Terns

Most tern species forage within 10 km of the coast (Becker et al., 1993; Furness and Tasker 2000; Bertolero et al., 2005; Perrow et al., 2006; Rock et al., 2007 as referenced in Cook and Burton, 2010),

and plunge dive for prey items which may vary between locations, depending on availability (Monaghan et al., 1989; Furness and Tasker 2000; Garthe and Hüppop 2004; King et al., 2009 as referenced in Cook and Burton, 2010). As they are constrained to a short foraging range, tern species are highly vulnerable to reduced food availability (Furness and Tasker 2000; Garthe and Hüppop 2004; King et al., 2009 as referenced in Cook and Burton, 2010), therefore any changes in food availability at a local level could have a dramatic effect on populations. Terns require clear water for foraging (Essink 1999 as referenced in Cook and Burton, 2010), and may therefore be particularly sensitive to increased turbidity caused by dredging operations and the re-suspension of sediment (Cook and Burton, 2010). The effect of suspended sediment on prey items will be temporary and highly localised to the area around the dredging and although relatively restricted in their foraging ranges compared to more pelagic species terns are highly mobile, therefore effect magnitude is considered to be minor on a high value receptor, as Nigg Bay may be on the edge of the foraging range for many of the tern breeding colonies in the wider area. The effect significance is therefore judged to be **minor adverse,** which is not significant in EIA terms.

Gulls, Tubenoses and Gannet

Gulls, tubenoses and gannet forage on a wide variety of habitat and have a varied diet (however kittiwake are more constrained in their choice of prey) therefore any localised turbidity at Nigg Bay is unlikely to affect these species. The effect magnitude is considered to be negligible on a high value receptor for fulmar, gannet and kittiwake, and medium for other species, and the effect significance for gulls, tubenoses and gannet is therefore judged to be **negligible,** which is not significant in EIA terms.

Cormorant and Shag

The recorded use of Nigg Bay by cormorant and shag during the VP surveys shows that these species pass through the area between day and night time roosts, with shags using the outer area of the bay for feeding. Therefore the effect magnitude is considered to be negligible on a medium value receptor, and the effect significance for cormorant and shag is therefore judged to be **negligible,** which is not significant in EIA terms.

Auks

Auks, like terns species, are likely to be sensitive to the increases in turbidity and the indirect effects of the deposition of re-suspended sediments, which could potentially negatively affect their food supply (Cook and Burton, 2010). Species such as guillemot require clear water in which to pursue prey. The impacts will be localised, therefore the effect magnitude is considered to be negligible on a high value receptor, and the effect significance for auks is therefore judged to be **negligible,** which is not significant in EIA terms.

Sea-ducks and diver

In terms of both sea-duck and diver species, effects are likely to be very localised and therefore overall effect magnitude is considered to be minor. Red-throated diver forage by diving for fish and may be sensitive to aspects of dredging activity that negatively impact on herring populations (key prey item), such as increases in sediment deposition (Cook and Burton, 2010). Eider is a diving species

that specialises in foraging on shellfish, notably mussels (Guillemette and Himmelman 1996; Larsen and Guillemette 2000 as referenced in Cook and Burton, 2010) and therefore may be sensitive to the

indirect effects upon benthic communities and the deposition of re-suspended sediment which may have a detrimental effect on many of their prey species (Chandrasekara and Frid 1998; Posford Haskoning 2002; Powilleit et al., 2009 as referenced in Cook and Burton, 2010). As eider are often unable to switch to foraging in alternative habitats (Garthe and Hüppop 2004; King et al., 2009 as referenced in Cook and Burton, 2010) and a reduction in food availability has been linked to major mortality (Camphuysen et al., 2002 as referenced in Cook and Burton, 2010), such deposition could have a negative effect on eider distribution. However, as noted above these effects are highly localised and eider do, and can, utilise the wider coast as seen in Figure 14.3 therefore overall effect magnitude is considered to be minor on a high value receptor, and the effect significance for sea-ducks and divers is therefore judged to be **minor adverse,** which is not significant in EIA terms.

Waders

Waders typically feed in the intertidal zone, often in turbid conditions and therefore the effect magnitude is considered to be negligible on a medium value receptor, and the effect significance for wading birds is therefore judged to be **negligible,** which is not significant in EIA terms**.**

Accidental Release of Environmentally Harmful Substances

Releases of chemicals such as fuel, oil and lubricants during construction of the harbour into the marine environment has the potential to be harmful to marine life. Marine birds have varying degrees of sensitivity to pollutants depending on the proportion of the time they spend swimming, the type and quantity of substance entering the marine environment and the dilution and dispersion properties of the receiving waters.

Most oil pollution in the sea is not derived from oil tankers (Hampton et al., 2003 as referenced in Cook and Burton, 2010) but general leakage from ships. Even a small spill can have a serious effect upon seabird populations, especially on survival during winter (Votier et al., 2005 as referenced in Cook and Burton, 2010). Oiling rates are highest in species which spend most of the time swimming, especially in areas of frequent oil spills such as around shipping lanes. Up to 50% of the guillemots found washed up on the beaches of the North Sea were found to be oiled (Camphuysen, 1998 as referenced in Cook and Burton, 2010).

The magnitude of this effect on marine bird receptors depends upon the quantities and nature of the spillage/release, the dilution and dispersal properties of the receiving waters and the bio-availability of the spilt contaminant. There will be an increased risk of oil spillage from the dredging activities in construction.

Terns

During the construction phase of the new harbour, tern species will be able to utilise the area surrounding the bay as well as along the immediate coastline, therefore the effect magnitude is considered to be minor on a high value receptor, and the effect significance for terns is judged to be **minor adverse,** which is not significant in EIA terms.

Gulls, Tubenoses and Gannet

Gulls, tubenoses and gannet do not generally utilise Nigg Bay for feeding although fulmar have been seen feeding in the outer areas of the bay. Some gull species such as common gull do form large

roosts in the bay (during winter and spring) and may continue to do so outside of the breakwaters post construction of the harbour, and thus may be at a greater risk from potential pollution due to the time spent on the water. Thus, the effect magnitude for common gull is considered to be minor on a high value receptor, and the effect significance is judged to be **minor adverse**. Generally for gulls, tubenoses and gannet the effect magnitude is considered to be negligible on a high value receptor, and the effect significance is judged to be **negligible,** which is not significant in EIA terms.

Cormorant and Shag

Cormorant and shag generally pass through the area between day and night time roosts. In terms of water quality or pollution the effect magnitude is considered to be negligible on a medium value receptor, and the effect significance for cormorant and shag is judged to be **negligible,** which is not significant in EIA terms.

Auks

Auk species such as puffins tend to feed further offshore of Nigg Bay and thus are less likely to be encounter any oil spillage. However razorbill and guillemot have been seen to feed in the outer areas of the bay. Species such as guillemot also go through an annual moult where they have a flightless period and thus may be more susceptible to potential pollution events. For puffins, the effect magnitude is negligible on a high value receptor, and the effect significance is judged to be **negligible**. However, for razorbill and guillemot the effect magnitude is considered to be minor on a high value receptor, and the effect significance for auks is judged to be **minor adverse,** which is not significant in EIA terms**.**

Sea-ducks and Divers

The disturbance factors from shipping and the loss of seabed habitat are likely to displace most sea-ducks and divers from using the harbour during the construction phase and therefore any potential impacts from potential pollution will be reduced or removed altogether. The effect magnitude is considered to be minor on a high value receptor, and the effect significance for sea-ducks and divers is judged to be **minor adverse,** which is not significant in EIA terms**.**

Waders

Waders are likely to be completely displaced from the northern and western shoreline of Nigg Bay and thus are less likely to be impacted by potential pollution and can also forage in the wider vicinity of the bay. Therefore, the effect magnitude is considered to be minor on a medium value receptor, and the effect significance for wading birds is judged to be **minor adverse,** which is not significant in EIA terms.

