

Section 8

Description of the Biological Baseline Environment



8 DESCRIPTION OF THE BIOLOGICAL BASELINE ENVIRONMENT

8.1 INTRODUCTION

This section describes the existing biological environment in and around the Humber Gateway site and the export cable route corridor.

The section begins with a list of designated sites, including Special Protection Areas, Special Areas of Conservation and Sites of Special Scientific Interest. The baseline is then described in relation to the following flora and fauna:

- intertidal ecology (*Section 8.3*);
- subtidal benthos (*Section 8.4*);
- fish (*Section 8.5*);
- marine mammals (*Section 8.6*); and
- birds (*Section 8.7*).

In addition, *Section 8.8* describes the underwater acoustic environment, as this is relevant to marine ecology, particularly marine mammals.

Each of the sub-sections is structured as follows:

- an introduction, including a summary of consultation responses and a description of relevant policies and plans that are specific to that topic;
- a description of any surveys that have been carried out and a summary of the methodologies adopted; and
- a description of the baseline environment, including the survey results.

The description of the baseline has been drawn from a range of data sources, including previously published data and the following site specific surveys that have been carried out on behalf of E.ON:

- intertidal survey;
- subtidal macrofauna grab sampling and epifauna trawl surveys;
- *Sabellaria* survey;
- fish trawl surveys and fish stomach analysis;
- marine mammals survey;
- boat and aerial based ornithology surveys; and
- ornithological radar surveys.

8.2 DESIGNATED SITES AND LEGISLATION

8.2.1 INTRODUCTION

The following section provides information on sites that are protected under European Directives and / or British legislation, most notably the *Wildlife and Countryside Act 1981*, that are located near to, or that could possibly be affected by, the Humber Gateway project. There is also a brief description of generally applicable legislation. *Figure 8.1* shows national conservation sites in the vicinity of the Humber Gateway site and a summary of the European designations located within the study area is presented in *Table 8.1*. It should be noted that there are no areas at the cable landfall site designated as being of national or international nature conservation importance.

8.2.2 INTERNATIONAL DESIGNATIONS – RAMSAR SITES

The Convention on Wetlands, signed in Ramsar, Iran (in 1971) is an intergovernmental treaty providing a framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. Criteria to assess the site for inclusion within the Ramsar listing is if the wetland regularly supports 20,000 water birds and/or if it supports 1% of the individuals in a population of one species or subspecies of water bird.

The Government has made it clear that Ramsar sites will (as a matter of policy) be afforded the same protection as Special Protection Areas (SPAs) and Special Areas of Conservation (SACs).

8.2.3 EUROPEAN DESIGNATIONS

Overview

European designations of nature conservation importance comprise SPAs and SACs. The legislative context for these designations is described below.

Consideration of the qualifying interests of each of the European designations is important in the context of ornithology, which is described in detail in *Section 8.7*.

Special Protection Areas

Special Protection Areas (SPAs) are designated under Article 4 of the *EC Directive on the Conservation of Wild Birds (79/409/EEC)*, also known as the *Birds Directive*, which came into force in April 1979. SPAs are classified for rare and vulnerable birds, listed in Annex I to the *Birds Directive*, and for regularly occurring migratory species. Criteria for selection of SPAs are described in *The Birds Directive - Selection Guidelines for SPAs*, published in 1999 by the Joint Nature Conservation Committee (JNCC).

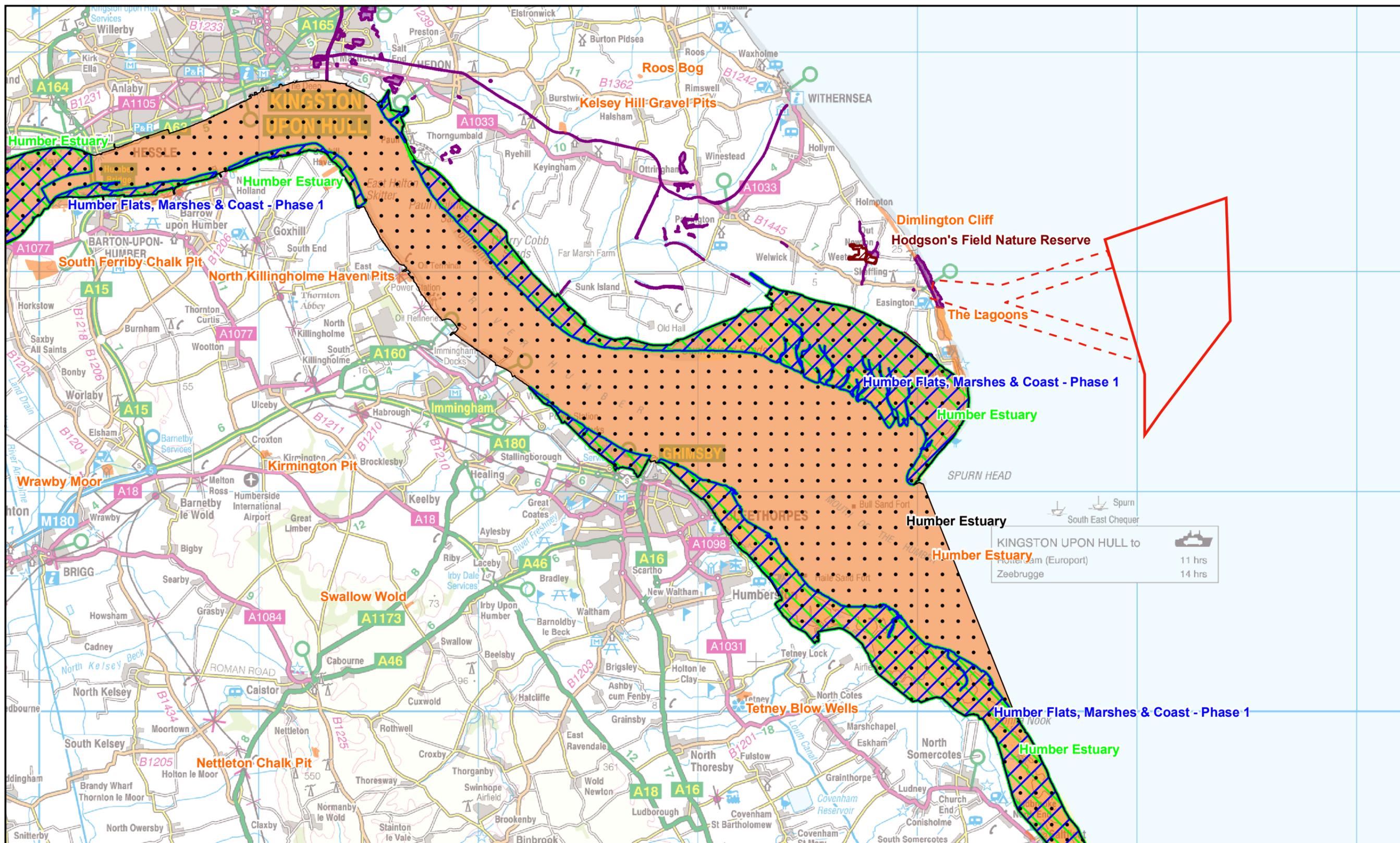
Special Areas for Conservation (SACs)

Special Areas for Conservation (SACs) are designated under the *EC Habitats Directive*. Article 3 of the *Habitats Directive* requires the establishment of a European network of important, high-quality conservation sites that will make a significant contribution to conserving the 189 habitat types and 788 species identified in Annexes I and II of the Directive (as amended). The listed habitat types and species are those considered to be most in need of conservation at a European level (excluding birds). There are 76 Annex I habitat types that occur in the UK and of the Annex II species, 43 are native to the UK.

Protection of Designated Areas

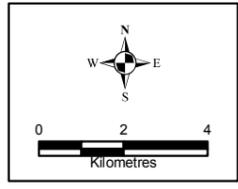
Any proposed development must be assessed in terms of its implications for the protected site. If this assessment, known as an Appropriate Assessment (AA), concludes that the development would have an adverse affect on the integrity of the protected site, then the development can only proceed if the authority making the AA is satisfied that there are no alternative solutions and (in turn) that the project should proceed for reasons of overriding public interest (which may be economic or social in nature). The need for an AA extends to candidate SACs, provided that such sites have been submitted for designation by the UK Government for the approval of the European Commission, and to sites which qualify, but which have not yet been classified as SPAs. As a matter of policy, AA extends to effects on Ramsar sites.

The authority making an AA is known as a Competent Authority, as defined in Regulation 6 of the *Habitats Regulations 1994*. In the case of the Humber Gateway development these will include the Secretary of State BERR, the Secretary of State DEFRA, the Secretary of State DfT and the onshore local planning authority (with regard to impacts of the onshore elements of the Humber Gateway development on coastal protected sites). However, Regulation 52(2) 1994 makes it clear that there is no requirement on every Competent Authority to make an AA. Rather, a single AA should be made by the most appropriate Competent Authority.



KEY:

	Humber Gateway Site		Candidate Special Area of Conservation
	Ramsar Site		
	Special Protection Area		
	Site of Special Scientific Interest		
	Sites of Importance for Nature Conservation		
	Yorkshire Wildlife Trust Nature Reserve		



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TITLE: **Figure 8.1 Designated Sites in the Vicinity of Humber Gateway Site**

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8.2.4 NATIONAL DESIGNATIONS

Site of Special Scientific Interest (SSSI)

SSSIs are areas of special interest for wildlife, geology and landforms as notified under the *Wildlife and Countryside Act 1981*. The *Countryside and Rights of Way Act 2000* gives additional protection to SSSIs, which are awarded a particular level of protection against damaging activities to preserve the natural heritage. *Planning Policy Statement 9 (Biodiversity and Geological Conservation) 2005*, although not having direct applicability to offshore developments, sets out Government's policy with regard to protecting such areas. Some coastal SSSIs could potentially be affected by the project.

National Nature Reserves and Marine Nature Reserves

National Nature Reserves (NNRs) and Marine Nature Reserves (MNRs) are designated under the *National Parks and Countryside Act 1949* as places of importance for wildlife and natural features in the UK. All NNRs are SSSIs, but the NNR focus is more on conservation. Although onshore, coastal NNRs could potentially be affected by the project.

8.2.5 LOCAL DESIGNATIONS

Site of Importance for Nature Conservation

A Site of Importance for Nature Conservation (SINC) is an area of land and / or wetland of local importance for the conservation of semi-natural habitats including mosaics of heathland, unimproved grassland, scrubland and plantation and/or habitats that support rare local wildlife species. They are not of sufficient extent or quality to qualify for national recognition as a SSSI. Although onshore, coastal SINC could potentially be affected by the project and are therefore mentioned in *Table 8.1* as appropriate.

Local Nature Reserve

The *National Parks and Access to the Countryside Act 1949* gives local planning authorities the power to acquire, declare and manage Local Nature Reserves (LNRs). These reserves are designated as being of particular importance to nature conservation and public understanding of nature conservation issues is encouraged. There are no coastal NNRs in the vicinity of the Humber Gateway project.

8.2.6 GENERALLY APPLICABLE LEGISLATION

The *Water Framework Directive (2000/60/EEC)* addresses the quality of inland, estuarine and groundwater bodies with a view to ensuring a "good ecological status" by 2015. It also applies to coastal waters up to one nautical mile from the shore. Although the Humber Gateway project will be largely beyond this limit, the sub-sea export cable route will enter this zone and the Directive is therefore applicable to part of the project.

In addition, a *Marine Bill* is under development in the UK in order to address five key marine issues:

- marine spatial planning and development;
- consenting;
- fisheries;
- nature conservation; and
- a new marine management organisation.

It should be stressed that, although a Government White Paper has been published, the *Marine Bill* has not yet been enacted. However, reference is made to the proposals under the Bill as appropriate, as this provides an indication of the Government's thinking with regard to the protection of the marine environment. These proposals include, for example, by-laws to prohibit activities such as anchoring in sensitive benthic environments and the designation of Marine Conservation Zones (MCZs) in order to protect species and habitats that can not currently receive protection through EU law.

Table 8.1 Designated Sites

Site	Distance from Humber Gateway site	Status	Area (ha)	Main Conservation Interest
Humber Flats, Marshes and Coast (Phase 1) 28/07/94. Ramsar site no. 663	8 km	Ramsar Wetland, SPA	15,203 ha	This site is designated for vegetation interests including extensive reedbeds, areas of mature and developing saltmarsh, grazing marsh or low sand dunes and brackish pools. Regularly supports internationally important numbers of various species of breeding and wintering water birds as well as many passage birds, notably internationally important populations of ringed plover <i>Charadrius hiaticula</i> , and sanderling <i>Calidris alba</i> . The site supports Britain's most southeasterly breeding colony of grey seal <i>Halichoerus grypus</i> . Human activities include tourism, recreation, commercial and recreational fishing, livestock grazing, and hunting.
Humber Estuary	8 km	Candidate SAC	39,493 ha	This site is recommended for designation for its wide variety of habitats and species. This includes vegetative communities such as: <ul style="list-style-type: none"> coastal lagoons; estuaries; fixed dunes with herbaceous vegetation; Atlantic salt meadows; and sandbanks consisting of <i>Hippophae rhamnoides</i>. Populations of sea lamprey <i>Petromyzon marinus</i> , river lamprey <i>Lampetra fluviatilis</i> , and grey seal, <i>Halichoerus grypus</i> , have also been identified within the estuary.
Humber Estuary	8 km	SSSI	37,000 ha	This site consists of seven biological and geological SSSIs which were previously designated separately. Components of this SSSI include: <ul style="list-style-type: none"> geology; estuary; saline lagoons; geomorphology; sand dunes; vascular plant assemblage; standing waters; invertebrate assemblage; wintering and passage waterfowl species; breeding bird assemblage of lowland open waters and their margins; breeding colony of grey seals; and river and sea lamprey.
The Lagoons	7.9 km	SSSI	67.9 ha	This site comprises of a variety of coastal habitats including: <ul style="list-style-type: none"> saltmarsh; shingle; sand dune; swamp; and most significantly, saline lagoons and pools that represent the only existing example in North Humberside of this nationally rare habitat. These lagoons support populations of the nationally scarce spiral tasselweed <i>Ruppia cirrhosa</i> together with a range of invertebrate species characteristic of coastal saline water habitats. Of particular importance is the colony of over 1% of the British breeding population of little tern, a rare species and another notable species breeding in this habitat is ringed plover.
Spurn	10.6 km	NNR	296 ha	The NNR has sandy beaches and the North Sea on its eastern side, and areas of saltmarsh and extensive mudflats on its western side. The latter attracts thousands of birds.
Donna Nook	14.7 km	NNR	341 ha	The reserve is made up of dunes, slacks, saltmarsh and inter-tidal areas. The area is rich in bird life, supports breeding dune birds include red list species ⁽¹⁾ skylark, yellowhammer and tree sparrow, as well as species such as red-legged partridge, dunnock, whitethroat and linnets in summer. The mudflats provide a winter home for substantial numbers of twite, brent geese, shelduck, lapland bunting, shore lark, knot and dunlin, and a wide variety of other wading birds. In addition, Donna Nook has one of the largest and most accessible breeding colonies of grey seals in the UK.
Dimlington Cliff	7.9 km	SINC		No information was available about this site.

⁽¹⁾ A Red List Species. These are bird species that are globally threatened, whose population or range has declined rapidly in recent years (ie by more than 50% in 25 years), or which have declined historically and not recovered.

8.3 INTERTIDAL ECOLOGY

8.3.1 INTRODUCTION

Overview

The intertidal or littoral zone extends from the foreshore at the cliff base to the mean low water mark.

This section contains a review of the environmental legislation and planning policies relevant to the intertidal zone. It also describes the existing ecology and nature conservation interests of the Humber Gateway intertidal cable routes, and provides details regarding the intertidal baseline survey that was conducted in 2005.

Consultation

The Centre for Environment, Fisheries and Aquaculture Science (Cefas) were consulted on the scope of the intertidal survey and comments were taken into consideration in relation to the final design of the survey. In addition, Natural England (formerly English Nature), Cefas and the Marine and Fisheries Agency (MFA) were given the opportunity to review the marine ecology survey report (presented in *Appendix C1*).

Relevant Policies and Plans

The policy context of the intertidal zone is often accounted for through the designation of protected habitats that include intertidal areas such as the SAC that extends offshore at Flamborough Head. There are other nature conservation designations in the surrounding areas as described below. There are, however, no areas at the cable landfall site designated as being of national or international nature conservation importance.

8.3.2 INTERTIDAL SURVEY METHODOLOGY

During April 2005, intertidal sampling was carried out along three high to low shore transects, each comprising three sampling stations (high, mid and low

shore)⁽¹⁾. Five replicate cores were taken to a depth of 15 cm using a 0.01 m² diameter corer, giving a total of 45 cores. One replicate sample was taken from each station for particle size and organic content analysis (expressed as percentage loss on ignition). All samples (sediment and macrofaunal) were placed in pre-labelled, sealable plastic bags.

Upon return to the laboratory, sediment samples were frozen and macrofaunal samples were transferred to plastic buckets and preserved using a borax-buffered 4% formo-saline solution containing rose bengal. Sampling was timed to coincide with a spring tide to ensure maximum coverage of the intertidal area. The position of each site was recorded using GPS and the physical characteristics of the sediment were described and photographed.

Photographs of the beach within the survey area were also taken (*Figure 8.2*, *Figure 8.3* and *Figure 8.4*). The locations from which the photographs are taken are shown in *Figure 8.5*.

⁽¹⁾ Institute of Estuarine and Coastal Studies, 2005. Humber Gateway: Baseline Study of the Marine Ecology.

Figure 8.2 *Typical Intertidal Habitat Showing Mobile Sediments and Boulder Clay*



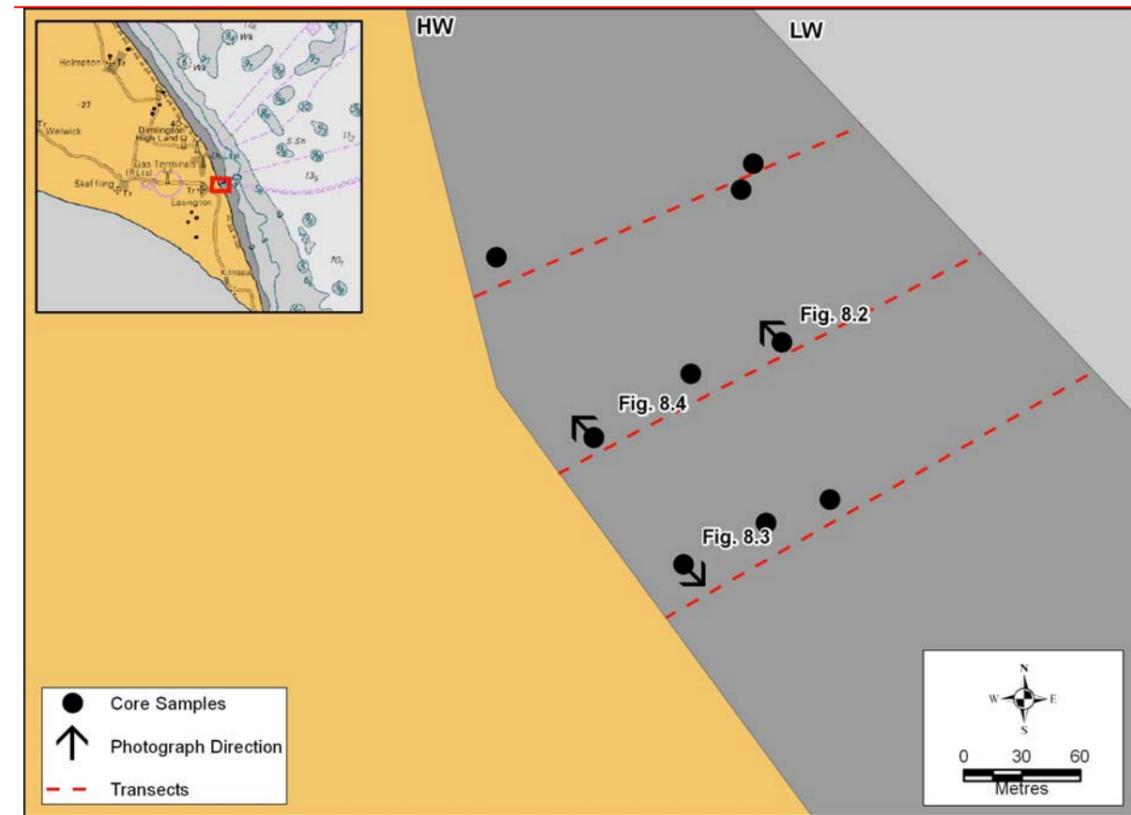
Figure 8.3 *Typical View of Cliff Erosion at Intertidal Survey Site and Mixed Sediments*



Figure 8.4 Coastal Protection and Mixed Sediments on the Upper Shore



Figure 8.5 Intertidal Sampling Sites



© British Crown and SeaZone Solutions Limited, 2005. All rights reserved. Data License No. 122005.007. PROJECTION: British National Grid

8.3.3 DESCRIPTION OF THE INTERTIDAL ECOLOGY

The Holderness Coast, including the cable landfall site and adjacent areas, consists of cliffs of glacial till underlain by chalk. Fronting this area of coastline is a nearshore zone of wave-driven, highly mobile sand and shingle covering the underlying boulder-clay, as shown in *Figure 8.2*. The sand cover varies in thickness depending upon sediment supply and wave conditions. The depth and profile of the beach therefore determines the erosion rate of the boulder-clay sub-layer.

There are some mid-shore areas of fine-grained sands and there is a clay cliff several metres high that forms a boundary between the eroding inshore zone and the stable offshore sea bed (*Figure 8.3*). Studies undertaken indicate that the cliff is eroding at a rate of between 1.5 and 2 m y⁻¹ (*Section 7.5.3*). Rock armour is present in some areas, including the area to the north of the landfall site (*Figure 8.4*).

The sediments at the intertidal ecology baseline survey sites are largely composed of coarse sand and gravel overlaying boulder clay that becomes exposed in places. The highest proportions of gravel were located at sites on the upper shore. In general, the silt content was negligible with the highest concentration found at the upper shore site.

Spurn Peninsula forms the southern extremity of the Holderness Coast and is composed of sand dunes and sandy vegetated shingle. Spurn Head, a sand and shingle spit, extends 5.5 km across the mouth of the Humber Estuary. As noted in *Table 8.1*, The Lagoons SSSI near Easington comprise a variety of coastal habitats. The maintenance and integrity of The Lagoons and Spurn Head requires a constant source of sediment from the north, along established sediment pathways (*Section 7.5.1*).

The site specific intertidal surveys indicated that infaunal invertebrates in the intertidal area were extremely scarce with a total of three species recorded, and only 14 individuals found across the area as a whole. Consequently, the intertidal area is considered extremely impoverished with low diversity both at individual sites and across the whole survey area.

The isopod *Eurydice pulchra* was the dominant species overall at the mid and lower shore sites with the exception of the lower shore sampling stations which were characterised by the amphipod *Haustorius arenarius*. The amphipod *Pontocrates arenarius* was also recorded occasionally in the upper, mid and lower shore sampling stations. No epifaunal species were identified within the study area.

The low level of diversity and abundance is characteristic of coarse mobile sediments that contain very little organic matter. The mobile nature of the sediments prevents epifaunal colonisation and renders the substrate too stressful for many species. This habitat is representative of much of the Holderness Coast.

8.4 SUBTIDAL BENTHOS

8.4.1 INTRODUCTION

Overview

This section describes the existing marine ecological baseline in the vicinity of the Humber Gateway project.

Consultation

Cefas were consulted on the scope of the benthic survey and comments were taken into consideration for the final design of the survey.

Natural England (formerly English Nature), Cefas and the Marine and Fisheries Agency (MFA) have had the opportunity to review the marine ecology survey report (presented in *Appendix C1*) and made a number of comments which have been taken into consideration in the following section. Comments are recorded in *Appendix A* and concerns include the following:

- potential habitat loss associated with the physical presence of the turbine foundations;
- the status and potential for impacts to *Sabellaria* communities; and
- the status and potential impacts to cobble reef communities.

As a result of the above comments, two stand alone reports (one covering *sabellaria* and one covering cobble habitats) were produced and are presented in *Appendix C2* and *Appendix C3* respectively.

Natural England, Cefas and the Marine and Fisheries Agency (MFA) have had the opportunity to comment on the cobble reef and *Sabellaria* reports and comments have been taken into consideration in this ES as appropriate.

Relevant Policies and Plans

Under the *EC Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC)*, reef structures are an Annex I habitat of relevance to the subtidal benthic environment. They may be broadly divided into reefs that comprise substrates that support animals and plants (e.g. cobbles or artificial

habitats), or those where the reef structure is created by the species themselves (biogenic reefs). In the UK, the most important biogenic reefs in inshore waters are those comprising *Sabellaria alveolata*, *S. spinulosa*, *Mytilus edulis*, *Modiolus modiolus* and *Serpula vermicularis*. There are currently no reef habitats designated along the Holderness Coast but the area does support cobble habitats, some of which could be classified as cobble reef. Cobble and biogenic reef habitats will certainly receive consideration in the context of advancement of candidate offshore SACs.

8.4.2 SUBTIDAL BENTHIC SURVEYS

Overview

An evaluation of the marine benthos in the vicinity of the Humber Gateway site was conducted by IECS between November 2004 and April 2005. The assessment and methods used were in compliance with the Centre for Environment Fisheries and Aquaculture Science (Cefas) *Guidance Note for Environmental Impact Assessment* in respect of the *Food and Environment Protection Act 1985* (FEPA) and the *Coast Protection Act 1949* (CPA) requirements⁽¹⁾. In addition, all methodologies were agreed with Cefas prior to initiation.

The assessment investigated infaunal and epifaunal subtidal benthos (the intertidal surveys are discussed separately in *Section 8.3*). Sampling was timed to coincide with a spring tide to ensure maximum coverage of the area. The following surveys were carried out:

- subtidal macrofaunal sampling (December 2004);
- epifaunal trawl survey (October 2004); and
- characterisation of *Sabellaria* species at specific sites where presence was highlighted by the macrofaunal and epifaunal surveys.

⁽¹⁾ Cefas, 2004. Offshore wind farms: Guidance note for Environmental Impact Assessment in respect of FEPA and CPA requirements. Version 2. Prepared by the Centre for Environment, Fisheries and Aquaculture Science (Cefas) on behalf of the Marine Consents Unit (MCEU).

Subtidal Macrofauna Survey

A comprehensive grab sampling survey was carried out in December 2004 with the prior approval of Natural England and Cefas. Stratified sampling was carried out with sampling stations being chosen based on a grid system, taking into consideration geophysical data and other hydrographic information. Guidance documents ⁽¹⁾ were used to determine the sampling strategy, which was then agreed with Cefas.

In total, macrofaunal sampling was carried out at 54 stations. Twenty samples were taken within the Humber Gateway site, 18 within the two alternative cable route corridors and surrounding areas and 12 within the tidal excursion (six to the north and six to the south of the development area). An additional four control stations were situated outside the area of influence, two to the east and two to the north of the Humber Gateway development area (*Figure 8.6*).

Three replicate samples were taken at 23 of these stations to allow statistical comparisons (i.e. an assessment of the degree of variability within the benthic communities, between and within sites). Replicate samples were taken from eight stations within the development area, seven stations along the cable route, all the control sites and at five stations within the area of the tidal excursion to the north and south. Single samples were taken at a further 31 stations to ensure representative sampling of different habitats.

A 0.1 m² Hamon Grab was used and the position, water depth, sea state, time and weather conditions were recorded at each site. Upon recovery, the samples were examined and photographed in order to determine the sample volume, the visual characteristics of the sediment, the presence of anoxia and the presence of epifauna. Particular attention was paid to the presence of *Sabellaria* species.

At three designated stations, an additional grab sample was collected for chemical analysis including: metals, Polycyclic Aromatic Hydrocarbon (PAH) compounds, Polychlorinated Biphenyls (PCBs), water soluble boron, selenium and oil and grease. Samples for chemical analysis were collected using a stainless steel Shipek Grab to ensure that no cross contamination of metals occurred. All samples were stored in amber glass jars and placed in cool boxes and analysis was carried out by a UKAS accredited laboratory.

The position of each site was recorded using GPS and the physical characteristics of the sediment were described and photographed. Complete specimens were counted individually, whilst incomplete specimens were identified as far as possible and recorded as being present. These organisms

⁽¹⁾ Boyd S E (compiler), 2002. Guidelines for the conduct of benthic studies at aggregate extraction sites. London: Department for Transport, Local Government and the Regions.

were not included in any quantitative analysis. Encrusting organisms and meiofauna were recorded as being present or absent, but did not form a quantitative dataset.

Beam Trawl Surveys

Trawl routes were identified following consultation with Cefas. A total of 29 trawl routes were chosen (including controls) to ensure spatial coverage of the Humber Gateway project area, the cable route and the predicted tidal excursion. The nearshore coastal margin of the Holderness Coast (Spurn lighthouse to the north of Hornsea at Witter) is a no-trawl area under North Eastern Sea Fisheries Committee (NESFC) bylaws and therefore special dispensation to use trawl gears within the site was requested and approved by NESFC and Defra. The locations of the beam trawl sites are shown in *Figure 8.7*.

Epifaunal sampling was carried out in October 2004, using a 2 m beam trawl with a 10 mm mesh and a 6 mm cod end liner. The trawl comprised two 60 x 550 x 500 mm detachable steel shoes with a 2,120 mm steel tube brace and was towed at a speed of 1.5 to 2 knots. Following sampling, the trawl was brought to the surface and the sample recovered by opening the cod end over a stainless steel hopper. The net was examined and any remaining epifauna or fish were added to the sample before re-deployment at the next station. The start and end position of each trawl was recorded using GPS. The invertebrates were identified to species level (where possible), enumerated and returned to the sea. Examples of each species were retained for a reference collection.

Additional epifaunal data were derived from the 11 sites trawled during the 4 m trawl survey that was undertaken in March 2005 to assess fish populations. This survey is described in *Section 8.5.2*. Whilst this type of survey is not optimal for assessing epifaunal assemblages, where epifaunal organisms were encountered they were identified and measured for length, weight and sex where possible to supplement data from the dedicated epifaunal trawls.

Figure 8.6 Subtidal Benthic Sampling Stations Indicating Degree of Replication

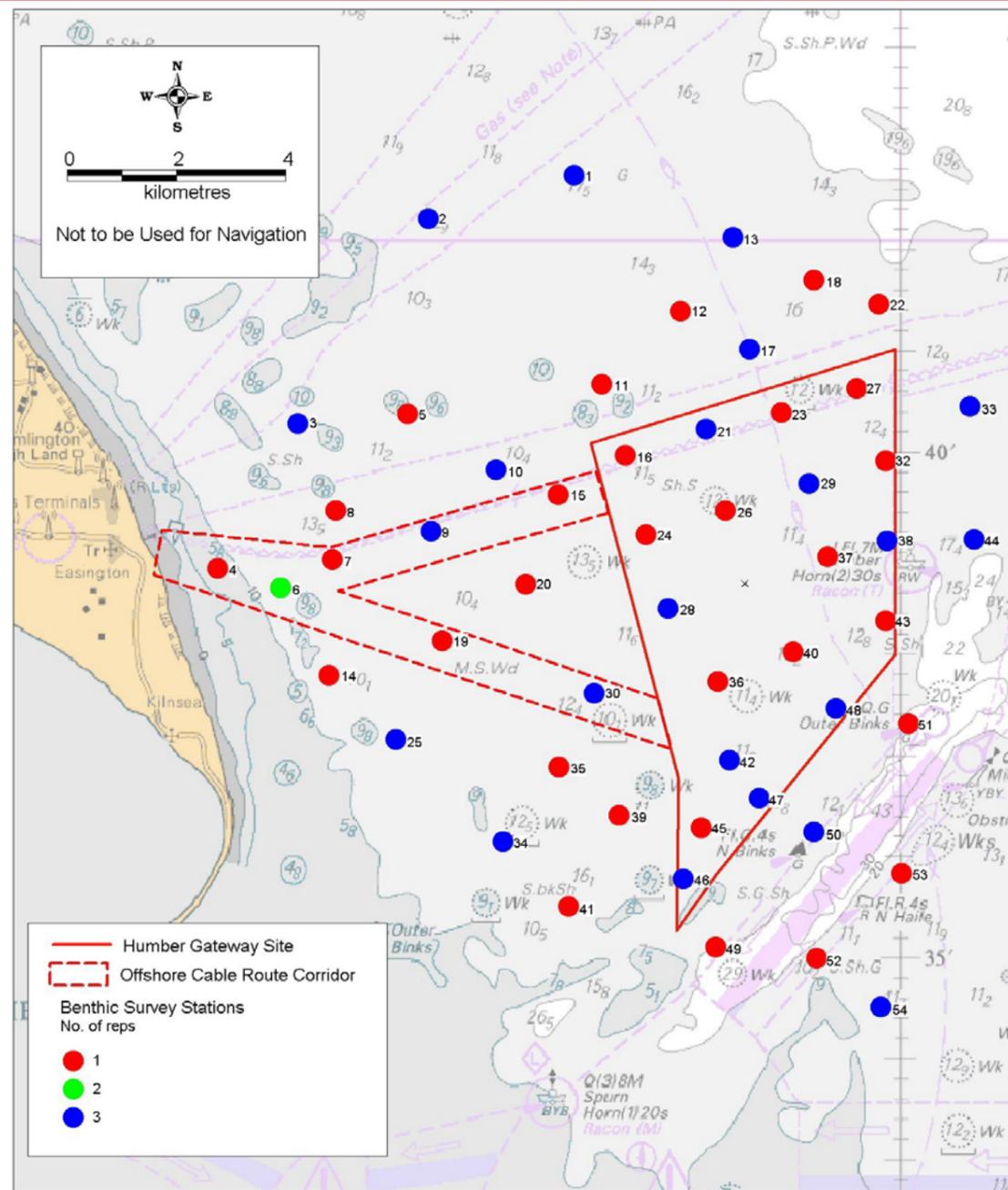
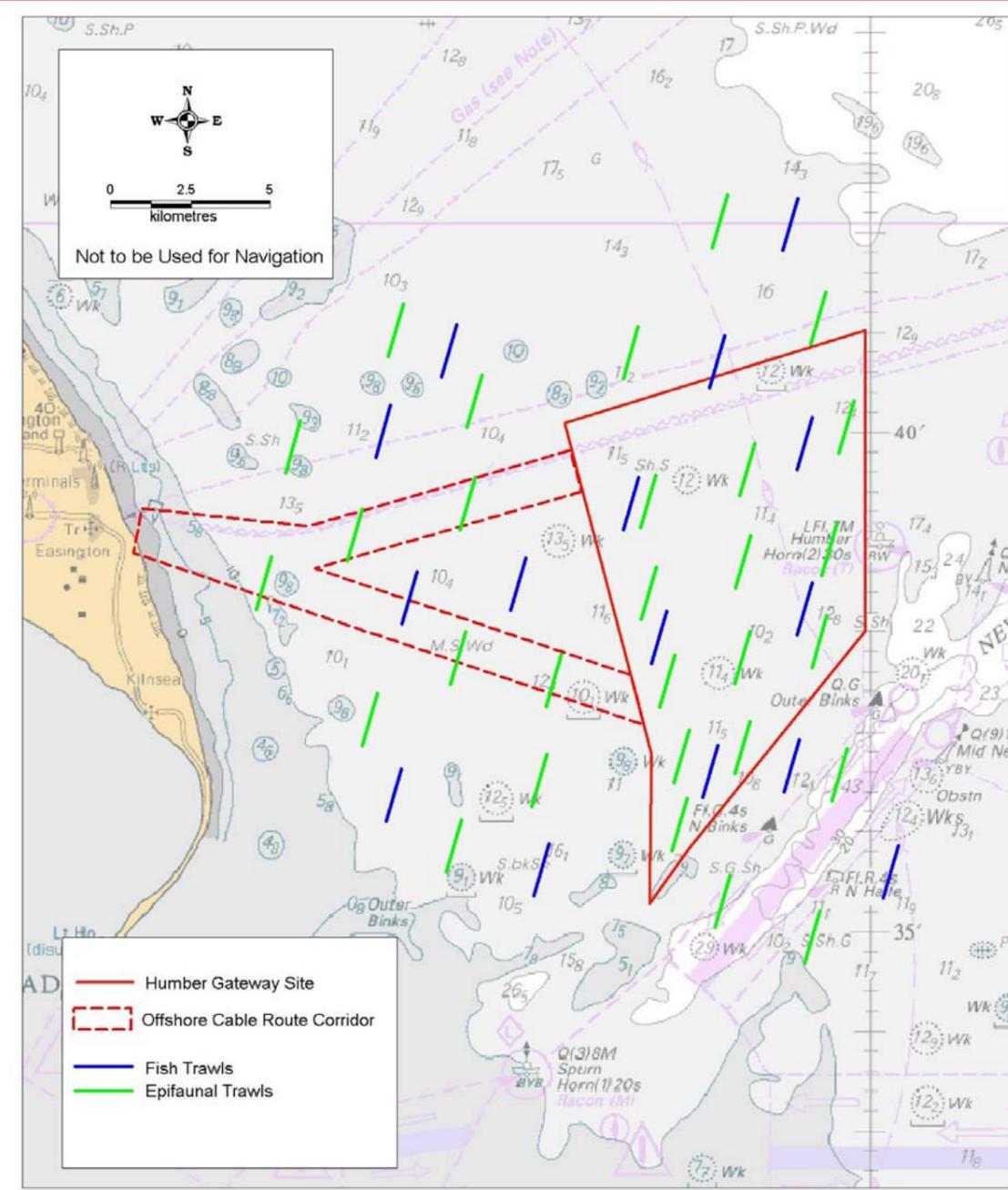


Figure 8.7 Beam Trawl Sites in the Vicinity of the Humber Gateway Site and the Cable Corridors



Sabellaria Survey

Initial benthic and epifaunal surveys identified the presence of *Sabellaria spinulosa* and *Sabellaria alveolata* in vicinity of the Humber Gateway site and cable route options. These species have potential nature conservation importance in respect of their reef forming capabilities so further survey work was deemed necessary to assess the nature and extent of the *Sabellaria* populations. This section describes the survey design and the results of the survey are presented in *Section 8.4.4*.

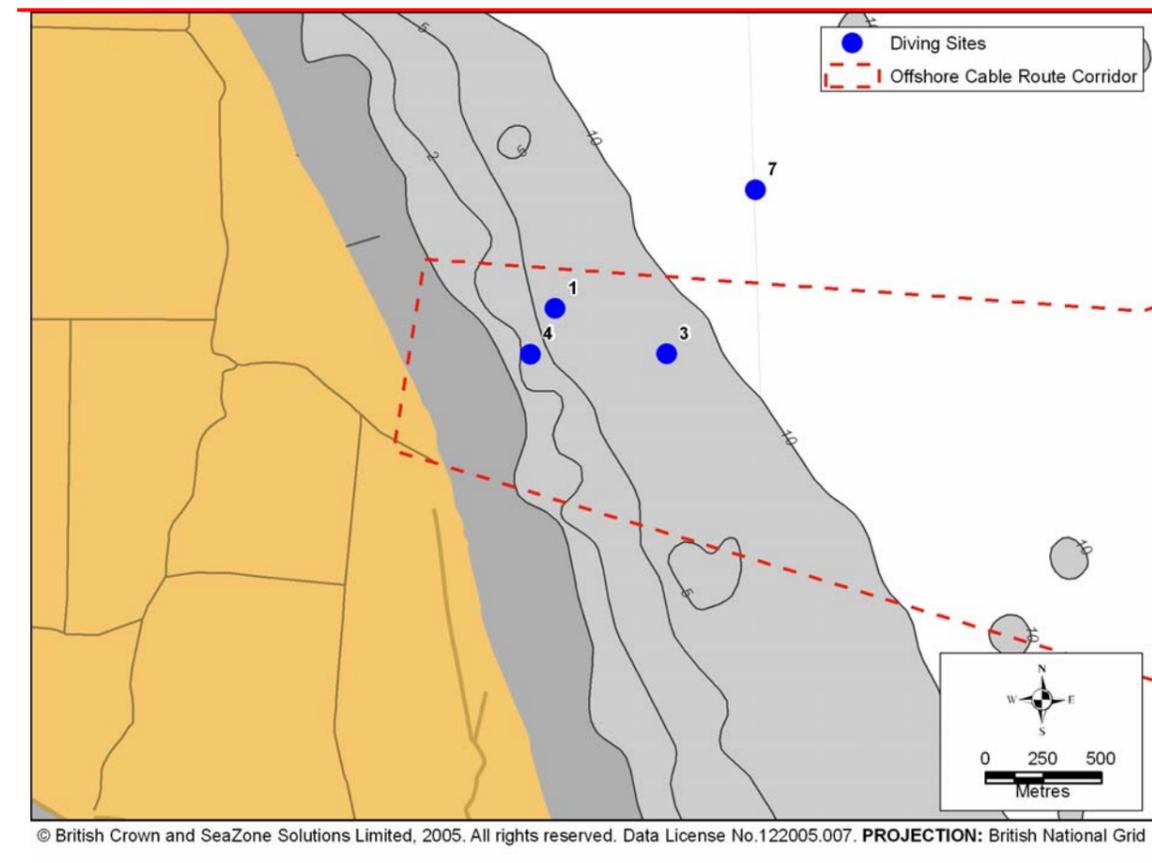
This survey used a drop down video at selected sites to enable an assessment of the status of the species. This enabled an assessment of *Sabellaria* spp. within and adjacent to the Humber Gateway site. The video camera was kept as close to the seabed as possible to allow for a clear representation of the bed and faunal type to be recorded. A maximum period of 5 minutes was allowed for each video-recording, dependant on the strength of tidal currents / water clarity and subsequent movement of the vessel before the video camera was retrieved. This procedure was repeated 100 to 200 m east and west from each sampling station. Surveys were carried out on the 9 to 10 August, 13 to 14 September and 5 October 2005. A combination of neap tides and calm weather gave the best chance of good water clarity during this time.

In addition to the drop-down video, a 200 kHz RoxAnn Groundmaster single beam AGDS (Acoustic Ground Discrimination System) was deployed whilst running the transects. This provided supplementary information on seabed sedimentary characteristics and the depth profile at the areas where *Sabellaria* spp had been recorded.

Diver Survey

A diver survey was conducted during December 2006 in order to determine the physical characteristics of the sea bed at certain locations along the cable route. The dive locations are shown in *Figure 8.8*.

Figure 8.8 Locations of Diver Survey Points



8.4.3 DESCRIPTION OF BIOTOPES

Sediment Types

The coastal and subtidal environments from Flamborough Head to the Humber Estuary are predominantly sedimentary in nature. The geophysical survey found the sediments to be poorly sorted and highly variable across the Humber Gateway site and surrounding area. The sedimentary composition consists of pebbles (4 to 64 mm diameter), cobbles (65 to 256 mm diameter) and boulders (257 to 2,048 mm diameter)⁽¹⁾ overlying coarse sands and gravels with no extensive homogenous areas. Offshore gravel associations of this type are common and widespread around the UK, commonly supporting communities of characteristically high variability and patchiness. The epifaunal community is

⁽¹⁾ As defined by Wentworth, 1922.

often a better descriptor of community type and diversity than the infauna, particularly as such habitats are difficult to sample quantitatively. The location of the various existing biotopes may show temporal variation due to the dynamic nature of the area. The broader biotope and habitat complexes that exist may, however, be relatively consistent.

The sediment mapping data (*Figure 7.20*) (combined with results of the ecological multivariate analysis) allowed an approximate classification of habitat types to be carried out. This was based on the *2004 Joint Nature Conservation Committee (JNCC) Marine Habitat Classification*⁽¹⁾. There are difficulties in marrying biotopes defined from infaunal data to those which are more readily identified from video, especially where an epifaunal biotope overlies the infaunal biotope sampled by grab.

The habitats identified at the benthic sampling stations have been extrapolated across the wider area in order to provide a preliminary description of the various coarse and fine-grained biotopes. The biotopes have been mapped in relation to the development site (*Figure 8.9*) and can be described as follows:

- SS.SBR.PoR.SspiMx (*Sabellaria spinulosa* on stable circalittoral mixed sediment);
- SS.SBR.PoR.SalvMx (*Sabellaria alveolata* on variable salinity sublittoral mixed sediment);
- SS.SCS.CCS (Circalittoral coarse sediment);
- SS.SCS.CCS.MedLumVen: *Mediomastus fragilis*, *Lumbrineris* spp. and venerid bivalves in circalittoral coarse sand or gravel;
- SS.SCS.CCS.Pkef (*Protodorvillea kefersteini* and other polychaetes in impoverished circalittoral mixed gravelly sand);
- SS.SMx.CMx.FluHyd: *Flustra foliacea* and *Hydrallmania falcate* on tide-swept circalittoral mixed sediment;
- SS.SCS.CCS.PomB: *Pomatoceros triqueter* with barnacles and byozoan crusts on unstable circalittoral cobbles and pebbles; and

- CR.HCR.XFA.SpNemAdia: Sparse sponges, *Nemertesia* spp. and *Alcyonidium diaphanum* on circalittoral mixed substrata.

Two of these biotopes may be classified as cobble habitats with the potential to form cobble reefs, namely CR.HCR.XFA.SpNemAdia and SS.SMx.CMx.FluHyd. Cobble habitats are discussed in *Section 8.4.4*.

Clay Huts

The dive survey revealed emergent boulder clay formations at approximately 1 km offshore along the export cable corridor route, specifically located at sites 3, 4 and 7. The formations are clay mounds that rise 1 to 2 m high out of a flat sand and clay bed with round stones or cobbles set in. Sedimentary samples were collected, analysed and classified, showing them to consist predominantly of clays with some sand, pink granite and chalk.

The emergence of such sublittoral boulder clay is known to occur along much of the Holderness Coast, as it is a remnant of the underlying Quaternary geology of the region. The clay structures are an essential habitat for juvenile and adult lobsters that burrow up to 1.5 m deep, providing shelter and protection from predators. These burrows may shelter juvenile lobsters and are referred to as 'clay huts' by local fishermen. The common smooth hound *Mustelus mustelus* and starry smooth hound *Mustelus asterias*, are known to hunt in the area during the early summer due to the aggregation of crustacea.

⁽¹⁾ Connor D W, Allen J H, Golding N, Howell K I, Lieberknecht L M, Northern K and Beker J B, 2004. The Marine Habitat Classification for Britain and Ireland Version 04.05 JNCC, Peterborough. ISBN 1 861 07561 8.

8.4.4 DESCRIPTION OF BENTHIC COMMUNITIES

Subtidal Benthic Infauna

A total of 357 species representing 22 phyla or classes of marine invertebrates were recorded during the Humber Gateway benthic macrofauna survey. The distribution and abundance of these species was highly variable reflecting the diverse nature of the sediment characteristics across the survey area. A total of 44 species represented 80% of the community. Dominant species included *Pisidia longicornis*, *Sabellaria alveolata*, *Salmacina dysteri*, Nematodes, *Mediomastus fragilis*, *S. spinulosa*, *Galathea intermedia*, *Leptocheirus hirsutimanus*, *Hiatella arctica*, *Achelia echinata* and *Spio armata*.

Collectively, these eleven species comprised 50% of the community. The most abundant species was *Pisidia longicornis* which was present in 42 samples and the dominant species in 17 samples, representing between 13.5% and 45% of the community. Abundances of this species ranged from 20 per 0.1 m² at site 1, to 285 per 0.1 m² at site 40 (mean of 30).

Analysis of survey data shows that the dominant class of subtidal benthic invertebrates across the survey area were polychaetes, with 166 species being recorded. *Sabellaria spinulosa* was the tenth most abundant species recorded within 3 km of the coastline during the 2004 survey. The next major group were crustaceans with 89 species from 10 major orders within the crustacean phyla. The dominant orders were; amphipoda (49 species), decapoda (19 species) and isopoda (10 species). Molluscs were also well represented, with 67 species being recorded in total, the dominant classes being bivalvia (or Pelecypoda) (40 species), gastropoda (19 species) and opisthobranchia (eight species).

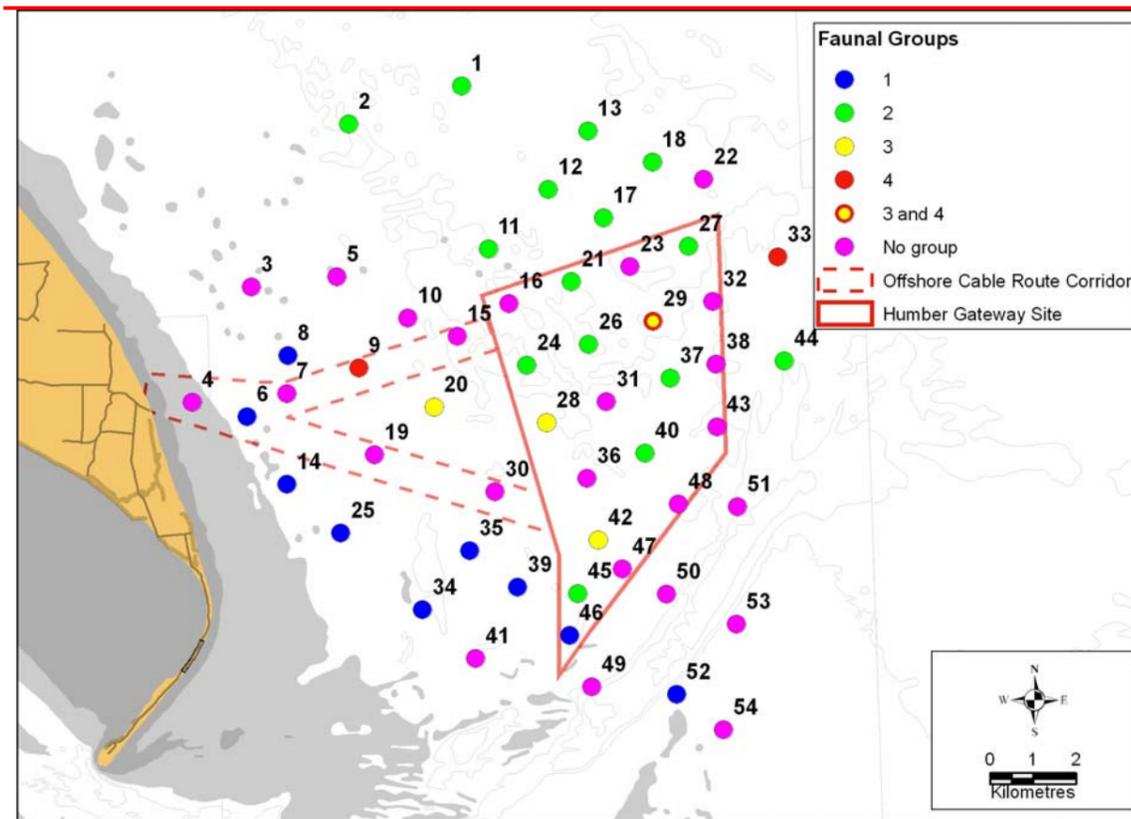
Photographs of the seabed showing examples of starfish and crab species are shown in *Figure 8.10*.

Figure 8.10 Examples of Benthic Species from Video Footage



Source: JH Allen, IECS.

Figure 8.12 Groups of Samples with 40% Community Similarity



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PROJECTION: British National Grid

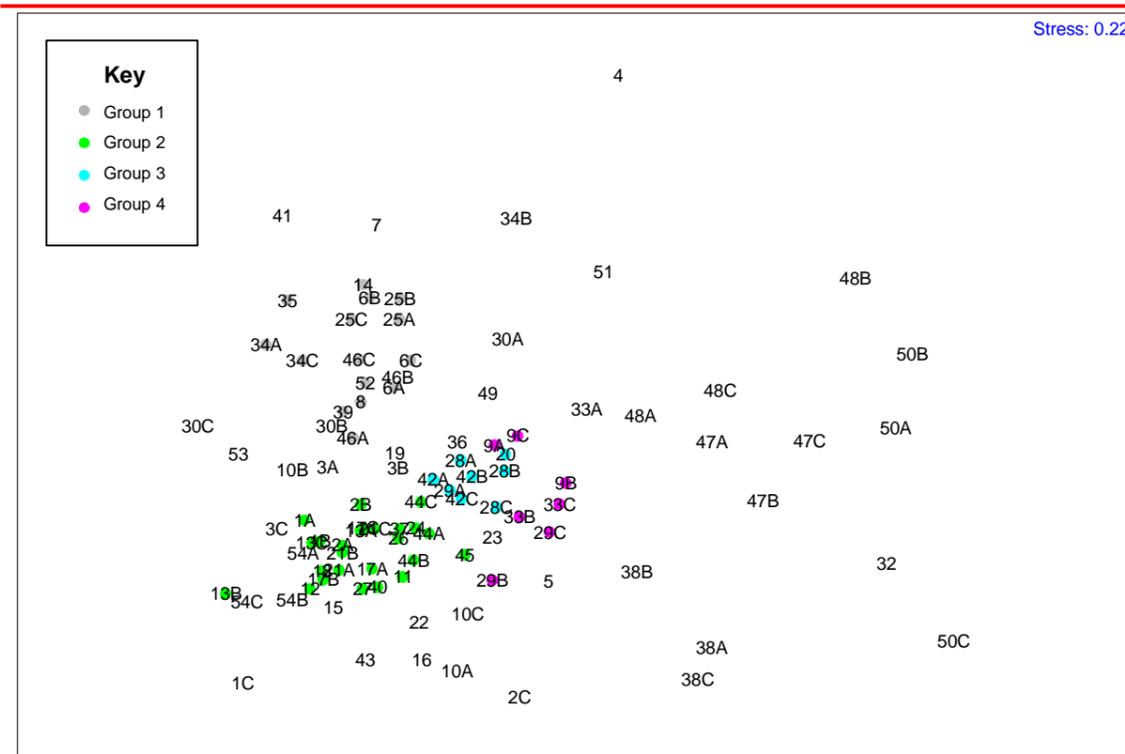
The SIMPER routine was applied to square root-transformed data to identify those species that provided the greatest contribution to each of these faunal groups. Table 8.2 lists the five species with the largest contribution to defining the five groups identified from Cluster analysis. Overall, the SIMPER analysis showed that the species with the greatest contributions to group identity were *Sabellaria alveolata* (which differentiated the Group 1 community from the other groups), *Pisidea longicornis* (which differentiated the Group 2 community from the other groups) and *Leptocheirus hirsutimanus* (which differentiated Group 3 from Group 4).

Table 8.2 Key Species Contributing to Identity of Faunal Groups

Key Species Contributing to Group Similarity	Group 1	Group 2	Group 3	Group 4
Species 1	<i>Sabellaria alveolata</i>	<i>Piscidia longicornis</i>	<i>Nematoda</i> spp. Indet	<i>Chone filicaudata</i>
Species 2	<i>Sabellaria spinulosa</i>	<i>Galathea intermedia</i>	<i>Leptocheirus hirsutimanus</i>	<i>Pisidea longicornis</i>
Species 3	<i>Pisidea longicornis</i>	<i>Mediomastus fragilis</i>	<i>Pomatoceros lamarcki</i>	<i>Spio armata</i>
Species 4	<i>Pomatoceros lamarcki</i>	<i>Nematoda</i> spp. indet	<i>Protodorvillea kefersteinia</i>	<i>Amphipholis squamata</i>
Species 5	<i>Lepidonotus squamatus</i>	Juvenile <i>Harmothoe</i> sp. Indet	<i>Mediomastus fragilis</i>	<i>Pomatoceros lamarcki</i>

Multidimensional Scaling (MDS) ordination analysis is another standard multivariate technique used to identify groups of samples with high similarities. The technique plots each sample as a point and the distance between one sample and another represents the degree of similarity between those two samples. MDS plots have no axes, coordinates or scales. If a sample is similar to other samples, the points on the MDS plot will group together closely. Samples that are very different from the other samples (for example if they have only a small number of species in common) they will appear as outliers on the MDS plot.

In a survey where more than one distinct habitat type is sampled, the MDS plot will show two or more distinct groups of samples that can then be considered to be representative of different communities. This was not the case for data gathered during the benthic survey on the Humber Gateway site (i.e. there are no distinct groups). Figure 8.13 shows an MDS plot for the data set, which illustrates this.

Figure 8.13 MDS Ordination Plot for Replicate Grab Data

MDS ordination analysis, using all replicate data, did not show any distinct groups of sites but did generally indicate a greater degree of similarity between replicate grab samples. There are a number of sample sites that are aggregated together representing ecological similarity. Some sites, however, fall as outliers to the majority of the MDS points. Sites 4 and 7, for example, are shown as being distinct from the majority of the sites. As these sites were located in the inshore area and are characterised by species representative of inshore environments such as *Eteone longa* and *E. flava*, it is expected that they should fall as outliers. The outlier sites 47, 48, and 50 are located at the southerly end of the Humber Gateway site where sand patches were identified by the geophysical survey. The different substrate accounts for differences between these samples and the samples taken within the Humber Gateway site itself.

The stress value gives an indication of how well the MDS plot represents the similarities between samples. In this case, the stress value is relatively high (0.22) which indicates that confidence in the detail of any apparent groupings on

the MDS plot is low. Clarke and Warwick (1994)⁽¹⁾ recommend that in such cases conclusions should be cross checked against those from an alternative technique, such as cluster analysis. The four groups of statistically similar stations identified from cluster analysis (*Figure 8.11*) have therefore been superimposed on the MDS plot. From *Figure 8.13*, it is clear that samples within a cluster group do generally aggregate together on the MDS plot, while those samples that belong to none of the groups tend to lie as outliers.

A secondary technique was applied to the data to investigate whether distinct communities exist in different parts of the survey area. Each sample at the Humber Gateway site was assigned a 'factor' according to its location relative to the turbine area as follows:

- sites to the north of the Humber Gateway site;
- inshore sites (including the cable route area);
- sites within the Humber Gateway site; and
- sites further offshore than the Humber Gateway site.

The MDS analysis showed that the offshore areas all had a significant overlap in terms of their ecological composition. The inshore area showed a slightly different ecological composition, an expected result given the natural differences in habitat that exist between inshore and offshore subtidal environments.

In summary, the multivariate analyses demonstrated that the faunal communities across the survey area are highly variable, even at nearby stations. There is also continuity of this variability across the majority of the site. The only clear evidence of distinctly different communities was found at the southerly inshore stations where *Sabellaria* spp. were found, and on the sand patches and ribbons of the southerly offshore end of the Humber Gateway Site. The distribution of *Sabellaria* spp. is discussed in more detail in *Section 8.4.4*.

Subtidal Epibenthos

A 2 m beam trawl survey was undertaken and a total of 75 qualitative epifaunal species and 28 quantitative species were recorded from 27 beam trawls⁽²⁾⁽³⁾. The quantitative epifaunal component was dominated by five major taxonomic groups; Bryozoa, Crustacea, Hydrozoa, Polychaeta and Mollusca. Bryozoans

⁽¹⁾ Clarke K R & Warwick R M, 1994. Change in Marine Communities: An approach to statistical analysis and interpretation. Natural Environment Research Council.

⁽²⁾ Quantitative epifauna are individual animals that can be counted, whereas qualitative epifauna comprises colonial animals that cannot be enumerated.

⁽³⁾ Institute of Estuarine and Coastal Studies, 2005. Humber Gateway: Baseline Study of the Marine Ecology.

also accounted for 60% of the occurrence of qualitative taxa. The predominance of sessile species (hydrozoan, bryozoan and tunicate) reflects the coarse nature of the substrate.

The data indicate that the area as a whole has a similar community type, and that the Humber Gateway site is comparable, in terms of species diversity, to its adjacent waters. Opportunistic species predominate in the benthic infaunal community, whereas the mobile epifaunal community is dominated by species of an opportunistic, scavenging and predatory nature.

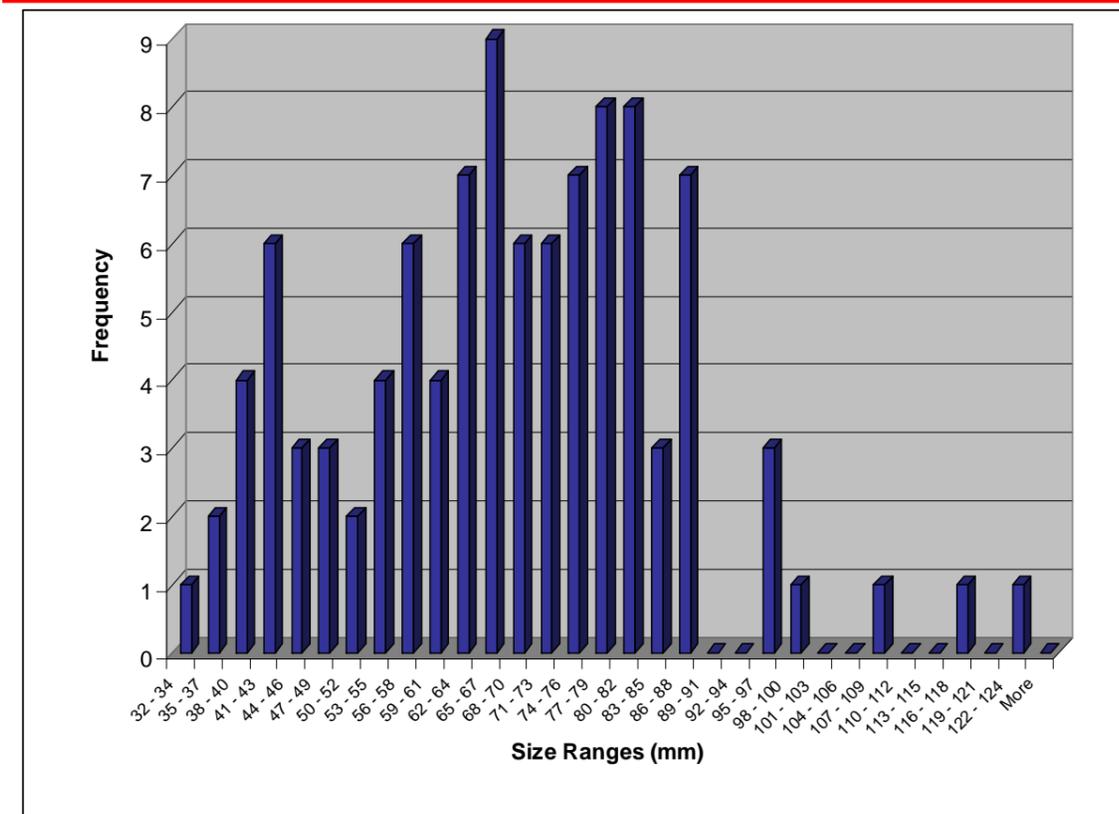
The quantitative epifaunal community was dominated by three major groups (*Crustacea*, *Echinodermata* and *Mollusca*). Within these groups, a few species dominated the assemblage. The crustacean assemblage was dominated by the pink shrimp *Pandalus montagui*, the livid swimming crab *Liocarcinus holsatus* and the velvet swimming crab *Necora puber*, which together accounted for 78% of the total abundance.

Additional epifaunal data were derived from the 11 sites trawled during the March 2005 fish trawl survey (discussed in *Section 8.5.2* and *Appendix C1*). This type of survey is not optimal for assessing epifaunal assemblages, but does provide additional information to complement the dedicated epifaunal survey data. The livid swimming crab *Liocarcinus* spp., the velvet crab *Necora puber* and the lobster *Homarus gammarus* were the most commonly recorded epifaunal species during this survey. The pink shrimp *Pandalus montagui* and the echinoderm *Echinus esculentus* were also relatively common, whilst other species of decapods (*Cancer pagurus*, *Macropodia linearesi* and *Carcinus maenas*, the latter being predominantly a nearshore species and not therefore expected on the wind farm site itself) and echinoderms (*Crossaster papposus*, *Asterias rubens* and *Henricia sanguinolenta*) were present in low numbers.

There appeared to be no clear spatial pattern in terms of species richness or overall abundance of quantitatively recorded taxa. Less than 20 individuals were recorded in the quantitative dataset at the majority of sites. However the low abundances are as a direct result of the gear type and its efficiency in capturing and retaining species such as these, rather than a probable low density at community level.

The length frequency data for lobster (measured as carapace length) indicate that all size classes, up to the minimum landing size (87 mm), are relatively abundant within the survey area (*Figure 8.14*). There is a comparatively even spread within each size class up to the minimum landing size. However, there is a significant decline once the minimum landing size is attained. These findings are considered typical for the region which supports a significant commercial crustacean fishery.

Figure 8.14 Length Frequency Analysis for Lobster (*Homarus gammarus*)



Commercially important crustacean species are abundant in the northern sector of the Humber Gateway site (as discussed further in *Section 9.5*) and are likely to spawn in the area surrounding the Humber Gateway site. Brown crabs *Cancer pagurus* are widespread on mixed substrates of sand gravel and rock around the coasts of England and Scotland. Spawning takes place between November and December and the Humber Gateway site lies within the region of spawning activity. Larvae live in the plankton for approximately one month before settling to the seabed and assuming adult form ⁽¹⁾.

Lobsters *Homarus gammarus* and crabs such as the brown crab *Cancer pagurus* and velvet crab *Necora puber* demonstrate migratory behaviours. However, the migratory patterns of male and female crabs and lobsters vary in line with the different life cycles of the two sexes. In addition, lobsters tend to be more

⁽¹⁾ Cefas, 2001: Technical Report for Strategic Environmental Assessment – SEA2: North Sea Fish and Fisheries. Technical Report TR_003.

territorial with less well understood migration patterns. Male brown crabs, for example, tend to remain inshore in winter whilst females migrate to offshore spawning grounds, following mating in the summer. Both sexes of crab are therefore most abundant in the nearshore during May to July. The most sensitive period for crabs therefore is the autumn to winter period, as egg-bearing females are migrating.

Lobsters begin to appear along the nearshore coastal margins off the Holderness coast during June and July, however, by late August and September, this nearshore distribution is significantly reduced as the adult and sub adult components migrate away from these margins into deeper water, within the wider inshore area. The coastal margins surrounding the Humber Gateway site are used by juvenile crustacea, particularly lobsters that use the 'clay huts' (Section 8.4.3) for shelter, and also by juvenile brown and velvet crabs. On maturity these crustacea will become available to the commercial crustacean fishery (Section 9.5).

The qualitative epifaunal assemblage is broadly characteristic of this stretch of coastline, although a wider variety of habitats are present further north along the Holderness coast. Seasonal changes in diversity and dominance can also be expected to occur within the Humber Gateway site itself. The elevated suspended sediments present during the winter months may, for example, reduce the growth rate of sessile organisms. In some instances, the feeding and reproductive polyps of hydroids may die off, leaving bare stolons⁽¹⁾. As the levels of suspended sediment decrease during settled weather patterns (spring / summer), polyps begin to regenerate allowing the colony to grow back to the expected levels for the species and season. It is clear from trawl data that the greater epibenthic diversity and abundance is found further offshore, with the community becoming relatively impoverished further inshore. This is presumably due to the effect of the Humber Estuary plume and the more dynamic environment in this inshore region.

Cobble Reefs

Cobble reef habitats are increasingly being included as habitats of conservation importance. They will be a key component of forthcoming offshore SAC designations and will receive consideration in the context of the advancement of candidate offshore SACs. There is currently no precise definition of what constitutes a cobble reef, and existing data is under review by JNCC and Natural England in order to clarify definitions. The *Habitats Directive* is used for guidance, but it does not specifically define the exact characteristics of cobble reefs. The *Habitats Directive* specifies reefs as being structures which arise from

⁽¹⁾ The stolon is the 'shoot' or 'runner' of the hydrozoan, from which new polyps form.

the seafloor. In terms of cobble reef, this may be difficult to assess in many cases so it is likely that this will be interpreted as areas that are topographically distinct (i.e. areas of cobble forming a distinct habitat compared to other areas of adjacent seabed).

Reef stability can be related to substrate stability, with more developed biogenic formations occurring on the harder less mobile substrates. Areas that consist of significant numbers of cobbles (particle size 64 to 256 mm as defined by the Wentworth scale) and larger rocks are therefore more likely to allow the development of extensive *Sabellaria* concretions than finer gravels and sands. In this case, cobble habitats that support biogenic reef forming species can be considered to have the potential for developing reef-like habitat qualities.

JNCC is currently conducting a programme entitled "*Best methods for identifying and evaluating biogenic and cobbly reef*". This programme intends to assist offshore industries and advisory bodies in the selection of appropriate tools to assess this habitat.

