Environmentally
Sustainable Systems Ltd

ANNUAL FEPA MONITORING REPORT (2005-6)

RHYL FLATS OFFSHORE WIND FARM

INTERIM ORNITHOLOGY CHAPTER

Interim Report to RWE Group

29 January 2007

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10.1 INTRODUCTION

10.1.1 Background

The construction of the Rhyl Flats Offshore Wind Farm is planned to commence in March 2007.

A licence was issued on <CC to <CC Celtic Offshore Wind Ltd. under the Food and Environment Protection Act, 1985 (Part II) as amended - Deposits in the Sea in Connection with Marine Construction Works, by the Marine Consents and Environment Unit of the Department for Environment, Food and Rural Affairs (DEFRA) on behalf of The National Assembly for Wales (the Licensing Authority). COWL was subsequently purchased by npower renewables on <CC.

Annex <CC this is from the NH license please edit if necessary> of the licence contained details of the ornithological monitoring that was required. In summary, monitoring was required to assess the impacts of:

- *"avoidance / disturbance of behaviour around turbines, effectively resulting in habitat loss; and,*
- *barrier effect of turbines, prohibiting movement of birds through the wind farm and so potentially removing or preventing access to habitat that would otherwise be accessible to birds".*

As significant movements of birds through Rhyl Flats were not observed during survey work for the EIA, monitoring of collision was not automatically required. The need for such monitoring was to be triggered by:

- *"the monitoring of avoidance/disturbance and the barrier effect shows that populations of conservation concern are attracted to the wind farm, or changes in distribution result in such populations being present in future years; and*
- *the birds' behaviour (flight height) puts birds at risk from collision".*

The bird monitoring was also to be linked with the benthic monitoring where the two interacted.

The licence required the survey design to be developed by npower renewables and agreed with Countryside Council for Wales (CCW) before the monitoring commenced. The specification produced contained five objectives, which has to be implemented for the duration of monitoring period (see Section 10.2).

10.1.2 Purpose of report

This chapter has been prepared by Environmentally Sustainable Systems Ltd. (ESS) and reports the statistical findings of the ornithological survey data for the period August 2005 to November 2006, and presents maps of data collected from August 2005 to March 2006.

10.1.3 Structure of report

The remainder of this report is set out as follows:

- Section 10.2 summarises the objectives that form part of the specification for the ornithological analysis and assessment.
- Section 10.3 provides an overview of the ornithological survey methods used to collect the data and the approach to the analysis of the data.
- Section 10.4 provides a summary of the ornithological survey findings.
- Section 10.5 summarises the findings of the analysis.
- Section 10.6 sets out the conclusions and recommendations.
- Section 10.7 lists the references.

Additional supporting information is provided in the following appendices:

- Appendix 10.1 Aerial Surveys - Species Distribution Maps
- Appendix 10.2 Boats Surveys - Species Distribution Maps
- Appendix 10.3 Boat Surveyors Reports
- Appendix 10.4 Map showing Benthic Sampling Locations

10.2 ORNITHOLOGICAL MONITORING OBJECTIVES

10.2.1 Introduction

At the start of the monitoring studies, a list of the key bird species was agreed with CCW. These are the species of highest conservation concern around the Rhyl Flats wind farm for which an ecologically significant reduction would be of concern. The list contained eleven species (red-throated diver, fulmar, cormorant, shag, common scoter, kittiwake, common tern, Sandwich tern, little tern, guillemot, razorbill), which are the qualifying interest for the nearby SSSIs and SPAs. These species are the focus of this report.

The specification for the ornithological analysis and assessment comprises five objectives. Each of the five objectives is introduced in the following sections.

10.2.2 Objective 1

Objective 1: Determine whether there is a change in bird use, measured by numbers and behaviour, of the wind farm and a buffer to be specified.

This objective is addressed by each year undertaking twelve monthly boat transects of the wind farm site and at least 2km of the surrounding waters, and seven aerial surveys of the wind farm site and an aerial reference area separate from the Rhyl Flats wind farm and boat control site and North Hoyle Wind Farm). These survey findings will be analysed statistically during and after construction to determine whether there have been any changes between different phases of the Rhyl Flats Wind Farm's life and whether these are statistically significant, and if so whether any of these may be ecologically significant.

10.2.3 Objective 2

Objective 2: Determine whether there is a barrier effect to movement of birds through the site.

In so far as this is possible, the findings of both the aerial and boat surveys have been used to determine whether the Rhyl Flats Offshore Wind Farm may act as a barrier to bird movement, and preventing birds from flying within and/or through the wind farm. This may be partially achieved by noting the directions of species seen flying within and/or through the wind farm. Such an approach may not be helpful for divers and scoter, since both groups are disturbed by approaching boats (including survey vessels) and often fly in directions determined by their interaction with the survey vessel.

10.2.4 Objective 3

Objective 3: Determine the distribution of common scoter and divers in Liverpool Bay, through continued contribution to the aerial survey, covering Rhyl Flats and the vicinity.

To determine whether the Rhyl Flats Offshore Wind Farm may affect the distribution of common scoter and divers within Liverpool Bay, it has been necessary to monitor the distribution of this species through both aerial and boat surveys and undertake year on year comparisons, allowing for seasonal variation. In spite of the known sensitivity of common scoter to boats, the distribution maps have been generated using the findings of both the aerial and boat surveys. The aerial analyses and maps cover only the relevant part of aerial survey area NW5, and the aerial survey maps are most detailed for scoter and for divers, the two groups for which CCW specified aerial surveys were required, and since confirmed by Camphuysen (2004) to be suitable for surveying these groups. As NPR continues to contribute to the aerial survey this fully meets Objective 3.

10.2.5 Objective 4

Objective 4: IF Objective 3 shows change in common scoter population in the vicinity of Rhyl Flats, monitor the benthos to determine whether the change is a result of change in common scoter food supply.

This objective requires that a pre-construction benthic biomass baseline be available (see Appendix 10.4). If the assessment under Objective 3 indicates a "significant" change in the distribution and numbers of the common scoter population, then further benthic sampling would need to be undertaken. The aim of this programme is be able to distinguish between the effects of any changes in the birds' food resources and changes that may be caused by the presence of turbines.

10.2.6 Objective 5

Objective 5: IF Objectives 1 or 2 reveal significant use of Rhyl Flats by populations of conservation concern, at heights that could incur a risk of collision, a programme of collision risk monitoring will be implemented.