Changes to Prey Availability

Reduced Prey Availability

Dredging will disturb the seabed resulting in abrasion and compaction effects on benthic habitats, increased sediment instability and uptake (entrainment) of sessile and sedentary benthic invertebrates via the action of a draghead or backhoe tool on the seabed. This will result in the displacement, mortality and loss of seabed invertebrate and fish and shellfish which form the primary diet prey species within the dredging footprint. Whilst some benthic fish and scavenging shellfish, such as

crabs, may initially derive some benefit, due to the release of benthic resources within sediment plumes arising from seabed disturbances, this is likely to be very short-lived (hours or days) following each dredging event in any one area. As dredging progresses across the bay over time, an overall incremental reduction in local benthic invertebrate prey availability is expected. Chapter 12: Benthic Ecology provides a comprehensive assessment of the impact of dredging on benthic ecology.

Chapter 12: Benthic Ecology identified that sandeels were present in Nigg Bay but in lower numbers than elsewhere in the wider region. It is believed that Nigg Bay provides a sub-optimal habitat due to particle size of the seabed strata. Key spawning and nursery grounds for sandeels, were identified just outside Nigg Bay, the results of this can be found in the Chapter 13: Fish and Shellfish these areas will be unaffected by the construction and operation of the harbour.

Birds will be affected by the development to varying degrees according to their use of the bay, as reflected in their seasonality, numbers, feeding and foraging regimes. As a result of frequent flushing by ships using the area, even where there are large concentrations of harvestable prey, it is difficult for many species to maintain a favourable energy balance within shipping lanes (Kube 1996, referenced in Cook and Burton, 2010).

Terns

During the construction phase there will be a reduction in prey availability which will displace tern species to other areas along the coast. However, as their principal prey sandeel are more abundant outside of the Bay this effect will be localised therefore effect magnitude is considered to be minor on a high value receptor, and the effect significance for terns is therefore judged to be **minor adverse,** which is not significant in EIA terms.

Gulls, Tubenoses and Gannet

As discussed above gulls, tubenoses and gannet forage on a wide variety of habitat and have a varied diet. Kittiwake are more likely to be sensitive to the effects of dredging operations than other gull species as they are more constrained in their choice of prey species (Furness and Tasker, 2000 as referenced in Cook and Burton, 2010). However, like other gulls they are typically flexible in their habitat use (Garthe and Hüppop 2004; King et al., 2009 as referenced in Cook and Burton, 2010), therefore as this effect is localised the effect magnitude is considered to be negligible on a high value receptor, and the effect significance for gulls, tubenoses and gannet is therefore judged to be **negligible,** which is not significant in EIA terms.

Cormorant and Shag

The recorded use of Nigg Bay by cormorant and shag during the VP surveys shows that these species pass through the area between day and night time roosts, with shags using the outer area of the bay for feeding. Therefore the effect magnitude is considered to be negligible on a medium value receptor, and the effect significance for cormorant and shag is therefore judged to be **negligible,** which is not significant in EIA terms.

Auks

The use of Nigg Bay by auk species as recorded in the VP survey shows that these species tend to forage in the outer areas of the bay, where there are likely to be higher concentrations of sandeels.

Therefore they will be marginally affected by any reduction in prey items in the construction phase. The effect magnitude is considered to be negligible on a high value receptor, and the effect significance for auks is therefore judged to be **negligible,** which is not significant in EIA terms.

Sea-ducks and Divers

Species of sea-duck and divers are likely to be more sensitive than other species to reduced prey availability due to their relative sedentary use of the area, spending most of their time swimming (loafing, foraging). These effects are localised therefore the effect magnitude is considered to be minor as Nigg Bay is a very small part of a larger similar habitat along the Aberdeenshire coastline, on a high value receptor, and the effect significance for sea-duck and divers is therefore judged to be **minor adverse,** which is not significant in EIA terms.

Waders

Waders will be affected by any activity which impacts on the sub-littoral zone for feeding. The effect of prey reduction will be localised and therefore the effect magnitude is considered to be minor on a medium value receptor, and the effect significance for wading birds is therefore judged to be **minor adverse,** which is not significant in EIA terms.

Increase in the Risk of Collision and Changes to Ambient Light

Much research has been carried out to measure potential collisions between seabirds and offshore wind turbines, less so regarding collisions with shipping activity. Birds that avoided offshore wind farms during the day were shown to stray into them during the night (Desholm and Kahlert, 2005). It is possible that birds could be similarly disorientated by lighting on board construction vessels during night time operations in Nigg Bay. Vessel movements during the construction phase will be sporadic and erratic in nature across the project site depending on the activities occurring at any one time. Bird activity during the night will be fairly limited as many birds will be roosting, however some species such as gannet do forage at night, although this is likely to be further offshore. There is potential for birds to have roosted in the bay when little or no construction activity was occurring, and then for this activity to subsequently start which may lead to the birds taking flight and potentially colliding with a vessel or structure. However, any night time activities will be undertaken with the appropriate safety lighting in place, which is likely to discourage birds from roosting in construction areas.

Certain bird species including sea-ducks and auks undergo a moult of their plumage post breeding, which makes them either incapable of flight or severely impaired flight. Their ability to move out of the way of fast moving vessels will be reduced, although these species are likely to be able to dive out of the way of any immediate threat.

Therefore, for all seabirds species the effect magnitude is considered to be negligible. For waders the effect magnitude is considered to be minor due to nocturnal migration. The receptor value of terns, kittiwake, fulmar and gannet, auks, sea-ducks and divers is high, and cormorant and shag, gull species (other than kittiwake) and waders is medium. The significance of effect for terns, gulls, tubenoses and gannet, auks, sea-ducks and divers is therefore judged to be **negligible**, and for waders is **minor adverse,** which is not significant in EIA terms.

Table 14.38 summarises the construction effects magnitudes and significance for receptor groups.