The benthic and towed video survey results (Appendix C1) revealed a substrate comprising of mixed sands and gravels (Figure 7.20), with cobbles present at 49 of the 54 grab sample sites, including all sample sites within the Humber Gateway site and along the cable route corridors. Cobbles were present at all of the sites at which *Sabellaria* spp. were identified and the video survey highlighted the mixed nature of the seabed (cobbles, pebbles and boulders on sand and gravel). The sites that did not contain any cobble were in the sandy areas at the mouth of the Humber Estuary and the locations of the buried pipelines to the north of the Humber Gateway site. It is recognised that the result of the particle size analysis are likely to underestimate the proportion of cobble habitat in the area. This is due to video footage that indicated that the majority of the survey area contains a relatively high proportion of cobbles.

Overall, the survey area appears to comprise a mosaic of coarse or mixed sediment biotopes, with a moderately high pebble/cobble content that provides a suitable habitat for a varied epibiota. Habitats on the inshore side of the Humber Gateway site are heterogeneous with a slightly higher silt content compared to offshore areas, forming a mosaic of encrusting *Sabellaria* biotopes.

Given the nature of the surveys carried out to date, and the fact that the definitions and characteristics of cobble reefs are still under development (as discussed above), it is difficult to definitively assess the status of cobble reefs in the area. Whilst somewhat variable, the majority of the Humber Gateway site and surrounding area includes sections of cobble habitat, within which there may exist biotopes that could be considered under the cobble reef definition.

Whilst cobble habitats cover much of the area (some of which could be examples of silt influenced cobble reef), the specialist studies undertaken have indicated that, on the basis of existing data and guidance on the topic, the majority of cobble habitats identified would probably not qualify as Annex 1 reef habitats (Appendix C3). Areas of cobble habitat are understood to be relatively widespread in this area but those within the Humber Gateway site are relatively impoverished compared to the widespread and well developed cobble habitats further north along the Holderness Coast⁽¹⁾. Furthermore, the habitat substrate is not topographically distinct from the surrounding area, a characteristic that is required for an area to be classified as reef.

Sabellaria

Overview

Biogenic reef habitats are discussed in JNCC report 325⁽²⁾ and defined in the *Interpretation Manual of European Habitats (EC, 1999)* under Annex 1 of the *Habitats Directive* as:

“Submarine or exposed at low tide, rocky substrates and biogenic concretions, which arise from the seafloor⁽³⁾ in the sublittoral zone but may extend into the littoral zone where there is an uninterrupted zonation of plant and animal communities. These reefs generally support a zonation of benthic communities of algae and animal species including concretions, encrustations and corallogenic concretions”.

Dense aggregations of *Sabellaria* spp. can form biogenic reef structures⁽⁴⁾. Two species of *Sabellaria* were identified during the ecological survey; *S. spinulosa* and *S. alveolata*. Both species are sedentary, tube dwelling polychaetes that colonise hard substrata such as cobbles, boulders and areas of mixed sediment composed of cobbles and sand. Extensive concretions of *Sabellaria* spp. can increase habitat heterogeneity by stabilising unconsolidated sediments such as sands, by providing a hard substratum for the attachment of sessile organisms. They also create crevices and overhangs available for colonisation by a number

⁽¹⁾ Allen J, in preparation. Habitat diversity in no trawl zones along the Yorkshire Coast. Report NESFC and Natural England.

⁽²⁾ Johnston C M, Turnbull C G & Tasker M L, 2002, Natura 2000 in UK Offshore Waters, JNCC Report 325, ISSN 0963 8091.

⁽³⁾ Where 'arise from the seafloor' is interpreted as the reef being topographically distinct.

⁽⁴⁾ Holt T J, Rees E I, Hawkins S J, and Seed R, 1998. Volume IX. Biogenic reefs: an overview of dynamic and sensitivity characteristics for conservation management of marine SACs. Scottish Association for Marine Science (UK Marine SACs Project).

of species that would otherwise be absent from the area. These crevices also accumulate organic debris that can serve as an important food source for scavenging species. Therefore, the presence of biogenic reef forming species such as *Sabellaria* spp. can lead to increased localised species diversity.

As *Sabellaria* spp. can represent key habitat structuring species, they have been included as a sub-feature of the specific “marine reefs” habitat defined in Annex 1 of the *Habitats Directive (92/43/EEC)*⁽⁵⁾. Intertidal concretions of both species of *Sabellaria* spp. may occur as sub-features of non-reef Annex I Habitats (e.g. “intertidal mudflats and sandflats” or “sandbanks which are slightly covered by seawater all the time”). Statutory protection in the UK for intertidal examples of *S. alveolata* may be achieved through designation of the site as a SSSI. The biogenic reef-like structures formed by the species *S. spinulosa* and *S. alveolata* are also classed as priority habitats under the UK Biodiversity Action Plan⁽⁶⁾.

Whilst *Sabellaria* spp. are generally solitary species, they can form solid raised reef-like structures on the seabed, up to several metres across and up to 60 cm in depth, when the tubes they inhabit become aggregated^{(7) (8)}.

The honeycomb worm *S. alveolata* is predominantly an intertidal species although it may extend into the shallow sublittoral. The UK represents the northern extremity of this species' range. It had previously been thought to be confined to the south and west coast of the UK (between Lyme Regis and the Solway) with few reliable records further east or north. The presence of this species along the Holderness coast is therefore of ecological interest, as it represents a change in our understanding of the distribution of the species in the UK. *S. alveolata* may form extensive reef structures up to one metre high in which the tubes of the worms form tightly packed concretions on cobble, pebble or bedrock with a characteristic honeycomb appearance.

The ross worm, *S. spinulosa* is documented as having a somewhat wider distribution than *S. alveolata*. It is primarily found in the shallow sublittoral zone and is commonly recorded along the eastern coastline of England. This species

⁽⁵⁾ Allen J H, Billings I, Cutts N and Elliot M, 2002. Mapping, condition and conservation assessment of Honeycomb worm *Sabellaria alveolata* reefs on the eastern Irish Sea coast. Institute of Estuarine and Coastal Studies, University of Hull. Report to English Nature. Report No. Z122-F-2002.

⁽⁶⁾ UK Biodiversity Group Tranche 2 Action Plans - Volume V: Maritime species and habitats (October 1999, Tranche 2, Vol V, p125).

⁽⁷⁾ English Nature, 1999. Habitat Action Plan: *Sabellaria spinulosa* reefs. <http://www.ukbap.org.uk/UKPlans.aspx?ID=38> [cited October 2007].

⁽⁸⁾ Northern Ireland Habitat Action Plan. *Sabellaria spinulosa* reefs. March 2005. <http://www.ehsni.gov.uk/pubs/publications/Sabellariaspinulosareefs.pdf> [cited October 2007].

tends not to form extensive reef formations but instead is either solitary or found in low-lying aggregations of tubes in mixed sediment or sometimes encrusting cobbles and pebbles. However, in some areas this species may form more extensive reef-like structures that cover large areas of seabed, such as that in the Wash.

Typical examples of intertidal and subtidal *sabellaria* reef from other locations are shown in *Figure 8.15*.

Sabellaria Communities Present

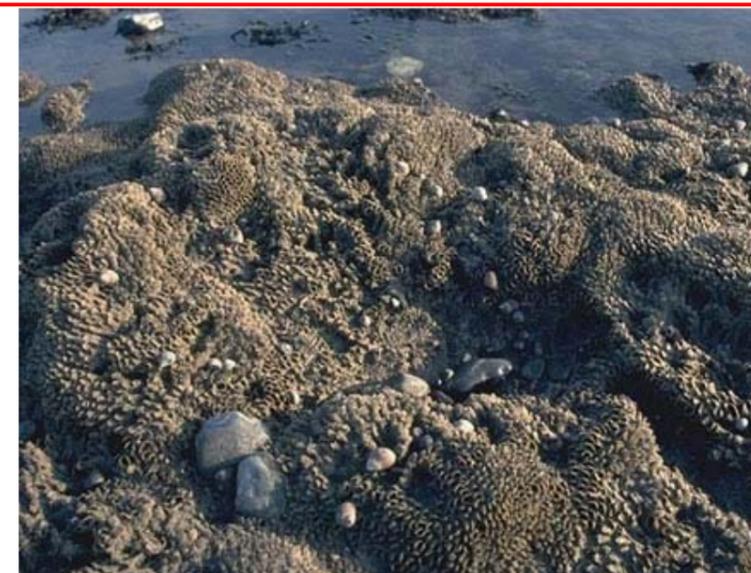
Sabellaria alveolata was abundant in the benthic macrofauna samples and represented 10% of the total abundance although the species was only recorded at 12 out of 54 sampling stations. *Figure 8.16* shows that in two areas, patches of relatively developed reef were encountered with abundances of between 200 and 300 individuals per 0.1 m². It is notable that the sampling stations at which *S. alveolata* was common were not inside the Humber Gateway site, but inshore, perhaps due to the tendency for this species to grow in intertidal and shallow subtidal areas.

In total, 37 stations of the benthic grab sample survey contained *S. spinulosa* in varying densities ranging between one to 32 individuals per 0.1 m² grab. Abundance of *S. spinulosa* was generally low (less than 15 per 0.1 m²) within the turbine area. There was no evidence from the surveys carried out to suggest that the species is present in any form other than the characteristic low lying, encrusting type; extensive reef features were not evident. Previous surveys carried out by IECS indicate that the low lying, encrusting type is the most common form of *S. spinulosa* along the Holderness Coast.

Given its conservation importance, it was considered necessary to map the distribution and density of the species and to determine the status of any reef structures found. The species abundance of *S. alveolata* and *S. spinulosa* recorded during the subtidal macrofauna survey are shown in *Figure 8.16* and *Figure 8.17*, respectively.

No quantitative data for *Sabellaria* spp. was obtained from the epibenthic and fish trawls (*Section 8.5*). However, at some sites occasional small pieces of structures that had been formed by *Sabellaria* spp. were found in the trawls. In total, of the 27 beams trawls and 17 otter trawls only four contained some evidence of *Sabellaria* spp., although not in any significant quantity.

Figure 8.15 Examples Taken from JNCC Literature of Intertidal *Sabellaria alveolata* and Subtidal *S. spinulosa* Reef



A



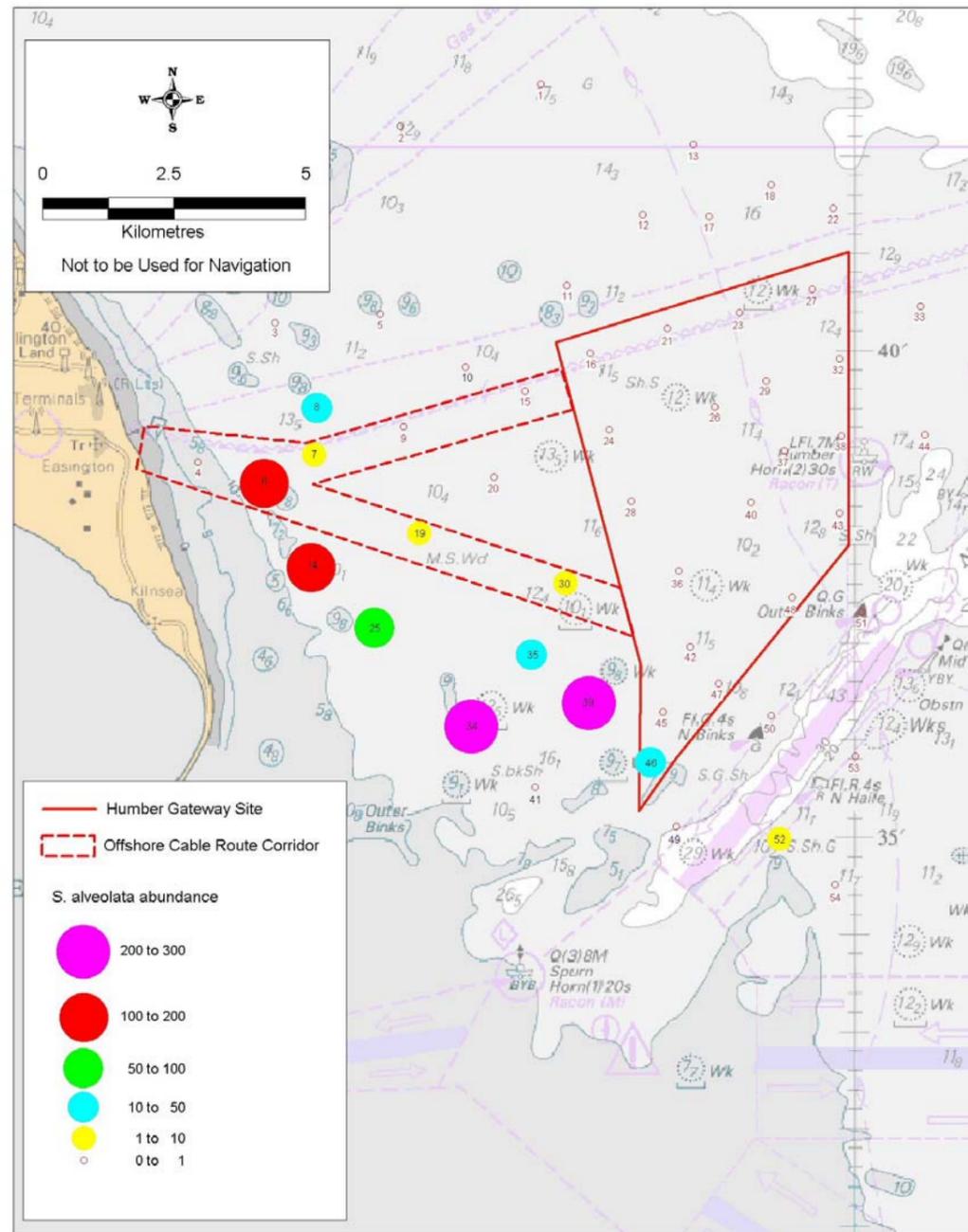
B

Source: A JNCC⁽¹⁾, B Sue Hiscock (c) JNCC⁽²⁾

⁽¹⁾ Conner D W, Allen J H, Golding N L, Howell K L, Lieberknecht L M, Northern K O & Reker J B, 2004. The Marine Habitat Classification for Britain and Ireland Version 04.05 JNCC, Peterborough. ISBN 1 861 07561 8 (internet version). http://www.jncc.gov.uk/marine/biotopes/biotope_image.aspx?biotope=JNCCMNCR00000204&cd=3548&image=IMG0008.JPG [cited November 2007].

⁽²⁾ <http://www.marlin.ac.uk/species/Sabellariaspinulosa.htm> [cited November 2007].

Figure 8.16 *Distribution of Sabellaria alveolata* (average abundance per 0.1 m²)



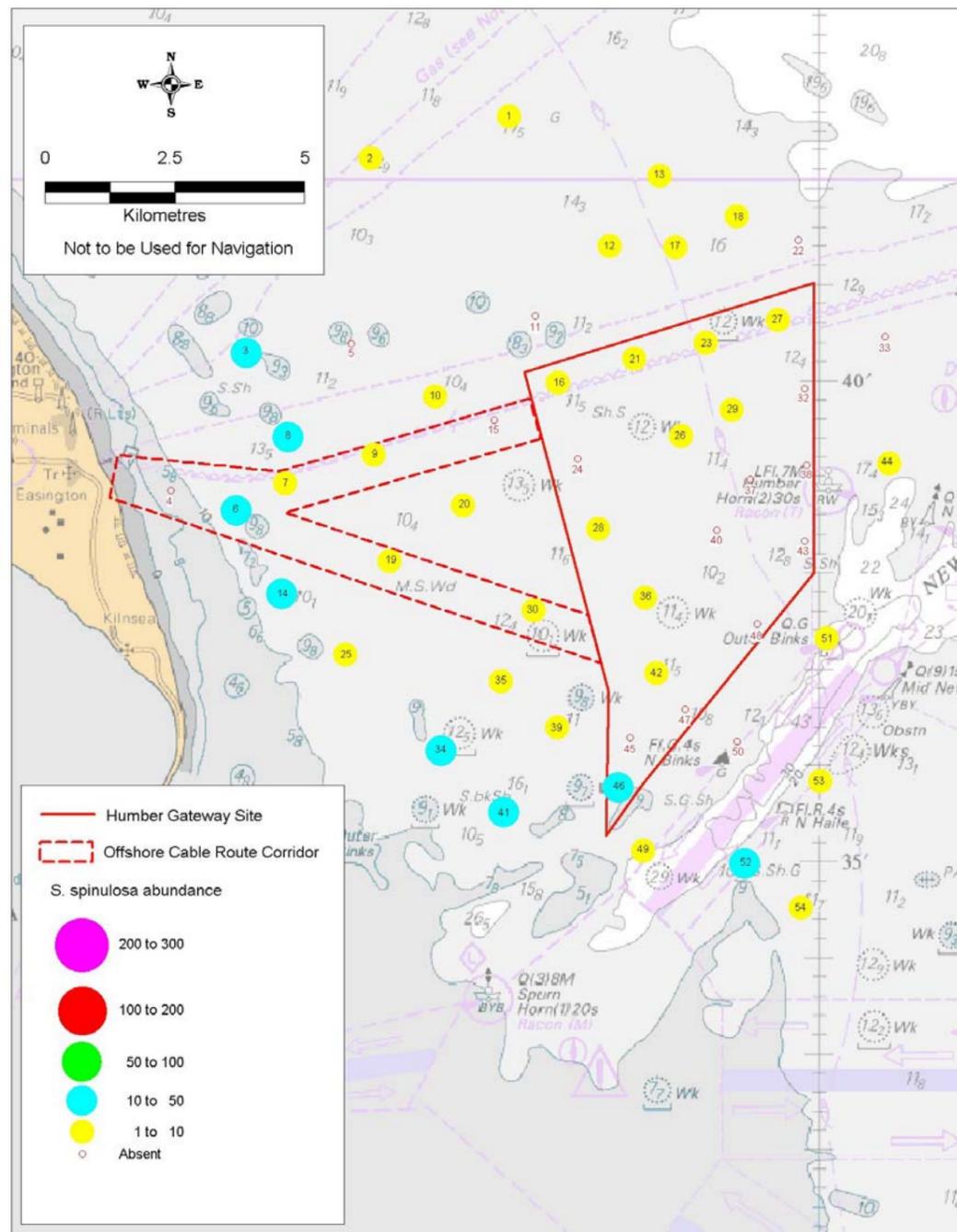
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As expected, the results derived from the Acoustic Ground Discrimination System (AGDS) and benthic studies indicate that *S. alveolata* is more prevalent in shallower inshore waters, whilst *S. spinulosa* extends further offshore into slightly deeper waters. The highest abundances of both species are inshore of the Humber Gateway site. In terms of seabed type, the results of the AGDS (and ground-truthed by video) indicate that much of the area is moderately rough / hard (i.e. primarily coarser sediments such as pebbles and cobbles) on sand and gravel, whilst the softer sediments (sand) are found closer to the shore. These results broadly correlate with the results of the side-scan survey. Values of E1 (seabed roughness) and E2 (seabed hardness) appear to increase somewhat offshore. There is some indication that *S. alveolata* is found in heterogenous habitats with a higher proportion of soft sediment (and in more turbid waters), whilst *S. spinulosa* is also found on slightly rougher ground offshore.

The results of the video survey confirmed the results of the geophysical and AGDS surveys. Given the low lying encrusting nature of the populations evident within the area, it was often difficult to identify any areas of reef. The highest abundances of *Sabellaria* spp. were recorded in the grab survey, outside of the wind farm site.

Of the areas in which *Sabellaria* spp. were identified, the colonies were generally low-lying, encrusting on or between cobbles, or attached to rocks and boulders in a mound or hummock formation. Distribution was patchy with a relatively low tube density and no evidence of large, extensive reef structures was found. Video footage revealed more extensive sheets of encrusting *Sabellaria* spp. in the area inshore of the Humber Gateway site, which occasionally formed patchy, slightly elevated hummocks.

Figure 8.17 Distribution of *Sabellaria spinulosa* (average abundance per 0.1 m²)



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Foster-Smith and White ⁽¹⁾ have suggested that areas where more than 500 *S. spinulosa* individuals per 0.1 m² are recorded (with extensive coverage and structures up to 30 cm above the bed), are of sufficient quality to constitute a reef. More recent studies suggest that numbers in excess of 375 per 0.1 m² would distinguish reefs that are sufficiently distinct from other biotopes and these abundances could be a useful indicator of reef quality. During the Humber Gateway survey, the highest number of *S. spinulosa* individuals recorded in a single sample was 32 (site 34).

A recent JNCC publication based on the findings of a workshop into the definitions of *Sabellaria spinulosa* reef defined such habitats (in the context of the *Habitats Directive*) as an area of *Sabellaria spinulosa* that is elevated from the seabed and has a large spatial extent. Colonies may be patchy within an area defined as reef and show a range in elevations. The suggested criteria for 'reefiness' in the context of *Sabellaria spinulosa* are shown in *Table 8.3* ⁽²⁾.

Table 8.3 JNCC Suggested Criteria for *Sabellaria spinulosa* Reefs

Measure of 'Reefiness'	Not a reef	Low	Medium	High
Elevation (cm) (average tube height)	<2	2-5	5 - 10	>10
Area (m ²)	<25	25 - 10,000	10,000 - 1,000,000	>1,000,000
Patchiness (% cover)	<10	10 - 20	20 - 30	>30

Given the abundances and structure of *Sabellaria* spp. shown from the grab and video surveys, it would appear that in many areas, and particularly within the Humber Gateway site, the populations are of moderate to low 'quality' in terms of abundance and life form. The results of the study indicate that the main areas where higher quality communities of *Sabellaria* spp. may be found tend to be inshore of the Humber Gateway site (mainly to the south of the cable route area). *Figure 8.18* shows examples of *Sabellaria* communities recorded during the drop down video survey.

⁽¹⁾ Foster-Smith R L, and White W H, 2001. *Sabellaria spinulosa* reef in the Wash and North Norfolk coast cSAC and its approaches: Part I, mapping techniques and ecological assessment. A report for the Eastern Sea Fisheries Joint Committee and English Nature.

⁽²⁾ Gubbay S, 2007. JNCC Report No. 405: Defining and Managing *Sabellaria spinulosa* reefs: Report of an inter-agency workshop 1-2 May, 2007.

Figure 8.18 Examples of *Sabellaria* from Drop Down Video Survey (Sites 25 and 52)



In summary, the results of the various surveys indicate that whilst *Sabellaria* spp. are relatively widespread throughout the area, their distribution is patchy. It is generally restricted to the low lying 'encrusting' form in most areas. Given the abundances of *Sabellaria* spp. shown from the grab surveys, it would appear that in many areas, and particularly in the wind farm site, the populations are of moderately low 'quality' in terms of abundance. However, some areas of larger, more developed *Sabellaria* spp. concretions were encountered outside the Humber Gateway site where abundances of between 200 and 300 individuals per 0.1 m² were recorded. Video footage from these areas revealed more extensive sheets of encrusting *Sabellaria* spp. which occasionally formed elevated hummocks.

8.5 FISH

8.5.1 INTRODUCTION

Overview

This section describes the baseline ecology of the fish resources in the vicinity of the Humber Gateway site and cable route areas. To gain a full understanding of the ecological and fisheries baseline in the study area, this section should be read in conjunction with *Section 8.4* and *Section 9.6*.

Consultation

Cefas and Natural England were consulted on the scope of the fish survey work and the MFA also had the opportunity to comment on the survey findings. Where appropriate, the comments have been taken into consideration in the following section.

Relevant Policies and Plans

Special measures were introduced by the EU in 2003 to conserve cod in the North Sea, and a long-term recovery plan was adopted in 2004. However, at present the EU Commission's targets for the recovery of cod have not been achieved. As a consequence, the cod recovery plan is under review, and the EU commission issued a proposal in late 2007 to conserve cod and reinforce the measures laid down in the original recovery plan ⁽¹⁾.

In 2007, the EU Commission also adopted a long-term management plan for North Sea plaice *Pleuronectes platessa* and Dover sole *Solea solea*, and European recovery plans were initiated for the common eel *Anguilla anguilla* and the Atlantic bluefin tuna *Thunnus thynnus*.

A summary of the conservation measures is given in *Table 8.3*. The species listed in Annex IIa are defined as species "of community interest whose conservation requires the designation of special areas of conservation". Annex Va species are defined as "species of community interest whose taking in the

⁽¹⁾ Commission of the European Communities (2007) COM/2007/759 Proposal for a Council Resolution fixing for 2008 the fishing opportunities and associated conditions for certain fishing stocks and groups of fish stocks, applicable in Community waters, and for Community vessels, in waters where catch limitations are required.

wild and exploitation may be subject to management measures". It should be noted that there are no areas designated for the protection of these species within the southern North Sea.

Twaite shad *Alosa fallax*, sea lamprey *Petromyzon marinus* and river lamprey *Lampetra fluviatilis* are also listed on Appendix III of the *Bern Convention* which defines species for which legislative and administrative measures must be taken to ensure the protection of wild populations. Any exploitation of species specified in Appendix III is regulated in order to keep the populations out of danger. Measures which may be taken include:

- closed seasons and / or other procedures regulating the exploitation;
- the temporary or local prohibition of exploitation, as appropriate, in order to restore satisfactory population levels; and
- the regulation as appropriate of sale, keeping for sale, transport for sale or offering for sale of live and dead wild animals.

There is a 'Grouped' Species Action Plan for commercial marine fish. This provides detailed information on the threats facing species and the opportunities for maintaining and enhancing populations. A 'Grouped' Species Action Plan was developed because a range of common policies and actions are required for a number of similar species. The Commercial Marine Fish Action Plan differs from others in that it is aimed at particular stocks, rather than all species. There is also a Species Action Plan for the common skate *Dipturus batis* and twaite shad, and sea lamprey is a Long List Species in the UK Biodiversity Action Plan.

Table 8.3 Conservation Measures in Place to Protect Southern North Sea Fish Species

Species	EC Habitats Directive (Annex number)	Wildlife and Countryside Act (Schedule 5)	IUCN Red Data List Species	Bern Convention (Appendix III)	Biodiversity Action Plan
Common skate <i>Dipturus batis</i>	-	-	Endangered (Provisional)	-	Common skate Species Action Plan
Twaite shad <i>Alosa fallax</i>	II and V	Yes	-	Yes	Twaite shad Species Action Plan
Atlantic salmon <i>Salmo salar</i>	II and V	-	-	-	-
Sea lamprey <i>Petromyzon marinus</i>	II and V	-	-	Yes	Long List Species
River lamprey <i>Lampetra fluviatilis</i>	II and V	-	-	Yes	-
Cod <i>Gadus morhua</i>	-	-	-	-	EU long term Cod Recovery Plan
Herring <i>Clupea harengus</i>	-	-	-	-	Commercial marine fish grouped Species Action Plan
Mackerel <i>Scomber scombrus</i>	-	-	-	-	Commercial marine fish grouped Species Action Plan
Plaice <i>Pleuronectes platessa</i>	-	-	-	-	EU North Sea Plaice and Dover sole management plan
Dover Sole <i>Solea solea</i>	-	-	-	-	EU North Sea Plaice and Dover sole management plan

Table notes:

Annex II EC Habitats Directive – This annex includes “Animal and plant species of community interest whose conservation requires the designation of special areas of conservation”.

Annex V EC Habitats Directive – This annex includes “Animal and plant species of community interest whose taking in the wild and exploitation may be subject to management measures”.

Bern Convention – Conveys special protection to those species which are vulnerable or endangered. In England the Bern Convention is implemented through the *Wildlife and Countryside Act 1981*.

Biodiversity Action Plan – This is the UK Government’s response to Article 6 of the *Convention on Biological Diversity (1994)*. The overall goal is to conserve and enhance biodiversity in the UK. A Species Action Plan provides detailed information on the threats facing species and the opportunities for maintaining and enhancing populations. A ‘Grouped’ Species Action Plan has been produced for Commercial Marine Fish as a range of common policies and actions are required for all species listed.

8.5.2 FISH SURVEYS

Survey Methods

Trawl surveys were undertaken in November 2004 and March 2005, to provide information on the distribution and ecology of fish and shellfish resources in the area ⁽¹⁾. The surveys were carried out in accordance with the latest industry guidelines ⁽²⁾, which recommend the identification and description of spawning, nursery and feeding grounds of important species, and in line with the best field sampling techniques and guidance ⁽²⁾⁽³⁾.

The survey area consisted of International Council for Exploration of the Sea (ICES) rectangles 35F0, 35F1, 36F0, 36F1, 37F0 and 37F1 that contain and lie adjacent to the Humber Gateway site and associated cable routes. Information from the entire North Sea was used to supplement data from baseline fish survey data to provide a comprehensive overview of the ecology of important fish species in the area.

Transitory fish communities can be influenced by natural changes in the localised and wider marine environment, including changes in the light and temperature regimes, elevated sediment concentrations and changes in the localised weather pattern. In order to account for such variation in the fish communities, fish surveys were carried out. The trawl locations are shown in *Figure 8.7*.

Due to the seabed being coarser than originally anticipated, the November 2004 survey did not produce sufficiently representative data and consequently the data has not been used in the quantitative evaluation of fish assemblages within the site. The trawl was upgraded for the March 2005 survey to account for the ground hardness following consultation with local fishing operators and Cefas fisheries scientists, and this provided a robust data set.

During the March 2005 survey, fifteen trawls were carried out to ensure coverage of the Humber Gateway site, cable route areas and predicted tidal excursion. Sites were chosen based on information regarding hydrodynamics and sediment characteristics. At each station, the otter trawl was towed for 30 minutes. The cod end was then opened over a stainless steel hopper to contain the whole catch, and the fish species were separated from the epifaunal invertebrates.

⁽¹⁾ Institute of Estuarine and Coastal Studies, 2006. Baseline Study of the marine Ecology at the Humber Gateway Offshore Wind Farm Development.

⁽²⁾ Cefas, Offshore Wind Farms, Guidance Note for Environmental Impact Assessment in Respect of FEPA and CPA Requirements, Version 2, 2004.

⁽³⁾ Cefas, Guidelines for the Conduct of Benthic Studies at Aggregate Extraction Sites, 2002. Dept. of Transport, Local Government and the Regions.

All fish and shellfish were identified to species level (where possible) with a sub-sample of common species being measured for length, weight and sex (when possible) to allow determination of year class strengths across the area. Any epifaunal and fish species not identified onboard were retained for laboratory identification, with all other organisms being returned to the sea.

An additional fish survey was undertaken during March 2007 ⁽⁴⁾, in order to investigate the presence and abundance of sea bass within the development area. The gear used in this survey was similar to that used in the fishery (trammel nets with a minimum mesh size of 100 mm in order to account for the smaller size classes). The nets comprised two panels of different mesh sizes, with an outer mesh size of 635 mm. Each net deployed was 100 m in length with a depth of 10 ft (30 meshes). Weighted anchors secured the net to the seabed and marker buoys were used to mark the position of the net on the surface.

Six fleets in total were deployed, a fleet consisting of a single net deployed four times. Two fleets were deployed randomly throughout the Humber Gateway site and cable route areas to account for varying depth and habitat, two fleets deployed along the cable route and two fleets deployed within the near shore area of the cable landfall. *Figure 8.19* shows the location of the nets during the survey.

The nets were deployed during a medium neap tidal cycle and allowed to fish either side of the slack water period and recovered following a suitable period, determined by local conditions. A local vessel fitted with a net hauler was used to undertake the survey, with precautions taken to ensure the crew were fully conversant with the safe deployment and recovery of static finfish gears.

Following the recovery of each fleet, fish were carefully removed from the net with live fish placed into a container filled with aerated seawater and dead fish placed into fish boxes. Live fish were analysed as a priority and released. Both sets of fish were measured for length, weight and sex (where possible for live fish) and scales removed for ageing purposes. Each fleet was treated in an identical manner and nets were removed from the water following recovery of fish.

Fish Stomach Analysis

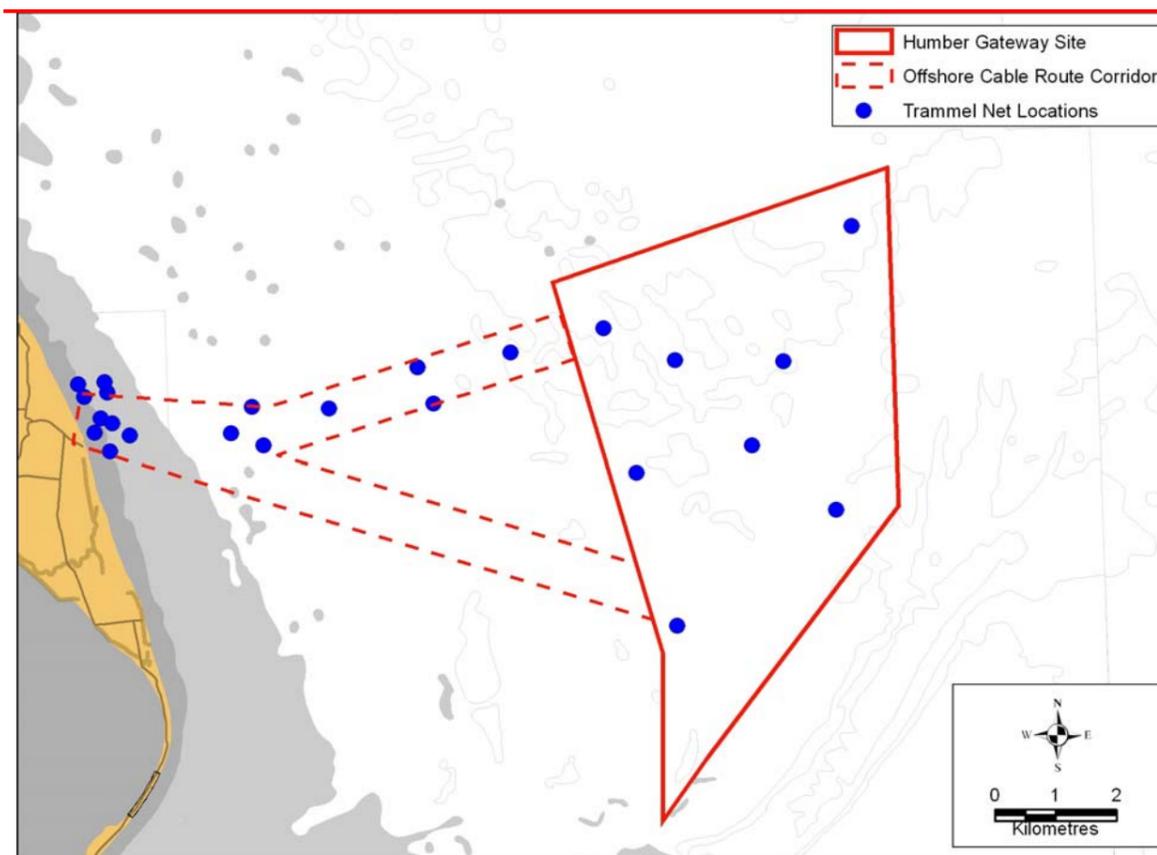
Stomach analysis was carried out on a range of abundant species collected during the site specific surveys in March 2005 and indicated the importance of mobile epifauna, especially crustaceans, as a food source. Five key species

⁽⁴⁾ Precision Marine Surveys Limited (PMSL), 2007. Sea Bass & Natural Fish Ecology in and around the Humber Gateway Wind Farm Development Area, East Yorkshire.

were analysed, although only dab *Limanda limanda*, flounder *Platichthys flesus*, cod *Gadus morhua* and whiting *Merlangius merlangus* contained sufficient identifiable material.

All species were found to prey upon a range of crustacean, to a greater or lesser degree. The flatfish (dab and flounder) were found to feed predominantly on crustaceans such as prawns *Pandalus montagui*, shrimp *Crangonidae* and porcelain crabs *Pisidea longicornis*, plus some polychaetes. Adult gadoids (cod and whiting) fed predominantly on fish, with whiting being the dominant identifiable prey item for both species. Prawns and shrimp were found to be an important component of the diet of juvenile and adolescent cod.

Figure 8.19 Trammel Net Locations during the March 2007 Sea Bass Survey



© British Crown and SeaZone Solutions Limited, 2005. All rights reserved. Data License No. 122005.007. PROJECTION: British National Grid

The area in the vicinity of the Humber Gateway site is important to fish in terms of the availability of prey. However, the principal prey items for the most commonly encountered finfish species are found throughout the general area due to their

mobility. Therefore, they are subject to seasonal fluctuation in terms of presence and availability.

8.5.3 DESCRIPTION OF FISH BASELINE

Data Review

The principal data and information sources reviewed to establish the baseline conditions and examine the fish ecology and resources of the area include:

- Humber Gateway benthic grab sampling and epibenthic trawl surveys (October 2004);
- fish trawl surveys (November 2004 and March 2005);
- trammel net surveys (March 2007);
- Cefas reports and other research publications;
- International Council for the Exploration of the Seas (ICES) stock assessment reports and FishMap species summaries;
- academic journals detailing spawning grounds, nursery habitats, feeding and migration;
- Fishbase's online fish information database (www.fishbase.org)⁽¹⁾; and
- North Eastern Sea Fisheries Committee (NESFC) annual statistics.

⁽¹⁾ Froese R & Pauly D., (Eds). 2007. Fish Base. World Wide Web electronic publication. www.fishbase.org, version (04/2007).

Overview of the Survey Results

During the March 2005 fish trawl surveys, a total of 21 fish species were recorded from 11 trawls, with a mean of 8.5 species and 101 individuals per trawl (Table 8.4). The assemblage was found to be dominated by small demersal and benthic species. The long spined sea scorpion *Taurulus bubalis* was the dominant species, in conjunction with the whiting *Merlangius merlangus*. Other key species included pogge *Agonus cataphractus*, pouting *Trisopterus luscus*, herring *Clupea harengus*, cod *Gadus morhua*, dab *Limanda limanda* and flounder *Platichthys flesus*, but all were present in low abundance and are representative of the fish assembly at that time.

Table 8.4 Mean Abundance and Dominance of Fish Species from the Trawl Survey

Species	Common Name	Mean Abundance	Percentage Dominance	Cumulative Percentage
<i>Taurulus bubalis</i>	Long-spined sea scorpion	46.4	45.9	45.9
<i>Merlangius merlangus</i>	Whiting	32.4	32.0	77.9
<i>Agonus cataphractus</i>	Pogge	6.4	6.3	84.2
<i>Trisopterus luscus</i>	Pouting/bib	4.0	4.0	88.2
<i>Clupea harengus</i>	Herring	3.4	3.3	91.5
<i>Gadus morhua</i>	Cod	2.3	2.3	93.8
<i>Limanda limanda</i>	Dab	2.1	2.1	95.9
<i>Platichthys flesus</i>	Flounder	1.0	1.0	96.8
<i>Liparis liparis</i>	Striped sea snail	0.7	0.7	97.6
<i>Callionymus lyra</i>	Common dragonet	0.5	0.5	98.0
<i>Microstomus kitt</i>	Lemon sole	0.5	0.5	98.5
<i>Liparis montagui</i>	Montagu's sea snail	0.4	0.4	98.8
<i>Ciliata mustela</i>	Rockling	0.3	0.3	99.1
<i>Solea solea</i>	Dover sole	0.3	0.3	99.4
<i>Mustelus mustelus</i>	Smooth hound	0.1	0.1	99.5
<i>Raja clavata</i>	Thornback ray	0.1	0.1	99.5
<i>Sprattus sprattus</i>	Sprat	0.1	0.1	99.6
<i>Cyclopterus lumpus</i>	Lumpsucker	0.1	0.1	99.7
<i>Mullus surmuletus</i>	Red mullet	0.1	0.1	99.8
<i>Echiichthys vipera</i>	Lesser weaver	0.1	0.1	99.9
<i>Pholis gunnellus</i>	Butterfish	0.1	0.1	100.0
Mean abundance		101	100	-
Total number of species		21.0	-	-
Mean number of species		8.5	-	-

Species richness and abundance in the trawls was variable, with the most diverse trawl locations being those at the southern end of the Humber Gateway site, adjacent to New Sand Hole. The spatial pattern of trawls where a high abundance of individuals was recorded was more random, although the number of individuals per trawl generally increased with distance offshore.

During the trammel net survey, a total of 18 fish species were recorded (Table 8.5). In contrast to the trawl survey the most dominant species in terms of numbers was the snake pipefish *Entelurus aequoreus* followed by cod *Gadus morhua*. However, the occurrence of snake pipefish was only recorded in very high numbers in the nearshore fleets where they formed 81% of the total numbers caught. In the offshore and cable route fleets the snake pipefish represents only 10% of the total. In these sites cod and whiting were the most abundant species. Cod were more numerous in the nearshore fleets but due to the large number of snake pipefish their relative abundance is much lower.

In terms of biomass, cod were the most dominant species and pipefish, due to their small size, were ranked 9th. The survey target species, sea bass *Dicentrarchus labrax* ranked 3rd in terms of biomass but only represented 2% of the total numbers. Other key species included whiting *Merlangius merlangus*, lesser spotted dogfish *Scyliorhinus canicula*, pouting *Trisopterus luscus*, Dover sole *Solea solea* and thornback ray *Raja clavata*.

Table 8.5 Percentage Abundance Recorded at Each Trammel Net Site and Total Biomass

Species	Common name	Abundance			Biomass (kg)
		Cable Route Fleets	Offshore Fleets	Nearshore Fleets	
<i>Scyliorhinus canicula</i>	Dogfish	20%	4%	2%	189
<i>Raja clavata</i>	Thornback ray	1%	1%	0.1%	15
<i>Alosa fallax</i>	Twaite shad	0.3%	0%	0%	0.7
<i>Clupea harengus</i>	Herring	0.3%	0%	0%	0.02
<i>Salmo trutta</i>	Sea trout	0.3%	0%	0%	0.02
<i>Gadus morhua</i>	Cod	24%	28%	9%	749
<i>Merlangius merlangus</i>	Whiting	19%	39%	2%	66
<i>Pollachius pollachius</i>	Pollock	0%	0%	0.03%	1
<i>Pollachius virens</i>	Coalfish/Saithe	0%	0%	0.03%	0.03
<i>Trisopterus luscus</i>	Pouting/Bib	11%	11%	1%	17
<i>Entelurus aequoreus</i>	Snake pipefish	10%	3%	81%	6
<i>Cyclopterus lumpus</i>	Lumpsucker	0.3%	0%	0.03%	1
<i>Dicentrarchus labrax</i>	Sea bass	3%	0%	2%	119
<i>Limanda limanda</i>	Dab	4%	6%	0%	7
<i>Microstomus kitt</i>	Lemon sole	0%	1%	0%	0.8
<i>Platichthys flesus</i>	Flounder	0%	0.4%	0.03%	0.5
<i>Pleuronectes platessa</i>	Plaice	1%	1%	0%	0.9
<i>Solea solea</i>	Dover Sole	7%	6%	1%	17

Age group (cohort) analysis was undertaken on the most abundant fish species captured during the March 2005 and March 2007 surveys. However, some species of commercial value were not present in high enough densities to enable cohort analysis to be carried out. The results of size frequency analysis are as follows:

- **Herring** (*Clupea harengus*): The size frequency analysis of the herring data from the March 2005 trawl survey indicate that assemblage is dominated by adult forms.
- **Dab** (*Limanda limanda*): Data collected in adjacent areas for other projects shows that dab is commonly recorded along this stretch of coastline, and is the most common flatfish species in this region. However, seabed type is an important factor that determines the distribution of the species and the seabed of the survey area is not considered 'typical' flatfish terrain. The abundance of this species within the March 2005 trawl survey was relatively low, making the determination of specific cohorts more difficult, however there

is some indication that the composition is dominated by adolescent to maturing adult fish.

- **Cod** (*Gadus morhua*): The March 2005 trawl survey found all size classes of cod at the Humber Gateway site, although the largest cohort present was the 0 group (0 to 1 year old fish). During the March 2007 trammel net survey the 2 group cohort (2 to 3 year old fish) was the largest. This group of 24 to 26 month year old fish originate from the 2005 year class identified as the dominant cohort by Armstrong *et al.* (2007)⁽¹⁾. The reduced availability of older cohorts is likely to be a reflection of the depleted status of the overall North Sea stock.
- **Whiting** (*Merlangius merlangus*): The cohort analysis (length frequency) found that a single cohort dominated the assemblage during the March 2005 survey, although a second cohort of larger fish was also identified. The dominant cohort was the 1 group (1 to 2 years old), with 2 group whiting (2 to 3 years old) less abundant. There is limited evidence to indicate the presence of 3 group fish within the data (greater than 33 cm). There was no evidence of the 0 group which is usually represented at this time of year (March) by individuals in the 5 to 10 cm range. It is likely that such fish would take up residence in the Humber Estuary and along inshore areas. The March 2007 trammel net survey found a few 0 group and 1 group fish, but the 2 group fish dominated the fish caught. In contrast to the trawl survey all year classes up to the 5 group cohort were identified. These differences between the two surveys are likely to be caused by inter-annual variability in the whiting population and differences in gear selectivity.
- **Sea bass** (*Dicentrarchus labrax*): The size ranges recorded during the survey indicate that a number of year classes are present within the dataset. Throughout the survey, no bass below 40 cm were caught, with the largest bass recorded 65 cm. Scale samples were taken from 20 fish, with 11 bass tagged and released in accordance with Cefas guidelines. The data indicate that 7 year classes were present in the captured bass population. Of these year classes, individuals recruited from 2002, 2001, 1999 and 1998 dominate the assemblage. The most abundant size range was the 48 to 49 cm (1999 year class), closely followed by the 46 to 47 cm fish (2000 year class). Similar numbers of fish were found in the 42 to 43 cm (2002 year class) and 44 to 45 cm range (2001 year class).

A large proportion of the fish caught during the March 2005 fish survey were immature or adolescents. During the first beam trawl survey (November 2004),

⁽¹⁾ Armstrong, M., Dann, J., Shaw, S., Bush, R. & Whittaker, C., 2007. Programme 1: North East Cod. Final Report. Fisheries Science Partnership: 2005/06. Cefas, Lowestoft.

no herring were recorded, and whilst the species was recorded at all but one station during the March 2005 survey, there was no evidence of any spawning potential. Similarly flounder *Platichthys flesus* were investigated, but found to have no spawning potential. Dab *Limanda limanda* were generally sub-adults and, where adult specimens were recorded, they were spent.

Other species investigated included whiting *Merlangius merlangus*, pouting *Trisopterus luscus* and cod *Gadus morhua*. Adult cod and whiting exhibited ripening gonads, with both species having a higher abundance of females with spawning potential than males. However, the whiting assemblage was dominated by juvenile or sub-adult forms and the cod were considered to be of a poor quality. Pouting exhibited the highest gonad development, with males releasing sperm during handling.

During the March 2007 survey, a sub-sample of Dover sole above 30 cm in length was collected and examined for spawning condition. All of the examined fish were female of which four had fully developed gonads that were not ripe. The remainder were all at earlier stages of development.

Cod

In the North Sea, cod may be found from shallow coastal waters to the shelf edge down to 200 m depth. However over the last 20 years, the distribution pattern of small cod has shown a significant change. The southeastern North Sea has almost completely lost its importance as a nursery area. In recent years, the highest abundances off the British coast are found north of the 50 m depth contour between Flamborough Head and Jutland Bank ⁽¹⁾.

Cod migrate through the study area towards winter spawning grounds, and in the summer they are spread out over a wider area. Spawning takes place between February and April during which eggs and larvae drift within the plankton. After about two months the young fish become demersal (live on or near the seabed) and inhabit the nursery areas. Cod aged one to two years can be found all over the North Sea, but are concentrated in shallow coastal waters in the eastern North Sea ⁽²⁾. However, there is a recognised cod nursery ground to the north of the Humber Gateway site, stretching from Newcastle Upon Tyne to Withernsea and another smaller area to the south (*Figure 8.20*). In the trawl survey the 0 group fish (i.e. zero to one year old) were the most commonly recorded year

⁽¹⁾ Blanchard J L., Heffernan O A. and Fox C J. 2005. North Sea Cod (ICES Divs. IVa-c and VIIId). In: ICES. 2005. Spawning and life history information for North Atlantic cod stocks. ICES Cooperative Research Report, No. 274.

⁽²⁾ Cefas, 2001. Technical report produced for Strategic Environmental Assessment - SEA2: North Sea Fish and Fisheries.

class, whereas the 1 group fish (i.e. one to two year old) were the most commonly found year class in the trammel net survey.

Cod was found in relatively high abundance in comparison to all other species in the trammel net survey, other than snake pipefish. In the nearshore fleets, cod was found to be more numerous than all the other commercial fish, although this abundance was masked by the number of snake pipefish caught. The nearshore fleets of trammel nets caught 351 cod, whereas the cable route and offshore fleets caught considerably less (87 and 72 respectively). This demonstrates that the Humber Gateway site and cable routes are areas where fewer cod are found, whilst the nearshore area is more important locally in terms of cod abundance (*Figure 8.21*).

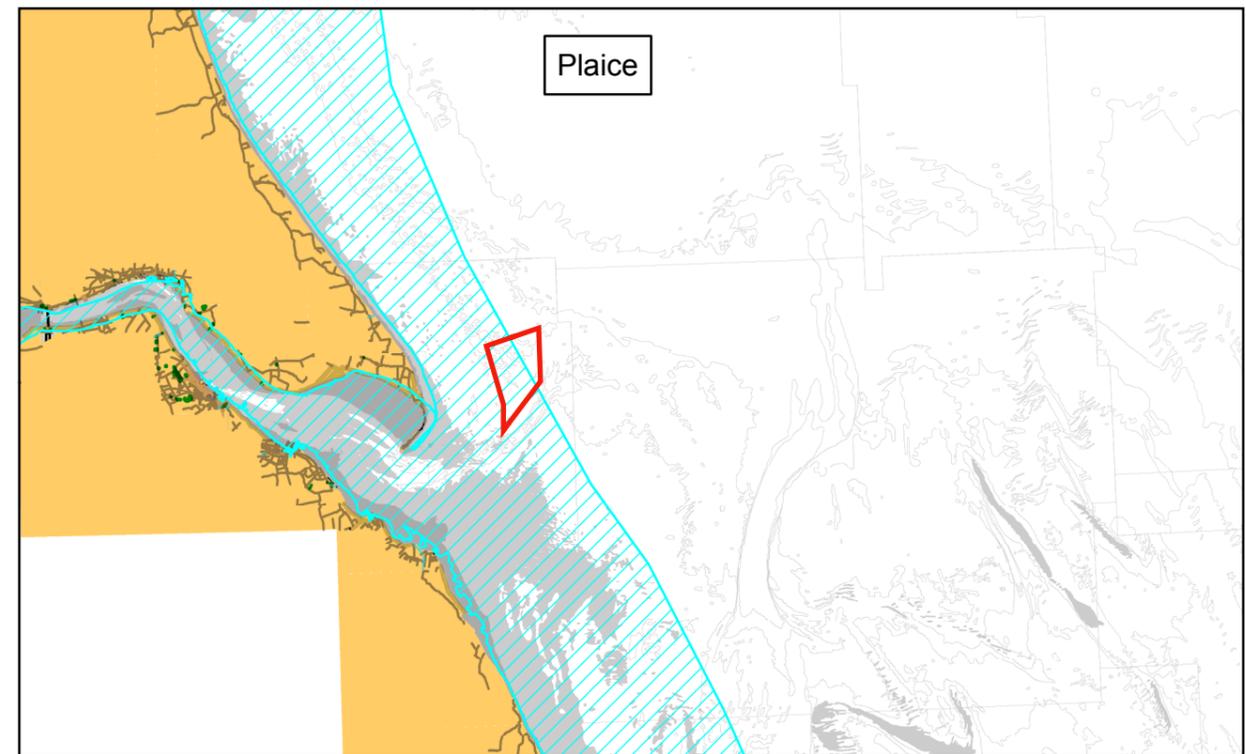
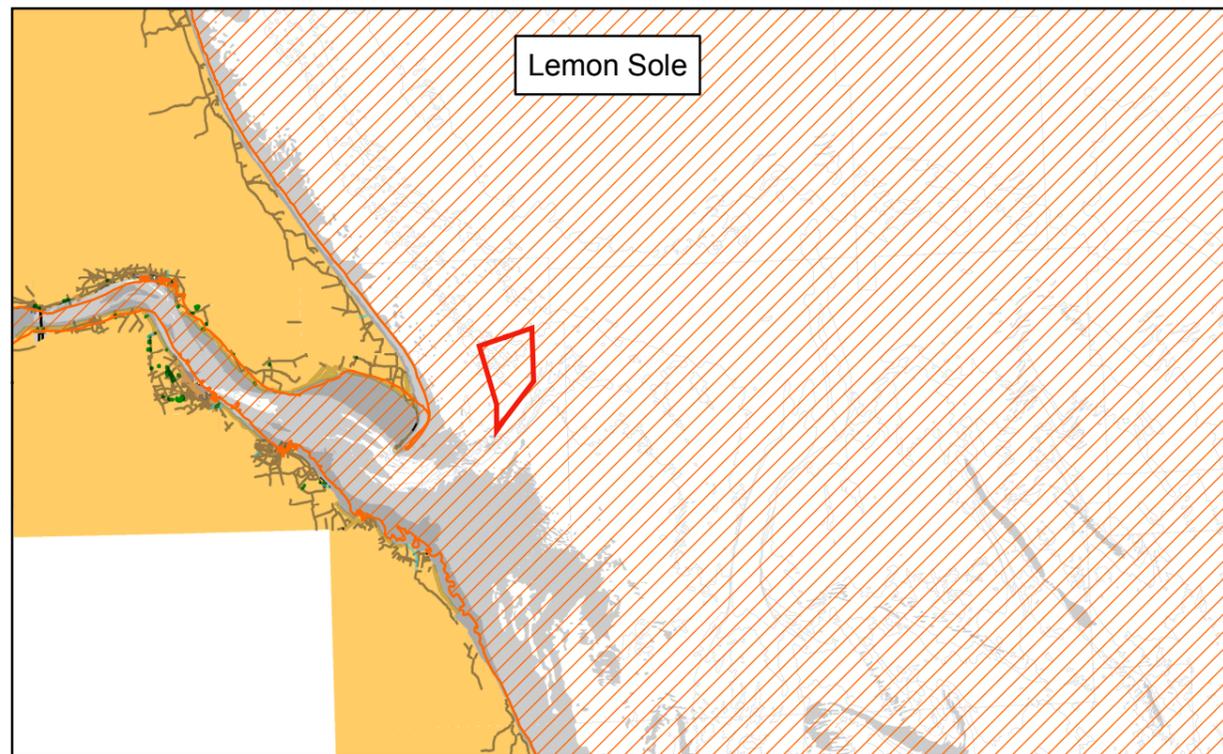
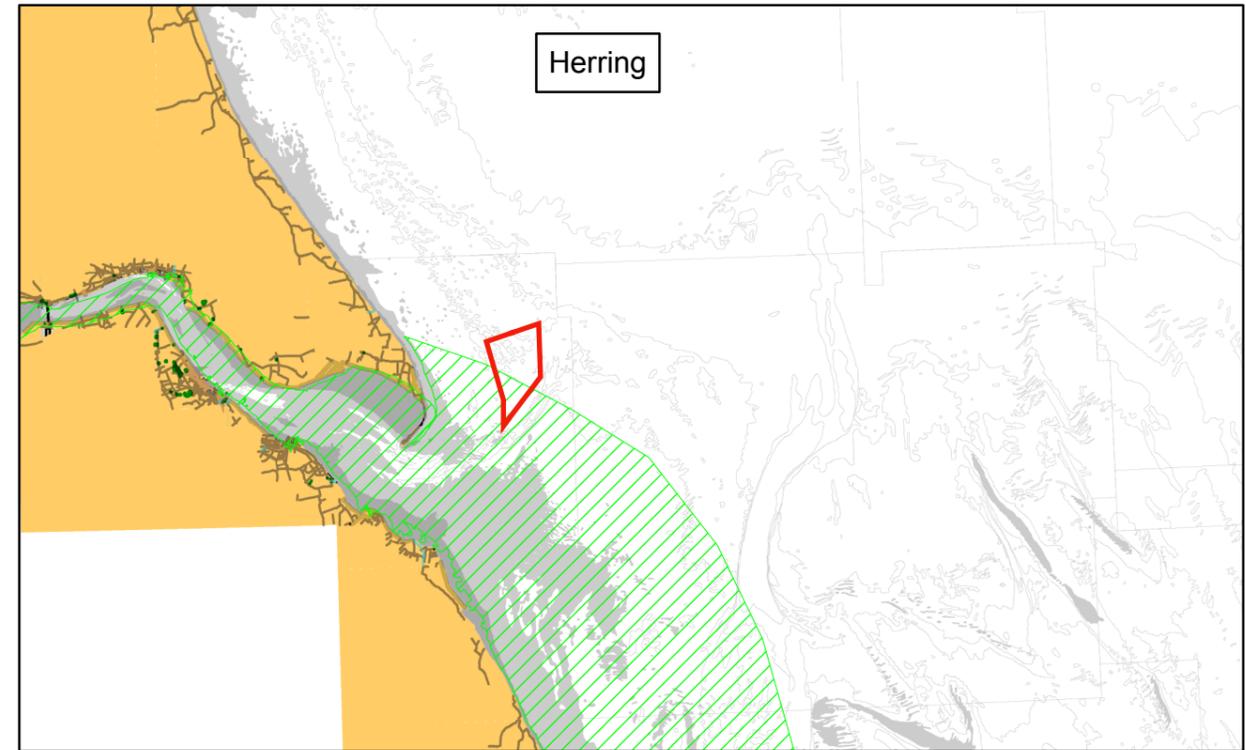
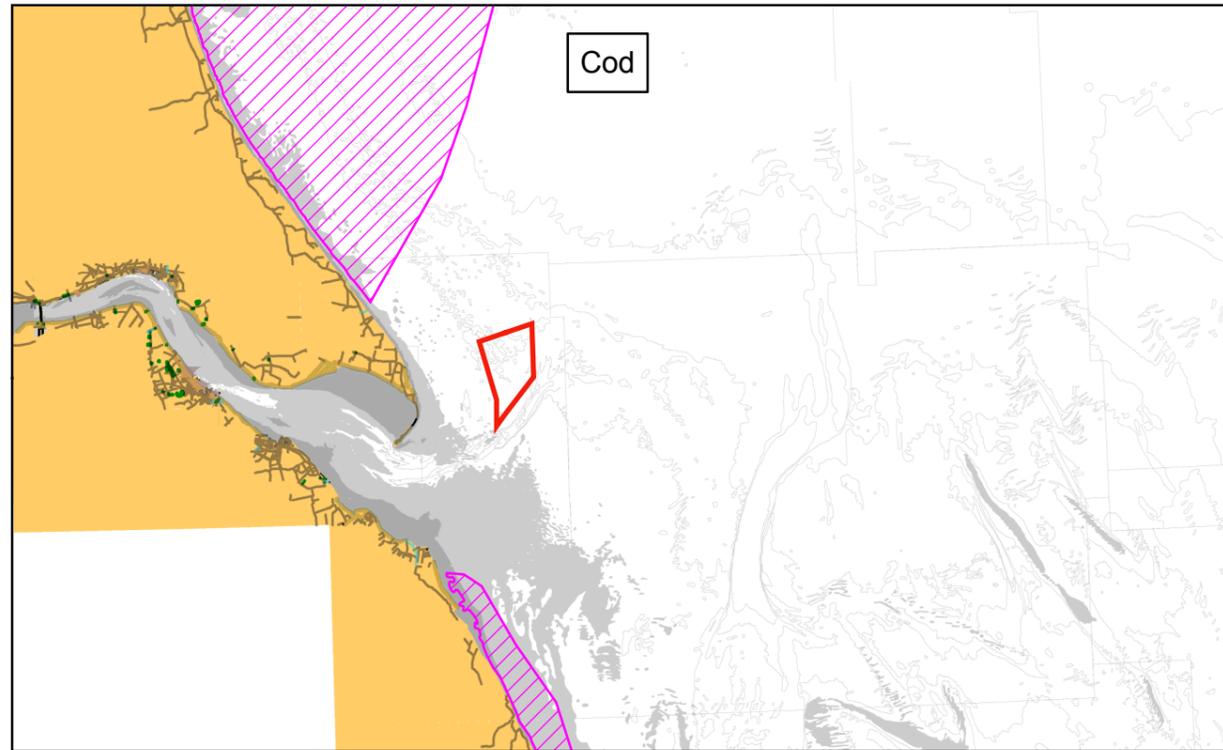
The cohort analysis demonstrated that the majority of the cod were in the 2 group cohort. These fish, most likely from the 2005 age class, are considered to be the strongest cohort in recent years ⁽³⁾. The results show that cod are found in all parts of the Humber Gateway site, but are most numerous in the nearshore area where fish are likely to be a mix of 1 group and 2 group fish. Older fish were found in the sites further offshore as cod migrate offshore as they mature (ontogenic migration). These comprised a smaller proportion of the population.

Cod larvae of 2 to 8 mm in length feed principally on the larvae of copepods. The 0 group fish continue to feed pelagically after metamorphosis but their diet changes as they grow larger. At 5 cm, cod have already changed to a diet dominated by fish ⁽⁴⁾. From a length of 7 cm onwards, the juveniles become demersal, which is mirrored in their diet where crustacean prey (e.g. the brown shrimp *Crangon crangon* and a range of crab species) are increasingly important. Larger specimens feed predominantly on fish, most of which are of commercial importance and include gadoids, sandeel, flatfish, and clupeids ⁽⁵⁾.

⁽³⁾ Armstrong M., Dann J., Shaw S., Bush R. & Whittaker C., 2007. Programme 1: North East Cod. Final Report. Fisheries Science Partnership: 2005/06. Cefas, Lowestoft.

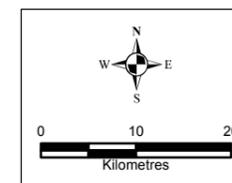
⁽⁴⁾ Robb A P and Hislop J R G, 1980. The food of five gadoid species during the pelagic 0-group phase in the northern North Sea. *Journal of Fish Biology* 16: 199-217.

⁽⁵⁾ Daan N (ed), 1989. Data base report of the stomach sampling project 1981. Cooperative Research Report 164.



KEY:

-  Humber Gateway Site
-  Cod Nursery
-  Herring Nursery
-  Lemon Sole Nursery
-  Plaice Nursery



CLIENT:

e-on

SIZE:

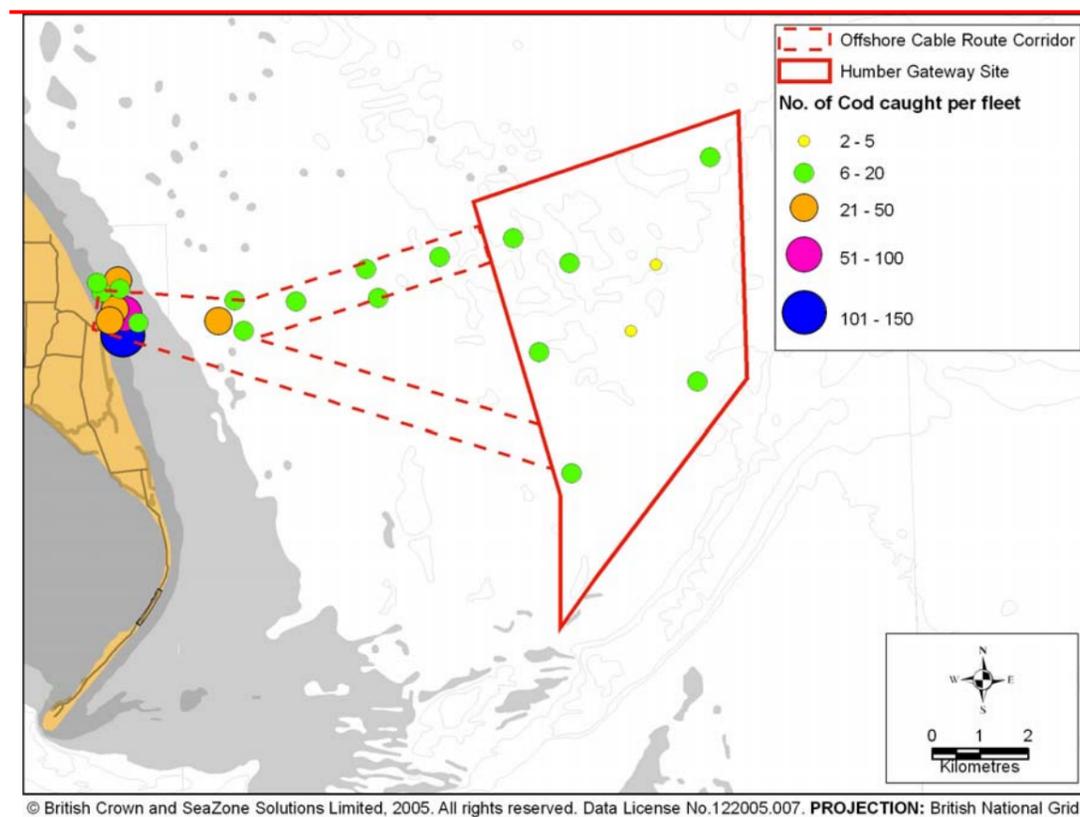
A3

TITLE:

**Figure 8.20
Nursery Areas of Important
Species (Herring, Plaice, Lemon
Sole, Cod)**

DATE: 05-12-2007	CHECKED: HV	PROJECT: 0022303
DRAWN: FS	APPROVED: CW	SCALE: as per scale bar
DRAWING: Fig 8.20 NurseryGrounds.mxd		REV: 0



Figure 8.21 Abundance of Cod Captured during the Trammel Net Survey

Herring

Herring is numerically one of the most important pelagic species in several North Atlantic ecosystems. Intensive exploitation goes back several centuries, with large stock fluctuations in the past, due to both natural environmental variations and human exploitation.

Juveniles and adults are primarily pelagic and their distribution is influenced by many hydrographical features, as well as abundance and composition of the zooplankton on which they feed⁽¹⁾. Adult fish are found mostly in continental shelf seas to depths of 200 m. Juveniles tend to occur in shallower water,

⁽¹⁾ ICES 2006b. <http://www.ices.dk/marineworld/fishmap/ices/pdf/herring.pdf> [cited September 2007].

restricted to within the 100 m isobath. After spending their first few years in coastal nurseries, two-year-old herring move offshore into deeper waters⁽²⁾. Herring congregate on traditional spawning grounds in order to reproduce. They return year after year to the same grounds, and lay their eggs on the sea bed on specific, gravely substrates. Many of the spawning grounds on shoals and banks are in shallow water approximately 15 to 40 m deep. Herring shoals deposit sticky eggs in coarse sand, gravel, shells and small stones more or less simultaneously to produce an 'egg carpet' which is four to nine layers thick. Individual females can produce between 42,000 and 67,000 eggs in any one year⁽³⁾.

The spawning stock in the vicinity of the Humber Gateway are those associated with the Dogger or Central North Sea Banks⁽⁴⁾. Spawning is confined to small areas along the east English coast, from the Farne Islands to the Dowsing area and takes place in these areas between August and October⁽¹⁾.

A spawning ground identified within the Humber Gateway site was based on a series of pooled studies that ended in the 1980s⁽⁴⁾. However, recent information suggests that the main spawning ground has moved to the north of the site. Herring spawning surveys conducted in 2002 and 2003 found the main site for herring spawning is located approximately 53 km north of the Humber Gateway development at Flamborough Head, as shown in *Figure 8.22*.

During the spawning period, fishermen using static nets and pots may quite often find their gear covered in herring eggs. However, anecdotal evidence from local fishermen suggests this does not occur in or around the Humber Gateway site⁽⁵⁾.

Planktonic development of herring lasts three to four months during which time they are subjected to residual drift. This takes them to various coastal nursery areas on both sides of the North Sea (*Figure 8.23*), bringing larvae to nursery areas away from spawning grounds.

⁽²⁾ MacKenzie K, 1985. The use of parasites as biological tags in population studies of herring (*Clupea harengus* L.) in the North Sea and to the north and west of Scotland. *Journal du Conseil International pour l'Exploration de la Mer* 42: 33-64.

