CONTENTS

8 ORNITHOLOGY

8.1 Introduction

This section provides information on the existing environment with respect to ornithological interests and describes the potential impacts during construction, operation and decommissioning of the Thanet Offshore Wind Farm (Thanet) project. The details of international and national conservation designations for birds that are relevant to the site and surrounding area are contained in **Section 4, Policy Framework and Guidance**.

8.2 Assessment Methodology

8.2.1 Literature review

Given the remoteness of the Thanet site, there is very little specific information on the area contained in the literature. The purpose of the literature review was, therefore, to set the surveys undertaken specifically for the project (see **Section 8.2.2**) in the context of information already known on bird distributions in the wider area. This information can be placed in one of the following categories.

- *Recent survey work prior to 2004-2005 in the Thames Estuary.* This includes both aerial and boat based surveys, similar to the ones described in **Section 8.2.2**. Many of these have been commissioned as part of studies for other Round One and Round Two offshore wind farms in the area, including Kentish Flats and London Array.
- *Seabird Distributions across the North Sea 1979-1994*. This information is derived from the European Seabirds at Sea (ESAS) database, which has been contributed to by a variety of environmental organisations from across northwest Europe. The UK Seabirds at Sea Team (SAST) carried out research of seabird distribution in the North Sea between 1979 and 1994, using both aerial and boat based survey techniques. This data is summarised in Skov *et al* (1995), which also provides estimates of seabird populations in the wider area, for example the North Atlantic.
- *UK and local breeding seabird populations*. The most up to date and comprehensive estimates of numbers and locations of breeding seabirds in the UK comes from the 'Seabird 2000' survey, which is reproduced in Mitchell *et al* (2004). Details of local breeding populations of seabirds close to the site have also been taken from the latest available Kent Bird Reports (2000-2002).

The literature review also included key studies that have been undertaken at offshore wind farms to provide information on the effect of wind farms on bird behaviour and distribution. These have included the Before After Control Impact (BACI) studies and some key examples include Horns Rev and Nysted offshore wind farms in Denmark and the Kalmar Sound in Sweden.

8.2.2 Bird surveys

Boat based and aerial surveys have been undertaken in order to collect both site specific bird data and data from the wider Thames Estuary area. The surveys were

carried out using standard European Seabird at Sea techniques, which makes them comparable in terms of methodology to other survey data contained in the ESAS database (see **Section 8.2.1**). It is likely however, that the monthly frequency of these surveys may be more successful in identifying concentrations of birds than the less frequent surveys for the ESAS database, which are generally funded by governments.

English Nature has stipulated the need for two years of survey data during *key seasons* for all Round Two projects, so that variation in numbers and distributions of species that may occur between years can be properly assessed. In the case of the Thanet project, the key season is the overwintering period i.e. November to March, when large numbers of wintering divers may be present, as well as a range of other species.

Further data, which is part of the ongoing survey programme, would be included as an Addendum report.

Boat based surveys

Twelve boat based surveys were carried out at monthly intervals between November 2004 and October 2005, taking into account the availability of suitable weather windows. The surveys were undertaken by Jon Ford and Ian Harding, two experienced Joint Nature Conservation Committee (JNCC) accredited observers who have undertaken seabird surveys from boats for several years on a number of offshore wind farm sites. Surveys will continue until April 2006, by which time the majority of overwintering species will have left the Thanet site. Wherever possible, the programme of boat routes has sought to randomise the sequence of transects sampled in relation to tidal state and time of day, while ensuring that tidal, day length and other constraints are observed.

The survey area included the wind farm site itself plus a buffer zone extending 1km to the north and south, together comprising the Survey Block, and a control area south of the Survey Block and approximately half the size, referred to as the Control Block. The purpose of the Control Block is to separate the effects of the wind farm from other potential causes of bird population change during the process of ornithological monitoring, which would continue after construction (see **Section 8.8**). The Control Block is an area of similar bathymetry, tidal excursion, sediment profile and structure, and benthic communities to the Survey Block, and from the data collected appears to be used by a similar range of seabirds. The Survey and Control Blocks were agreed with English Nature before surveying commenced.

Parallel transects, 1km apart, were steamed in an east-west or west-east direction across the Survey and Control Blocks. Points at the ends of each transect, recorded as waypoints on the boat's Global Positioning System (GPS), were used to navigate routes during the survey programme. The transects were kept as consistent as possible between visits, but some alterations did need to be made at the beginning of the survey period. The Control Block was positioned just over 4km from the Survey Block during the first survey in November 2004 and a total of 15 transects were steamed, eight in the Survey Block and six in the Control Block, with one in between. It became clear at the end of the November 2004 visit that there would not be sufficient daylight to steam this distance in a single visit, so the Control Block was moved further north to a distance of 1.5km from the Survey Block. Despite this move, there was still only time to steam 13 transects during the December 2004 survey. However, this was considered preferable to splitting the survey across two days, during which time bird populations would have

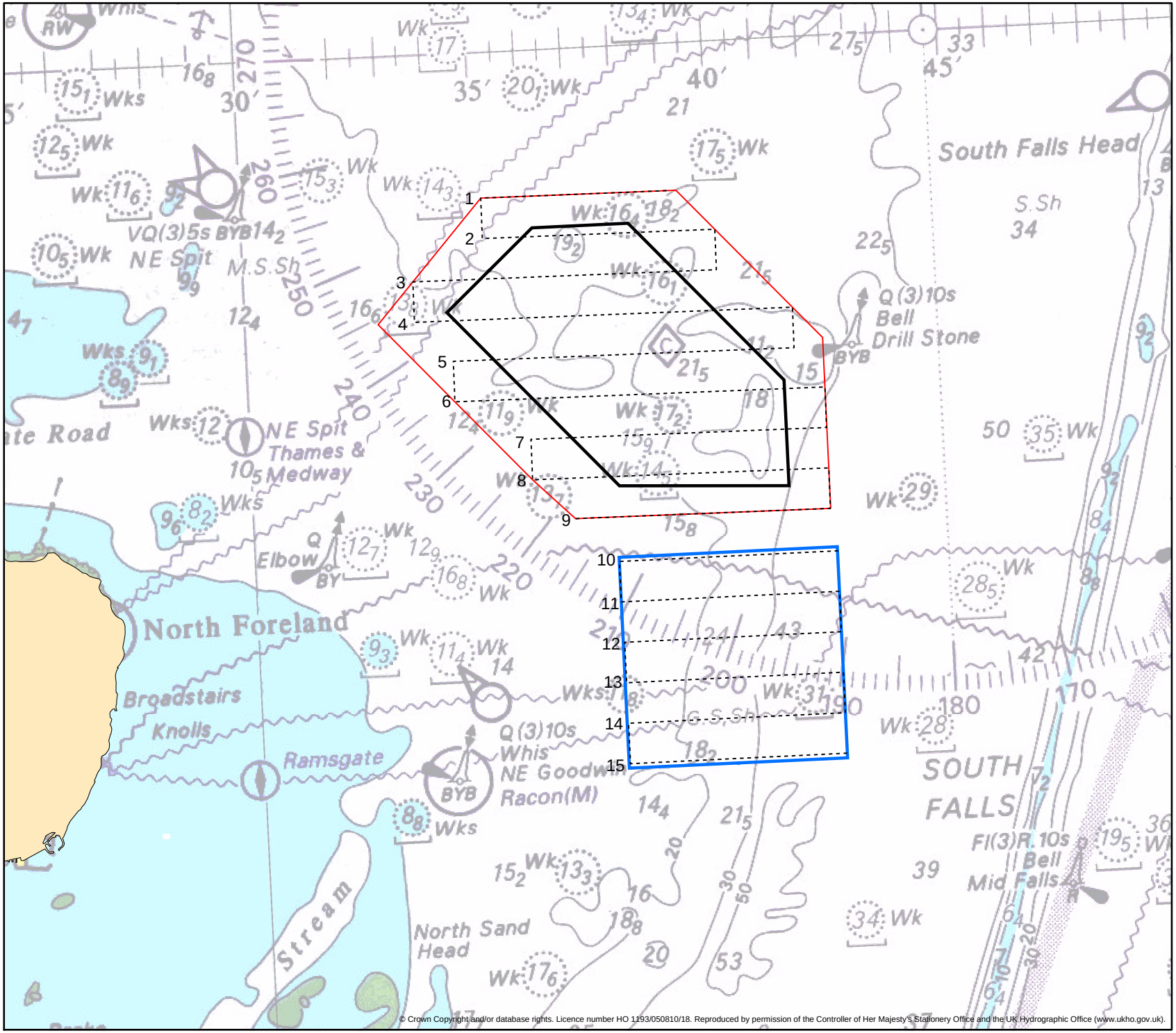
the opportunity to redistribute around the site. The Control and Survey Blocks were not subsequently changed. **Figure 8.1** shows the Survey and Control Blocks that were employed throughout the majority of the surveys.

The survey methods closely follow the European Seabirds at Sea (ESAS) protocols described in *Counting birds from ships* in Komdeur *et al* (1992), and also set out in standard bird survey methodology handbooks (Gilbert *et al,* 1998). An important refinement of the ESAS methodology in the current study is that transects are spaced at 1km apart, much closer together than the 10-30km spacing for surveying large expanses of sea suggested in Komdeur *et al* (1992).

Gulls, which follow or otherwise associate with the survey vessel, were not recorded on the field forms or included in the statistical analyses. There is good evidence that such 'followers' associate more strongly with survey vessels moving at speeds of around 7 knots (Garth and Huppop, 1999). The survey vessel used in this study travelled at an average speed of 7.5 to 8 knots, so the inclusion of followers would have been very likely to bias the results in favour of gulls, and could have distracted attention from recording key species.

Bird data was collected using the 'scan with band transect' and the snapshot technique method (Komdeur *et al,* 1992). This involves the recording of all birds seen in an 180^{o} scan with the naked eye from straight ahead round to perpendicular to the vessel on each side. Binoculars are used to assist in identification. Birds are recorded as being in one of five bands perpendicular to the vessel (A 0-50m; B 50-100m; C 100-200m; D 200-300m; E >300m). One side of the vessel is chosen as the 'transect side', where recordings are analysed to produce population density estimates. All birds on the water on the chosen 'transect side' within a distance 300m perpendicular to the vessel i.e. band D, are considered 'in transect'.

In addition, a 'snapshot' is taken every two minutes of all birds flying within band D, on the 'transect side' and within the distance ahead that the vessel travels in that two minute period. These birds are also recorded as being 'in transect' and used in the statistical analysis. In this case, the survey vessel averages eight knots and so travels approximately 493m in two minutes. The snapshot method has been developed by ESAS to prevent double counting of flying birds. Observations were made from a specially constructed platform that gives a 5m eye level height above sea level. Snapshots were carried out by one observer on one side of the ship only, whilst all other observations were simultaneously undertaken by the other observer from both sides of the ship, taking care not to double count.



Legend:

- Wind Farm Location
- Control Area
- Boat Transects
- Buffer Zone

Title:

BOAT-BASED BIRD SURVEY AREA

Project:

THANET OFFSHORE WIND FARM

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Drawn by:	Checked:	Drawing No:
SMG	SDG	9P5164/06/316
Date: 25/10/2005		Figure: 8.1
Scale: 0 0.5 1 1.5 2 Kilometres		Revision No: 002

ROYAL HASKONING

The following data were recorded for each recorded bird sighting when applicable or possible:

- Time;
- Species;
- Number;
- Age/sex/plumage;
- In flight/on sea;
- Direction of flight;
- Distance from survey vessel (Bands A, B, C, D, E);
- Height; and
- Behaviour e.g. feeding.

The raw data for the boat based surveys can be found in **Appendix 8.1** along with further details of the boat based survey methodology.

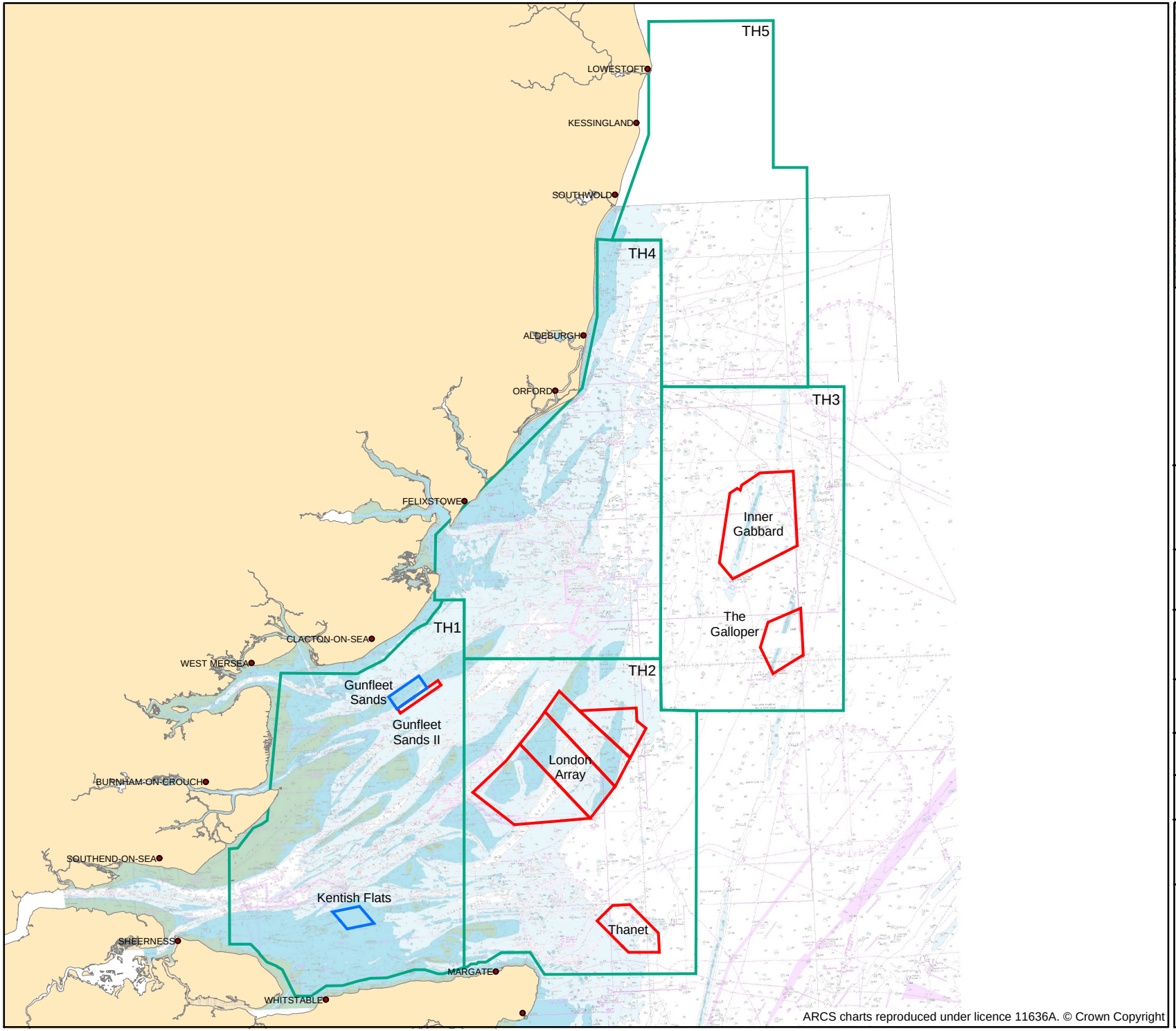
Aerial surveys

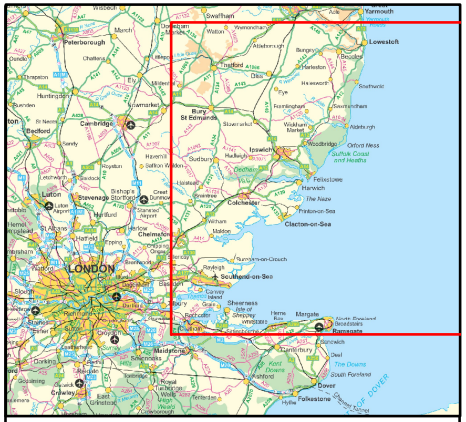
Four aerial surveys were carried out between November 2004 and March 2005 within the sector corresponding to the Thanet site. The relevant time periods are shown in **Table 8.1**.

Table 8.1 Aerial survey periods

Period	Season	Target Dates Flown
1	Early Winter	1st October 2004 to 22nd November 2004
2	Mid-Winter 1	23rd November 2004 to 31st December 2004
3	Mid-Winter 2	1st January 2005 to 9th February 2005
4	Late Winter	10th February 2005 to 11th March 2005

The programme of aerial surveys was agreed, designed and implemented across all three Round Two Strategic Environmental Assessment areas (see **Section 1, Introduction**) through close co-ordination between wind farm developers, the Department of Trade and Industry (DTI) and statutory nature conservation agencies including English Nature and JNCC. The Thames Estuary was divided into five blocks, each capable of being flown in a day (see **Figure 8.2**). The Thanet site was located in survey area TH2.





Legend:

- Round 1 Wind Farm Sites
- Round 2 Wind Farm Sites
- Proposed Individual Flying Day Blocks

Title:

AERIAL SURVEY SECTORS
IN THE THAMES ESTUARY

Project:

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SMG	SDG	9P5164/06/317
Date: 25/10/2005		Figure: 8.2
Scale: 0 2 4 6 8 10 Kilometres		Revision No: 002

ROYAL HASKONING

The surveys were carried out using a methodology recently developed in Denmark by the National Environment Research Institute (NERI) (Kahlert *et al*, 2000, summarised in COWRIE, 2004). Birds were recorded from a twin-engine Partenavia P68 aircraft flying 76m above the sea surface and a distance sampling approach was employed, similar to that used for the boat based surveys, but with estimated distances for each bird or flock, rather then the five discrete distance categories, which are more problematic from the air. The distances were subsequently grouped into four distance bands (A 44-163m; B 164-282m; C 282-426; and D 426-1,000m). Parallel transects were flown at a distance of 2km apart in a north-south orientation to reduce the effect of sun glare during the survey and aid the ability to detect and identify birds. The species, number, behaviour, distance and time at which it was perpendicular to the north-south flight path of the aircraft were recorded using a dictaphone for each bird or flock of birds.

The survey work was carried out by the consultancy Wetland Advisory Services (WAS), which is the commercial part of the Wildfowl and Wetlands Trust (WWT). Coverage of the winter periods was a requirement for all Round Two projects, but it was agreed with English Nature, the JNCC and the DTI that at other times of the year, when key species would not be present in large numbers in a particular area, that the monthly boat based surveys would be sufficient and aerial surveys would not be necessary.