Table 14.38: Summary of construction effects

Effect	Receptor	Effect Magnitude	Receptor Value	Effect Significance
Disturbance and displacement due to marine construction activities	Terns	Negligible	High	Minor adverse
	Gulls, tubenoses and gannet (Herring gull, lesser black backed gull and kittiwakes, fulmar, gannet)	Negligible (Negligible)	Medium (High)	Negligible (Negligible)
	Cormorant and shag	Negligible	Medium	Negligible
	Auks	Minor	High	Minor adverse
	Sea-ducks and divers	Minor	High	Minor adverse
	Waders	Minor	Medium	Minor adverse
Disturbance and displacement due to terrestrial construction activities	Terns	Negligible	High	Minor adverse
	Gulls, tubenoses (shearwaters) (Fulmar, gannet and kittiwake)	Negligible (Negligible)	Medium (High)	Negligible (Negligible)
	Cormorant and shag	Negligible	Medium	Negligible
	Auks	Negligible	High	Negligible
	Sea-ducks and divers	Minor	High	Minor adverse
	Waders	Minor	Medium	Minor adverse
Reduced prey availability for visual predators due to the presence of sediment plumes	Terns	Minor	High	Minor adverse
	Gulls, tubenoses (shearwaters) (Fulmar, gannet and kittiwake)	Negligible (Negligible)	Medium (High)	Negligible (Negligible)
	Cormorant and shag	Negligible	Medium	Negligible
	Auks	Negligible	High	Negligible
	Sea-ducks and divers	Minor	High	Minor adverse
	Waders	Negligible	Medium	Negligible
Accidental release of environmentally harmful substances	Terns	Minor	High	Minor adverse
	Gulls, tubenoses and gannet (Common gull)	Negligible (Minor)	High (High)	Negligible (Minor adverse)
	Cormorant and shag	Negligible	Medium	Negligible
	Auks (Razorbill and guillemot)	Negligible (Minor)	High (High)	Negligible (Minor adverse)
	Sea-ducks and divers	Minor	High	Minor adverse
	Waders	Minor	Medium	Minor adverse

Table 14.38: Summary of construction effects continued

Effect	Receptor	Effect Magnitude	Receptor Value	Effect Significance
Changes to prey availability (Reduced prey availability)	Terns	Minor	High	Minor adverse
	Gulls, tubenoses and gannet	Negligible	High	Negligible
	Cormorant and shag	Negligible	Medium	Negligible
	Auks	Negligible	High	Negligible
	Sea-ducks and divers	Minor	High	Minor adverse
	Waders	Minor	Medium	Minor adverse
Increase in the risk of collision with vessels	Terns	Negligible	High	Negligible
	Gulls, tubenoses (shearwaters) (Kittiwake, fulmar and gannet)	Negligible (Negligible)	Medium (High)	Negligible (Negligible)
	Cormorant and shag	Negligible	Medium	Negligible
	Auks	Negligible	High	Negligible
	Sea-ducks and divers	Negligible	High	Negligible
	Waders	Minor	Medium	Minor adverse

14.6.1.2 Sources of Impacts during Operational Phase

Loss of Habitat

Nigg Bay is a natural bay offering a higher level of shelter than many other bays along the north-east coastline, the congregations of birds recorded during the wintering bird survey and the late summer aggregations of sea-ducks are as a result of this natural refuge from offshore storms. Operationally this refuge area will be lost to these bird species.

Any loss of habitat poses a potential effect on bird species utilising the area for breeding, roosting and feeding with many species being site faithful, returning to the same sites year after year. The development will result in a complete and irreversible loss to some areas of existing habitat within Nigg Bay. The loss of habitat will affect birds during all different seasonal use of the site from breeding, foraging and to a lesser extent, roosting.

Marine birds are effectively the top predators of the benthos, fish and shellfish populations found within Nigg Bay. During the construction of the new harbour the seabed will be dredged to 9 m below CD for the majority of the harbour with dredging down to 10.5 m below CD in the approach channel and eastern quayside. There will be a loss of 212,118 m^2 of seabed habitat within Nigg Bay as a result of the placement of the proposed harbour infrastructure on the seabed.

If the habitat, (and therefore the prey species that use this habitat is required by marine birds as part of their foraging range) is lost and there no ability for the prey species to recolonise any new habitat created, the area is effectively devoid of any potential food source for the birds, and therefore this area is unlikely to be able to support the foraging population that it once was. Regular maintenance dredging of the seabed is likely to prevent any re-colonisation of this site for seabirds in the future and therefore the site must be assessed as a permanent and irreversible loss in foraging terms.

Birds which are more concentrated in their feeding within the bay are likely to be affected more than birds which range over wider distances. Eider for example will be feeding on sedentary prey such as mussels, which are likely to be attached to subsea structures or the seabed and will be concentrating their foraging activity in a narrow area.

Terns

Species which pursue their prey (tern species) will be foraging over a much wider area and their dependence on a relatively confined area will be reduced, and thus any potential effect of habitat loss will be reduced. These species are either present in very low numbers already or are likely to display some degree of habituation to the activities, as has been witnessed from the data gathered adjacent to the existing harbour operation. These species are known to breed along the Aberdeenshire coastline and are a feature of the nearby Ythan Estuary, Sands of Forvie and Meikle Loch SPA and are known to have offshore roosts and crèches of young on the rocky shore in Greyhope Bay. Data from the wintering bird survey suggest that a proportion of the east coast breeding population (common, Arctic and Sandwich) roost in Nigg Bay prior to arrival on breeding grounds. Therefore effect magnitude is considered to be minor on a high value receptor, and the effect significance for terns is judged to be **minor adverse,** which is not significant in EIA terms.

Gulls, Tubenoses and Gannet

Gulls, tubenoses and gannet tend to have a varied diet taken from a wide variety of habitats, and therefore are less susceptible to loss of any feeding habitat at Nigg Bay. However, gull species such as kittiwake have been recorded forming large roosts in the existing harbour and common gull roosts of two thousand birds have been recorded within Nigg Bay itself. Therefore for kittiwake and common gull, effect magnitude is considered to be minor on a high value receptor, and effect significance is judged to be minor. Overall, effects on this group is assessed to be negligible on a high value receptor, and the effect significance for gulls, tubenoses and gannet is judged to be **minor adverse,** which is not significant in EIA terms.

Cormorant and Shag

Cormorant pass through Nigg Bay between day and night time roosts and shag tend to feed in the outer area of the bay. Therefore the effect magnitude is considered to be negligible on a medium value receptor, and the effect significance for cormorant and shag is judged to be **negligible,** which is not significant in EIA terms.

Auks

Auk species tend to spend their time at the outer edges of the bay or further offshore. Therefore the effect magnitude is considered to be negligible on a high value receptor, and the effect significance for auks is judged to be **negligible,** which is not significant in EIA terms.

Sea-ducks and Divers

For the more sedentary feeders like sea-ducks the effect magnitude has been judged to be moderate on a high value receptor, and the effect significance is judged to be moderate. Effects on long-tailed duck are considered to be of minor magnitude on a high value receptor as it is not likely to

demonstrate the same degree of displacement as other sea-ducks, therefore the effect significance is judged to be **minor** adverse, which is not significant in EIA terms.

Diver species deviate from sea-ducks in terms of how they feed, with divers being pursuit feeders similar to terns, however these species will likely be excluded from the bay when the harbour is operational due to disturbance. However the construction of the southern breakwater will provide a shelter belt for bird species further out in the bay, either from northerly or southerly storms. The offshore area just south of Girdle Ness is situated between the two designated shipping lanes (the existing harbour and that of the proposed development) and as such will be excluded to all large commercial shipping, therefore this area should provide bird species such as sea-duck and divers with an area protected from human disturbance. Therefore the effect have been assessed as having a minor effect magnitude on a high value receptor, and the effect significance for sea-ducks and divers is judged to be **moderate adverse,** which is significant in EIA terms.