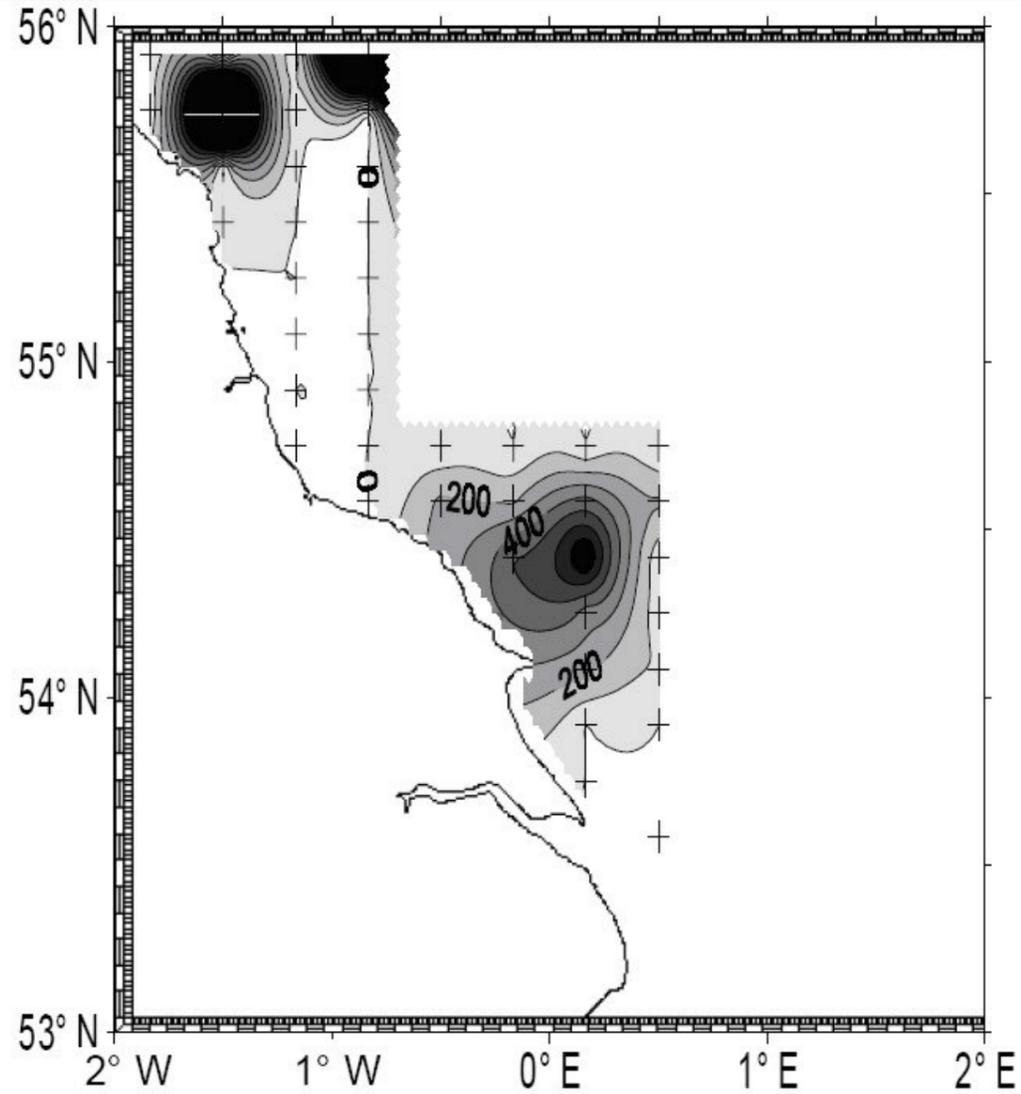
⁽³⁾ Holliday F.G T, 1958. The spawning of the herring. *Scottish Fisheries Bulletin* 10: 11-13.

⁽⁴⁾ Cefas, 2001. Technical report produced for Strategic Environmental Assessment - SEA2: North Sea Fish and Fisheries.

⁽⁵⁾ N. Proctor, 2007. Pers. Comm.

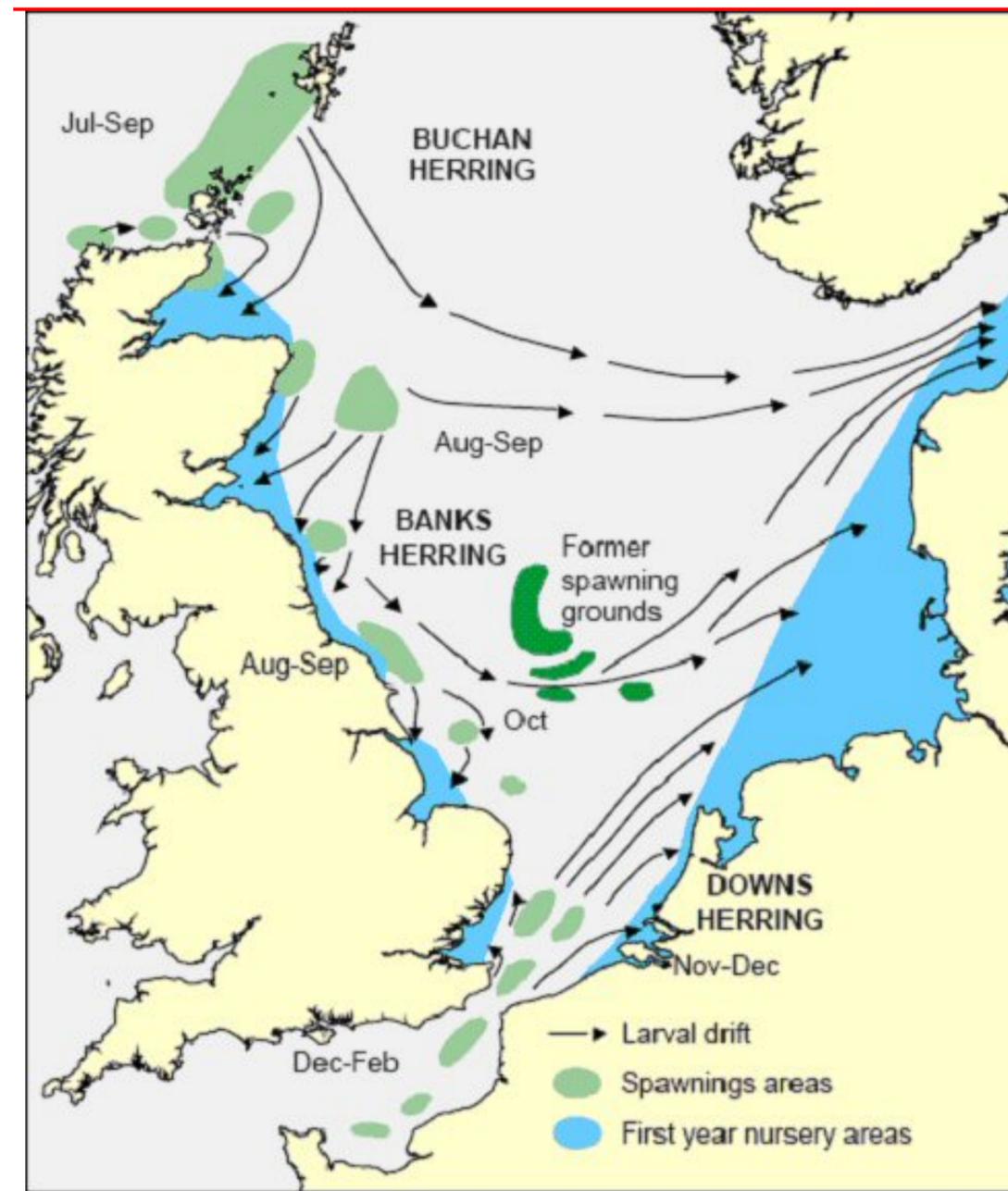
Larvae observed by International Council for Exploration of the Seas (ICES) ⁽¹⁾ to the north of the Humber Gateway site is likely to drift down the coast towards the Humber Estuary (Figure 8.23).

Figure 8.22 Abundance of Herring Larvae in Central North Sea



Source: ICES 2003 ⁽¹⁾.

Figure 8.23 Herring Spawning and Nursery Grounds in the North Sea



Source: Cefas, 2007 ⁽²⁾.

⁽¹⁾ ICES, 2003: Report of the Herring Larvae Surveys in the North Sea in 2002/2003. ICES CM 2003/ACFM:12

⁽²⁾ Cefas, 2007. Herring in the North Sea (ICES Division IV, VIId and IIIa).

The pelagic larvae feed on copepods and other small planktonic organisms. Calanoid copepods are the predominant prey items during the early juvenile stages, but euphausiids, hyperiid amphipods, juvenile sandeels, *Oikopleura* spp. and fish eggs are also eaten. Larger herring predominantly consume copepods, small fish, arrow worms and ctenophores⁽¹⁾. Herring themselves are an important prey for large gadoids, elasmobranchs, marine mammals and sea birds⁽²⁾.

Herring have an open swimbladder where a duct connects the swimbladder to the oesophagus. They also have connections between the swimbladder and the inner ear, where the diverticula of the swimbladder extends into the skull, helping propagate vibrations from the swimbladder to the ear. Hence, herring is regarded as a species that will be sensitive to anthropogenic noise disturbance⁽²⁾.

Most of the herring caught during the baseline surveys were adults, with a few adolescent fish. The absence of juveniles suggests that any potential nursery areas are likely to be closer to shore or further north than the Humber Gateway site.

Plaice

Plaice spawn over most of the offshore and deeper parts of the southern North Sea, off the east coast of Britain from Flamborough Head to the Moray Firth⁽³⁾, in areas where eggs and larvae will be transported effectively to coastal nurseries. The duration of the planktonic egg and larval stages of plaice is three to four months and larvae are exposed to drifting in long residual currents, settling in areas far away from spawning areas. Variability in year-class strength is determined during the pelagic phase where density-dependent processes appear to fine-tune year-class strength. Significant numbers of plaice eggs have been found in the stomachs of herring and sprat. Variations in their abundance may thus cause long-term changes in plaice egg-mortality⁽⁴⁾.

⁽¹⁾ Last J M, 1989. The food of herring, *Clupea harengus*, in the North Sea, 1983-1986. Journal of Fish Biology 34: 489-501.

⁽²⁾ ICES, 2006b. <http://www.ices.dk/marineworld/fishmap/ices/pdf/herring.pdf> [cited September 2007].

⁽³⁾ Harding D., Nichols J.H., and Tungate D.S, 1978. The spawning of plaice (*Pleuronectes platessa* L.) in the southern North Sea and English Channel. Rapports et Procès-Verbaux des Réunions du Conseil International pour l'Exploration de la Mer 172: 102-11.

⁽⁴⁾ Russell F R, 1976. The eggs and planktonic stages of British marine fishes. Academic Press, London.

Juvenile plaice are found in shallow coastal waters and outer estuaries. Plaice utilise shallow sandy bays and estuaries as nursery areas, and the Holderness coastal margins and Humber Estuary are both recognised as important nursery grounds for plaice (*Figure 8.20*). Juvenile plaice migrate from spawning grounds north of the site to the nursery areas within The Wash and Humber Estuary along the coastal fringe. As they grow older plaice gradually move into deeper water⁽⁵⁾.

The diet of plaice larvae consists of planktonic tunicates such as *Oikopleura dioica* and *Fritillaria borealis*, but several stages of copepods, algae, and bivalve post-larvae are also eaten. Polychaete worms, bivalves, small crustaceans, siphons of bivalve molluscs (e.g. *Abra* spp., *Mya* spp. and *Venus* spp.) and brittle stars *Ophiura* spp. are important food groups for larger plaice.

The fish trawl survey used rock hopper gear due to the presence of cobbles in the surveyed area. This type of substrate is unsuitable for plaice as they prefer sandy substrates throughout their life-cycle. In addition, the use of rockhopper gear makes it difficult to catch flatfish, as generally the gear does not fish close enough to the seabed. The length of the fish caught indicate that the individuals were adolescent or young adults, and this indicates to a limited extent the importance of the nearshore coastal margins as a migratory corridor.

Sprat

Sprat are found all along the British coast and being a pelagic species their distribution is strongly affected by hydrographic conditions⁽⁶⁾. Large variations in populations are observed between years.

Sprat first spawn at two years of age, though a small proportion of the population spawn as one year olds. Sprat do not spawn within the Humber Gateway site or the cable route but spawn approximately 10 km further offshore (*Figure 8.24*). Sprat spawn around all UK coasts and throughout the North Sea⁽⁷⁾ and the Humber region represents a small percentage of the total spawning area. There is no indication that the Humber region or the Humber Gateway site represents a particularly important spawning ground for sprat.

⁽⁵⁾ Rijnsdorp A D. 1989. Maturation of male and female North Sea plaice (*Pleuronectes platessa* L.). Journal du Conseil International pour l'Exploration de la Mer 46: 35-51.

⁽⁶⁾ Valenzuela G S, Vargas C A, 2002. Comparative larval growth rate of *Sprattus sprattus* in relation to physical and biological oceanographic features in the North Sea. Archive of Fishery and Marine Research, 49(3): 213-230.

⁽⁷⁾ Cefas, 2001. Technical report produced for Strategic Environmental Assessment - SEA2: North Sea Fish and Fisheries.

Large numbers of juvenile sprat move inshore to overwinter from late September to March and nursery areas for sprat in the Humber region include the Humber Gateway site and export cable route (*Figure 8.20*).

Larvae feed on diatoms, copepods and crustacean larvae. After metamorphosis, larger planktonic organisms are also eaten, including cladocerans, *Oikopleura*, bivalve larvae, mysids, and euphausiids ⁽¹⁾. Sprat also represent an important prey for larger gadoids, as well as diving seabirds.

Sea Bass

The European sea bass is a strongly migratory predator. Adult fish are found in deep water, inshore waters, shallow estuaries, bays and sometimes in brackish and freshwater rivers ⁽²⁾. The distribution of sea bass in northwest European waters has expanded considerably over the past twenty years, with a definite expansion northwards, to the extent that a large population is now resident in Norwegian waters. European sea bass have been reported as thriving in recent years as a consequence of both large recruitments to the stock and declines in cod populations ⁽³⁾. They now form an important part of the finfish fishery within the southern part of the NESFC district, with continued efforts to increase populations. Until recently, intertidal and subtidal fishing effort was concentrated to the north of the development site and the extent of sea bass usage of the development site itself was unknown.

In addition to the species identified by Cefas, and shown in *Figure 8.24*, it is probable that sea bass now spawn in the region, although the actual location of spawning grounds remains unknown. Spawning starts well offshore in February and continues mainly outside the UK 12 nm zone, through March and April ⁽⁴⁾. Spawning moves closer inshore during May and June but is still centred three miles or more offshore.

The March 2007 survey found the majority of the sea bass caught were larger than 40 cm (*Figure 8.25*). Male sea bass mature at a length of between 31 and 35 cm whilst female sea bass mature between 40 and 45 cm. Mature adults have been caught in spawning condition during April along the Holderness Coast and 0 group juveniles have been found in the Humber Estuary and Filey Bay. As the closest identified spawning area is the Thames region, this suggests that spawning activity within the Humber region is likely to occur. However, the Humber Estuary has not been designated a nursery area as there is no evidence to suggest 0 group fish can survive low winter temperatures.

Young sea bass are often found in estuaries and bays ⁽²⁾ staying close inshore. As they approach maturity, sea bass move into coastal areas for a year or so before becoming fully mature ⁽²⁾. Upon reaching maturity, sea bass adopt a habit of migrating between summer feeding areas and offshore spawning areas.

Sea bass are opportunistic predators feeding on a wide range of fish, shellfish and plankton species, including shrimps, marine worms, sandeels, sprats and mackerel ⁽²⁾. Compared with most northern temperate roundfish species, sea bass grow slowly and in UK waters sea bass may live up to a maximum of 30 years but are now rarely found beyond 15 years old (*Figure 8.26*).

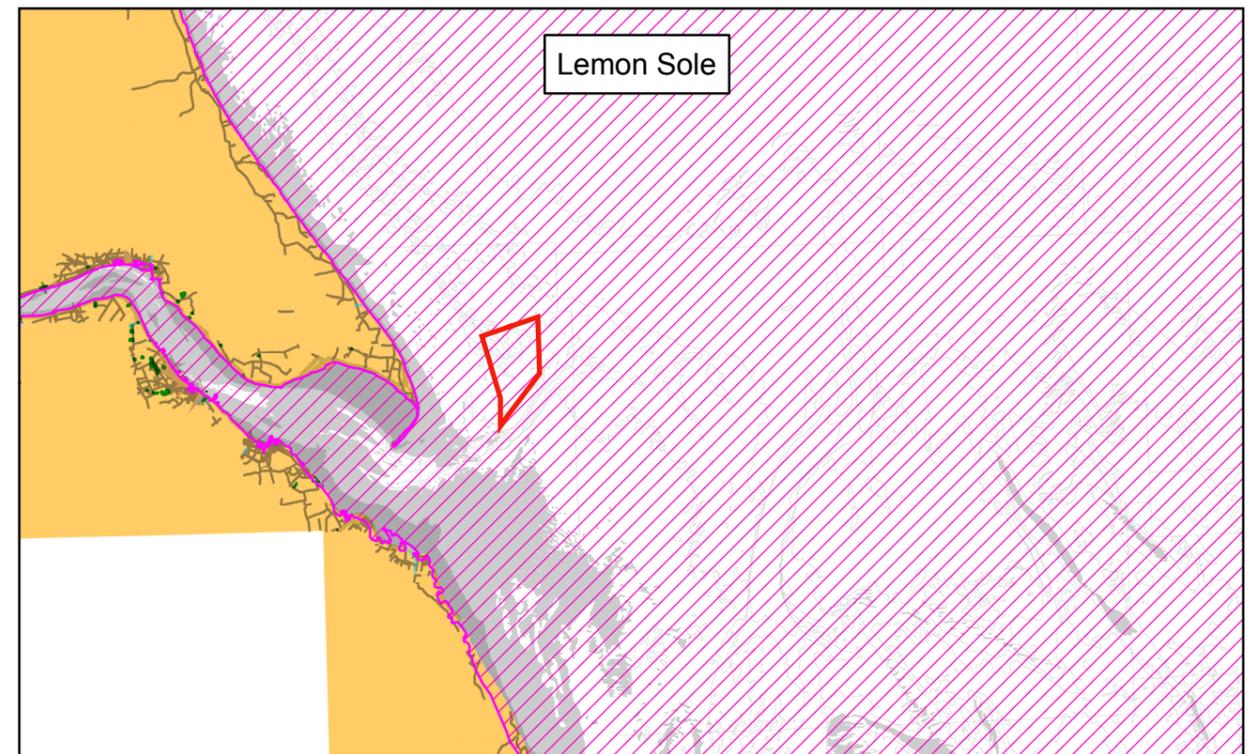
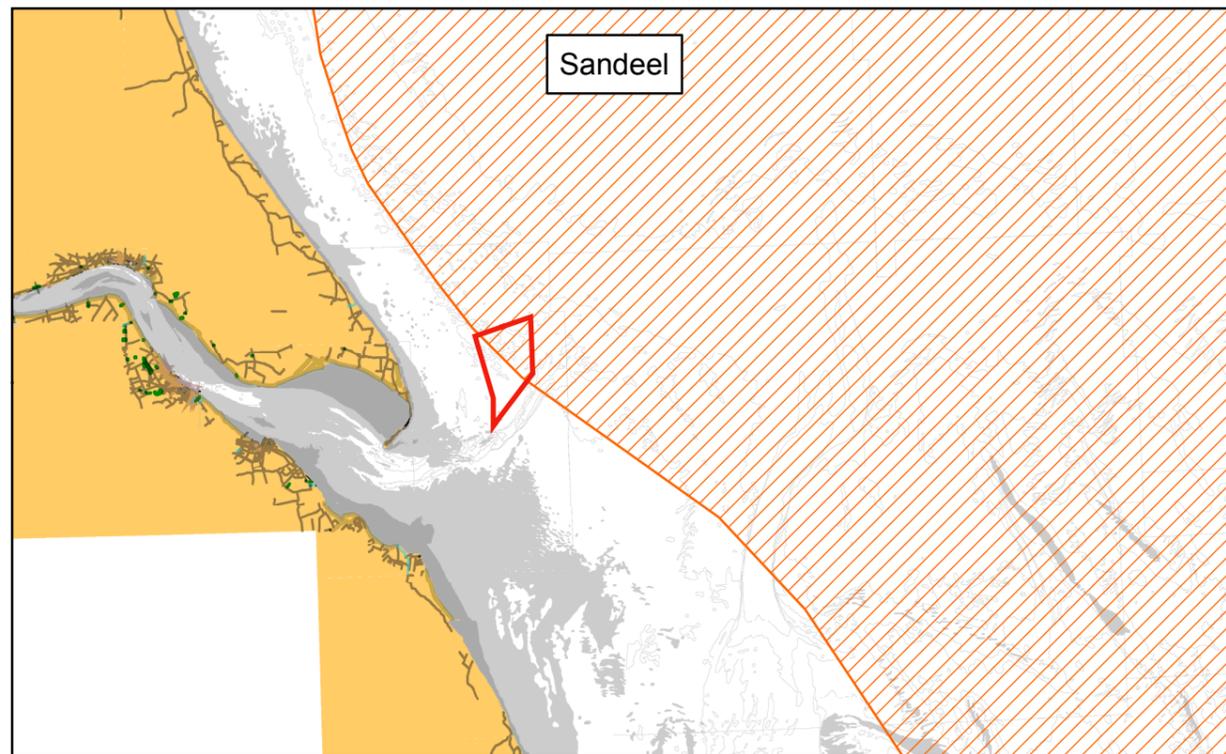
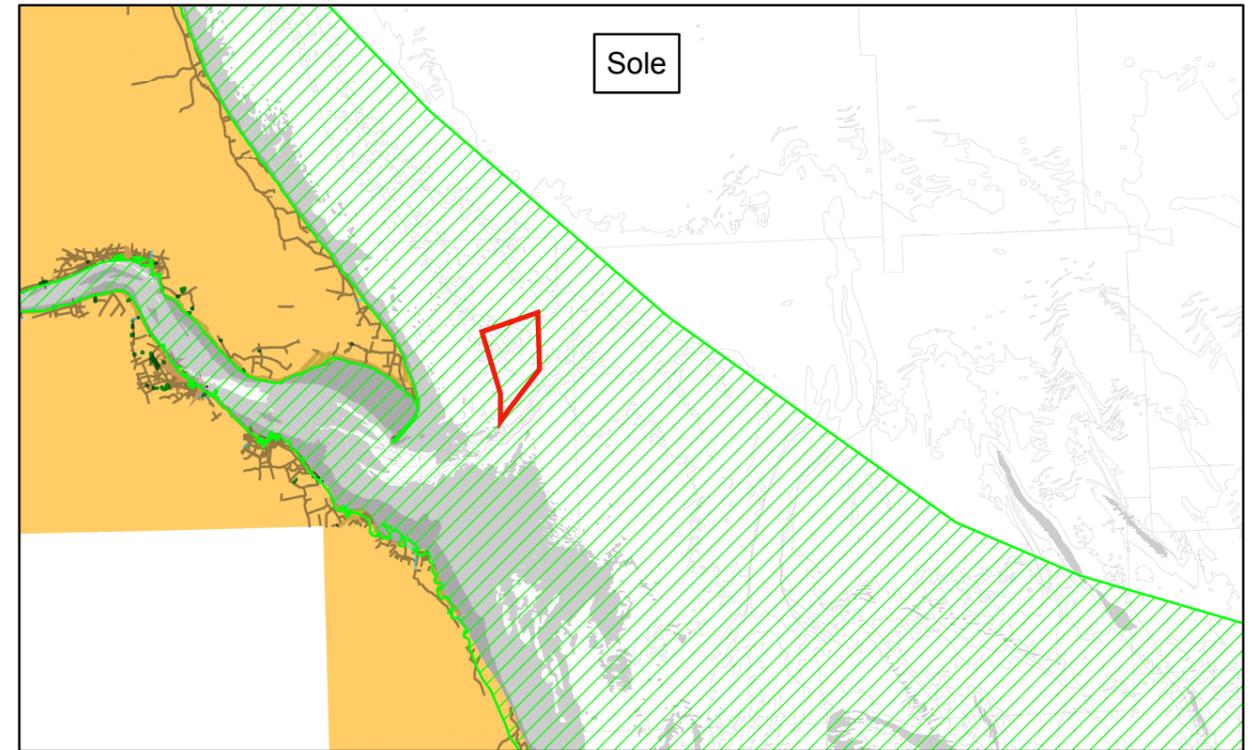
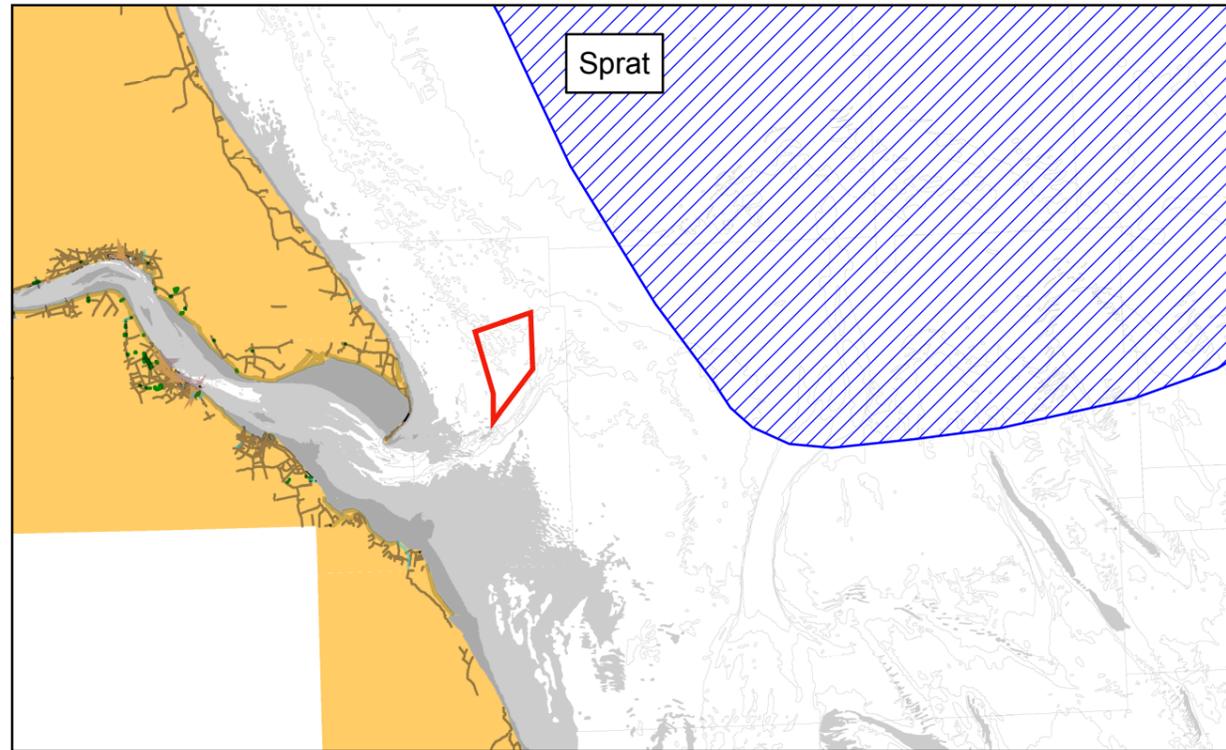
The survey data clearly indicate that sea bass were restricted in their distribution to the nearshore coastal margins (*Figure 8.27*) where 89% (82 fish) of the total numbers were caught. No bass were recorded in the Humber Gateway site itself and only 11% (10 fish) of the total catch was taken along the cable route. The distribution of sea bass appears to be predominantly restricted to waters of less than 10 m depth along the Holderness coast, at least during the period of the survey where only a single sea bass was recorded outside the 10 m depth contour.

⁽¹⁾ Russell F S, 1976. The eggs and planktonic stages of British marine fishes. Academic Press, London.

⁽²⁾ Pickett G D, 2005. A 3-year gillnetting trial (1-31 October 2002 - 2004) and complimentary studies undertaken near Bridlington, East Yorkshire. Cefas Contract Report, No. C2277.

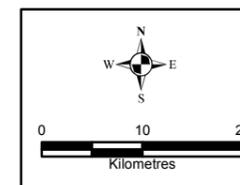
⁽³⁾ Fahy E, 2003. Recent Findings On Sea Bass Undermine Some Beliefs But Emphasise The Need For a Continued Active Conservation Policy. Published in: The Marine Times: April 2003.

⁽⁴⁾ Thompson B M & Harrop R T, 1987. The distribution and abundance of bass (*Dicentrarchus labrax*) eggs and larvae in the English Channel and southern North Sea. J. Mar. Biol. Ass. U.K., 67, (2) 263 – 274.



KEY:

-  Humber Gateway Site
-  Sprat Spawning Area
-  Sole Spawning Area
-  Sandeel Spawning Area
-  Lemon Sole Spawning Area



CLIENT:

e-on

SIZE:

A3

TITLE:

**Figure 8.24
Areas Identified as Potential
Spawning Grounds**

DATE: 05-12-2007	CHECKED: HV	PROJECT: 0022303
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DRAWING: Fig 8.24 Spawning Grounds.mxd	REV: 0	



Figure 8.25 Size Range of Bass (from the March 2007 Trammel Net Survey)

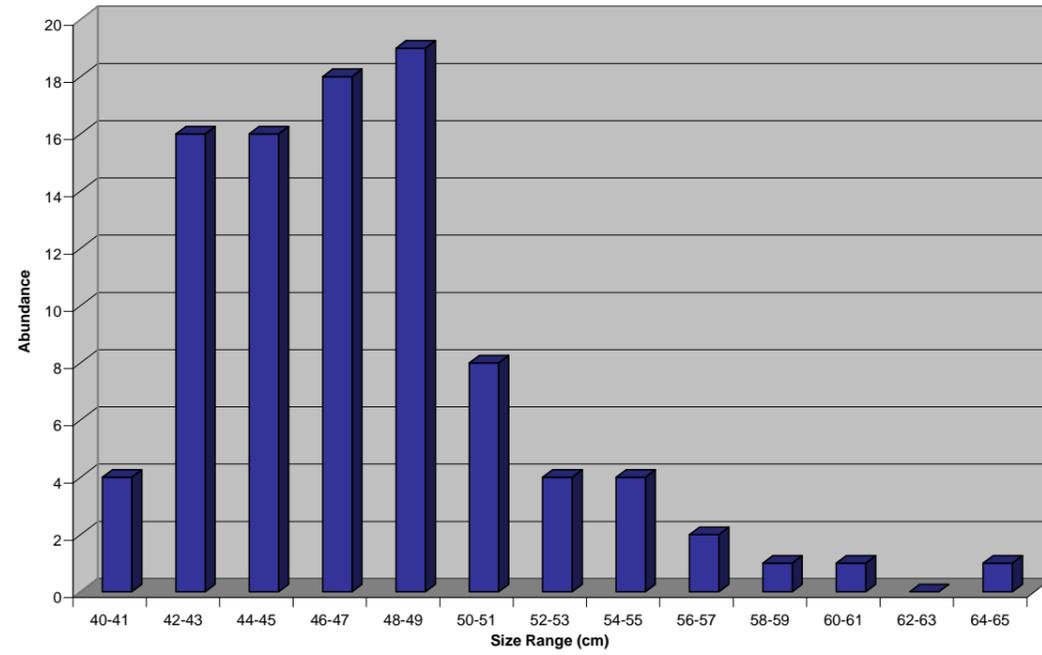


Figure 8.26 Age Range of Bass (from the March 2007 Trammel Net Survey)

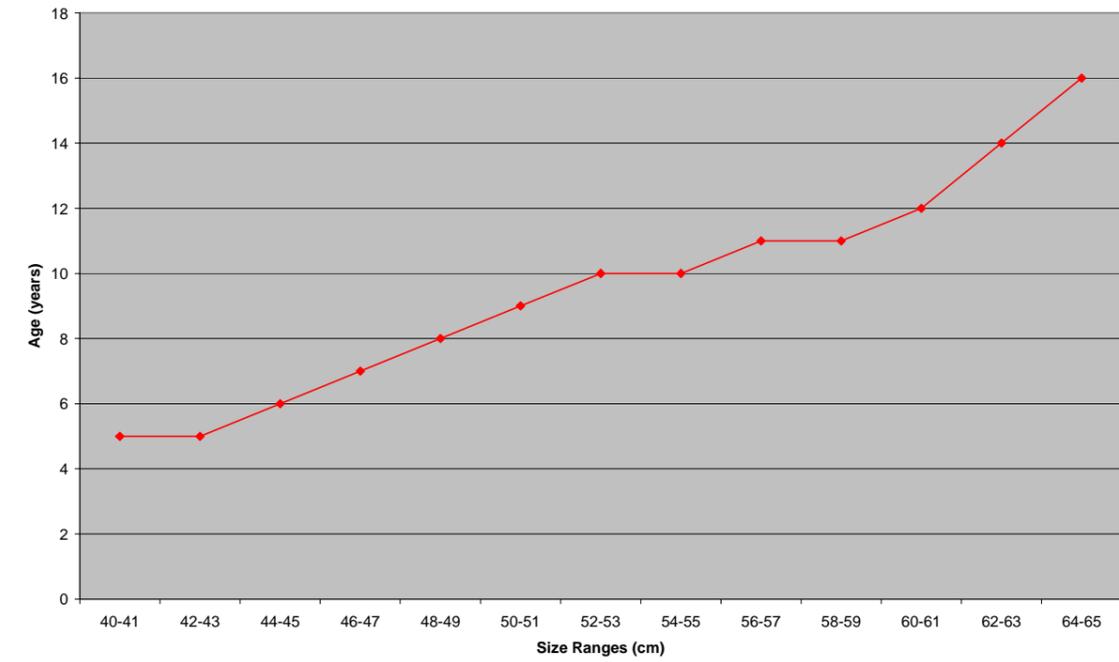
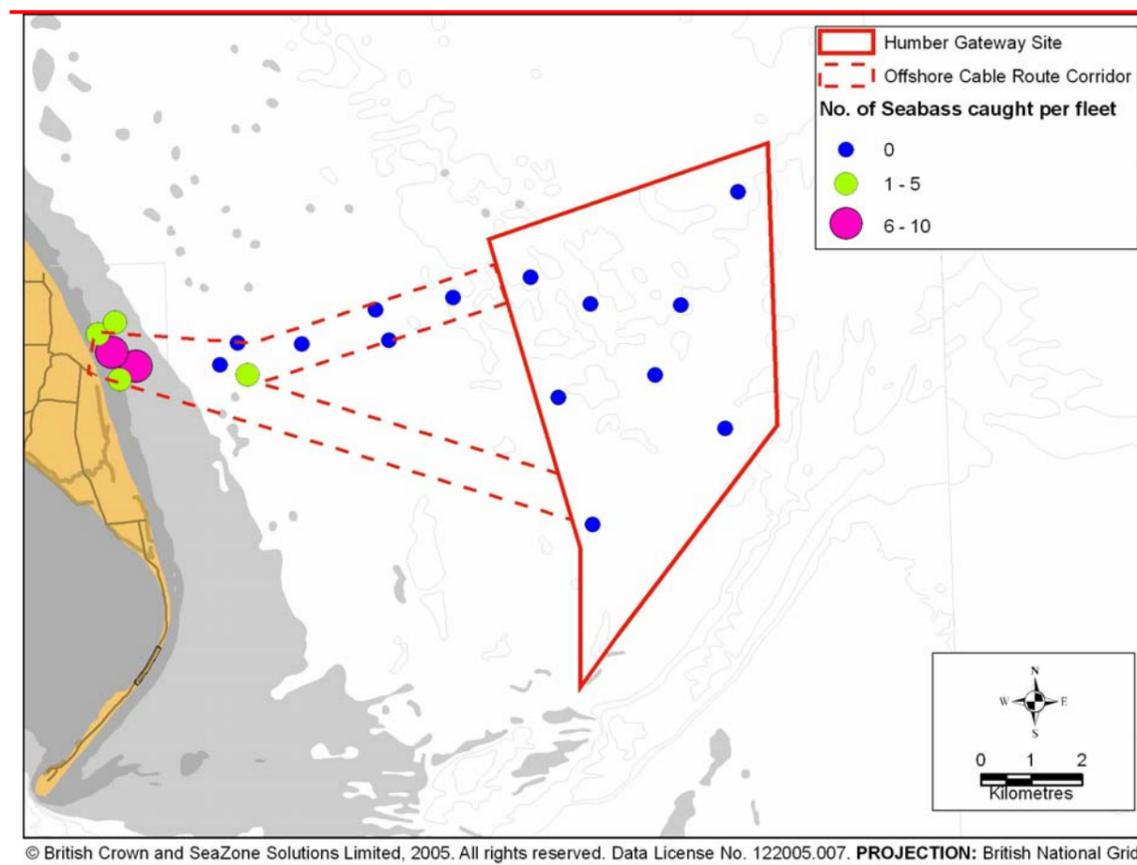


Figure 8.27 Abundance of Sea Bass**Dover Sole**

Sole is mainly found in the southern and eastern North Sea, south of the line from Flamborough to North Jutland. This line corresponds to the position of a steep temperature gradient that, in summer and autumn, divides the North Sea into a cold stratified northern section and a warm mixed southern section. Similar to plaice, older and bigger individuals tend to occur in deeper waters than the juveniles, but they remain largely restricted to waters of more than 50 m deep ⁽¹⁾.

Sole tend to occupy shallow, sandy and sandy/muddy habitats and such habitats are widespread in the North Sea. Tagging experiments support the suggestion that spawners return to the same spawning grounds year after year, but it is not known whether recruits return to the grounds where they were born. Dover sole

⁽¹⁾ Rijnsdorp A R & Beek F A van, 1991. Changes in growth of plaice *Pleuronectes platessa* (L.) and sole *Solea solea* (L.) in the North Sea Netherlands Journal of Sea Research 27(3/4): 441-457.

spawn in shallow inshore waters, close to sandbanks that are less than 30 m deep. The major spawning grounds for this species are located in the south in the North Sea and the northeast coast of England represents the northerly limit of its spawning range ⁽²⁾. The Holderness Coast and the Humber Gateway site are both within the most northerly spawning grounds and represent a small portion of the total spawning area (Figure 8.24).

Nurseries are situated all along the continental and English coasts in waters of a few metres depth, on sandy or muddy bottoms, but the relative contribution of the different regions to the recruitment to the total stock varies considerably from year to year. As sole is mainly found in the southern and eastern North Sea, nursery areas in the Humber region are likely to be at the northernmost edge of its distribution (Figure 8.28).

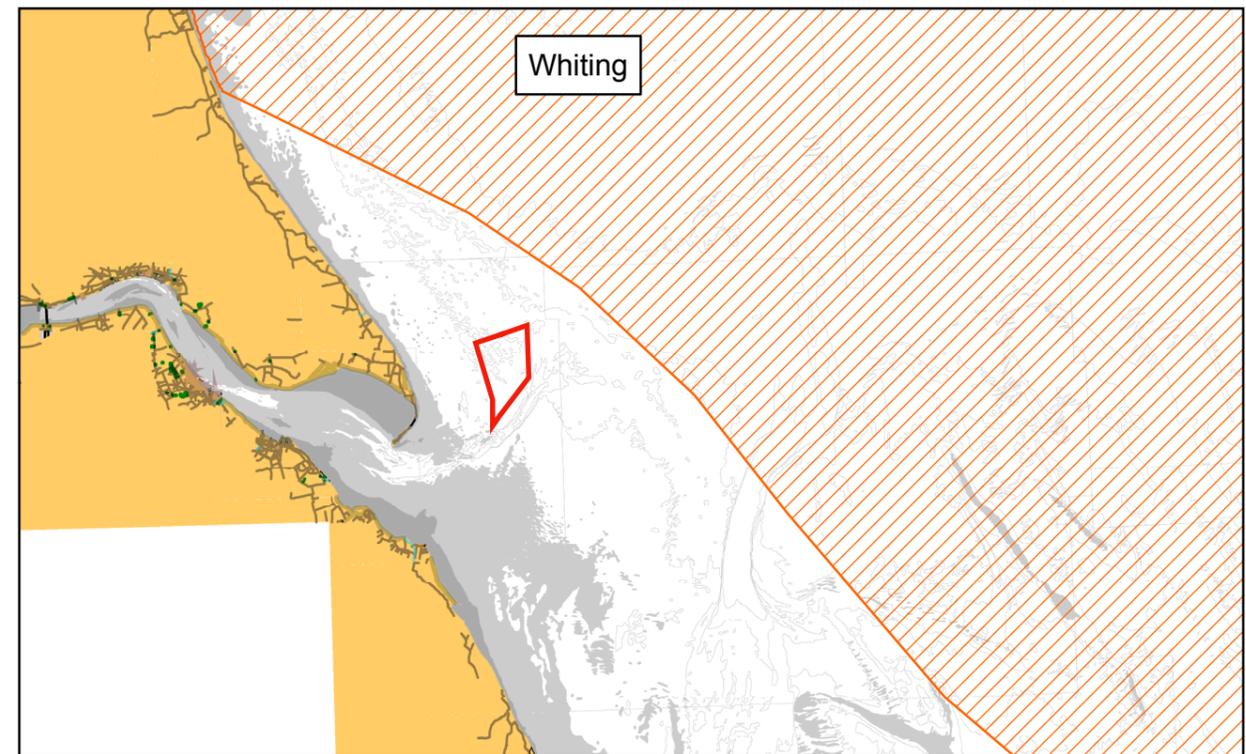
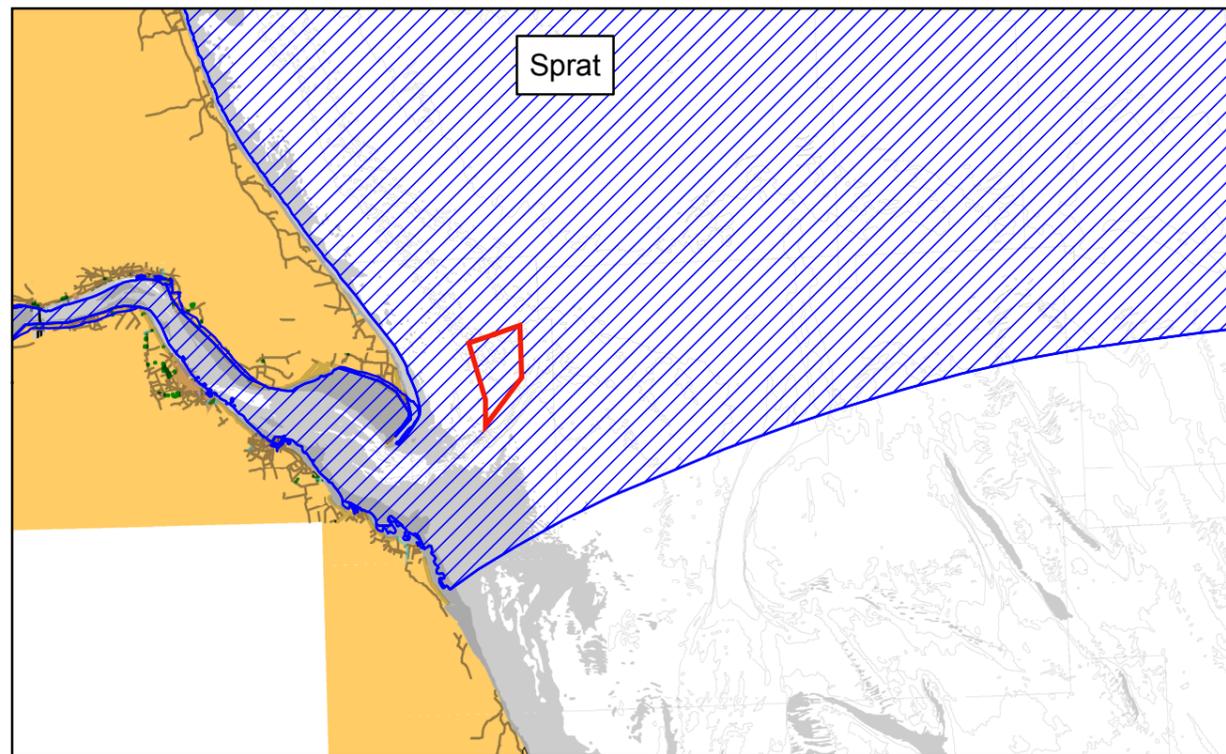
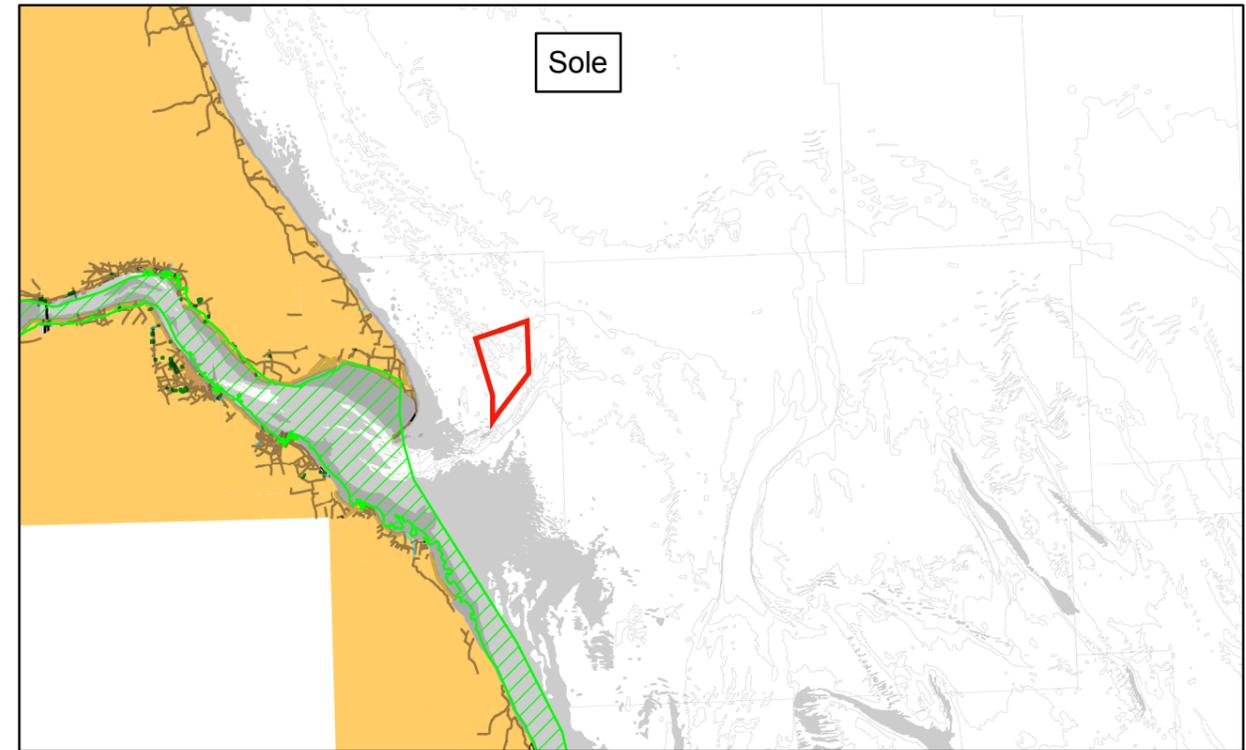
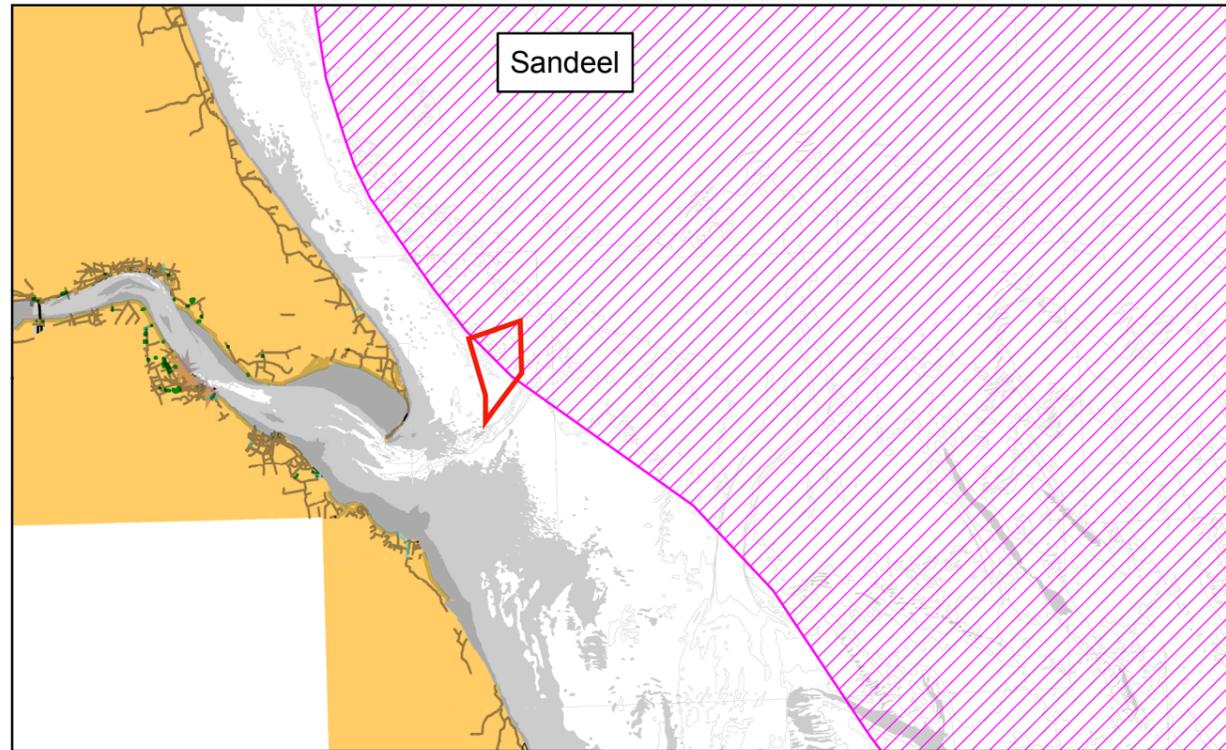
In severe winters, Dover sole may form dense aggregations in the deeper and less cold parts in the southern North Sea and the eastern Channel, migrating from shallower water to deeper water offshore. For instance, the Silver Pit, near the Humber Gateway site, owes its name to the valuable catches of sole made there during cold winters ⁽³⁾. Dover sole may therefore both migrate to and through the Humber Gateway site.

Sole is a nocturnal and olfactory feeder, spending the day buried in bottoms with fine sediments. The pelagic larvae feed on copepod nauplii whereas juveniles and adults feed mainly on polychaete worms, particularly *Arenicola marina*, *Janice* spp. and *Nereis* spp. but small echinoderms (eg brittlestars and the small sea urchin *Echinocyamus pusillus*) may also be eaten by adults ⁽⁴⁾.

⁽²⁾ ICES, 2003: Report of the Herring Larvae Surveys in the North Sea in 2002/2003. ICES CM 2003/ACFM:12.

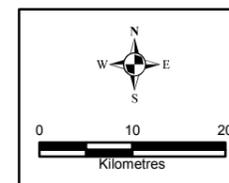
⁽³⁾ Woodhead P M J, 1964. Changes in the behaviour of the sole, *Solea vulgaris*, during cold winters, and the relation between the winter catch and sea temperatures. Helgoländer Wissenschaftliche Meeresuntersuchungen 10: 328-342.

⁽⁴⁾ Braber L, and Groot S J, de 1973. The food of five flatfish species (*Pleuronectiformes*) in the southern North Sea. Netherlands Journal of Sea Research 6 (1-2): 163-172.



KEY:

-  Humber Gateway Site
-  Sandeel Nursery
-  Sole Nursery
-  Sprat Nursery
-  Whiting Nursery



CLIENT:

e-on

SIZE:

A3

TITLE:

**Figure 8.28
Nursery Areas of Important
Species (Whiting, Sole,
Sprat, Sandeel)**

DATE: 05-12-2007	CHECKED: HV	PROJECT: 0022303
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Whiting

High densities of both small and large whiting may be found almost everywhere within the North Sea. The spatial pattern of the sea surface temperature appears to affect the spatial distribution of whiting in the northern North Sea during winter and spring. Where the water is relatively warm, whiting abundance is relatively high, probably reflecting the indirect influence of North Atlantic waters entering the northern North Sea. This positive relationship between abundance and sea surface temperature breaks down in summer ⁽¹⁾.

During spawning the pelagic eggs, which take about ten days to hatch, are shed in numerous batches over a period that may last up to 14 weeks ⁽²⁾. Juvenile whiting are found throughout the coastal waters, from 5 to 30 m depth, in eastern England, and so there are likely to be large numbers of juveniles in the vicinity of the Humber Gateway site. Whiting leave the nursery areas for the open sea after the first year of life. In the vicinity of the Humber Gateway site, the nursery areas of whiting are not found close to the development area or cable route (*Figure 8.28*) but are further offshore. Whiting undergo a similar migration to cod, moving further offshore as they grow older. There are also migrations inshore during spawning in the central region ⁽¹⁾.

The main prey of larval whiting is the larvae of copepods. Immature whiting feed on crustaceans such as euphausiids, mysids and crangonid shrimps. The importance of fish prey increases with size and whiting greater than 30 cm feed almost entirely on fish, including a variety of small species like Norway pout, sprat, sandeel, and younger age classes of herring, cod and haddock.

Whiting, especially juveniles, are an important prey for larger gadoids (including other whiting) and other demersal fish ⁽²⁾.

Lemon Sole

Lemon sole occur throughout the central and northern North Sea. Lemon sole are thought to spawn across this whole area but there is some evidence to suggest that spawning is confined to depths between 50 and 90 m in the northwestern North Sea ⁽³⁾. In the Humber region, lemon sole are known to

⁽¹⁾ ICES, 2006d. <http://www.ices.dk/marineworld/fishmap/ices/pdf/whiting.pdf> [cited September 2007]

⁽²⁾ Hislop J R G, Robb A P, Bell M A & Armstrong D W, 1991. The diet and food consumption of whiting (*Merlangius merlangus*) in the North Sea. *ICES Journal of Marine Science* 48: 139-156.

⁽³⁾ Froese R and Pauly D, (Eds). 2007. FishBase. World Wide Web electronic publication. www.fishbase.org, version (04/2007).

spawn in the Humber Estuary, the wider coastal area and within the Humber Gateway site and cable route areas (*Figure 8.24*). There do not appear to be any distinct patterns in distribution, or any extensive migrations, and adolescent and adults often occur in the same habitat. In the Humber region, the nursery areas cover the same area as the spawning grounds, including the Humber Gateway site (*Figure 8.28*). However, as lemon sole are likely to spawn in many locations the nursery and spawning areas in the Humber Gateway development area are unlikely to represent a significant portion of these habitats.

Sandeels

Sandeels are an important prey item for seabirds and commercially important fish species ⁽⁴⁾. Evidence suggests that sandeels spawn in areas close to the Humber Gateway site (*Figure 8.24*) but this represents one of a number of sites spread across the entire North Sea and only a small percentage of the total spawning area used by sandeels. Females scatter their eggs on the substratum (sand or gravel) where the eggs develop until hatching. However, sandeels are not reliant upon specific substratum types like herring ⁽⁴⁾.

Sandeels adopt a demersal habit after two to five months of hatching ⁽⁵⁾ and these areas can often overlap with areas where spawning occurs at other times of the year ⁽⁶⁾. Evidence suggests sandeel nursery areas are also within the Humber Gateway site (*Figure 8.28*).

Crustaceans

Juvenile crustaceans are found throughout the Humber Gateway site and cable route areas and are comparable to adjoining areas to the north. Commercially important crustacean species that spawn in the region are:

- brown crab *Cancer pagurus*;
- lobster *Homarus gammarus*; and
- velvet crab *Necora puber*.

The ecology of these species is discussed in *Section 8.4.4*.

⁽⁴⁾ Cefas, 2001. Technical report produced for Strategic Environmental Assessment - SEA2: North Sea Fish and Fisheries.

⁽⁵⁾ Wright P J & Bailey M C, 1996. Timing of hatching in *Ammodytes marinus* from Shetland waters and its significance to early growth and survivorship. *Marine Biology*, 126, 143-152.

⁽⁶⁾ Kunzlik P A, Gauld J A & Hutcheon J R. 1986. Preliminary results of the Scottish sandeel tagging project. ICES CM 1986/G:7.

Migratory Species

The twaite shad *Alosa fallax* is anadromous. This means that individuals spawn in freshwater, where they also feed and grow for approximately five months before heading downstream to the sea. Growth in the first year is fairly rapid, and juveniles can reach 5 cm in six months and 10 to 15 cm after one year ⁽¹⁾. Thereafter, growth is steady and most fish reach 20 to 25 cm after two years and 25 to 30 cm after three years. At maturity, adult twaite shad stop feeding and gather in the estuaries of suitable rivers between April and May, moving upstream to spawn. One individual of this species has been recorded within the Humber Gateway cable route area ⁽²⁾.

The Atlantic salmon *Salmo salar* is also anadromous and may also be found in the coastal waters off the Holderness Coast but is considered rare in comparison to the sea trout *Salmo trutta* which is common in the area and readily caught by commercial fixed engines (static nets). The south to north migration of this species may cause it to pass through the Humber Gateway development area but it is more likely to move inshore across the export cable route.

Sea lamprey *Petromyzon marinus* may pass through the Humber Gateway site and cable route areas to reach the Humber Estuary but are relatively rare. The river lamprey *Lampetra fluviatilis* migrates from the Humber to the open sea and may pass through the Humber Gateway site and cable route areas. Although more common than the sea lamprey, the river lamprey is still considered to be a rare or occasional migrant within the Humber Gateway development area and associated cable routes.

It should be noted that, although these species were not recorded in the surveys, it is considered that Atlantic Salmon *Salmo salar* will be present, as will the sea lamprey *Petromyzon marinus* and river lamprey *Lampetra fluviatilis*.

Only two species (twaite shad *Alosa fallax* (one individual) and Sea trout *Salmo trutta* recorded within the study area are protected by the *Habitats Directive* (Table 8.3). The species are listed on Annex IIa (species “of community interest whose conservation requires the designation of special areas of conservation”) and also Annex Va (“species of community interest whose taking in the wild and exploitation may be subject to management measures”). However, there are no areas designated for the protection of these species within the southern North Sea.

⁽¹⁾ Aprahamian M W, 1988. The biology of the twaite shad *Alosa fallax fallax* (Lacépède) in the Severn Estuary. *Journal of Fish Biology* 33A, 141-152.

⁽²⁾ Potts G W & Swaby S E, 1993. Marine fishes on the EC Habitats and Species Directive. Peterborough: Joint Nature Conservation Committee. (Confidential report to the Joint Nature Conservation Committee).

The nearshore coastal margin of the Holderness Coast is considered to be a key migratory corridor for juvenile flatfish. However, there was no significant abundance of juvenile flatfish in the Humber Gateway site or cable route areas during the trawl or trammel net surveys (although this may have been a result of the type of survey equipment used).

Elasmobranchs

A number of elasmobranch species are known to occur in the vicinity of the Humber Gateway site and throughout the North Sea and are landed as bycatch including spurdog *Squalus acanthias*, lesser spotted dogfish *Scyliorhinus canicula*, smooth hound *Mustelus mustelus*, Starry smooth hound *Mustelus asterias*, tope *Galeorhinus galeus*, thornback ray *Raja clavata* and spotted ray *R. montagui*.

Within the North Sea, interest in these species increased when it was demonstrated that elasmobranchs in general were susceptible to overfishing ⁽³⁾. Specific management advice for elasmobranchs affected by fishing interests in the North Sea was formulated in 1997 ⁽⁴⁾, the available data indicating that stocks were outside safe biological limits.

Of the shark species, smooth hound in particular are common to the area and migrate parallel to the coast. Rays are also common in the area. Currently thornback rays are most abundant in the south-western North Sea, especially in the Outer Thames Estuary and the Wash ⁽⁵⁾. These areas also include spawning and nursery grounds often encountered in inshore waters. Adults undertake seasonal migrations, moving into shallower water during summer and offshore in winter. This migration pattern, common to other ray species, is likely to cause some adults to move through the Humber Gateway site.

Three elasmobranch species have been encountered during site-specific surveys. Thornback ray *Raja clavata* and smooth hound shark *Mustelus* spp. were encountered during the March 2005 trawl surveys of the Humber Gateway site and cable route areas. During the March 2007 trammel net survey, eight thornback rays and 167 lesser spotted dogfish *S. canicula* were encountered within the Humber Gateway site and cable route areas.

⁽³⁾ Stevens J D, Bonfil R, Dulvy N K. & Walker P A. 2000. The effects of fishing on sharks, rays and chimaeras (*Chondrichthyans*) and the implications for marine ecosystems. *ICES Journal of Marine Science*, 57, 476-494.

⁽⁴⁾ Dann N, Heessen H. and Hofstede R. ter, 2005. North Sea Elasmobranchs: distribution, abundance and biodiversity. ICES CM 2005/N: 06.

⁽⁵⁾ Cefas, 2001. Technical report produced for Strategic Environmental Assessment - SEA2: North Sea Fish and Fisheries.

During the trammel net survey, a large number of egg cases were found attached to the fishing gear. During examination of the lesser spotted dogfish, a high percentage of females released egg capsules whilst being handled and several other females contained eggs or had recently spawned. Clearly the lesser spotted dogfish is spawning in the area and spawns in spring between March and April.

Tope and common skate are also listed on the World Conservation Union (IUCN) Red List of Threatened Species and common skate are the subject of a Species Action Plan. Common skate can be found at low densities throughout the northern part of the North Sea, but are rarely encountered in the southern North Sea ⁽¹⁾.

⁽¹⁾ Cefas, 2001. Technical report produced for Strategic Environmental Assessment - SEA2: North Sea Fish and Fisheries.

8.6 MARINE MAMMALS

8.6.1 INTRODUCTION

Overview

This section describes the baseline marine mammal ecology, in the vicinity of the Humber Gateway site and cable route areas.

Marine mammals found in the waters around Britain comprise cetaceans (whales and dolphins) and pinnipeds (seals). Information has been gathered from existing sources on distribution and abundance of marine mammals in the southern North Sea area around the Humber Gateway site. Information from specific surveys has also been used to provide a more accurate baseline for the site, where possible.

Consultation

Natural England was consulted on the scope of the marine mammal survey and their comments were taken into consideration when undertaking the work. The results of the marine mammal survey are presented in *Section 8.6.3*.

A number of other organisations were contacted and asked for any relevant data relating to marine mammals in the vicinity of the Humber Gateway site.

Organisations contacted included:

- Sea Mammal Research Unit;
- Doncaster Museum;
- Yorkshire Mammal Group;
- Whale and Dolphin Conservation Society;
- Marine Conservation Society;
- Mammal Society;
- Humber Data Centre; and
- British Divers Marine Life Rescue.

A detailed bibliography was provided by Doncaster Museum which has been used in the following section as appropriate.

Relevant Policies and Plans

Marine mammals are protected by conservation legislation, with all species of cetacean covered by Annex IV of the *Habitats Directive*. This Directive prohibits the keeping, sale or exchange, deliberate capture, killing or disturbance of the species listed. In addition, the harbour porpoise, bottlenose dolphin, grey seal and common seal are listed in Annex II of the *Habitats Directive*, under which SACs can be established. As a result of this, a number of terrestrial candidate SACs (cSACs) have been established for grey or common seals (including in The Wash) with marine cSACs proposed in the Moray Firth and Cardigan Bay for the bottle-nosed dolphin. Dolphins, porpoises and whales (all species) are also included in Schedule 2 of the *Habitats Regulations 1994*.

To date, no cSACs have been announced for the harbour porpoise, however offshore SAC sites are currently being investigated and the harbour porpoise is one of the species being considered ⁽¹⁾. This species is also subject to a Biodiversity Action Plan classification. All species of cetacean are protected in England through the *Wildlife and Countryside Act 1981*.

Seals are covered by the *Conservation of Seals Act 1970*, although it is legal for seals to be killed to prevent damage to nets or fish within nets. Seals are also protected by the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS) and the Bern Convention.

8.6.2 MARINE MAMMAL SURVEY METHODOLOGY

A site specific marine mammal survey was carried out on behalf of E.ON ⁽²⁾ in order to evaluate the presence of marine mammals both within the Humber Gateway site, the cable route areas and adjacent waters (*Appendix E1*). In addition, marine mammal sightings were also recorded during the aerial and vessel based seabird surveys of the site. These were conducted monthly over a two year period and a dedicated marine mammal surveyor was used on the vessel on four separate occasions to augment these incidental records.

The aerial and boat-based survey transects are the same as those described in the ornithology section (*Section 8.7*) and are shown in *Figure 8.34* and *Figure 8.35* respectively. The survey site and transect routes for the boat based surveys covered the Humber Gateway site and a control site. The aerial survey consisted of two sets of transects that covered a large area around the wind farm

⁽¹⁾ Johnston C M, Turnbull C G, & Tasker M L. 2002. Natura 2000 in UK Offshore Waters: Advice to support the implementation of the EC Habitats and Birds Directives in UK offshore waters. JNCC Report, No. 325, Peterborough.

⁽²⁾ RPS, 2005. Humber Gateway Marine Mammal Survey Report.

site to ensure adequate coverage for control data. Both sets of transects overlap substantially and both cover a much larger area than the Humber Gateway site.

Initially, surveys were conducted in conditions up to sea state 4, in order to ensure that it was possible to collect data during all the winter months. During this period, the preferred maximum sea state of 3, as set out in COWRIE guidelines⁽¹⁾, did not occur for several weeks at a time. Therefore, on the recommendation of Natural England (formerly English Nature), surveys during the second half of 2004 and into 2005 were not carried out in conditions above sea state 3, with a reduced frequency requirement of surveys during the winter months. This allowed for more leeway in survey timing and a greater potential for programme completion, whilst still maintaining a robust survey methodology that was acceptable to Natural England.

Marine mammal observations taken during the seabird surveys were conducted on a monthly basis, if the conditions were predicted to be better than sea state 5 and with a wind speed less than force 6 on the Beaufort scale. During four survey trips between May 2004 and April 2005 a marine mammal surveyor, dedicated to spotting and recording marine mammals, was present on the vessel. A sea state of less than 3 and good visibility was specified for the marine mammal survey trips to maximise the chances of seeing marine mammals, in particular harbour porpoises and seals. In order to account for effort intensity, sightings were indexed against distance travelled during the survey. Indices of sightings are therefore reported as animals per km to allow comparisons between different areas or periods of time.

Observations were conducted by alternate scanning with the naked eye and binoculars. Signs indicating the presence of animals e.g. spray, dark shapes or regular splashes were checked using binoculars. Range was estimated by eye but checked using radar targets. The time of the sightings of marine mammals was recorded and position obtained from the GPS logger after the survey. Data included species, numbers of animals and whether calves, pups or immature animals were present.

⁽¹⁾ Camphuysen K, Fox T, Leopold M & Petersen I K, 2004. *Towards standardised seabirds at sea census techniques in connection with environmental impact assessments for offshore wind farms in the U.K.* Commissioned by COWRIE.

8.6.3 SPECIES ACCOUNTS

Overview

This section summarises the results of the marine mammal surveys and published data to describe the baseline with regard to marine mammals.

In summary, the surveys confirmed that common seal *Phoca vitulina vitulina*, grey seal *Halichoerus grypus* and harbour porpoise *Phocoena phocoena* occurred in the study area throughout the year. A total of 88 harbour porpoises, 78 grey seals and eight common seals were recorded. One other species of cetacean was seen but could not be identified to species level. A total of 30 unidentified seals were recorded, the majority of which were thought likely to be grey seals given the relative abundances of each species recorded.