This agreement applied to block TH2, the aerial survey block that covers the Thanet site, which was consequently not flown during the summer months. This decision was made because it was considered that this block was not in close proximity to any tern colonies nor was it thought likely to hold any aggregations of seaducks or auks undergoing their post-breeding moults. **Figure 8.3** shows the aerial transects flown for block TH2 only. Further aerial surveys are scheduled for all four winter periods during 2005-2006, with the survey programme scheduled to recommence in October 2005.

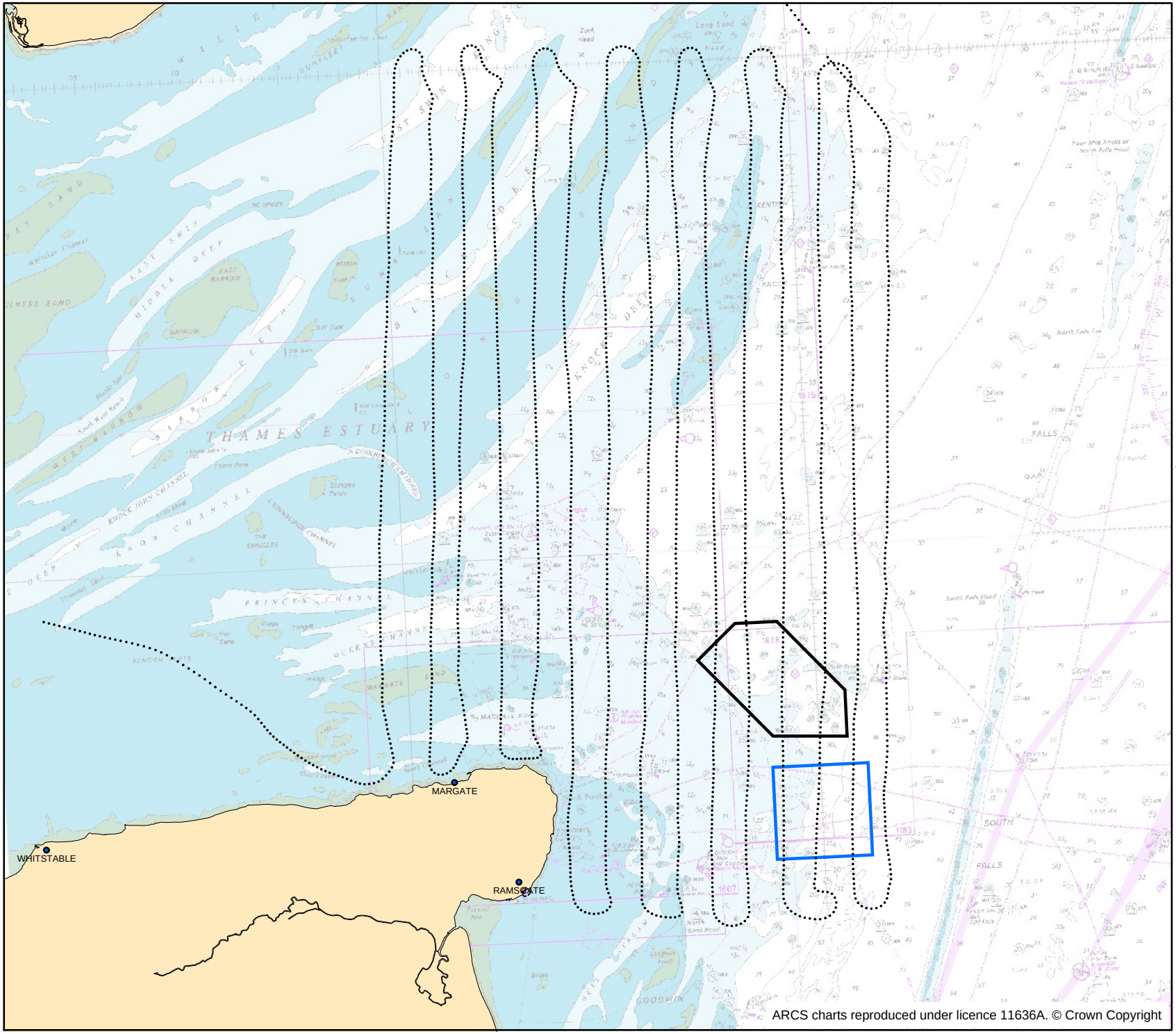
Further details of the aerial survey methodology can be found in **Appendix 8.1**.

8.2.3 Statistical analysis

The practicalities of boat based and aerial surveys are such that not all birds present will be recorded. Some birds furthest from the boat and aircraft are inevitably missed because they are less visible. Statistical analysis is undertaken, therefore, in order to provide density estimates that take into account those birds that were missed.

Their visibility during boat based surveys depends upon the distance of the bird from the observer, whether the birds are on the water or flying, the height of the observer, and the sea state and visibility conditions. Those birds seen in the distance bands furthest from the boat have been corrected for this bias using factors applicable to the distance Bands C and D in accordance with Stone *et al* (1995). Observations made of birds seen beyond 300m i.e. band E on the 'transect side', and on the other side of the boat were not used for population density estimation. Such birds however, were included as part of the Collision Risk Assessment (see **Sections 8.2.4** and **8.5.3** and **Appendix 8.2**) and the visual assessment of bird distribution (see **Section 8.3.2**).

Published boat based survey correction factors for birds seen on the sea, based upon large data sets for band D observations, range from 1.7 for terns, 1.4 for gulls and guillemots, 1.3 for divers and 1.0 for gannet and seaduck (Stone *et al,* 1995).



Legend:

- Wind Farm Location
- Control Area
- TH2 Survey Transects

Title:

TH2 AERIAL SURVEY AREA

Project:

THANET OFFSHORE WIND FARM

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SMG	SDG	9P5164/06/318
Date: 25/10/2005		Figure: 8.3
Scale: 0 1 2 3 4 Kilometres		Revision No: 002

ROYAL HASKONING

Once sufficient distance band data have been collected during the current study, dedicated correction factors may be estimated from the boat survey data, and applied retrospectively to all the boat survey data. Some preliminary calculations have been made for some of the more common species groups.

For the aerial data, birds seen further from the aircraft also tend to be under-recorded, and their visibility also depends upon the distance of the bird from the observer, whether the birds are on the water or flying, the altitude of the aircraft, and upon the sea state. To date, no correction factors for the aerial survey bird data have been supplied to wind farm developers by the Wetlands Advisory Service.

To compensate for under-recording effects, density estimates have been based only upon data from bands A, B and C, as data collected within band D reveals significant under-recording, with very little data collected from more than 426m from the path of the aircraft. Data collected in bands B and C reveals significant under-recording, but in the absence of any distance band analyses made available by the WAS or DTI for their survey aircraft, no distance band correction has been applied. Therefore, the aerial survey population densities are likely to underestimate densities of birds seen, especially for smaller birds such as auks. The summary results for the statistical analysis can be found in **Section 8.3.3**. The full statistical analysis can be found in **Appendix 8.1**.

8.2.4 Collision risk modelling

The data obtained from the boat based surveys was also used to model the collision risk of the wind farm to all species recorded using or passing through the Thanet site. Counts were included from the Survey and Control Blocks in the Collision Risk Model at the request of English Nature. The Scottish Natural Heritage (2000) model, which is widely used within the wind farm industry, has been selected for this purpose. This model uses two stages to calculate collision risk:

- *Estimating the number of birds passing through the area swept by the rotor blades*. This involves identifying the risk window i.e. the volume of the wind farm's rotor swept area perpendicular to the general flight direction of the seabird population. Two wind farm layout scenarios were used in the modelling, where the number of turbines was set at 60 and 100 respectively.
- *Calculating the probability of collision for birds passing the area swept by the rotor blades*. For the purposes of this assessment, and at the request of English Nature, the model used five probabilities of 0%, 50%, 95%, 97% and 99% likelihood of avoidance. The first two are considered worst case scenarios, whilst the last three are in line with collision rates taken from direct observations and published in wind farm literature.

The output of this two stage process is an estimated number of collisions that might occur per annum for each species, which is then compared to background mortality rates.

This approach, using the Scottish Natural Heritage (2000) model, has been agreed with English Nature. Full details of the methodology can be found in **Appendix 8.2**.

8.2.5 The use of radar

Although radar has been used with some limited success to record movements of birds across wind farms, it was not practical to use this as a survey tool at the Thanet site because the distance of the site from the nearest stretch of coastline at Foreness Point (11-12km) is beyond the current range of land based radar. This was agreed with English Nature during the scoping phase.

8.3 Existing Environment

8.3.1 Introduction and overview

The following section describes each of the principal species that occurred in the study area during 2004-2005, their conservation status, seasonal distribution, ecological requirements and the results of the surveys discussed in **Section 8.2**. The results of the 2005-2006 aerial and boat based surveys are not yet available and will be submitted as supplementary information on completion of the surveys at the end of April 2006, thus fulfilling English Nature's requirement for two years of data for key seasons. It is expected that this additional data will validate the findings of the first period of data collected.

8.3.2 Seabird species accounts

Red-throated diver

The red-throated diver *Gavia stellata* is listed under Annex I of the Birds Directive and Schedule 1 under the Wildlife and Countryside Act, 1981. They breed on pools and lakes in high northern latitudes including Scotland and Scandinavia moving south to warmer waters during the winter, where they are associated with shallow inshore sandy bays, usually no more than 30m deep. They occur singly and in loose aggregations and major prey items include crustaceans, sand eels, sprat, herring, flatfish and codling, which are caught by diving. The availability of many of the prey items is often determined by external factors such as weather conditions and levels of pollution. Consequently, the distribution and abundance of this species fluctuates with prey availability.

The majority of wintering individuals are located along the east coast of Britain. Passage on the east coast occurs both in late summer, with the arrival of the Shetland population, and in early autumn, with the migration of birds from Scandinavia. Return passage occurs in late February to early March, with the return to Scotland of the British breeding populations, followed by a second movement in April and May involving the Scandinavian population.

All divers have two moults during the year, one before and one after breeding. For red-throated diver, the major moult occurs in October and November, and during this period the birds are flightless and, therefore, vulnerable to disturbance and/or pollution. Even outside these times, they are still easily disturbed by human activity and will sometimes be flushed by survey vessels up to 1km or more away depending on the sea state (pers. comm. Ian Harding, boat based surveyor). The most recent population is estimated at 12,500 individuals within the wider aerial survey area i.e. blocks TH1 to TH5 inclusive (RPS, 2005).

A peak of 25 divers was recorded during boat based surveys during February 2005. Of these, all were identified to species level as red-throated divers, with the exception of three records of black-throated diver *Gavia arctica*. A maximum of 1,408 divers were recorded in the Thames Estuary during January 2005 and February 2005 during the aerial surveys. Three diver species were present during these surveys, namely red-throated diver, black-throated diver and great northern diver *Gavia immer*. Divers can be difficult to distinguish from the air and as a result the vast majority of records were assigned to diver *sp*. The majority of these records are likely to be red-throated divers, since black-throated and great northern divers in the main are distributed more towards the southern and western coasts of the UK (Snow and Perrins, 1998). For the purposes of this assessment, all diver species are considered together, as their ecological requirements during the winter are similar along with their likely behavioural responses to wind farm developments.

Figure 8.4 shows the distribution of divers across the Thames Estuary during winter 2004-2005. Numbers do not start to build up until late November and early December, indicating that they are not undergoing their main moult here. Numbers then remain fairly consistent throughout the winter occurring in most parts of the Thames Estuary, but hotspots of activity tend to be more towards the inner Thames Estuary or on sandbanks, where waters are shallower. As birds congregate prior to their northerly spring migration in late February and early March, numbers increase in and around the Thanet site. Birds start to move out from key feeding areas in the inner Thames Estuary and concentrate themselves in the outer Thames Estuary prior to migrating north to their breeding grounds. This is when the largest numbers were recorded in the 2004-2005 winter period around the Thanet site.

Fulmar

The northern fulmar *Fulmarus glacialis* is the most abundant seabird in the wider region, with the Atlantic breeding population estimated to be over ten million pairs. They feed mainly on a variety of organisms taken from or near the surface such as planktonic crustaceans, cephalopods and small fish. Their population has expanded spectacularly over the last 150 years, possibly because of the provision of offal and discards from whalers and trawlers and the gradual warming of the eastern Atlantic (Lloyd *et al*, 1991, cited from Skov et al, 1995). Non-breeding birds i.e. birds under 10-12 years old, will range very widely over much of the North Atlantic. Breeding birds are present around the colonies for most of the year, eggs are laid in May and the young leave the cliffs in September.

Seabird 2000 estimated a total of 538,000 Apparently Occupied Sites (AOS) in the UK. The distribution of colonies across the country is highly skewed with 90% in Scotland and only 2% in England (Mitchell *et al,* 2004).

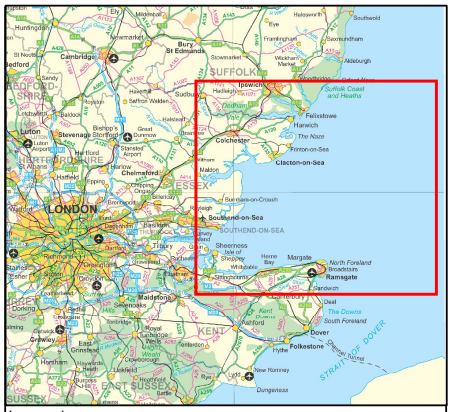
DIVERS

Early Winter

Mid Winter (1)

Mid Winter (2)

Late Winter



Legend:

- Wind Farm Location
- Control Area

Diver Grid Values

High : 214

Low : 1

Title:
DISTRIBUTION OF DIVERS ACROSS THE GREATER THAMES ESTUARY DURING AERIAL SURVEYS, WINTER 2004/5

Project:
THANET OFFSHORE WIND FARM

Source: Main Chart - Not to be used for navigation.
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Drawn by:	Checked:	Drawing No:
SMG	DC	9P5164/06/319

Date:	Figure:
25/10/2005	8.4

Scale: 0 4 8 16 Kilometres

Revision No: 003

ROYAL HASKONING

Very few birds were recorded during the boat based surveys in the winter months. Numbers increased to 35 birds during the spring and summer, as individuals returned to their breeding colonies. Fulmars breed in very small numbers around the Kent Coast, including Thanet. For example, there were approximately 50 pairs, located between Minnis Bay and Pegwell Bay in 2004 (pers. comm. Ian Harding, boat based surveyor). An exceptional count of 152 birds was recorded in August 2005. This was significantly higher than counts throughout the rest of the season and greatly exceeds the local breeding population. Fulmars can range over vast distances and need to be able to respond quickly to food sources that are sparsely distributed in time and space across the ocean. Baits balls were observed during the August 2005 survey near to the site, so this aggregation may have been a response to sudden food availability at the site for a limited time period, as they were not present in September 2005.

Gannet

The Northern Gannet *Morus bassanus* is listed under the Birds Directive, Appendix III of the Berne Convention, and the Wildlife and Countryside Act 1981. They plunge dive for shoaling fish and supplement their diet with fish discards. Two thirds of the world population of gannets breed in the northeast Atlantic with 259,000 breeding in UK waters. The majority of colonies are found in Scotland (72%) and there are no breeding colonies located in the southern and eastern North Sea (Mitchell *et al,* 2004). Their distribution is widespread outside the main breeding season of March to August and includes the study area.

Gannet were present during the boat based surveys throughout much of the year at the Thanet site. Between 10 and 22 birds were present in the winter, but few were seen feeding at the site. There was a northerly passage of adult birds on their way to their breeding colonies during the spring months. Peak numbers occurred during the summer, with birds showing more feeding activity. A maximum of 58 birds were seen in August 2005 at the same time that the fulmar numbers peaked and possibly for the same reasons. Summering birds, as might be expected this far from the main breeding sites, were mainly immature.

Auks

Two species of auk regularly occur in the study area, namely guillemot *Uria aalge* and razorbill *Alca torda*. Both species are listed under the Birds Directive, Appendix III of the Berne Convention, and the Wildlife and Countryside Act 1981. They can be difficult to separate in the field and this is reflected in the fact that a number of birds were not identified to species level, and are simply referred to as auk *sp*. For the purposes of this assessment, both species are considered together, due to this identification problem as well as their similarities in terms of conservation status, distribution and ecological requirements.

Both species spend the majority of their lives at sea typically eight to nine months of the year, returning to their breeding colonies during April and having mostly left by the end of July. Birds undergo their main moult in mid to late summer, which leaves them flightless for up to two months until they attain their winter plumage. Their distribution in winter is patchy around most British coasts, with concentrations occurring just offshore. Prospective breeding birds then gradually return to the vicinity of the colony in early winter, swiftly moulting back to their breeding plumage. Visits to the breeding colony continue through to the spring. In the periods when the birds are not in attendance at

colonies, birds disperse widely, with the first year birds dispersing the furthest. Feeding birds will, however, gather in small flocks. Feeding involves diving to depths of up to 60m and the main prey items are a variety of fish, squid, pelagic worms and crustaceans.

Nearly 1,560,000 guillemots and 216,000 razorbills were counted during Seabird 2000, with the vast majority of colonies located in Scotland (Mitchell *et al,* 2004). There are no breeding colonies of auks in southeast England.

Auks were present during the boat based surveys in relatively large numbers throughout the winter, reaching a peak of 292 in February 2005. The majority of the birds identified to species level were guillemots. Very few auks were present at the site outside winter and passage periods.

Figure 8.5 shows how auks were distributed across the Thames Estuary during winter 2004-2005. In direct contrast to divers, auks seem to noticeably prefer the outer Thames Estuary, with few occurring west of a line running north from Herne Bay to Felixstowe. They are numerous throughout the outer Thames Estuary during the first half of the winter, including off the Thanet coast, although there is no one part of the area that they seem to favour. Numbers decrease rapidly during the second half of the winter i.e. from January onwards, as the auks start to disperse east into the North Sea. There are few birds left in the Thames Estuary by February/March, as they move north towards their breeding colonies.