Waders

The existing harbour has a habitat that will be similar to that created at Nigg Bay when the new harbour is operational, such as an artificial rocky shoreline (including sea defence stonework) which forms a major part of the shoreline habitat. The presence of rock pools, abundant shellfish (including mussels cast up by storms) and seaweed make this a useful feeding area for wading birds such as oystercatcher and turnstone, as well as various species of gull. This habitat is important both within the harbour as well as in the adjacent Greyhope Bay. Breakwaters form a major focus for roosting birds. The OSBW of the existing harbour is an important local roost for waders, particularly for purple sandpipers, while the southern breakwater holds large numbers of roosting shags and cormorants, along with various gulls and small numbers of roosting waders. During bad weather, with waves breaking over the southern breakwater, larger numbers of birds congregate on the OSBW. In addition to the importance of these breakwaters for roosting purposes, at low tide ledges are exposed, particularly on the northern breakwater. These are exploited as feeding areas by various waders. Skate's Nose Jetty is infrequently used as a loafing spot, although it appears not to be favoured as a roosting site (Envirocentre, 2012).

The inter-tidal zone within the operational new harbour will be lost and this will impact on waders. This loss of habitat will be permanent and irreversible, however as a group of birds their dependence on this site is likely to be low, with other suitable habitats available elsewhere along the Aberdeenshire coastline. Therefore the effect magnitude is considered to be minor on medium value receptors and the effect significance for wading birds is judged to be **minor adverse,** which is not significant in EIA terms.

Disturbance due to Operational Activities

Whilst some groups such as gulls have been shown to be attracted to areas with increased shipping activity (Garthe and Hüppop 1999; Skov and Durinck 2001; Christensen et al., 2003 as referenced in Cook and Burton, 2010), many others, including sea-duck, divers, shearwaters, grebes and terns, have been shown to actively avoid shipping lanes (Kube 1996; Mitschke et al., 2001; Kaiser 2004; Borberg et al., 2005 as referenced in Cook and Burton, 2010).

Studies of common scoter in Liverpool Bay suggest that birds can be flushed at distances of up to 2 km by large vessels (Kaiser 2004 as referenced in Cook and Burton, 2010). As a result of frequent flushing by ships using the area, even where there are large concentrations of harvestable prey, it is difficult for many species to maintain a favourable energy balance within shipping lanes (Kube, 1996 as referenced in Cook and Burton, 2010). However, certain species are known to be highly sensitive to disturbance effects, particularly red-throated diver, common and velvet scoters, cormorants, and shag, all of which utilise Nigg Bay. During the VP surveys, records were taken of vessel movement and their attraction or disturbance to birds. From these observations it is clear that normal, regular ship movements have little or no effect on roosting birds (or even much on birds loafing on the water). The ships are largely ignored. Occasionally significant numbers of gulls will follow one of the larger ships, particularly as they enter the harbour, feeding in the wake as sediment is disturbed.

Sea-ducks and Divers

Eider are considered highly sensitive to disturbance effects and given their usage of roosting and feeding within Nigg Bay this species has potential for permanent displacement, especially as they foraging areas are likely to be impaired. Alternative habitat is available in the open waters of Aberdeen Bay and the existing harbour and Greyhope Bay which they currently utilise (Figure 14.2) and (Figure 14.3) primarily for feeding and loafing (AOWFL, 2011). Roosting areas for this species overlap with the proposed development footprint and it is expected that effects will arise. Effect magnitude for sea-ducks, particularly eider, is considered to be moderate. Red-throated diver display low tolerance for disturbance and therefore the effect magnitude will also be moderate, with both species groups having a receptor value being high with the effect significance is judged to be **moderate adverse, which is significant in EIA terms**.

Terns

Tern species avoid shipping lanes but are generally tolerant of shipping activity and therefore will be able to still feed in the vicinity of Nigg Bay but may be displaced in the bay itself, therefore effect magnitude is considered to be minor on a high value receptor, and the effect significance for terns is judged to be **minor adverse,** which is not significant in EIA terms.

Gulls, Tubenoses and Gannet

The main species of birds found on the water washing, loafing and, during the correct conditions (particularly after a ship has passed), feeding on disturbed prey, are various species of gulls. Nigg Bay hosts a winter time roost of several thousand common gull, whilst herring gull and lesser black-backed gull are breeding birds on the local Aberdeenshire coastline. These birds are generalist feeders and are able to exploit foraging opportunities from human activities in the locality (for example feeding on fishing industry discards, landfill waste, and farming practices in particular pig farms). Fulmars and gannet have been observed foraging in the outer areas of Nigg Bay. Both species have very wide foraging ranges, therefore the effects on them are very localised. Therefore effect magnitude is considered to be negligible on a high value receptor, and the effect significance is judged to be **negligible,** which is not significant in EIA terms.

Cormorant, Shag and Guillemot

Cormorant pass through Nigg Bay between day and night time roosts and shag tend to feed in the outer area of the bay. Therefore the effect magnitude is considered to be negligible on a medium

value receptor, and the effect significance is judged to be **negligible,** which is not significant in EIA terms.

Guillemot are regularly recorded in low numbers, diving for small fish. Cormorants and shag also use this habitat for fishing in small numbers. These species are likely to be displaced due to prey availability being lost as part of the habitat loss referred to above, therefore the likelihood of these species being disturbed by port activities will be reduced. Effect magnitude for these prey pursuit species is considered to be minor on a medium value receptor, and the effect significance is judged to be **minor adverse,** which is not significant in EIA terms.

Razorbill and Puffin

Other species of auk have been recorded in the VP surveys as primarily using the outer areas of Nigg Bay for foraging, with puffin recorded further offshore. Therefore effect magnitude is considered to be negligible on a medium value receptor, and the effect significance is judged to be **negligible,** which is not significant in EIA terms.

Waders

Waders are known to utilise the existing harbour and thus are tolerant to general shipping activity, however as the intertidal area along the northern and western shoreline of the bay with be lost under the quayside when the harbour is operational, these birds will be permanently displaced from this area and may be disturbed from the southern less developed shoreline as ships come and go from the harbour. This area is a small part of a wider area that these birds are able to utilise therefore the effect magnitude is considered to be minor on a medium value receptor, and the effect significance is judged to be **minor adverse,** which is not significant in EIA terms.

Water Quality and Accidental Release of Environmentally Harmful Substances

Releases of chemicals such as fuel, oil and lubricants during operation of the harbour into the marine environment has the potential to be harmful to marine life. Marine birds have varying degrees of sensitivity to pollutants depending on the proportion of the time they spend swimming, the type and quantity of substance entering the marine environment and the dilution and dispersion properties of the receiving waters.

Most oil pollution in the sea is not derived from oil tankers (Hampton et al., 2003 as referenced in Cook and Burton, 2010) but general leakage from ships. Even a small spill can have a serious effect upon seabird populations, especially survival during winter (Votier et al., 2005 as referenced in Cook and Burton, 2010). Oiling rates are highest in species which spend most of the time swimming especially in areas of frequent oil spills such as around shipping lanes (or ports). Up to 50% of the guillemots found washed up on the beaches of the North Sea were found to be oiled (Camphuysen, 1998 as referenced in Cook and Burton, 2010).

The magnitude of this effect on marine bird receptors depends upon the quantities and nature of the spillage/release, the dilution and dispersal properties of the receiving waters and the bio-availability of the spilt contaminant. There will be an increased risk of oil spillage from both the dredging activities in construction and operation and general increased vessels using the ports.