Flight heights of birds are recorded during the boat surveys undertaken for Objective 1. This will be related to the minimum height above sea level that the Rhyl Flats rotors will sweep.

10.3 METHODOLIGIES

10.3.1 Introduction

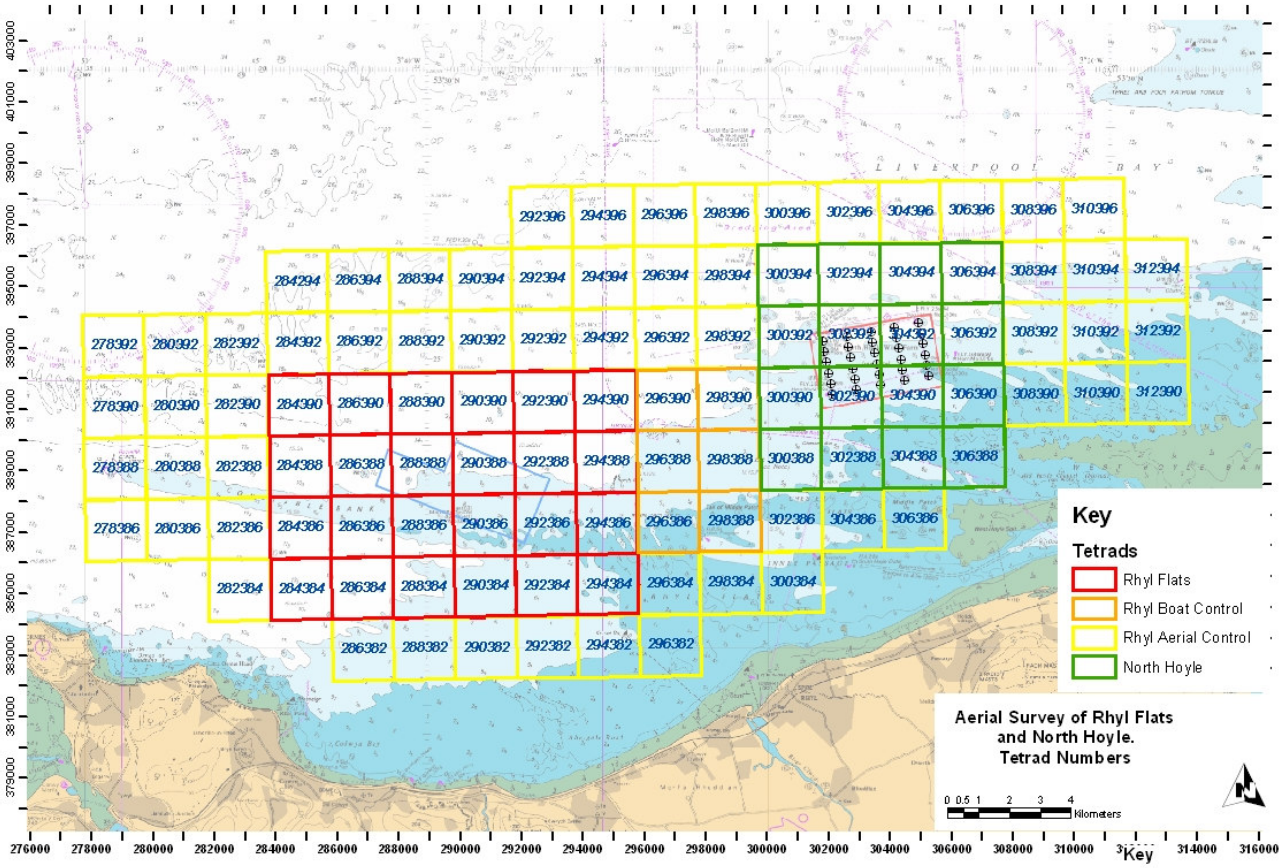
The following sections summarise the survey methods used for the aerial and boat surveys, and set out the approach used in the analysis of the data.

The use of aerial surveys has been recommended particularly for detecting common scoter and red-throated diver (Camphuysen 2004). Because common scoter and red-throated diver are the qualifying interest of the proposed Liverpool Bay marine Special Protection area (mSPA) aerial data has fulfilled objectives for government in identifying and justifying SPAs, and in monitoring these important waterbird populations, as well as meeting FEPA license requirements for offshore wind farms.

Boat surveys provide additional information on these species, including flight height and more accurate densities for most other species. Accordingly, most other bird species have been monitored primarily from boat survey data.

It has been possible for the first time to compare and combine the results of aerial and boat surveys by presenting and analysing bird data using 2km x 2km Ordnance Survey grid squares. These are a convenient sampling unit for subdividing survey areas and are called 'Tetrads' hereafter. This term is commonly used in other biological mapping contexts. Those relevant to this study are shown in Figure 1 below.

Figure 1 Tetrad design for analysis of aerial and boat survey data



10.3.2 Aerial surveys

The aerial surveys follow North/South transects, following odd numbered Ordnance Survey (OS) grid lines as far as possible. These transects traverse Tetrads within the Rhyl Flats wind farm site, buffer, boat control site and potential aerial control areas.

Aerial surveys have been undertaken in Liverpool Bay and have been ongoing since the winter of 2000/2001 as follows:

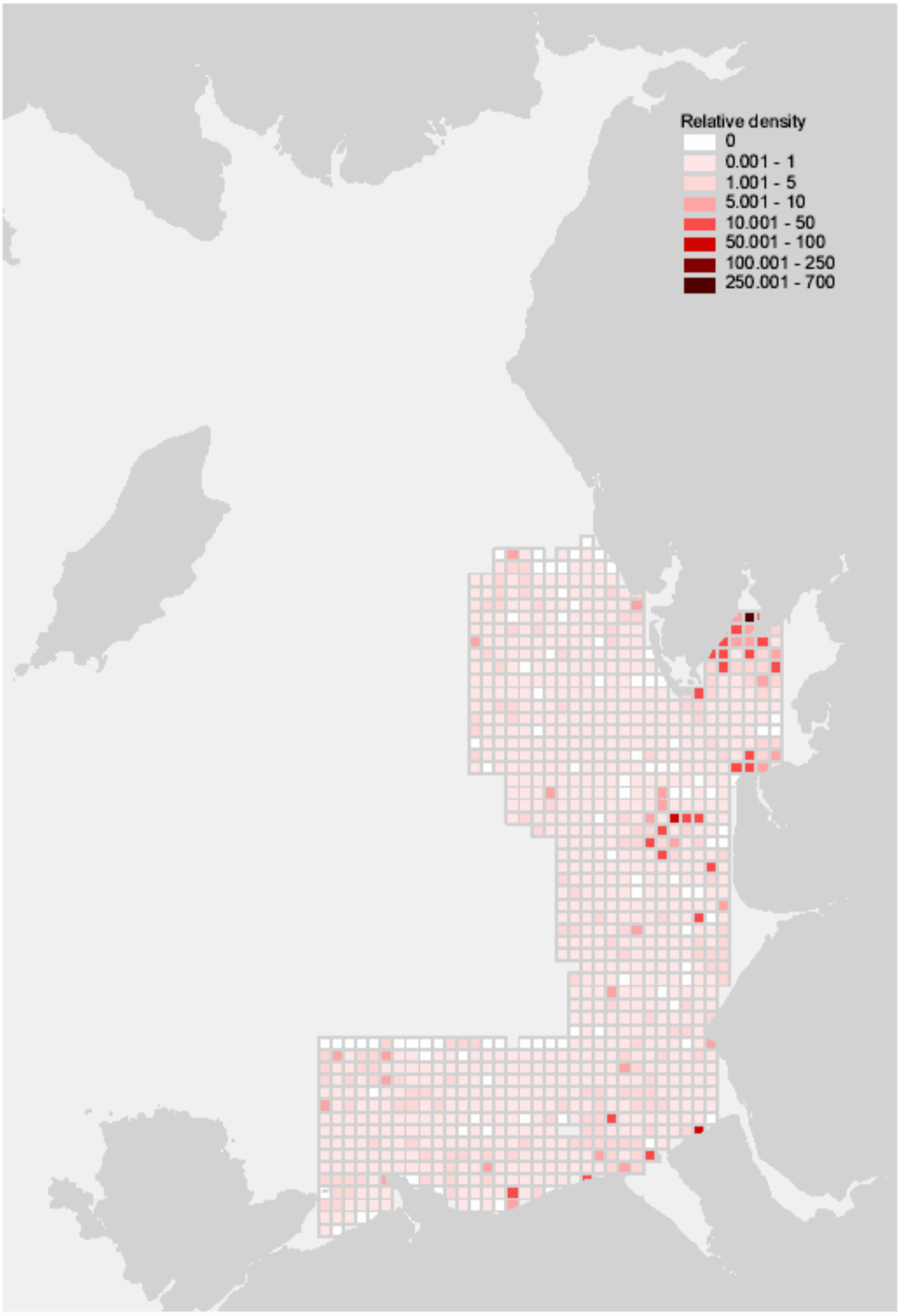
- between 2000/2001 and 2003/2004 by the Wildfowl and Wetlands Trust (WWT) as part of the All Wales Common Scoter Survey commissioned by the Countryside Council for Wales (CCW);
- by the National Environmental Research Institute (NERI) for East Irish Sea Developers Group in July and August 2004; and
- by the Wildfowl and Wetland Trust (WWT) over the winter of 2004/2005 and from May 2005 to November 2006 (and beyond) for the Department of Trade and Industry (DTI) as part of their survey programme for the North West Strategic Area.

The aerial surveys described here cover a wider area extending far beyond the wind farm site, and are part of the wider aerial bird survey regime that covers the North West strategic offshore wind farm area (see Figure 10.2 below). Only data from the 16 tetrads containing the Rhyl Flats wind farm, six containing the boat control site, and 63 tetrads containing the possible aerial reference area which are relevant to monitoring changes in bird abundance have been analysed and an area extending slightly beyond these have been mapped (see Figure 1 above).

Aerial survey methods applied by WWT and NERI have remained the same as those described as in the 2004-5 North Hoyle FEPA Report (Npower renewables 2006a) up to 2004. However, since large scale surveys of strategic wind farm areas have been organised by WWT with the assistance of the DTI, survey protocols have been clarified (e.g. WWT 2005) and are summarised below, as in and the 2005-6 North Hoyle FEPA Report (Npower renewables 2007).

A programme of aerial surveys has been undertaken by the WWT's Wetlands Advisory Service (WAS) from winter 2004/05 through to November 2006 (and will continue in 2007), with financial contributions from offshore wind farm developers, and with financial assistance from the DTI. This programme will recommence in January 2007 and has been designed to provide large-scale survey data covering the nearshore waters in Northwest England (from Anglesey to the Solway Firth), as well as in the Greater Wash and in the Thames (from Flamborough Head, Yorkshire, to Sandwich Bay, Kent). These data are being used to inform the environmental impact assessments of Round II offshore wind farms, fulfil some of the FEPA license monitoring requirements for Round I projects such as Rhyl Flats, and to aid marine SPA identification.

Figure 2 Relative density of birds recorded in North West OWF Strategic Area during aerial surveys, summer 2005 (Periods 5-7 inclusive). Numbers of all species are summed by 2x2 km OS grid squares, corrected for survey effort. From WWT 2005



10.3.2.1 Study areas, Transects and Survey Programme

The north-south transects are orientated perpendicular to the major environmental gradients in the vicinity of the wind farm (primarily water depth). This orientation also reduces the effect of sun glare. Surveys are generally conducted over a four-hour period centred on midday GMT, primarily to minimise the effects of glare on counts. Surveys are undertaken in good weather conditions, generally with winds of 15 knots or less. Observations are not made along the flight path during the turns between the end of one transect and the start of the next, though any significant observations, *e.g.* cetaceans or large flocks of birds, are sometimes recorded on an *ad-hoc* basis. The transects sampled by each WWT survey have remained in the same positions throughout the study, although some have varied in length.

The month but not dates of RF and NH surveys 1-22 were listed in Table 10.1 of the previous 2004-5 *FEPA Monitoring Report* (Npower renewables, 2006a).