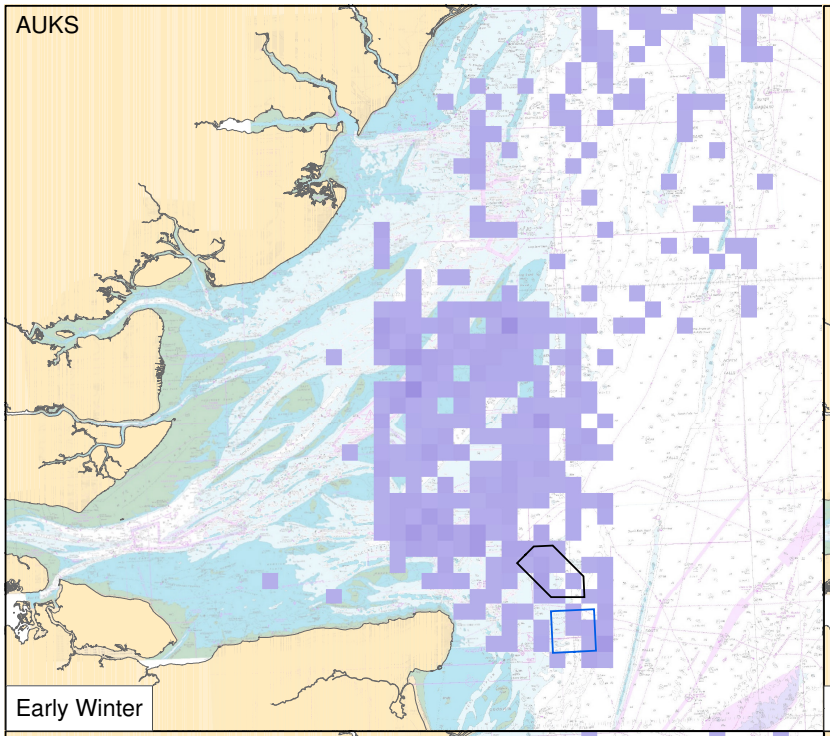
Kittiwake

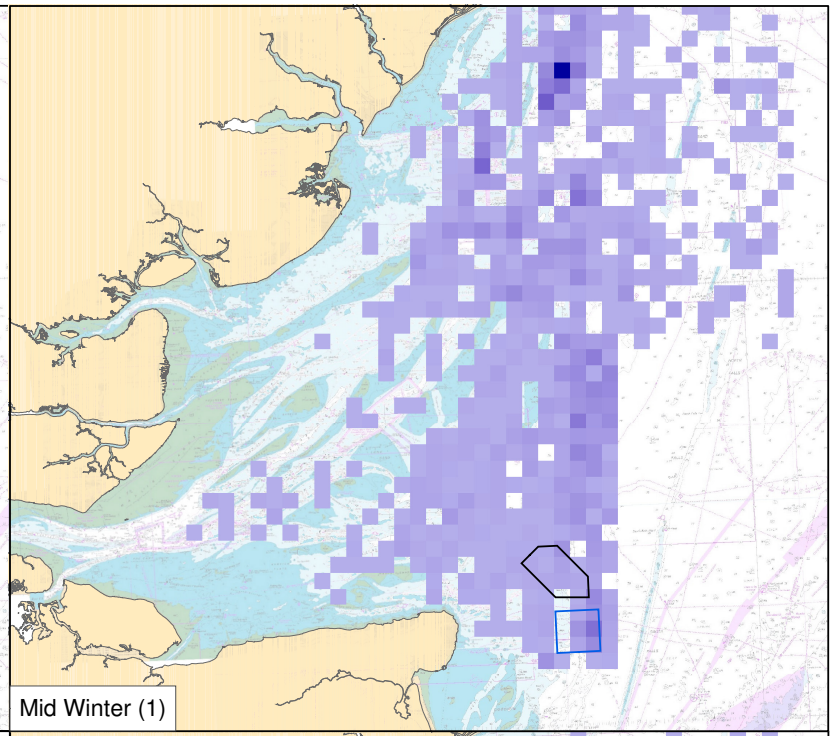
The kittiwake *Rissa tridactyla* are small, dainty, pelagic gulls that breed on cliffs and islands from the temperate to the Arctic zones in the Atlantic, Arctic and Pacific zones. They number some 4.2 million pairs in the northeast Atlantic, which represents 53-70% of the world population (Skov *et al,* 1995).

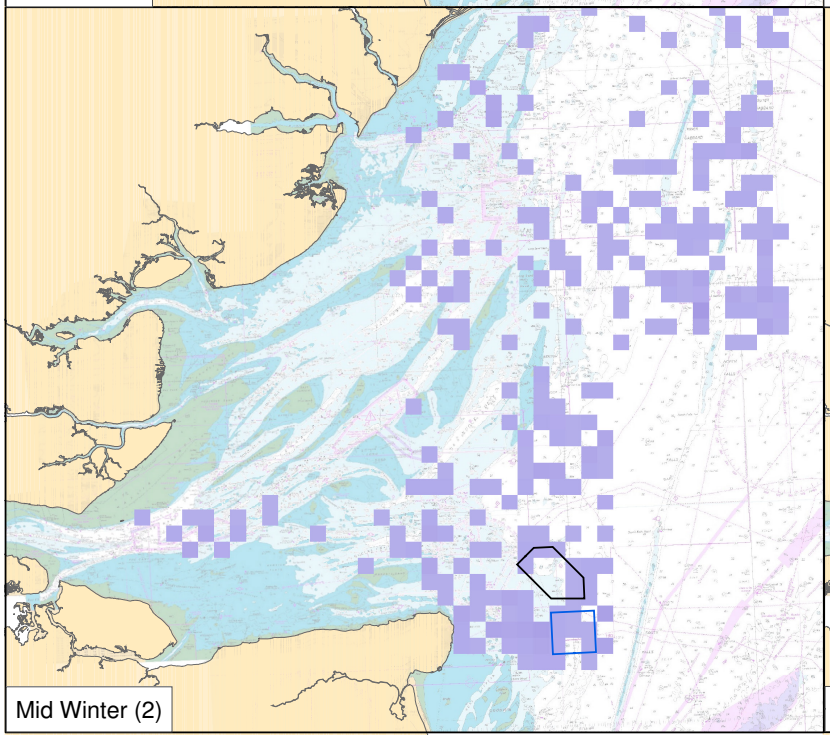
The UK population was estimated as nearly 416,000 pairs during Seabird 2000. The majority of these breed along the East Coast from Flamborough to Shetland, but they also breed in Kent, where 1,121 nests were counted between Dover and St Margaret's during the summer of 2002 (Kent Bird Report, 2002). Outside the breeding season, they disperse widely over the North Sea, with no one area holding particularly significant numbers. They are surface feeders, feeding on small shoaling fish and taking advantage of any scavenging opportunities, including taking waste from trawlers.

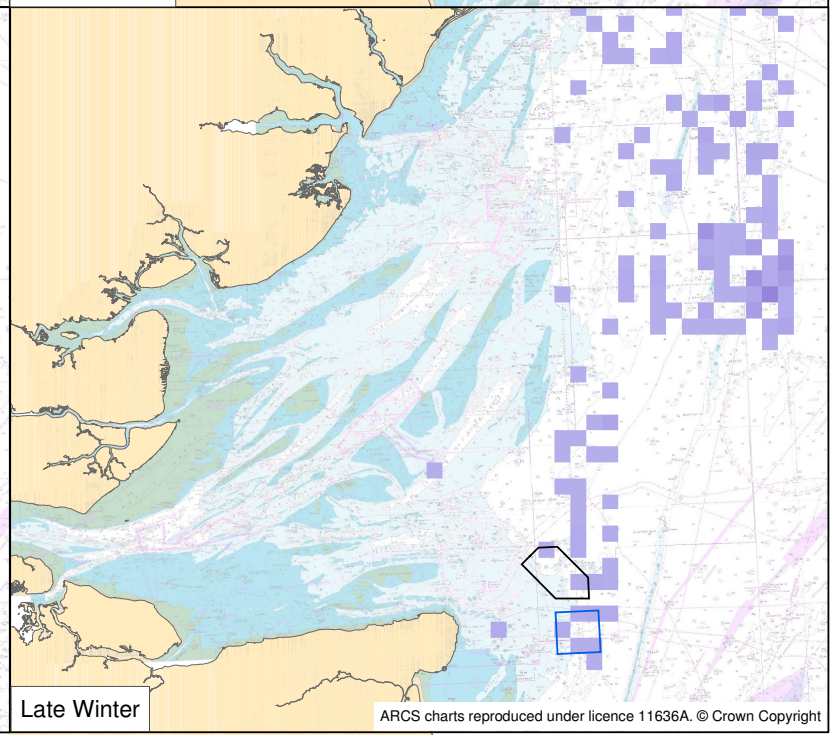
Kittiwakes were present throughout the surveys during the boat based surveys, but numbers were at their highest in December 2004 and February 2005, when 68 were recorded.

Figure 8.6 shows how kittiwakes were distributed across the Thames Estuary during winter 2004-2005.









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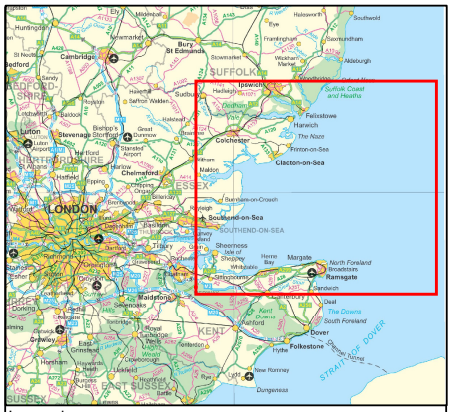

Legend:

- Wind Farm Location
- Control Area

Auk Grid Values

High : 140

Low : 1

Title:
DISTRIBUTION OF AUKS ACROSS THE GREATER THAMES ESTUARY DURING AERIAL SURVEYS, WINTER 2004/5

Project:
THANET OFFSHORE WIND FARM

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Drawn by:	Checked:	Drawing No:
SMG	DC	9P5164/06/320

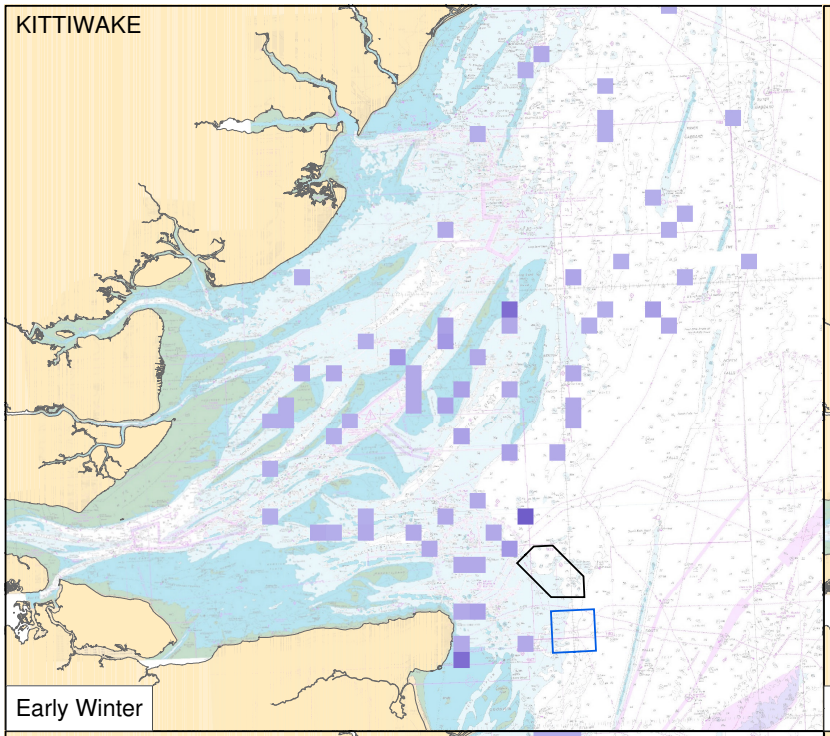
Date:	Figure:
25/10/2005	8.5

Scale: 0 4 8 16 Kilometres

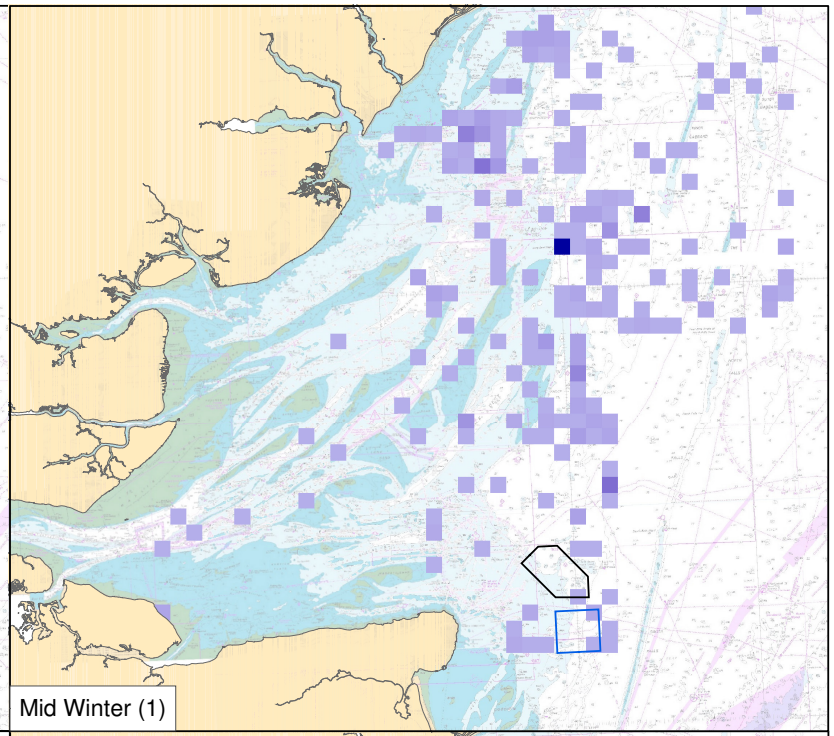
Revision No: 003

ROYAL HASKONING

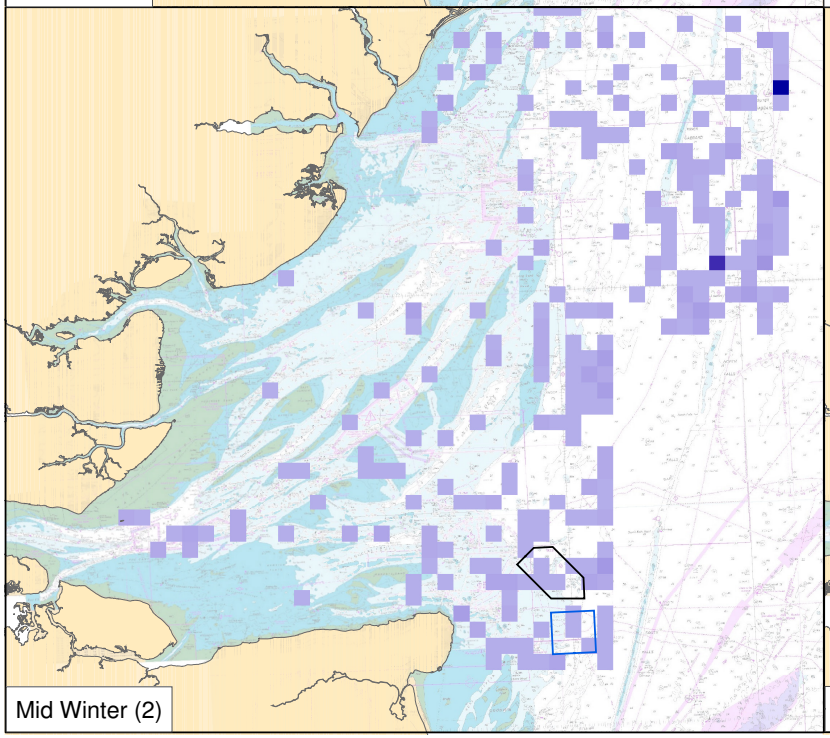
KITTIWAKE



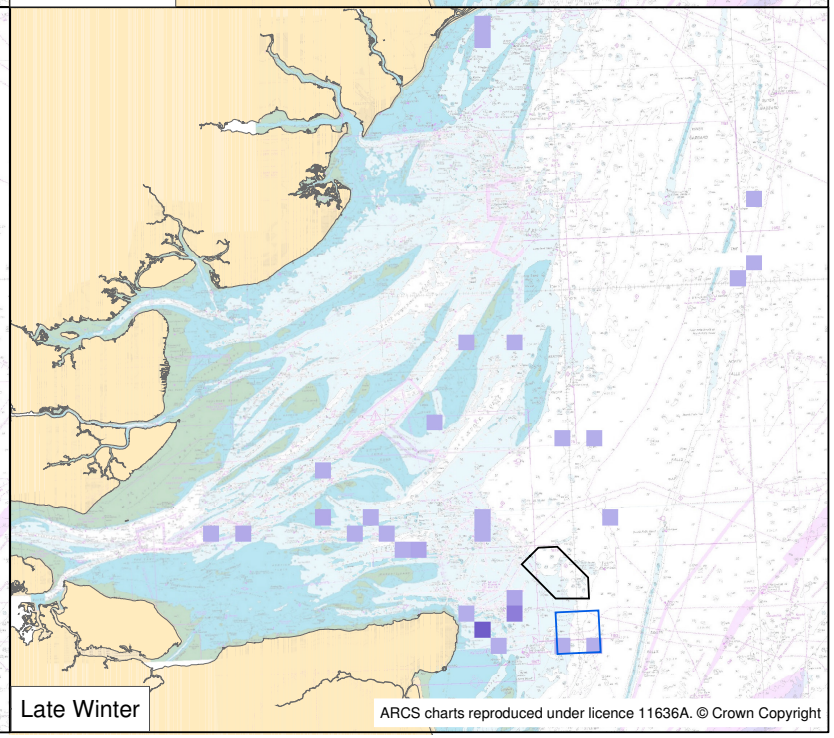
Early Winter



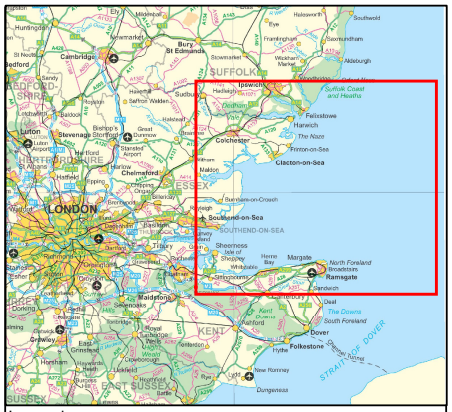
Mid Winter (1)



Mid Winter (2)



Late Winter



Legend:

Wind Farm Location

Control Area

Kittiwake Grid Values

High : 50

Low : 1

Title:

DISTRIBUTION OF KITTIWAKE ACROSS THE GREATER THAMES ESTUARY DURING AERIAL SURVEYS, WINTER 2004/5

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SMG	DC	9P5164/06/321

Date:	Figure:
25/10/2005	8.6

Scale: 0 4 8 16 Kilometres

Revision No: 003

ROYAL HASKONING

Common gull

The UK supports some 50,000 pairs of common gull *Larus canus* with 97% of these being in Scotland and only 50 pairs in England and the Isle of Man (Mitchell *et al,* 2004). As a whole, they favour inland breeding sites. The population locates more towards the marine environment during the winter, with 175,000 found in the North Sea, although they tend to occur more off continental coasts, with numbers off the British East Coast remaining relatively low (Skov *et al*, 1995).