Another major factor to the water quality of the bay will be the effective concentration in the harbour of the contaminants from the various discharges currently made. There are a number of wastewater discharges, comprised of treated sewage effluent, trade effluent, landfill leachate, and combined sewer storm overflows, that discharge either directly into Nigg Bay or the adjacent headlands (Chapter 7: Marine Water and Sediment Quality).

At present these discharges receive considerable dilution from surrounding seawater. An effect of the breakwaters and harbour walls will be to effectively increase the retention of these discharges within the harbour basin for longer periods of time, and the complete flushing of Nigg Bay will reduce from 90% to 10% in a 6 hour period.

The implications of these discharges and effects on the water quality and benthic and fish life are discussed in detail in the Chapter 7: Marine Water and Sediment Quality, Chapter 12: Benthic Ecology and Chapter 13: Fish and Shellfish Ecology. The effects on marine birds will be essentially one of prey availability if the changes to the water quality of the bay were to affect the population of prey items, through reduction in dissolved oxygen for example. However, Nigg Bay is a small part of a wider habitat for prey items, so it is unlikely to be used exclusively for foraging in the wider Aberdeen Bay area and this is likely to continue post construction of the new harbour.

Reductions in dissolved oxygen availability could in the most severe case render most of the harbour unsuitable for fish life (albeit that this is not predicted). This will impact on species of bird whose predominant diet are fish, for example divers, cormorants, shag, terns, auks and gannet, however, many of these species currently forage on the outer reaches of the bay will be able to continue to do so post-construction.

Benthic ecology will be impacted by the loss of the seabed habitat; the increased concentrations of heavy metals in the harbour will likely be absorbed and concentrated within filter feeders found within the harbour such as bivalves and mussels. If sea-ducks remain in the area and feed exclusively on these organisms then there is a potential for some long term effects on the health of these species. However it is highly likely that with a heavily modified seabed the populations of benthic organisms will decrease, and together with other effects like disturbance from vessels the attraction to sea-ducks will be reduced too. Research on the bioaccumulation of heavy metals in sea-ducks is limited, although there is some evidence to suggest a higher tolerance to heavy metals in sea-ducks than freshwater ducks (Savard et al., 2015), with evidence that mercury in the form of methyl mercury is redistributed from body tissues to feathers, which will be shed during the annual moult.

Terns

During the operational phase of the new harbour, tern species will be able to utilise the area surrounding the bay as well as along the immediate coastline, therefore the effect magnitude is considered to be minor on a high value receptor, and the effect significance is judged to be **minor adverse**, which is not significant in EIA terms.

Gulls, Tubenoses and Gannet

Gulls, tubenoses and gannet do not generally utilise the bay for feeding although fulmar have been seen feeding in the outer areas of the bay. Some gull species such as common gull do form large

roosts in the bay (during winter and spring) and may continue to do so outside of the breakwaters post construction of the harbour and thus may be at a greater risk from potential pollution due to the time spent on the water. Thus the effect magnitude for common gull is considered to be minor on a high value receptor, and the effect significance is judged to be **minor adverse**, which is not significant in EIA terms. Generally for gulls, tubenoses and gannet the effect magnitude is considered to be negligible on a high value receptor, and the effect significance is judged to be **negligible,** which is not significant in EIA terms.

Cormorant and Shag

Cormorant and shag generally pass through the area between day and night time roosts. Therefore in terms of water quality or pollution the effect magnitude is considered to be negligible on a medium value receptor, and the effect significance for cormorant and shag is judged to be **negligible,** which is not significant in EIA terms.

Auks

Auk species such as puffins tend to feed further offshore of Nigg Bay and thus are less likely to be encounter potential oil spillages. However, razorbill and guillemot have been seen to feed in the outer areas of the bay. Species such as guillemot also go through an annual moult where they have a flightless period and thus may be more susceptible to potential pollution events. Effects on auks have a magnitude of negligible on a high value receptor, and the effect significance is judged to be **negligible**. However for razorbill and guillemot the effect magnitude is considered to be minor on a high value receptor, and the effect significance is judged to be **minor adverse,** which is not significant in EIA terms.

Sea-ducks and Diver

The disturbance factors from shipping and the loss of seabed habitat are likely to displace most sea-ducks from using the harbour during the operational phase and therefore any potential effects from the water quality will be reduced or removed altogether. The effect magnitude is considered to be minor on a high value receptor, and the effect significance for auks is judged to be **minor adverse,** which is not significant in EIA terms.

Waders

Waders are likely to be completely displaced from the northern and western shoreline and thus are less likely to be affected by potential pollution or water quality effects and can also forage in the wider vicinity of the bay. Therefore the effect magnitude is considered to be minor on a medium value receptor, and the effect significance is judged to be **minor adverse,** which is not significant in EIA terms.

Increased Turbidity during Maintenance Dredging

The planned channel dredge and ongoing channel maintenance dredging will increase SSCs, increase local sediment deposition and lower the seabed. Regular maintenance dredging activities will be undertaken.

Increases in suspended sediment concentrations (SSCs) will occur as a result of the action of the dredger draghead or the backhoe dredging tool on the seabed and also from any overspill from the dredger hopper. Suspended sediments will be initially transported from the point of release under their own momentum within a dynamic phase, and subsequently via tidal current movements within a passive phase, and will be eventually deposited back to the seafloor during periods of reduced tidal movement.

Any increase in turbidity will reduce the visual ability of a number of species who actively pursue their prey in the water by vision, including species such as gannet, terns and guillemot. As a result water clarity may play an important role in the foraging success of these and other species.

Pelagic species will generally be less sensitive to increases in turbidity as they tend to forage further offshore and over a wider variety of habitat and prey. Gannet for example is a visual foraging diving species but is able to exploit a number of different prey species over a wide foraging range and therefore the potential loss of foraging opportunities in Nigg Bay will have limited effects on breeding success (Martin, 1989; Furness and Tasker 2000; Hamer et al., 2000 as referenced in Cook and Burton, 2010). This ability to forage widely results in lower sensitivity to prey changes.

It is generally considered that prey items (benthic, shellfish and fish) will be lost within Nigg Bay in the course of the development as their habitats are removed (limited to the footprint of the development itself). Therefore any subsequent operational activities such as dredging will have a lesser impact on bird species as most species will already be displaced either due to general disturbance from vessel movements, or absence of their prey items that attract them to the bay in the first place.

Terns

Most tern species forage within 10 km of the coast (Becker et al., 1993; Furness and Tasker 2000; Bertolero et al., 2005; Perrow et al., 2006; Rock et al., 2007 as referenced in Cook and Burton, 2010), and plunge after their prey. Prey species may vary between locations, depending on availability, and include fish species such as sandeel and herring (Monaghan et al., 1989; Furness and Tasker 2000; Garthe and Hüppop 2004; King et al., 2009 as referenced in Cook and Burton, 2010). As they are constrained to a short foraging range, they are highly vulnerable to reduced food availability (Furness and Tasker 2000; Garthe and Hüppop 2004; King et al., 2009, referenced in Cook and Burton, 2010). Thus any changes in food availability at a local level could have a dramatic effect on populations. As they require clear water for foraging (Essink 1999, referenced in Cook and Burton, 2010), terns may thus be particularly sensitive to the turbidity caused by dredging operations and the re-suspension of sediment. However this effect will be highly localised and temporary. Thus the effect magnitude is considered to be minor on a high value receptor, and effect significance for terns is judged to be **minor adverse,** which is not significant in EIA terms.