<To be completed in draft 2007 RF FEPA Final Report

Rhyl Flats Survey Number	Date	Survey	Sampled RF/RC?	Survey Start Time	Survey Finish Time
1	NOV 2001				
2	DEC 2001				
3	JAN 2002				
4	FEB				
5	MAR				
6	APRIL				
7	AUG				
8	NOV				
9	DEC 2002				
10	JAN 2003				
11	FEB				
12	MAY 2003				
13	FEB				
14	27/05/04		?		
15	JULY				
16	AUG		?		
17	26/10/04				
18	NOV				
19	02/12/2004				
20	JAN				
21	FEB				
22	02/03/2005				
23	11/05/2005	1:NW5	RF/RC	10:51	14:24:56

24	17/05/2005	2:NW6A	-	10:28:18	11:50:00
25	15/06/2005	3:NW6 & 5 (PART)	-	11:33:23	14:17:28
26	16/06/2005	4:NW5	RF/RC	11:08:09	13:58:05
27	20/07/2005	5:NW6A & 5 (PART)	RC?	09:53:33	12:26:24
28	21/07/2005	6:NW5	RF/RC?	09:55:18	12:32:25
29	04/08/2005	7:NW5	RF/RC	11:03:16	15:22:44
30	19/10/2005	8:NW6	-	10:20	14:32
31	10/11/2005	9:NW5	RF/RC	10:58	14:46
32	22/11/2005	10:NW6B & NW5(PART)	-	12:11	15:12
33	08/12/2005	11:NW6A & NW5(PART)	RF/RC	10:28	14:16
34	17/01/2006	12:NW6	-	10:17	13:47
35	01/02/2006	13:NW5	RF/RC	11:07	14:38
36	14/02/2006	14:NW6	-	10:18	14:01
37	06/03/2006	15:NW5	RF/RC	10:41	14:21

Table 10.1 Schedule of aerial surveys in 2005/6

10.3.2.2 Mapping of Location of Birds

Using a combination of the time at which birds were encountered and the track flown by the plane (recorded using a GPS), the locations of observed birds can be calculated (in most cases, to within a few hundred metres). The locations of each observation are subsequently plotted digitally in ArcGIS 8.3 software. The results of surveys numbered 23, 26, 27, 28, 29, 31, 33, 35 & 37 for North West Area NW5 are presented in Appendix 10.2.

The route of each aerial transect is indicated on the maps by a band that is 564m wide (282m either side of the plane). This 564m wide band shows which birds have been included in the data analysis because those beyond 282m from the plane (in survey bands C & D), have not been included in the analysis. This is because very few birds where seen beyond 282m from the flight path of the plane.

Eight aerial survey maps have been reproduced, one for each date that the survey took place covering both Rhyl Flats and the Rhyl Flats boat control site. Only on 20th and 21st of July 2005 were the RF and NH sites covered on different days with both days being represented on one map. In addition to these maps the main species of major conservation concern, common scoter has been mapped separately for each month when they were present to highlight the areas around the Rhyl Flats site where they are most often seen.

10.3.2.3 Sampling Methods

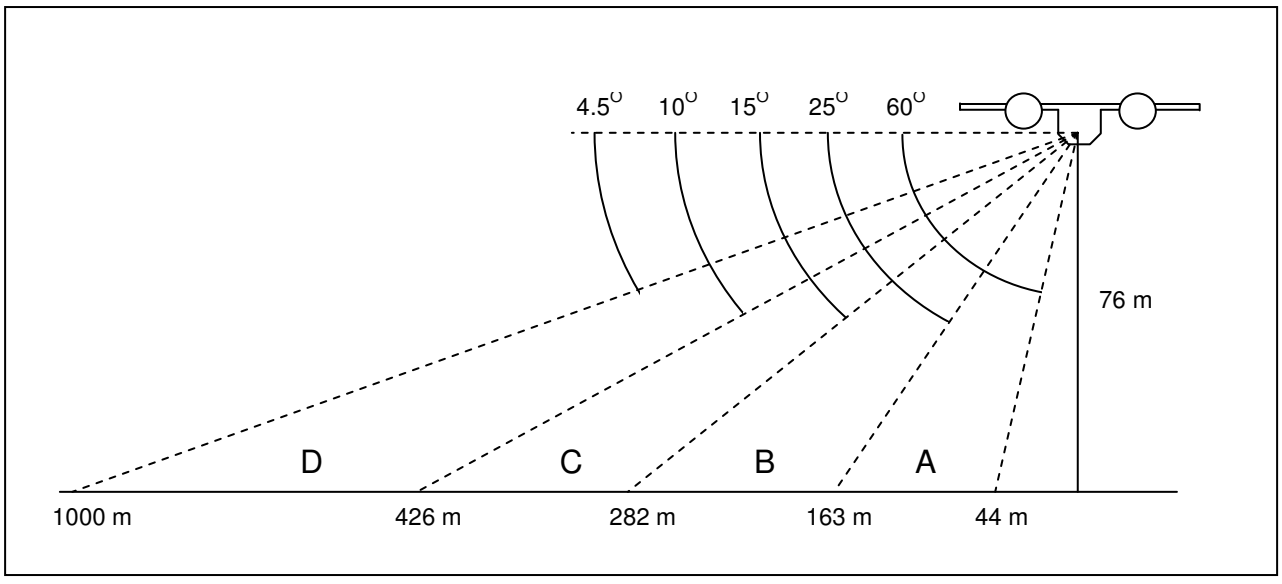
The methodology used for the North West strategic area aerial surveys closely follows that developed by the National Environment Research Institute (NERI) in Denmark (Kahlert *et al* 2000, see also NIOZ 2004). A Partenavia PN68 twin engined aircraft is used, flying at an altitude of 250 ft (76m) and at a speed of approximately 200 kmh^{-1}. The location of the plane is recorded every five seconds using a GPS.

All waterbirds and seabirds, cetaceans and human activity are recorded. For each observation, the species, number, behaviour, distance band and the time at which it was perpendicular to the flight path of the plane are recorded using a dictaphone.

Birds are recorded on both sides of the aircraft and are assigned to one of four distance bands. The surveys employ a distance sampling approach, whereby the distance to each bird/flock of birds is estimated using a clinometer. Birds are located in one of four distance bands covering an area from 44 m to 1000 m either the side of the plane (see Figure 10.3 below). The survey method assumes that all birds in distance Band A are detected, and effort is concentrated on this band.

The area from 0-44m is hidden from view beneath the aircraft. Inevitably, birds further from the plane in other bands (especially C and D) may be missed owing to distance and the need for the observers to concentrate observation on the area of sea nearest the flight line.

Figure 3 Distance bands used for aerial survey (not to scale). From WWT 2005



Following the WWT August 2002 survey, which used three (slightly different) distance bands, all subsequent surveys to date have used four distance bands. Because the earlier band B extended 164 to 432 metres from the plane's track, whereas the current band B extends 163-282m, and band C extends 282-426m from the track (see Figure 3), earlier surveys may have slightly higher numbers of some birds, though very few birds were seen in band C or D (see Figures in Appendix 10.1).