They feed on fish and marine invertebrates in the marine environment but will also take offal and discards from fisheries. Twelve pairs bred in Kent in 2002, on the Channel sea coast at Dungeness (Kent Bird Report, 2002).

Common gulls were completely absent during the boat based surveys between April 2005 and September 2005. Only small numbers used the site during the winter, with the exception of one large count of 140 during December 2004.

Figure 8.7 shows how common gulls were distributed across the Thames Estuary during winter 2004-2005.

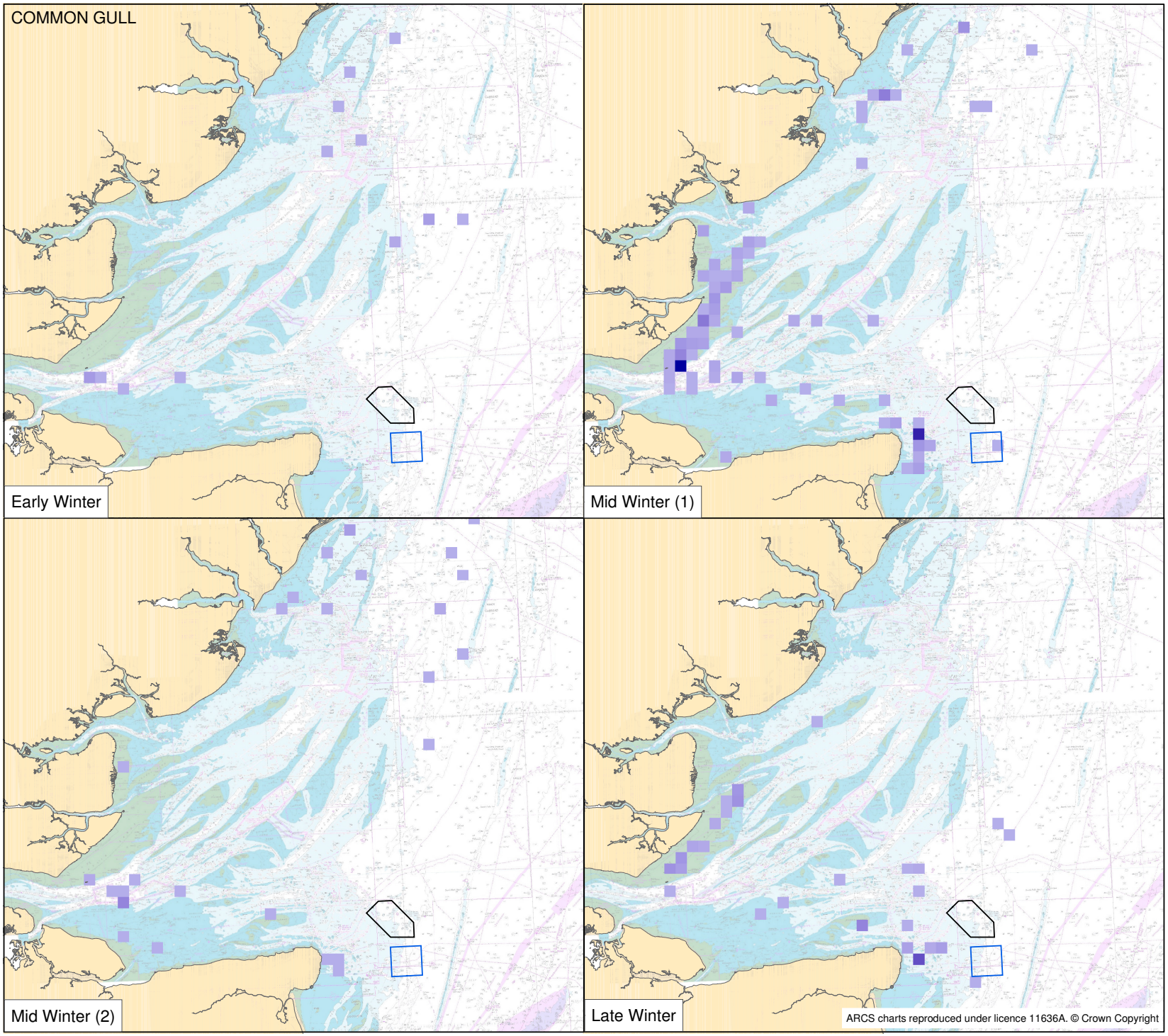
Herring gull

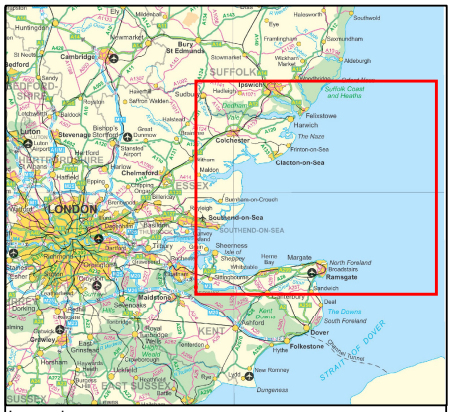
The herring gull *Larus argentatus* is the most widespread species of gull in the Northern Hemisphere and a total of 1.35 million pairs are though to breed in west and northwest Europe. Herring gulls from Western Europe are mostly sedentary, whilst birds from further north migrate into the North Sea after the breeding season. Their diet comprises mainly of fish and invertebrates whilst at sea and they are the most common species within the study area associated with seabird flocks that follow fish trawlers.

Herring gulls were present at the site during the boat based surveys throughout the year, although numbers were generally high during the winter, peaking at 354 birds in December 2004. This was also the peak month for counts of all gull species (1,035), which includes unidentified gulls, the vast majority of which are likely to have been either this species or lesser black-backed gull.

It should be noted that in the case of herring gull, lesser black-backed gull and to a smaller extent other species of gull, it is difficult to build an accurate picture during boat based surveys of how many birds would use the site under natural conditions. This is because they will activity seek out and follow the survey boat as a potential food source in the same way that they follow fish trawlers. This has been allowed for to an extent, by not counting birds that are obviously following the boat, but numbers recorded at the site may still be an overestimate.

Figure 8.8 shows how herring gulls were distributed across the Thames Estuary during winter 2004-2005.





Legend:

Wind Farm Location

Control Area

Common Gull Grid Values

High : 51

Low : 1

Title:

DISTRIBUTION OF COMMON GULL ACROSS THE GREATER THAMES ESTUARY DURING AERIAL SURVEYS, WINTER 2004/5

Project:

THANET OFFSHORE WIND FARM

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SMG	DC	9P5164/06/322

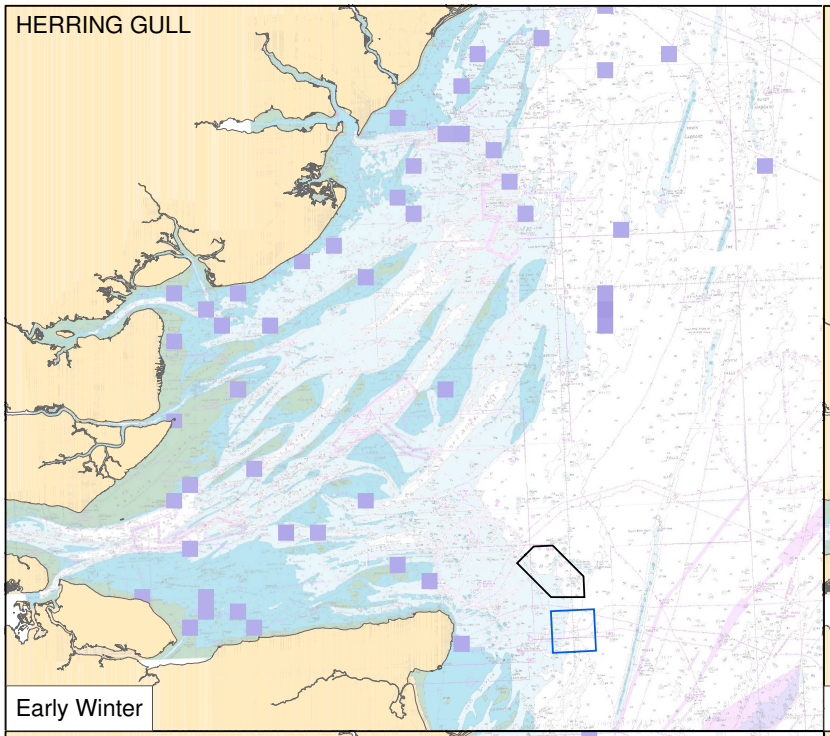
Date:	Figure:
25/10/2005	8.7

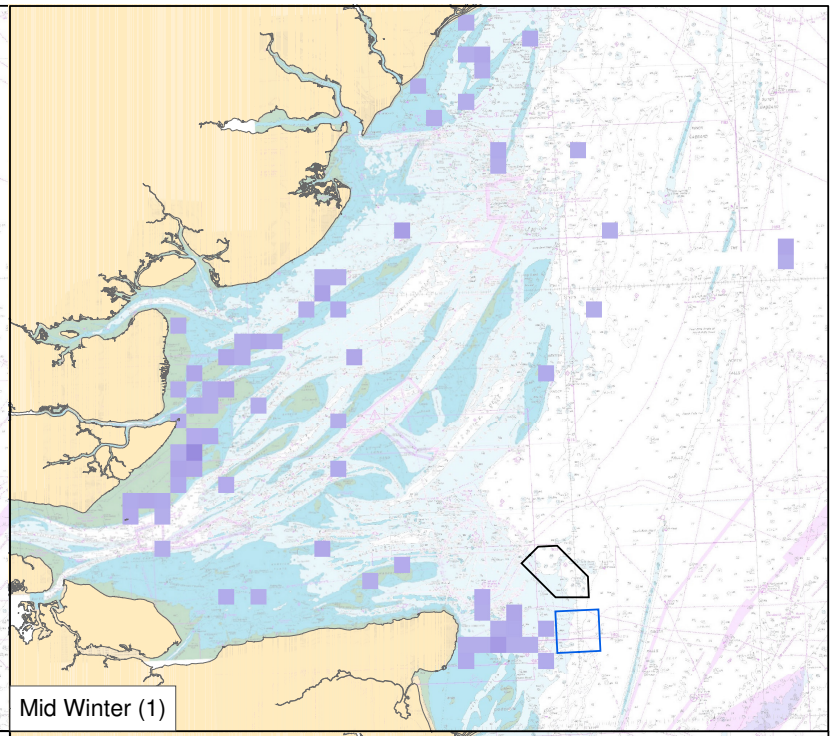
Scale: 0 4 8 16 Kilometres

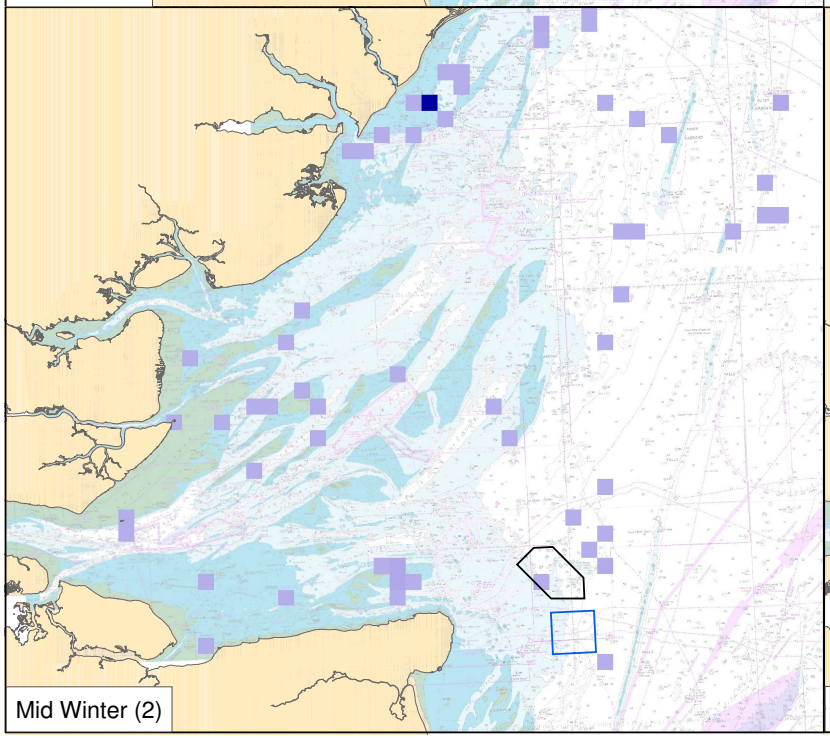
Revision No: 003

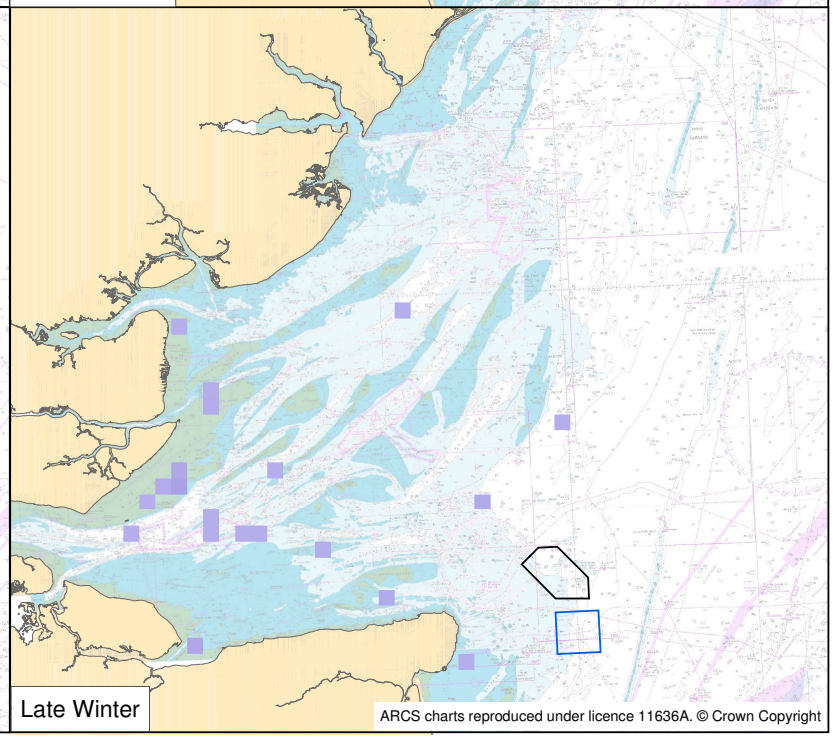
ROYAL HASKONING

HERRING GULL









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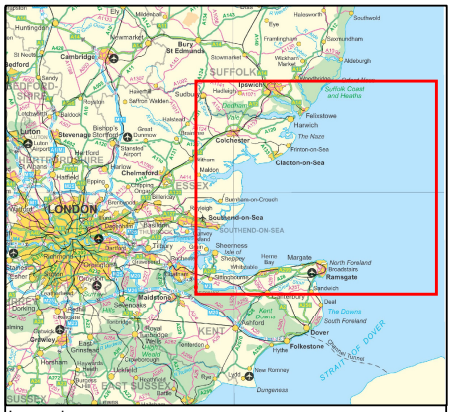

Legend:

- Wind Farm Location
- Control Area

Herring Gull Grid Values

High : 549

Low : 1

Title:
DISTRIBUTION OF HERRING GULL ACROSS THE GREATER THAMES ESTUARY DURING AERIAL SURVEYS, WINTER 2004/5

Project:
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SMG	DC	9P5164/06/323

Date:	Figure:
25/10/2005	8.8

Scale: 0 4 8 16 Kilometres

Revision No: 003

ROYAL HASKONING

Lesser black-backed gull

Lesser black-backed gulls *Larus fuscus* breed on most of Europe's Atlantic seaboard and inland from Siberia to Iceland and as far south as Portugal. The approximate breeding population in northwest Europe is 700,000, with around 117,000 pairs in Britain and Ireland (Mitchell *et al,* 2004). Numbers reach their peak of 130,000 birds in the North Sea between March and August. The majority of birds will then winter much further south in African waters, but some 15,000 will remain in the Channel and some will spend time in and around the study site (Skov *et al*, 1995). Their diet whilst at sea comprises mainly of fish, invertebrates and fishery waste.

Lesser black-backed gulls were present during the boat based surveys throughout the year with the peak month being in September 2005, when 188 birds were seen. Numbers remained reasonably constant, but were at their lowest towards the end of the winter.

Figure 8.9 shows how lesser black-backed gulls were distributed across the Thames Estuary during winter 2004-2005.