Cetaceans

Introduction

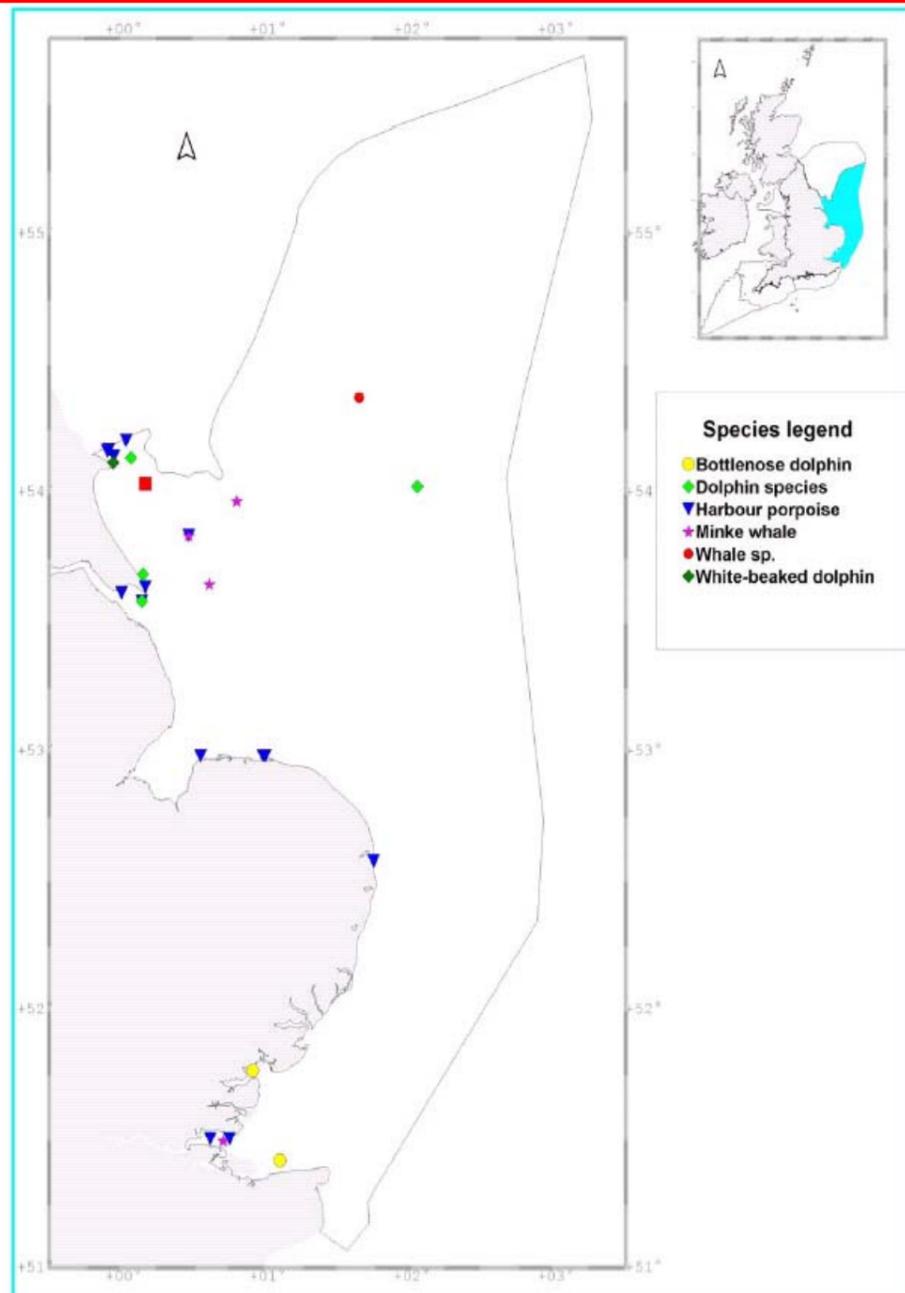
There are two main sub-orders of cetacean, namely odontocetes and mysticetes. The odontocetes, or toothed whales, include dolphins and porpoises and are generally smaller than mysticetes. Many of these species are commonly encountered in shallower coastal waters. Mysticetes, or baleen whales, are larger filter feeding species and tend to inhabit deeper waters. Some UK species, such as the minke whale, are relatively common near the coast. Odontocetes are more common in the Humber Gateway area.

Cetaceans are generally more common in the northern North Sea, becoming less abundant in number and species in the more southerly areas. Four species of cetacean are regularly reported within the southern North Sea (Figure 8.29):

- harbour porpoise *Phocoena phocoena*;
- white-beaked dolphin *Lagenorhynchus albirostris*;
- bottle-nosed dolphin *Tursiops truncatus*; and
- Minke whale *Balaenoptera acutorostrata*.

Species that are occasionally observed within the study area are humpback whale *Megaptera novaeangliae*, sperm whale *Physeter macrocephalus*, long-finned pilot whale *Globicephala melas*, killer whale *Orcinus orca*, short-beaked common dolphin *Delphinus delphis* and Atlantic white-sided dolphin *Lagenorhynchus acutus*.

Figure 8.29 Cetacean Sightings in the Southern North Sea



Source: Evans et al, 2003 ⁽¹⁾

⁽¹⁾ Evans, P G H, Anderwald P & Baines M E, 2003. UK cetacean status review. Report by Sea Watch Foundation to English Nature & Countryside Council for Wales.

Harbour Porpoise

The harbour porpoise is the smallest and most abundant of all cetaceans. It is found throughout the temperate waters of the north Atlantic and north Pacific Oceans and adjoining seas. It is the most frequently sighted cetacean species in the North Sea, sighted throughout the year, particularly between July and November when calving occurs. Harbour porpoises are generally seen in small groups of up to three individuals. Population estimates suggest that approximately 280,000 occur in the North Sea ⁽²⁾.

Within the North Sea, harbour porpoises are found more commonly in the central and north western regions, with fewer sighted within the south and southeastern regions. However, the area around Spurn Head and the outer Humber Estuary is considered to be an important coastal site in England for harbour porpoise, and they are known to occur within the vicinity of the Humber Gateway site.

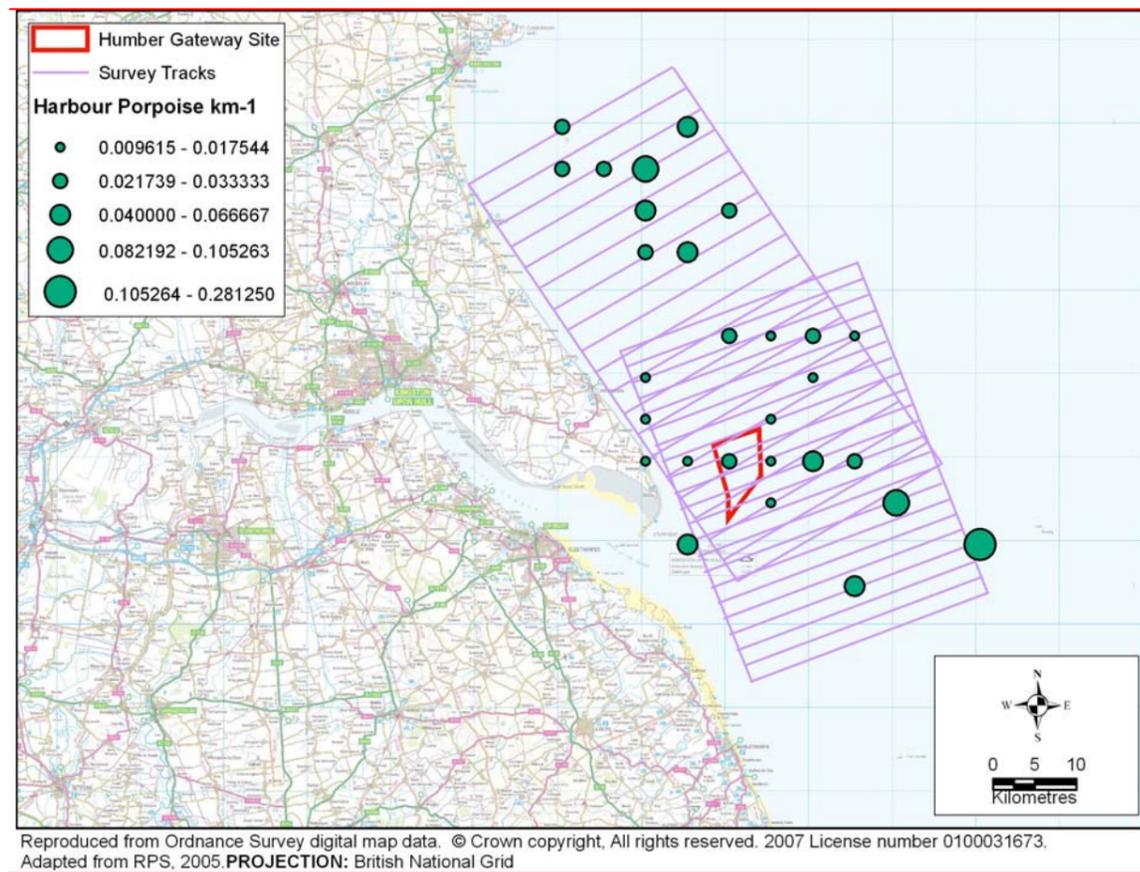
The site specific survey data indicate that numbers of harbour porpoise are relatively low in comparison to previous studies which reported distance-based sightings indices. However, the data show a wide distribution across the study area and common occurrence in and around the Humber Gateway site. The survey results are shown in *Table 8.4* and *Figure 8.30*.

Table 8.4 Overall Sighting Summary and Sightings Indices for Harbour Porpoises (number recorded km⁻¹)

Survey	Distance Travelled (km)	Number of Animals	Sightings Index	Abundance
Boat based vessel bird survey	2,020	19	0.009	Low
Aerial survey	6,372	55	0.009	Low
Dedicated marine mammal survey	366	10	0.027	Low to moderate

⁽²⁾ Reid J B, Evans P G H and Northridge S P, 2003. Atlas of Cetacean distribution in north-west European Waters. JNCC, Peterborough.

Figure 8.30 Harbour Porpoise Sightings



As would be expected, the marine mammal survey recorded significantly higher numbers of porpoises, given the intensity of the survey.

Several calves or juveniles were observed during three sightings of this species, indicating that nursing females use the area. It is reported that porpoises give birth mainly in spring and summer, however calves have been recorded throughout the year around the UK ⁽¹⁾.

The survey data were inconsistent in terms of seasonal changes of porpoise population. Data collected during the aerial and vessel survey indicated peak populations in summer, while the dedicated marine mammal survey detected no porpoises in summer (*Table 8.5*).

⁽¹⁾Benson C., Coast Watch. 2007. Pers comm.

Table 8.5 Relative Abundance Indices for Harbour Porpoise across Seasons (number recorded km⁻¹)

Season	Aerial Survey Data	Vessel Survey Data	Dedicated Marine Mammal Survey Data
Spring	0.004	0.008	0.039
Summer	0.233	0.015	0
Autumn	0.011	0.008	0.012
Winter	0	0.011	-

White-Beaked Dolphin

The white-beaked dolphin is the most common dolphin species in the North Sea ⁽²⁾. Its distribution is limited to the North Atlantic and European continental shelf where it is common and widespread in offshore waters. Like most cetacean species in the North Sea, this species is more common in the northern North Sea, occurring more frequently off the Scottish and northeast English coasts. Sightings do occur throughout the year, but are most common in the late summer or early autumn ⁽³⁾.

Bottle-Nosed Dolphin

The bottle-nosed dolphin has a very wide distribution, occurring in both temperate and tropical areas around the globe. It is also very adaptable, being found in a variety of habitats from estuaries to open oceans. In coastal waters, this species often favours river estuaries, headlands and sandbanks due to the irregular bottom-relief and strong tidal currents ⁽³⁾. This is similar to the coastal habitat in the vicinity of the Humber Gateway site.

However, the bottle-nosed dolphin is less common in the southern North Sea than either the harbour porpoise or white-beaked dolphin. Its distribution is generally limited to the waters off Scotland and northern England. It is rarely reported around the Humber Estuary area.

⁽²⁾ Evans P G H, Wales, Dolphins and Porpoises. In Barne J H, Robson C F, Kaznowska S S, Doody J P and Davidson N C. Eds, 1995. Coasts and Seas of the United Kingdom. Region 6 Eastern England: Flamborough Head to Great Yarmouth, Peterborough, JNCC.

⁽³⁾ Reid J B, Evans P G H and Northridge S P, 2003. Atlas of Cetacean distribution in north-west European Waters. JNCC, Peterborough.

Minke Whale

One species of baleen whale, the minke whale, occurs occasionally in the Humber region, especially off Flamborough Head. This is because they seek warmer waters in the late summer or early autumn and feed in the plankton frontal system that occurs in this area. Minke whales are rarely seen in the North Sea to the south of the Humber Estuary ⁽¹⁾. Due to their preference for coastal waters, most sightings are made between May and September and within 100 km of the coast. Individuals usually occur singly or in pairs ⁽²⁾, but have been known to form larger groups during feeding.

Other Cetaceans

The following six cetacean species have historically been sighted in the southern North Sea on occasion:

- humpback whale *Megaptera novaeangliae*;
- sperm whale *Physeter macrocephalus*;
- long-finned pilot whale *Globicephala melas*;
- killer whale *Orcinus orca*;
- short-beaked common dolphin *Delphinus delphis*; and
- Atlantic white-sided dolphin *Lagenorhynchus acutus*.

The long finned pilot whale occasionally occurs within the Humber region, generally during the autumn months. This species is uncommon in the North Sea as it tends to prefer the deeper waters found at the edge of the continental shelf. It often becomes stranded on beaches after entering shallow waters. Although strandings were recorded in the 1980s, the National Whale and Dolphin Stranding Recording Scheme has not recorded any on the east coast of England in recent years ⁽³⁾.

Killer whales frequent the North Sea on occasion, with small pods sighted off Hornsea and Flamborough Head in November 1990 and July 1995 respectively. There have been no sightings of the other species listed in recent years.

⁽¹⁾ Reid J B, Evans P G H and Northridge S P, 2003. Atlas of Cetacean distribution in north-west European Waters. JNCC, Peterborough.

⁽²⁾ Evans P G H, 1995. Guide to the Identification of Whales, Dolphins and Porpoises in European Seas. Sea Watch Foundation, Oxford.

⁽³⁾ Natural History Museum Website, 2007. <http://www.nhm.ac.uk/research-curation/projects/strandings/> [cited October 2007].

Seals

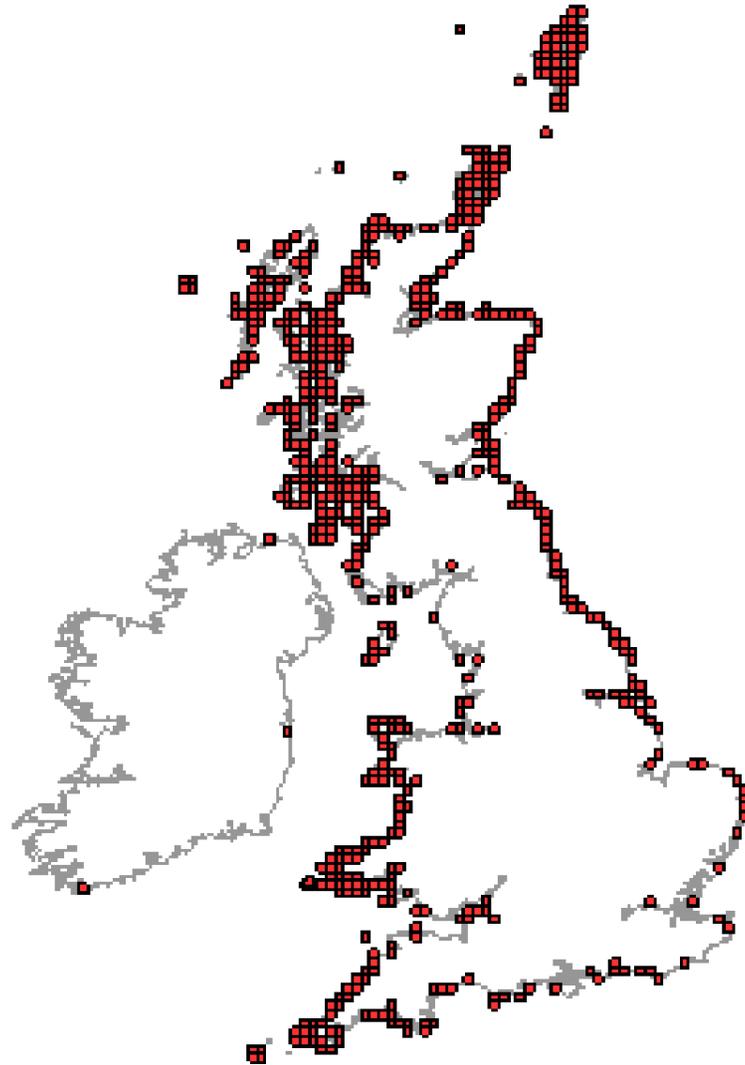
Introduction

There are two species of seal commonly found in British waters, the grey seal *Halichoerus grypus* and the common or harbour seal *Phoca vitulina vitulina*.

Grey Seal

Grey seals are the larger and more abundant of the two species in British waters, with around 12,000 animals (over 40% of the world's population) breeding in Britain. Distribution in the UK is centred in the northwest around the Hebrides and Northern Isles, although grey seals are common around the coasts of Scotland and Northern England. A map of distribution is shown in *Figure 8.31*.



Figure 8.31 Grey Seal Distribution – Presence in 10 km Grid Squares

Source: NBN Gateway, 2007 ⁽¹⁾

⁽¹⁾ NBN Gateway, 2007. www.searchnbn.net [cited November 2007]. Data providers; Biological Records Centre, Bristol Regional Environmental Records Centre, Countryside Council for Wales, Devon Biodiversity Records Centre, Highland Biological Recording Group, Joint Nature Conservation Committee, Marine Biological Association, Scottish Natural Heritage.

A large colony of grey seals exists at Donna Nook, approximately 14 km to the south of the Humber Gateway site on the Lincolnshire coast. This site is one of the largest and most accessible breeding colonies of grey seals in the UK and accounts for 9% of the UK population ⁽²⁾. The number of pups born at monitored sites (which include Donna Nook) has shown an increasing trend since 1984 ⁽³⁾. The total UK population in 2005 is estimated to be between 97,000 and 159,000. A total of 1,276 pups were born at Donna Nook during 2005 ⁽³⁾.

Grey seals on the east coast of Britain were studied between 1985 and 1991 to determine their distribution and movement ⁽⁴⁾. The seals tracked during the study moved between the north of St. Andrew's Bay to south of the Wash, up to 300 km offshore. The study concluded that long distance movements are important to grey seals and that animals off the east coast of Britain must be considered as a single population unit. This study considers the Humber Gateway turbine site and cable route areas to be of low density for grey seal usage.

Tagging studies of grey seals from the Farne Islands showed that although long distance trips to other haul out sites are not uncommon, most foraging seals (88%) returned to their current haul out. The majority of return foraging trips were short (mean duration 2.33 days, mean distance 39.8 km), although the distance of foraging trips will ultimately depend on the distribution of prey species ⁽⁵⁾.

Grey seals pup during the winter between October and January, with males coming ashore before females and securing a territory. Females give birth and suckle their young for three weeks, during which time females will often not feed. This is particularly the case if there is no immediate sea access from the rookery. The Stonebridge rookery at Donna Nook has limited access to the sea and females here have been reported to stay with their pups until they are weaned ⁽⁶⁾.

Grey seals feed primarily on fish living on or close to the seabed, particularly sandeels, whitefish and flatfish, averaging 4 to 7 kg fish per seal per day ⁽³⁾.

⁽²⁾ Jones L A, Coyle M D, Evans D, Gilliland P M, & Murray A R, Southern North Sea Marine Natural Area Profile: A contribution to regional planning and management of the seas around England. Peterborough: English Nature.

⁽³⁾ SCOS, 2006. Scientific advice on matters related to the management of seal populations. Special Committee on Seals, UK.

⁽⁴⁾ Hammond P S, McConnell B J, & Fedak M A, 1993. Grey seals off the east coast of Britain: distribution and movements at sea. Symposium of the Zoological Society of London, 66, 211–224.

⁽⁵⁾ McConnell B J, Fedak M A, Lovell P, Hammond P S, 1999. Movements and foraging areas of grey seals in the North Sea. The Journal of Applied Ecology Vol. 36 No. 4.

⁽⁶⁾ Lidgard 1996. The Effects of human disturbance on the maternal behaviour and performance of grey seals (*Halichoerus grypus*) at Donna Nook, Lincolnshire, UK.

The site specific surveys showed that within the study area grey seals were more commonly encountered than common seals, with a total of 78 animals from 74 sightings (Table 8.6 and Figure 8.32).

Grey seals were distributed widely across the whole of the study area, and did not show any seasonal distribution patterns. However grey seal numbers peaked in the summer and autumn, with higher numbers recorded from both the aerial and vessel based bird surveys and an autumn peak from the marine mammal survey data shown in Table 8.7. These increases were thought to be linked to seals gathering in the area around the rookery at Donna Nook prior to the breeding season.

Figure 8.32 Grey Seal Sightings

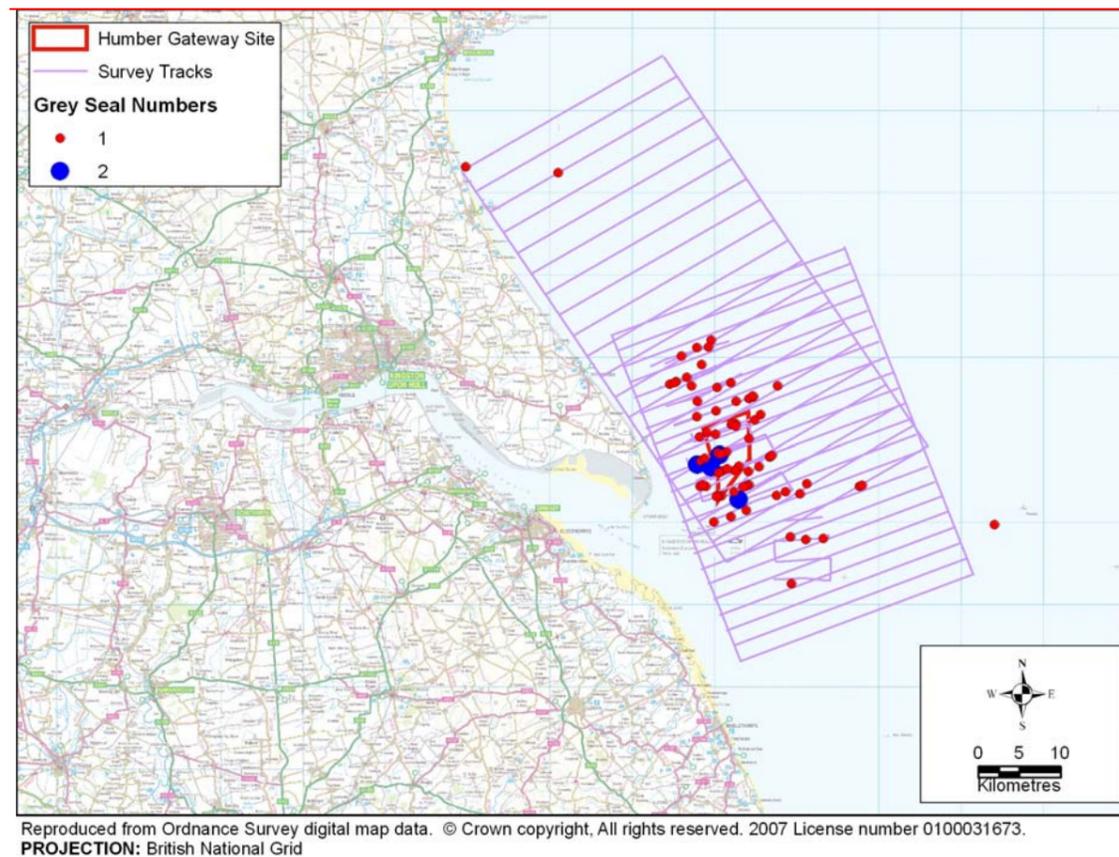


Table 8.6 Overall Sighting Summary and Sighting Indices for Grey Seals (number recorded km⁻¹)

Survey	Distance Travelled (km)	Number of Animals	Sightings Index	Abundance
Vessel bird survey	2020	45	0.022	Low
Aerial survey	6372	12	0.0018	Low
Marine mammal survey	366	21	0.057	Moderate

Table 8.7 Relative Abundances for Grey Seals across Seasons (number recorded km⁻¹)

Season	Aerial Survey Data	Vessel Bird Survey Data	Marine Mammal Survey Data
Spring	0.0013	0.01	0.056
Summer	0.043	0.69	0.04
Autumn	0.0057	0.026	0.08
Winter	0	0.0095	-

Overall the abundance of grey seals in the study area was reported to be low to moderate in comparison to other UK coastal waters.

Common Seal

There are 50,000 to 60,000 common seals in British waters, around 45% of the European population and 5% of the total world population ⁽¹⁾.

Common seals in the UK are found primarily along the west coast of Scotland, throughout the Hebrides and Northern Isles, with the east coast distribution being more restricted. The main concentrations on the east coast are in the Moray Firth, Tay Estuary and The Wash (Figure 8.33). 88% of the population is in Scotland and 12% in England, with The Wash harbouring the largest population in England. In 2000, population estimates in The Wash stood at around 2,124

⁽¹⁾ SCOS, 2006. Scientific advice on matters related to the management of seal populations. Special Committee on Seals, UK.

animals and 470 at Donna Nook ⁽¹⁾. Seal numbers were significantly reduced in the 1990s through a seal distemper virus outbreak, thus these figures indicate strong recovery of The Wash population to pre-epidemic numbers.

Common seals feed locally, taking a variety of prey but mainly sandeels, whitefish, herring, sprat, flatfish, octopus and squid. They have a requirement for 3 to 5 kg of food per day ⁽¹⁾.

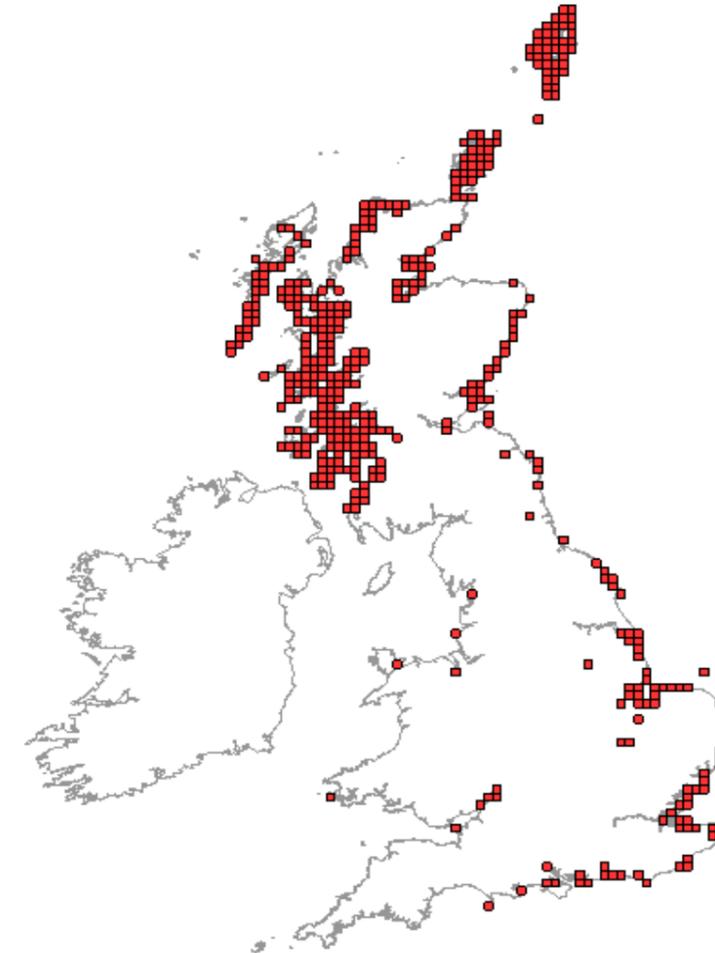
Common seals forage generally within 50 km of their haul out site ⁽²⁾. Common seals may change haul out sites to be closer to better foraging grounds, to join new social groups or to move to a site more suitable for pupping. Females tend to be faithful to pupping grounds and return to breed between June and September year after year. Donna Nook, a known haul out area for common seals, is located approximately 14 km to the south of the Humber Gateway site, on the north Lincolnshire coast.

Common seals come ashore to breed in June and July. As the pups disperse, numbers have been found to increase around Spurn, the Holderness Coast and Filey Bay ⁽³⁾. The Humber Gateway site does not contain exposed sandbanks suitable as seal pupping sites. Whilst suitable sandbanks exist on Spurn Head, it is not thought that they are used for pupping by common seals.

During the vessel-based surveys, eight records of common seal were obtained. None were recorded during the aerial survey perhaps due to difficulties of identification from the air. The records spanned the vessel study area from north to south and east to west and thus are occasionally present in or around the Humber Gateway site.

Common seals were only recorded singly and although three were recorded during one winter survey, this was too few to suggest any seasonal trends. Two were recorded during the summer and one in the spring. The number of common seal records were not sufficient for relative abundance maps.

Figure 8.33 Common Seal Distribution - Presence in 10 km Grid Squares



Source: NBN Gateway, 2007 ⁽⁴⁾

⁽¹⁾ SCOS, 2006. Scientific advice on matters related to the management of seal populations. Special Committee on Seals, UK.

⁽²⁾ Fedak M A & Thompson D, Behavioural and physiological options in diving seals. *Symp Zool Soc Lond* 66:333 – 348.

⁽³⁾ Allen J, Boyes S, Burdon D, Cutts N, Hawthorne E, Hemingway K, Jarvis S, Jennings K, Mander L, Murby P, Proctor N, Thomson S & Waters R. 2003. The Humber Estuary: A comprehensive review of its nature conservation interest. English Nature Research Report 547.

⁽⁴⁾ NBN Gateway, 2007. www.searchnbn.net [cited November 2007]. Data providers; Biological Records Centre, Bristol Regional Environmental Records Centre, Countryside Council for Wales, Marine Conservation Society, Highland Biological Recording Group.

8.7 ORNITHOLOGY

8.7.1 INTRODUCTION

Overview

This section summarises the baseline ornithological environment in the vicinity of the Humber Gateway site, including the main designated sites of ornithological importance, the findings of dedicated bird surveys and published information about bird species and populations in the area.

Separate consideration is also given to the effects of the proposals on European designated sites in accordance with the requirements of the *Conservation (Natural Habitats, &c.) Regulations 1994* as amended (*Section 14*).

This section has drawn on surveys carried out specifically for this project, plus a number of other sources of information, as listed below.

- An extensive two year survey programme was undertaken on and around the Humber Gateway site between September 2003 and December 2005. This was part of the EIA and in accordance with relevant survey guidance and best practice, and included both aerial surveys and boat-based surveys. Three additional months of surveys were also undertaken between September and December 2005, over and above that requested by Natural England. This was undertaken to verify previous data and provide three years of data covering the passage and early winter period. Full details are provided in *Section 8.7.3* and in a report entitled *Seabird Survey Programme Findings Humber Gateway Wind Farm* (15 March 2007) undertaken by the Institute of Estuarine and Coastal Studies (IECS), University of Hull, which is contained in *Appendix D1*.
- An additional, dedicated little gull *Larus minutus* survey undertaken in October 2005 to determine the passage movements of little gull across the Humber Gateway site. This followed consultation with Natural England (see below and *Section 8.7.3*). October is the peak period of passage movement along the east coast of England.
- A review of bird records from the Spurn Bird Observatory, made available by the Spurn Bird Observatory Trust, for a seven year period between 1999 and 2005. Peak numbers and months of occurrence of key bird species at the Observatory are provided in *Appendix D1*.

- The findings of a radar study undertaken near the Spurn Bird Observatory by the Central Science Laboratory (CSL) in late October 2004. There are currently many difficulties with the use of this technology to assess offshore bird movements, and whilst radar is not a current survey requirement for offshore wind farms, COWRIE guidance suggests the need for continuing development of monitoring techniques, other than aerial and boat-based surveys. This study was therefore seen as contributing to the development process and was undertaken following consultations with the Natural England and the Yorkshire Wildlife Trust (*Section 8.7.3*).
- Published information sources, which are referenced throughout, for example findings from the Seabird 2000 surveys as reported in Mitchell et al (2004)⁽¹⁾ and published atlases on seabirds.

Consultation

In addition to the above sources of information, key statutory and non-statutory organisations were consulted throughout the EIA. The following organisations provided information and views on the baseline ornithology and survey requirements:

- Natural England (NE);
- the Royal Society for the Protection of Birds (RSPB); and
- the Yorkshire Wildlife Trust (YWT).

The scope of and approach to the baseline surveys was discussed and agreed with NE, YWT and RSPB, including any refinements made, for example, to the survey area, the survey methods and species covered, and to ensure that the work undertaken conformed to expected standards and best practice (*Section 8.7.3*).

The ornithological surveys undertaken as part of this EIA reflect these consultations and in particular:

- the dedicated little gull survey which was undertaken following discussions of initial survey findings with NE and YWT; and
- the radar study which was progressed in discussions with NE and the YWT.

⁽¹⁾ Mitchell P I, Newton S F, Ratcliffe N & Dunn T, 2004. Seabird Populations of Britain and Ireland. T & A D Poyser.

Some changes to the aerial surveys were also made following discussions and agreement with consultees. These are discussed in *Section 8.7.3*.

The review of the bird data provided by the Spurn Bird Observatory Trust also reflected discussions with YWT about the use of this information from Spurn and where possible, to help ground truth any sightings from the boat / aerial surveys.

A full list of organisations consulted and their comments is provided in *Appendix A*.

Relevant Policies and Plans

The main protection for birds comes from European legislation such as the *EU Birds and Habitats Directives (Section 8.2)* and national legislation such as the *Wildlife and Countryside Act, 1981* as amended.

8.7.2 GENERAL ORNITHOLOGICAL CONTEXT

Introduction

The majority of the bird species which may be affected by the Humber Gateway development are seabirds and waterfowl species, with passerines on migration. These groups forage or roost offshore and / or fly across the open water. The North Sea and its coastal surrounds support internationally and nationally important populations of breeding and wintering seabirds and migrant and wintering waterfowl ⁽¹⁾. Many of the seabirds from these designated sites forage in the offshore waters in the North Sea. As a result, there are a number of coastal sites which have been designated for their ornithological interest and these are considered further below.

Designated Sites

This section includes an overview of the designated sites which are considered relevant to the assessment. The locations of sites considered relevant to the Humber Gateway development are shown in *Figure 8.1*.

⁽¹⁾ Tasker M L, Webb A, Hall A J, Pienkowski M W & Langslow D R, 1987. Seabirds in the North Sea. Nature Conservancy Council.

European Protected Sites

Humber Estuary European Marine Site

The main ornithological interest in the vicinity of the wind farm site is the Humber Flats, Marshes and Coast SPA ⁽²⁾/ Ramsar. The nearest point of this SPA to the proposed development site is approximately 8 km. The estuary supports important numbers of waterbirds (especially geese, ducks and waders) during the migration periods and in the winter. It also supports breeding populations of terns and raptors in summer.

This site qualifies under Article 4.1 of the *Wild Birds Directive (79/409/EEC)* by supporting populations of European importance of the following species listed on *Annex I* of the Directive (*Table 8.8*). It also qualifies under Article 4.2 of the Directive by supporting migratory species populations of European importance (*Table 8.9*).

⁽²⁾ A SPA is a site designated (or pending designation) under the *European Directive on Conservation of Wild Birds (79/409/EEC)* (known as the Birds Directive) to protect birds that are considered rare or vulnerable within the European Community and all regularly occurring migratory birds. Enacted in the UK through the *Wildlife and Countryside Act, 1981* and subsequent amendments and the *Conservation (Natural Habitats, &c.) Regulations, 1994*.

Table 8.8 Humber Flats, Marshes and Coast SPA - Qualifying Species and Populations as Listed in Annex I of the Wild Birds Directive (79/409/EEC)

Species	Population
Breeding Birds	
Little tern <i>Sterna albifrons</i>	63 pairs representing at least 2.6% of the breeding population in Great Britain.
Eurasian marsh Harrier <i>Circus aeruginosus</i>	11 pairs representing at least 6.9% of the breeding population in Great Britain (count as at 1995).
Wintering Birds	
Great bittern <i>Botaurus stellaris</i>	Two individuals representing at least 2.0% of the wintering population in Great Britain (five year mean 1991/92 - 1995/96).
European golden plover <i>Pluvialis apricaria</i>	29,235 individuals representing at least 11.7% of the wintering population in Great Britain (five year peak mean 1991/92 - 1995/96).
Hen harrier <i>Circus cyaneus</i>	20 individuals representing at least 2.7% of the wintering population in Great Britain (five year peak mean 1984/85 - 1988/89).

Source: JNCC SPA Review data ⁽¹⁾

Table 8.9 Humber Flats, Marshes and Coast SPA - Qualifying Internationally Important Bird Populations (Wintering and Migratory Species)

Species	Population
Passage Birds	
Common redshank <i>Tringa tetanus</i>	5,212 individuals representing at least 2.9% of the Eastern Atlantic - wintering population (five year peak mean 1991/92 - 1995/96).
Sanderling <i>Calidris alba</i>	1,767 individuals representing at least 1.8% of the Eastern Atlantic / Western and Southern Africa wintering population (two year mean May 1993 - 1995).
Wintering Birds	
Dunlin <i>Calidris alpina</i>	23,605 individuals representing at least 1.7% of the wintering Northern Siberia / Europe / Western Africa population (five year peak mean 1991/92 - 1995/96).
Red knot <i>Calidris canutus</i>	33,848 individuals representing at least 9.7% of the wintering north-eastern Canada / Greenland / Iceland / northwestern Europe population (five year peak mean 1991/92 - 1995/96).
Common redshank <i>Tringa totanus</i>	4,452 individuals representing at least 3.0% of the wintering Eastern Atlantic - wintering population (five year peak mean 1991/92 - 1995/96).
Common shelduck <i>Tadorna tadorna</i>	4,083 individuals representing at least 1.4% of the wintering northwestern Europe population (five year peak mean 1991/92 - 1995/96).

Source: JNCC SPA Review data ⁽¹⁾

⁽¹⁾ Stroud D A, Chambers D, Cook S, Buxton N, Fraser B, Clement P, Lewis P, Mclean I, Baker H & Whitehead S (eds) 2001. The UK SPA Network: Its Scope and Contents. Volume 2 Species Accounts. Peterborough. JNCC.

The area additionally qualifies under Article 4.2 of the Directive by regularly supporting at least 20,000 waterfowl. Over winter, the area regularly supports 187,617 individual waterfowl (five year peak mean 1991/92 to 1995/96) including the following:

- mallard *Anas platyrhynchos*;
- European golden plover *Pluvialis apricaria*;
- bar-tailed godwit *Limosa lapponica*;
- common shelduck *Tadorna tadorna*;
- red knot *Calidris canutus*;
- dunlin *Calidris alpina alpina*;
- common redshank *Tringa tetanus*;
- great cormorant *Phalacrocorax carbo*;
- dark-bellied brent goose *Branta bernicla bernicla*;
- great bittern *Botaurus stellaris*;
- Eurasian teal *Anas crecca*;
- Eurasian curlew *Numenius arquata*;
- common pochard *Aythya farina*;
- common goldeneye *Bucephala clangula*;
- Eurasian oystercatcher *Haematopus ostralegus*;
- ringed plover *Charadrius hiaticula*;
- grey plover *Pluvialis squatarola*;
- northern lapwing *Vanellus vanellus*;
- sanderling *Calidris alba*;
- black-tailed godwit *Limosa limosa islandica*;
- Eurasian wigeon *Anas Penelope*; and
- whimbrel *Numenius phaeopus*.

Flamborough Head and Bempton Cliffs European Marine Site

This is a European Marine Site (Flamborough Head and Bempton Cliffs SPA and Flamborough Head SAC) located at about 55 km to the north of the Humber Gateway site. The area covers over 6,300 ha, including the steep chalk cliffs of the headland which rise to 135 m, adjacent cliff-top vegetation, the intertidal chalk platforms at the base of the cliffs and adjacent subtidal chalk reefs and caves. The site supports large numbers of breeding seabirds (over 300,000 birds) including black-legged kittiwake *Rissa tridactyla* and auks, as well as one of only two mainland-breeding colonies of northern gannet *Morus bassana* in the UK (over 1,500 pairs, depending on year). The seabirds feed and raft in the waters around the cliffs, outside the SPA, as well as feeding more distantly in the North

Sea. The inter-tidal chalk platforms are also used as roosting sites, particularly at low water and notably by juvenile black-legged kittiwakes ⁽¹⁾.

This site qualifies under Article 4.2 of the *Wild Birds Directive (79/409/EEC)* by supporting migratory species populations of European importance (*Table 8.10*).

Table 8.10 Flamborough Head and Bempton Cliffs SPA - Qualifying Internationally Important Bird Populations

Status	Species	Population
Breeding	Black-legged kittiwake <i>Rissa tridactyla</i>	83,370 pairs representing at least 2.6% of the breeding Eastern Atlantic - Breeding population (count, as at 1987) ¹

Source: JNCC SPA Review data ⁽¹⁾

The area additionally qualifies under Article 4.2 of the Directive by regularly supporting at least 20,000 seabirds. During the breeding season, the area regularly supports 305,784 individual seabirds including:

- Atlantic puffin *Fratercula arctica*;
- razorbill *Alca torda*;
- common guillemot *Uria aalge*;
- herring gull *Larus argentatus*;
- northern gannet *Morus bassanus*; and
- black-legged kittiwake *Rissa tridactyla*.

Hornsea Mere European Site

Hornsea Mere is the largest freshwater lake in Yorkshire, situated less than 1 km from the sea on the East Yorkshire coast. It is of glacial origin, shallow (1 to 2 m deep), eutrophic and fringed with reedbeds, fen and carr. Hornsea Mere supports breeding and wintering waterbirds, which feed on the open water and use the marginal vegetation for feeding and roosting ⁽¹⁾.

This site qualifies under Article 4.2 of the *Wild Birds Directive (79/409/EEC)* by supporting migratory species populations of European importance (*Table 8.11*).

⁽¹⁾ Stroud D A, Chambers D, Cook S, Buxton N, Fraser B, Clement P, Lewis P, Mclean I, Baker H & Whitehead S (eds) 2001. The UK SPA Network: Its Scope and Contents. Volume 2 Species Accounts. Peterborough. JNCC.

Table 8.11 Hornsea Mere SPA/Ramsar - Qualifying Internationally Important Bird Populations

Status	Species	Population
Wintering	Gadwall <i>Anas strepera</i>	300 birds, representing 1% of the NW European population

Source: JNCC SPA Review data ⁽¹⁾

Other Sites

Spurn Head, as well as being part of the Humber Flats, Marshes and Coast SPA / Ramsar / SSSI, is of importance as a coastal landform and associated habitat for the landfall of many common migrant passerines. A bird observatory has been established here, run by volunteers on behalf of the Spurn Bird Observatory Trust which has compiled a comprehensive database of records of bird movements along and onto the coast at this point. A summary of key species and their peak numbers and months they occurred between 1999 and 2005 is provided in *Appendix D1 (Humber Gateway Seabird Survey Report)*.

8.7.3 ORNITHOLOGICAL SURVEY METHODOLOGY

Introduction

The baseline ornithological survey findings reported in this section are predominantly from aerial and boat-based surveys across and around the wind farm site which were undertaken between September 2003 and December 2005. The aerial surveys were undertaken to provide information on the wider distribution of seabirds around the wind farm site and help set records on the site in the context of the adjacent coastal waters. The boat-based surveys were focussed more on the site and immediate surrounds, and associated control area. In addition to the above, a combined radar and observation study was undertaken, however it should be noted that the ornithological baseline presented in this report relies primarily on the more reliable boat-based and aerial survey data.

⁽¹⁾ Stroud D A, Chambers D, Cook S, Buxton N, Fraser B, Clement P, Lewis P, Mclean I, Baker H & Whitehead S (eds) 2001. The UK SPA Network: Its Scope and Contents. Volume 2 Species Accounts. Peterborough. JNCC.

All surveys were undertaken by qualified surveyors in accordance with relevant guidelines and best practice (eg Defra, 2005 ⁽²⁾; Camphuysen et al, 2004 ⁽³⁾). The scope and approaches taken were approved by Natural England throughout.

The following sections describe the survey areas and the work undertaken in more detail.

Survey Areas

The survey areas used for the aerial and boat-based surveys during the period September 2003 to May 2004 and June 2004 to December 2005 are shown in *Figure 8.3.4* and *Figure 8.35* respectively (*Appendix D1 - Humber Gateway Seabird Survey Report*).

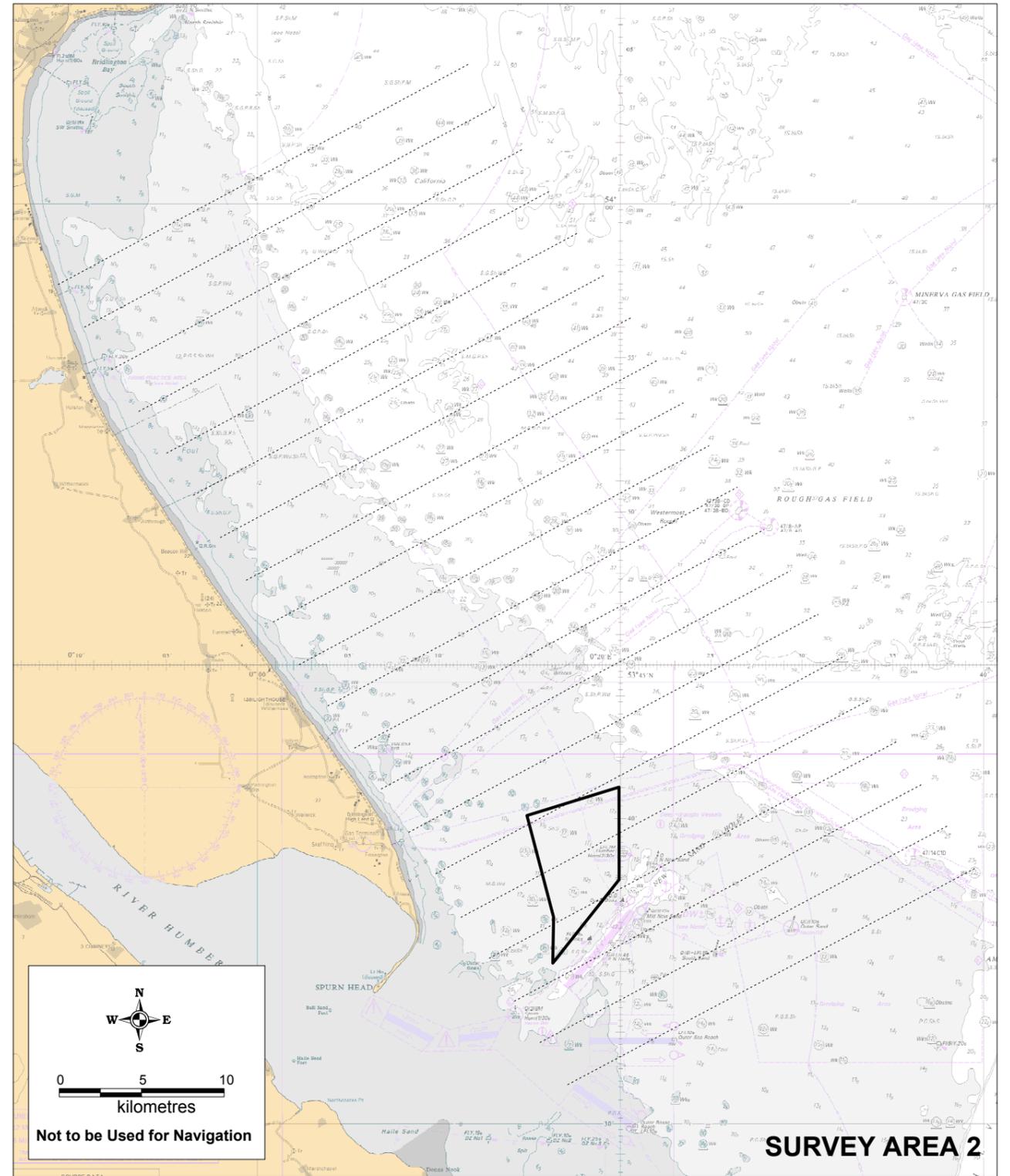
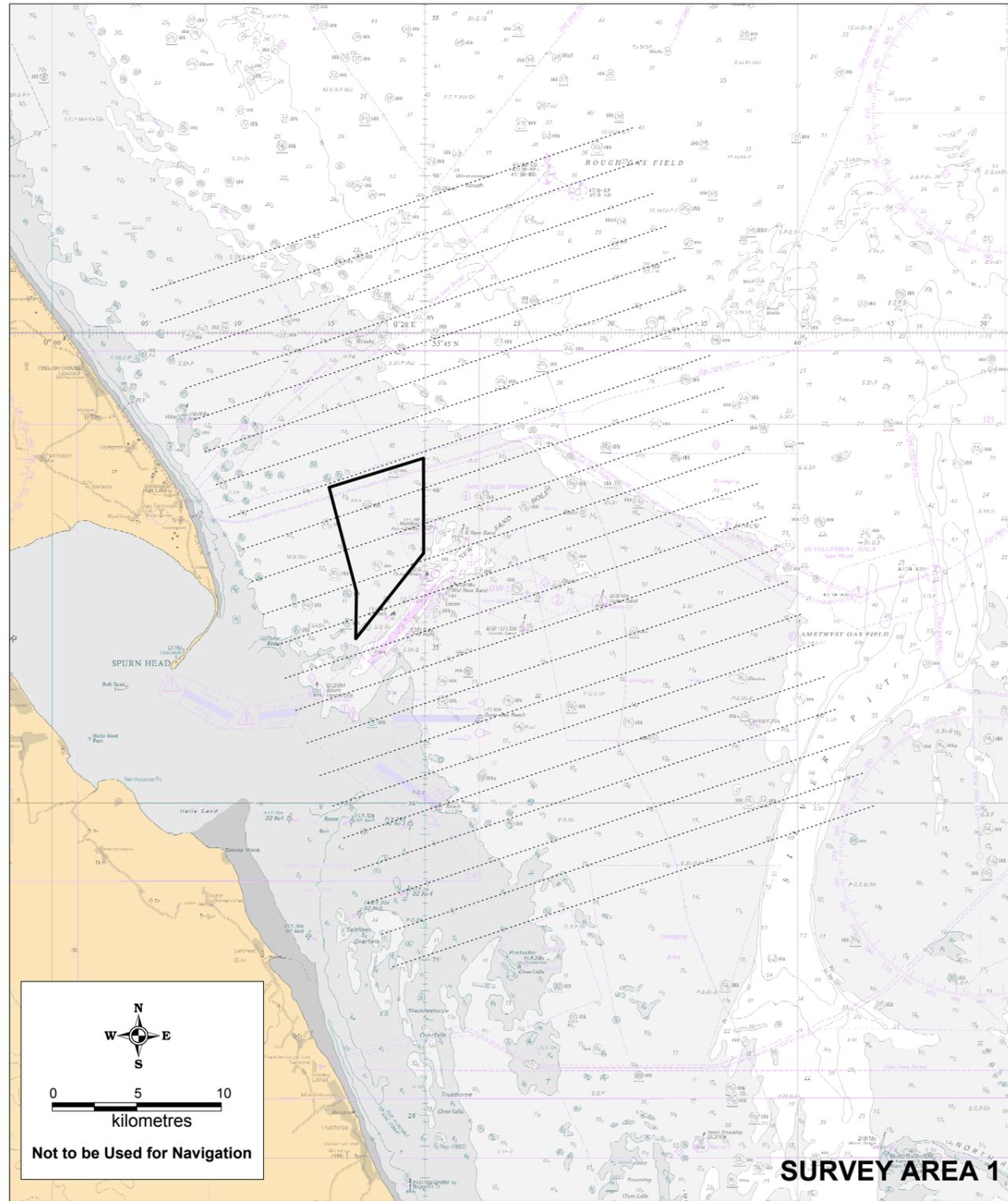
As shown in *Figure 8.34* and *Figure 8.35*, the survey area locations were refined in June 2004 and then remained the same for the rest of the survey. The changes were made to:

- incorporate the proposed Westernmost Rough wind farm licence area into the aerial survey area; and
- exclude the Ministry of Defence's (MOD) Donna Nook Practice and Exercise Area (PEXA) as access into this area was often restricted by the MOD.

These changes did not affect the validity of the data collected throughout the survey programme as all survey areas included the Humber Gateway site and immediate surrounds. All changes were discussed and agreed with NE, RSPB and YWT. In the following descriptions, the survey area for September 2003 to May 2004 is referred to as Survey Area 1 and that for June 2004 to December 2005 as Survey Area 2.

⁽²⁾ Department for Environment, Food and Rural Affairs March 2005. Nature Conservation Guidance on Offshore Wind Farm Development (Version R1.9). Defra.

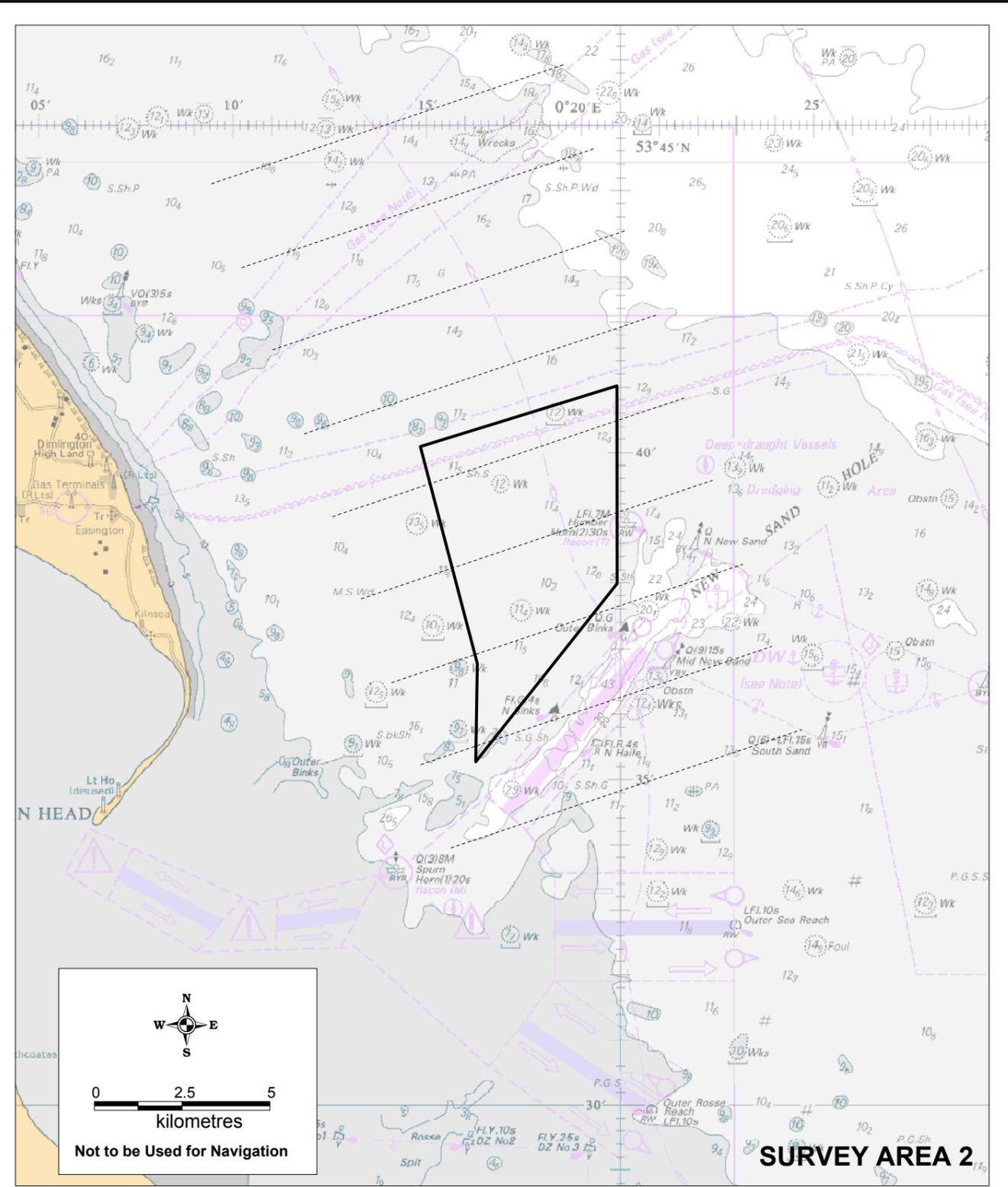
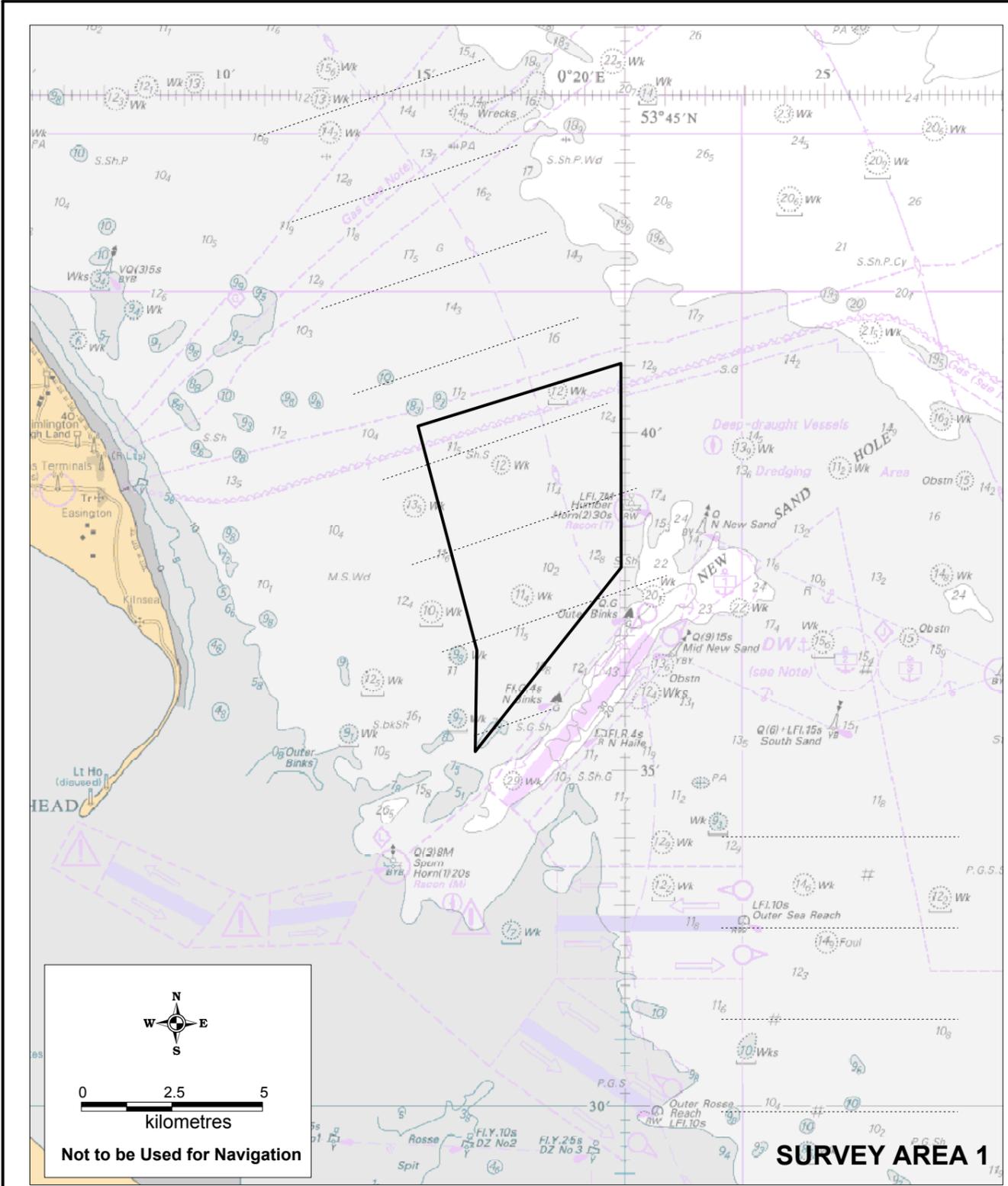
⁽³⁾ Camphuysen C J, Fox A D, Leopold M F & Petersen I K, 2004. Towards Standardised Seabirds at Sea Census Techniques in Connection with Environmental Impact Assessments for Offshore Wind Farms in the UK Report commissioned by COWRIE. The Netherlands: Royal Netherlands Institute for Sea Research.



KEY:

Legend	Depth (m)
	Intertidal, 0-10
	10-20
	20+
	Aerial Transect
	Humber Gateway Site

CLIENT: 	SIZE: A3	TITLE: Figure 8.34 Aerial Survey. Areas 1 & 2
	DATE: 01.03.07	CHECKED:
DRAWN: SMT	APPROVED:	SCALE:
DRAWING: Aerial Area 1&2.wor		REV: FINAL



KEY:

Legend	
Depth (m)	
	Intertidal, 0-10,
	10-20,
	20+
	Boat Transect
	Humber Gateway Site

CLIENT:		SIZE:	A3	TITLE:	Figure 8.35 Boat Survey. Areas 1 & 2.
DATE: 01.03.07	CHECKED:	PROJECT:			
DRAWN: SMT	APPROVED:	SCALE:			
DRAWING:					REV:
Boat Area 1&2.wor					FINAL

Aerial Transect Surveys

The aerial surveys used the standard seabird census techniques as described in Camphuysen et al, 2004 ⁽¹⁾. This involved a distance sampling method whereby the distance to each bird or flock was recorded by two observers, one on either side of the aircraft. The aircraft, a Partenavia PN68 with twin engines and high wings, was flown at an altitude of 80 m and at a speed of 185 km per hour.

Twenty two transects (each 30 km in length and 2 km apart) were flown in Survey Area 1, and 20 transects (each 28 km in length and 3 km apart) were flown in Survey Area 2. For each bird or flock of birds, the species, number, behaviour including on the water or in flight (and any flight direction), distance band from the aircraft were recorded. Birds were assigned to one of the following three distance bands using an inclinometer:

- Band A (44 m to 163 m from the track line);
- Band B (164 m to 432 m); and
- Band C (433 m to 1,000 m).

Sea state and glare were also recorded. The aircraft position was recorded by a flight co-ordinator using an Ormtec 412 DGPS (Differential Geographical Positioning System) linked to a laptop running MapInfo and ARCS. All sightings were recorded on dictaphone with a time reference to the nearest second.

Eighteen flights were made between October 2003 and September 2005 (*Table 8.12*). It was agreed with consultees that the aerial survey should concentrate on the key periods for species that formed the qualifying interest of SPAs, in particular those associated with Flamborough Head and Bempton Cliffs SPA, including during the summer months (June to August) to identify any concentrations of rafting auks and other seabirds. Monitoring of waterfowl from the Humber Flats, Marshes and Coast SPA would be achieved more appropriately by the boat-based surveys.

⁽¹⁾ Camphuysen C J, Fox A D, Leopold M F & Petersen I K, 2004. Towards Standardised Seabirds at Sea Census Techniques in Connection with Environmental Impact Assessments for Offshore Wind Farms in the UK Report commissioned by COWRIE. The Netherlands: Royal Netherlands Institute for Sea Research.

Table 8.12 Survey Dates (October 2003 to September 2005)

Date	Wind conditions (direction and Beaufort force)	Sea State	Survey	Survey Start Time (GMT)	Survey Finish Time (GMT)
27/10/03	west F1-2	1-2	1	11:37 a.m.	15:35 p.m.
28/11/03	southwest F2-3	1-2	2	12:01 p.m.	15:52 p.m.
09/01/04	west F3-4	3-4	3	11:21 a.m.	14:40 p.m.
29/01/04	northwest F4-5	3-5	4	11:53 a.m.	15:41 p.m.
25/02/04	northeast F3-4	3-4	5	11:10 a.m.	14:10 p.m.
18/03/04	west F3-4	2	6	11:43 a.m.	15:25 p.m.
23/06/04	west F2-3	1-2	7	10:25 a.m.	13:38 p.m.
27/07/04	northeast F1-2	1-2	8	11:06 a.m.	14:31 p.m.
26/08/04	northwest F2-3	2-3	9	10:51 a.m.	14:28 p.m.
23/09/04	northwest F5-6	3-4	10	11:08 a.m.	15:09 p.m.
18/10/04	southwest F3-4	3	11	11:20 a.m.	14:44 p.m.
16/11/04	west F3	1-2	12	10:47 a.m.	14:10 p.m.
09/02/05	southwest F4-5	2-3	13	11:14 a.m.	15:05 p.m.
21/03/05	southeast F4	3	14	11:39 a.m.	15:16 p.m.
27/06/05	variable then south F1-2	0-2	15	10:43 a.m.	14:07 p.m.
27/07/05	east F2-3	1-2	16	10:48 a.m.	14:24 p.m.
23/08/05	west F2-3	1-2	17	10:25 a.m.	14:05 p.m.
13/09/05	southwest F4-5	2-3	18	10:15 a.m.	14:04 p.m.

Changes to the survey programme were agreed in discussions with consultees including the following.

- The aerial survey in December 2003, which was not possible due to bad weather, was replaced with a survey in the first week of January 2004 (in conditions more than Force 4), hence two surveys were undertaken in January 2004.
- A reduction in the frequency of the winter aerial surveys between September 2004 and March 2005 as the monthly surveys during the previous winter's survey showed a low level of seabird usage at this time, and to allow greater flexibility in survey timing to avoid poor sea state conditions.
- No aerial surveys were required over the spring period as aerial surveys are not well suited to the assessment of flying birds (especially small waders and passerines). Determination of flight height is not possible for most of the records and this is an important factor in assessing collision risk impacts of migratory birds.

- The May survey requirement as highlighted by guidance for aerial surveys (presumably to cover colonial tern activity) was not required as there was little or no tern activity in the vicinity of the Humber Gateway site, and any that did occur would be picked up by the boat-based surveys.
- The aerial surveys should concentrate on the key periods for species that formed the seabird qualifying interests of the SPA at Flamborough Head and Bempton Cliffs, with the boat surveys being more appropriate for recording waterfowl interest from the Humber Flats, Coasts and Marshes SPA.
- Aerial surveys were carried out in June, July and August to identify any offshore post breeding concentrations of birds from the Flamborough Head and Bempton Cliffs SPA, including rafting auks.
- During the second half of 2004 and 2005, surveys were not undertaken in conditions of sea state 3 or above – surveys in January and February 2004 were conducted in conditions up to sea state 4 to 5.

Further details about these agreed changes are provided in *Section 8.7.1*, and about the aerial survey methods and programme in *Appendix D1 (Humber Gateway Seabird Survey Report)*.

Boat Surveys

The boat-based survey programme employed the standard seabird census techniques for use on a boat platform as described by Camphuysen et al (2004). The vessels used were large tug boats with a viewing platform well in excess of the recommended minimum of 5 m. A constant 10 knot speed was maintained during the transects. Between September 2003 and May 2004 each survey visit comprised eight transects across the wind farm site (each 6.5 km in length, excepting the shorter southern most transect which was 2.2 km), and four across the southern control site (each 6.5 km in length).

Following the revisions to the survey area, the remainder of the surveys comprised six transects across the wind farm site (each 10.5 km in length) and three across the control site (also 10.5 km in length). These three transects were originally ones which had been surveyed across the north of the wind farm in Survey Area 1.

The transect intervals were 2.5 km, slightly larger than the 2 km recommended in Camphuysen et al (2003), as high current velocities in the area meant that rafting birds could move between transects, and hence there was a risk of birds on the water being double counted on adjacent transects.

Between September 2003 and December 2005, 29 surveys were carried out as shown in *Table 8.13*. An additional survey was undertaken in October 2005 to coincide with the peak passage of little gull. For this survey transects were extended by 2.75 km inshore, and 6.5 km offshore in order to better capture any offshore spatial patterns, making each transect 20 km long.

The survey work was undertaken by two experienced observers recording birds in a band 300 m wide on either side of the vessel. Birds in the band were noted as being 'in transect', and flying birds were recorded using the snapshot technique, which comprised two minute periods given the small area and coastal location. For each bird / flocks the following attributes were recorded in order of importance:

- species;
- numbers;
- transect (e.g. in or not);
- behaviour (e.g. on water, flying, flushed);
- distance from the ship (bands sub-divided as described in Camphuysen et al, 2004);
- flight heights (0 to 2 m, 2 to 10 m, 10 to 15 m, 15 to 25 m, 25 to 50 m, 50 to 100 m, greater than 200 m);
- flight direction; and
- plumage.

All transect start and finish point co-ordinates were input into the survey boat's GPS system. Survey logging of transects was carried out with an Ormtec 412 DGPS and logger with backup from a hand held GPS. Observational data was recorded on standard Seabirds at Sea Team (SAST) recording sheets.

Further details on the boat-based survey approach are contained in *Appendix D1 (Humber Gateway Seabird Survey Report)*.