Gulls, Tubenoses and Gannet

Gulls, tubenoses and gannet - in general gulls are likely to be of low sensitivity to the effects of maintenance dredging activities as they have a broad diet, are able to use a wide variety of habitats. Gannets are plunge divers and will pursue their prey under water. They take a wide range of prey items, have very wide foraging ranges and so are unlikely to be impacted by the localised dredging in the development area. Tubenoses are pelagic in their foraging habitats and again are unlikely to be

impacted by the localised effects of dredging. Therefore the effect magnitude is considered to be negligible on a high value receptor, and the effect significance for gulls, tubenoses and gannet is judged to be **negligible,** which is not significant in EIA terms.

Cormorant and Shag

Cormorant and shag feed on fish and shellfish and have been observed foraging at water depths of up to 18 m (Gremillet et al., 2005; Roycroft et al., 2004 as referenced in Cook and Burton, 2010) and they are not pursuit feeders, as is commonly believed (White et al., 2007 as referenced in Cook and Burton, 2010) so may be less sensitive to changes to turbidity in comparison to other diving species. These species are also often seen passing through Nigg Bay between day and night time roosts. Therefore the effect magnitude is considered to be negligible on a medium value receptor, and the effect significance for Cormorant and shag is judged to be **negligible,** which is not significant in EIA terms.

Auks

Auks, like terns species, are likely to be sensitive to increases in turbidity and the indirect effects of deposition of re-suspended sediments, which could potentially negatively impact on their food supply (Cook and Burton, 2010). Species such as guillemot require clear water in which to pursue prey. However the impacts from maintenance dredging will be highly localised and temporary and therefore effect magnitude is considered to be negligible on a high value receptor, and the effect significance for auks is judged to be **negligible,** which is not significant in EIA terms.

Sea-ducks and Divers

Sea-duck species such as eider feed generally on mussels and other molluscs which tend to be attached to subsea strata or the seabed. Routine maintenance dredging is likely to prevent such species being able to recolonise the seabed, and whilst it is possible that mussels are able to colonise the harbour walls, they are likely not to be available to sea-ducks due to their proximity to shipping. It is likely that sea-ducks have been displaced due to loss of prey species and disturbance from shipping. Divers are pursuit prey specialists and therefore if present are likely to be impacted by an increase in turbidity. However this effect is highly localised and temporary. Therefore the effect magnitude is from maintenance dredging is likely to be minor on a high value receptor, and the effect significance for sea-duck and divers is judged to be **minor adverse,** which is not significant in EIA terms.

Waders

Waders typically feed in the intertidal zone, often in turbid conditions and therefore the magnitude is negligible on a medium value receptor, and the effect significance is judged to be **negligible,** which is not significant in EIA terms.

Increase in the Risk of Collision and Changes to Ambient Light

Most bird species will be displaced from the development site once it becomes operational due to loss of habitat and disturbance, so the likelihood that any species will be at risk of a collision with a vessel is extremely unlikely.

Although there will be an increase in the overall number of vessels using the site from the construction phase, a speed limit is likely to be imposed by the AHB within the harbour site, together with the deployment of pilots and tugs, will make it even more unlikely that there will be any collisions with any species of marine bird.

Similarly the lighting deployed on the harbour quayside and buildings will not impact on any migratory bird species to any greater extent than exists already. Operational lighting will be directional and dimmable to minimise the spillage of light.

Terns

Therefore effect magnitude for tern species is considered to be negligible on a high value receptor, and the effect significance is judged to be **negligible,** which is not significant in EIA terms.

Gulls, Tubenoses and Gannet

For gulls, tubenoses and gannet, the effect magnitude is considered to be negligible on a high value receptor, and the effect significance is judged to be **negligible,** which is not significant in EIA terms.

Cormorant and Shag

For cormorant and shag the effect magnitude is considered to be negligible on a medium value receptor, and the effect significance is judged to be **negligible,** which is not significant in EIA terms.

Auks

For auk species the effect magnitude is considered to be negligible on a high value receptor, and the effect significance is judged to be **negligible,** which is not significant in EIA terms.

Sea-ducks and Divers

For sea-ducks and divers effect magnitude is considered to be negligible on a high value, and the effect significance is judged to be **negligible,** which is not significant in EIA terms.

Waders

For waders the effect magnitude is considered to be minor adverse on a medium value receptor, and the effect significance is judged to be **minor adverse,** which is not significant in EIA terms.

Table 14.39: Summary of operational and maintenance effects

Impact	Receptor	Effect Magnitude	Receptor Value	Effect Significance
Loss of habitat	Terns	Minor	High	Minor adverse
	Gulls, tubenoses, and gannet (Common gull and kittiwake)	Negligible (Minor)	High (High)	Minor adverse (Minor adverse)
	Cormorant and shag	Negligible	Medium	Negligible
	Auks	Negligible	High	Negligible
	Sea-ducks and divers (Long-tailed duck)	Moderate (Minor)	High (High)	Moderate adverse (Minor adverse)
	Waders	Minor	Medium	Minor adverse
Disturbance due to operational activities	Terns	Minor	High	Minor adverse
	Gulls, tubenoses and gannet	Negligible	High	Negligible
	Cormorant and shag	Negligible	Medium	Negligible
	Auks (Guillemot)	Negligible (Minor)	Medium (Medium)	Negligible (Minor adverse)
	Sea-ducks and divers	Moderate	High	Moderate adverse
	Waders	Minor	Medium	Minor adverse
Degraded water quality/accidental release of environmentally harmful substances	Terns	Minor	High	Minor adverse
	Gulls, tubenoses and gannet (Common gull)	Negligible (Minor)	High (High)	Negligible (Minor adverse)
	Cormorant and shag	Negligible	Medium	Negligible
	Auks (Razorbill and guillemot)	Negligible (Minor)	High (High)	Negligible (Minor adverse)
	Sea-ducks and divers	Minor	High	Minor adverse
	Waders	Minor	Medium	Minor adverse
Increased turbidity during maintenance dredging	Terns	Minor	High	Minor adverse
	Gulls, tubenoses and gannet	Negligible	High	Negligible
	Cormorant and shag	Negligible	Medium	Negligible
	Auks	Negligible	High	Negligible
	Sea-ducks and divers	Minor	High	Minor adverse
	Waders	Negligible	Medium	Negligible
Risk of collision	Terns	Negligible	High	Negligible
	Gulls, tubenoses and gannet	Negligible	High	Negligible
	Cormorant and shag	Negligible	Medium	Negligible
	Auks	Negligible	High	Negligible
	Sea-ducks and divers	Negligible	High	Negligible
	Waders	Minor	Medium	Minor Adverse

14.7 Mitigation and Residual Effects

With the exception of the effects on sea-ducks and divers as identified below, effects on marine birds have in general been judged to be of negligible or minor adverse significance based on the localised nature of the effects and the widespread distribution of marine bird receptors and their prey items and habitat across the region. In order to further protect birds, a pollution prevention plan will be developed and will be incorporated into the overall Construction and Operational Environmental Management Plans. AHB will also have an existing Oil Spill Response Contingency Plans (OSRCP).