A cautionary approach is taken with regard to species identification from aerial surveys, such that only those individuals that are observed clearly are identified to species level; otherwise, birds are identified as being in a species group, e.g. diver (*Gavia* spp.), pale-backed gull (common *Larus canus* or herring gull *Larus argentatus*), dark-backed gull (lesser black-backed *Larus fuscus* or great black-backed gull *Larus marinus*), large gull (herring, lesser black-backed or great black-backed gull), Small gull (black-headed *Larus ribidundus*, common, little gull *Larus minutus* or kittiwake *Rissa tridactyla*) or gull (*Larus* spp. or kittiwake). Many divers and gulls can be identified to species, but auks are very difficult to distinguish except when using binoculars. All pale backed gulls have been amalgamated with gulls in the figures for this report.

10.3.3 Boat surveys

The boat surveys were undertaken from one of two research vessels (RV), either the RV Prince Madog (35m), or the RV Aora (22m) depending on availability. Both ships provide a suitable viewing platform in excess of the 5m recommended in the COWRIE (NIOZ 2004) guidance (observer seated eye heights - Prince Madog 8.5m and Aora 7m).

10.3.3.1 Study Area and Transects

The main area covered by the boat surveys comprises parts of 24 tetrads. This area is a rectangle bounded by the OS East/West lines 284000 and 296000 and by the North lines 384000 and 392000. The 16 outer tetrads have been designated as Buffer and the 8 inner tetrads as Wind Farm for the purpose of this report. The Rhyl Flats boat control area comprises six tetrads to the east of the Wind Farm and Buffer study site. The same subdivisions were used for analysing the aerial survey data, so that the methods may be compared directly (see Figure 1).

The eight transect routes used during this period sampled the lines shown in Figure 4. Transects are labelled from A (most Northern) to H (most southern). The dates, times, wind direction and speed, and sea states are summarised in Table 1.

Figure 4 Boat survey transects August 2005 to November 2006

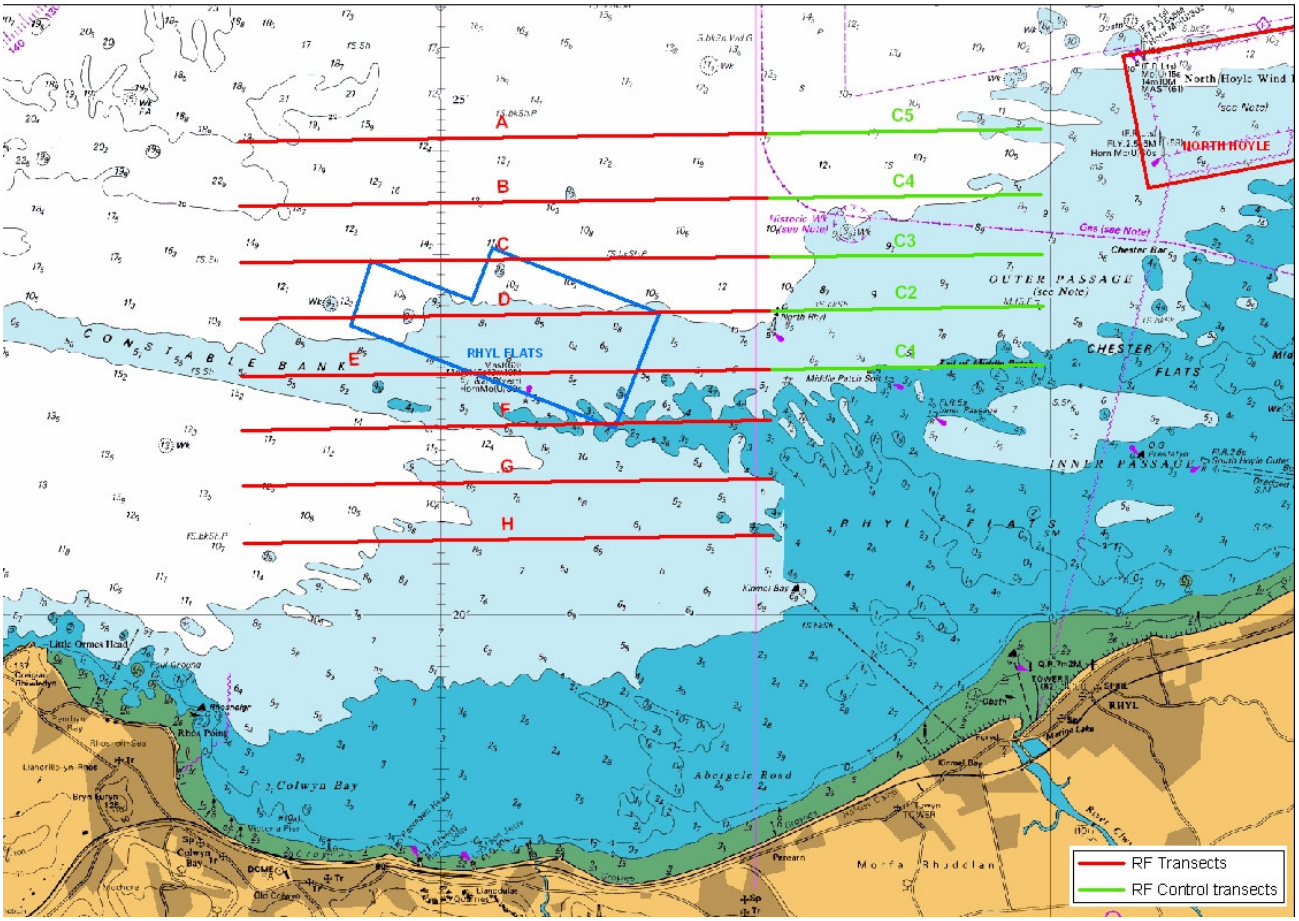


Table 1 Schedule of boat surveys and weather in period August 2006-November 2006

Date	Rhyl Flats Boat Survey	Time		Wind Direction	Wind Speed	Sea State
		Start	End			
09/08/2005	1	11:42	16:04	W-NW	2-3	2
18/09/2005	2	08:32	13:20	SW	3	1-2
30/10/2005	3	11:20	16:11	S-SW	5-7	3-4
14/11/2005	4	10:03	15:16	W - WSW	4-6	3-5
10/12/2005	5	11:07	16:04	S-SW	2	1-2
18/01/2006	6	10:24	15:14	W	2-3	2-3
19/02/2006	7	11:09	16:04	NE	3-4	3
16/03/2006	8	06:11	10:46	E	5-6	3
22/04/2006	9	06:07[1]	15:10[1]	NE-SE	1-2	1-2
23/04/2006	10	08:27[2]	18:37[2]	N-NW	2-3	2-3
04/05/2006	11	06:59[3]	16:27[3]	E-SE	0-4*	1-5*
14/06/2006	12	06:00	11:17	N	2	2-3
05/07/2006	13	06:56	12:32	E-W	0-1	1
12/09/2006	14	13:00	18:07	S-W	2	2
27/09/2006	15	12:35	17:51	SE	3-4	2-4
04/10/2006	16	12:03	18:32	NW-W	3-5	3-4
08/11/2006	17	07:51[4]	14:20[4]	W	2-4	2-4