Table 8.13 Survey Dates (September to December 2005)

Date	Wind conditions (direction and Beaufort force)	Sea State	Survey	Survey Start Time (GMT)	Survey Finish Time (GMT)
30/09/03 ⁽¹⁾	southeast F2-3	2-3	1	11:24	17:23
28/10/03	southeast F3-4	2-3	2	08:22	14:06
25/11/03	southeast F4-5	3-4	3	08:44	16:22
09/12/03	south F2	1-2	4	08:27	14:12
22/01/04	south F3-4	2-3	5	08:22	15:22
03/03/04	south F4	2-3	6	07:29	13:52
24/03/04	north F4-5	4-5	7	09:15	16:02
23/04/04	south F1-2	0-1	8	07:09	13:51
19/05/04	northwest F4-5 then west F3-4	2-4	9	08:52	16:28
<i>Modification of the survey areas</i>					
16/06/04	west F2	1-2	10	06:38	16:21
13/07/04	northwest then southeast F2	2-4	11	07:04	13:06
27/08/04	southwest to west F4-5	2-3	12	07:12	13:22
16/09/04	south F4-5 decreasing F2-3	2-4	13	08:02	14:42
26/10/04	west to northwest F4	2-3	14	07:10	14:02
24/11/04	south F2-3	2-3	15	08:19	14:43
09/12/04	southwest F1-2 then south F3-4	1-3	16	07:55	14:23
26/01/05	northwest F2-3	2-3	17	08:27	14:53
17/02/05	variable F1, north northeast F2-3	1-3	18	11:48	17:56
19/03/05	variable then southeast F1	0-1	19	10:58	17:18
12/04/05	southwest F1-3	1-2	20	07:42	13:46
12/05/05	southeast F1 then east F2-3	1-2	21	06:54	12:54
06/06/05	northeast F3-4	4	22	09:33	16:01
12/07/05	variable F1 then southeast F2-3	0-1	23	11:27	17:57
04/08/05	west F2-4	0-1	24	06:06	12:24
02/09/05	north F2-3	0-3	25	07:00	13:38
07/10/05 ⁽²⁾	variable then south F1-2	0-2	26	08:28	15:38
07/11/05	southwest F4-5 decreasing F2-3	2-4	27	08:24	14:26
23/11/05	west to southwest F1-2	0-1	28	09:56	16:06
21/12/05	southwest F3-5	2-4	29	08:34	15:20

⁽¹⁾ Familiarisation survey⁽²⁾ Dedicated little gull survey**Data Analyses**

The data from the surveys have been used in the following ways:

- to produce distribution maps showing the locations of birds recorded in flight, and on the water during the aerial and boat-based surveys; and
- to produce density figures from the boat survey data to help assess the impacts of Humber Gateway on key bird species recorded within the survey area.

The analysis used birds 'in transect' only to produce bird species and group totals. The total number of birds seen during the visual scan was used in the mapping and in the analysis. For less common or rare species, all records have been plotted on the distribution maps, but only 'in transect' records were used in the data analysis (e.g. density calculations). Correction factors (taken from Stone et al, 1995⁽³⁾) were used to compensate for the reduced visibility of birds at distances of more than 100 m.

The area surveyed was calculated (distance travelled multiplied by width of transect), and the total number of birds in transect was then divided by this area, during a unit time to obtain density figures for birds in flight and on the water. Densities were calculated for each boat survey between October 2003 and December 2005 (data from the familiarisation survey in September 2003 were excluded).

Further details including the correction factors used are contained in *Appendix D1 (Humber Gateway Seabird Survey Report)*.

Radar Surveys

COWRIE guidance recommends that further development of other approaches to bird monitoring should be undertaken, for example the use of radar particularly during the migration periods when birds can fly at night⁽⁴⁾⁽⁵⁾.

⁽³⁾ Stone C J, Webb A, Barton C, Ratcliffe N, Reed T C, Tasker M L, Camphuysen C J & Pienkowski M W, 1995. An Atlas of Seabird Distribution in North-west European Waters. JNCC, Peterborough.⁽⁴⁾ Camphuysen C J, Fox A D, Leopold M F & Petersen I K, 2004. Towards Standardised Seabirds at Sea Census Techniques in Connection with Environmental Impact Assessments for Offshore Wind Farms in the UK Report commissioned by COWRIE. The Netherlands: Royal Netherlands Institute for Sea Research.⁽⁵⁾ Desholm M, Fox A D & Beasley P D, 2004. Best Practice Guidance for the Use of Remote Techniques for Observing Bird Behaviour in Relation to Offshore Wind Farms. Report Produced for COWRIE.

Although not requested by the statutory bodies, E.ON commissioned Central Science Laboratories (CSL) to undertake a radar survey between 26 and 29 October 2004. The monitoring survey (84 hours) was carried out in order to investigate offshore bird flight activity in the vicinity of the Humber Gateway site. The radar unit, which requires a stable platform, was sited near the Spurn Bird Observatory to provide uninterrupted views east towards the wind farm site. The horizontal limit of detection of the radar system used was 11.1 km, although the peak detection capability is approximately 1 km from the unit. The vertical distance over which the unit operates is approximately 1.4 km either side of the unit.

There are a number of difficulties with the use of radar technology for monitoring bird movements at offshore wind farms, especially when located onshore.

- The Humber Gateway site lies 8.2 km from the location of the radar unit which means that part of the wind farm site lies beyond the range of the radar unit.
- The signal strength returned by a target (i.e. a bird) decreases with increasing distance from the unit, and hence the effectiveness of the recordings also decrease. The majority of the readings were within 7 km from the shore (i.e. approximately 1.2 km inshore from the wind farm site). Comparison with the findings of the simultaneous boat survey found that records beyond 7 km did not reflect all the bird movements which were known to be taking place.
- The effectiveness of the radar unit is further influenced by weather conditions, for example, rainfall which reduces the ability of the unit to track birds.
- Further complications arise from the inability in some cases to determine species accurately and also to determine the numbers of birds being recorded.

The location of the radar unit offshore was considered, however it is prohibitively expensive to locate such units offshore due to the requirement for a stable platform, as many of the avian lab units are large and designed for onshore use ⁽¹⁾.

The use of standard marine navigational radar units within survey vessels was considered. However, as described in Desholm et al (2004), there are also many problems with recording bird movements using these units too, including range resolution, bird species identification, recording of flight height and interference from weather.

⁽¹⁾ Desholm M, Fox A D & Beasley P D, 2004. Best Practice Guidance for the Use of Remote Techniques for Observing Bird Behaviour in Relation to Offshore Wind Farms. Report Produced for COWRIE.

In addition to the radar unit, simultaneous sea watching (by CSL) and boat-based observations (by IECS) were undertaken to assist with ground truthing the radar records, which are otherwise difficult to interpret. Sea watching was undertaken from the beach close to the radar unit, and the boat was positioned 6 km offshore between the radar unit and the wind farm site.

8.7.4 ORNITHOLOGICAL BASELINE - SPECIES ACCOUNTS

Introduction

This section contains a summary of the findings of the boat and aerial surveys undertaken by IECS and is presented on a species by species basis.

The surveys recorded a range of bird species, predominantly seabirds with some wildfowl, waders and passerines. The following sections describe the distributions of the main bird species that were recorded during the surveys. Where appropriate the descriptions include details of the following:

- any seasonal variation (particularly in key months);
- any links with other parameters such as water depths, distance offshore, benthic habitats;
- foraging activity observed and any key foraging areas identified;
- observations of birds on the water as opposed to flying;
- general comments on flight activity, cross referencing with the flight height table (*Section 8.7.5*);
- other behavioural responses, for example, responses to existing boat movements, other developments etc; and
- maps illustrating the distribution of some key species.

A number of maps are presented on the following pages. Further details about the survey findings and a complete set of species distribution maps are contained in *Appendix D1 (Humber Gateway Seabird Survey Report)*.

Divers

Overview

A number of diver species were identified during the survey programme, with the red-throated diver being the most commonly recorded.

Red-throated Diver *Gavia stellata*

The red-throated diver is included in *Annex I* of the *Birds Directive* and *Schedule 1* under the *Wildlife and Countryside Act, 1981* as amended, and is a SPEC 3 species (i.e. has an unfavourable conservation status in Europe, but is not concentrated in Europe).

The surveys recorded small numbers of red-throated diver predominantly during the winter and autumn periods, with only small numbers on passage during the spring. The peak number of birds recorded in an individual survey was ten, during the boat surveys in December 2005. The majority were in the vicinity of the Binks, an area of shallow sand and gravel east of Spurn Head (*Figure 8.36*). There was no evidence of any concentrations of birds in the survey area.

The aerial surveys recorded fewer red-throated divers than the boat survey, with most records in the coastal waters off the Holderness Coast between Spurn and Dimlington, a stretch of 5 to 6 km, inshore of the Humber Gateway site (*Figure 8.37*). This concurs with the findings of other studies, which have recorded coastal distributions of wintering red-throated divers in shallow waters (*Appendix D1, Humber Gateway Seabird Survey Report*).

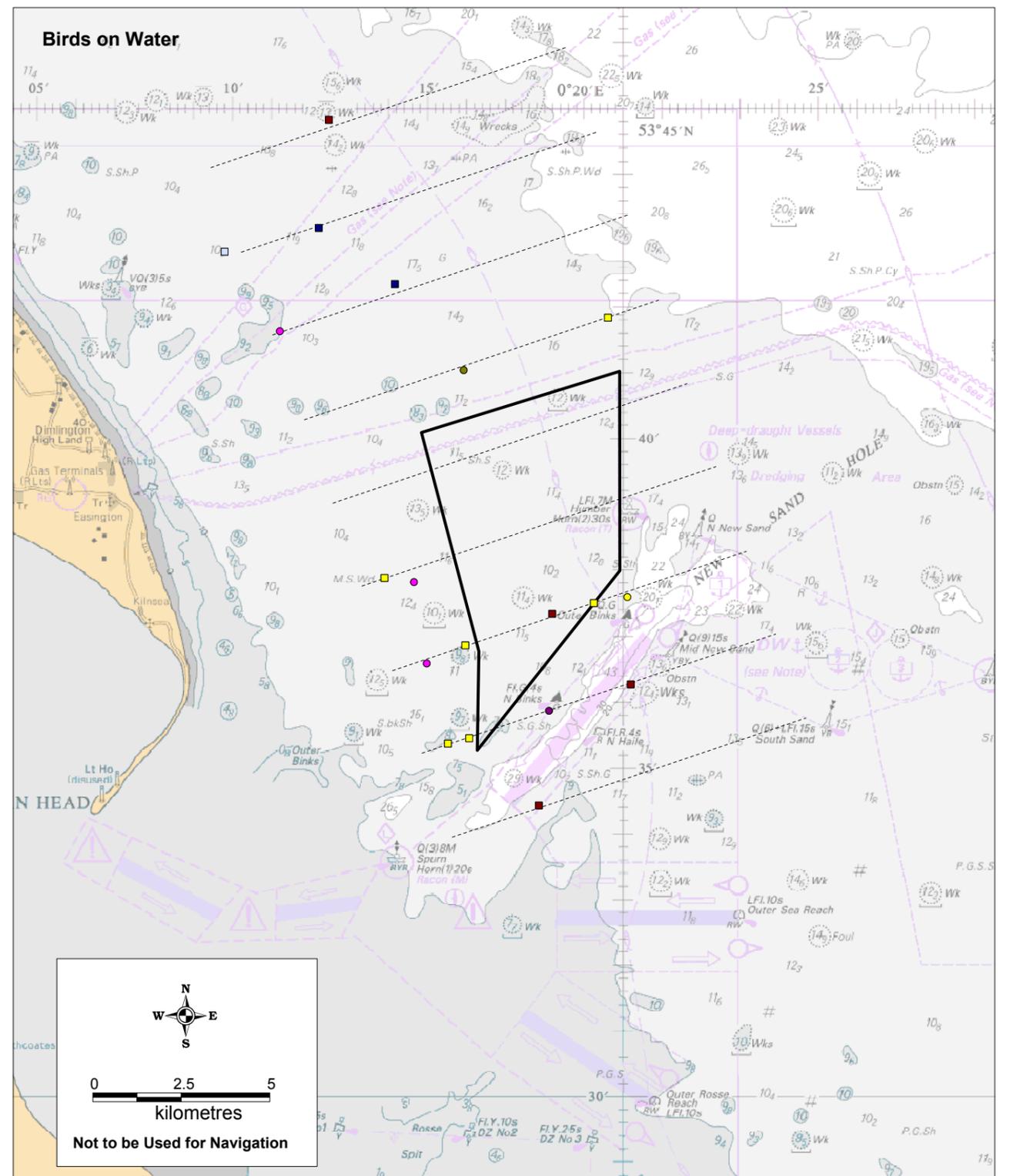
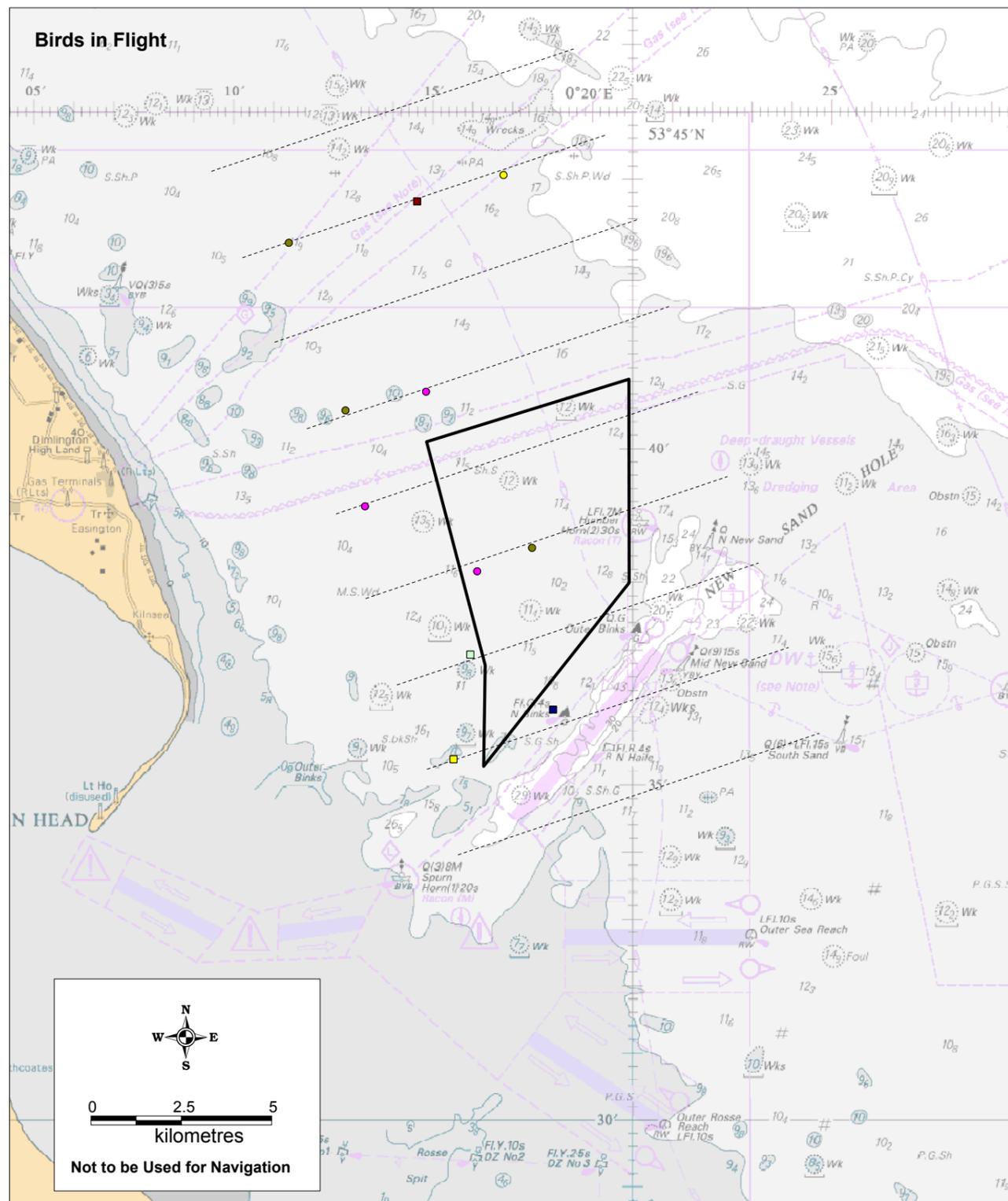
The inshore records along the Holderness Coast also reflect the more favourable conditions for this species in the inshore waters, including shallow waters and a sandy substratum supporting a Nephthys and amphipod community. Off the Holderness Coast, these parameters are largely confined to the nearshore, coastal margins, and around the Binks. The majority of mobile sands are confined to the coastal margins, e.g. Smithic Sands, except around the Binks and in Bridlington Bay ⁽¹⁾. The Humber Gateway site features water depths of approximately 15 m and has a variable substratum of sand, cobble, pebble and shell ⁽²⁾.

⁽¹⁾ Allen J, in preparation. Habitat diversity in no trawl zones along the Yorkshire Coast. Report NESFC and Natural England.

⁽²⁾ Allen J, Proctor K, Mazik K, & Thomson S. 2006. Baseline Study of the Marine Ecology at the Humber Gateway Offshore Windfarm Development. The Institute of Estuarine and Coastal Studies. Report to ERM. The University of Hull, Hull.

The peak density recorded was 0.5 birds per km² (*Appendix D1, Humber Gateway Seabird Survey Report*). Assuming a national importance threshold of 49 birds per km² 2006 ⁽³⁾, and the large numbers recorded in the Greater Thames Estuary, the numbers of birds recorded during the Humber Gateway surveys are of low importance.

⁽³⁾ Banks A, Collier M, Austin G, Hearn R & Musgrove A (2006) Waterbirds in the UK 2004/05. The Wetland Bird Survey British Trust for Ornithology, Wildfowl & Wetlands Trust, Royal Society for the protection of Birds and Joint Nature Conservation Committee.



KEY:

<p>Legend</p> <p>Depth (m)</p> <p>Intertidal, 0-10, 10-20, 20+</p> <p>Boat Transect</p> <p>Humber Gateway Site</p>	<p>Number of Birds</p> <table border="0"> <tr> <td></td> <td>2003</td> <td>2004</td> <td>2005</td> </tr> <tr> <td>40 to 50</td> <td>◇</td> <td>○</td> <td>□</td> </tr> <tr> <td>30 to 40</td> <td>◇</td> <td>○</td> <td>□</td> </tr> <tr> <td>20 to 30</td> <td>◇</td> <td>○</td> <td>□</td> </tr> <tr> <td>10 to 20</td> <td>◇</td> <td>○</td> <td>□</td> </tr> <tr> <td>1 to 10</td> <td>◇</td> <td>○</td> <td>□</td> </tr> </table>		2003	2004	2005	40 to 50	◇	○	□	30 to 40	◇	○	□	20 to 30	◇	○	□	10 to 20	◇	○	□	1 to 10	◇	○	□	<p>Month</p> <table border="0"> <tr> <td>January</td> <td>July</td> </tr> <tr> <td>February</td> <td>August</td> </tr> <tr> <td>March</td> <td>September</td> </tr> <tr> <td>April</td> <td>October</td> </tr> <tr> <td>May</td> <td>November</td> </tr> <tr> <td>June</td> <td>December</td> </tr> </table>	January	July	February	August	March	September	April	October	May	November	June	December
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<p>DATE: 12.02.07</p> <p>DRAWN: SMT</p> <p>DRAWING: Divers spp_Boat Area 2.wor</p>		<p>CHECKED:</p> <p>APPROVED:</p> <p>PROJECT:</p> <p>SCALE:</p> <p>REV: FINAL</p>																																				

Black-throated Diver *Gavia arctica*

Black-throated divers also winter and occur on passage along the east coast of England, but along the Yorkshire coast they are present in smaller numbers than the red-throated diver. The species is included in Annex I of the *Birds Directive* and Schedule 1 of the *Wildlife and Countryside Act, 1981* as amended.

Only a single bird was observed on a boat-based survey in December 2004 (*Appendix D1, Humber Gateway Seabird Survey Report*).

Great Northern Diver *Gavia immer*

The great northern diver is listed on *Annex I* of the *Birds Directive* and Schedule 1 under the *Wildlife and Countryside Act, 1981* as amended.

The species occurs on passage along the Yorkshire coast, but in substantially lower numbers than the red-throated diver. One or two birds are usually recorded along the Holderness Coast for short periods over the winter. There were only two sightings of the species during the surveys, both of flying birds, one in May 2005 during the boat surveys and one in February 2004 during the aerial surveys.

Fulmars, Shearwaters and Petrels***Northern Fulmar *Fulmaris glacialis****

The majority of records of northern fulmar were made during and immediately after the breeding season, with densities of up to around 0.5 bird per km² recorded from the boat surveys in the control area during the summer months, with up to 20 birds recorded during June in both 2004 and 2005. Numbers then decrease during the late summer and early autumn with post-breeding dispersion. Much lower numbers were recorded during the winter (*Appendix D1, Humber Gateway Seabird Survey Report*).

The majority of the northern fulmar records were of birds in flight rather than on the water, presumably foraging across the area, and in the summer months flying back to the Flamborough colony to feed young.

The findings from the aerial survey programme support this pattern, with a relatively high number of birds recorded during May to August, compared with September and October.

The aerial survey data show that the majority of fulmar records were over 12 km offshore, and hence most were recorded in the waters beyond the Humber Gateway site (*Figure 8.38*). It is assumed that the majority of the birds recorded over the summer months are part of the breeding population of Flamborough Head, although

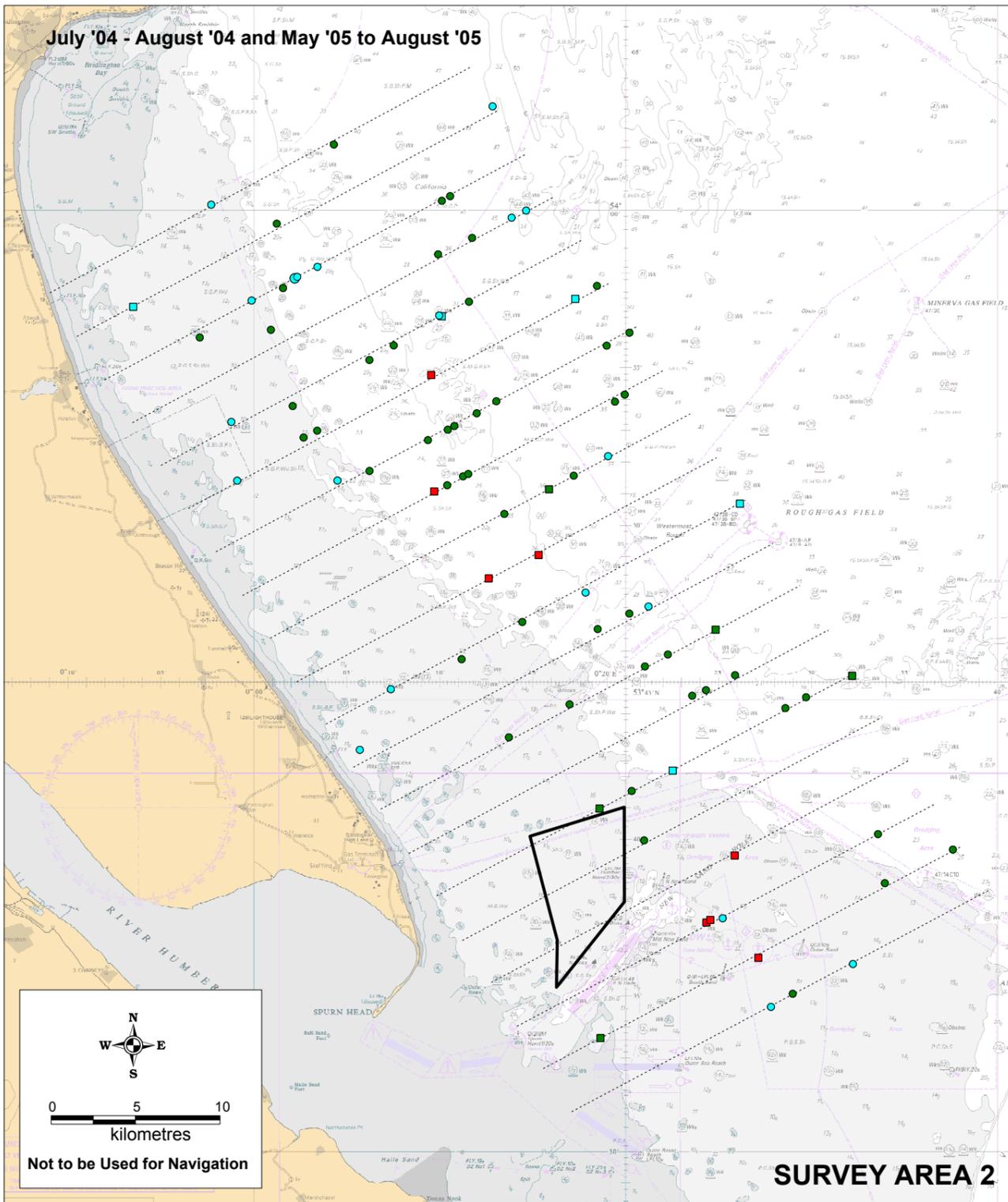
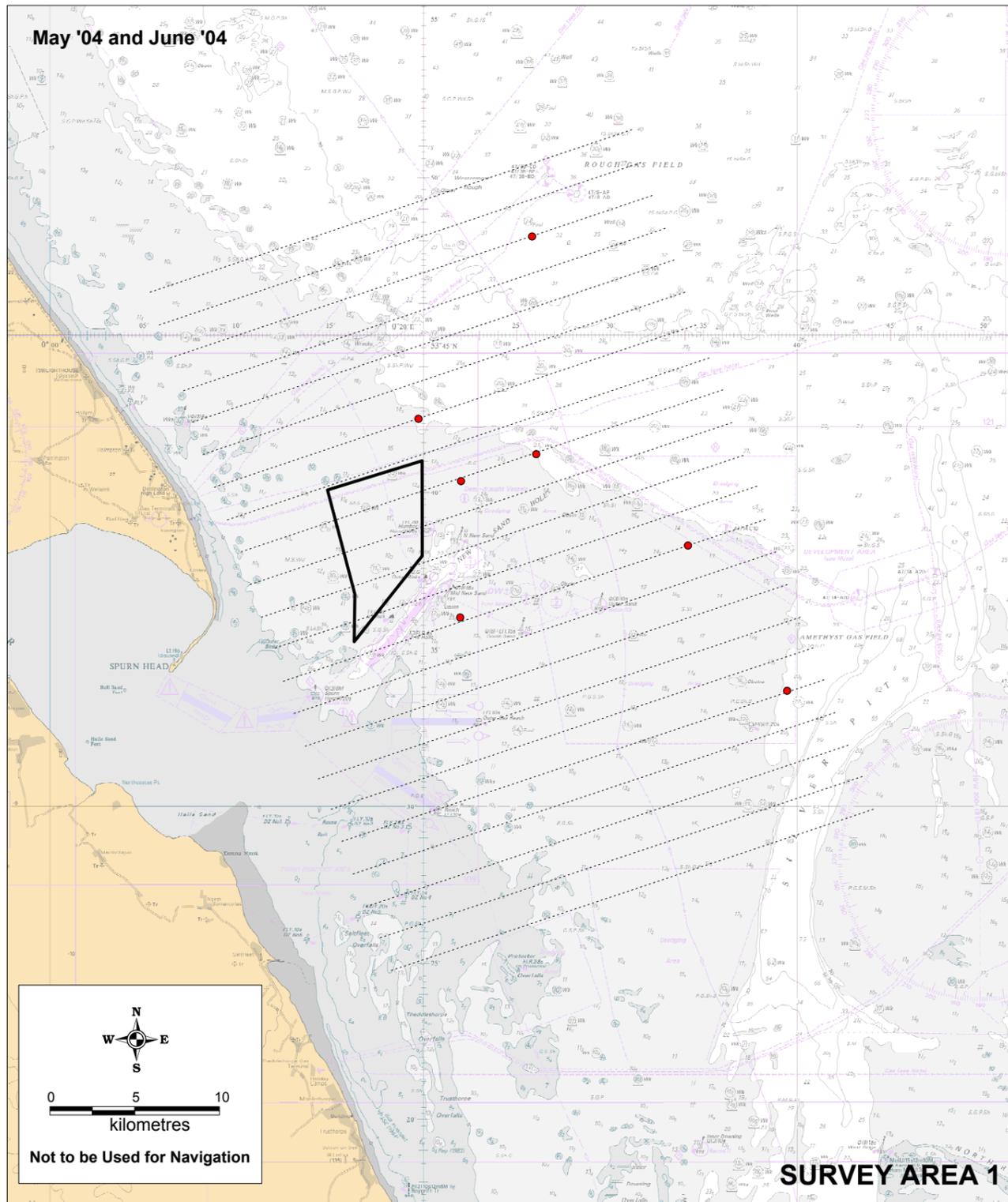
the survey findings did not show any particular flight patterns or foraging movements. Only a very small percentage of the breeding population, approximately 1% (based on a maximum of 20 birds in any survey), was present within the boat survey area, and hence the Humber Gateway site is potentially used by substantially less than 1% of the breeding population on a daily basis.

Manx Shearwater *Puffinus puffinus*

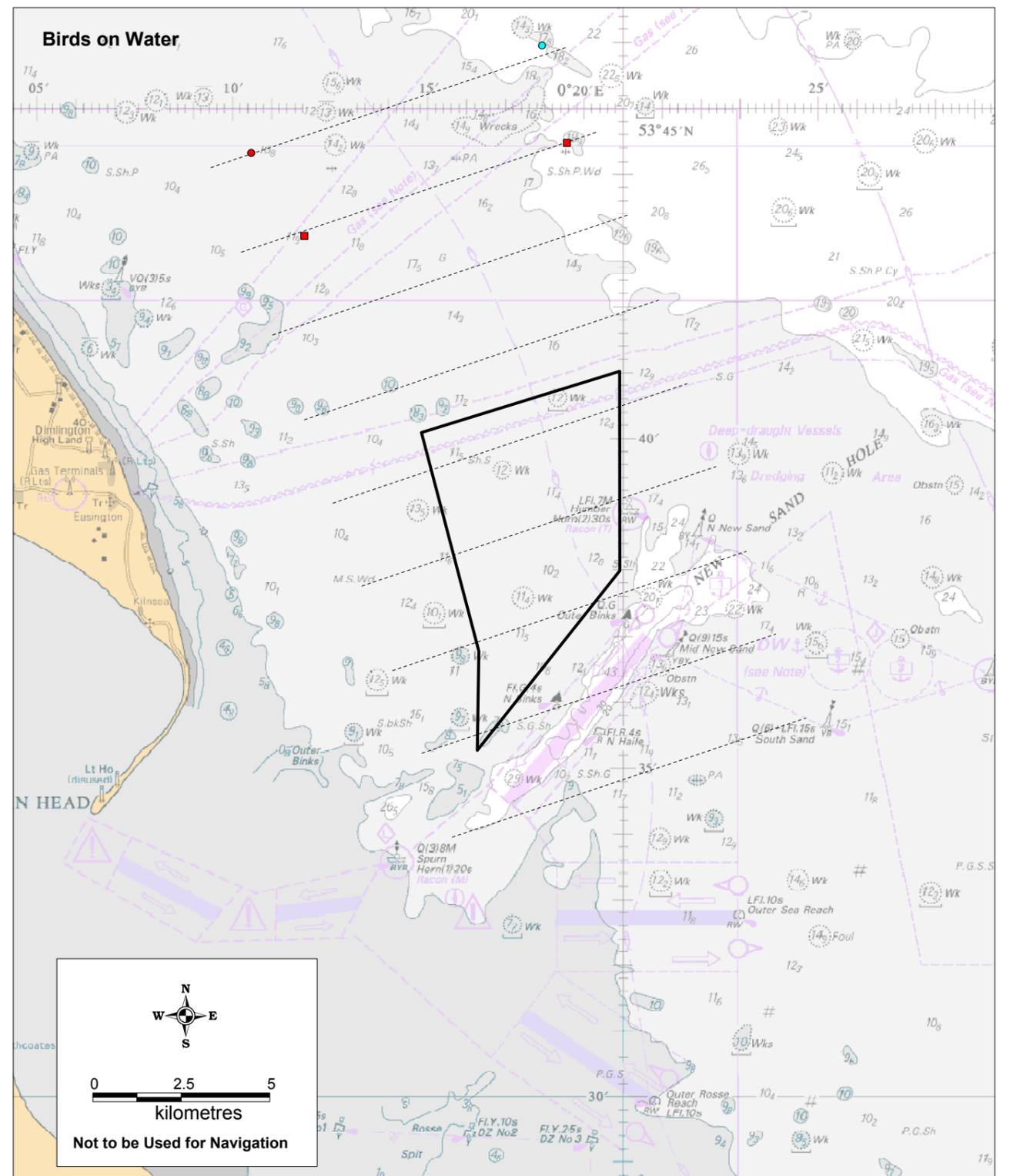
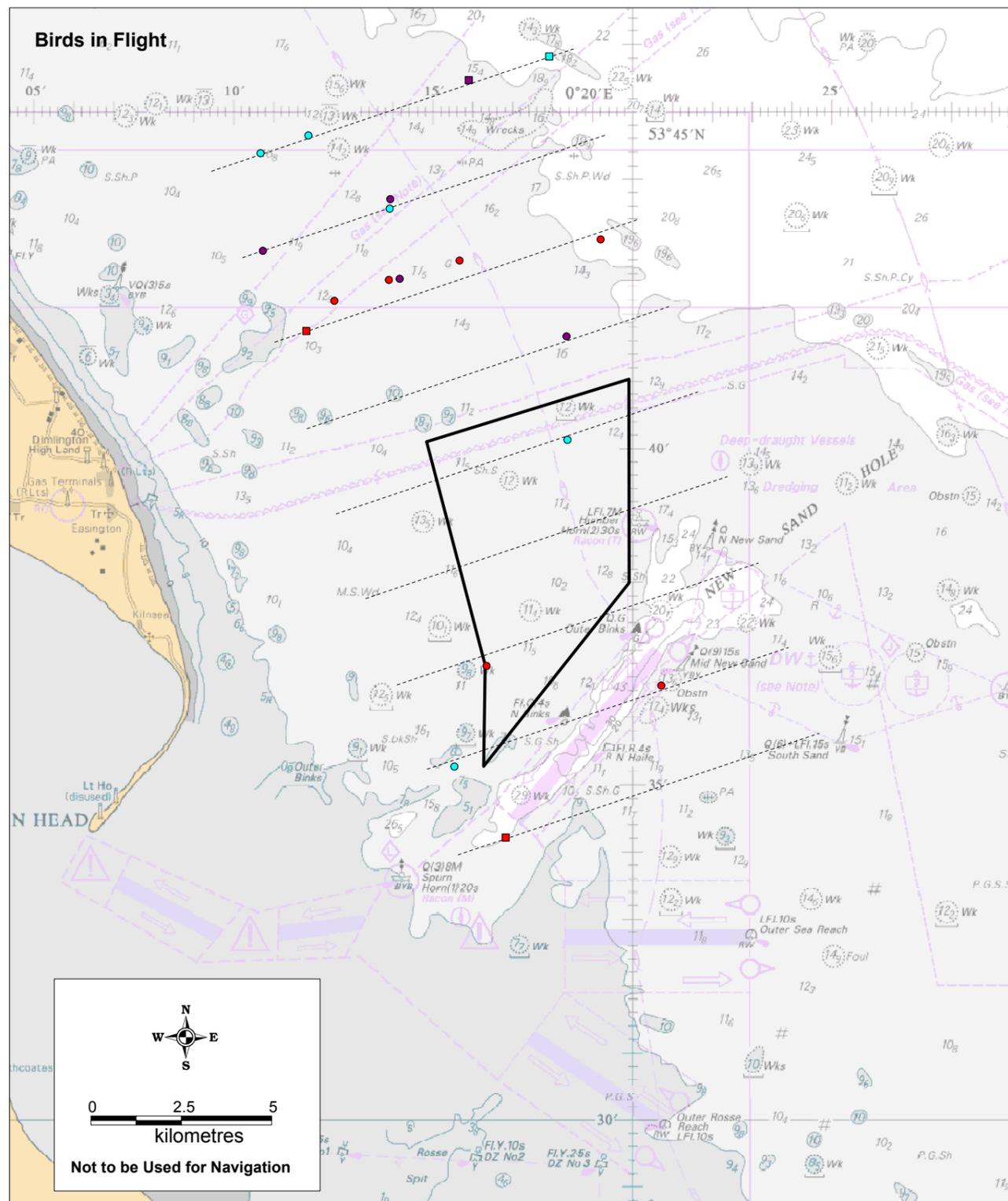
Manx shearwater was recorded in the survey area in June, July and September, with records both within the Humber Gateway survey area and the control site. This is consistent with the records from the Spurn Bird Observatory which have recorded the majority of movements off the Holderness Coast during the early to late summer. The boat-based survey recorded low densities of birds. In June and July 2004, up to 14 and 12 birds were recorded respectively (*Figure 8.39*), and may have been late or early passage movements of adults, or foraging activity by individuals from the Atlantic and Irish Sea breeding colonies. The September movement (up to seven birds) is likely to have been a post breeding dispersion, probably of juveniles.

The records from the aerial surveys were in July and September, with only occasional records in August and October. The birds were generally over 10 km offshore and all but one record was observed away from the Humber Gateway site (*Figure 8.40*).

The majority of registrations observed during the surveys were of birds in flight, with no particular pattern of distribution within the survey area, although the September survey recorded a number of birds off the mouth of the Humber Estuary, further offshore from the Humber Gateway site (*Appendix D1, Humber Gateway Seabird Survey Report*).

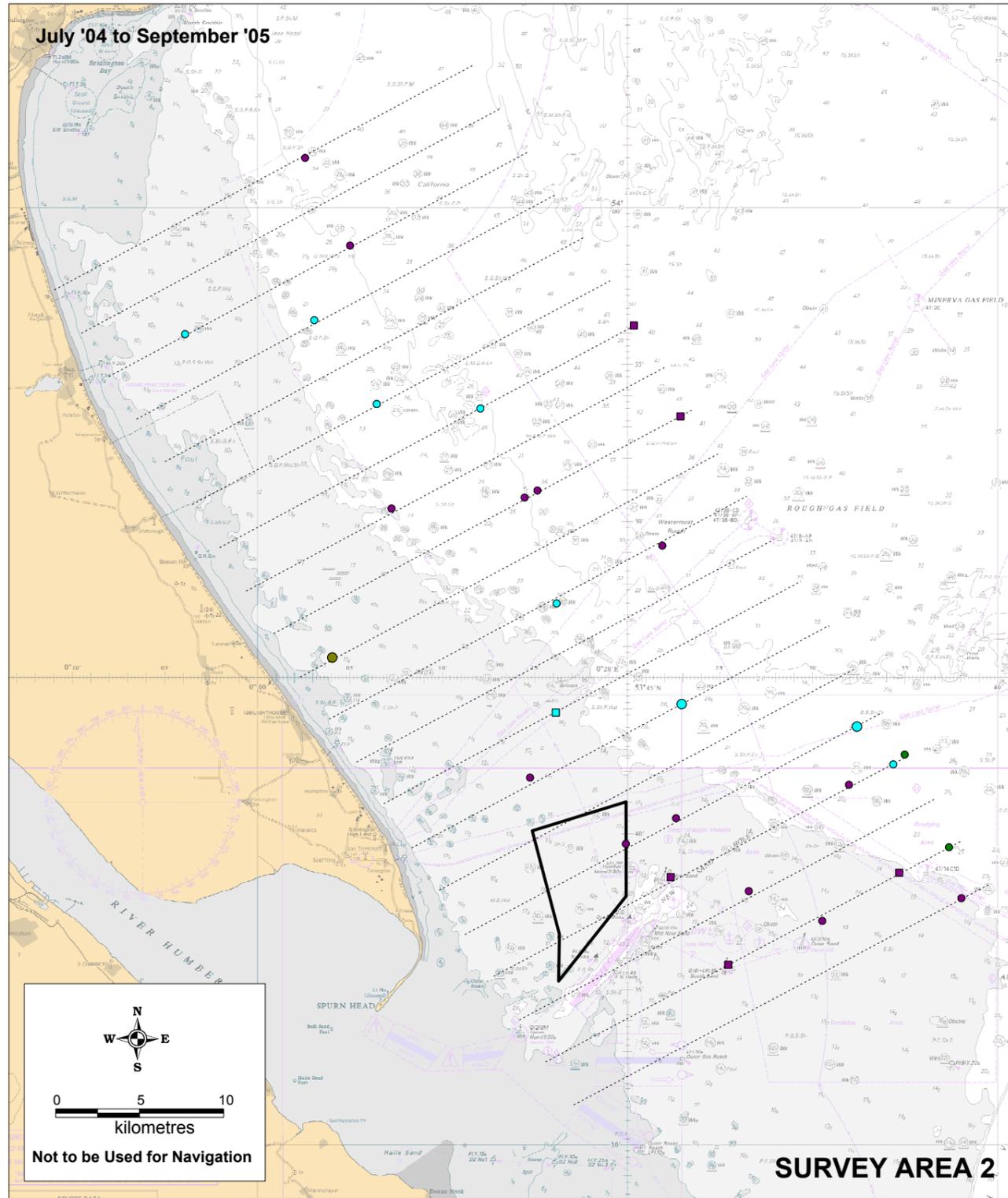
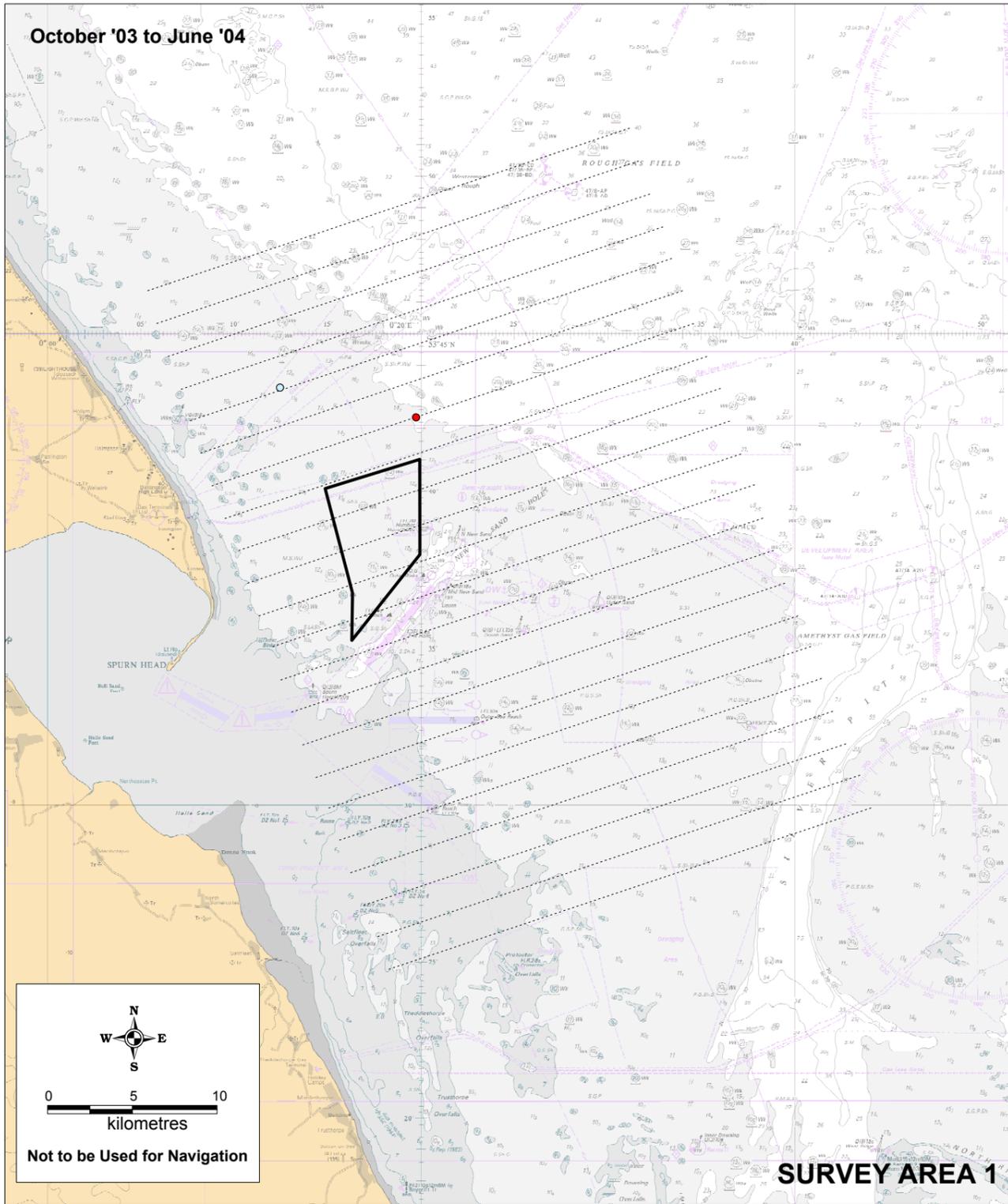


KEY: Legend 	Depth (m) Intertidal, 0-10, 10-20, 20+	Number of Birds 200 to 400 100 to 200 50 to 100 10 to 50 1 to 10	Month January February March April May June July August September October November December	CLIENT: 	SIZE: A3	TITLE: Figure 8.38 - Northern Fulmar Aerial Survey. Areas 1 & 2 Breeding Season - May to August
	DATE: 12.02.07	CHECKED:	PROJECT:	DRAWN: SMT	APPROVED:	SCALE:



KEY:

Legend	Depth (m)	Number of Birds			Month	
	<ul style="list-style-type: none"> ■ Intertidal, 0-10, 10-20, 20+ Boat Transect ▭ Humber Gateway Site 	<ul style="list-style-type: none"> ◇ 40 to 50 ◇ 30 to 40 ◇ 20 to 30 ◇ 10 to 20 ◇ 1 to 10 	<ul style="list-style-type: none"> ○ 2003 ○ 2004 ○ 2005 	<ul style="list-style-type: none"> ● January ● February ● March ● April ● May ● June ● July ● August ● September ● October ● November ● December 	<p>CLIENT: </p> <p>INSTITUTE OF ESTUARINE & COASTAL STUDIES THE UNIVERSITY OF HULL</p> <p></p>	
<p>DATE: 12.02.07</p> <p>DRAWN: SMT</p> <p>DRAWING: Shearwater_Boat Area 2_All Records.wor</p>		<p>CHECKED:</p> <p>APPROVED:</p>	<p>PROJECT:</p> <p>SCALE:</p>	<p>REV: FINAL</p>		



KEY:		Legend			Number of Birds			Month		CLIENT:	SIZE:	TITLE:
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	▭ Humber Gateway Site				50 to 100	◇	○	□	March	ERM		
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Sooty Shearwater Puffinus griseus

Sooty shearwater is occasionally recorded off the Yorkshire coast. Three birds in total were recorded during the boat-based surveys in September 2003 and 2004, whilst a single bird was observed during the aerial survey in September 2004 (*Appendix D1, Humber Gateway Seabird Survey Report*).

Unidentified Shearwaters

A further 14 shearwaters were observed during the aerial surveys in 2004 but could not be identified. These were recorded in June 2004 (two birds), September 2004 (two birds) and in October 2004 (10 birds).

Leach's Petrel Oceanodroma leucorhoa

Leach's petrel is included in *Annex 1* of the *Birds Directive* and Schedule 1 of the *Wildlife and Countryside Act, 1981* as amended. Three individuals were recorded during the November 2005 boat-based survey. It is possible that these individuals were on late migratory passage, but there is no evidence to suggest that large numbers pass through the wind farm survey area during autumn.

Northern Gannet Morus bassana

The northern gannet is a SPEC2 species (i.e. it has an unfavourable conservation status in Europe and has localised populations). The nearest breeding colony to the Humber Gateway site is at the Flamborough Head and Bempton Cliffs SPA, which lies approximately 55 km to the northwest. This is the only mainland gannet breeding colony on the east coast of England, with approximately 2,500 pairs estimated to be breeding in 2001⁽¹⁾. The only other colonies which occur on the east coast of Britain are at Bass Rock (a long way north of the wind farm in the mouth of the Firth of Forth of the East Lothian coast) where estimates suggest that the colony supports over 44,000 apparently occupied site / nests (AOS/AONs), and Troup Head (north of the wind farm off the Banff and Buchan coast) which supports approximately 1,100 AOS/AONs⁽²⁾.

The findings of the surveys during the main breeding period (May to August) showed birds in flight to be distributed across the survey area. Whilst some birds

⁽¹⁾ Stroud D A, Chambers D, Cook S, Buxton N, Fraser B, Clement P, Lewis P, Mclean I, Baker H & Whitehead S (eds) 2001. *The UK SPA Network: Its Scope and Contents*. Volume 2 Species Accounts. Peterborough. JNCC.

⁽²⁾ Mitchell P I, Newton S F, Ratcliffe N & Dunn T 2004 *Seabird Populations of Britain and Ireland*. T & A D Poyser.

were recorded within 2 km of the coastline, the majority were over 10 km offshore, and also closer to the colony at Flamborough Head and Bempton (*Appendix D1, Humber Gateway Seabird Survey Report*). Few birds were recorded within or immediately adjacent to the Humber Gateway site. The majority of birds on the water were recorded to the north of the Humber Gateway site (*Appendix D1, Humber Gateway Seabird Survey Report*).

The majority of the birds were recorded in June and July (*Appendix D1, Humber Gateway Seabird Survey Report*), a period of the year when chicks are being fed, and the adults are making regular movements between the foraging areas and nesting colonies (*Figure 8.41*). Some birds are known to travel long distances during such periods, with satellite tagging studies recording birds foraging 540 km from Bass Rock and 240 km from the colony at Great Saltee of the eastern Irish coast⁽³⁾. However, Tasker et al (1985)⁽⁴⁾ suggests that the majority feed at distances of approximately 30 to 40 km from the breeding colonies. Hence records on and around the wind farm site may include birds from colonies some distance from the Humber Gateway site. Densities of approximately one bird per km² were recorded in the wind farm survey area during the breeding season and up to two birds per km² in the control area during the same period. Stone et al (1995)⁽⁵⁾ reported densities of less than one bird per km² along the Holderness Coast during the breeding season (May to August).

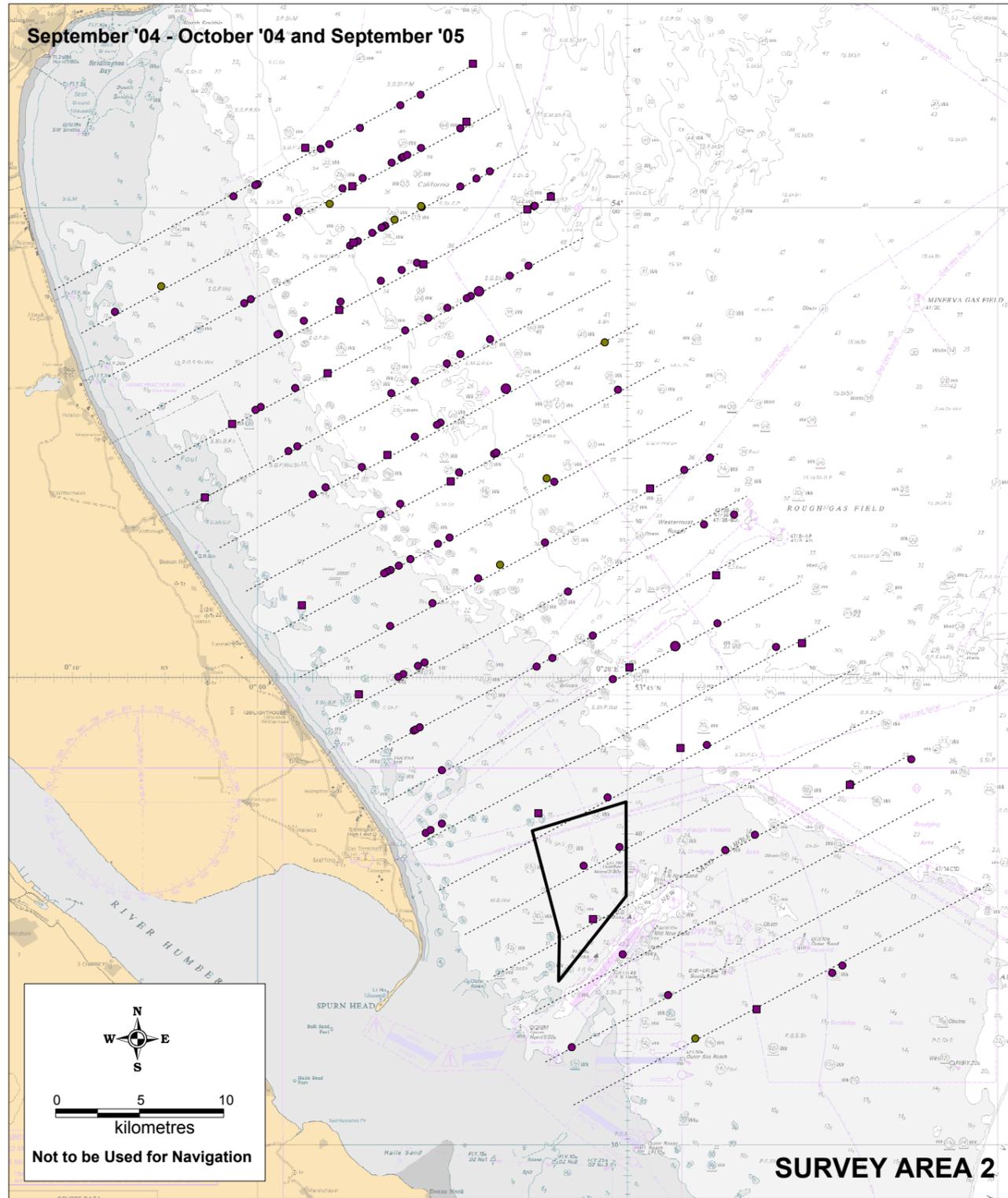
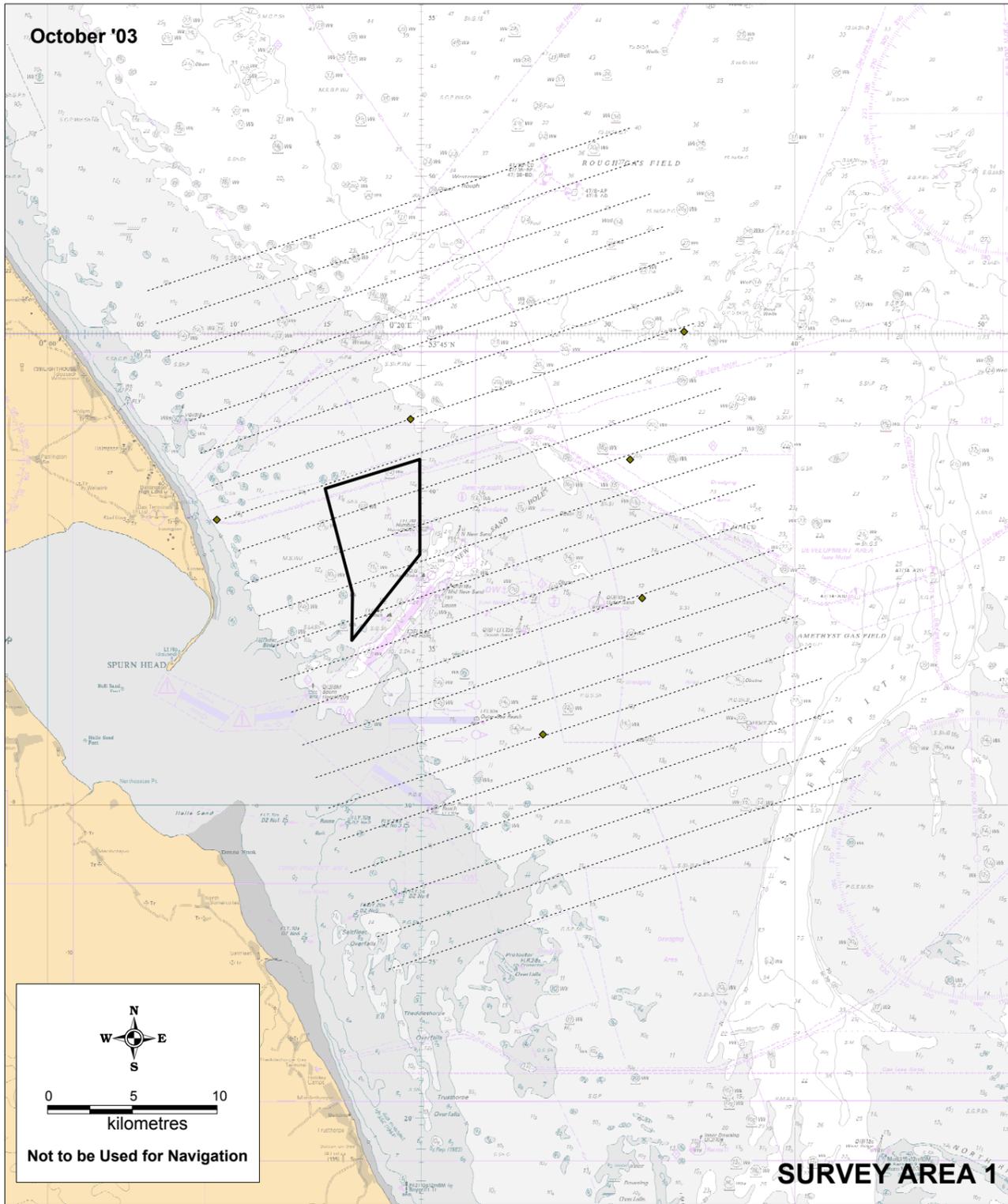
The aerial surveys recorded birds in September, especially north of the Humber Gateway site, although this was not picked up by the boat-based surveys (*Figure 8.42*). The distribution was similar to that recorded over the summer months, although with a more pronounced increase in the density of birds closer to Flamborough Head and Bempton (*Appendix D1, Humber Gateway Seabird Survey Report*). By October, numbers and densities were greatly reduced and this continued to be the case over the winter months, before they started to increase into March. Again, records were typically further north of the wind farm site (*Appendix D1, Humber Gateway Seabird Survey Report*). This is as expected given that northern gannets are known to migrate southwards after the breeding season, with many of the first year birds travelling as far as Senegal and the Gulf of Guinea⁽⁶⁾. No birds were recorded during the April surveys, but this is a time when the adults are established on their territories at the breeding colony.

⁽³⁾ Hamer K C, Phillips R A, Hill J K, Wanless S & Wood A G, 2001. *Contrasting Foraging Strategies of Gannets Morus bassanus at Two North Atlantic Colonies*. *Mar Ecol Progr Ser* 224, 283 - 290.

⁽⁴⁾ Tasker ML, PH Jones, BF Blake and TJ Dixon, 1985. *The marine distribution of the gannet Sula bassana in the North Sea*. *Bird Study* 32: 82 - 90.

⁽⁵⁾ Stone C J, Webb A, Barton C, Ratcliffe N, Reed T C, Tasker M L, Camphuysen C J & Pienkowski M W, 1995. *An Atlas of Seabird Distribution in North-west European Waters*. JNCC, Peterborough.

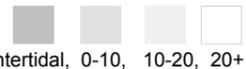
⁽⁶⁾ Wernham C, Toms M, Marchant J, Clark J, Siriwardena G & Baillie S, 2002. *The Migration Atlas - Movements of the Birds of Britain and Ireland*. T & A D Poyser.



KEY:

Legend

Depth (m)
Intertidal, 0-10, 10-20, 20+



..... Aerial Transect

□ Humber Gateway Site

Number of Birds

	2003	2004	2005
200 to 400	◇	○	□
100 to 200	◇	○	□
50 to 100	◇	○	□
10 to 50	◇	○	□
1 to 10	◇	○	□

Month

January	July
February	August
March	September
April	October
May	November
June	December

CLIENT:



SIZE:

A3

TITLE:

**Figure 8.42 - Northern Gannet
Aerial Survey. Areas 1 & 2
Post Breeding - September and October**

DATE: 12.02.07

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PROJECT:

DRAWN: SMT

APPROVED:

SCALE:

DRAWING:

Northern Gannet_PB_A1&2.wor

REV:

FINAL

Very little active fishing by the species was observed during the surveys, with birds either loafing on the water or flying through the site. Regular flight movements were observed within the survey area, predominantly along the coastline in the inshore areas west of the wind farm site, with few from within the wind farm site. The boat-based surveys recorded 67% of the flying northern gannet heading in a northerly or southerly directions, suggesting those birds were travelling between the Flamborough colony and foraging areas to the south of the Humber, for example the area around the Silver Pit.

Cormorant Species

Great Cormorant Phalacrocorax carbo

The boat survey showed a very low level of usage in the survey area, with only four birds recorded. Three of these birds were in flight suggesting that they were probably associated with the Humber Estuary.

The aerial surveys recorded a cluster of sightings immediately off the coast, in the vicinity of Hornsea. It is likely that these birds were associated with Hornsea Mere SPA, presumably fishing and roosting on the site. A further small number of records were made off the mouth of the Humber, and as with the boat survey records, it is assumed that these birds were associated with the Humber Estuary.

European Shag Phalacrocorax aristotelis

The shag is typically a bird of rocky coastlines and, in the survey area, is almost exclusively restricted to the coastal waters around the Flamborough Head and Bempton Cliffs colony where it breeds. Only two birds were recorded in the wind farm survey area during the boat-based surveys. The numbers were also scarce from the aerial survey, with the sightings during the breeding season restricted to the most northerly transects (approximately 20 km from the colony at Flamborough Head).

Wildfowl

Pink-footed Goose Anser brachyrhynchus

Pink-footed geese are associated with the Humber Estuary, rather than the Holderness Coast, hence their inclusion within the Humber Estuary SPA assemblage. Records from Spurn Bird Observatory have also recorded migratory movements off the coast (*Appendix D1, Humber Gateway Seabird Survey Report*). Two flocks of geese were recorded in flight (greater than 25 m) during the boat-based surveys:

- six birds in November 2004; and

- 39 birds in October 2005.

On both occasions, the birds were recorded in inshore waters, with the birds seen moving along the coast in a southerly direction.

Common Shelduck Tadorna tadorna

A flock of four birds was recorded in flight during the boat-based survey in January 2004, with the birds flying towards the mouth of the Humber Estuary.

Shelduck is associated with the Humber Estuary rather than the Holderness Coast, and is included within the Humber Flats, Marshes and Coast SPA / Ramsar assemblage. This species also undertakes migratory movements off the coast, moving between wetland sites in the UK and moult areas on the continent such as the Waddenzee, with movements to this area occurring during the mid to late summer, and return flights arriving from the autumn and through the winter ^{(1) (2)}.

Eurasian Wigeon Anas penelope

A flock of nine birds was flushed from the sea surface during the boat-based survey in November 2005. It is possible these birds were in active migration through the area. Wigeon forms part of the Humber Flats, Marshes and Coast SPA / Ramsar assemblage with a population comprising over 4,000 birds. This species migrates to and from breeding grounds in northern Europe (Iceland, Fennoscandia and northern Russia), with flocks arriving in the Humber Estuary during the autumn and departing in the spring.

Common Scoter Melanitta nigra

The species is listed on Schedule 1 under the *Wildlife and Countryside Act, 1981* as amended. It is also a Red List species and has a UK Biodiversity Action Plan.

The majority of records of this species were made during the autumn and early winter during the boat-based surveys. The peak occurred in October 2004 when a flock of 15 birds was seen on the water in the waters inshore of the Humber Gateway site (*Appendix D1, Humber Gateway Seabird Survey Report*).

⁽¹⁾ Lack P, 1986. An Atlas of Wintering Birds in Britain and Ireland. Calton Poyser.

⁽²⁾ Meltofte H, Blew J, Frikke J, Rösner H-U & Smit C J (1994) Numbers and Distribution of Waterbirds in the Wadden Sea. Results and Evaluation of 36 Simultaneous Counts in the Dutch-German-Danish Wadden Sea 1980-1991. IWRB Publication 34/Wader Study Group Bull. 74 Special issue Common Secretariat for the Co-Operation on the Protection of the Wadden Sea.

All other records were of small numbers of birds in flight. Single birds were observed in January 2004 and April 2005 several kilometres to the southeast of the Humber Gateway site. In November 2004, two birds were observed several kilometres north of the Humber Gateway site, and nine birds (five in the wind farm survey area and four in the control area) were observed in August 2004, again several kilometres away from the Humber Gateway site. In general, the majority of records were from an area of sea off the Humber mouth, in the region of the Binks, a sand, gravel and cobble area which may have the potential to support mussel bed communities.

Other Ducks

Three other duck species were recorded during the surveys, mallard *Anas platyrhynchos*, teal *Anas crecca* and eider *Somateria mollissima*. Both mallard and teal are part of the waterfowl assemblage of the Humber Flats, Marshes and Coast SPA.

A largely resident population of mallard occurs within the Humber catchment. However, there may be an influx of continental birds during the winter, depending on weather conditions, with return movements undertaken during the late winter or early spring. There were only two sightings of mallard during the surveys in November 2005, with two birds in the wind farm survey area and six birds in the control area. The relative lack of sightings reflected the low importance of the area for wintering and migratory mallard populations.

The majority of teal flocks move into the estuary during autumn, over-winter and then return to northern breeding grounds (Fennoscandia and western Russia) in the spring, although a small population breeds in the Humber catchment⁽¹⁾. Teal was recorded on only one occasion on the water in the control area in November 2005 along with the mallard.

Common eider was only recorded on one occasion during the surveys when a flock of five birds was recorded in the most northern transect of the control survey area during the December 2004 boat-based survey when the birds were seen flying in a northeasterly direction.

Waders

Very few waders were recorded during the boat-based surveys. Those that were recorded include the following:

- a single golden plover *Pluvialis apricaria* in December 2004 flying southwest in the wind farm survey area;
- two redshank *Tringa totanus* in the control survey area in July 2004 flying in a southwesterly direction;
- three woodcock *Scolopax rusticola* on passage across the control and wind farm survey areas in November 2004 flying in a southwesterly direction just above sea level;
- one red phalarope *Phalaropus fulicarius* which was recorded in January 2005; and
- five other birds *Calidris* genus which were recorded in December 2005, with a single bird recorded flying west in the control site and four birds flying south in the wind farm survey area – all the birds were flying just above sea level.

Additionally, three unidentified waders were recorded during the aerial surveys.

Skua Species

Overview

Skuas move through the area during the autumn, with the Spurn Observatory data for Spurn Head indicating the main movement occurs between September and November. On occasion, over 200 birds have moved through the coast within a day. There are also records for both great skua and arctic skua during spring passage, and other skua species may be recorded in small numbers on occasions.

Great Skua *Stercorarius skua*

Observations from the boat-based and aerial surveys showed the species to be restricted to the spring and autumn passage periods. Great Skuas remain close to their breeding colonies in northern Scotland, Iceland, Norway and Northern Russia during the breeding season and the sightings during the autumn period reflect the dispersion of these birds from their breeding colonies. Fourteen birds were recorded during the aerial surveys, and three birds were recorded in flight during the boat-based survey. From the aerial surveys, it appeared that the birds were dispersed throughout the survey area, with no apparent area of concentration. Ninety percent of the aeroplane sightings related to single or paired birds sitting on the sea surface.

⁽¹⁾ Gibbons D W, Reid J B & Chapman R A, 1993. The New Atlas of Breeding Birds in Britain and Ireland 1988-1991 London, T.A.D. Poyser.

Arctic Skua Stercorarius parasiticus

A total of 14 individuals, mostly in flight, were recorded during the boat-based survey over the period July to October, predominantly in the waters surrounding the Humber Gateway site. A small flock was recorded on the water to the southeast of the Humber Gateway site in September 2005. There was no apparent concentration of birds within the survey areas. Sightings from the aerial survey were lower with only six birds noted.

Unidentified Skua Species Stercorarius spp

It was often not possible to differentiate the species of skuas recorded during the aerial surveys, and hence many were recorded as skua species. Birds were observed in low numbers and scattered across the survey area between Flamborough Head to Spurn Head over the period July to September (*Appendix D1, Humber Gateway Seabird Survey Report*).

Gulls*Little Gull Larus minutus*

The little gull is listed on Annex I of the *Wild Birds Directive*. Along the Yorkshire coast, the species can be recorded daily (100 birds plus, although up to 10,000 have been recorded) during the passage periods, with the main movement occurring during September and October. Having bred in the Baltic and undergone their post-breeding moult, these birds are part of a substantial movement of little gull onto the UK North Sea coast, before moving out to wintering grounds.