Loss of Habitat: Sea-ducks and Divers – Operation and Maintenance Phase

The effect of the loss of habitat on sea-ducks and divers, without mitigation, is judged to be of **moderate adverse** significance as a result of their likely current use of the area such as their feeding habits i.e. diving species close to the coast or seabed foraging species.

Disturbance: Sea-ducks and Divers – Construction and Operational Phases

The effect of disturbance due to operational activities on sea-ducks and divers, without mitigation, is judged to be of **moderate adverse** significance as a result of their likely current use of the area and the probability that they will be displaced.

Potential mitigation measures to ameliorate these effects are as follows:

Breakwaters: breakwaters are likely to provide some mitigation for the lost rocky foreshore and provide roosting sites. A breakwater with void areas would be advantageous for wildlife as the potential for nest sites. The proposed armoured units to be used in the breakwater design (see Chapter 3: Description of the Development) would be likely to provide such voids. This would provide benefit for a number of other species of bird assessed in this chapter, including gull species which are likely to use the breakwaters as a roost site, and tern species that would be likely to use it as a roosting and crèche site, as they do at the present harbour location. The value of any breakwater for marine birds will be enhanced as human access to the breakwaters will be prohibited expect for inspection/maintenance activities or in emergency situations; this will reduce disturbance to birds and provide a safe refuge discussed above.

During the construction phase, it is possible that construction vessel traffic will be transiting in the area of sea between the development area and the existing harbour entrance. The water depths in this shallow inshore area are between 0 m and 7 m below Chart Datum, which will limit the movement of vessels very close to the coast, and therefore will limit the disturbance to birds in this area.

Vessel movements will be co-ordinated through the Marine Co-ordinator and AHB's Vessel Traffic Services (VTS) – see Chapter 21: Shipping and Navigation for further details. The Marine Co-ordinator will also advise vessel skippers of any aggregations of birds (particularly sea-ducks and auks in moult) and temporary avoidance areas may be put in place where possible.

During the operational phase, the deeper drafted vessels that will typically use the harbour will follow the approach channel until they reach deeper water (greater than 10.5 m below CD) and so will not be navigating close to the shore.

Depending on the prevailing wind conditions, the shallow coastal area to the south of the southern breakwater will provide a suitable shelter belt for loafing and roosting sea-ducks, divers and auks.

The post construction monitoring will be used to record bird and marine mammal usage of the bay and the immediate vicinity, to measure the effectiveness of the mitigation measures proposed, and of the effects of the completed development on birds. A report of this monitoring will be submitted to the regulatory authorities on its completion.

The final design and implementation of the mitigation measures will be developed and agreed in consultation with the regulators and stakeholders for subsequent incorporation within the Construction Plan and Environmental Management Plan and conditioned within the Marine Licence.

With the above measures in place the effects on sea-ducks and divers (loss of habitat, and disturbance due to operational activities) significance are judged to be of **minor adverse significance**, which is not significant in EIA terms.

14.8 Cumulative Effects

Cumulative effects have been identified and assessed where the potential effect and receptor footprints of the current scheme overlap with the effects that are predicted to arise from the other developments listed in Table 14.39. As five of the offshore wind farms are currently undergoing legal challenge/judicial review it is uncertain at this stage what the extent of any in combination effects regarding the construction periods will be. As the effects of the development at Nigg Bay are highly localised it is not anticipated that effects like displacement will extend far enough to be considered in combination.

Table 14.40: Projects and plans considered within the assessment

Project/Proposed Development	Description	Location	Approximate Distance to Project [km]	Status	Rationale
Aberdeen Maintenance Dredging	Harbour Maintenance Dredging	Aberdeen	2	Consented, ongoing	An existing part of the baseline; effects relating to construction plumes will be considered for cumulative assessment
European Offshore Wind Deployment Centre	Offshore Wind Demonstrator	Aberdeen	10	Consent approved. Under legal challenge	Loss of habitat within the wind farm array (or associated infrastructure), displacement and barrier effect for species of ducks and divers. Potential collision risk for gulls, terns and gannets, not likely to be major issue for key focal bird species for this development.
Kincardine Offshore Wind Farm	Floating Offshore Wind Farm	Aberdeen	12	Application	
Peterhead Carbon Capture and Storage Project	Subsea Pipeline	Peterhead	30	Application	
Hywind Scotland Pilot Park Offshore Wind Farm	Floating Offshore Wind Demonstrator	Offshore of Peterhead	51	Application	

Table 14.40: Projects and plans considered within the assessment continued

Project/Proposed Development	Description	Location	Approximate Distance to Project [km]	Status	Rationale
Seagreen Alpha and Bravo Round 3 Wind Farm	Round 3 Offshore Wind Farm	Outer Firth of Forth	64	Consent approved. Under judicial review	Loss of habitat within the wind farm array (or associated infrastructure), displacement and barrier effect for species of ducks and divers, not likely to have in combination effect due to distance. Potential collision risk for gulls, terns and gannets, not likely to be major issue for key focal bird species for this development.
Inch Cape Round 3 Wind Farm	Scottish Territorial Waters Offshore Wind Farm	Outer Firth of Forth	65		
Neart na Gaoithe Round 3 Wind Farm	Scottish Territorial Waters Offshore Wind Farm	Outer Firth of Forth	95		
Moray Firth Eastern Development Area 1 and 2 Wind Farm	Round 3 Offshore Wind Farm	Outer Firth of Forth	130	Consent approved	
Moray Firth Western Development Area	Round 3 Offshore Wind Farm	Outer Moray Firth	130	Concept	Loss of habitat within the wind farm array (or associated infrastructure), displacement and barrier effect for species of ducks and divers, not likely to have in combination effect due to distance. Potential collision risk for gulls, terns and gannets, not likely to be major issue for key focal bird species for this development.
Beatrice Round 3 Offshore Wind Farm (BOWL)	Scottish Territorial Waters Offshore Wind Farm	Outer Moray Firth	135	Consent approved	

14.8.1 Cumulative Effects of Loss of Habitat, Displacement and Collision

As the effects from the development both in construction and operational phases on marine birds can be described as local, the cumulative effect from the developments referred to in Table 14.40 are unlikely to have an effect. Species of bird most likely affected by this development are sea-ducks and red-throated diver, which are likely to be displaced to areas along the Aberdeenshire coast adjacent to this development. Seabird species with a wide foraging range like gannet and fulmar might be foraging over a wide area that includes this development and those others referred to in the table above. However as they are foraging over such wide areas, the potential loss of feeding represented by this development will be negligible. Tern species have a shorter foraging range, and are generally confined to foraging within 10 km of the shore, however the area of the foraging habitat lost to them through this development and any cumulative effects from other developments are likely to be low.

Cumulative Effects of Maintenance Dredging

As described in Section 14.6.1, capital dredging operations in Nigg Bay will result in a series of localised short-lived episodes of increased SSC restricted to Nigg Bay itself. Peak SSC from TSHD

overspill is not predicted to exceed 100 mg/l to 200 mg/l north of Girdle Ness (see Figure 7.3, Chapter 7 Marine Water and Sediment Quality), and average plumes are not predicted to extend beyond the mouth of Nigg Bay.