1. Actual survey periods on 22/04/2006: 06:07-08:42, 10:25-11:39 &13:53-15:10
2. Actual survey periods on 23/04/2006: 08:27-09:00, 09:51-10:33, 12:13-12:46, 13:47-14:22 & 15:57-18:37
3. Actual survey periods on 04/05/2006: 06:59-08:50, 09:36-10:12, 11:41-12:55 & 15:08-16:27
4. Actual survey periods on 08/11/2006: 07:51-10:30, 11:09-12:27 & 13:08-14:20

* Higher wind speeds and sea states recorded on final transect only

10.3.3.2 Influence of Weather

Weather will have an influence on the ability of surveyors to record birds. It may reduce visibility (e.g. fog, rain, sun glare, wave height) or make physical conditions for recording harder (e.g. cold, wet, wind). Weather will therefore have an influence on the number of birds that are recorded.

10.3.3.3 Sampling Method

The boat surveys between August 2005 and February 2006 (inclusive) were undertaken by ERM and largely followed the methods recommended after the COWRIE research project and as described in Camphuysen *et al* (2004).

The surveys up to February 2006 were undertaken by a team comprising two bird surveyors with only one surveyor observing (from one side of the boat) at any one time, and another working as a designated scribe. Observations were made using the naked eye, with binoculars used where necessary to facilitate identification. In addition to the bird species, surveyors recorded relevant details on age, sex, plumage, number of birds,

direction if in flight, flight height band and any specific behavioural characteristics including feeding, scavenging, and escape flight/dive.

Birds were recorded within a 90° scan from one side of the vessel and assigned to one of the following distance bands:

- Band A (0-50m perpendicularly away from the vessel);
- Band B (50-100m);
- Band C (100-200m);
- Band D (200-300m); and
- Band E (>300m).

Birds seen on the water within 300m of the vessel (*i.e.* in Bands A – D) on the scan side of the boat were considered to be 'in transect', and were subsequently used in the density calculations, along with birds seen during snapshot samples taken every two minutes of birds in the air within a rectangle extending 300m ahead and perpendicular to the vessel.

The height of birds seen in the air was assigned to one of three height bands:

- <1m above the water surface;
- 1 – 20m;
- >20m

The height of 20m above the water surface is used for consideration of the risk of bird collision with turbine blades since the clearance of the blade tip (at its lowest point) from the water's surface being approximately 22m at mean high water springs.

The boat surveys from March 2006 to November 2006 was undertaken by ESS. On the same day as these surveys the Rhyl Flats boat control site was surveyed.

The survey methods applied at Rhyl Flats from March 2006 were very similar to those applied by ERM, with the exception that one bird surveyor observed each side of the boat. This refinement was agreed with CCW as being more suitable for monitoring change. Additionally, for each bird seen flying its flight height was estimated, rather than banded. Also by agreement with CCW bird records were timed to the nearest minute (as recommended by COWRIE and ESAS).

For some records, a bearing and distance are recorded so that these the locations of these sightings can be more accurately plotted offset from the boat position.

10.3.3.4 Data Recording, Entry and Summarisation

Survey data was recorded on paper form in the field and then transferred to an Access database. A visual check of the data entered against the paper forms also undertaken prior to entry. The database was designed to reduce the risk of incorrect data entries and to allow all data to be stored in a hierarchical, linked system for easy recall and analysis.

10.3.3.5 Mapping of Location of Birds

The boat survey bird data has been offset from the track of the boat to position the actual locations of the birds more accurately than would otherwise be possible. The approximate bird positions are calculated using the ships position at the time of observation, position of observer (port or starboard), and the distance of the bird from the ship (mid-point of its distance band).

Distribution maps based on the observations from each of the boat surveys have been produced for each visit showing all bird species seen from the survey vessel as a different shape/colour combination.

Maps showing the distributions of the main seabird species over the whole year August 2005-November 2006 were also produced. These are colour coded by species grouping with different shapes for different species and show the precise number of birds involved. In addition the maps for each survey (see Appendix 10.1 and 10.2) several important species groups have been plotted separately including auks, divers and scoter.

The boat survey distribution maps are generally plotted at a larger scale than the aerial maps which cover a larger area. A scale bar shows distance in metres on each map.