The boat-based surveys recorded birds in flight and on the water. Densities of more than 1 bird per km² were recorded in the wind farm area and control site during July 2005, with a peak of 100 birds recorded in the wind farm survey area. Smaller numbers were recorded during the late summer to early winter in both 2004 and 2005.

A dedicated boat-based survey for little gull was completed in October 2005. It was undertaken at a time which coincided with the main period of movement of the species along the coast, based on land based observations from Spurn Observatory (*Appendix D1, Humber Gateway Seabird Survey Report*). The majority of birds recorded were at distances of between approximately 10 km and 22 km offshore (i.e. the end of transect), with the largest flocks (on the water) around 15 km to 20 km offshore (*Figure 8.43*).

In contrast the aerial surveys recorded much greater numbers of little gulls than the boat surveys, predominantly between July and September, with the majority of the birds recorded to the north of the wind farm site (*Figure 8.44*). Concentrations were

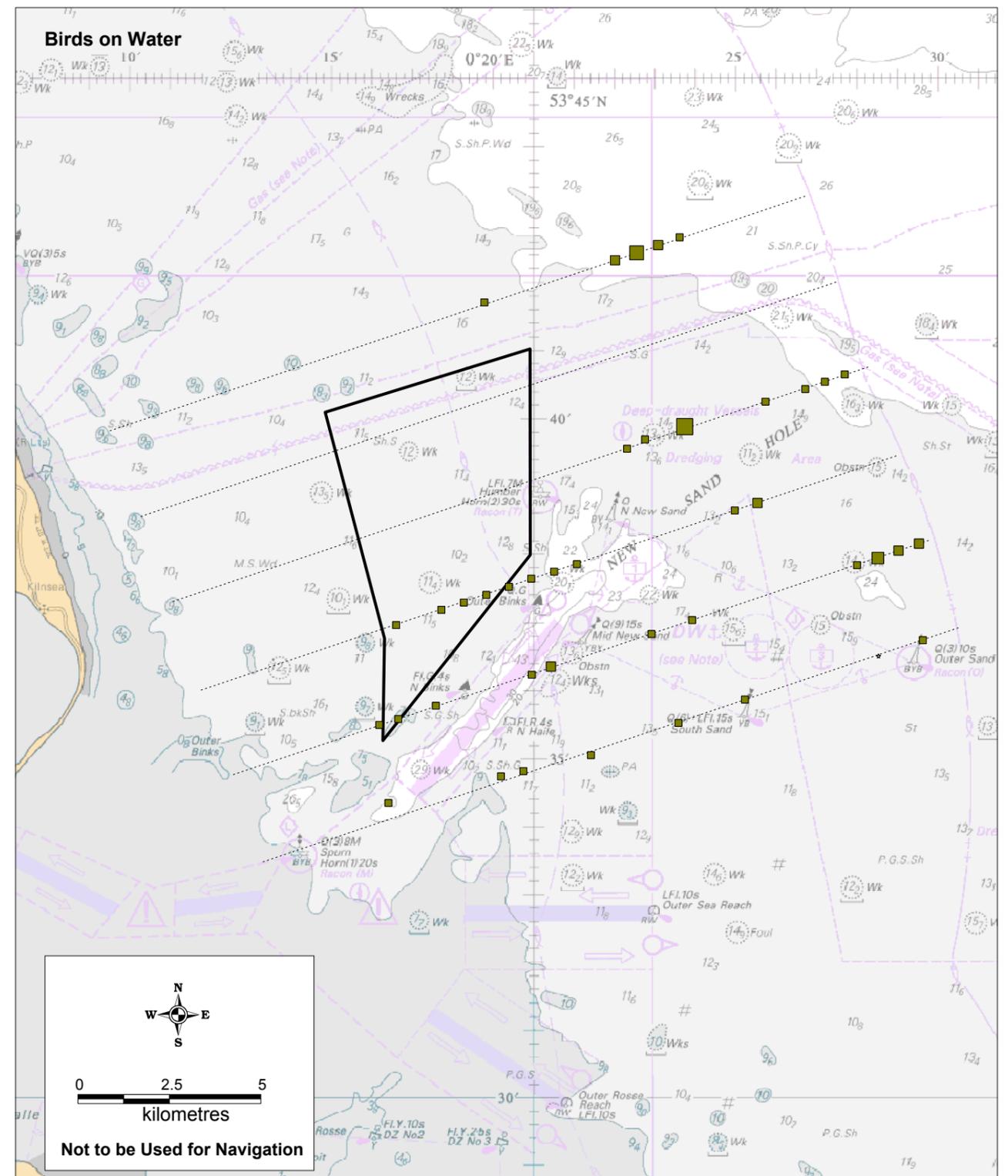
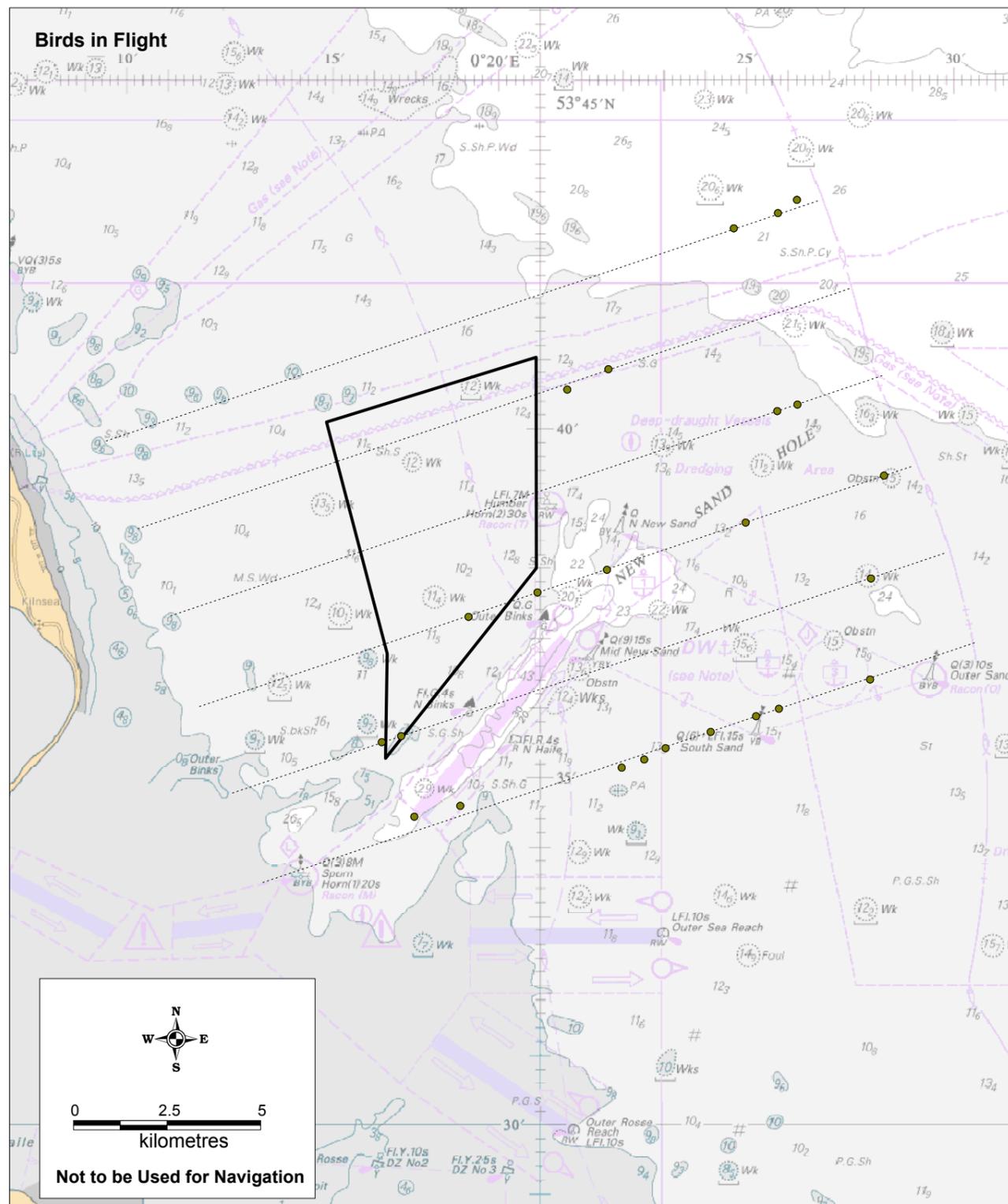
mainly offshore from Hornsea, between 7 km and 17 km off the coast, and at the transect end, between 25 to 30 km offshore (*Appendix D1, Humber Gateway Seabird Survey Report*). Sizeable concentrations of little gulls are known to use Hornsea Mere during the late summer⁽¹⁾. By September, the aerial survey findings showed that the main flocks were further south, covering the area offshore from north of Withernsea to Easington, with a few flocks off the mouth of the Humber Estuary. During the September surveys, birds were also recorded across a much wider area, ranging from 7 km offshore to 25 km offshore. Occasional flocks were also recorded in October, around 9 km off Spurn Head. Little gulls were virtually absent from the survey area during the winter months.

The main feeding areas of little gull are, therefore, at some distance offshore and away from the wind farm development area. However, the findings show that little gull is present within the inshore waters on occasions, including within the Humber Gateway site.

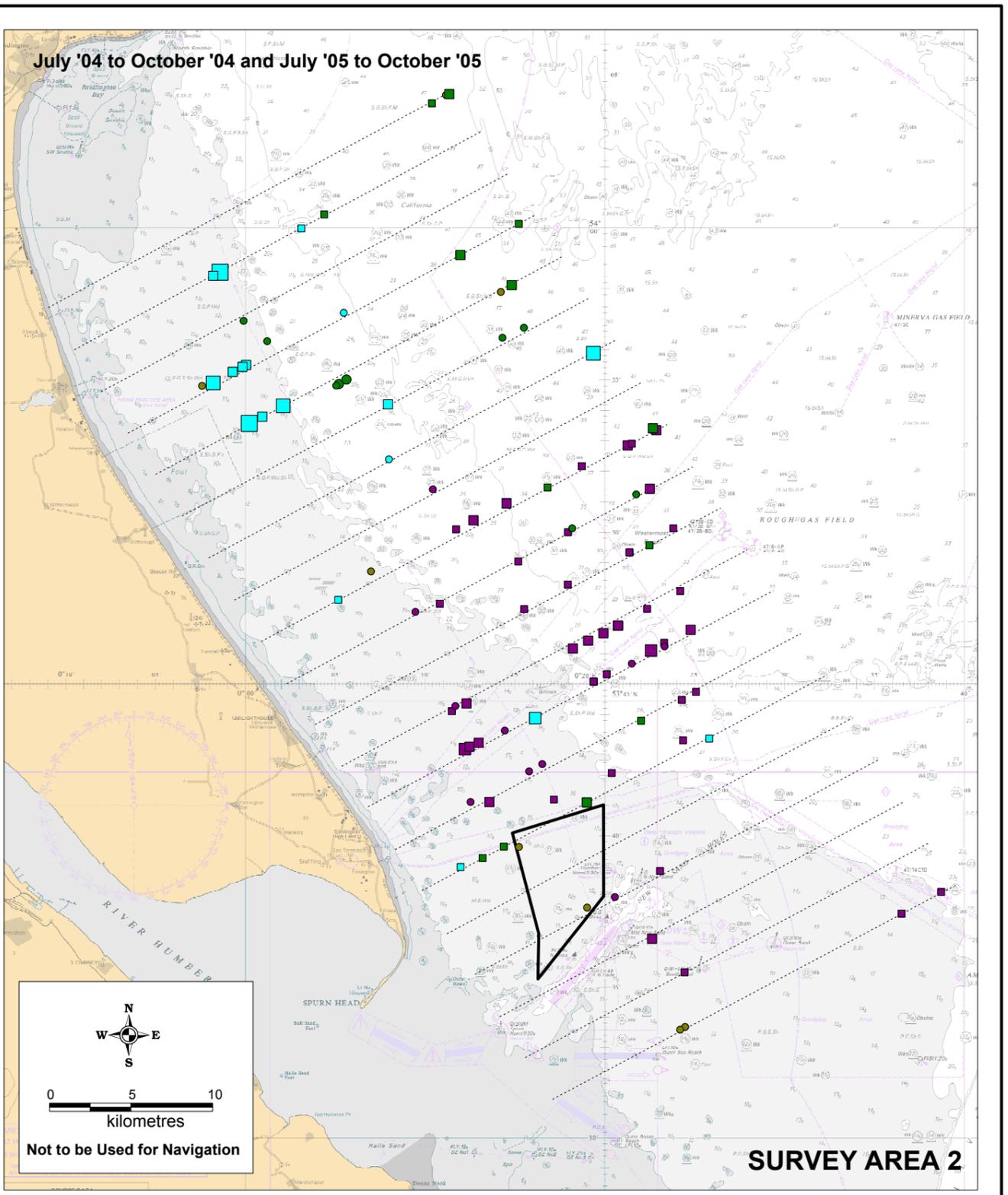
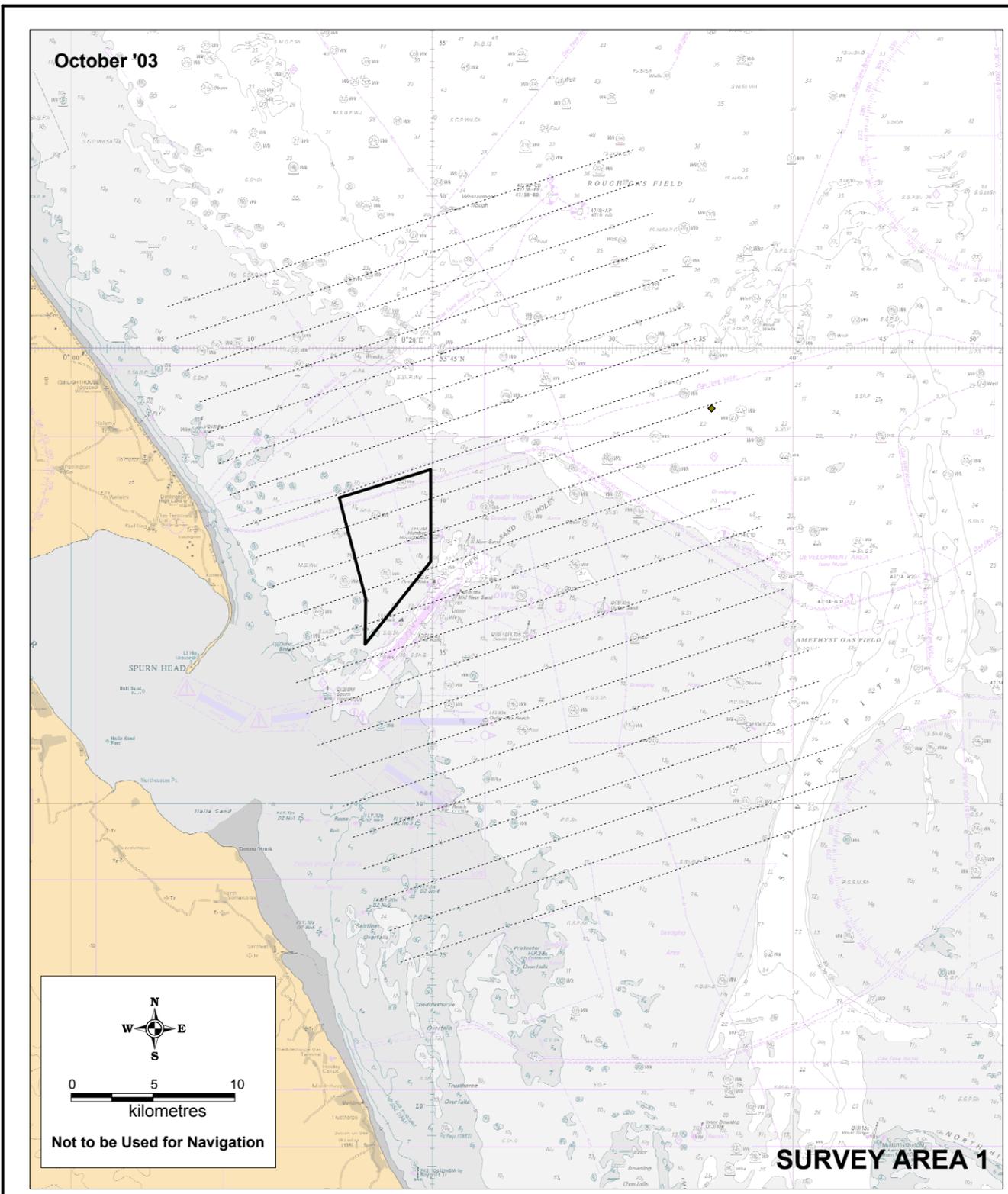
Black-headed Gull Larus ridibundus

Both the boat-based and aerial surveys recorded relatively few birds in the survey predominantly in the autumn period, perhaps reflecting post-breeding moult and dispersion to wintering grounds. The majority of records during the boat surveys were of individual birds flying in a westerly or southwesterly direction. All records were of birds in the waters to the north and to the south of the Humber Gateway site (*Appendix D1, Humber Gateway Seabird Survey Report*).

⁽¹⁾ Hartley C, 2004. Little Gulls at Sea off Yorkshire in Autumn 2003. *British Birds* 97.



KEY: Legend Depth (m) Intertidal, 0-10, 10-20, 20+ Boat Transect Humber Gateway Site	Number of Birds 2003 2004 2005 40 to 50 ◊ ○ □ 30 to 40 ◊ ○ □ 20 to 30 ◊ ○ □ 10 to 20 ◊ ○ □ 1 to 10 ◊ ○ □			Month January (light blue), February (light green), March (pink), April (red), May (dark blue), June (red) July (cyan), August (green), September (purple), October (olive), November (magenta), December (yellow)		CLIENT: 	SIZE: A3	TITLE: Figure 8.43 - Little Gull Dedicated Survey. All Records - October 05
	DATE: 12.02.07 CHECKED: PROJECT: DRAWN: SMT APPROVED: SCALE: DRAWING: Little Gull October Dedicated Survey.wor REV: A							



KEY: Legend 	Depth (m) Intertidal, 0-10, 10-20, 20+	Number of Birds 200 to 400 2003 2004 2005 100 to 200 50 to 100 10 to 50 1 to 10	Month January July February August March September April October May November June December	CLIENT: 	SIZE: A3	TITLE: Figure 8.44 - Little Gull Aerial Survey. Areas 1 & 2 Autumn Passage (July to October)
	DATE: 12.02.07 DRAWN: SMT DRAWING: Little Gull_A_A1&2.wor	CHECKED: APPROVED:	PROJECT: SCALE: REV: FINAL			

Mew (Common) Gull Larus canus

The mew gull is in an unfavourable conservation status and is declining in Europe (SPEC2).

Mew gull was most commonly recorded in the winter months (*Figure 8.45 and Figure 8.46, and Appendix D1, Humber Gateway Seabird Survey Report*). Between 15 and 70 birds were recorded in the main survey area, whilst on the majority of surveys, fewer than 20 birds were recorded in the control area. A peak of 100 birds was, however, recorded in the control block in April 2004. The species was present during the passage and winter months, with a near absence during the period July to September.

The highest density recorded was approximately two birds per km² during the March 2005 surveys, with typical densities of approximately one bird per km² over the winter months. The Humber Gateway site was not found to be of particular value to mew gull for foraging.

Lesser Black-backed Gull Larus fuscus

A small number of lesser black-backed gulls were recorded during the surveys. The majority of records were made in August and included some records from within the Humber Gateway site (*Appendix D1, Humber Gateway Seabird Survey Report*), suggesting a degree of migratory movement through the area at this time, from inland and coastal breeding sites further to the north.

Herring Gull Larus argentatus

This species is generally present in greatest numbers during the winter and spring, with between two and 12 birds recorded on most surveys in the wind farm survey area, and between one and seven in the control area (*Appendix D1, Humber Gateway Seabird Survey Report*). The number of birds recorded over the winter of 2004/05 was substantially lower than the winter of 2003/04. The majority of individuals were observed in flight, but occasionally birds were seen on the sea surface around fishing vessels, mainly potting boats. The boat-based surveys indicated a slight clustering of birds off the mouth of the Humber, although this is based on a small sample size. Densities of herring gull were low throughout the survey programme (*Appendix D1, Humber Gateway Seabird Survey Report*).

The aerial surveys recorded birds scattered across the survey area throughout the year, although very few registrations were made within, or adjacent to, the Humber Gateway site (*Appendix D1, Humber Gateway Seabird Survey Report*).

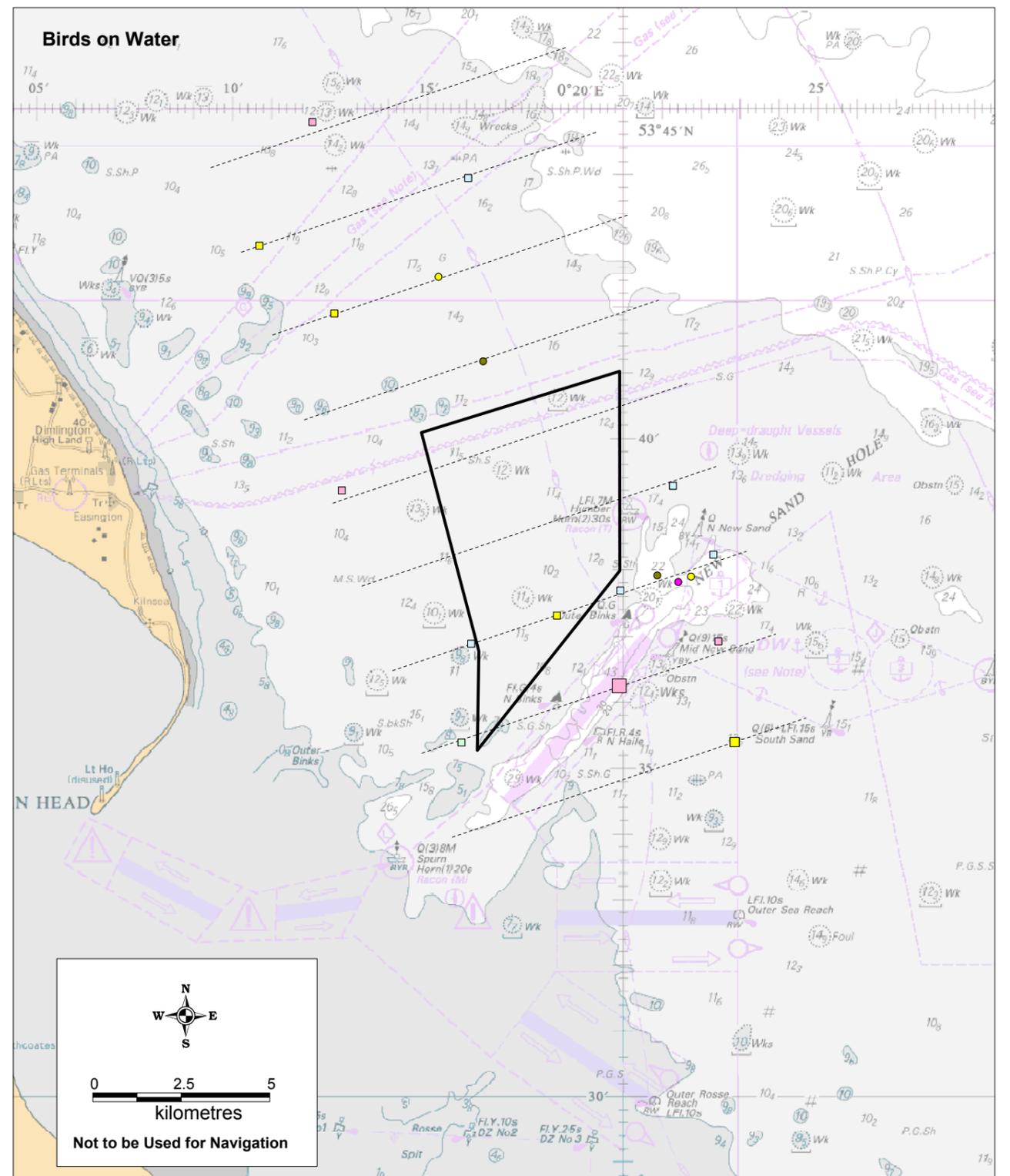
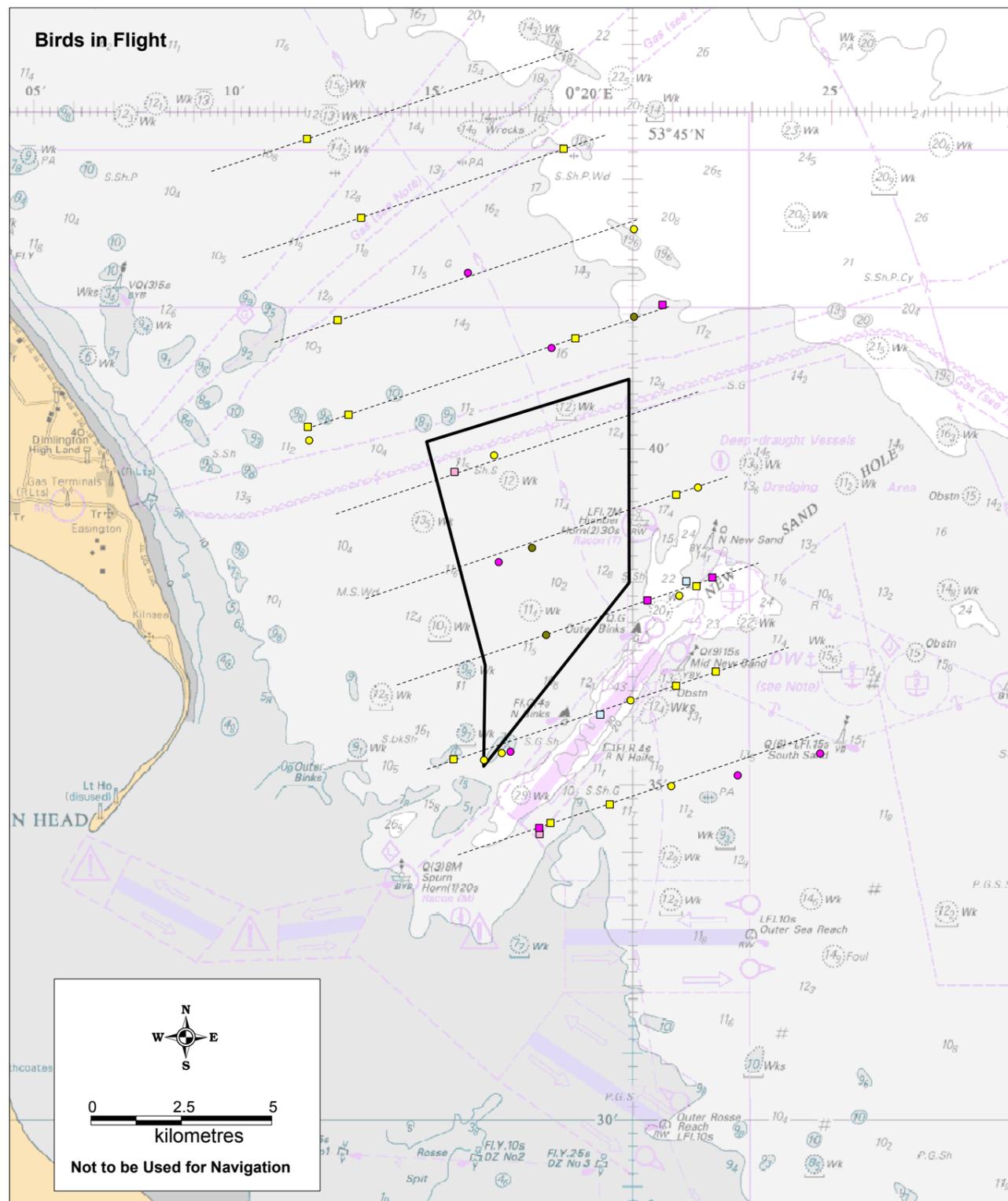
Glaucous Gull Larus hyperboreus

This species is uncommonly recorded along the Yorkshire coast, and is not a species of particular conservation concern at a European level ⁽¹⁾. An immature bird was recorded in the wind farm survey area during the March 2005 boat-based seabird survey.



Source: Andy Coates, ERM.

⁽¹⁾ Papazoglou et al, 2004. Birds in the European Union: A Status assessment. Birdlife International.



KEY:

Legend	Depth (m)	Number of Birds			Month									
	<ul style="list-style-type: none"> ■ Intertidal, 0-10, 10-20, 20+ Boat Transect ▭ Humber Gateway Site 	<ul style="list-style-type: none"> ◇ 40 to 50 ◇ 30 to 40 ◇ 20 to 30 ◇ 10 to 20 ◇ 1 to 10 	<ul style="list-style-type: none"> ○ 2003 ○ 2004 ○ 2005 	<ul style="list-style-type: none"> ● January ● February ● March ● April ● May ● June ● July ● August ● September ● October ● November ● December 	<p>CLIENT: Institute of estuarine & coastal studies THE UNIVERSITY OF HULL</p> <p>SIZE: A3</p> <p>TITLE: Figure 8.45 - Mew Gull Boat Survey. Area 2. Winter (October to March)</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>DATE: 12.02.07</td> <td>CHECKED:</td> <td>PROJECT:</td> </tr> <tr> <td>DRAWN: SMT</td> <td>APPROVED:</td> <td>SCALE:</td> </tr> <tr> <td colspan="2">DRAWING: Mew Gull_Boat Area 2 Winter.wor</td> <td>REV: FINAL</td> </tr> </table>		DATE: 12.02.07	CHECKED:	PROJECT:	DRAWN: SMT	APPROVED:	SCALE:	DRAWING: Mew Gull_Boat Area 2 Winter.wor	
DATE: 12.02.07	CHECKED:	PROJECT:												
DRAWN: SMT	APPROVED:	SCALE:												
DRAWING: Mew Gull_Boat Area 2 Winter.wor		REV: FINAL												

*Great Black-backed Gull *Larus marinus**

The boat-based surveys recorded low numbers of great black-backed gulls with most birds recorded during the period October to December. The birds were dispersed across the outer part of the survey area, predominantly over 10 km from the coast. The birds were recorded both in flight and on the water (*Appendix D1, Humber Gateway Seabird Survey Report*).

The aerial surveys identified birds during the same period and particularly during November 2003, but also recorded birds throughout the rest of the year (*Figure 8.47 to Figure 8.50 and Appendix D1, Humber Gateway Seabird Survey Report*). The records were scattered across the survey area with no significant concentrations, except the occasional use by roosting birds of the helicopter landing pad on the Rough Gas Field offshore gas platform on the edge of the aerial survey area.

Densities recorded were typically less than 0.5 birds per km², although in October 2003 a density of 0.86 birds per km² was recorded.

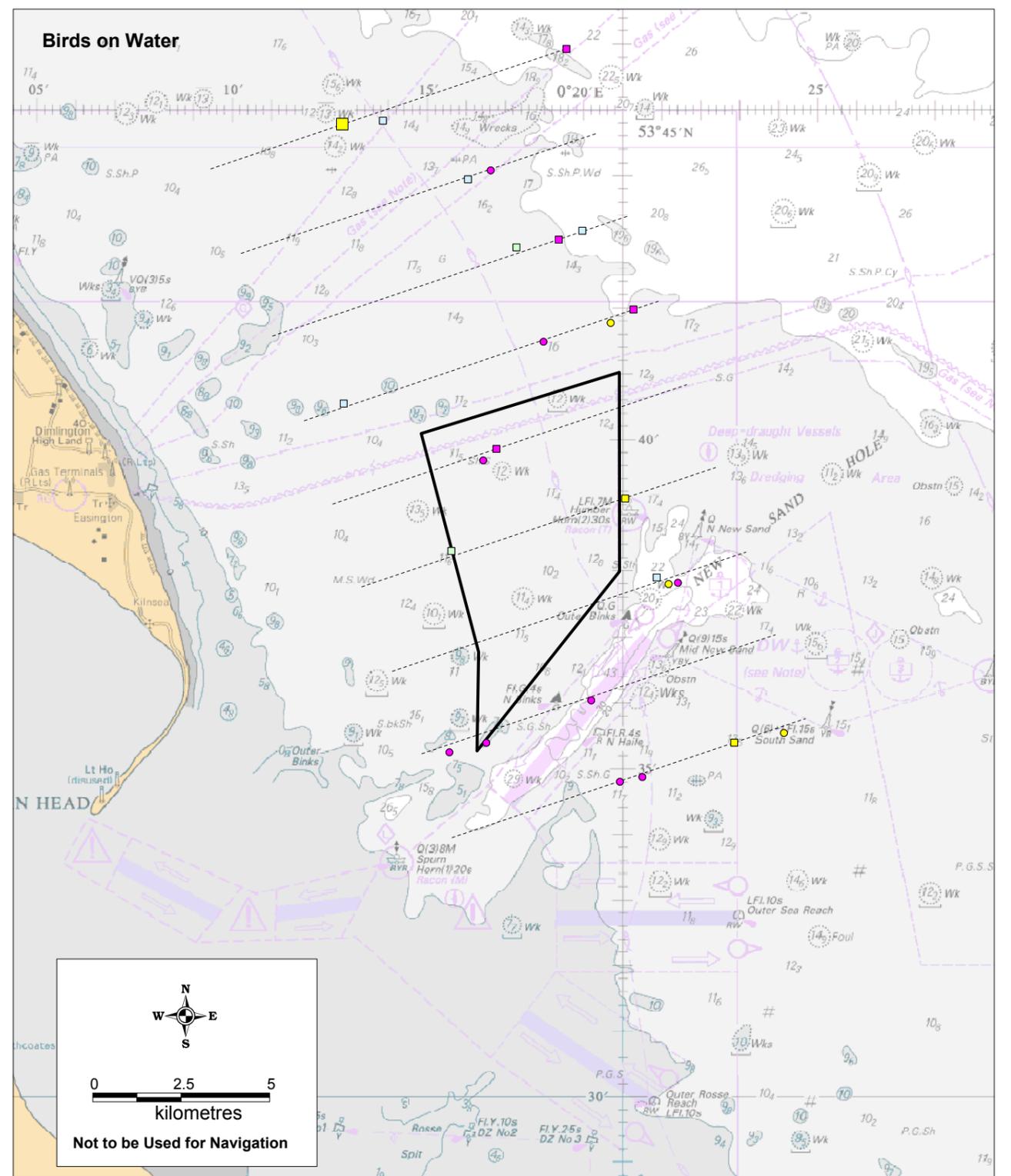
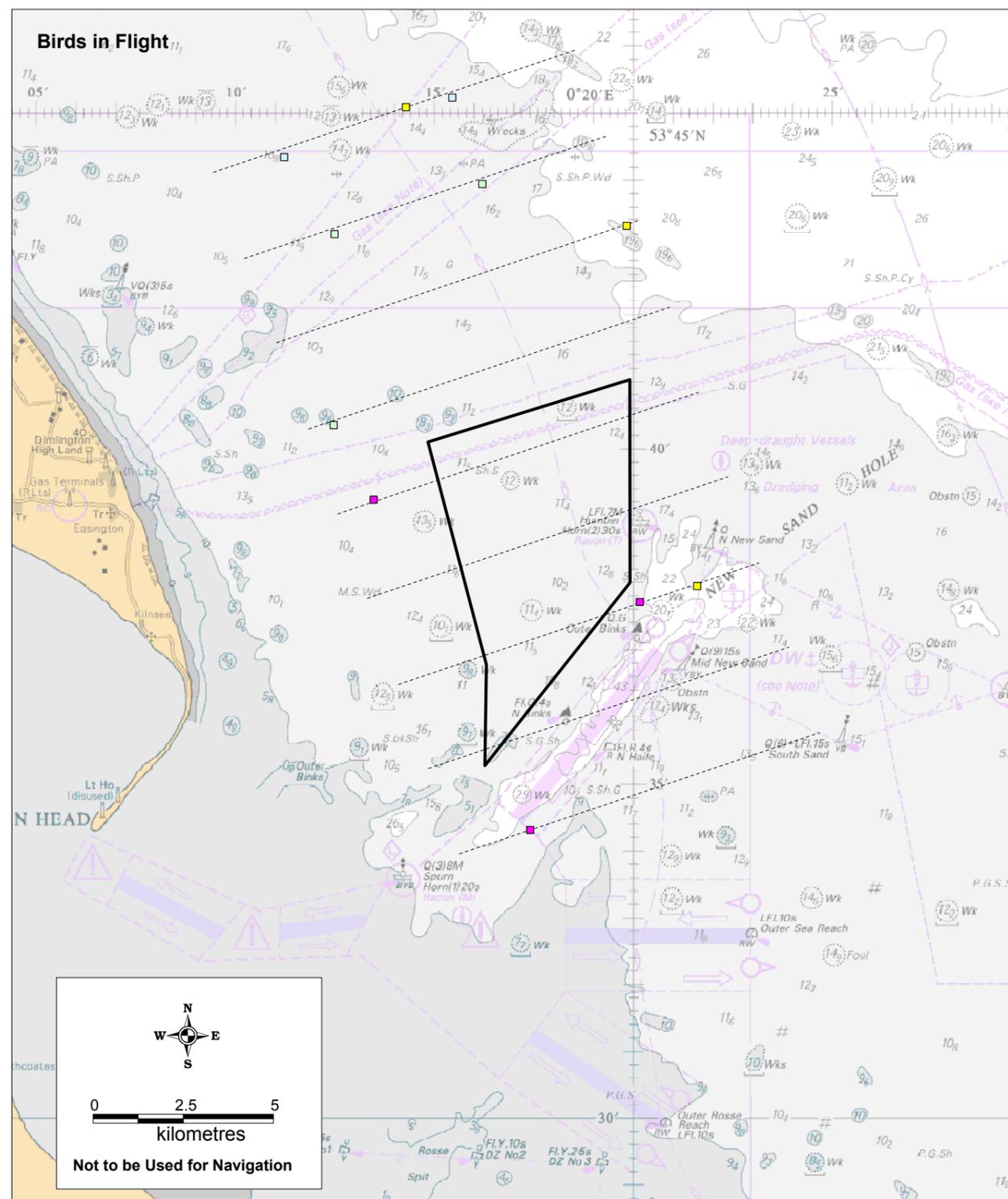
*Black-legged Kittiwake *Rissa tridactyla**

Kittiwakes were recorded in most months, throughout the survey area (during both the boat-based and aerial surveys). The numbers recorded during the boat-based surveys were greatest during the period April to July, and especially during June, with birds recorded in flight and on the water including occasional records within the Humber Gateway site (*Figure 8.51 and Appendix D1, Humber Gateway Seabird Survey Report*). Between 20 and 50 birds were recorded per survey visit during the boat-based surveys, with a peak of just over 200 birds in June 2004, with peak densities of over two birds per km² in the wind farm survey area and over four birds per km² in the control area. The numbers and densities recorded in June reflect the presence of the breeding colony at Flamborough Head, which is the largest breeding colony of kittiwake in the UK.

The aerial survey findings show that the majority of the birds were recorded over 10 km offshore. Whilst some birds were recorded on the Humber Gateway site, the greatest numbers were further offshore to the north and east in all months. Some concentrations were observed, for example northeast of the Humber Gateway site in June 2003, to the east in June 2004 and generally north of the site in August and September 2004 (*Figure 8.52 and Figure 8.53, and Appendix D1, Humber Gateway Seabird Survey Report*). In other months, the distribution was more even across the survey areas, with some birds recorded within the Humber Gateway site.



Source: Andy Coates, ERM.



KEY:

Legend

Depth (m)

Intertidal, 0-10, 10-20, 20+

Boat Transect

Humber Gateway Site

Number of Birds

	2003	2004	2005
40 to 50	◇	○	□
30 to 40	◇	○	□
20 to 30	◇	○	□
10 to 20	◇	○	□
1 to 10	◇	○	□

Month

January	July
February	August
March	September
April	October
May	November
June	December

CLIENT:



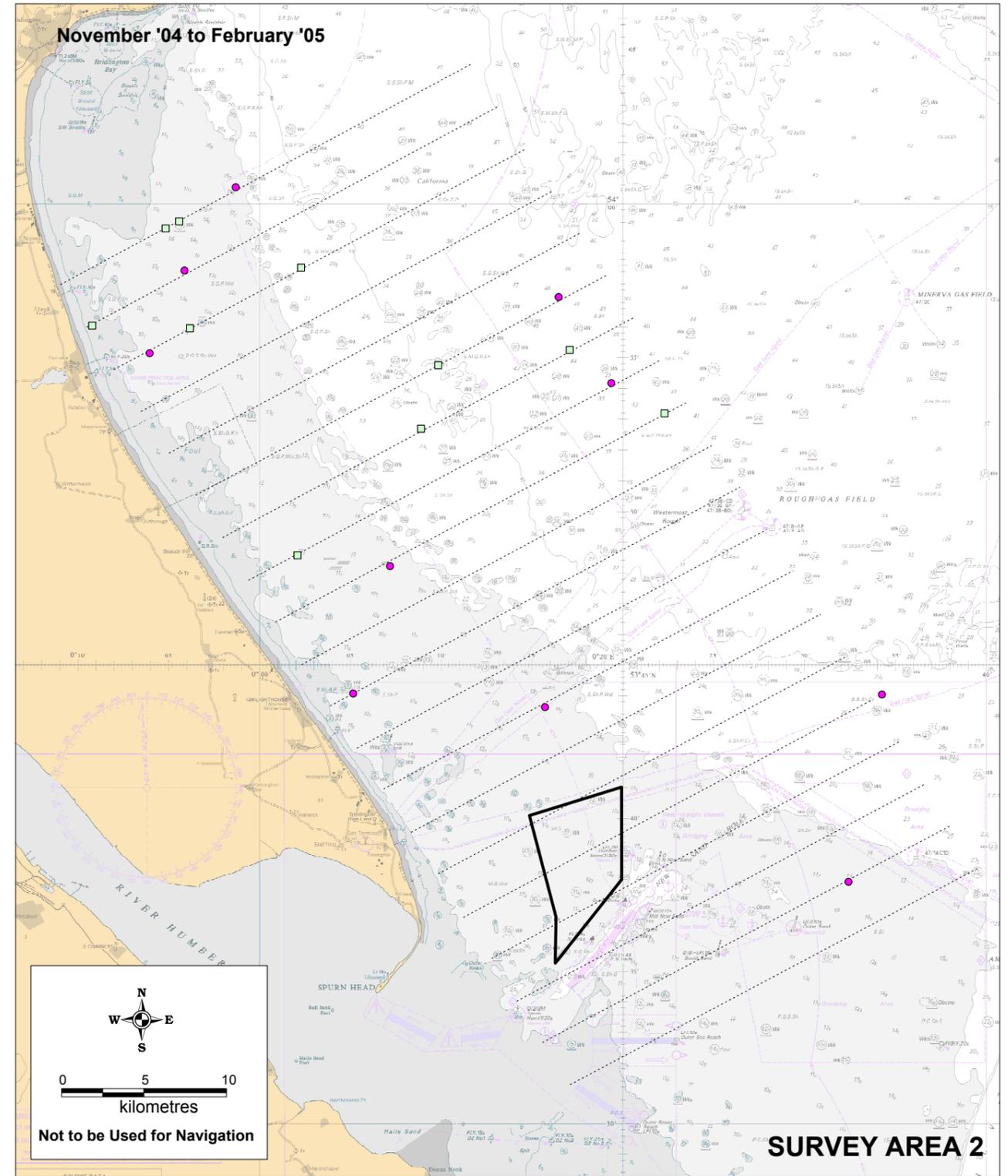
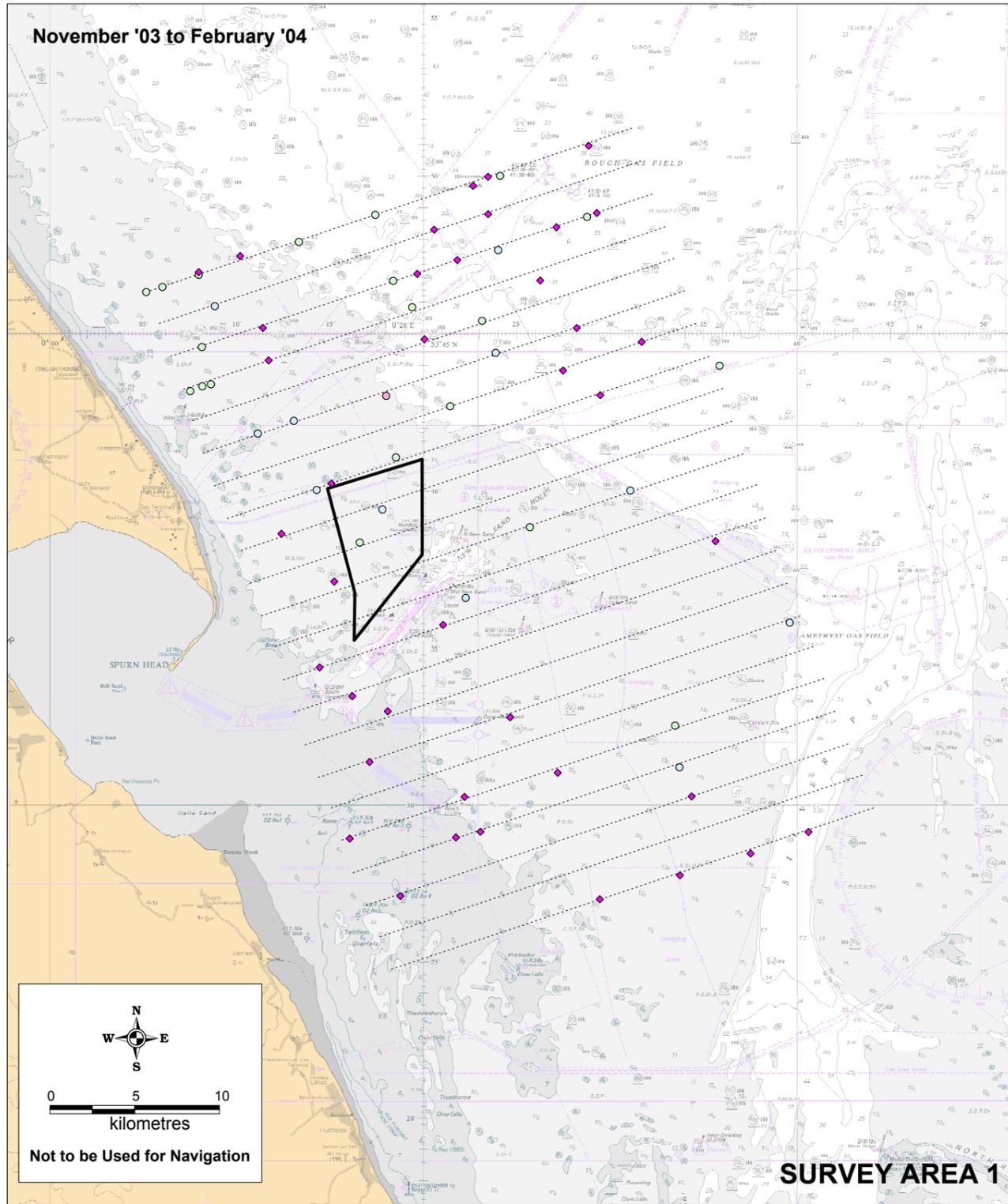
SIZE:

A3

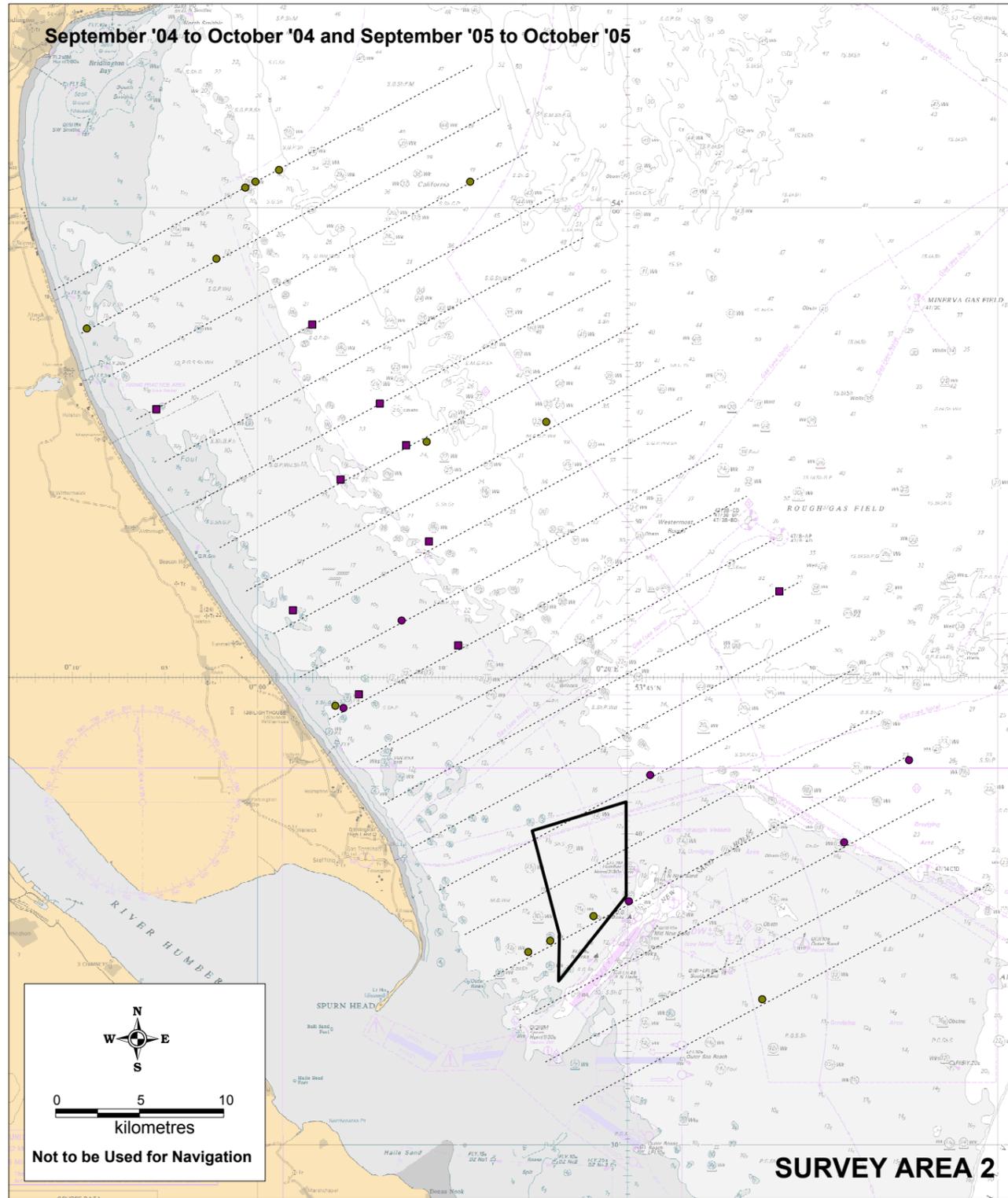
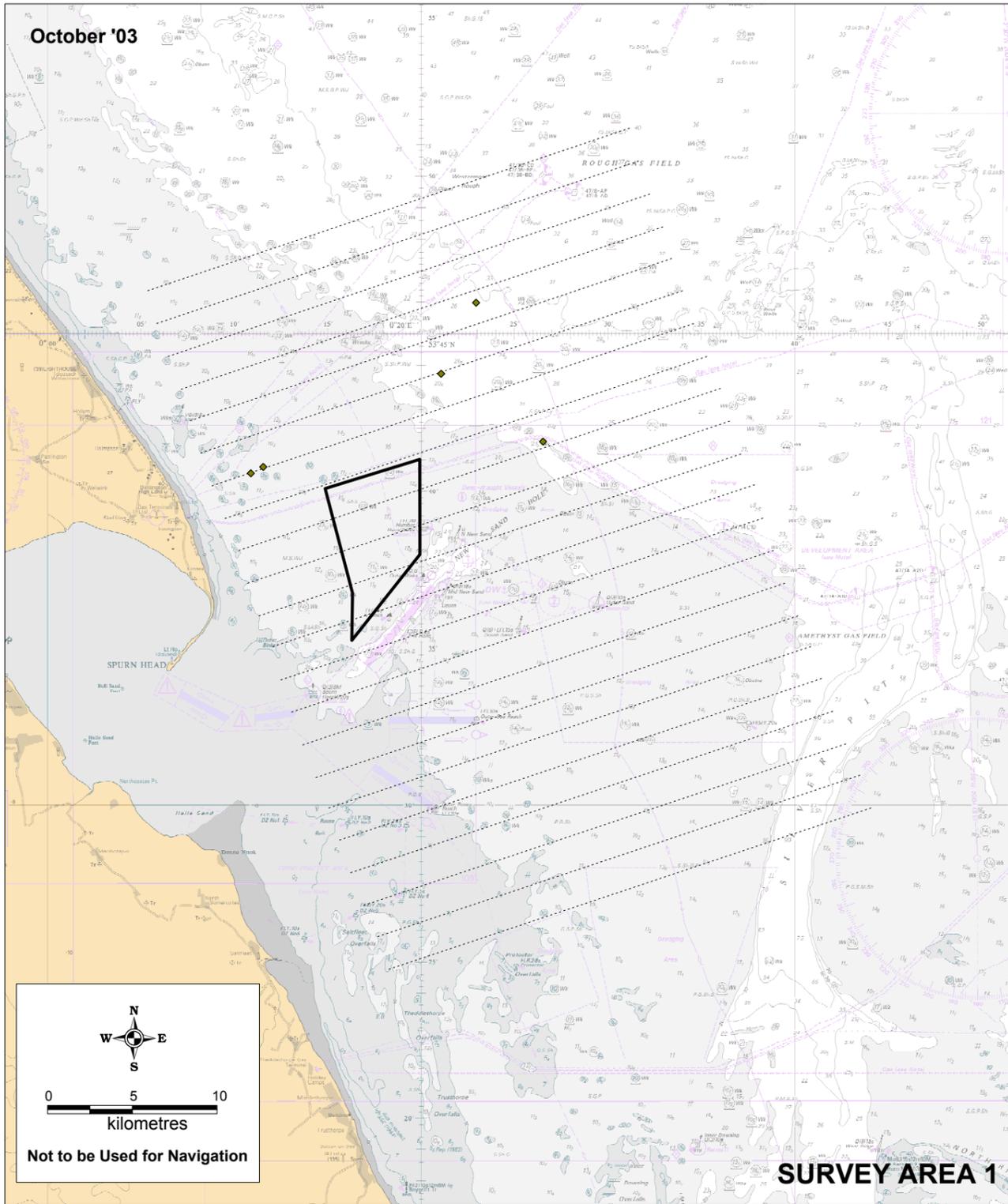
TITLE:

Figure 8.47 - Great Black-backed Gull Boat Survey. Area 2. Winter (November to February)

DATE: 12.02.07	CHECKED:	PROJECT:
DRAWN: SMT	APPROVED:	SCALE:
DRAWING: Grt Blk Backed Gull_Boat Area 2_Winter.wor		REV: FINAL



KEY: Legend Depth (m) Intertidal, 0-10, 10-20, 20+ Aerial Transect Humber Gateway Site	Number of Birds 2003 2004 2005 200 to 400 ◊ ○ □ 100 to 200 ◊ ○ □ 50 to 100 ◊ ○ □ 10 to 50 ◊ ○ □ 1 to 10 ◊ ○ □	Month January (light blue), February (light green), March (pink), April (red), May (dark blue), June (orange), July (cyan), August (green), September (purple), October (olive), November (magenta), December (yellow)	CLIENT: 	SIZE: A3	TITLE: Figure 8.48 - Great Black-backed Gull Aerial Survey. Areas 1 & 2 Winter (November to February)
				DATE: 12.02.07 CHECKED: PROJECT: DRAWN: SMT APPROVED: SCALE: DRAWING: Great Black-backed Gull_W_A1&2.wor REV: FINAL	



KEY:

Legend

Depth (m)



..... Aerial Transect

□ Humber Gateway Site

Number of Birds

	2003	2004	2005
200 to 400	◇	○	□
100 to 200	◇	○	□
50 to 100	◇	○	□
10 to 50	◇	○	□
1 to 10	◇	○	□

Month

January	July
February	August
March	September
April	October
May	November
June	December

CLIENT:



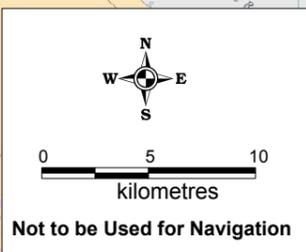
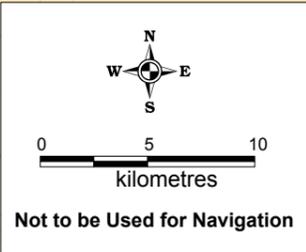
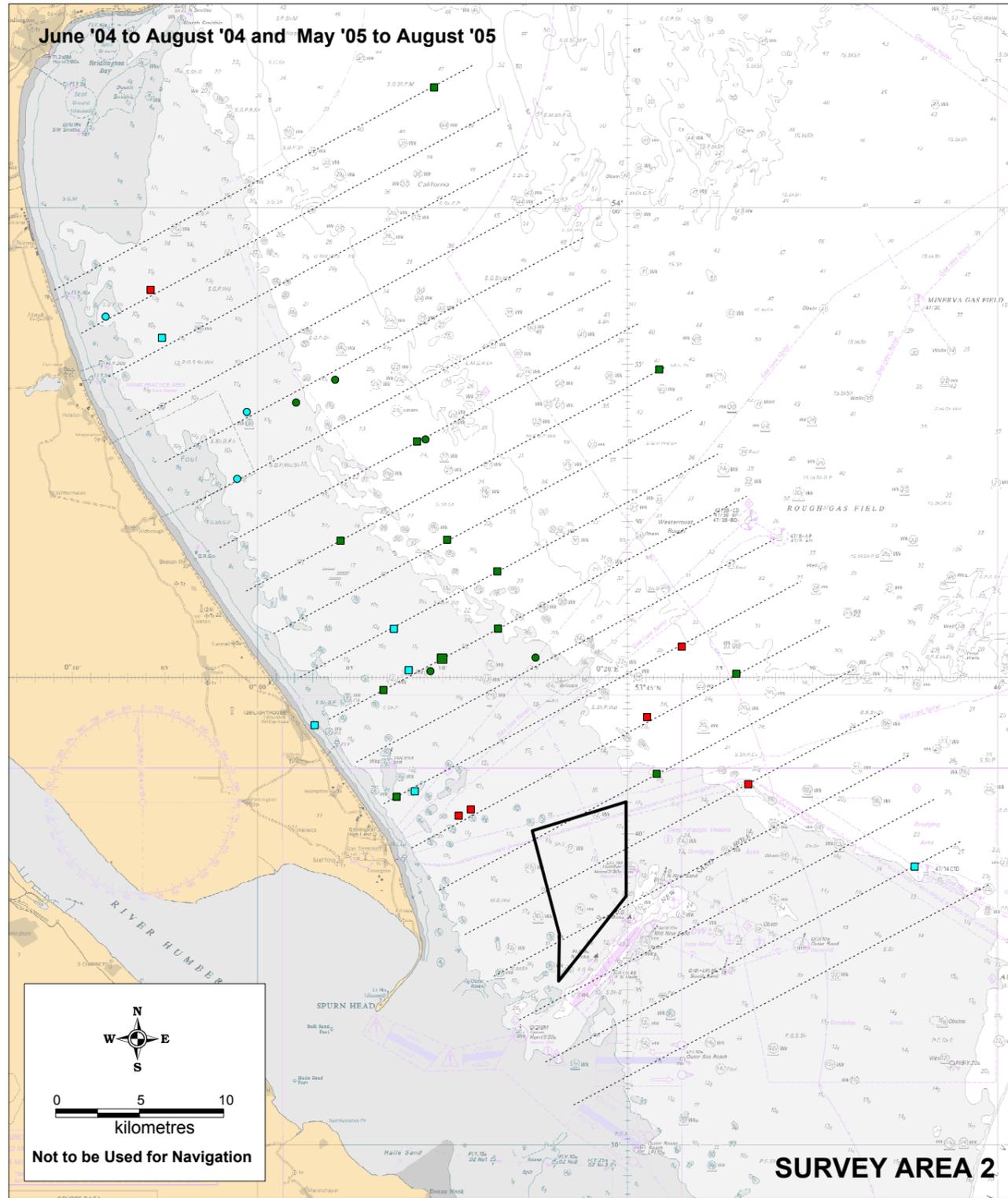
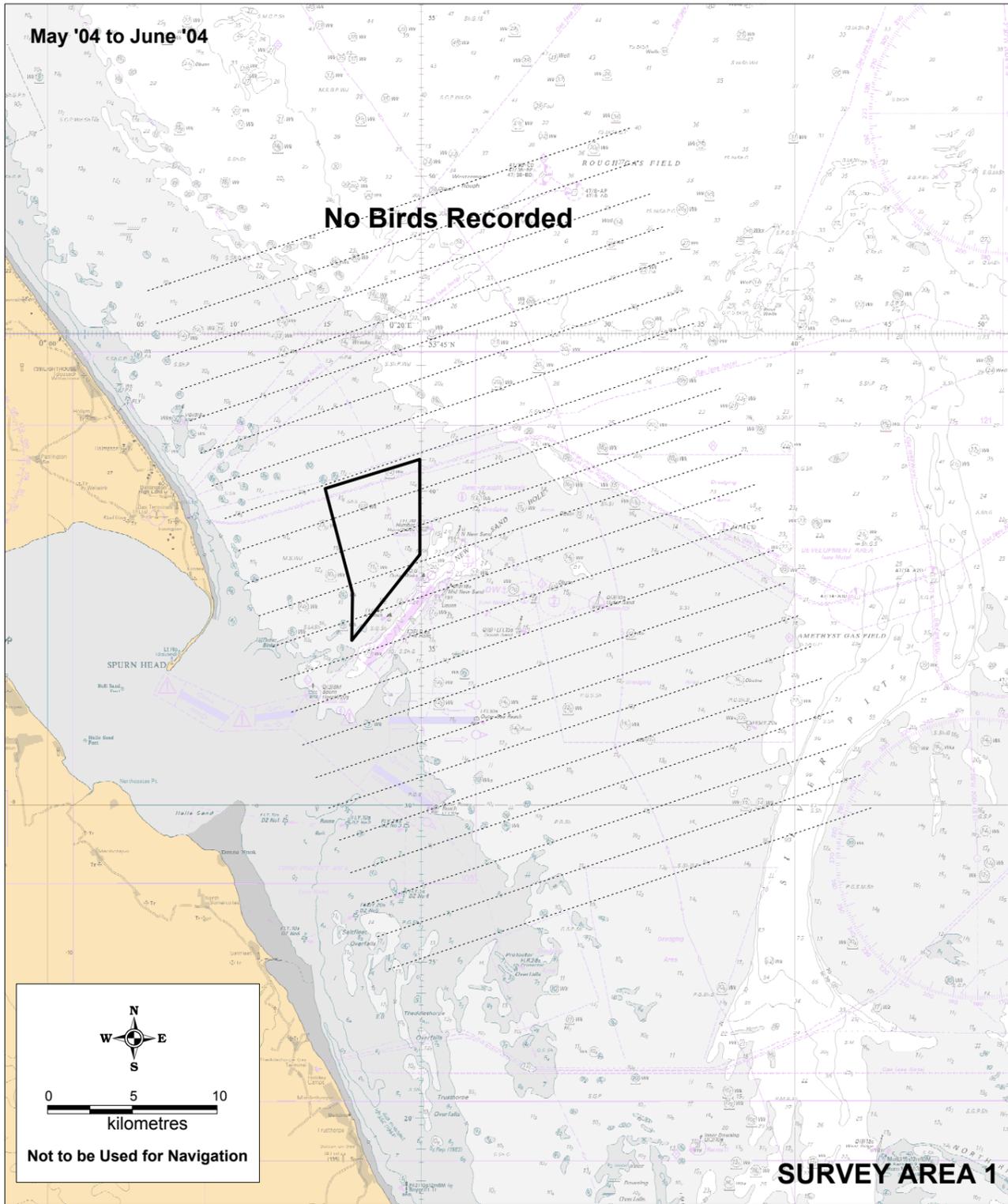
SIZE:

A3

TITLE:

Figure 8.49 - Great Black-backed Gull Aerial Survey. Areas 1 & 2 Autumn (September to October)

DATE: 12.02.07	CHECKED:	PROJECT:
DRAWN: SMT	APPROVED:	SCALE:
DRAWING:	REV:	
Great Black-backed Gull_A_A1&2.wor	FINAL	



KEY:

Legend

Depth (m)
Intertidal, 0-10, 10-20, 20+

..... Aerial Transect

▭ Humber Gateway Site

Number of Birds	Year		
	2003	2004	2005
200 to 400	◇	○	□
100 to 200	◇	○	□
50 to 100	◇	○	□
10 to 50	◇	○	□
1 to 10	◇	○	□

Month

January	July
February	August
March	September
April	October
May	November
June	December

CLIENT:



SIZE:

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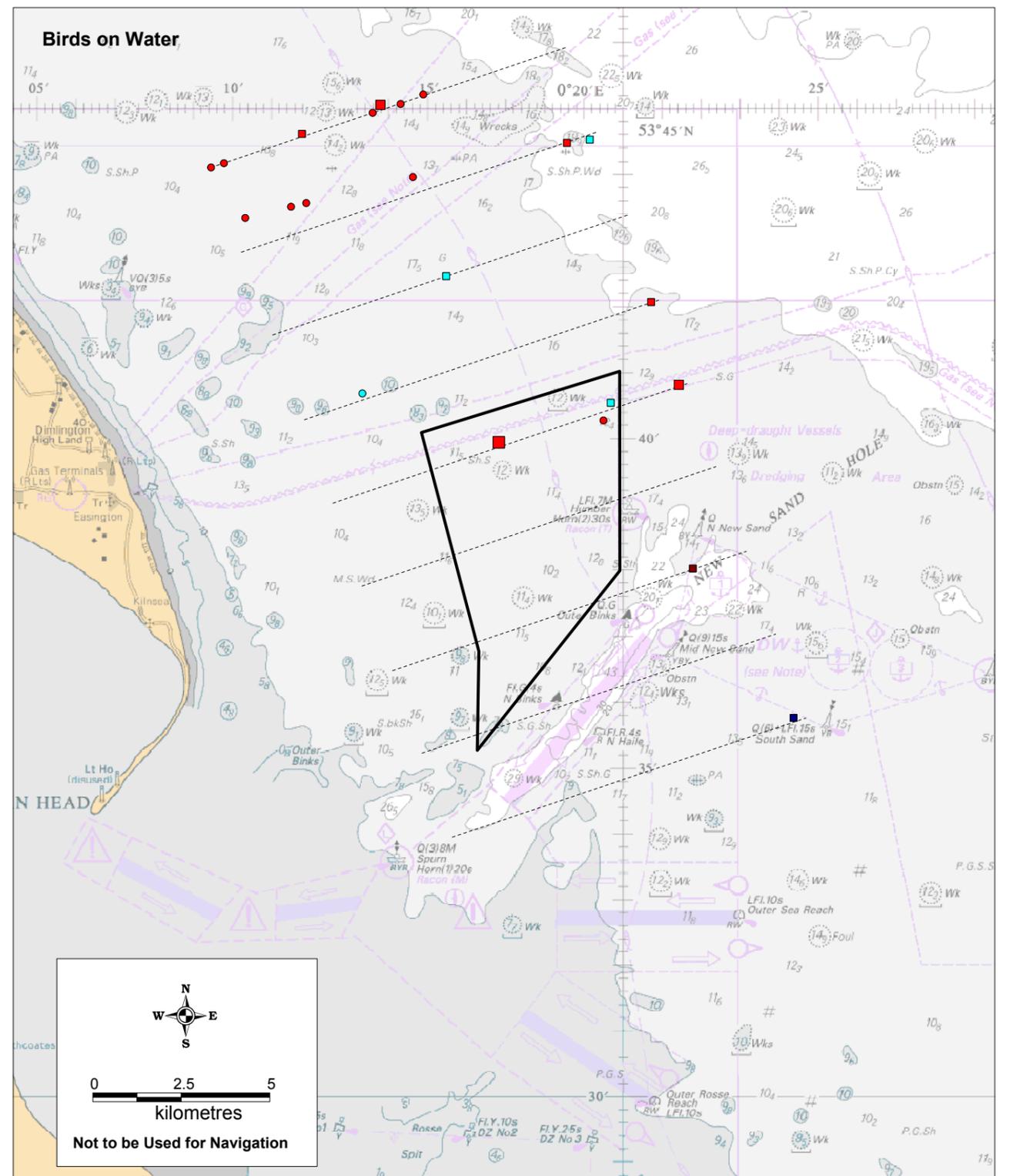
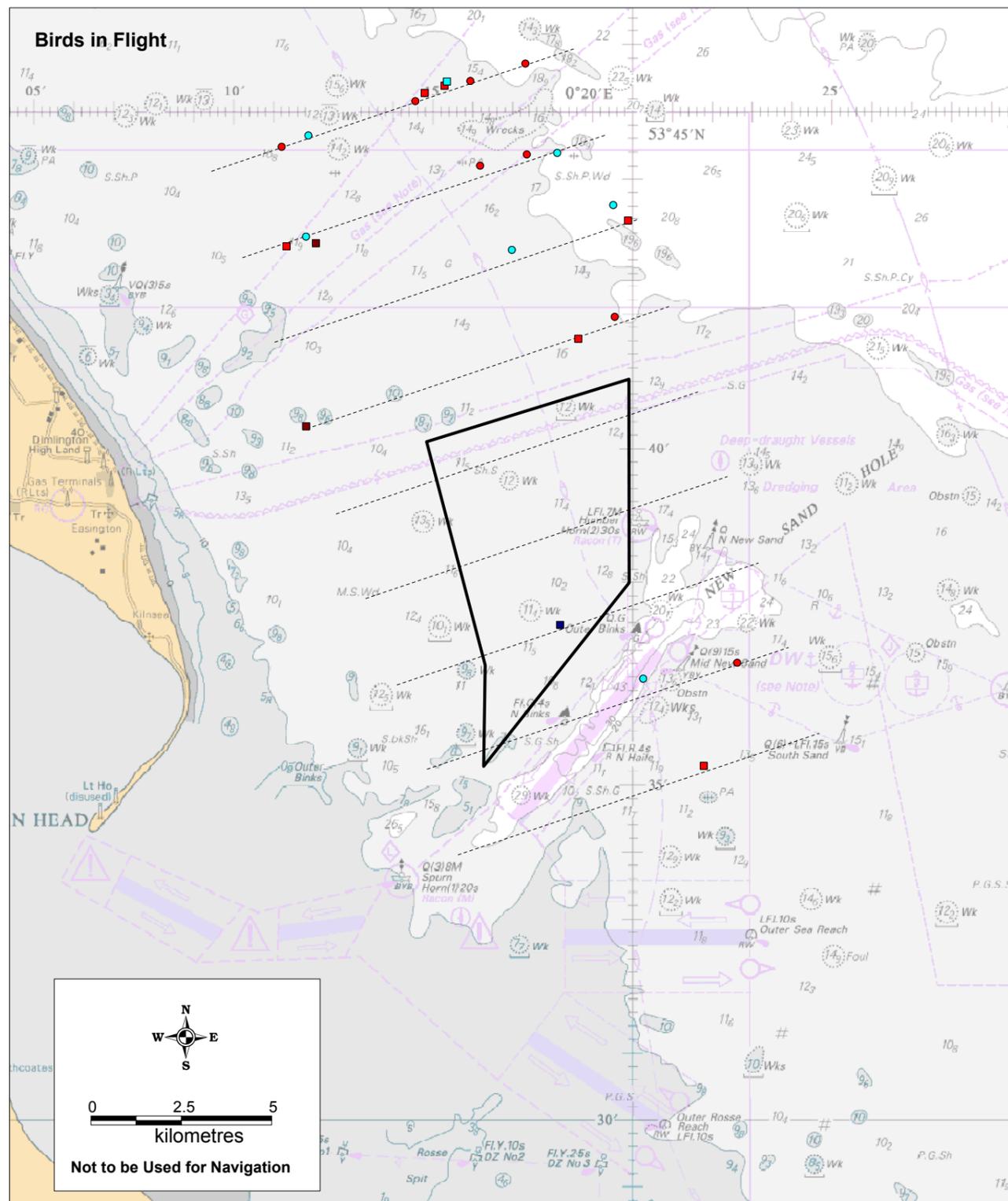
TITLE:

Figure 8.50 - Great Black-backed Gull Aerial Survey. Areas 1 & 2 Breeding Season (May to August)

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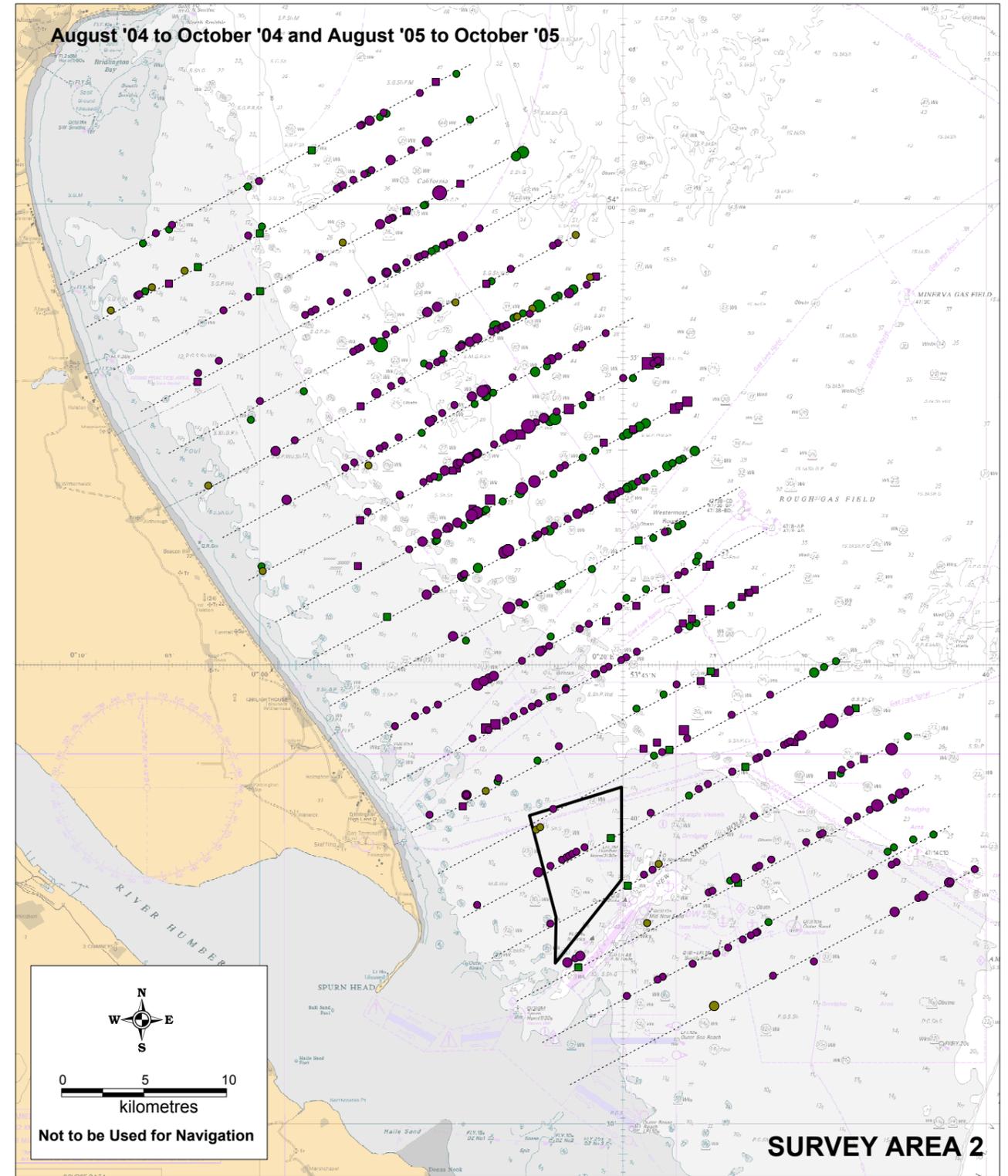
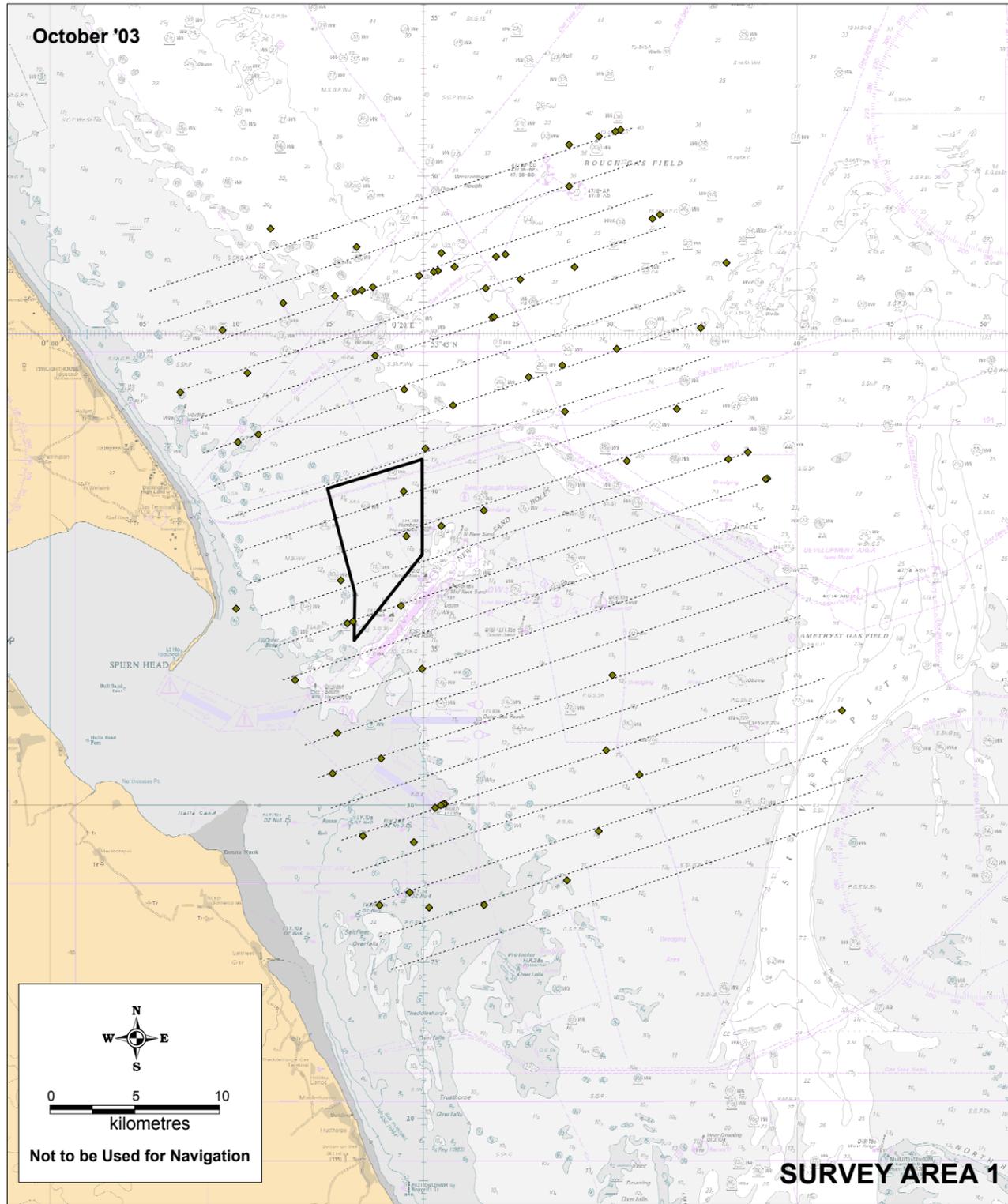
DRAWN: 12.02.07 APPROVED: SCALE:

DRAWING: **Great Black-backed Gull_B_A2.wor** REV: **FINAL**



KEY:

Legend	Depth (m)	Number of Birds			Month	
	<ul style="list-style-type: none"> ■ Intertidal, 0-10, 10-20, 20+ Boat Transect ▭ Humber Gateway Site 	<ul style="list-style-type: none"> ◇ 40 to 50 ◇ 30 to 40 ◇ 20 to 30 ◇ 10 to 20 ◇ 1 to 10 	<ul style="list-style-type: none"> ○ 2003 ○ 2004 ○ 2005 	<ul style="list-style-type: none"> ● January ● February ● March ● April ● May ● June ● July ● August ● September ● October ● November ● December 	<p>CLIENT: </p> <p>INSTITUTE OF ESTUARINE & COASTAL STUDIES THE UNIVERSITY OF HULL</p> <p></p>	
DATE: 12.02.07		CHECKED:		PROJECT:		
DRAWN: SMT		APPROVED:		SCALE:		
DRAWING: BIK-legged Kittiwake_ Boat A2_Breeding.wor					REV: FINAL	



KEY:	Legend	Depth (m)	Number of Birds			Month		CLIENT:	SIZE:	TITLE:
		<ul style="list-style-type: none"> Intertidal, 0-10, 10-20, 20+ Aerial Transect Humber Gateway Site 	<ul style="list-style-type: none"> 2003 2004 2005 200 to 400 ◇ ○ □ 100 to 200 ◇ ○ □ 50 to 100 ◇ ○ □ 10 to 50 ◇ ○ □ 1 to 10 ◇ ○ □ 	<ul style="list-style-type: none"> January July February August March September April October May November June December 	e-on	A3	Figure 8.53 - Black-legged Kittiwake Aerial Survey. Areas 1 & 2 Post Breeding (August to October)			
							DATE: 12.02.07	CHECKED:	PROJECT:	
							DRAWN: SMT	APPROVED:	SCALE:	
							DRAWING:			REV:
							Black-legged Kittiwake_PB_A1&2.wor			FINAL

Terns

Overview

Tern species are frequently recorded along the Holderness Coast, both on passage and during the breeding season (various Spurn Observatory reports and *Appendix D1, Humber Gateway Seabird Survey Report*). The majority of the birds recorded were sandwich and common terns.

Very few terns were recorded during the late autumn, winter and early spring, but with a greater number of observations during the late spring, summer and early autumn. In particular, the numbers recorded during the boat surveys appeared to peak in August, with the return of adult and juvenile birds through the area (*Figure 8.54*). The aerial surveys recorded peak numbers in July, again indicating a return passage movement (*Figure 8.55*). No particular concentrations were observed during the surveys but, as expected, the majority of birds were recorded in flight rather than on the water, and there was little evidence of foraging activity on the Humber Gateway site.

Sandwich Tern *Sterna sandvicensis*

Sandwich tern is included in Annex I of the Birds Directive and Schedule 1 of the *Wildlife Countryside Act 1981* as amended. It is a colonial nester with very localised populations. Various Spurn Observatory reports show records of large numbers of sandwich terns on passage off Flamborough Head and Spurn Point during the late summer (*Appendix D1, Humber Gateway Seabird Survey Report*).

This species is generally present between April and September / October, with passage movements occurring during the spring and autumn, and feeding movements during the summer months. The majority of the boat-based surveys recorded no more than ten birds in either the Humber Gateway survey area, or the control area. A peak of 15 birds was recorded in the Humber Gateway survey area in July 2005, with 14 birds also recorded in the Humber Gateway survey area in May 2005. Birds were occasionally recorded within the Humber Gateway site.

Densities throughout the surveys were low, both for the main survey and control areas, with highest levels recorded in May with approximately 0.5 bird per km².

Common Terns *Sterna hirundo*

Small numbers of common tern were recorded during the spring passage period. However, the majority of records were made during the autumn, with peak numbers recorded in August (just over 20 birds in the Humber Gateway survey

area and 169 birds in the control area) but with passage movements also recorded during July and September (*Appendix D1, Humber Gateway Seabird Survey Report*). In general, very low densities were recorded, although four birds per km² were recorded in the control area in August 2005.

Arctic Tern *Sterna paradisaea*

Arctic terns were rarely seen on the boat surveys. Extremely few birds of this species were recorded during both the breeding and non-breeding seasons, implying that the area is of no particular importance as a foraging site. The maximum recorded during the survey was 21 birds in August 2005, and the individuals were all recorded in the most northern transect of the control survey area (*Appendix D1, Humber Gateway Seabird Survey Report*). This peak might have included the birds dispersing southerly from their breeding sites.

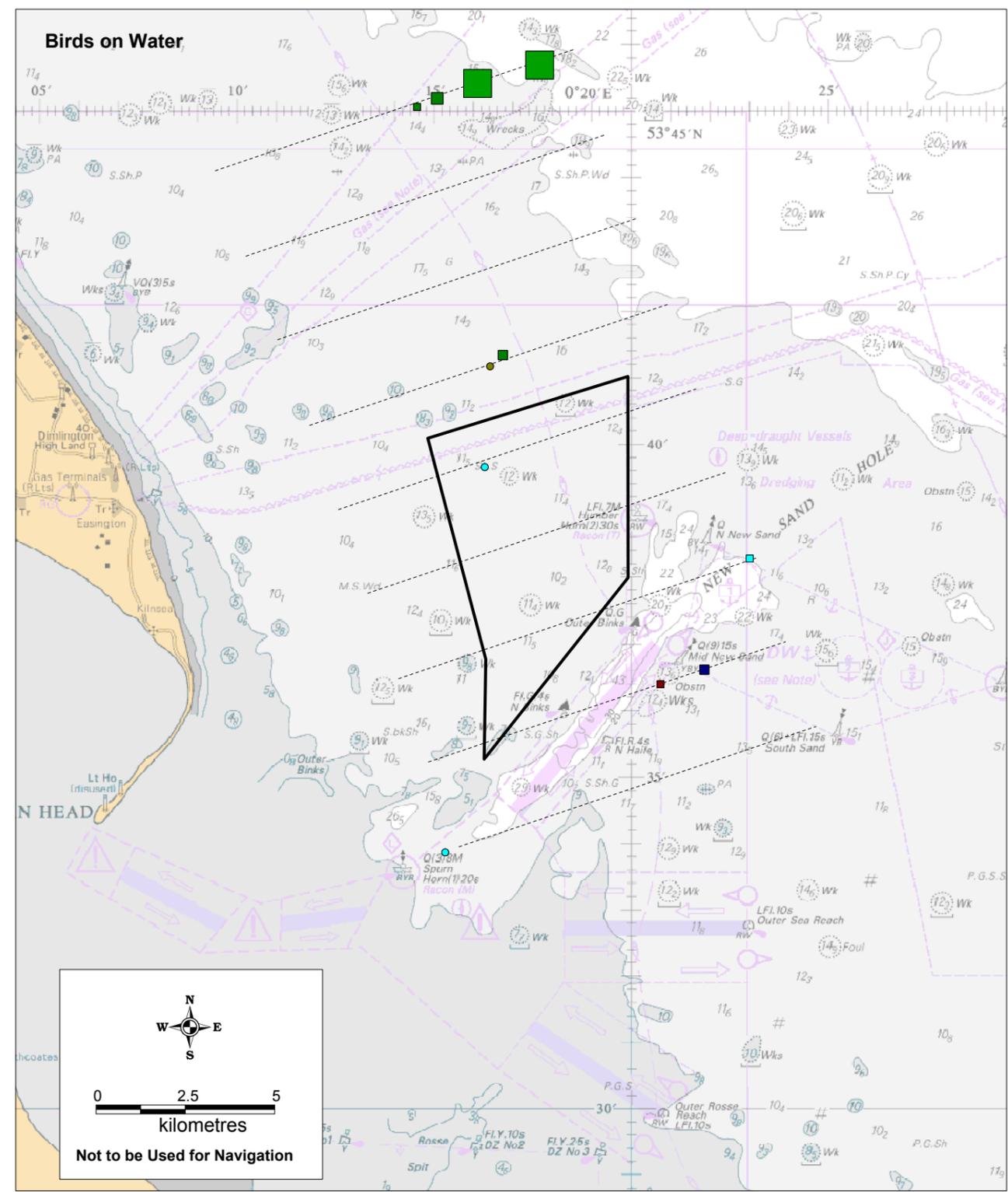
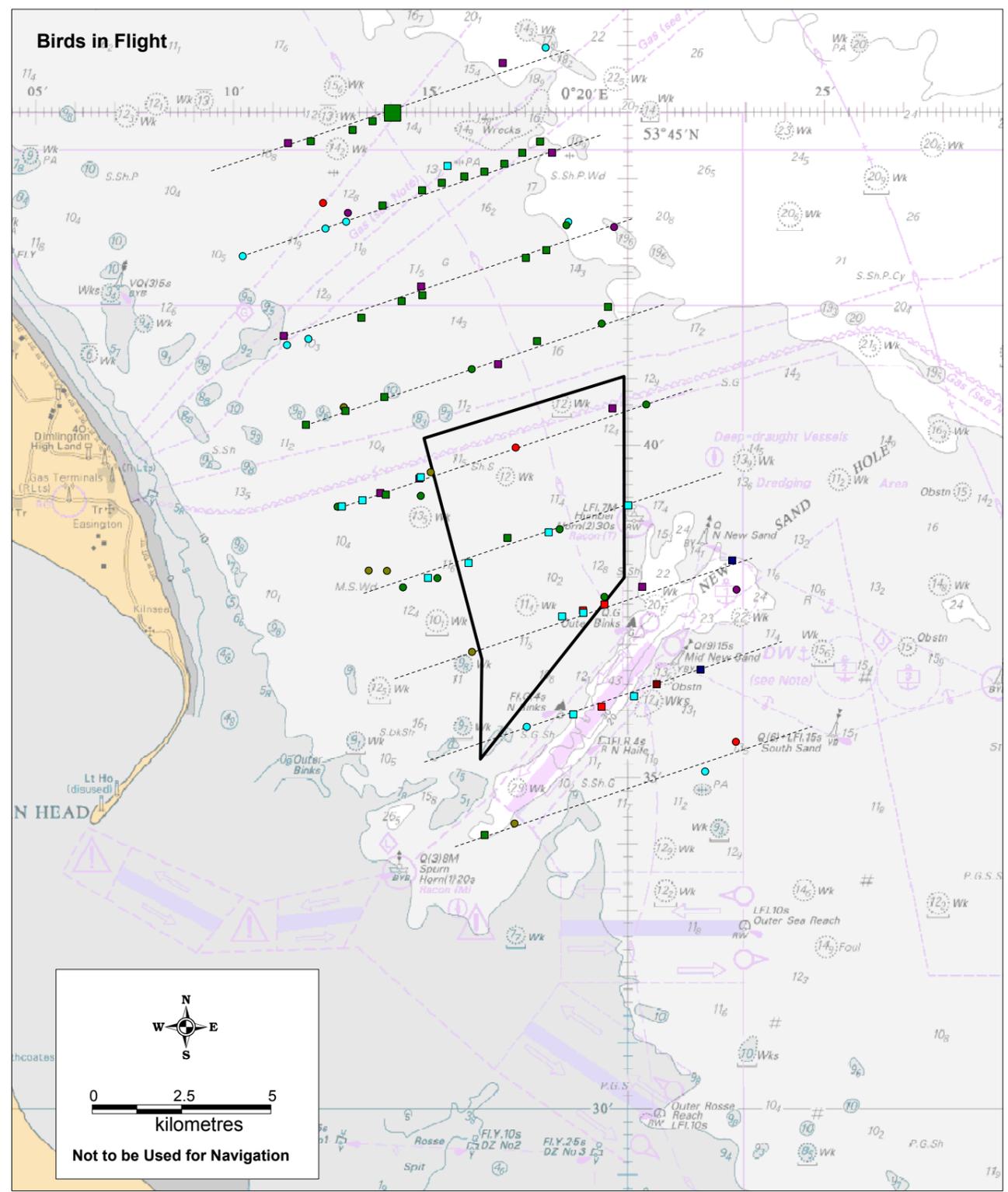
'Commic' Terns *Sterna spp*

In some instances, predominantly during the autumn passage periods of 2004 and 2005, it was not possible to separate the common and arctic terns during the surveys and in such cases they were referred to as 'commic' terns. It is likely that many of these birds were common terns, given the timing of these records closely matched that of common terns and also the low numbers of arctic terns recorded.

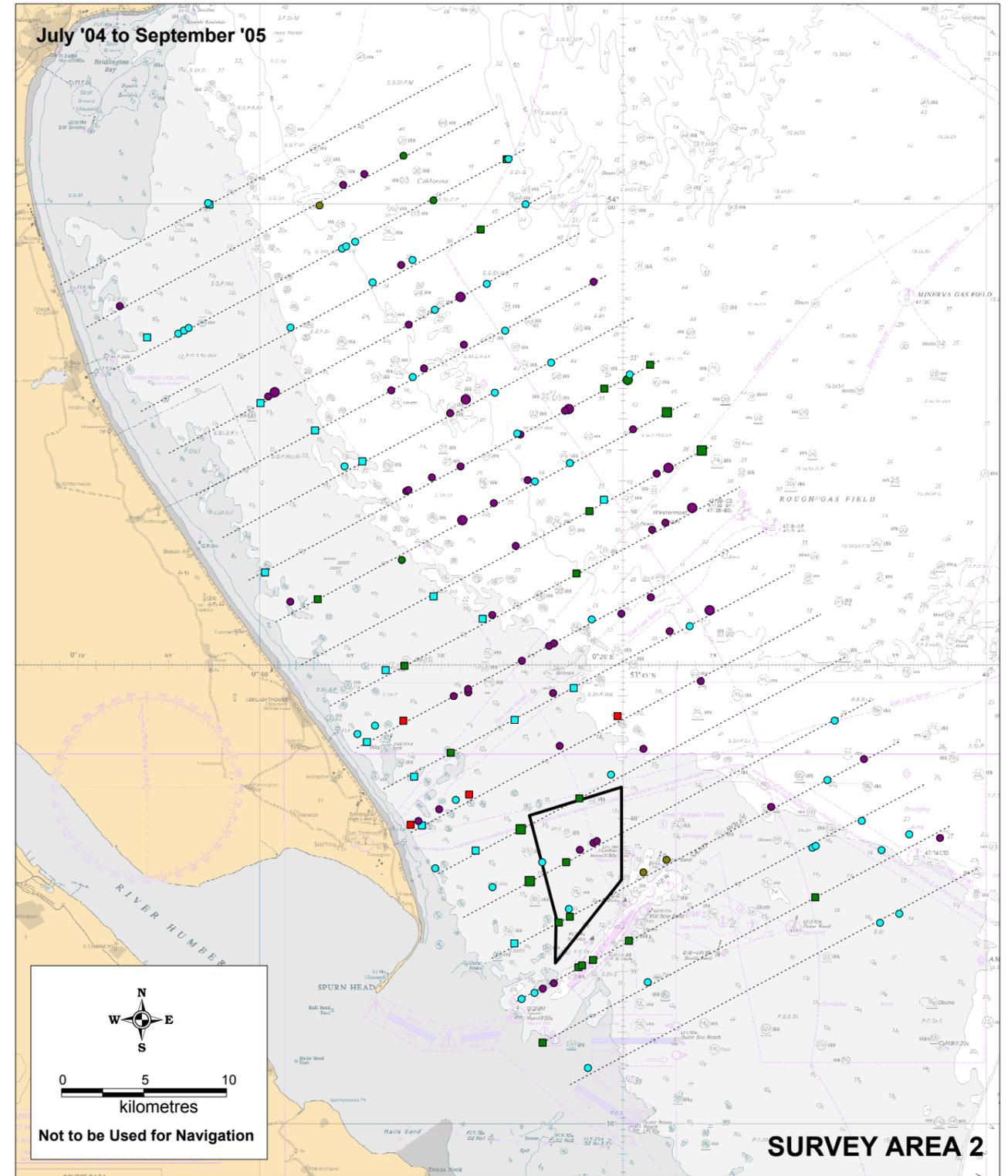
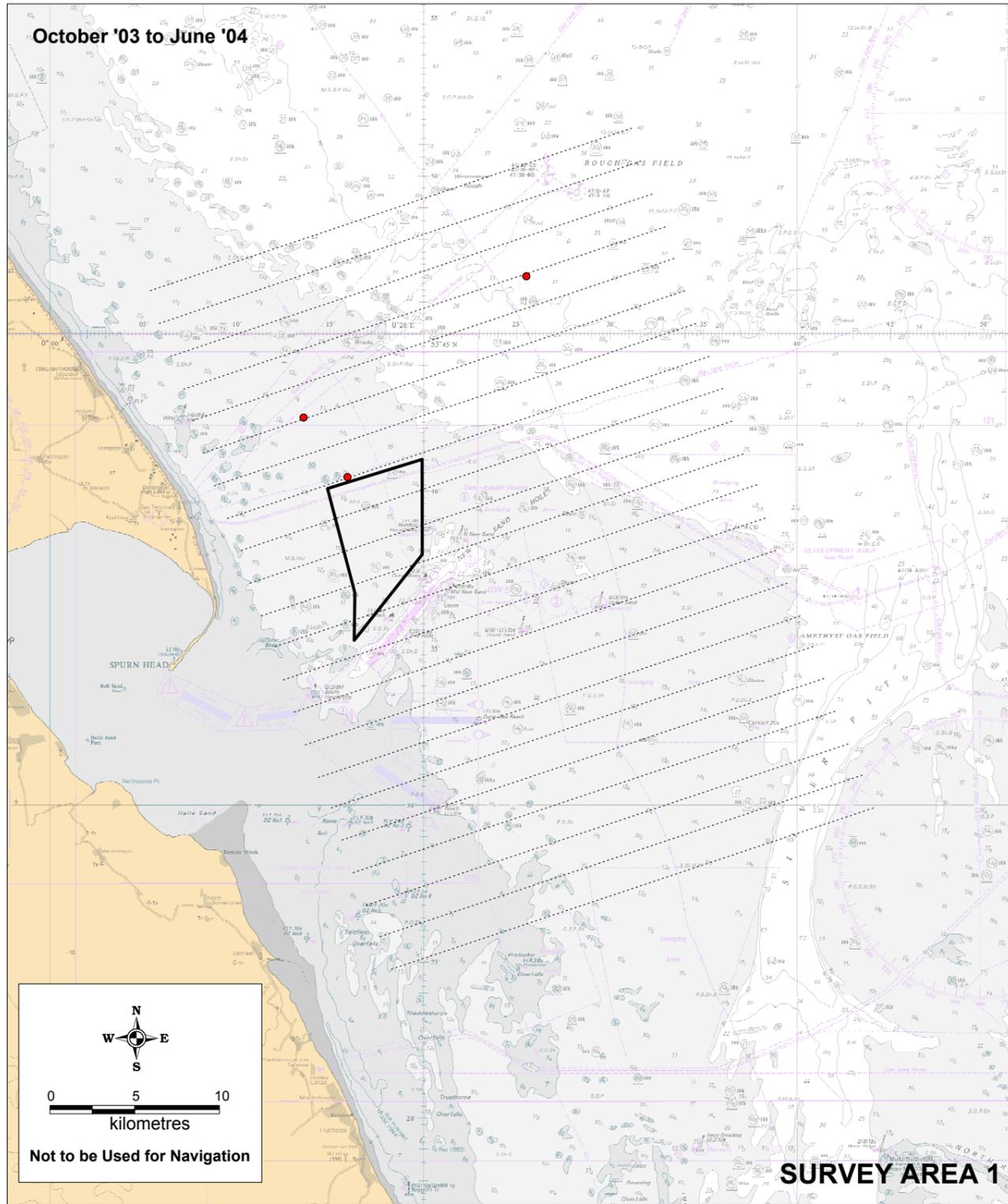
During the August 2005 survey, two flocks totalling 180 'commic' terns were recorded in the control area to the north of the Humber Gateway, with a density of 20 birds per km².

Black Tern *Chlidonias niger*

Three registrations were made in August 2005 during the ship-based survey, presumably the same bird counted on separate occasions.



KEY: Legend 	Depth (m) Intertidal, 0-10, 10-20, 20+	Number of Birds 40 to 50 30 to 40 20 to 30 10 to 20 1 to 10	Month January February March April May June July August September October November December	CLIENT: 	SIZE: A3	TITLE: Figure 8.54 - Tern Spp Boat Survey. Area 2. All Records - June 04 to December 05
	DATE: 12.02.07 DRAWN: SMT DRAWING: Tern Spp_Boat Area 2.wor	CHECKED: APPROVED:	PROJECT: SCALE: REV: A			



KEY:	Legend	Depth (m)	Number of Birds			Month		CLIENT:    	SIZE: A3	TITLE: Figure 8.55 - Tern spp. Aerial Survey, Areas 1 & 2 All Records - October '03 to September '05
		<ul style="list-style-type: none"> Intertidal, 0-10, 10-20, 20+ Aerial Transect Humber Gateway Site 	<ul style="list-style-type: none"> 200 to 400 100 to 200 50 to 100 10 to 50 1 to 10 	<ul style="list-style-type: none"> January February March April May June July August September October November December 	DATE: 12.02.07	CHECKED:	PROJECT:			
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Auks

Overview

Three species of auk breed on Flamborough Head, common guillemot, razorbill and Atlantic puffin, with common guillemot the most commonly recorded of these three species. They are present all year round in Bridlington Bay, and off the Holderness Coast, although numbers are greatest during the summer months when the birds are breeding. Little auk winters off the Holderness Coast and 'wrecks', (when large numbers of seabirds are washed up dead on the shoreline), have been reported, but its status is less well understood than the more commonly encountered species in the region (*Appendix D1, Humber Gateway Seabird Survey Report*).

Common Guillemot *Uria aalge*

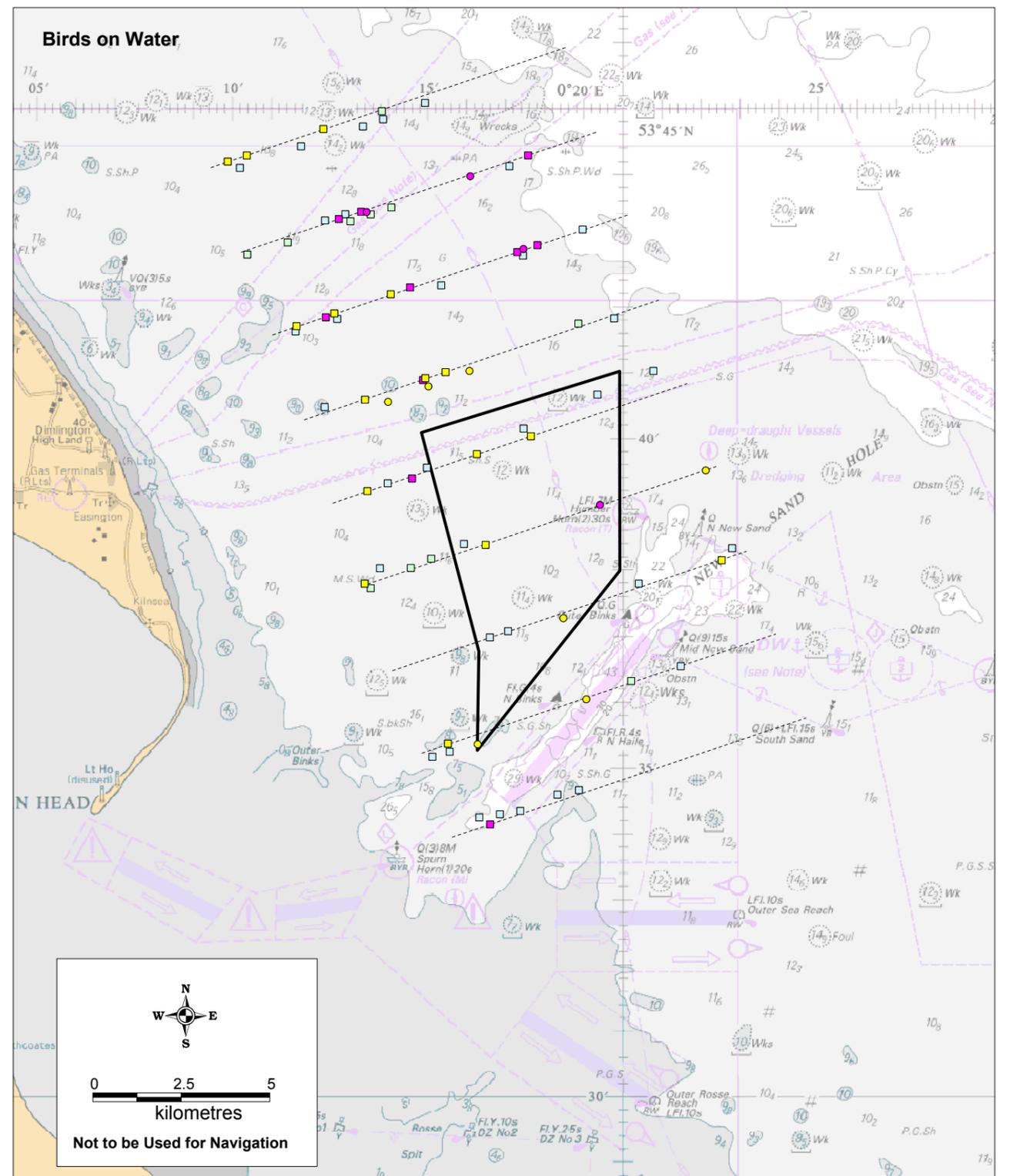
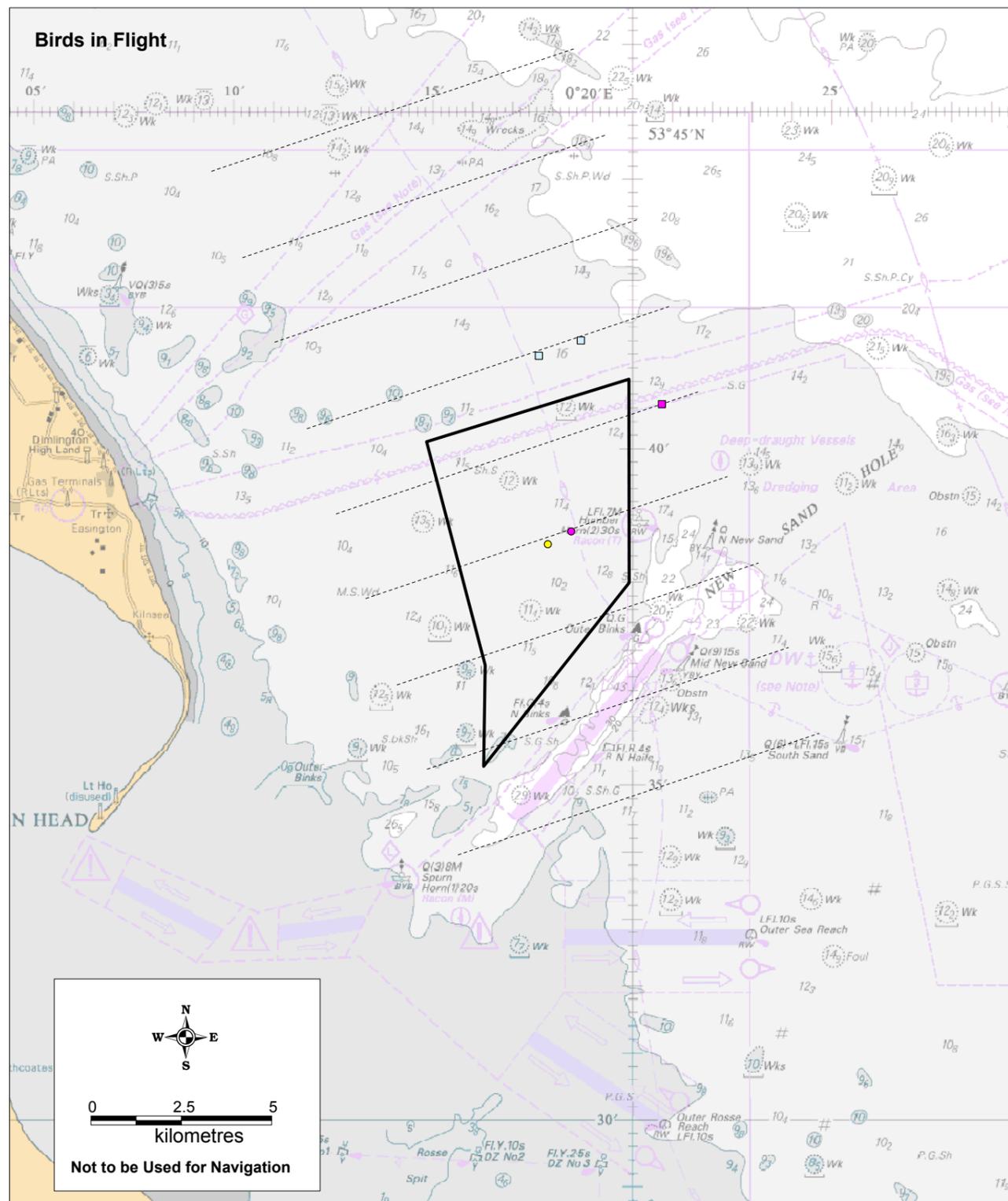
The boat-based survey recorded guillemots during all months of the year albeit at lower abundances during the winter period (*Figure 8.56*). Although it has a largely pelagic distribution over the winter months, common guillemots visit the breeding colony on occasions, and a residual population remains off the Holderness Coast and in Bridlington Bay to the north of the Humber Gateway site. Numbers start to increase in March (*Figure 8.57*), with most birds recorded on the water, and then continue to increase over the summer months, coinciding with activity at the breeding colony at Flamborough Head (*Figure 8.58* and *Figure 8.59*).

Again, the majority of the records were for birds on the water, rather than flying, with a relatively even distribution within the Humber Gateway survey area, including birds recorded within the Humber Gateway site. Numbers then declined into the late summer and autumn, although the distribution of birds across the survey area was broadly similar.

At least 50 birds were regularly recorded during the boat-based surveys, with a peak of nearly 160 birds in March 2004. Densities of around two birds per km² were recorded during most of the surveys, but this increased to around three birds per km² in September, probably coinciding with a post breeding moulting flock, and to around four birds per km² in March and June (*Appendix D1, Humber Gateway Seabird Survey Report*).

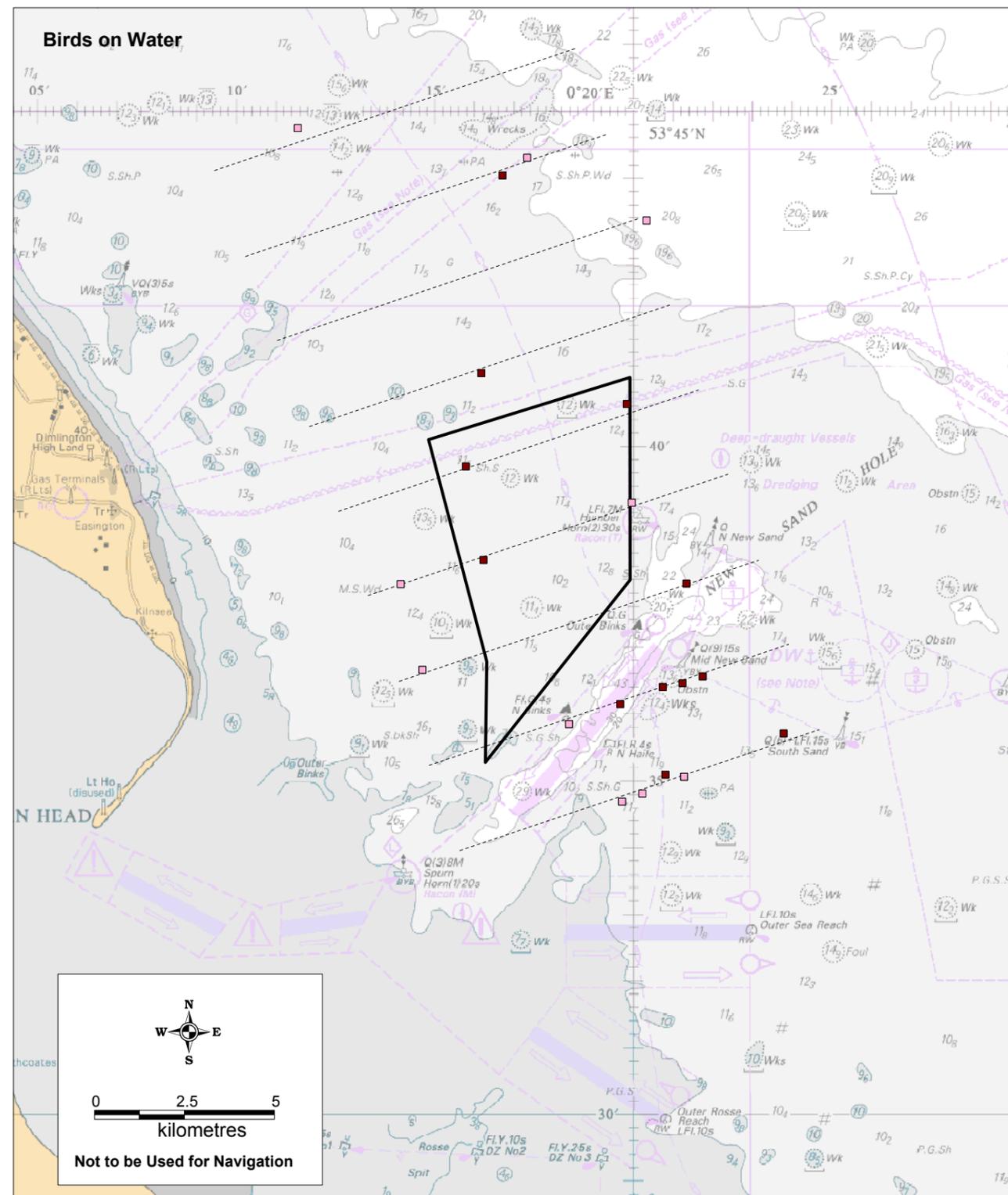
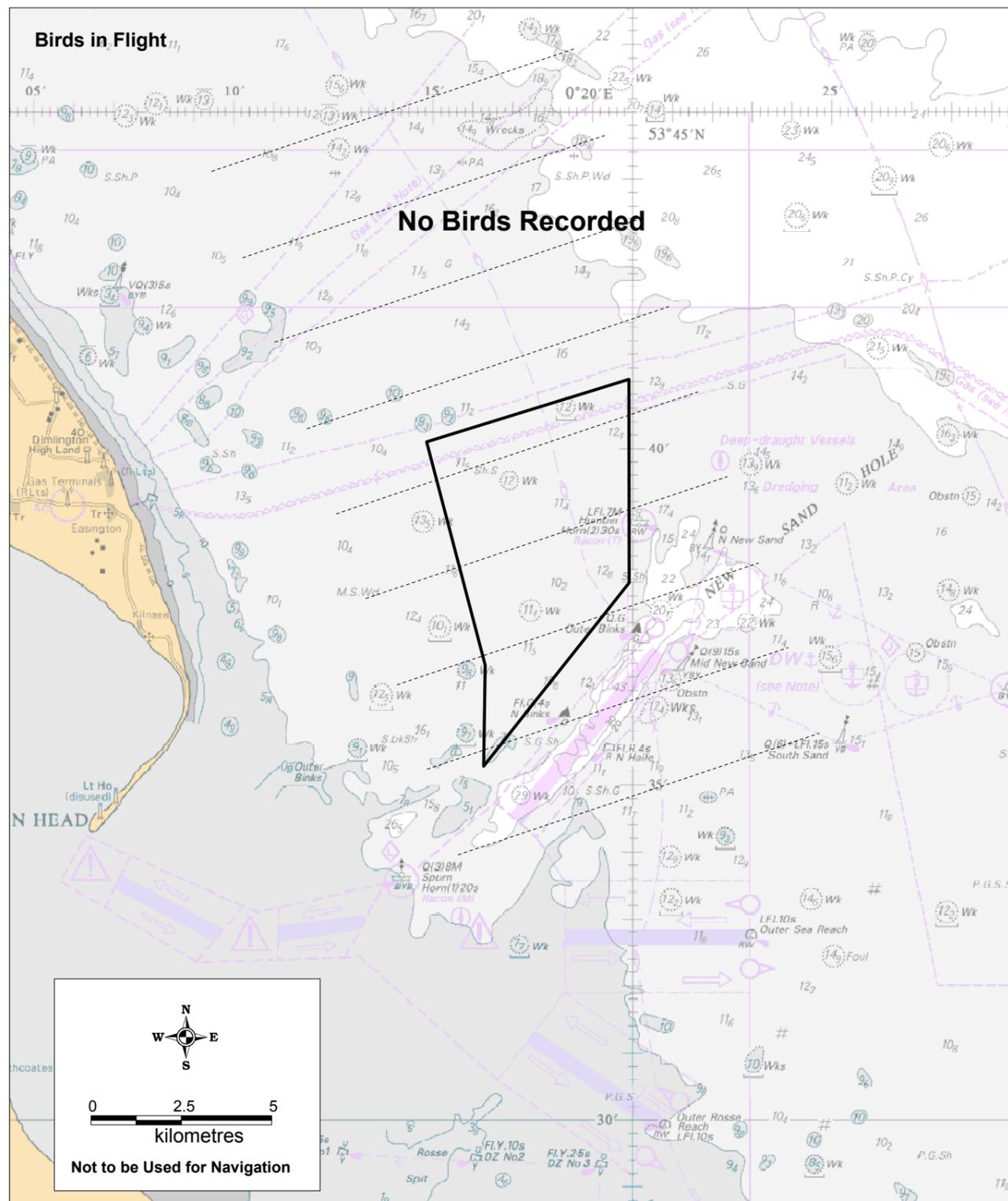


Source: Andy Coates, ERM



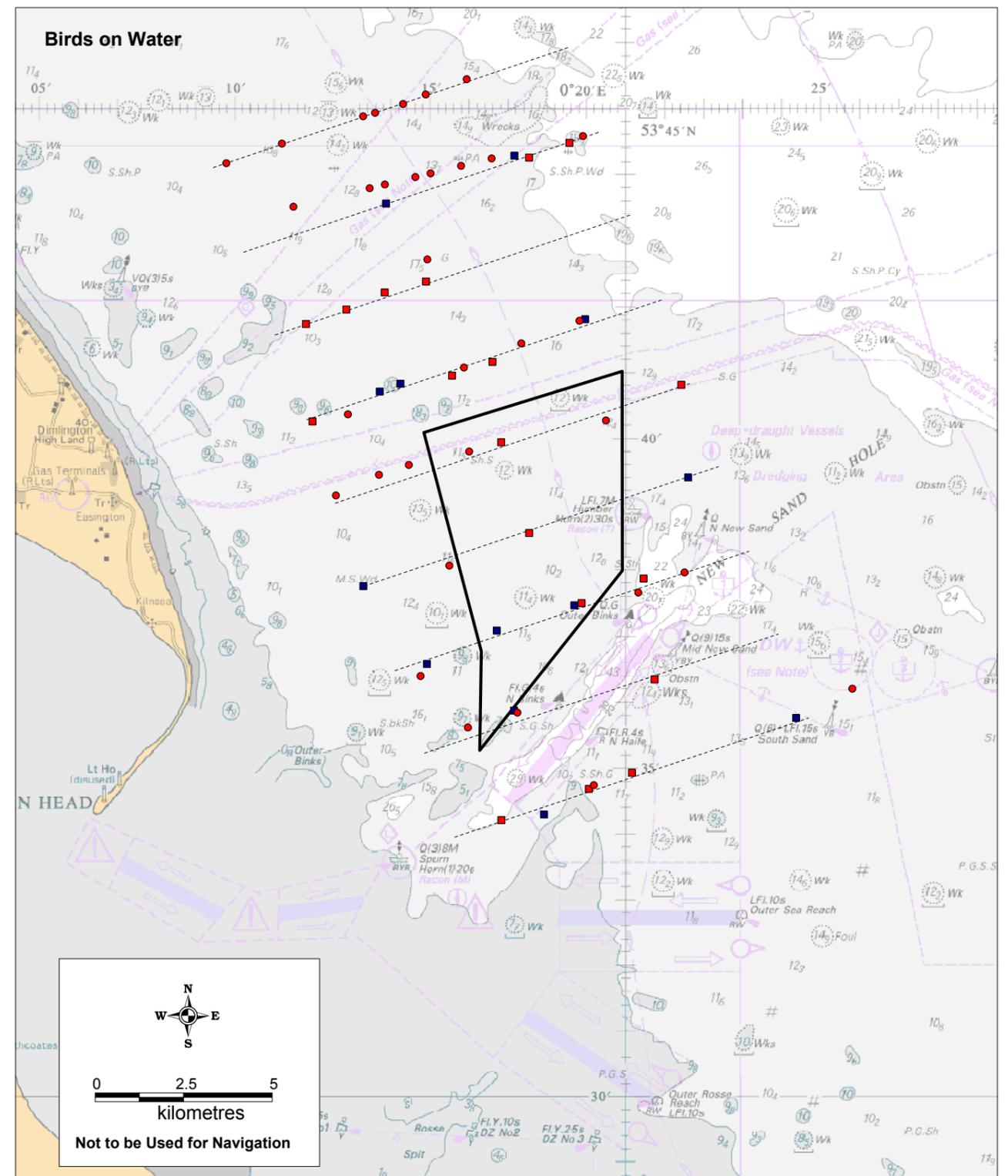
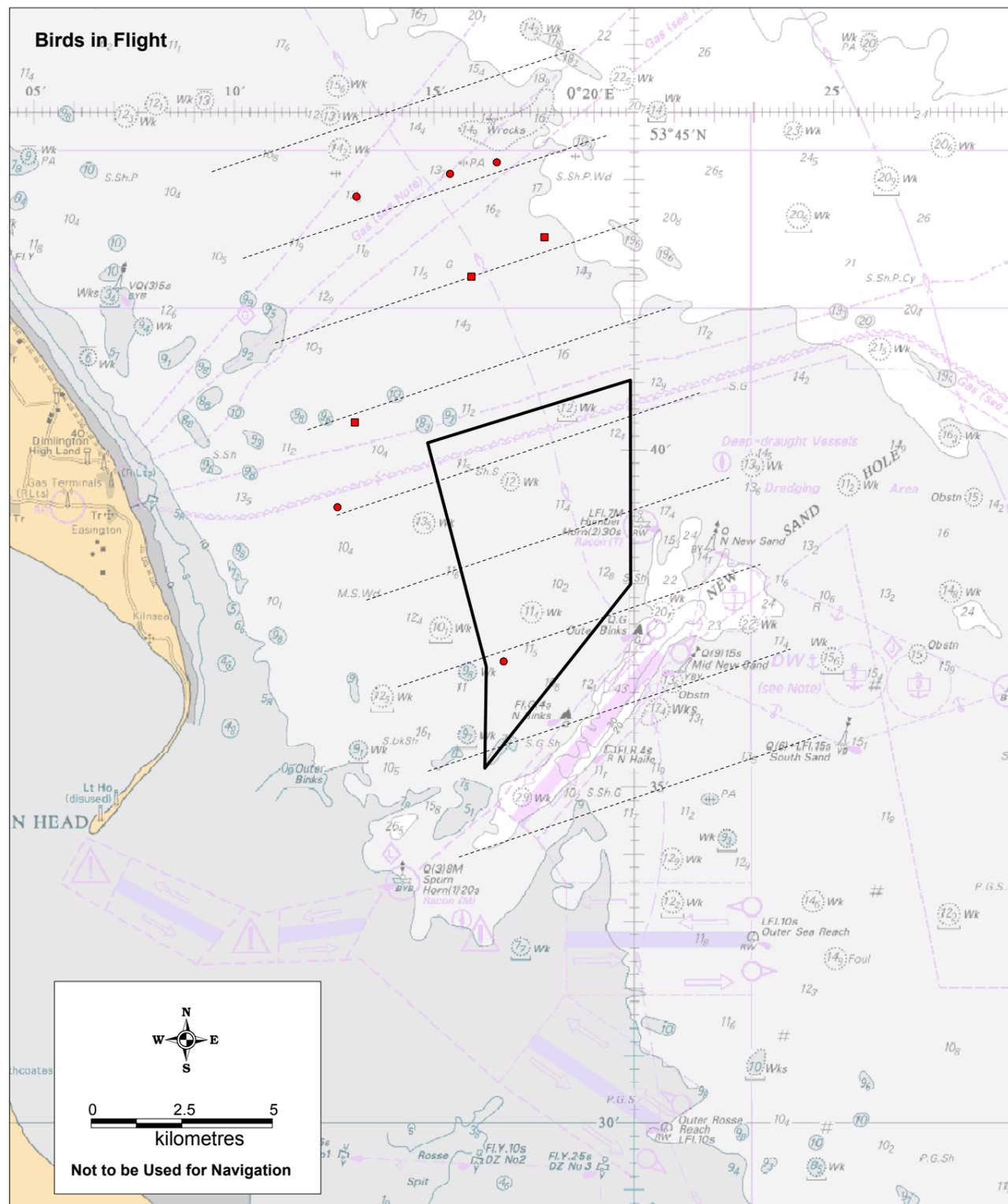
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<p>Legend</p> <p>Depth (m)</p> <p>Intertidal, 0-10, 10-20, 20+</p> <p>Boat Transect</p> <p>Humber Gateway Site</p>	<p>Number of Birds</p> <table border="0"> <tr> <td></td> <td>2003</td> <td>2004</td> <td>2005</td> </tr> <tr> <td>40 to 50</td> <td>◇</td> <td>○</td> <td>□</td> </tr> <tr> <td>30 to 40</td> <td>◇</td> <td>○</td> <td>□</td> </tr> <tr> <td>20 to 30</td> <td>◇</td> <td>○</td> <td>□</td> </tr> <tr> <td>10 to 20</td> <td>◇</td> <td>○</td> <td>□</td> </tr> <tr> <td>1 to 10</td> <td>◇</td> <td>○</td> <td>□</td> </tr> </table>		2003	2004	2005	40 to 50	◇	○	□	30 to 40	◇	○	□	20 to 30	◇	○	□	10 to 20	◇	○	□	1 to 10	◇	○	□	<p>Month</p> <table border="0"> <tr> <td>January</td> <td>July</td> </tr> <tr> <td>February</td> <td>August</td> </tr> <tr> <td>March</td> <td>September</td> </tr> <tr> <td>April</td> <td>October</td> </tr> <tr> <td>May</td> <td>November</td> </tr> <tr> <td>June</td> <td>December</td> </tr> </table>	January	July	February	August	March	September	April	October	May	November	June	December
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<p>DATE: 12.02.07</p> <p>DRAWN: SMT</p> <p>DRAWING: Common Guillemot_Boat A-2_Winter.wor</p>		<p>CHECKED:</p> <p>APPROVED:</p>	<p>PROJECT:</p> <p>SCALE:</p> <p>REV: FINAL</p>																																			



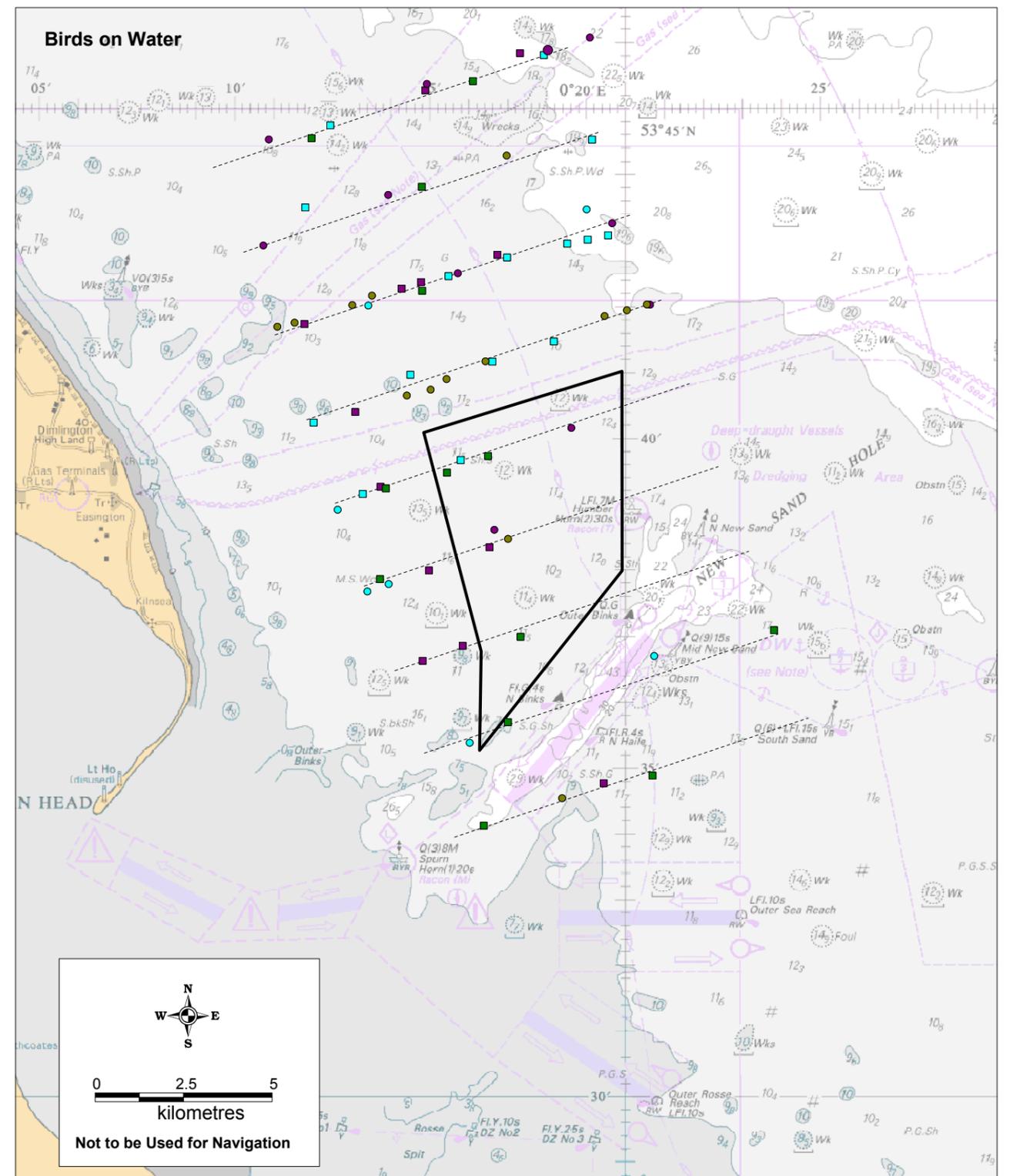
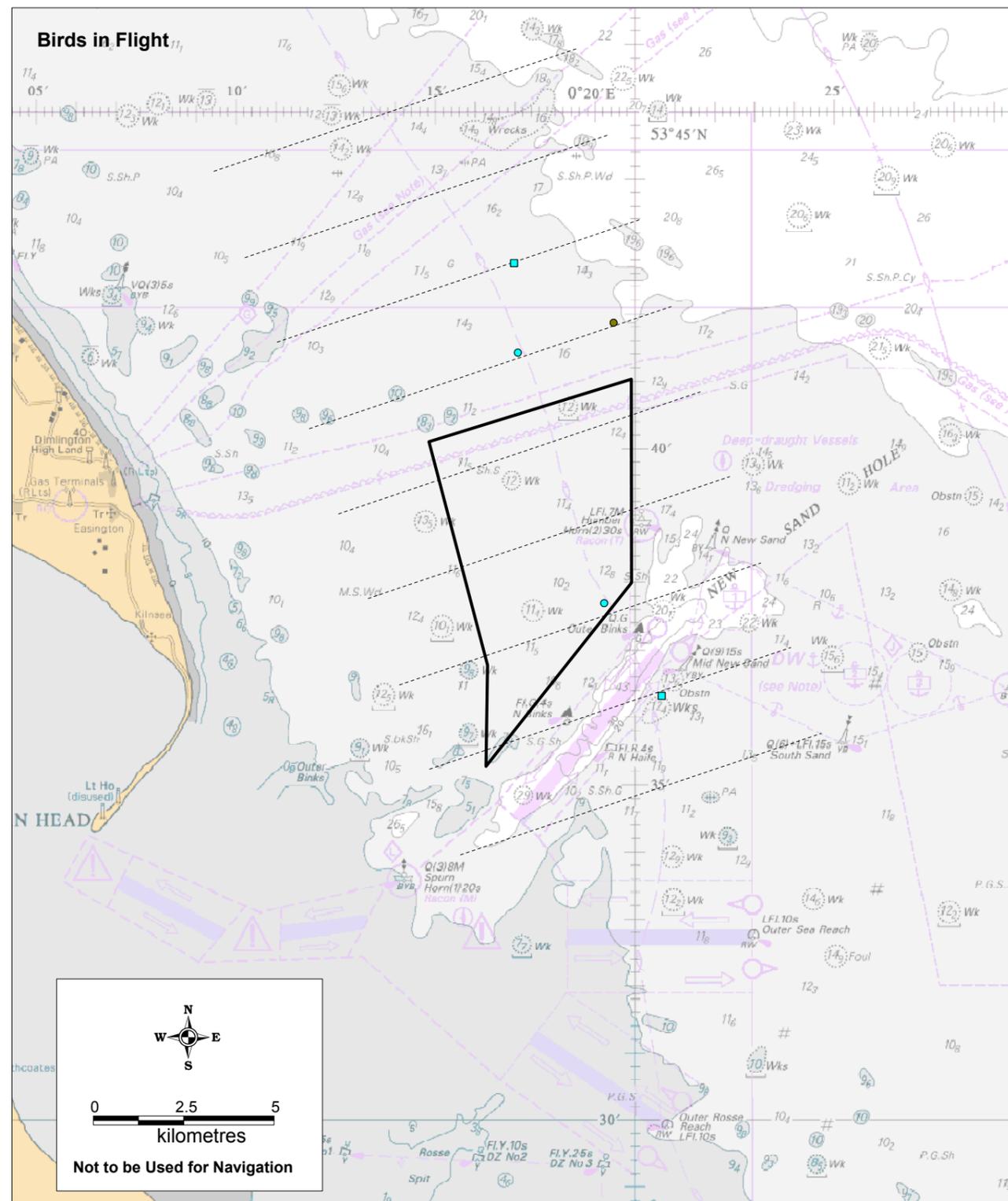
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Legend	Depth (m)	Number of Birds			Month									
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DRAWING: Common Guillemot_Boat A-2_Post Breed.wor		REV: FINAL												

Razorbill Alca torda

Razorbills were recorded in most months of the year, but generally in lower numbers than guillemot. Less than 20 birds were recorded per survey, except in August 2005 when a total of 122 birds were recorded in the wind farm survey area and 111 in the control area. Such numbers probably comprised post breeding dispersion and moulting birds. Very few birds were recorded during the spring and early part of the breeding season, with birds likely to be at the colonies around Flamborough Head at this time. Numbers then increased during the late summer and autumn with the post breeding dispersion, with sightings dispersed across the survey area during this period (August to October) (*Figure 8.60*). A residual wintering usage was also recorded, with a small number of sightings from November to January, but with fewer records for the late winter.

Densities were generally less than one bird per km², with up to six birds per km² in September, which like guillemot is probably due to a post breeding moulting flock.

Atlantic Puffin Fratercula arctica

Puffin is in an unfavourable conservation status in Europe and its populations are declining (SPEC2).

The pattern of use of the survey area by puffin recorded during the boat-based surveys was broadly similar to that of common guillemot and razorbill. Few birds were recorded during the spring and early summer, a time when the birds are more closely associated with the breeding colony, but numbers then increased during the late summer coinciding with a post-breeding dispersion.

Peak numbers were recorded in August 2005, with between 40 and 45 birds recorded in the Humber Gateway survey area and between 25 and 30 birds recorded in the control site survey areas. Numbers then decreased during the autumn, with a near absence during the winter, reflecting the birds' more pelagic distribution at this time.

Density values of puffin were lower than for the other two main auk species, peaking at around 0.5 birds per km².