Great-black backed gull

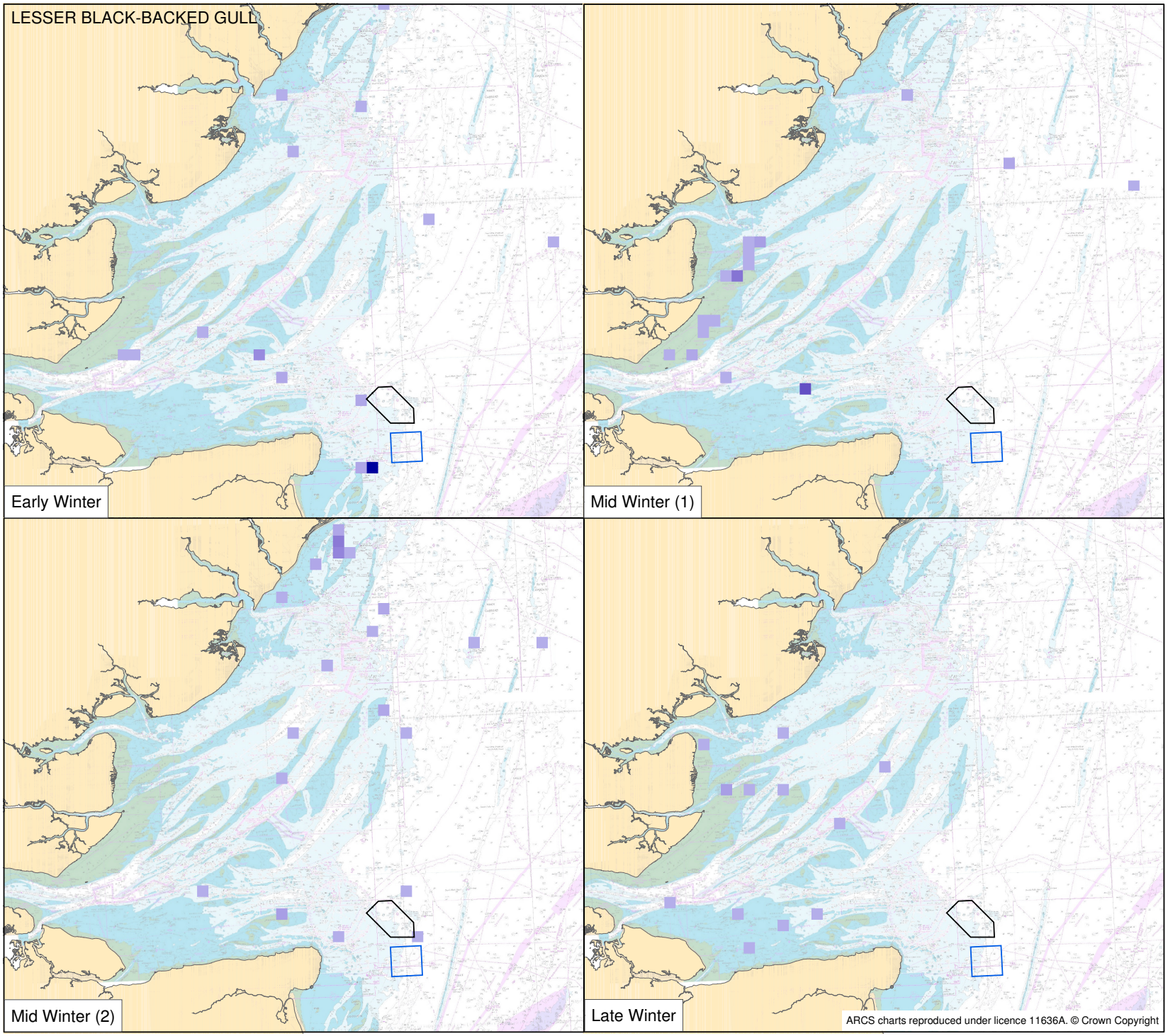
Great-blacked gull *Larus marinus* is the largest gull in the world and breeds on temperate, boreal and arctic coasts on both sides of the Atlantic. Roughly 75% of the world population breeds in Europe and the current northeast Atlantic population is around 240,000 pairs (Skov *et al*, 1995) of which around 20,000 nest in Britain and Ireland (Mitchell *et al,* 2004). Those birds that breed on North Sea, Irish Sea and Baltic Sea coasts are mainly sedentary, while breeders from higher latitudes will move south into the North Sea. As a result, numbers swell during the winter to 300,000 individuals in the North Sea, some 45% of the world population (Skov *et al*, 1995). Like other gulls at sea, they mainly feed on invertebrates and fish, including discards from trawlers.

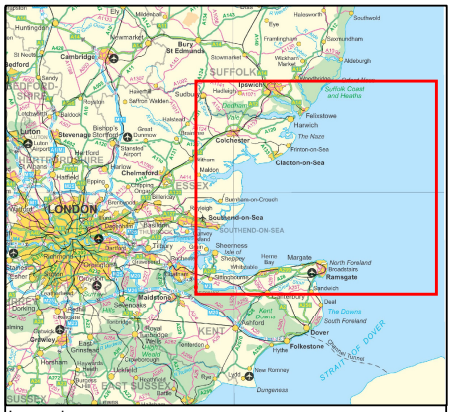
Great black-backed gulls were present in low numbers during the boat based surveys, less than 15 throughout the winter and almost completely absent during the summer months. A peak count of 22 was recorded in September 2005.

Figure 8.10 shows how great black-backed gulls were distributed across the Thames Estuary during winter 2004-2005.

Terns

Two species of tern were seen during the boat based surveys, namely common tern *Sterna hirundo,* and sandwich tern *Sterna sandvicensis*. A single little tern *Sterna albifrons,* was also seen, although not during a recorded transect in July 2005. All terns are summer migrants, present at their colonies between April to May, and July to August and wintering in Africa. Sandwich terns can arrive as early as late February and linger into November. Few common terns arrive much before April but can stay in Britain as late as November.





Legend:

Wind Farm Location

Control Area

Lesser Black Backed Gull Grid Values

High : 28

Low : 1

Title:
DISTRIBUTION OF LESSER BLACK-BACKED GULL ACROSS THE GREATER THAMES ESTUARY DURING AERIAL SURVEYS, WINTER 2004/5

Project:
THANET OFFSHORE WIND FARM

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Drawn by:	Checked:	Drawing No:
SMG	DC	9P5164/06/324

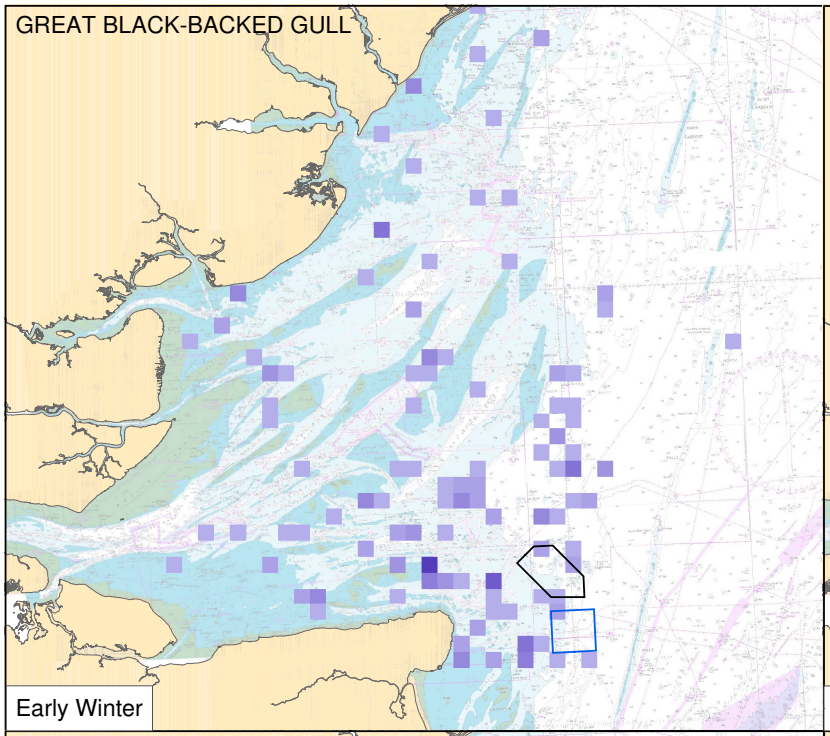
Date:	Figure:
25/10/2005	8.9

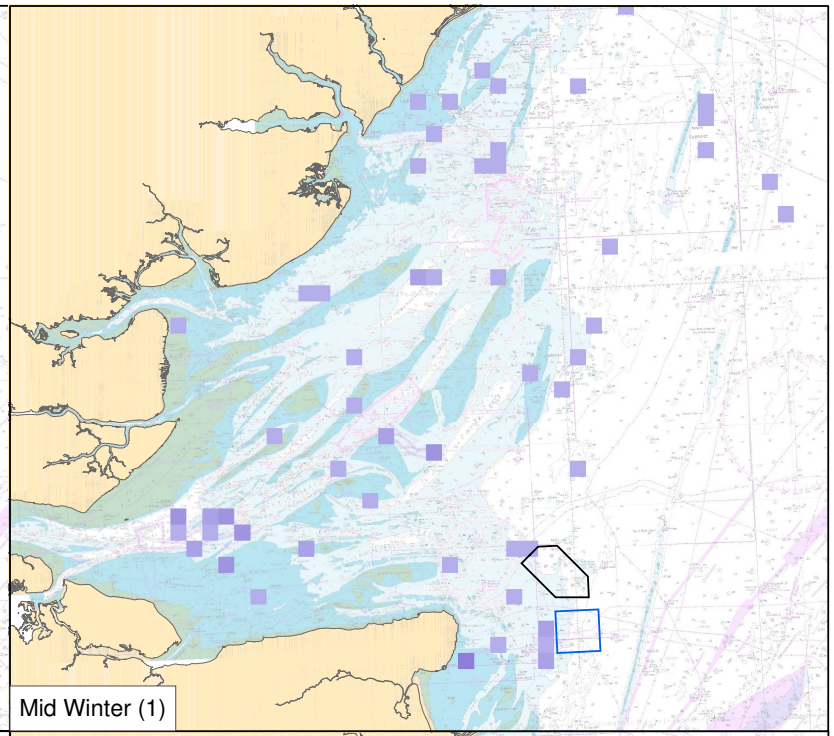
Scale: 0 4 8 16 Kilometres

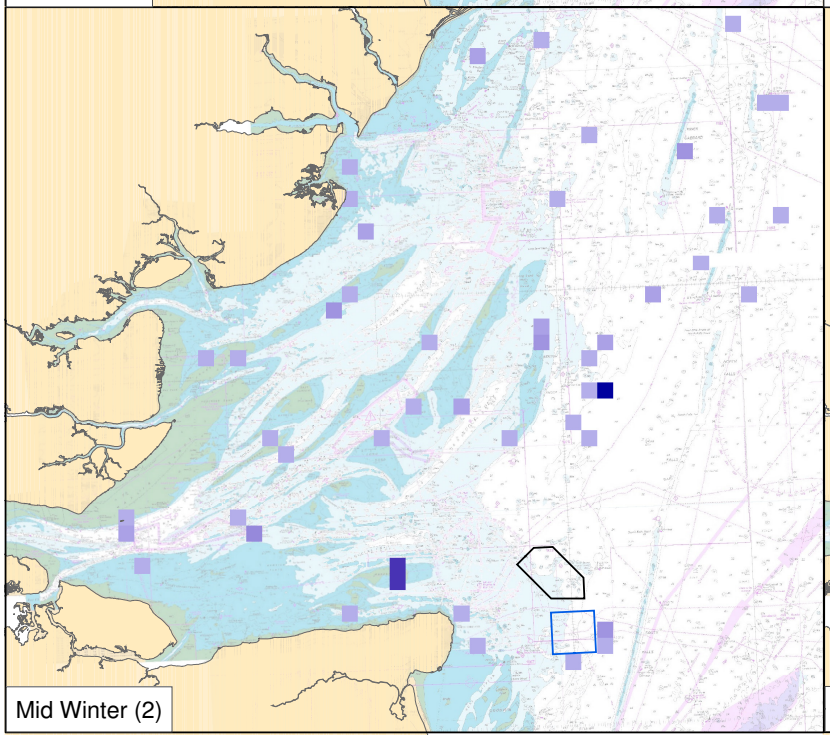
Revision No: 003

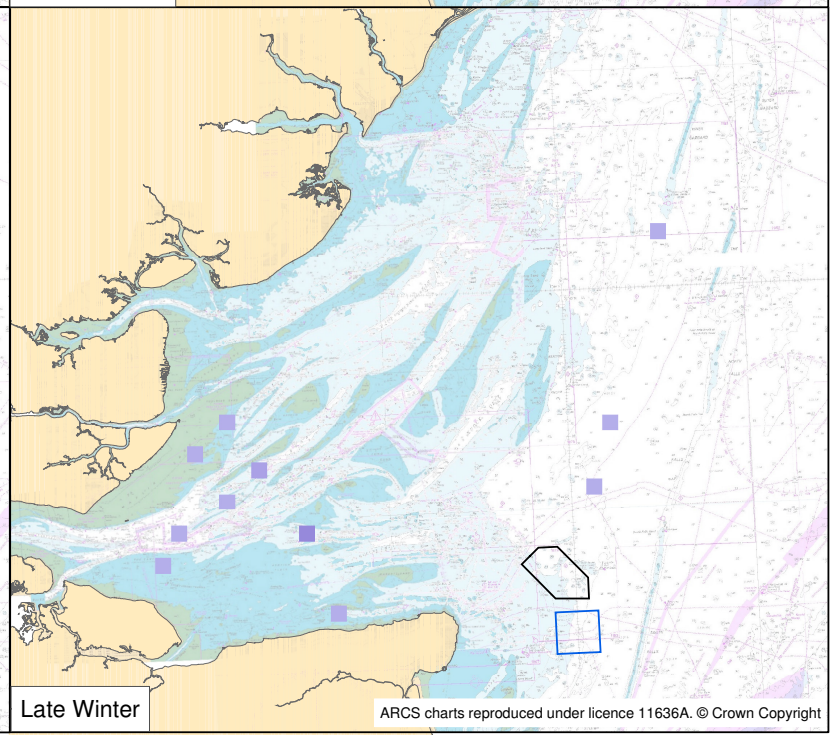
ROYAL HASKONING

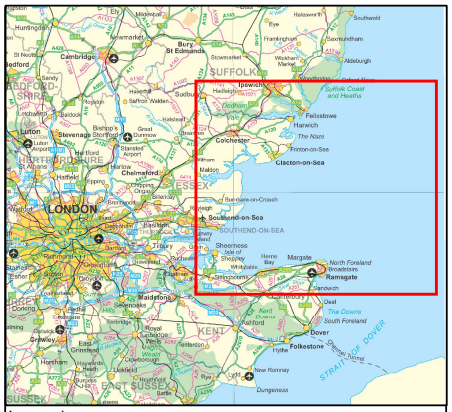
GREAT BLACK-BACKED GULL











Legend:

Wind Farm Location

Control Area

Great Black Backed Gull Grid Values

High : 17

Low : 1

Title:

DISTRIBUTION OF GREAT BLACK-BACKED GULL ACROSS THE GREATER THAMES ESTUARY DURING AERIAL SURVEYS, WINTER 2004/5

Project:

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SMG	DC	9P5164/06/325

Date:	Figure:
25/10/2005	8.10

Scale: 0 4 8 16 Kilometres

Revision No: 003

ROYAL HASKONING

Sandwich terns show a wide but patchy distribution around the coast of Britain and Ireland and Seabird 2000 estimated a breeding population of around 14,000 pairs (Mitchell *et al,* 2004). The only colony in the southeast is located in the Medway Estuary and consisted of 333 nests during 2000 (Kent Bird Report, 2000). Common terns also breed around most of the UK and Irish coasts, although they will also breed in smaller colonies inland, on lakes reservoirs and gravel pits. Coastal colonies are located within Kent at Cliffe Pools (53 Pairs), Burntwick Island in the Medway Estuary (228 pairs) and Dungeness RSPB reserve (60 Pairs).

The sporadic occurrences of terns in the study area until July 2005 suggests that terns breeding at the nearest colonies in the Medway are not using this area to fish and in deed birds were seen moving through the area at these times rather than stopping to feed. This increased in July 2005 and August 2005 when there was some feeding activity. Given their absence earlier in the season, and the distance from the nearest colony, it is thought that these are likely to be failed breeders, followed by adults with newly fledged young, rather than birds still feeding young and, therefore, tied to the colony.

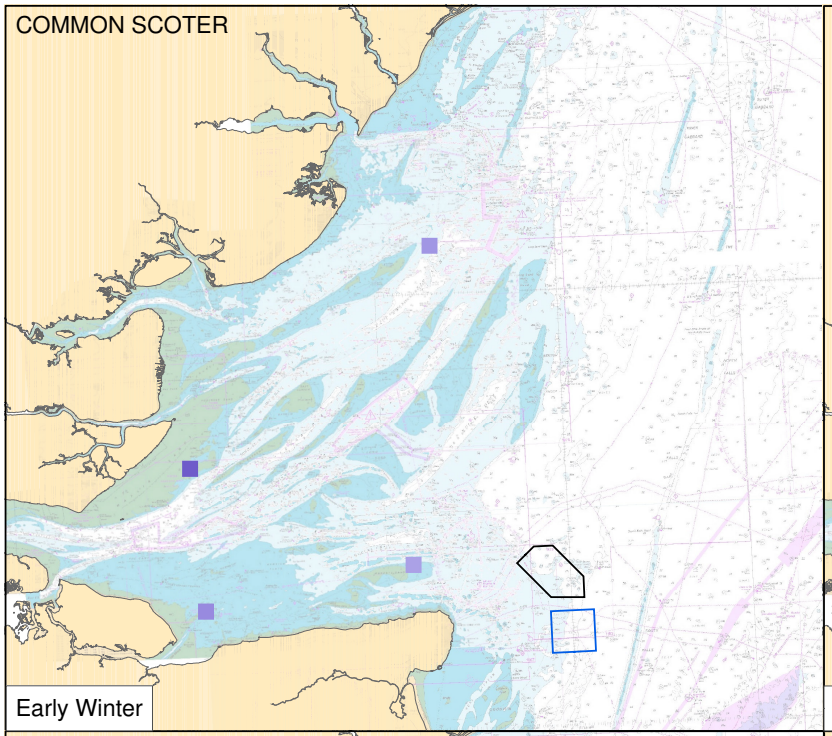
Common scoter

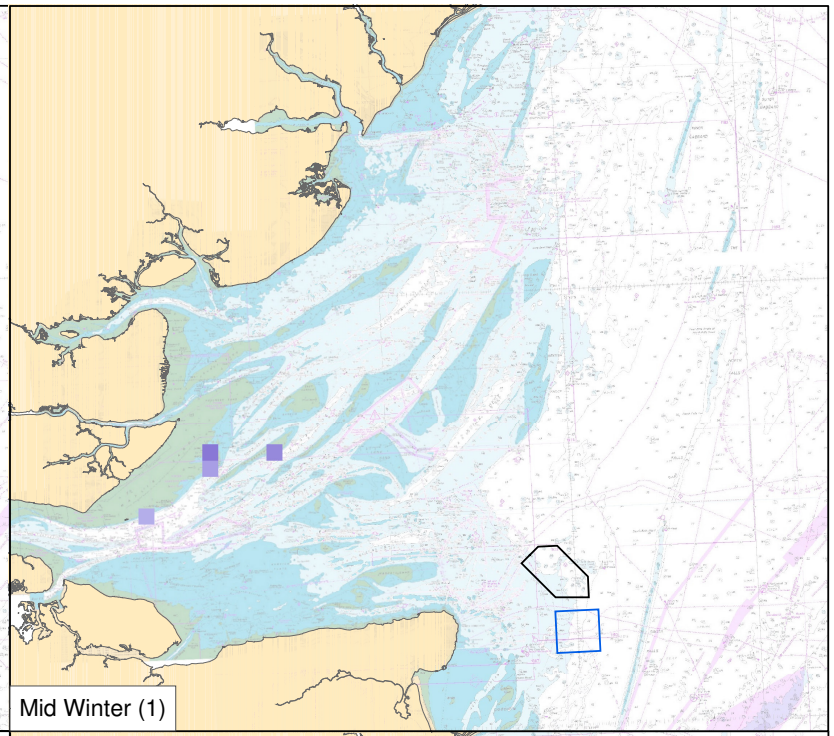
Common scoter *Melanitta nigra* is listed under Annex II/2 of the Birds Directive, Appendix III of the Berne Convention and Schedule 1 under the Wildlife and Countryside Act, 1981. The winter distribution of this species is predominantly coastal, with a generally even dispersion around all English coasts. Sandy beds and offshore shallows are favoured, with flocks of over 100 regularly occurring.