10.3.4 Data analysis

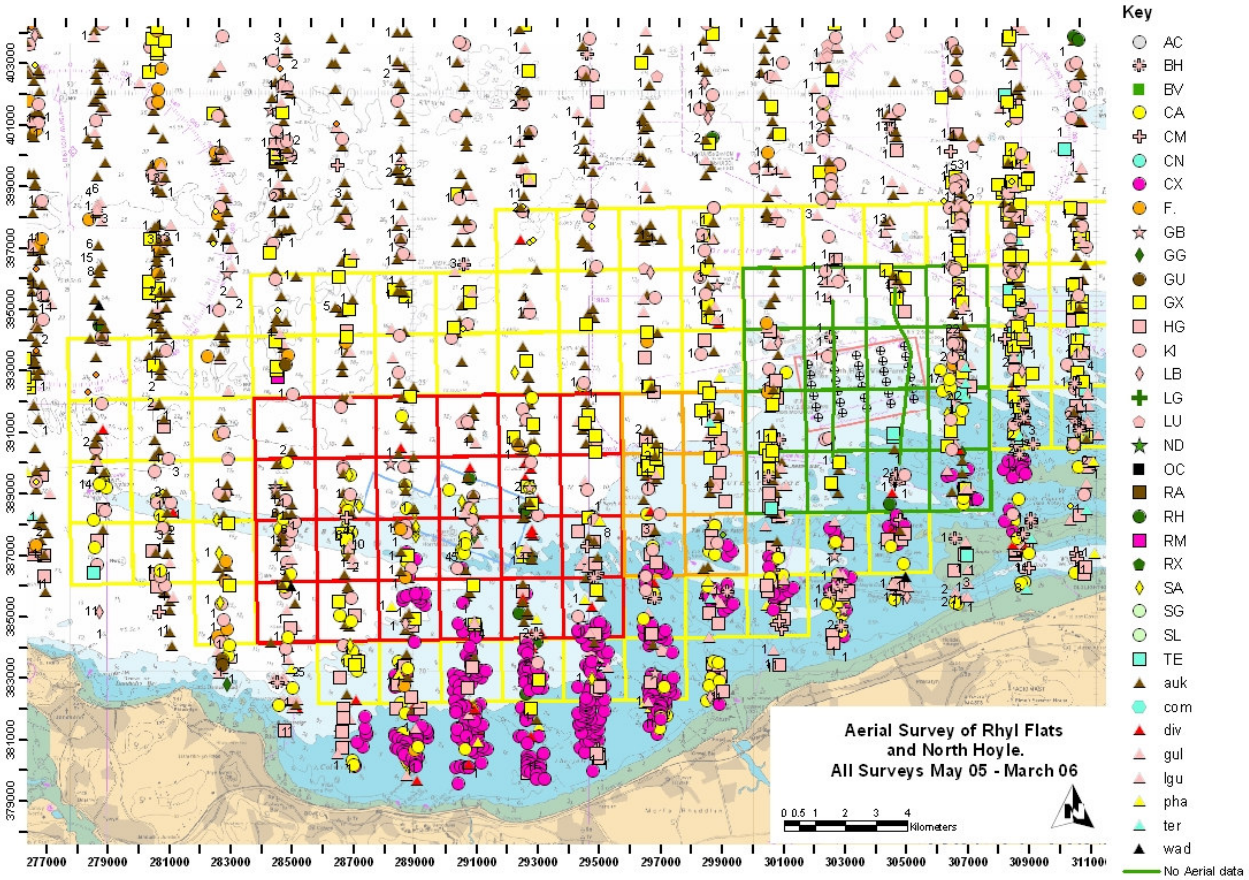
10.3.4.1 Aerial Survey Analysis

Birds are recorded on both sides of the aircraft and are assigned to one of four distance bands. This analysis used all observations from the three bands closest to the aircraft (44m to 426m) and did not use any band corrections. The density estimates will differ from WWT as they use four bands and apply band corrections. Not all birds are specifically identified, so the WWT grouping of species was used. The total for each group in each tetrad was calculated. These totals were used to calculate means and standard errors for the wind farm and buffer areas combined.

The aerial data analysis used tetrads for density estimation, so that the results could be compared directly with those from the boat surveys.

An aerial control site has not yet been finalised but a possible suggestion is shown in Figure 5.

Figure 5 Possible aerial control area for Rhyl Flats.



Density estimates for each tetrad will allow future tests for any changes in numbers caused by the Rhyl Flats Wind Farm to be carried out by analysing changes in density estimates within wind farm/buffer and control areas for each date using generalised linear models.

When considering the most important analyses of aerial survey data (divers, seabirds and seaducks) it is helpful to view the relevant aerial distribution map showing birds in relation to the wind farm and buffer.

10.3.4.2 Boat Surveys

On each visit, the total length sailed within each of the tetrads was calculated. The total number of birds in transect was also recorded for each tetrad, based on the boat position. This allows a density estimate to be obtained for each tetrad. These estimates will not be very reliable if only a short distance is sailed within a tetrad. Any tetrad where the distance covered was less than 1000 metres with one observer or less than 500 metres with two observers was omitted.

Some birds on the water between 100m and 300m from the boat are likely to be missed; standard species band correction factors (Stone et al 1995) were used to try to allow for this. The tetrad density estimates were then combined to obtain the mean densities for the wind farm, buffer and control areas, and to obtain standard errors of the estimates.

Density estimates for individual species were calculated for the wind farm, buffer and control areas. Tetrads have also been used for analysing the aerial survey data, so that the methods may be compared directly.

10.3.4.3 Comparison of Boat and Aerial Surveys

The boat and aerial surveys were carried out independently of each other, so took place on different dates. In FEPA reports after construction the results from the two methods can be compared by considering month and year combinations in which both sorts of survey were carried out.

10.4 ORNITHOLOGICAL SURVEY FINDINGS

10.4.1 Introduction

This section summarises the findings of the boat and aerial surveys, including statistical results, maps showing the distribution of the birds within the respective survey areas. Distribution maps for the main species recorded throughout the survey period are contained in Appendices 10.2 and 10.3. The most important maps are presented in this section.

10.4.2 Aerial surveys

The statistical results are presented using the five WWT species groupings used in WWT (2005). The recorded percentages are given for those groups that accounted for at least 1% of the records.

The aerial surveys are often unable to identify birds to species level, so the WWT uses standard groupings. Density estimates (birds per km^2) are presented below for the combined wind farm and buffer area for the five main groups. An indication of the composition of each group is given, based on aerial surveys from the whole of North Wales.

- divers: red-throated diver 24%, great northern diver 1%, unidentified 75%.
- cormorant: cormorant 86%, shag 8%, unidentified 6%.
- seabirds: auk species 94%, gannet 5%, fulmar 1%. The auks were not specifically identified on any of the aerial surveys.
- sea duck: common scoter 99%, red-breasted merganser 1%.
- gulls: kittiwake 18%, herring gull 11%, common gull 6%, greater black-backed gull 3%, lesser black-backed gull 2%, black-headed gull 1%, unidentified 59%. Some of the unidentified gulls were partially identified, for example as grey gull (herring gull or common gull).

No birds seen beyond the 282m distance band either side of the transect flight paths of the plane were analysed.

The birds outside of this 564m wide band can be clearly identified in the figures of each aerial survey as they fall outside of the flight paths that have been mapped individually for each survey.

Density estimates are summarised in Table 2 below.