Little Auk Alle alle

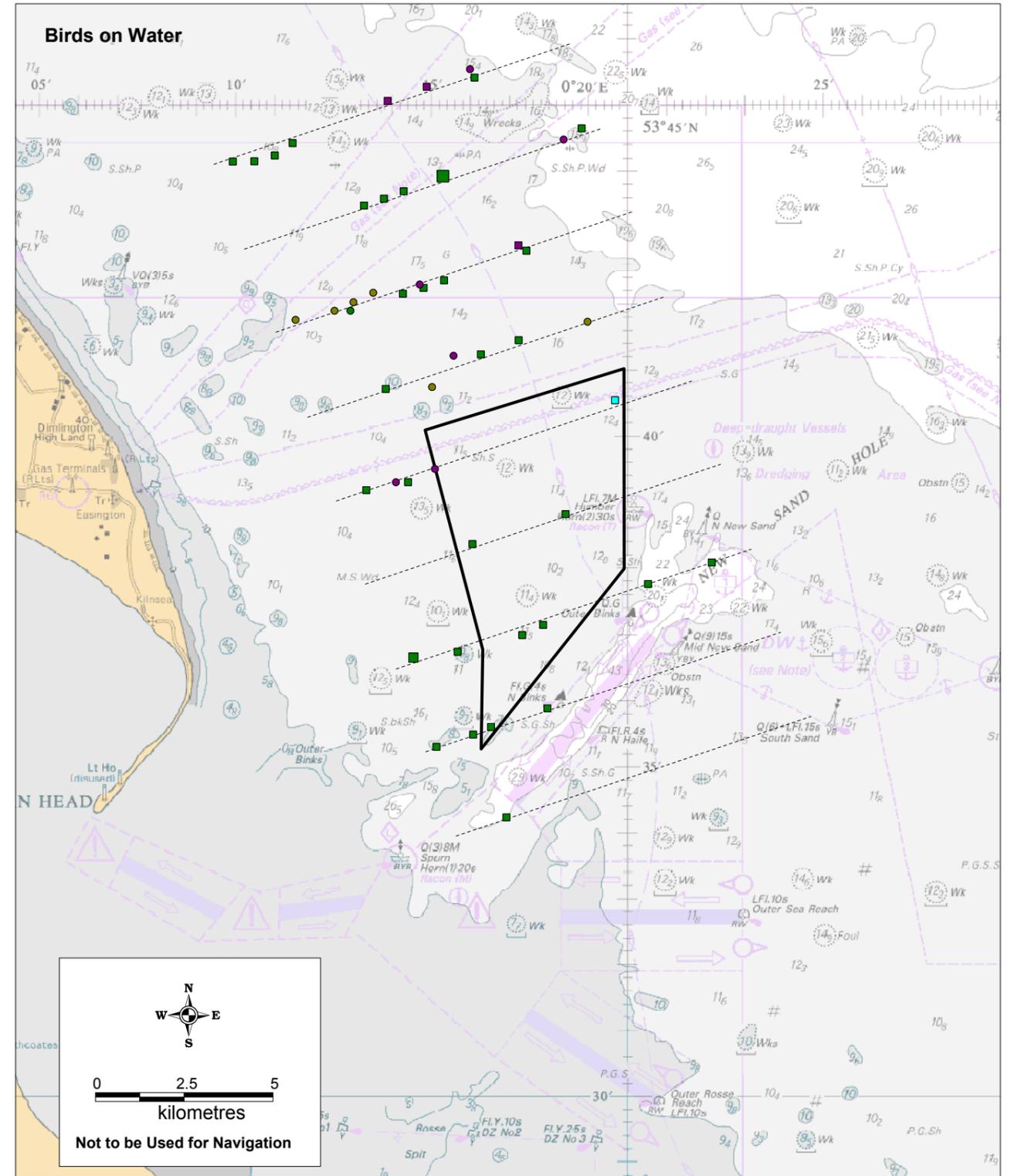
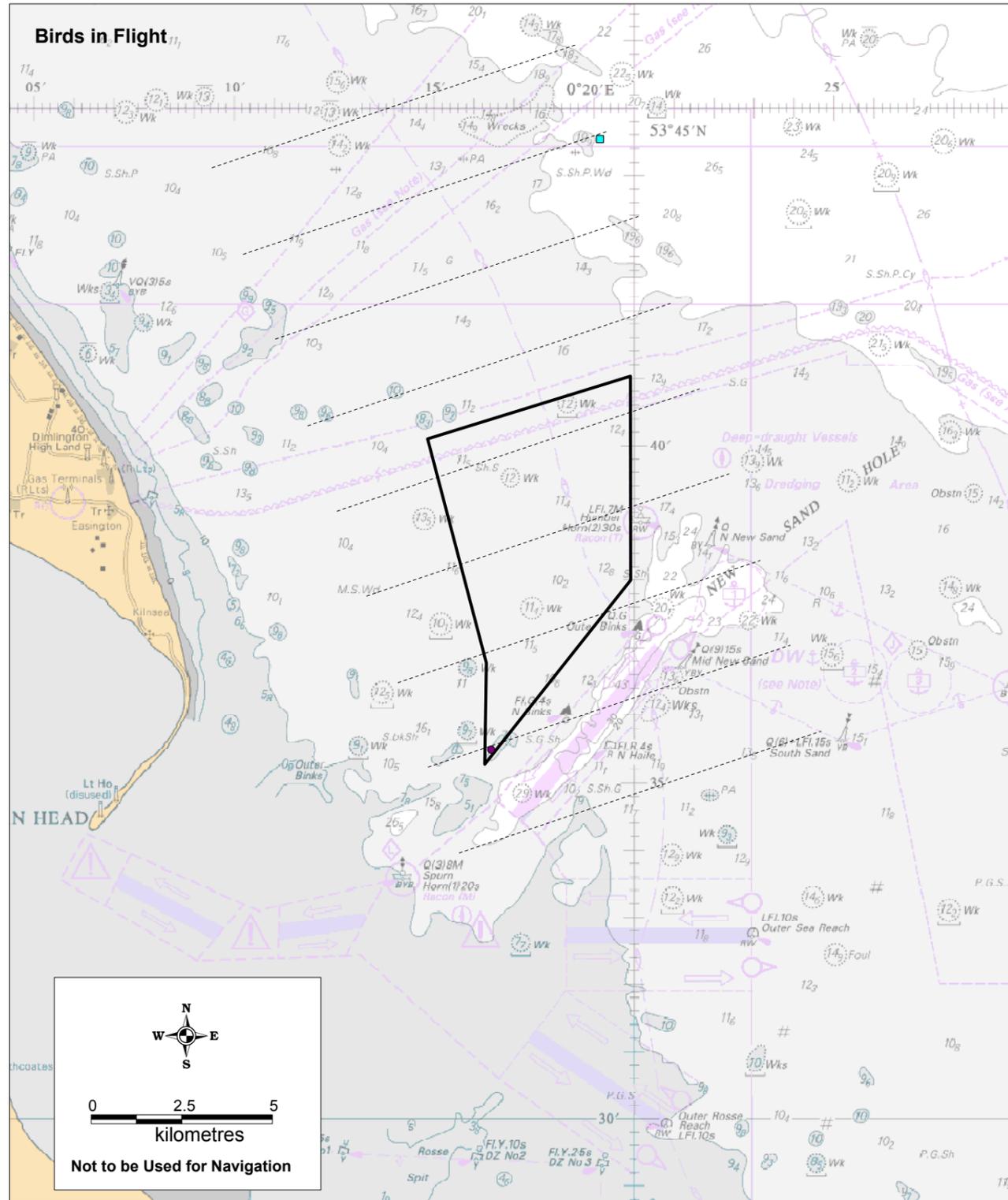
Single birds were recorded during both the October 2004 and 2005 boat-based surveys.

Auk Species

It was not always possible to distinguish between the various auk species during the boat-based surveys and also during the aerial surveys, and hence all auk records were combined. It is likely that the majority of the aerial survey records were of guillemots, based on the findings of the boats surveys.

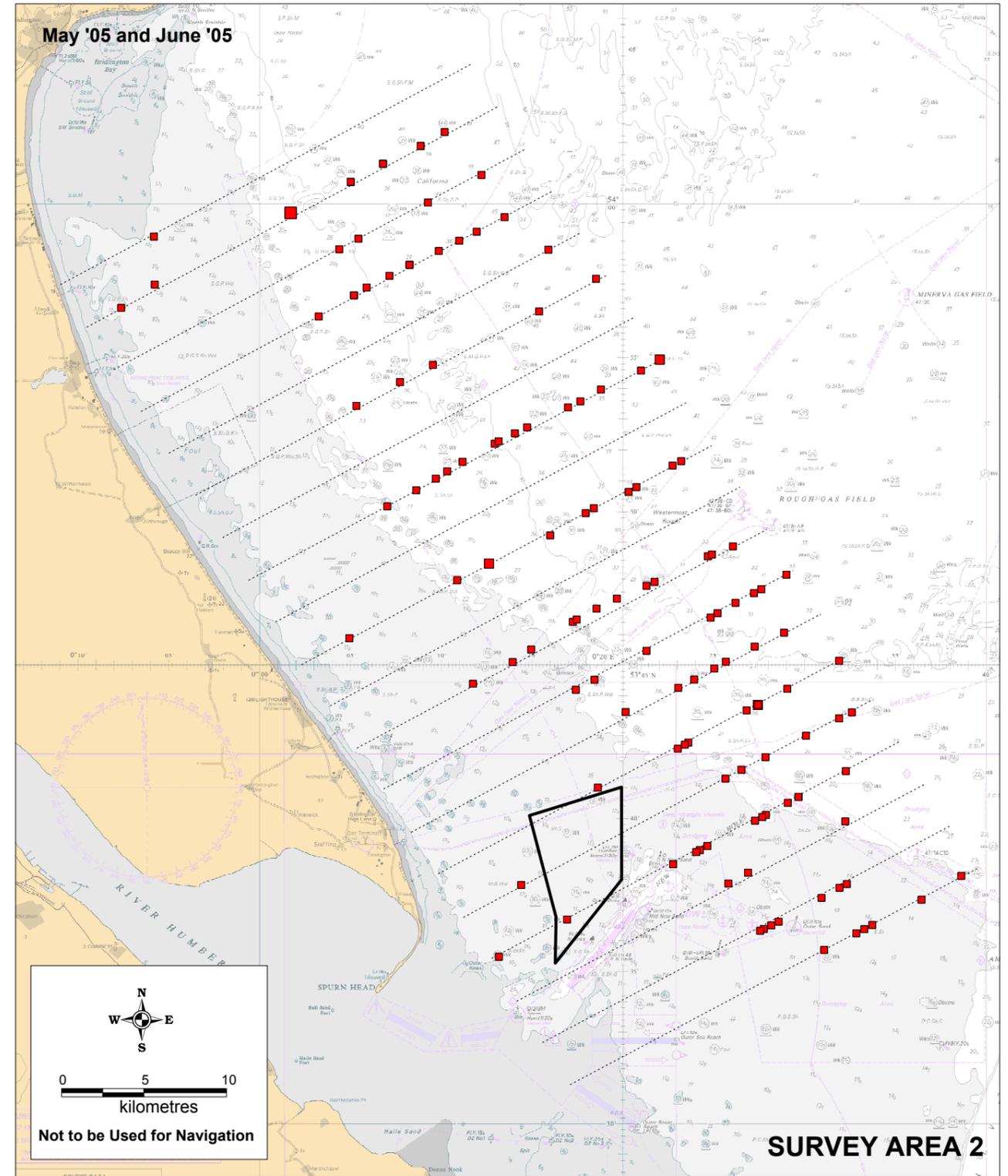
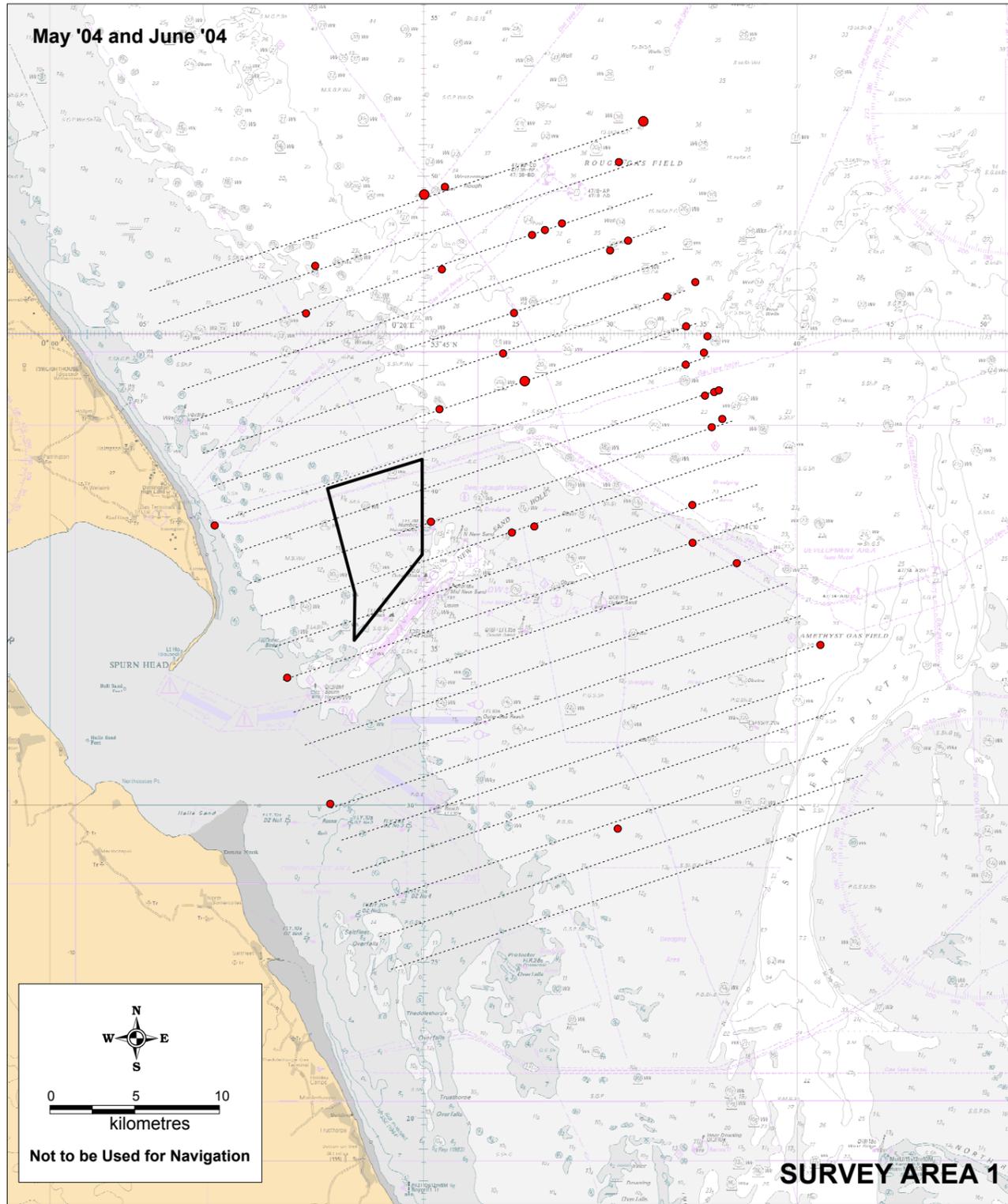
The aerial survey findings show auks to be widespread across the survey area with greatest numbers during the breeding and post breeding seasons (*Figure 8.61 to Figure 8.64*). During the breeding and post breeding periods the majority of the records were in the waters to the east of the Humber Gateway (i.e. further offshore), with concentrations closer to Flamborough Head during the post breeding surveys, reflecting dispersion of the birds from their breeding colonies.

The findings indicate that on most of the boat surveys, up to 15 birds could not be identified to species, however this increased to between 20 and 30 birds during the October 2004 surveys and to between 70 and 80 birds on the December 2004 survey. In October 2004, this was due to two large rafts of birds being observed, but at a distance that did not allow various auk species to be distinguished. For December 2004, all of the birds were recorded in flight, making reliable identification difficult. Only two flocks of auks were recorded within the Humber Gateway site, one of birds on the water in January 2005 and a second of birds flying across the site in November 2005 Humber Gateway site (*Appendix D1, Humber Gateway Seabird Survey Report*). The remainder of the records were predominantly of birds on the water and to the north of the Humber Gateway site.

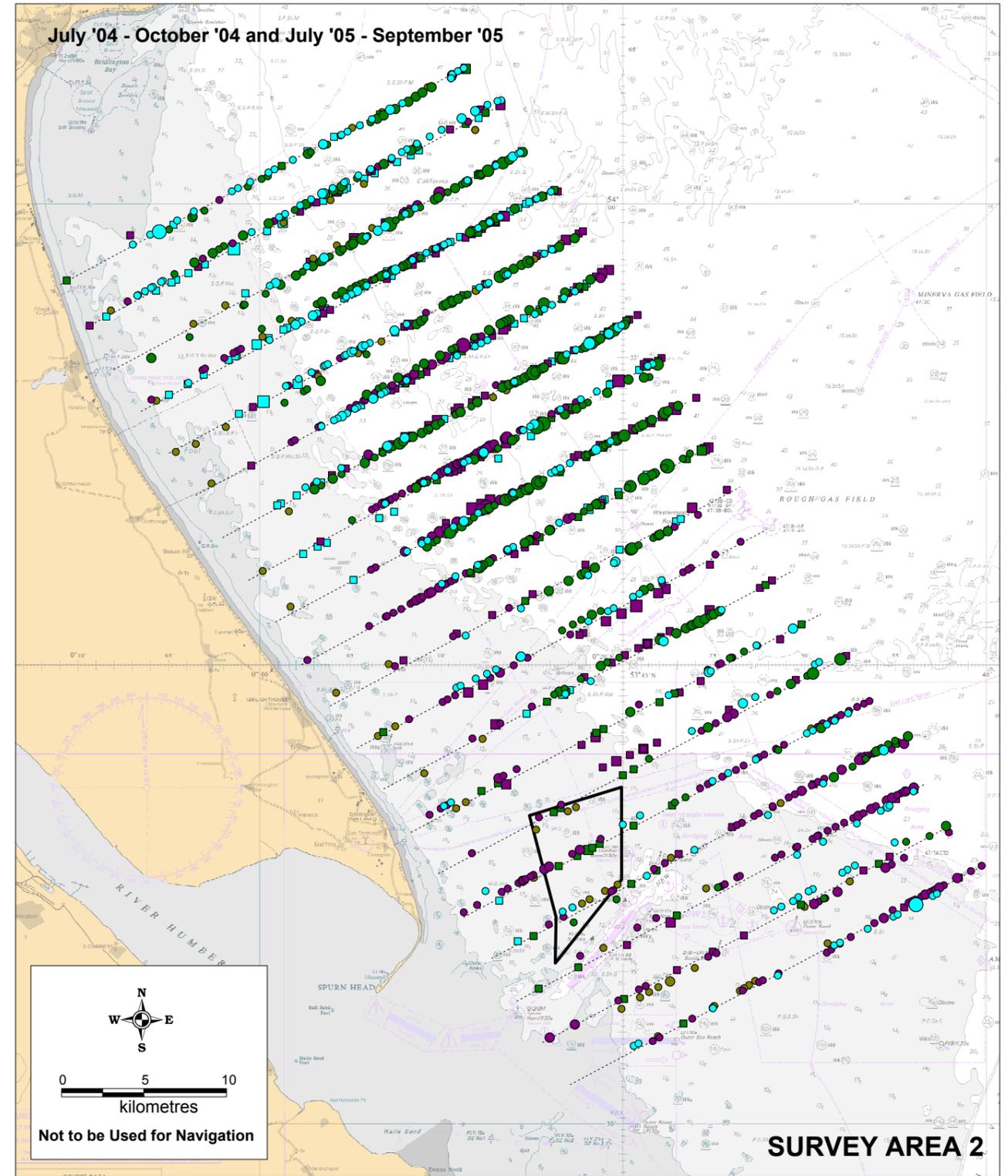
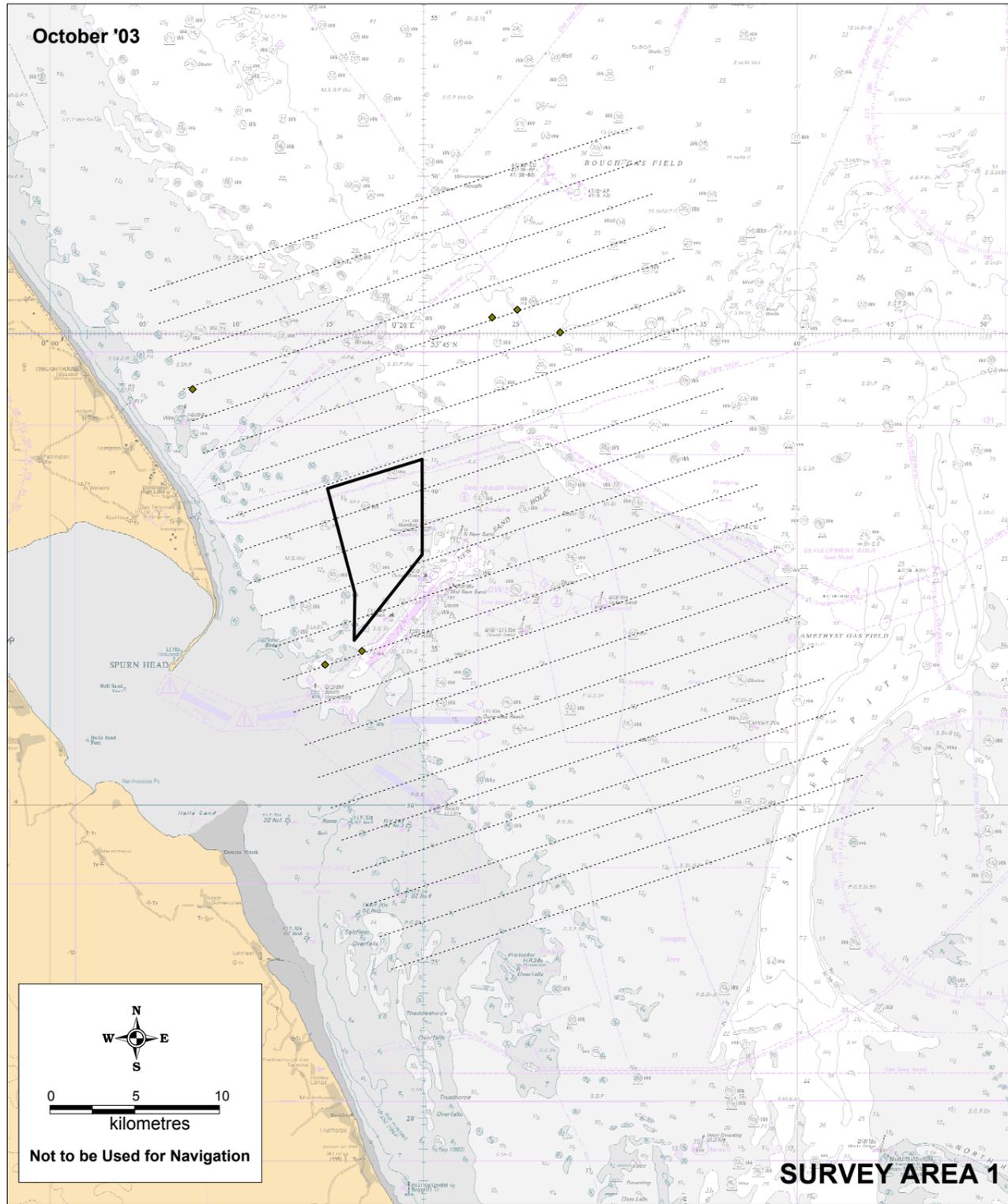


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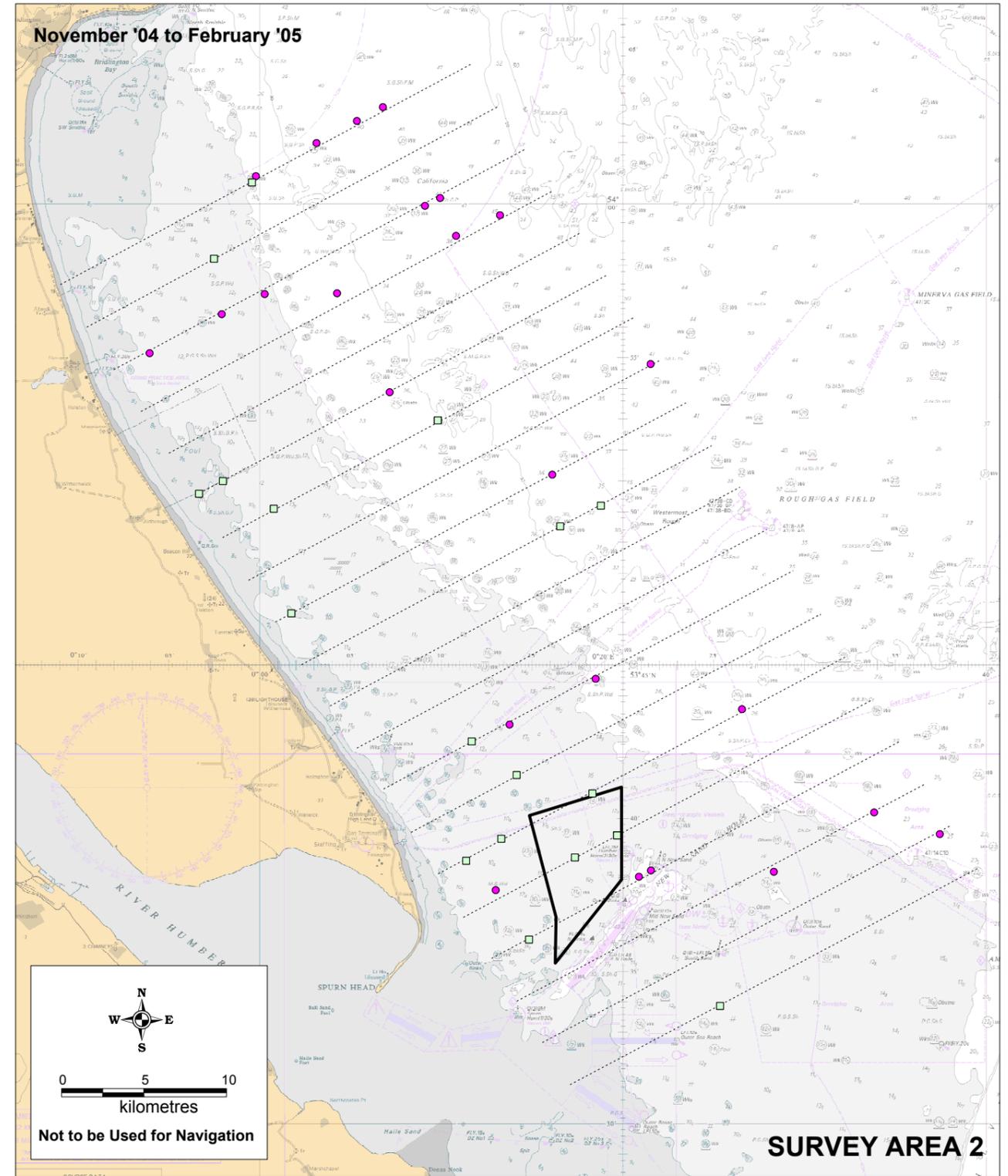
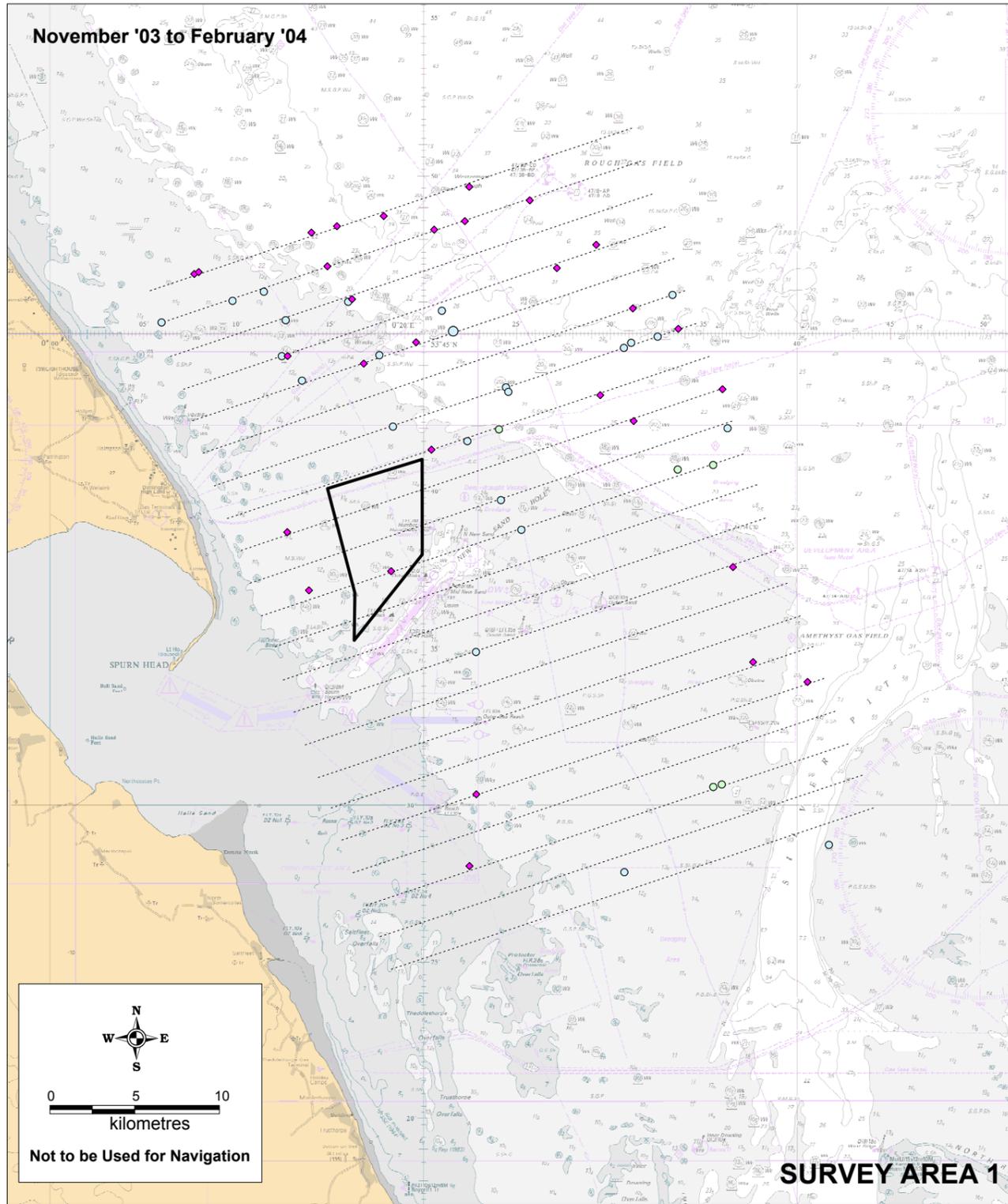
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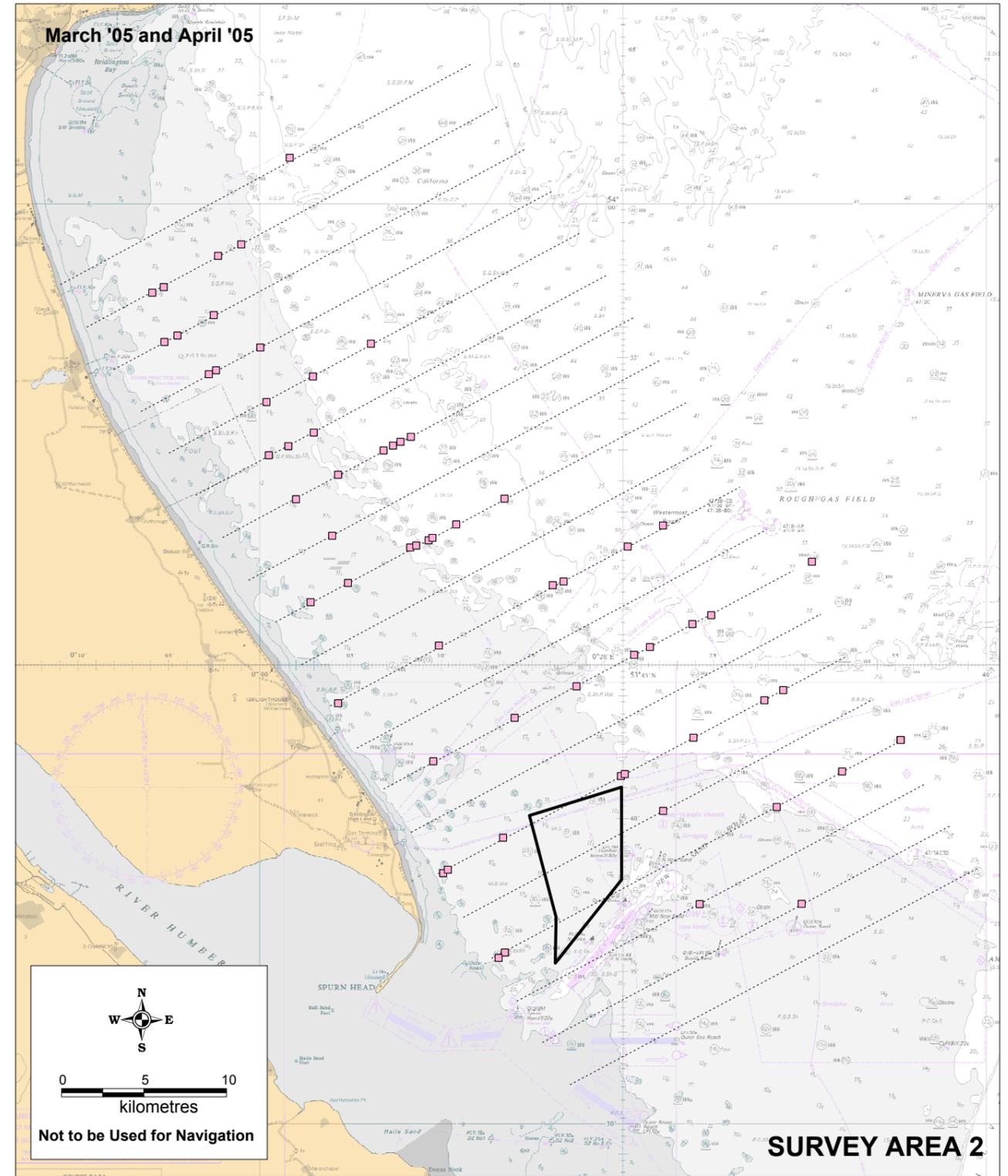
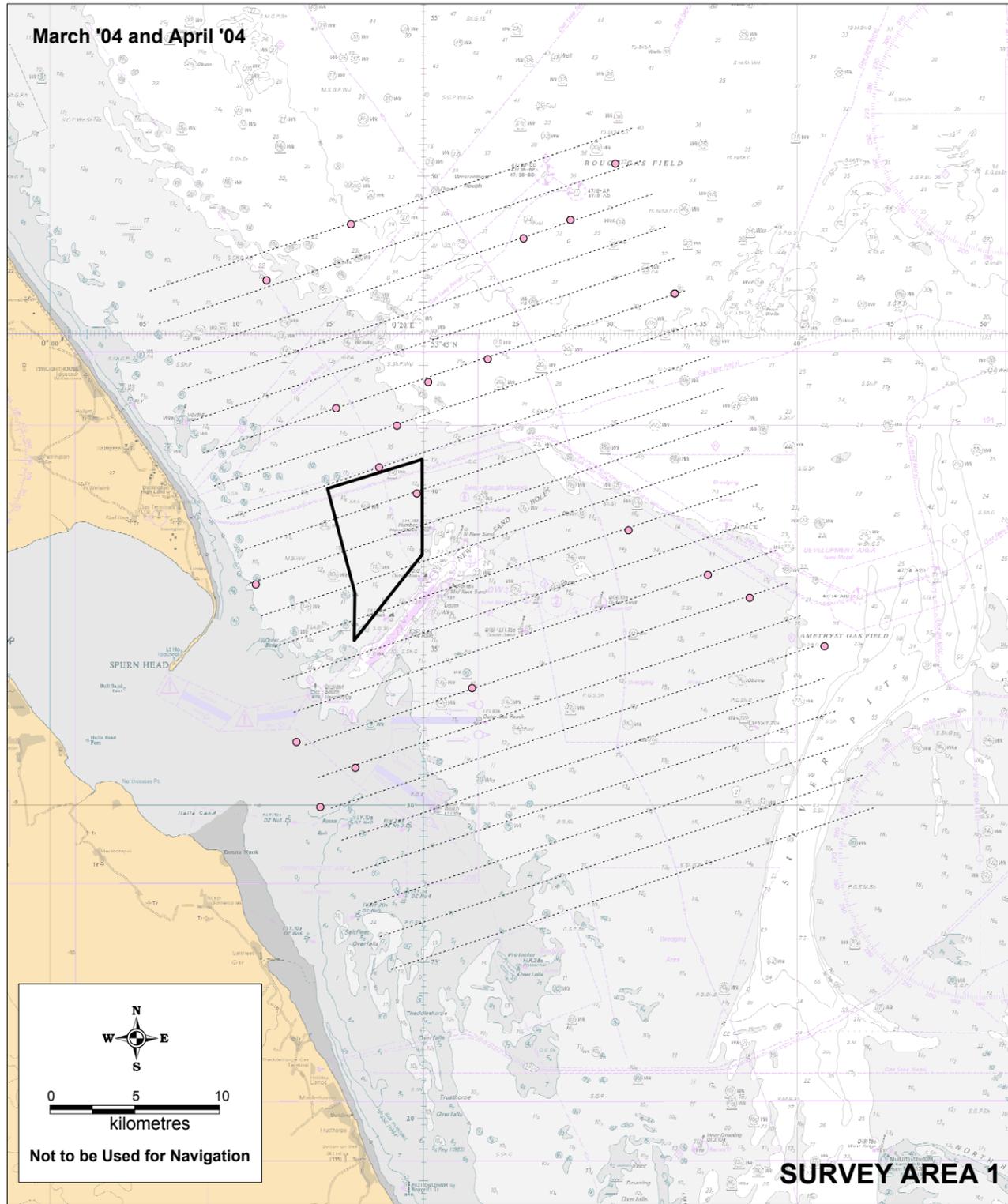
KEY: Legend Depth (m) Intertidal, 0-10, 10-20, 20+ Aerial Transect Humber Gateway Site	Number of Birds 2003 2004 2005 200 to 400 ◇ ○ □ 100 to 200 ◇ ○ □ 50 to 100 ◇ ○ □ 10 to 50 ◇ ○ □ 1 to 10 ◇ ○ □	Month January February March April May June July August September October November December	CLIENT: 	SIZE: A3	TITLE: Figure 8.61 - Auk spp. Aerial Survey. Areas 1 & 2 Breeding (May and June)
				DATE: 12.02.07 CHECKED: PROJECT: DRAWN: SMT APPROVED: SCALE: DRAWING: Auk spp_B_A1&2.wor REV: FINAL	



KEY:	Legend	Depth (m)	Number of Birds			Month		CLIENT: 	SIZE: A3	TITLE: Figure 8.62 - Auk spp. Aerial Survey. Areas 1 & 2 Post Breeding (July to October)
		Intertidal, 0-10, 10-20, 20+ Aerial Transect □ Humber Gateway Site	2003 2004 2005 200 to 400 ◇ ○ □ 100 to 200 ◇ ○ □ 50 to 100 ◇ ○ □ 10 to 50 ◇ ○ □ 1 to 10 ◇ ○ □	January July February August March September April October May November June December	DATE: 12.02.07 CHECKED: PROJECT: DRAWN: SMT APPROVED: SCALE: DRAWING: REV: Auk spp_PB_A1&2.wor FINAL					



KEY: Legend 	Depth (m) Intertidal, 0-10, 10-20, 20+	Number of Birds 200 to 400 100 to 200 50 to 100 10 to 50 1 to 10	Month January February March April May June July August September October November December	CLIENT: 	SIZE: A3	TITLE: Figure 8.63 - Auk spp. Aerial Survey. Areas 1 & 2 Winter (November to February)
				DATE: 12.02.07	CHECKED:	PROJECT:



KEY: Legend 	Depth (m) Intertidal, 0-10, 10-20, 20+	Number of Birds 200 to 400 2004 2005 100 to 200 50 to 100 10 to 50 1 to 10	Month January July February August March September April October May November June December	CLIENT: 	SIZE: A3	TITLE: Figure 8.64 - Auk spp. Aerial Survey. Areas 1 & 2 Pre-breeding (March and April)
				DATE: 12.02.07 CHECKED: PROJECT: DRAWN: SMT APPROVED: SCALE: DRAWING: Auk spp_PRE-B_A1&2.wor REV: FINAL		

Passerines

Although not a specific target of the seabird survey programme, records were made of flocks or individual passerines during the boat-based surveys. *Table 8.14* summarises these records.

Table 8.14 Passerine Records - Combined Surveys

Species	Maxima	Comments
Eurasian Collard Dove (<i>Streptopelia decaocto</i>)	1 (May 2005)	One bird heading east in May 2005.
Common Swift (<i>Apus apus</i>)	2 (May 2004)	Two birds were recorded in May 2004, these presumably being migratory birds.
Skylark (<i>Alauda arvensis</i>)	4 (March 2005)	The species was recorded in October, February, March and April.
Barn Swallow (<i>Hirundo rustica</i>)	3 (May 2004)	These birds were presumably local breeders blown out at sea by strong westerly winds.
Meadow Pipit (<i>Anthus pratensis</i>)	16 (March 2005)	Of a total of 21 birds recorded during the survey programme, 16 were recorded in March 2005.
White / Pied Wagtail (<i>Motacilla alba</i>)	2 (March 2005)	Only two sightings were made in March 2005.
European Robin (<i>Erithacus rubecula</i>)	1 (March & October 2005)	Singles were sighted in March 2005 and October 2005.
Common Blackbird (<i>Turdus merula</i>)	9 (November 2004)	Ship-based survey (November 2004) indicated very small westerly passage. The species was absent from the remaining surveys.
Fieldfare (<i>Turdus pilaris</i>)	4 (November 2005)	The majority of sighting occurred during the autumn migration (11 in total), with westerly movement observed through the survey area.
Song Thrush (<i>Turdus philomelos</i>)	6 (October 2005)	Only six birds were recorded in active migration during the October survey in 2005.
Blackcap (<i>Sylvia atricapilla</i>)	1 (October 2005)	One bird in active migration.
Goldcrest (<i>Regulus regulus</i>)	1 (October 2005)	One individual landed on the boat in October. The bird later died of exhaustion.
Common Starling (<i>Sturnus vulgaris</i>)	85 (March 2005)	Ship-based survey (March) showed movement through the area. Other registrations in October, November, February, total 91 birds.
Finch sp.	5 (October 2005)	Five Finch sp. were recorded in active migration in October 2005. The birds were heading in a southwesterly direction.
Chaffinch (<i>Fringilla coelebs</i>)	42 (March 2005)	Count of 42 birds included some recorded several times the same day. Dense fog affected migration movement in March 2005, birds appeared to be lost.
Brambling (<i>Fringilla montifringilla</i>)	2 (October 2005)	The same Brambling landed twice on the boat during the vessel-based survey in October 2005.
Snow Bunting (<i>Plectrophenax nivalis</i>)	1 (May 2004)	One bird was flying west in May 2004.

8.7.5 FLIGHT HEIGHTS

The main species recorded in flight during the boat-based surveys were gulls (especially black-legged kittiwake, great black-backed gull and mew gull), guillemot and northern gannet and terns. Approximately 20 to 25% of total flight records across the study area were of birds flying at wind turbine rotor height (28 m to 178 m). The percentage of each individual species at rotor height varied, for example:

- all guillemot flights across the wind farm survey area were below rotor height;
- in the period July 2004 to December 2005, 67 of the 87 flights recorded of great black-backed gull (i.e. 77%) were at rotor height; and
- 100% of the pink-footed goose flights across the control area were at rotor height, however this was one flock, whilst none were recorded at rotor height across the wind farm survey area.

Further details about the flight heights of the bird species recorded during the surveys are provided in *Table 8.15* to *Table 8.18*.

Table 8.15 Numbers and Flight Height of Bird Species Recorded During Boat Surveys-Wind Farm Survey Area October 2003 to June 2004

Species	Bird Flight Height Categories (metres)								No data	Total	Total flying at rotor height	% flying at rotor height
	0 to 2	2 to 10	10 to 15	15 to 25	25 to 50	50 to 100	100 to 200	200+				
Arctic Skua	-	-	1	-	-	-	-	-	-	1	0	0%
Atlantic Puffin	-	1	-	-	-	-	-	-	-	1	0	0%
Auk sp.	1	1	3	-	-	-	-	-	-	5	0	0%
Barn Swallow	-	1	-	-	-	-	-	-	-	1	0	0%
Black-headed Gull	-	-	1	-	-	-	-	-	-	1	0	0%
Black-legged Kittiwake	3	25	8	7	3	-	-	-	3	49	10	20%
Common Guillemot	30	26	12	-	-	-	-	-	4	72	0	0%
Common Shelduck	-	4	-	-	-	-	-	-	-	4	0	0%
Common Tern	-	-	-	3	-	-	-	-	-	3	3	100%
Great Black-backed Gull	-	4	8	1	9	-	-	-	-	22	10	45%
Great Cormorant	-	1	-	-	-	-	-	-	-	1	0	0%
Gull sp.	-	-	1	1	3	1	-	-	-	6	5	83%
Herring Gull	-	1	5	5	5	-	-	-	1	17	10	59%
Little Gull	-	-	-	1	-	-	-	-	-	1	1	100%
Mew Gull	1	6	31	15	3	-	-	-	1	57	18	32%
Northern Fulmar	10	6	-	-	-	-	-	-	-	16	0	0%
Northern Gannet	2	1	-	-	-	-	-	-	-	3	0	0%
Razorbill	1	-	-	-	-	-	-	-	-	1	0	0%
Red-throated Diver	-	2	-	-	-	-	-	-	-	2	0	0%
Sandwich Tern	-	-	-	1	-	-	-	-	-	1	1	100%
Totals	48	79	70	34	23	1	-	-	9	264	58	22%

Table 8.16 Numbers and Flight Height of Bird Species Recorded During Boat Surveys – Wind Farm Survey Area July 2004 to December 2005

Species	Bird Flight Height Categories (metres)									Total	Total flying at rotor height	% flying at rotor height
	0 to 2	2 to 10	10 to 15	15 to 25	25 to 50	50 to 100	100 to 200	200+	No data			
Arctic Skua	1	3	-	1	-	-	-	-	-	5	1	20%
Arctic Tern	-	-	2	1	-	-	-	-	-	3	1	33%
Atlantic Puffin	3	14	-	-	-	-	-	-	-	17	0	0%
Auk sp.	57	26	-	-	-	-	-	-	-	83	0	0%
Black Tern	-	2	1	-	-	-	-	-	-	3	0	0%
Black-headed Gull	-	7	1	4	-	-	-	-	-	12	4	33%
Black-legged Kittiwake	8	22	33	33	6	-	-	-	10	112	39	35%
Chaffinch	-	36	-	-	-	-	-	-	-	36	0	0%
Commic Tern	1	16	-	10	-	-	-	-	-	27	10	37%
Common Blackbird	-	5	-	-	-	-	-	-	-	5	0	0%
Common Guillemot	120	17	1	-	-	-	-	-	3	141	0	0%
Common Scoter	5	1	-	-	-	-	-	-	-	6	0	0%
Common Starling	1	44	4	-	-	-	-	-	-	49	0	0%
Common Tern	3	34	4	1	-	-	-	-	-	42	1	2%
Diver sp.	-	1	-	-	-	-	-	-	-	1	0	0%
Eurasian Collard Dove	-	-	-	-	-	-	-	-	1	1	0	0%
Eurasian Woodcock	1	1	-	-	-	-	-	-	-	2	0	0%
European Golden Plover	1	-	-	-	-	-	-	-	-	1	0	0%
European Robin	1	-	-	-	-	-	-	-	-	1	0	0%
Fieldfare	4	3	-	1	-	-	-	-	-	8	1	13%
Glaucous gull	-	1	-	-	-	-	-	-	-	1	0	0%
Great Black-backed Gull	4	10	5	36	28	3	-	-	1	87	67	77%
Great Northern Diver	-	-	2	-	-	-	-	-	-	2	0	0%
Great Skua	-	-	-	-	1	-	-	-	1	2	1	50%
Gull sp.	-	1	-	-	1	-	-	-	1	3	1	33%
Herring Gull	-	5	2	4	1	-	-	-	-	12	5	42%
Lesser Black-backed Gull	7	-	-	14	-	-	-	-	1	22	14	64%
Little Gull	4	14	4	4	-	-	-	-	-	26	4	15%
Mallard	-	-	2	-	-	-	-	-	-	2	0	0%
Manx Shearwater	4	8	-	-	-	-	-	-	-	12	0	0%
Meadow Pipit	-	4	10	-	-	-	-	-	-	14	0	0%
Mew Gull	1	60	61	129	31	-	-	-	4	286	160	56%
Northern Fulmar	47	16	-	-	-	-	-	-	-	63	0	0%
Northern Gannet	69	80	29	18	12	-	-	-	7	215	30	14%
Pink-footed Goose	-	6	-	-	-	-	-	-	-	6	0	0%
Razorbill	18	5	-	-	-	-	-	-	1	24	0	0%
Red-throated Diver	1	5	-	4	-	-	-	-	-	10	4	40%
Sandwich Tern	-	11	22	7	2	-	-	-	-	42	9	21%
Sky Lark	-	6	-	-	-	-	-	-	-	6	0	0%
Small wader sp.	4	-	-	-	-	-	-	-	-	4	0	0%
Sooty Shearwater	1	-	-	-	-	-	-	-	-	1	0	0%
Unidentified Passerine sp.	1	4	-	-	-	-	-	-	-	5	0	0%
White / Pied Wagtail	-	1	-	-	-	-	-	-	1	2	0	0%
Totals	367	469	183	267	82	3	-	-	31	1402	352	25%

Table 8.17 Numbers and Flight Height of Bird Species Recorded During Boat Surveys – Control Survey Area October 2003 to June 2004

Species	Bird Flight Height Categories (metres)								No data	Total	Total flying at rotor height	% flying at rotor height
	0 to 2	2 to 10	10 to 15	15 to 25	25 to 50	50 to 100	100 to 200	200+				
Arctic Skua	-	-	-	-	-	-	-	-	-	0	0	
Atlantic Puffin	-	-	-	-	-	-	-	-	-	0	0	
Auk sp.	17	19	1	-	-	-	-	-	-	37	0	0%
Barn Swallow	1	1	-	-	-	-	-	-	-	2	0	0%
Black-legged Kittiwake	7	36	10	17	7	-	-	-	5	82	24	29%
Common Guillemot	72	109	4	-	-	-	-	-	5	190	0	0%
Common Swift	-	1	1	-	-	-	-	-	-	2	0	0%
Common Tern	-	-	-	-	1	-	-	-	-	1	1	100%
Great Black-backed Gull	-	3	6	5	10	3	-	-	2	29	18	62%
Great Cormorant	-	2	-	-	-	-	-	-	-	2	0	0%
Gull sp.	-	-	2	-	4	1	-	-	-	7	5	71%
Herring Gull	-	-	1	10	4	-	-	-	5	20	14	70%
Meadow Pipit	-	1	-	-	-	-	-	-	-	1	0	0%
Mew Gull	1	7	18	18	15	-	-	-	8	67	33	49%
Northern Fulmar	9	5	-	-	-	-	-	-	-	14	0	0%
Northern Gannet	1	7	1	-	-	-	-	-	-	9	0	0%
Razorbill	-	5	-	-	-	-	-	-	-	5	0	0%
Red-throated Diver	1	2	-	-	-	-	-	-	-	3	0	0%
Sandwich Tern	-	-	2	3	-	-	-	-	-	5	3	60%
Snow Bunting	-	1	-	-	-	-	-	-	-	1	0	0%
Totals	109	199	46	53	41	4	-	-	25	477	98	21%

Table 8.18 Numbers and Flight Height of Bird Species Recorded During Boat Surveys – Control Survey Area July 2004 to December 2005

Species	Bird Flight Height Categories (metres)								No data	Total	Total flying at rotor height	% flying at rotor height
	0 to 2	2 to 10	10 to 15	15 to 25	25 to 50	50 to 100	100 to 200	200+				
Arctic Skua	1	-	-	2	-	-	-	-	-	3	2	67%
Arctic Tern	3	14	-	-	-	-	-	-	-	17	0	0%
Atlantic Puffin	1	-	-	-	-	-	-	-	-	1	0	0%
Auk sp.	18	14	-	-	-	-	-	-	-	32	0	0%
Black-legged Kittiwake	46	64	24	33	14	-	-	-	3	184	47	26%
Chaffinch	-	4	2	-	-	-	-	-	-	6	0	0%
Commic Tern	-	1	-	-	-	-	-	-	-	1	0	0%
Common Blackbird	3	-	-	-	-	-	-	-	-	3	0	0%
Common Eider	-	-	-	5	-	-	-	-	-	5	5	100%
Common Guillemot	99	15	-	-	-	-	-	-	2	116	0	0%
Common Redshank	2	-	-	-	-	-	-	-	-	2	0	0%
Common Scoter	-	4	-	2	-	-	-	-	-	6	2	33%
Common Starling	3	24	12	-	2	-	-	-	-	41	2	5%
Common Tern	5	109	5	4	-	-	-	-	4	127	4	3%
Diver sp.	1	-	-	-	-	-	-	-	-	1	0	0%
Eurasian Woodcock	-	1	-	-	-	-	-	-	-	1	0	0%
Fieldfare	-	3	-	-	-	-	-	-	-	3	0	0%
Finch sp.	5	-	-	-	-	-	-	-	-	5	0	0%
Great Black-backed Gull	2	44	5	16	16	1	1	-	8	93	34	37%
Gull sp.	1	6	-	2	8	-	-	2	-	19	10	53%
Herring Gull	-	1	-	4	-	-	-	-	-	5	4	80%
Lesser Black-backed Gull	-	1	-	-	-	-	-	-	-	1	0	0%
Little Auk	1	-	-	-	-	-	-	-	-	1	0	0%
Little Gull	8	8	3	-	-	-	-	-	-	19	0	0%
Manx Shearwater	24	8	-	-	-	-	-	-	-	32	0	0%
Meadow Pipit	4	2	-	-	-	-	-	-	-	6	0	0%
Mew Gull	-	13	26	49	6	-	-	-	1	95	55	58%
Northern Fulmar	22	7	-	-	-	-	-	-	2	31	0	0%
Northern Gannet	66	26	2	8	1	-	-	-	6	109	9	8%
Pink-footed Goose	-	-	-	39	-	-	-	-	-	39	39	100%
Razorbill	17	6	-	-	-	-	-	-	1	24	0	0%
Red-throated Diver	1	1	-	-	-	-	-	-	-	2	0	0%
Sandwich Tern	-	11	2	1	-	-	-	-	-	14	1	7%
Sky Lark	1	2	1	-	-	-	-	-	-	4	0	0%
Small wader sp.	1	-	-	-	-	-	-	-	-	1	0	0%
Sooty Shearwater	1	-	-	-	-	-	-	-	-	1	0	0%
Tern sp.	-	-	-	2	-	-	-	-	-	2	2	100%
Unidentified Passerine sp.	-	-	6	-	-	-	-	-	-	6	0	0%
Totals	336	389	88	167	47	1	1	2	27	1058	216	20%

8.7.6 RADAR STUDY

The radar study recorded a number of bird tracks particularly close to the radar unit (i.e. within 1 km) but also within 7 km of the shore. However, it recorded little bird movement further offshore at the Humber Gateway site, approximately 8 km from the radar. Of those records that were made, it was often not possible at this range to distinguish individuals of larger bird species from flocks of smaller species. Simultaneous watches from a boat also showed that not all bird movements were recorded, as the boat surveyors recorded significantly more bird flocks than the radar at distances beyond 6 km (the distance of the boat offshore during these simultaneous surveys).

The radar study did, however, record a migration event on 27 October 2004 when there was a strong southeasterly wind. At distances of between 6 and 12 km offshore, the peak numbers of tracks (80 to 90) were recorded between 10 am and 11 am. The boat did not sail on that day due to weather so simultaneous observations offshore closer to the Humber Gateway site were not possible. In contrast, a southwesterly wind on 26 October resulted in the majority of the bird movement being northwest – southeast (i.e. parallel to the coast).

The study also recorded a number of tracks during the night and recorded birds flying towards the coast both north and south of the Spurn Bird Observatory including north of Easington and into the mouth of the Humber, suggesting bird movements were occurring on a broad front.

The flight heights recorded throughout the study were predominantly low with peak numbers in the 8 to 20 m height band, which was thought to reflect the main movement of seabirds and waterfowl low over the water's surface. A secondary peak on 27 October 2004 in the 100 to 200 m height band was thought to reflect the movement of migratory birds. The data also show a peak in numbers between 500 and 1,000 m above sea level and visual observations suggested that these may have been flocks of pink-footed geese.

Visual observations from the shoreline (sea watches) and from the boat as part of the radar study recorded a similar range of species to those observed during the main boat-based surveys. The sea watches recorded more waterfowl, waders and passerine species. Some westerly movements were observed by waders and passerines were observed including nearly 120 redshank, 500 thrushes and 180 starlings, but the majority of the birds were recorded flying north-south parallel to the coast in shore of the Humber Gateway site.

Only small numbers of passerines were recorded during the boat surveys on 26 and 29 October at a location 6 km offshore, with four species blackbird (six), fieldfare (one), meadow pipit (one) and starling (seven flocks comprising 93 birds).

8.8 UNDERWATER ACOUSTIC ENVIRONMENT

8.8.1 OVERVIEW

A background underwater noise survey was undertaken in March 2007, as changes in the noise environment are of particular relevance to marine mammals ⁽¹⁾.

8.8.2 CONSULTATION

Natural England (formerly English Nature) was consulted on the scope of the subsea noise survey.

Comments relating to the scope of work were taken into consideration when undertaking the work and a summary of the results are presented in the remainder of this section.

8.8.3 BACKGROUND NOISE ENVIRONMENT

The key findings of the noise study are described below.

Ambient underwater noise is generated by a number of anthropogenic and natural sources, including:

- wind;
- rain;
- surf noise;
- sediment transport;
- biological noise;
- thermal noise;
- commercial shipping;
- dredging and aggregate extraction;
- industrial noise;
- sonar and geophysical surveying;
- aircraft noise;
- fishing activity; and
- marine piling.

⁽¹⁾ National Physical Laboratory, 2007. Baseline Underwater Noise Measurements for the Humber Gateway Offshore Wind Farm.

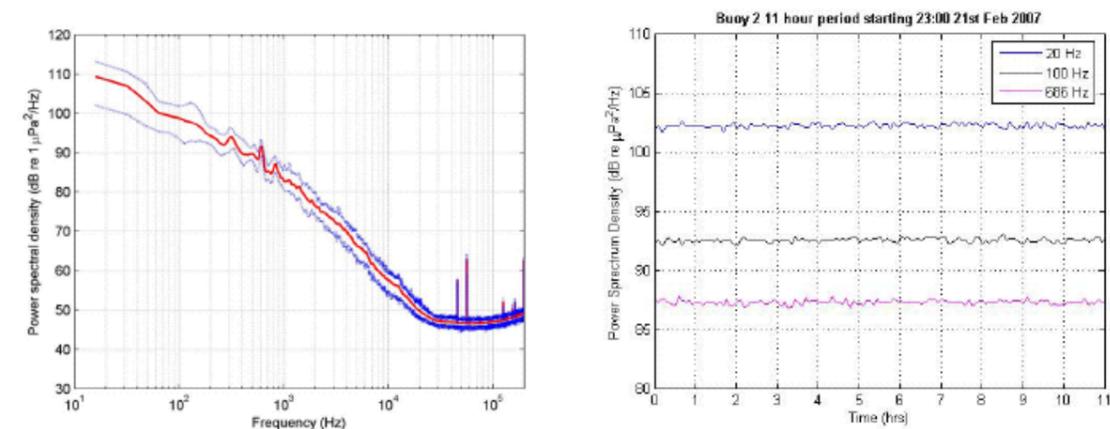
Background levels of underwater noise were sampled both spatially and temporally, using hydrophone equipment deployed from a vessel and from a static buoy. The spatial variation in the background noise was measured by recording short samples of the noise at selected locations throughout the site, and also near to Donna Nook, approximately 14 km away. The temporal variation was measured by making a longer duration recording of the noise at one location within the area around the Humber Gateway site. These were made for a total of 16 hours starting at 1730 on 21 February and finishing at 0945 on the 22 February.

Results showed that the underwater background noise is relatively high in the locality, by comparison with deep ocean noise. It is also slightly higher than the mean levels reported for other sites around the UK coastal waters.

The general levels at Donna Nook were not significantly different from those found at the Humber Gateway site, although nearer the coast the background noise will be dominated by noise generated in the surf zone.

The higher levels of background noise are almost certainly due to the high shipping traffic present during the surveys. Since this traffic is present almost continuously in the Humber Estuary area, it is likely that it is characteristic of the area. Long term monitoring showed no reduction in overnight levels, since the Humber ports are busy 24 hours a day.

Figure 8.65 Typical Noise Plot Measured at the Humber Gateway Site (left), and Individual Frequency Component Levels for a 11 hour Sequence on the Long Term Monitoring Buoy (right)



8.9 SUMMARY OF KEY BASELINE DATA

8.9.1 DESIGNATED SITES

The baseline review identified a number of sites with international, national and local designations, including a number of SSSIs, an SPA / Ramsar site and a possible SAC.

8.9.2 INTERTIDAL ECOLOGY

Infaunal invertebrates in the intertidal area are extremely scarce, with only 14 individuals found across the intertidal study area. No epifaunal species were identified. The mobile nature of the sediment substrate prevents epifaunal colonisation and renders the substrate too stressful for many species. The intertidal area is therefore considered to be extremely impoverished, with low diversity both at individual sites, and across the whole survey area. This habitat is representative of much of the Holderness Coast.

8.9.3 SUBTIDAL BENTHOS

Sediments at the Humber Gateway site comprise mixed cobbles, pebbles and boulders overlying coarse sands and gravels. The subtidal macrofaunal grab survey and epifaunal trawl survey found the distributions of sediment and fauna to be patchy and highly variable. Emergent boulder clay formations, known locally as 'clay huts', occur approximately 1 km from the coast. In total, eight different biotopes were recorded in the survey area and the underlying substrate.

The most common species present was *Pisidia longicornis*, the long tailed porcelain crab. Polychaete worms were the dominant class, with 166 species recorded. Crustaceans and molluscs were also well represented. Species richness and diversity were noted to be higher within the central and northern areas of the Humber Gateway site, due to their lower proximity to the strong currents and elevated turbidity generated by the Humber Estuary discharge.

The epifaunal community was dominated by five major taxonomic groups; Bryozoa, Crustacea, Hydrozoa, Polychaeta and Mollusca. No clear spatial trends in species richness or abundance were detected, although commercially important crustaceans are particularly abundant in the northern sector of the Humber Gateway site. The area is an important spawning and nursery ground for commercially important crustacean species including the lobster *Homarus gammarus*, brown crab *Cancer pagurus*, and velvet crab *Necora puber*. Juvenile lobsters use the 'clay huts' for shelter.

Cobble reef habitats are increasingly being included as habitats of conservation importance and will receive consideration in the context of the advancement of candidate offshore SACs. The majority of the Humber Gateway site and surrounding area includes sections of cobble habitat. However, the cobble habitats of the Humber Gateway site are relatively impoverished compared to cobble habitats further north along the Holderness coast and do not have all of the characteristics that are currently considered to define a cobble reef.

Dense aggregations of the tube dwelling polychaete *Sabellaria* spp. can form biogenic reef structures. Biogenic reefs are included in the definition of 'marine reefs' under Annex 1 of the Habitats Directive and are classed as priority habitats under the UK Biodiversity Action Plan. *Sabellaria* spp. were only present in low numbers within the Humber Gateway site but were more widespread in the inshore area to the west. In many areas, and particularly within the Humber Gateway site, the populations are of moderately low 'quality' in terms of abundance. However, some areas of larger, more developed *Sabellaria* spp. concretions were encountered outside the Humber Gateway site where abundances of between 200 and 300 individuals per 0.1 m² were recorded.

8.9.4 FISH

The fish species present in the vicinity of the Humber Gateway site and surrounding area are typical of the North Sea. The fish surveys identified the presence of a number of important species and their feeding, spawning and nursery grounds and their migratory routes.

The Humber Gateway site is important in terms of prey availability, and the 'clay huts' along the cable routes also provide habitats for a large number of crustacean prey. However, most of the prey items and fish species are highly mobile and found throughout the area.

A number of finfish species are known to have historically spawned in the vicinity of the Humber Gateway site. Most species of fish are broadcast spawners and release offspring into the water column without the need for specific habitat or substrate for egg and larval development. However, herring require specific substrate and often return to the same spawning area year after year. Data indicate that traditional spawning grounds for herring have moved further north and do not occur in the vicinity of the Humber Gateway site. Local areas of importance for spawning for other species may vary in their degree of functionality and to what degree they contribute to the wider stock of each species within the North Sea.

Those areas of the seabed favoured by juvenile fish are also important habitats and can often be spread over a wide area. Within the study area there are a

number of potential nursery areas but for many species, the nearshore coastal margins and Humber Estuary afford a greater level of protection than the Humber Gateway site. These areas offer manageable prey for a variety of species including juvenile sole, plaice, dab, herring, cod and whiting.

Within the Humber Gateway site, cohort analysis carried out on dominant species indicates that the area is used predominantly by adolescent and maturing adult finfish. There was no significant evidence of juvenile flatfish abundance within the survey area, either during late autumn or spring. However, it is likely that juvenile flatfish use the coastal fringe as a migratory corridor.

8.9.5 MARINE MAMMALS

The site specific surveys identified harbour porpoise, grey seal and common seal as being present in the area (in descending order of abundance). The numbers of individuals identified during the survey and an analysis of existing literature implies a low to moderate abundance of these species in relation to the wider UK population distributions.

There are seal haul-out and breeding sites at Donna Nook and along the Lincolnshire coast, south of The Wash. Seals from these colonies use the area around the Humber Gateway site for foraging but they are not known to forage in significant numbers within the site. The seal population off the east coast of England has been identified as a single unit population due to the movements of individuals along the coast.

The other marine mammal species identified in the existing literature are understood to move into or inhabit the area infrequently and in low abundance. They are therefore not considered to be key species for the area.

8.9.6 ORNITHOLOGY

The surveys across the Humber Gateway site and surrounding waters recorded mostly seabirds with, on occasion, migratory waterfowl and passerines. The main records were of gulls and auks, although both terns and divers were present. The Humber Gateway site was used throughout the year with abundance varying with the seasons. For example, auk numbers peaked during late summer and early autumn with dispersion away from the breeding colonies at Flamborough Head, whilst gull numbers peaked during the winter months.

The most common gull records were of mew (common gull) and black-legged kittiwake, and most birds were recorded foraging. No particular concentrations were found, although the sea off the mouth of the Humber was used more

extensively by some species, and a concentration of great black-backed gulls was recorded near the Rough Gas Field offshore platform, where the birds were recorded roosting on the helicopter landing pad. A dedicated little gull survey recorded sizeable flocks off the south Holderness Coast with birds predominantly 15 km offshore, but with some birds within the Humber Gateway site.

Auks were frequently recorded, which is to be expected given the breeding colonies at Flamborough Head, although there were no particular concentrations within the Humber Gateway site and no clear flight lines to and from feeding areas across the site. Large rafts of flightless auks occur in late summer and early autumn, as the birds undergo their post-breeding feather moult, which drift southwards with the residual current away from Flamborough colonies.

Small numbers of red-throated divers were recorded predominantly in the nearshore waters between the coastline and the Humber Gateway site. Northern fulmar was recorded foraging throughout the survey area particularly during the summer, although no particular concentrations were recorded. Relatively few northern gannets were recorded within the survey area and even fewer within the Humber Gateway site. Tern species were recorded with common tern the most frequent during the passage period and few birds during the breeding season. No particular concentrations were recorded within the Humber Gateway site.

The main species recorded in flight during the surveys were gulls (especially black-legged kittiwake, great black-backed gull and mew gull), guillemot and northern gannet and terns. Approximately 20 to 25% of total flight records were of birds flying at wind turbine rotor height.

The effective range of the radar located near the Spurn Bird Observatory did not extend to the Humber Gateway site. The study did record nocturnal movements and a migration movement of birds towards the east coast during a strong southeasterly wind. The radar tracks indicated that birds were arriving on a relatively broad front along the coast. Many of the flights recorded were at a low height (8 to 20 m above sea level). Visual observations undertaken as part of the radar study recorded similar species, especially from the boat offshore. More waterfowl, waders and passerines were recorded closer to the shore from sea watching. Many of these movements were north-south along the coast.

8.9.7 UNDERWATER ACOUSTIC ENVIRONMENT

Subsea noise surveys have found that the noise levels at the Humber Gateway site are higher than other sites around the UK and deep ocean noise. This is due to the high levels of ship traffic in the area.