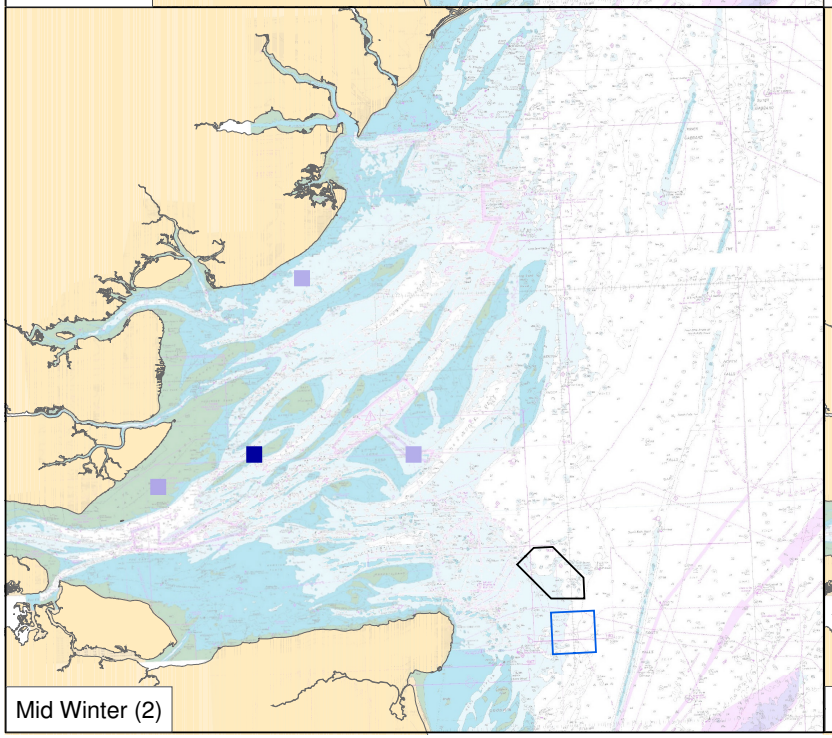
Preferred prey items are mussels, sand dwelling bivalves and sand eels. Feeding is carried out by day, with small diffuse flocks drifting with tide and current and then flying back to regain their original station. Roosting is assumed to occur close to the feeding areas. The major wintering influx occurs in October and November, with maximum numbers occurring between December and February, before dispersion. The wintering population for Britain and Ireland is estimated to be in the order of 25,000 to 30,000.

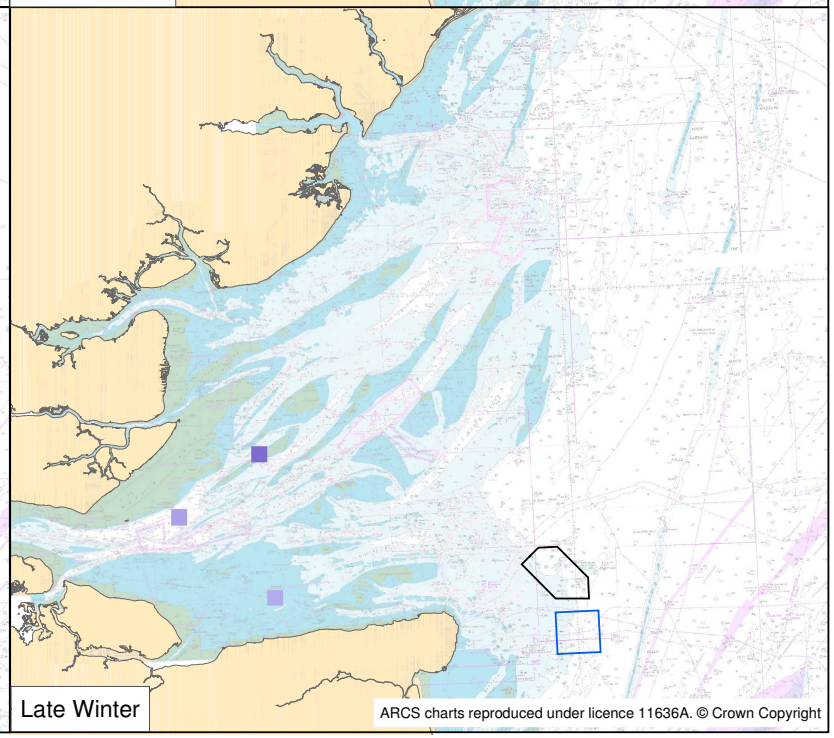
Only three flocks of common scoter were observed at the site during the boat based surveys comprising three birds in December 2004, seven in March 2005 and 15 in July 2005. The main flock of common scoter was seen in July 2005 and is, therefore, likely to be a post-breeding/moulting flock. By contrast, no common scoter were recorded during aerial surveys during the same period. Aerial surveys recorded this species almost exclusively during the winter months.

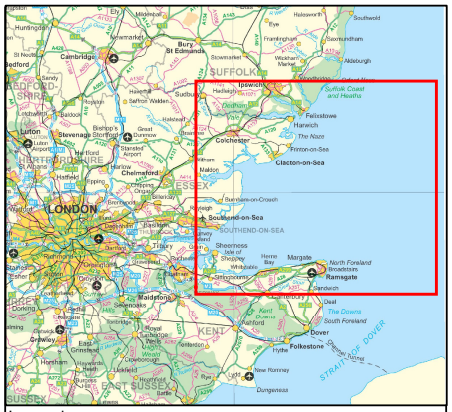
Figure 8.11 shows how common scoter were distributed across the Thames Estuary during winter 2004-2005.











Legend:

- Wind Farm Location
- Control Area

Common Scoter Grid Values

High : 650

Low : 1

Title:

DISTRIBUTION OF COMMON SCOTER ACROSS THE GREATER THAMES ESTUARY DURING AERIAL SURVEYS, WINTER 2004/5

Project:

THANET OFFSHORE WIND FARM

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SMG	DC	9P5164/06/326

Date:	Figure:
25/10/2005	8.11

Scale: 0 4 8 16 Kilometres

Revision No: 003

ROYAL HASKONING

Table 8.2 summarises the peak raw counts for the main seabird species and species groups found within the Survey and Control Blocks during the boat based surveys.

Table 8.2 Peak counts for seabirds using the Survey and Control Blocks during the boat based surveys

Species	Peak Raw Count			Survey Visit
	Survey Block	Control Block	Total	
Red-throated Diver	25	0	**25**	17th February 2005
Fulmar	64	88	**152**	2nd August 2005
Gannet	27	31	**68**	2nd August 2005
Common Scoter	15	0	**15**	9th July 2005
All Terns	23	46	**69**	2nd August 2005
All Gulls	735	304	**1,039**	12th December 2004
All Auks	239	53	**292**	17th February 2005

Turnstone

Turnstone *Arenaria interpres* is the only species qualifying the Thanet Coast and Sandwich Bay SPA. Turnstone occurs within the SPA in nationally important numbers i.e. greater than 1% of the British population. The Thanet Coast and Sandwich Bay qualifies as an SPA under Article 4.2 of the EC Birds Directive (79/409/EEC) by supporting overwintering populations of European importance of turnstone, 940 individuals representing at least 1.3% of the wintering Western Palearctic – wintering population (five year peak mean 1991-1992 to 1995-1996). No turnstone were seen during any of the boat based surveys.

Other species

In addition to the species discussed above, the following were also seen sporadically within the Survey and Control Blocks:

- Seven cormorant *Phalacrocorax carbo;*
- Seven white-fronted geese *Anser albifrons* and three Brent geese *Branta bernicla*;
- Six lapwing *Vanellus vanellus* and one curlew *Numenius arquata*;
- Six Arctic skua *Stercrorarius parasiticus*, one great skua *Catharactus skua* and one pomarine skua *Stercrorarius pomarinus*;
- Ten swallows *Hirundo rustica*, 26 swift *Apus apus* and four house martin *Delichon urbica;* and
- One redwing *Turdus iliacus*.

All these species were seen moving through the site rather than lingering or feeding. It should be noted that this is only a small percentage of the numbers of birds that may have crossed the site outside of surveys times.

Figures 8.12 and **8.13** show how wildfowl and waders respectively were distributed across the Thames Estuary during winter 2004-2005.

Although there was no flight directions associated with these movements, they indicate that both waders and wildfowl concentrated themselves around coastal locations. There were very few records in the middle of the Thames Estuary and none over the Thanet site.

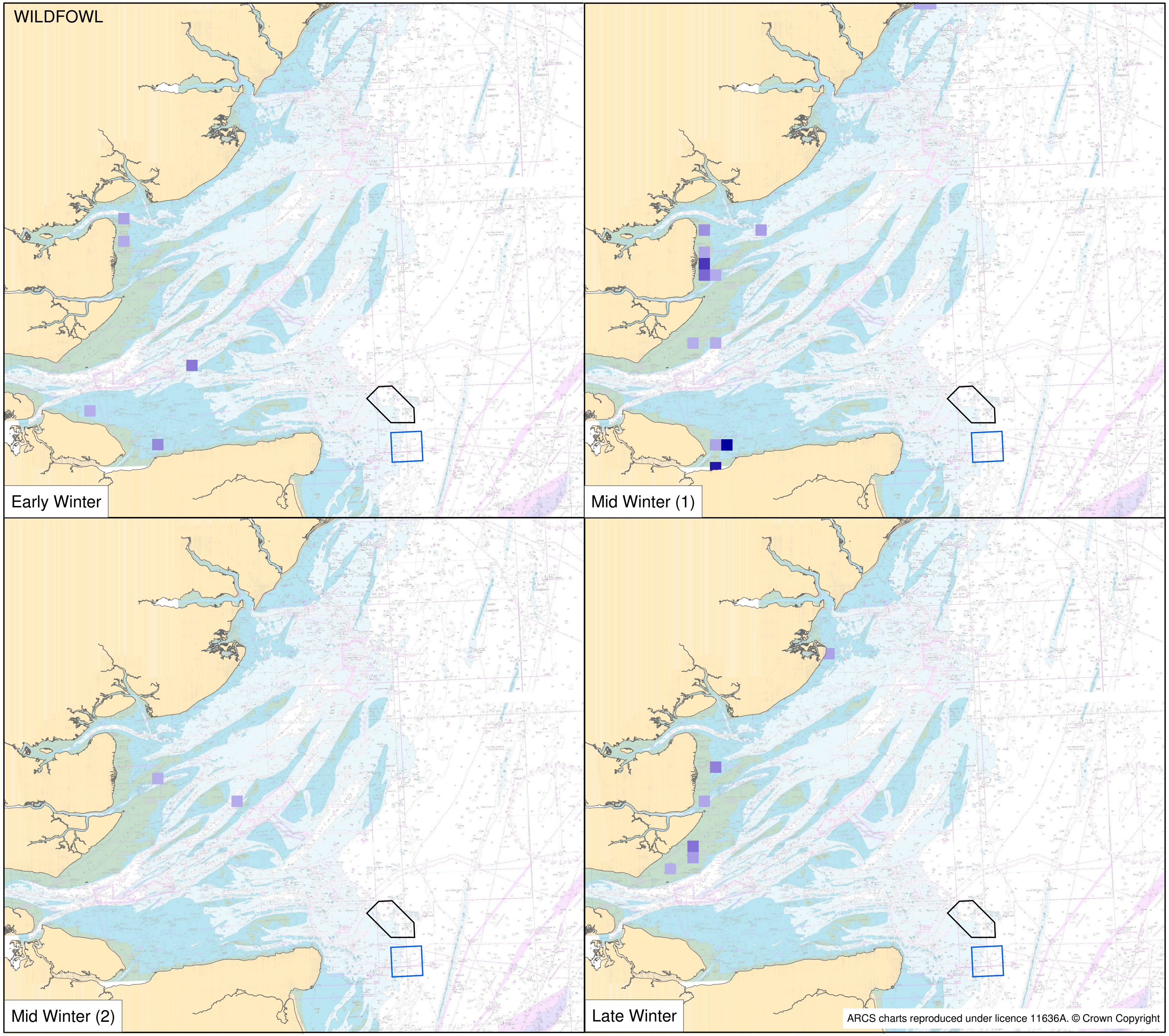
8.3.3 Statistical analysis

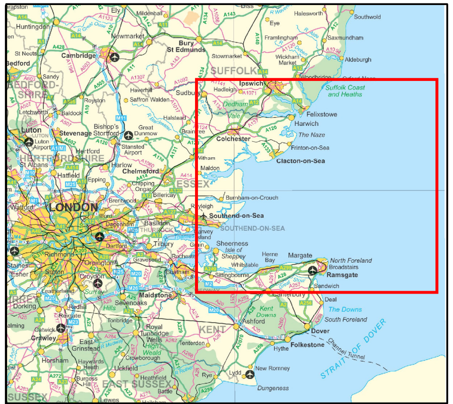
Table 8.3 summarises the peak densities of the key species observed during the boat based surveys at the site.

Table 8.3 Estimated peak densities of key species during the boat based surveys

Species	Wind Farm		Buffer		Control Block	
	Density Estimate	Standard Error	Density Estimate	Standard Error	Density Estimate	Standard Error
Red-throated Diver	0.45	0.08	0	0.41	0.20	0.27
Guillemot	1.50	0.55	2.03	1.76	3.15	0.78
Razorbill	0.39	0.07	1.12	0.55	0.59	0.21
Auk sp.	0.23	0.09	0.77	0.28	0.24	0.20
Northern Fulmar	0.69	0.25	0.28	0.15	0.68	0.32
Gannet	0.73	0.23	0.56	0.20	0.20	0.15
Common Gull	8.34	4.27	0	13.61	0.17	0.09
Lesser Black-backed Gull	1.96	0.37	2.74	1.11	2.31	1.38
Great Black-backed Gull	0.22	0.47	0.56	0.22	0.81	0.61
Herring Gull	5.00	0.85	0.92	1.83	2.72	1.22
Gull sp.	0.62	0.54	4.06	1.71	0	0.76
Kittiwake	0.59	0.16	0.75	0.25	0.43	0.16
Sandwich Tern	0.29	0.14	0	0.31	0.17	0.13
Common Tern	0.77	0.24	0.28	0.39	0.13	0.10

These figures confirm the low densities of divers recorded in and around the Thanet site with a peak of 0.45 per km^2 observed during February 2005 and March 2005. The figures also show low peak densities for sandwich and common terns. The largest densities are for gulls, with the greatest peak density being recorded for common gulls in December 2004. However, the density estimate for this species and, therefore, any subsequent population estimate is heavily skewed by a single large count of 140 birds in December 2004 and does not reflect the densities present at the site during the rest of the winter. The data suggests that common gulls were more abundant at the site then herring or lesser black backed gulls, which the survey results clearly show is not the case. Numbers are, therefore, more likely to be in line with the density estimates found in the Control Block (see **Appendix 8.1**).





Legend:

- Wind Farm Location
- Control Area

Wildfowl Grid Values

High : 226

Low : 1

Title:

DISTRIBUTION OF WILDFOWL ACROSS THE GREATER THAMES ESTUARY DURING AERIAL SURVEYS, WINTER 2004/5

Project:

THANET OFFSHORE WIND FARM

Source: Main Chart - Not to be used for navigation.
©Haskoning UK Ltd.
Inset Map -
Derived from MiniScale by Ordnance Survey.
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Licence number AL 100017728

Client:

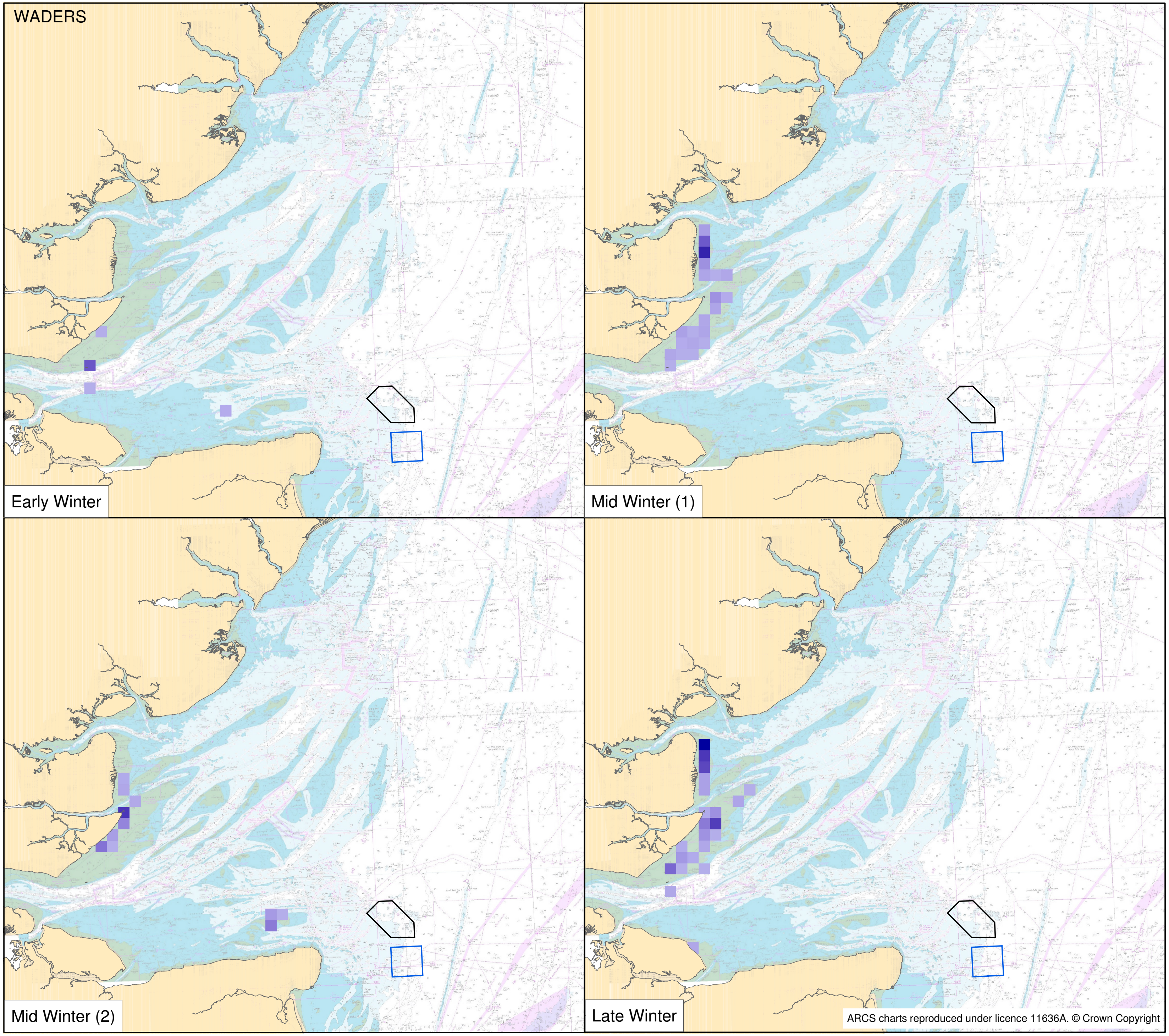
THANET OFFSHORE WIND LTD

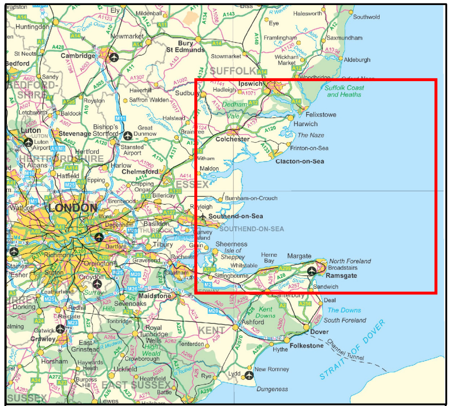
Drawn by:	Checked:	Drawing No:
SMG	DC	9P5164/06/327

Date:	Figure:
25/10/2005	8.12

Scale:	Revision No:
0 4 8 16 Kilometres	003

ROYAL HASKONING





Legend:

Wind Farm Location

Control Area

Wader Grid Values

High : 1121

Low : 1

Title:

DISTRIBUTION OF WADERS ACROSS THE GREATER THAMES ESTUARY DURING AERIAL SURVEYS, WINTER 2004/5

Project:

THANET OFFSHORE WIND FARM

Source: Main Chart - Not to be used for navigation.
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Client:

THANET OFFSHORE WIND LTD

Drawn by:	Checked:	Drawing No:
SMG	DC	9P5164/06/328

Date:	Figure:
25/10/2005	8.13

Scale:	Revision No:
0 4 8 16 Kilometres	003

ROYAL HASKONING

Standard errors have been provided for all density estimates in this section because they indicate how accurate estimates for individual species are likely to be. Large standard errors indicate greater uncertainty.