The disposal of the dredged material at the licensed disposal site will also result in intermittent short-lived episodes of elevated SSC. However, the spatial extent of maximum and average SSC of plumes caused by TSHD and backhoe dredge material disposal during construction are significantly smaller than for the existing baseline of licensed maintenance dredging for the existing harbour (see Figures 7.5 and 7.6, Chapter 7 Marine Water and Sediment Quality).

The characteristics of the disposed sediment and local hydrodynamic regime predicted quick settling times and extremely localised high SSC predicted for coarse sediments for both baseline maintenance dredging and construction dredging individually. This is also the case for modelling cumulative impacts for maintenance and construction dredging combined.

Peak rates were modelled for cumulative TSHD and AHB maintenance disposal, are discussed in detail in Chapter 7 Water and Sediment Quality. Peak SSC for cumulative TSHD and AHB at the disposal site was 29,169 mg/l, falling more than an order of magnitude to 2,774 mg/l at 708 m to the north, and to 2,363 mg/l at 886 m to the south. Average SSC was more than 35 times lower at the disposal site, at 813 mg/l. Average SSC falls to 101 mg/l at 463 m to the north and to 106 mg/l at 463 m to the south. These cumulative average levels are within natural background variability less than 0.5 km from the disposal site.

Any increase in turbidity will reduce the visual ability of a number of species who actively pursue their prey in the water by vision, including species such as gannet, terns and guillemot. However as stated above the effects are highly localised, intermittent and short-lived in nature. As a result, the nature of disposal events combined with the range of alternative foraging sites means that any cumulative effects are likely to have a similar magnitude to construction effects, and the and cumulative significance is therefore considered to be the same as for construction effects. Other uses of the area by marine birds such as loafing and roosting will be completely unaffected.

14.9 Summary and Conclusions

A total of 31 species of marine bird have been recorded in the study area from the vantage point survey, and a further 4 species recorded were more associated with freshwater habitats. Marine birds have been classified into two groups; coastal or littoral, and open sea or pelagic. Coastal birds include waders, cormorant, shag, sea-ducks, divers, terns and some species of gull. The pelagic birds include skuas, tubenoses, gannet and auks, kittiwake and great black-backed gull. Nigg Bay is a small part of these species' overall range and this has been reflected in this assessment.

The study area is likely to be used by populations of birds which utilise and are features of SPAs along the Aberdeenshire coast such as eider, common scoter, long-tailed duck and red-throated diver. Nigg Bay is unlikely to be used by any of the species assessed exclusively and these species also utilise the wider coastline and open sea for key phases such as breeding, feeding and roosting. The development area will be permanently lost as a foraging habitat to sea-ducks and divers due to increased levels of human disturbance from maintenance dredging activities, general vessel

movements and habitat loss. Overall the species and habitats of both the development and study area are considered typical of the surrounding North Sea region.

Potential effects originating from the project have been identified and assessed with respect to the construction and operation phases. In addition, cumulative effects have been considered to take into account a number of surrounding developments e.g. Beatrice, Inch Cape and Seagreen Round 3 offshore wind farms. The effects assessed include: loss of habitat, disturbance and displacement, and collision.

Mitigation measures are discussed in Section 14.7. The effects on a very local scale are significant (the likely permanent displacement of most species of marine bird). However, on a broader scale and given that these species, with one or two exceptions (birds in moult and juvenile guillemots), are highly mobile, the effects and cumulative effects assessed are considered to be of **negligible** or **minor adverse** significance. There will be local displacement from the development area, however in the context of the wider study area it is considered that any changes to the regional marine bird species will be within naturally occurring population fluctuations and will be temporary in nature, and as such they will not be adversely affected by the project. Table 14.41 summarises the marine bird assessment conclusions.

Table 14.41: Summary of marine bird assessment conclusions

Effect	Significance of Effect	Mitigation Proposed	Residual Significance of Effect
Construction			
Disturbance and displacement due to marine construction activities	Negligible *(Gulls, tubenoses and gannet; cormorant and shag)* Minor adverse *(Terns; Auks; waders; Sea-ducks and divers)*	No mitigation proposed Production of an Environment Management Plan (EMP)	Negligible Minor adverse
Disturbance and displacement due to terrestrial construction activities	Negligible *(Gulls, tubenoses and gannet; cormorant and shag; auks)* Minor adverse *(Terns; sea-ducks and divers; waders)*	No mitigation proposed Production of an EMP	Negligible Minor adverse
Reduced prey availability for visual predators due to the presence of sediment plumes	Negligible *(Gulls, tubenoses and gannet; cormorant and shag; auks; waders)* Minor adverse *(Terns; sea-ducks and divers)*	No mitigation proposed No mitigation proposed	Negligible Minor adverse

Table 14.41: Summary of marine bird assessment conclusions continued

Effect	Significance of Effect	Mitigation Proposed	Residual Significance of Effect
Construction			
Accidental release of environmentally harmful substances	Negligible *(Gulls, tubenoses and gannet; cormorant and shag; auks)* Minor adverse *(Terns; common gull; razorbill and guillemot; sea-ducks and divers; waders)*	No mitigation proposed Production of an EMP	Negligible Minor adverse
Changes to prey availability (Reduced prey availability)	Negligible *(Gulls, tubenoses and gannet; cormorant and shag; auks)* Minor adverse *(Terns; sea-ducks and divers; waders)*	No mitigation proposed No mitigation proposed	Negligible Minor adverse
Increase in the risk of collision with vessels	Negligible *(Terns; gulls, tubenoses and gannet; cormorant and shag; auks; sea-ducks and divers)* Minor adverse *(Waders)*	No mitigation proposed No mitigation proposed	Negligible Minor adverse
Operation and Maintenance			
Loss of habitat	Negligible *(Cormorant and shag; auks)* Minor adverse *(Terns; gulls, tubenoses and gannet; long-tailed duck; waders)* Moderate adverse *(Sea-ducks and divers)*	No mitigation proposed No mitigation proposed Breakwaters (with limited human access) as substitute for rocky shore. Adoption of an EMP	Negligible Minor adverse Minor adverse
Disturbance due to operational activities	Negligible *(Gulls, tubenoses and gannet; great cormorant and European shag; auks)* Minor adverse *(Terns; guillemot; waders)* Moderate adverse *(Sea-ducks and divers)*	No mitigation proposed No mitigation proposed Breakwaters (with limited human access) as substitute for rocky shore. Adoption of an EMP. Post construction VP survey for at least one year, to monitor the effectiveness of the above mitigation.	Negligible Minor adverse Minor adverse

Table 14.41: Summary of Marine Bird Assessment Conclusions continued

Effect	Significance of Effect	Mitigation Proposed	Residual Significance of Effect
Operation and Maintenance			
Water quality and accidental release of environmentally harmful substances	Negligible *(Gulls, tubenoses and gannet; cormorant and shag; auks)* Minor adverse *(Terns; common gull; razorbill, guillemot; sea-ducks, divers; waders)*	No mitigation proposed No mitigation proposed	Negligible Minor adverse
Increased turbidity during maintenance dredging	Negligible *(Gulls, tubenoses and gannet; cormorant and shag; auks; waders)* Minor adverse *(Terns; sea-ducks and divers)*	No mitigation proposed No mitigation proposed	Negligible Minor adverse
Risk of collision	Negligible *(Terns; gulls, tubenoses and gannet; cormorant and shag; auks; sea-ducks and divers; waders)*	No mitigation proposed	Negligible

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