The Survey Block had significantly more red-throated divers than the Control Block. However, the sample size is small, making it difficult to draw definite conclusions from the statistical analysis. For all other species, including gulls, where sample sizes were much higher, there was no statistically significant evidence of differences between the two Blocks, even though there was a tendency for the Survey Block to have higher densities.

Based on the density estimates in **Table 8.3** and the known areas of the Control and Survey Blocks, the following population estimates for the Thanet project and surrounding area have been produced in **Table 8.4**.

Table 8.4 Peak population estimates for key species during the boat based surveys

Species	Peak Population Estimate	
	Survey Block	Control Block
Red-throated Diver	16	7
All Auks	193	114
Northern Fulmar	33	7
Gannet	37	6
Common Gull	292	5
Lesser Black-backed Gull	153	65
Great Black-backed Gull	24	23
Herring Gull	203	76
Gull sp.	147	0
Kittiwake	44	12
Sandwich Tern	10	5
Common Tern	38	4

These population estimates are indicative only and should be treated with caution, as they are based on only one year of survey data. In some cases, the population estimates given in **Table 8.4** are actually less than the peak raw counts made during the boat based surveys (see **Table 8.4**). This may in part be due to some double counting of birds, which despite the experience of the surveyors cannot be completely eliminated and may lead to an overestimate of actual numbers. However, it is also likely that the population estimates in **Table 8.2** are underestimates, as they are based on distance correction factors for individual species, which were generally collected from observation platforms 6-25m above sea level (A. Webb, *pers. comm.*). Once sufficient data have

been collected, typically three to four years is necessary, dedicated correction factors may be estimated specifically for the site and applied to all the boat based survey data (see **Appendix 8.1**).

Table 8.5 summarises the peak densities of the key species and species groups for the aerial survey block TH2 that coincides with the Thanet site. The eastern transects overlap the Survey and Control Blocks, whilst the western transects have been included for comparison (see **Figure 8.3**).

Table 8.5 Estimated peak densities of key species during the aerial surveys

Species	Eastern Transects		Western Transects	
	Density Estimate	Standard Error	Density Estimate	Standard Error
Diver	0.597	0.152	0.945	0.239
Gannets	0.166	1.334	2.469	1.311
Gulls	3.983	1.465	3.765	1.491
Auks	7.001	1.364	2.792	0.357

Although the dates for the boat based surveys and aerial surveys did not match, comparison of the density estimates for dates, which were closest i.e. December 2004 and March 2005 gave a general agreement. The boat based surveys tended to give similar densities to the aerial surveys for divers and auks. The aerial data population estimates suggest that there may have been higher densities of gannets and divers to the west of the Thanet site. Conversely there appear to be significantly higher densities of auks within the eastern transects and this would be expected given the tendency for auks to prefer the deeper waters of the outer Thames Estuary. There were no significant differences for the other species. The boat based surveys tended to give rather higher densities for gulls, suggesting that despite making allowances for gull behaviour by discounting 'followers', these surveys are likely to overestimate numbers for this species group.

As expected, the boat based surveys were better at allocating records to species rather than to broader groupings, which can be seen by the lower standard errors. The aerial surveys cover wider areas, so give more precise estimates, although only on this coarser scale. These densities estimate should be treated with some caution as they are based on only four months of data

Maps for individual species showing densities of birds within the Control and Survey Blocks have not been produced in this report for the following reasons:

- The bird interest of the site, particularly where it concerns the key species red-throated diver, is limited;
- The density estimates are based on one year's data; and
- There are no ecological features such as shallow sandbanks that would be expected to concentrate birds into any one part of the site.

8.4 Impacts during Construction

8.4.1 Disturbance to and displacement of feeding seabirds

The noise levels and presence of a variety of vessels and other machinery associated with erecting the turbines during the construction process, as well as the turbines themselves, are likely to impact on the normal use of the site by the seabird species found there. Any impacts would be short term i.e. less than 12 months in each part of the wind farm, and given the overall low densities of birds observed throughout the year and availability of similar feeding areas close by, any impacts are considered to be short term and of **minor adverse** significance.

8.4.2 Disturbance and displacement of waterfowl along the export cable route

The installation of the export cables would require ploughing across an area of shallow coastal waters that may be attractive feeding areas for a variety of seabirds. In addition to those species seen regularly in the Control and Survey Blocks, these might include species of inshore coastal waters, such as grebes, cormorant, red-breasted merganser and terns. Common and Sandwich terns in particular build up in their hundreds off Pegwell Bay during late summer, feeding in the shallow waters prior to migration (pers. comm. Ian Harding, boat based surveyor). In addition, the installation of the export cables would also involve crossing the intertidal mudflats and shingle shores of Pegwell Bay, which would cause some temporary disturbance to waders feeding or roosting in this area, including turnstone, the key interest feature of the Thanet Coast and Sandwich Bay SPA (see **Section 4, Policy Framework and Giudance**).

Providing there are no unforeseen circumstances, the export cables would take 14 to 20 days to install and of this only two to four days would be spent crossing the mudflats themselves. Landfall connection works in the area of the beach and joint transition pit are estimated to take approximately ten days (see **Section 2, Project Details**). In order to avoid disturbing important populations of migratory waterfowl, construction would not be undertaken during the winter and passage periods i.e. September to April inclusive. Any seabirds feeding along the export cable route may be disturbed temporarily during construction, but given the short duration of the works, this is also not anticipated to have a significant impact. Prey availability in areas where the cables have been installed is not expected to change post construction (see **Section 9, Marine Ecology**). Overall, **no impacts** on overwintering waterfowl are anticipated.

8.4.3 Collision risk during construction

Although there is a collision risk involved wherever a structure is being erected, the construction activity and noise associated with it, is likely to deter most birds from using the wind farm site. The probability of any birds colliding with immobile structures should be considered very low and the risk to birds that persist in the wind farm area during the construction period is considered to be of **negligible** significance.

8.5 Impacts during Operation

8.5.1 Direct loss of habitat

The footprint of the wind farm on the seabed is relatively small and would be restricted to the foundation bases of the turbines themselves. The total area of habitat lost directly to the turbine foundations or affected by scour around the foundations would be 0.564% of the total wind farm area under the worst case scenario (see **Section 9**). Given the small percentage of seabed loss and its wide and similar distribution elsewhere, it is not considered that direct habitat loss would impact on any bird species, which use the Thanet site. No habitat loss is associated with the export cable route, since it would be buried beneath the seabed.

8.5.2 Displacement of feeding seabirds

Displacement of birds using the Thanet site could occur if birds are deterred from using the area due to the presence of the turbines, as well as the routine operation and maintenance activities. There are three elements of bird behaviour that need to be considered when assessing this potential impact:

- The relative importance of the disturbed area;
- The bird's susceptibility to this disturbance; and
- How far the bird might be displaced as a result.

These factors would vary considerably between species.

The relative importance of the Thanet site to individual species can be assessed using the data collected from the aerial and boat based surveys and comparing usage of the site with usage of other areas of the Thames Estuary. Assessing each species' susceptibility to disturbance and displacement however, is more problematic. Studies at existing offshore wind farms have shown a range of responses for different species, from avoidance through to preference, but it is sometimes difficult to separate how much is attributable to the wind farm and how much is a response to natural fluctuations in prey distribution and weather patterns (Peterson, 2005).

There is little information available for offshore wind farms on how far displacement effects could stretch beyond the perimeter of the wind farm array and, therefore, the overall area that could be affected. Avoidance distances recorded for onshore wind farms show displacement effects have been observed for feeding geese as far as 600m from the wind farm (Langston and Pullan, 2002). Eiders were demonstrated to avoid turbines by up to 1,500m at night at the Tuno Knob offshore wind farm (Langston and Pullan, 2002).

The potential impacts of displacement on the principal species groups are considered below.

Divers

Divers are amongst the more susceptible species to disturbance, often being flushed from the surface of the sea up to 1km away from vessels such as those employed during the boat based surveys (pers. comm. Jon Ford, boat based surveyor). The most

comprehensive study on the disturbance effects of offshore wind farms on seabirds to date is being carried out at Horns Rev, which comprises 80 turbines located approximately 14km west-south-west of Blavands Huk in the Danish part of the North Sea. The operation began in the last quarter of 2002 and a total of 25 waterbird surveys were carried out in the Horns Rev area between August 1999 and December 2003. Six of these were undertaken with the wind farm operational. The results so far indicate that divers, gannets, common scoter, and auks all showed an increased avoidance of the wind farm area (Peterson, 2005). Of these species, divers showed some of the highest avoidance levels.

The red-throated diver is the rarest species recorded regularly at the Thanet site and it is clear from surveys undertaken by wind farm developers in other areas, that the Thames Estuary is one of the most important wintering sites for red-throated divers in the UK (RPS, 2005). It is, therefore, considered the key species of conservation importance in this assessment and thus the one for which any potential impacts could be the most significant.

Divers were consistently a minor part of the overall seabird assemblage during the winter boat based surveys. For example, on 10th December 2004, in good surveying conditions with light wind, light swell, no glare or rain, only seven divers were seen out of a total of 1,312 birds (see **Appendix 8.1**). The peak count of 25 birds during February 2004 can be compared with the proposed London Array offshore wind farm, where numbers peaked during boat based surveys at 7,489 (RPS, 2005), and the Kentish Flats offshore wind farm, where populations were estimated at 62 during the initial survey period (EMU, 2002). These figures are not directly comparable, due to differences in site extent, and surveys being undertaken during different years, but survey methodologies were broadly similar and overall they do indicate that the numbers of divers recorded at the Thanet site are very low when compared with the overall population overwintering in the Thames Estuary.

According to the current threshold set by the JNCC, which is based upon published population estimates, 1% of the UK population of red-throated divers is 50 birds or 85 for all diver species. On this basis, only 0.6% of the UK population uses the Thanet site over the winter. In practice, the real percentage is likely to be far less than this as the 50 bird threshold is based on a UK population estimate of 4,850. The results of the Thames Estuary aerial surveys alone show that this is a significant underestimate and the percentage population using the Thanet site is more likely to be in the order of 0.2%.

The comparatively low numbers of divers in and around the Thanet site is not surprising considering the ecology of this species group (see **Section 8.3.2**). The waters at the Thanet site are deeper in comparison with other parts of the Thames Estuary, and in some areas approach the limit that these birds can dive to, which is considered to be about 30m (Snow and Perrins, 1998). Studies undertaken as part of the London Array project indicate that divers showed a strong preference for water depths less than 15m (RPS, 2005). Deeper dives require more energy expenditure, which appears to make the Thanet site less attractive to this species. Overall, therefore, the ability of the Thanet site to support nationally important populations of divers will always be limited, especially when compared with areas of the inner Thames Estuary, where the water is shallower, over sandy substrate with more abundant and easily exploitable prey.

In a worst case scenario, where all divers recorded during the boat based surveys were displaced from these feeding areas for the operational life of the wind farm, the impact on the Thames Estuary population would still be insignificant, given the numbers quoted above. In practice however, complete avoidance is unlikely. Offshore wind farm studies, such as those in Denmark, have only shown decreased usage of the site by species most susceptible to disturbance, including divers, but not complete avoidance (Peterson, 2005). Those individuals that are displaced from the site could be expected to find plenty of similar habitats close to the site, which could be exploited equally successfully.

Given the lack of preferred habitat at the site, the small numbers of birds involved, and the probability that not all birds would be displaced from the site as result of the operational wind farm, a **minor adverse** impact is predicted as a result of indirect habitat loss.

Auks

In contrast to divers, auks are more adept swimmers and can dive much deeper, up to 60m, so they are better able to exploit the prey resources available at the Thanet site. They are pelagic species and tend to linger just offshore throughout the winter, rather than being attracted into the shallower inshore waters of the Thames Estuary (Mitchell *et al,* 2004). Good numbers of auks occurred throughout the Thanet site with a peak of 292 observed in February 2005. However, auks are fairly abundant in the Northern Hemisphere, especially guillemots, which comprised the majority of records at the site and are generally a far more common wintering species in Kentish waters than razorbill (Kent Bird Report, 2002). UK colonies are home to over 1.5 million pairs of guillemots and in the context of this population, the numbers present in and around the Thanet site are not significant. Furthermore, aerial surveys show that densities are comparable to those elsewhere in the outer Thames Estuary (see **Figure 8.5**), indicating that the auks are present on a broad front and that there is nothing particular about the Thanet site that is attractive to these species.

Studies at Horns Rev showed that whilst auk numbers decreased at the site post-construction these declines were not statistically significant (Peterson, 2005). This indicates that auks are less susceptible to disturbance than more sensitive species such as divers.

Given that the relatively small numbers of birds using the site and that numbers are comparable with and certainly not exceptional in the context of the rest of the outer Thames Estuary, and taking into consideration the studies at Horns Rev, a **minor adverse** impact is predicted for this species.

Gulls

All of the gull species found at the site were capable to a lesser or greater extent of exploiting anthropogenic food sources such as offal and fish discards from trawlers. In fact, their propensity to follow vessels, including bird survey boats, in the hope of picking up scraps, makes it difficult to accurately gauge populations, even allowing for this behaviour by discounting 'followers' (see **Section 8.2.2**). It is likely that during wind farm operation, gulls would also see the wind farm as a potential feeding opportunity, following maintenance boats in the same way as they do survey boats and using parts of the wind farm structures to perch and rest on. Studies suggest that gulls are attracted

to existing operational offshore wind farms. For example, herring gull at Horns Rev showed a decreased avoidance around the wind farm, whilst great black-backed gull and little gull demonstrated a shift from avoiding the area pre-construction to actually preferring it post-construction (Peterson, 2005). It is unlikely, therefore, that gulls would be deterred from the Thanet site and may in fact be attracted to it. **No impact** due to disturbance on these species is envisaged.

Terns

Studies at Horns Rev showed that like gulls, common tern and arctic tern *Sterna paradisaea* also demonstrated a shift from avoiding the area pre-construction to a preference to it post-construction (Peterson, 2005). Terns feed by shallow plunge dives and cannot alight on the surface of the water for any length of time, so the presence of structures to rest on and spot prey from, would make offshore wind farms potentially more attractive and easily exploitable areas compared with similar parts of the sea nearby.

The nearest breeding colonies to the site are at Burntwick Island in the Medway Estuary, approximately 50km northwest of Margate. Whilst they are tied to their breeding colonies, terns tend to forage offshore fairly close to them, for example, Cramp *et al* (1974) observed that in the case of common tern most feeding takes place within 3-10km of the coast. However, at Kentish Flats, some terns were found to be flying over 30km from the colonies to feed on sandbanks beyond the wind farm site (pers. comm. Paul Gill, Environmentally Sustainable Systems). Despite this, no terns were seen at the site during the May 2005 and June 2005 boat based surveys, when the breeding season was at its peak. Sandwich and common terns were present at the site from July 2005 onwards, although these were probably failed breeders followed by adults and fledged young, but numbers peaked at only 48 sandwich terns and 31 common terns, which is less than 0.2% of the UK breeding population in both cases. In practice, therefore, given that the site is only being used by small numbers of non-breeding individuals, any habitat loss or even potential gain bought about by the wind farm is unlikely to have any impact on tern populations.

Overall **no impact** on terns is anticipated from the operational wind farm.

Other Species

Other species that regularly used the Thanet site during 2004-2005 included fulmar and gannet.

With the exception of a small colony in the Channel Islands, gannets do not breed further south than Grassholm Island off the coast of Pembrokeshire. The nearest colony on the East Coast is at Bempton Cliffs in Yorkshire (Mitchell *et al,* 2004). The peak count of Gannets at the site was 58 in August 2005. Birds were more often seen moving through the site, often in a northerly direction and seldom stopping to feed with the exception of immature birds, which foraged at the site during the summer months. At Horns Rev, studies indicated that gannets showed an increased avoidance of the site once the wind farm was operational (Peterson, 2005).

Although the breeding population of fulmars is also heavily skewed towards the north of England and Scotland, this is a species that has extended its range south significantly and they now breed in very small numbers around the Kent coast. Numbers recorded at

the site fluctuated, but with the exception of an unusually high count of 150 in August 2005, numbers stayed between three and 35. These figures are not significant in the context of the UK population and continuing success and range expansion of this species, although they are important in the regional context, as this is a rare breeding species in Kent.

The aerial surveys indicate fulmars do not exploit the site to a greater degree than anywhere else in the Thames Estuary. Furthermore, fulmars, like gulls, will also scavenge off fish trawlers, which is one of the reasons they have been so successful over the last 100-150 years, so they may be attracted to the Thanet site in the same way.

There does not appear to be any evidence to date of avoidance behaviour or otherwise by fulmar at any currently operational wind farm sites. Even if they were to be deterred from using the site to forage there are likely to be plenty of other feeding opportunities elsewhere in the Thames Estuary and beyond, especially given that in temperate and sub-arctic latitudes, fulmars can range as far as 320km from their breeding colonies to find food (Palmer, 1962 as cited in Cramp *et al,* 1977).

Overall it is considered that the operational wind farm would have **no impact** on gannets or fulmars as a result of disturbance and displacement effects.

Common scoter were also seen on three occasions at the Thanet site and this a species that has been shown to avoid wind farms (Peterson, 2005). Given the very low numbers present and only on sporadic occasions, **no impact** on this species is envisaged.

Table 8.6 summarises the likely responses to disturbance and displacement of all the seabird species and species groups observed at the Thanet site and the associated potential impact level.

Table 8.6 Likely disturbance and displacement impacts on seabirds using the Thanet site

Species	Sensitivity to Disturbance	Likely Effect	Peak Population Estimate	Peak Raw Count	Impact Level
Divers	High	Strong Avoidance	**16**	**25**	Minor Adverse
Common Scoter	High	Strong Avoidance	**Sample size too small**	**15**	Negligible
Auks	Medium	Avoidance	**193**	**239**	Minor Adverse
Terns	Low	Preference	**48**	**23**	No Impact
Gulls	Low	Preference	**863**	**735**	No Impact
Gannet	Medium	Avoidance	**37**	**27**	Negligible
Fulmar	Low	Potential Preference	**33**	**64**	No Impact

8.5.3 Collision risk

The collision risk modelling undertaken for the Thanet site predicts the number of collisions per annum for each species by calculating the number of birds that could fly through the rotor swept volume over the course of a year, based on the boat based survey results and then assuming a range of avoidance rates from 0% to 99%. A 99% avoidance rate has been used for the purposes of this assessment because this is in line with the majority of published rates of collision avoidance, based on direct observations and calculated rates from existing wind farms (see **Tables 8.7** and **8.8**).

Table 8.7 Direction observations of avoidance

Direct observation of avoidance	
Avoidance rate	**References**
100% - Barnacle, Greylag, White-fronted geese (Sweden)	(Percival, 1998)
99.9% - Gulls (Belgium)	(Everaert *et al*, 2002, in Langston and Pullan, 2003)
99.8% - Common terns (Belgium)	(Everaert *et al,* 2002, in Langston and Pullan, 2003)
99.5% - Common terns avoidance rate for powerlines	(Henderson *et al*, 1996)
99% - migrating birds - diurnal and nocturnal data (Holland)	(Winkelman, 1992a)
97.5% - waterfowl and waders (Holland)	(Winkelman, 1992b, 1994)
87% - waterfowl and waders at night (Holland)	(Winkelman, 1990)

Table 8.8 Calculated avoidance rates

Calculated Avoidance Rate	
Avoidance rate	**References**
99% - avoidance reported for waterfowl, waders and cormorants i.e. recorded fatalities compared with measured utilisation rates	(Percival, 2001)
99% - waterfowl, waders and Cormorants (UK)	(Percival, 2001)
99% - Common eider, Herring gull, Great black-backed gull and Black-headed gull	(Still *et al,* 1999)

Table 8.9 summarises the results of the collision risk model for the worst case scenario, which is in this instance 60 turbines, as they have the greatest combined rotor swept volume. It also includes data from the Control and Survey Blocks together as a precautionary measure, when in reality birds seen in the former area would not be at risk from collision. Results for the 100 turbine layout and all other avoidance rates can be found in **Appendix 8.2**.

Table 8.9 Possible rates of collision for species using the Thanet site

Species	No. of collisions per annum
Red-throated Diver	1
Fulmar	0
Gannet	1
Common Tern	0
Sandwich Tern	1
Kittiwake	1
Common Gull	17
Herring Gull	49
Lesser Black-backed Gull	32
Great Black-backed Gull	1
Gull *sp.*	23
Auks	0

The results of the Collision Risk Model indicate that the wind farm would pose the biggest risk for gull species, with herring gull and lesser black-backed gull predicted to suffer the highest levels of mortality. It should be reiterated that the figures in **Table 8.9** are based on using the Control and Survey Blocks and furthermore that the boat based surveys are likely to have overestimated the number of gulls using the site. Furthermore, not every collision would result in a fatality. Even for gull species, the additional mortality as a result of collision was only 0.2% of the published background level of mortality. The mortality rates for all other species were less than 0.2% (BTO, 2005).

The Scottish Natural Heritage (2000) is necessarily theoretical and makes a number of assumptions that may not be valid for all species including:

- It assumes a constant rate of movement throughout a 24hr period;
- It assumes that species present all year round use the site in the same way across all seasons;
- It cannot differentiate between different birds and the same bird visiting the site several times; and
- It makes no allowance for birds that would avoid the area completely or partially as a result of the wind farm being constructed.

The model is best used as a tool to indicate which species are likely to be the most vulnerable to collision and given these results a **moderate adverse** impact is anticipated for herring and lesser black-backed gull and **minor adverse** impact for all other species except for auks and fulmar for which there would be **no impact**.

8.5.4 Effects on migrants

Large scale migrations occur during spring and autumn as birds move across the North Sea between their wintering areas in the UK and breeding grounds in Scandinavia. These include numerous wildfowl and waders, as well as millions of passerines such as pipits, wagtails, warblers and thrushes. A proportion of these birds are likely to come into contact with the Thanet site and could be affected either directly as a result of collision risk or indirectly due to the "barrier effect" whereby individual birds avoid the wind farm by flying around it and in the process are deflected from their most direct route leading to an increase in energy expenditure. These effects are discussed further below.

Collision risk to waterfowl

Boat based surveys at the site identified few migrants, despite being present during peak migration periods. In the case of waterfowl, the sum total of birds amounted to ten geese and seven waders of four species. This is of course only a snapshot of the total migration occurring across the general area. Other flocks of waterfowl were seen during the aerial surveys or reported from bird watchers on the coast during the same day as the boat based surveys. The observations that were made included peak periods and the observers, who have a good knowledge of migration patterns around Thanet and north Kent, had expected more activity (pers. comm. Ian Harding, boat based surveyor). This suggests that only a very small proportion of the total spring and autumn passage is occurring directly through the Thanet site.

Studies to date at offshore wind farms in Denmark and Sweden have shown that mortality due to collision risk does not appear to be significant for migrant waterfowl that are passing through the site. For example, studies at a Swedish wind farm comprising seven turbines in the southern Kalmar Sound, situated at a point where the sound is 34km across, involved recording movements of over half a million migrating waterfowl during a four year period. The majority of birds were eider, but there were also other ducks, geese and cormorants. Most flocks flew at least 1km from the turbines during this time. Furthermore, only one collision event was recorded over the whole four year study. This comprised four eiders from a flock of 300, of which three survived (Petterson, 2005).

More recently, studies of migratory birds at Nysted in Denmark found that geese and eiders, some of the species considered to be potentially most vulnerable to collision due to their comparative lack of manoeuvrability, were capable of negotiating large arrays of turbines. Birds were tracked with radar and it was observed that those entering the wind farm flew almost exclusively down the corridors between the turbine rows, with less than 1% flying close enough to the turbines to risk collision. The birds gave the turbines an even wider berth at night, with a preference for flying down the middle of the corridors. Many avoided the wind farm altogether, preferring to fly over or around them (Kahlert *et al,* 2004).

It is, therefore, considered that given the relatively small numbers of birds crossing the Thanet site, combined with evidence indicating their ability to avoid the structures, a **minor adverse** impact would be anticipated on migrating waterfowl due to collision risk.

Collision risk to passerines

The situation is more difficult to judge in the case of migrating passerines and other land birds. At a distance of 12km offshore, all migration regardless of species can be expected to occur on a broad front, as there are no topographical features to concentrate birds into a particular area (Alerstrom, 1990). Given suitable weather conditions, land birds will fly at high altitudes and often at night, which takes them well beyond the range of the turbines but also makes them difficult to systematically observe. However, in certain weather conditions they may be forced to fly lower and can even be grounded in particularly poor weather, for example when fog banks occur over the North Sea. In these conditions, which are conducive to "falls" of migrants, it is not visually possible to undertake site surveys and make observations. As discussed in **Section 8.2.5**, the use of radar as an alternative to direct observations was not considered viable because of the distance from the shore.

It has been suggested that the Thanet project could pose a collision risk to these birds at such times. In addition, bright lights do disorientate birds and there have been significant bird kills at lighthouses on headlands and offshore oil rigs, where birds are attracted by the light and are killed by colliding with the structure. Collision risk for small birds that have low adult survival and high productivity is not generally considered to be a significant issue, as populations have a far greater capacity to replace themselves than some of the long-lived, less productive species discussed in earlier sections. For significant numbers of collisions to occur, very large numbers of birds would need to pass through the wind farm. Generally, such concentrations are found in close proximity to shore since, as noted above, birds typically migrate offshore over broad fronts, but are then concentrated by features such as headlands, when attempting landfall (Alerstrom, 1990). Furthermore, structures out to sea can actually benefit exhausted and disorientated migrants during periods of poor visibility allowing them to perch and rest before moving on again when conditions have improved.

Overall, given that passerine migration is believed to generally occur on a broad front offshore, there are no topographical features that would funnel birds through the site, and that the species are adapted to withstand high levels of mortality, there is expected to be a **minor adverse** impact on migratory passerines and other land birds and even then only in conditions of bad weather and poor visibility during peak migration periods.

Barrier effect

Offshore wind farm studies have demonstrated that birds will more often chose to avoid wind farms rather than fly through them. Radar studies at Nysted offshore wind farm, found that where flocks of migrating geese and eider were involved, 40% of flocks in the survey area crossed the wind farm site before construction started and only 9% per cent ventured among the turbines once they were operating (Kahlert *et al,* 2004). This implies a physiological cost, as by detouring from what would otherwise be a more direct path, birds would have to travel further and expend more energy. Where individuals are already operating at their limits, this could theoretically tip the balance and be the difference between mortality and survival.

In practice, the size of the Thanet project is sufficiently small that the maximum distance a bird could be deflected from its natural path, allowing for a 1km buffer zone of avoidance around the wind farm, would be an additional 8-10km. In the context of the entire migration journey they are capable of undertaking, for example, across the North Sea, this detour would be unlikely to make the difference between survival and mortality, unless the condition of the individual is extremely poor, in which case survival would be unlikely even under natural conditions.

Overall a **negligible** impact on birds due to any barrier effect is anticipated.

8.6 Impacts during Decommissioning

Impacts during decommissioning are anticipated to be similar to the construction impacts associated with the Thanet project. The export cables would be left in-situ and, therefore, there would be **no impact** on the SPA.

8.7 Cumulative Impacts

8.7.1 Disturbance, displacement and collision risk

Five offshore wind farm projects including the Thanet project are either consented or currently planned within the Thames Estuary area. Two Round One projects, namely Kentish Flats and Gunfleet Sands are consented and construction of the former has recently been completed. Of the Round Two projects, a consent application was submitted for London Array in June 2005 and further applications are expected for Greater Gabbard and a small extension to Gunfleet Sands.

As discussed previously, the most sensitive species to the proposed development is considered to be the red-throated diver, because of its conservation status and susceptibility to anthropogenic disturbance. The Environmental Impact Assessments for Kentish Flats, Gunfleet Sands and London Array also take this view and the situation is likely to be the same for any other site in the Thames Estuary area. **Table 8.10** provides information on these sites relating to the peak numbers of divers found there.

Table 8.10 Peak counts of divers for the Thames Estuary wind farms

Site Name	Number of Turbines	Stage	Status	Peak Diver Count / Population Estimate
London Array	271	Round 2	Application Submitted	7,849
Kentish Flats	30	Round 1	Constructed	62
Gunfleet Sands	30	Round 1	Consented	unknown
Greater Gabbard	Up to 140	Round 2	Application Submitted	98
Thanet	60 to 100	Round 2	Application	25

Given the extremely low numbers of divers found at the Thanet site throughout the winter, especially when compared with the other wind farm sites in the Thames Estuary, the capacity of the Thanet site to contribute to any cumulative wind farm impacts for this species is considered limited.

8.7.2 Barrier effect

It has already been discussed in **Section 8.5.4** that barrier effects are unlikely to have a significant impact when restricted to a single wind farm the size of Thanet, but if an individual bird was compelled to take similar deviations around other proposed wind farms in the Thames Estuary, the cumulative impact of this in terms of additional distance flown and energy expended may become significant.

The routes that migrants take across and around the Thames Estuary vary considerably between species groups and are heavily affected by the weather. Although much is known from ringing studies about eventual destinations at either end of migration routes, the movement of birds across offshore waters is less understood. It seems unlikely however, that birds would pass through all of the wind farm sites, as this would require several detours, which would be considered unlikely in the context of migrants, which prefer to take a direct route wherever possible. Nevertheless, it is possible that more than one wind farm could lie on a single migratory pathway. In this case, similar arguments can be applied for a single site, that is, the distance of the detour would still be small in comparison with the entire journey taken and unlikely to make the difference between survival and mortality. In addition, studies at Nysted wind farm show that migrants will on occasions chose not to detour and fly down the rows of the turbine array thus negating any barrier effects for these individuals (see **Section 8.5.4**).

8.8 Monitoring Proposals

It is anticipated that a full programme of post-construction monitoring would be implemented. This is likely to involve continued boat based surveys using the same methodology at key times of the year i.e. November to March, for at least one season. Full details will be agreed with English Nature prior to implementation. Aerial surveys of the Thames Estuary area may also be continued into 2006-2007 across all sectors, although this is dependent on needs and consensus of wind farm developers and statutory authorities.

8.9 Summary

In order to understand the ornithological interest at the Thanet site, monthly boat based surveys have been undertaken between November 2004 and October 2005. Aerial surveys of the whole Thames Estuary area, including the Thanet site, were undertaken between October 2004 and June 2005. Boat based and aerial surveys will continue until two years of data are collected during the key ornithological season for the Thames Estuary i.e. November to March. The additional data will be presented as an Addendum to the Environmental Statement.

Seabirds observed in the site at varying densities included *inter alia*, red-throated diver, fulmar, gannet, guillemot and razorbill, kittiwake, several gull species, common and sandwich tern and common scoter.

The surveys show that there are very few red-throated divers using the Survey or Control Blocks. Numbers were markedly low in comparison to populations discovered at other proposed and constructed wind farms in the Thames Estuary. Divers show a marked preference for the shallow waters often associated with sandbanks towards the

inner Thames Estuary, which explains their reduced presence in the deeper waters around the Thanet site.

Good numbers of auks including razorbill and guillemot used the site throughout the winter but showed no preference for the area compared with other parts of the outer Thames Estuary. Terns were largely absent until July 2005 and August 2005 when small numbers were seen foraging at the site and this indicates that this part of the Thames Estuary is not used for foraging during the breeding season by birds from nearby colonies. Gulls were the most common feature of the site, with herring and lesser black-backed gull forming the bulk of the numbers. Peak numbers counted may be artificially high due to the habits of these opportunistic species that actively seek out and follow survey vessels as a potential food source. Other seabirds recorded regularly at the site included fulmar, kittiwake and gannet. Common scoter were seen very infrequently.

The amount of visible migration that occurred through the site was remarkably low considering the site's proximity to the Thanet coastline, which is the most easterly point in Kent and a first point of landfall for a variety of species migrating across the North Sea. Only two flocks of geese and two flocks of waders were observed along with the occasional swallow, house martin, swift, skua and a single redwing. Although this is only a snapshot of the number of migrants that could pass through the Thanet site, observations were made at peak times and observers had expected to encounter more birds.

Noise levels and the presence of a number of construction vessels would be expected to disturb and displace seabirds using the area during construction of the Thanet project. Any impacts would be short term however, and given the low density of birds observed using the site, and the availability of similar feeding areas close by, a **minor adverse** impact is predicted. Similar impacts would be expected during the decommissioning phase.

Some populations of feeding and roosting waders at Pegwell Bay could be disturbed during installation of the export cables. The impact of the cables would be limited to the construction period and would involve crossing the intertidal area for only a few days. However, construction will be timed outside the overwintering and passage periods to ensure that any disturbance impacts to waterfowl populations is minimised. **No impact** on overwintering species is anticipated during construction. The export cables would be left in situ during decommissioning, so **no impact** is expected.

It is considered that the potential for more significant impacts to birds occurs during the operation of the wind farm. Birds using the Thanet site could be affected in one or more of the following ways:

- Disturbance and displacement from feeding areas;
- Mortality through collision; and
- Barriers to movement.

Disturbance and displacement

Red-throated divers are the most susceptible species to disturbance and generally avoid areas of human activity. Some level of avoidance of the Thanet site by this species is expected, but even assuming complete vacation of the site, the impacts on the Thames Estuary population as a whole is expected to be minimal, given that so few birds would be involved. Studies of other operational wind farms have indicated some displacement but not complete avoidance. Other species seen at the Thanet site may also exhibit some avoidance of the site, although this is likely to be less marked than for red-throated divers. In most instances, numbers of birds using the site were either lower or unexceptional in comparison with other areas in the Thames Estuary and there are plenty of similar habitats close by to accommodate any birds that are displaced. There is some evidence to suggest that gulls and terns may actually be attracted to the site due to the opportunities to perch and rest on the structures.

Collision mortality

A full collision risk assessment was carried out using the boat based survey data and a range of risk scenarios. The model results indicated that divers were at low risk from collision due to their low flight heights. Auks flew so close to the water that not a single bird would be at risk form the turbine blades. Gulls were at the greatest risk of collision, but even for these species, the additional mortality rate as a result of collision was only 0.2% of the background mortality rate. The mortality rates for all other species were less than 0.2%.

Barrier effect

The wind farm could act as a barrier to birds crossing the site, particularly during migration. Recent studies undertaken at operational wind farms have shown that birds such as geese would not necessarily detour around the wind farm and a proportion would fly between the rows of the turbine array. Some birds would completely avoid the site and increase their journey as a result. However, it is considered that the increase in distance would be minor in comparison to the whole journey travelled and unlikely to mean the difference between survival and mortality, unless the individual's condition is so poor that survival would be unlikely under natural conditions.

The Thanet project is one of several proposed, consented and operational wind farms in the Thames Estuary that could act cumulatively to increase the level of impact on seabird and migrant populations. Red-throated diver, the most susceptible species, is present at the Thanet site in such low numbers that when compared with much larger populations at the other sites in the Thames Estuary, the potential to contribute significantly to any cumulative impacts is very limited. Migrants that might avoid the Thanet site due to barrier effects could also have to detour other wind farms, but again, the overall additional distance that could be travelled is still not thought to be significant in the context of the overall journey.

Overall a **negligible** to **minor adverse** impact is anticipated on the ornithological interest of the Thanet site.

It is anticipated that during operation, monitoring of bird populations and behaviour would be undertaken.