Table 2 Summary of density estimates

	Density Estimates				
Date	Divers	Cormorant and Shag	Seabirds	Sea Duck	Gulls
17/11/02	0.14	0.63	5.51	3.93	1.23
06/12/02	0.08	0.41	1.94	1.20	0.41
11/01/03	0.55	0.41	1.75	4.69	2.70
08/02/03	0.08	0.22	0.35	5.13	0.11
09/05/03	0.00	0.11	0.16	0.00	0.65
11/02/04	0.16	0.38	1.88	5.13	4.80
28/02/04	0.38	0.08	0.30	6.38	0.38
10/03/04	0.00	0.11	0.85	0.25	0.30
02/11/04	0.00	0.68	3.84	0.41	1.01
30/11/04	0.00	0.30	0.79	0.00	0.27
16/01/05	0.16	0.44	0.33	0.03	0.25
16/02/05	0.63	0.52	0.98	4.28	3.63
11/05/05	0.00	1.58	0.55	0.00	1.88
16/06/05	0.00	1.23	0.60	0.00	0.30
20/07/05	0.00	1.69	0.44	0.00	0.46
04/08/05	0.00	1.45	0.46	0.95	0.08
10/11/05	0.08	0.98	0.65	0.95	0.65
08/12/05	0.25	0.27	2.95	0.14	2.29
01/02/06	0.19	0.41	3.05	2.45	0.41
06/03/06	0.44	0.79	1.04	3.60	0.63

10.4.2.1 Red-throated diver / diver species

<Discussion to follow in draft 2007 RF FEPA Final Report

10.4.2.2 Cormorant and Shag

10.4.2.3 Seabirds (Fulmar, Gannet and Auk species)

10.4.2.4 Sea Duck

<Discussion to follow in draft 2007 RF FEPA Final Report

10.4.2.5 Gulls

10.4.3 Boat surveys

The tables in this section give density estimates for each visit during the study period. Estimates are given for each of the species that were seen on more than 5 of the 17 visits. The units are the estimated number of birds per km2. The standard errors of these estimates have also been given. A dash (-) in the tables signifies that an estimate is not available.

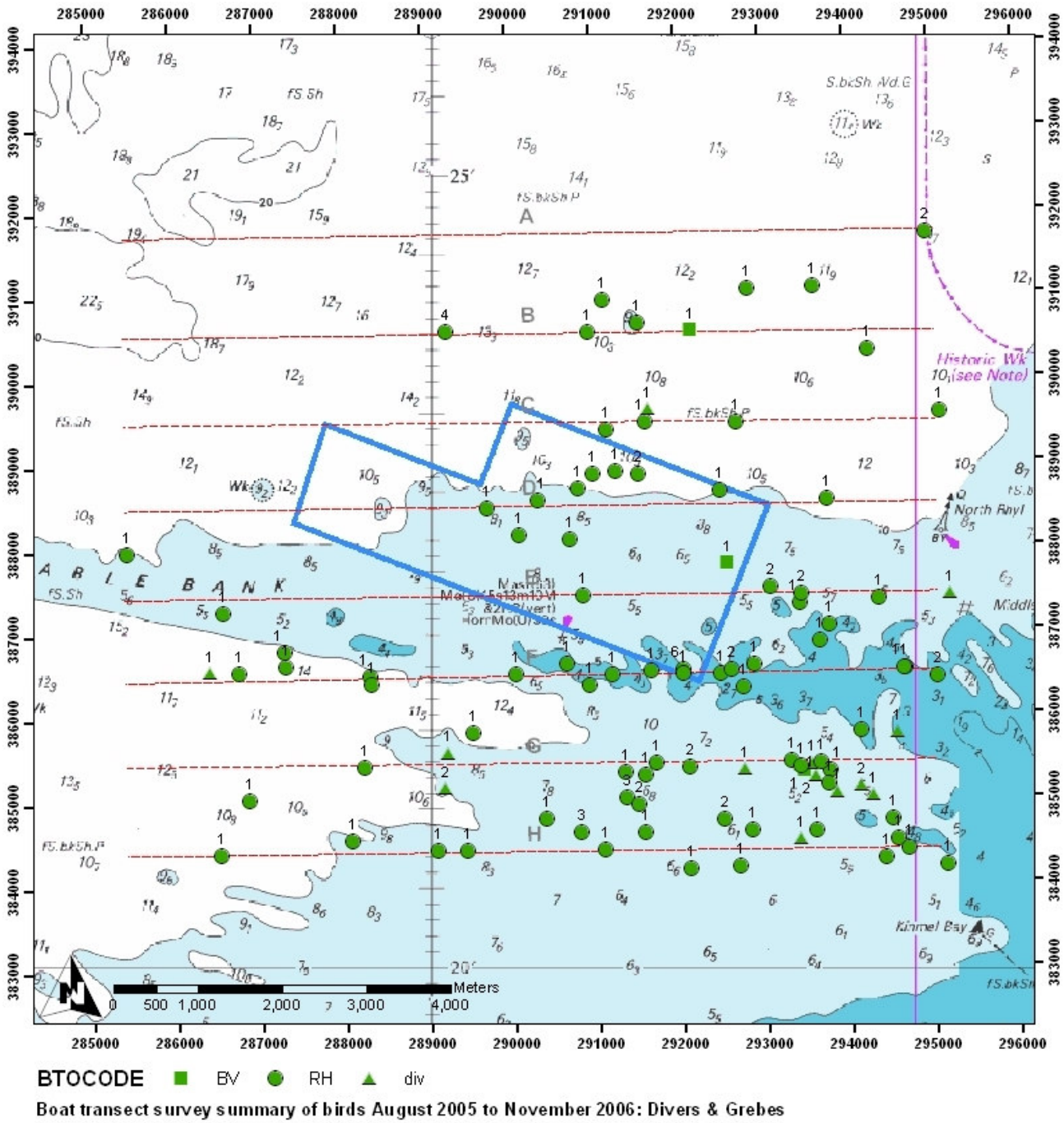
Birds that have not been identified to species level have been omitted from these tables. Thus some of the estimates below will be too small. In particular, the number of auks on 23/10/06 and large gulls on 23/4/06 and 8/11/06 would affect some of the estimates below.

10.4.3.1 Red-throated diver / diver species

Table 3 Diver density estimates

	Density Estimates			Standard Errors		
Date	Wind Farm	Buffer	Control	Wind Farm	Buffer	Control
18/09/2005	0.00	0.15	-	0.15	0.12	-
14/11/2005	0.48	0.07	-	0.49	0.38	-
10/12/2005	0.36	0.00	-	0.67	0.51	-
18/01/2006	0.00	0.35	-	0.26	0.22	-
19/02/2006	0.36	0.67	-	1.00	0.78	-
16/03/2006	0.96	0.22	0.00	1.85	1.58	-
23/04/2006	0.00	0.00	0.06	-	-	0.06
04/05/2006	0.00	0.03	0.00	0.04	0.03	-
12/09/2006	0.12	0.03	0.06	0.32	0.23	0.06
27/09/2006	0.00	0.28	0.29	0.18	0.13	0.21
04/10/2006	0.06	0.18	0.10	0.19	0.13	0.10
08/11/2006	0.00	0.00	0.11	-	-	0.11

Figure 6 Red throated and other divers



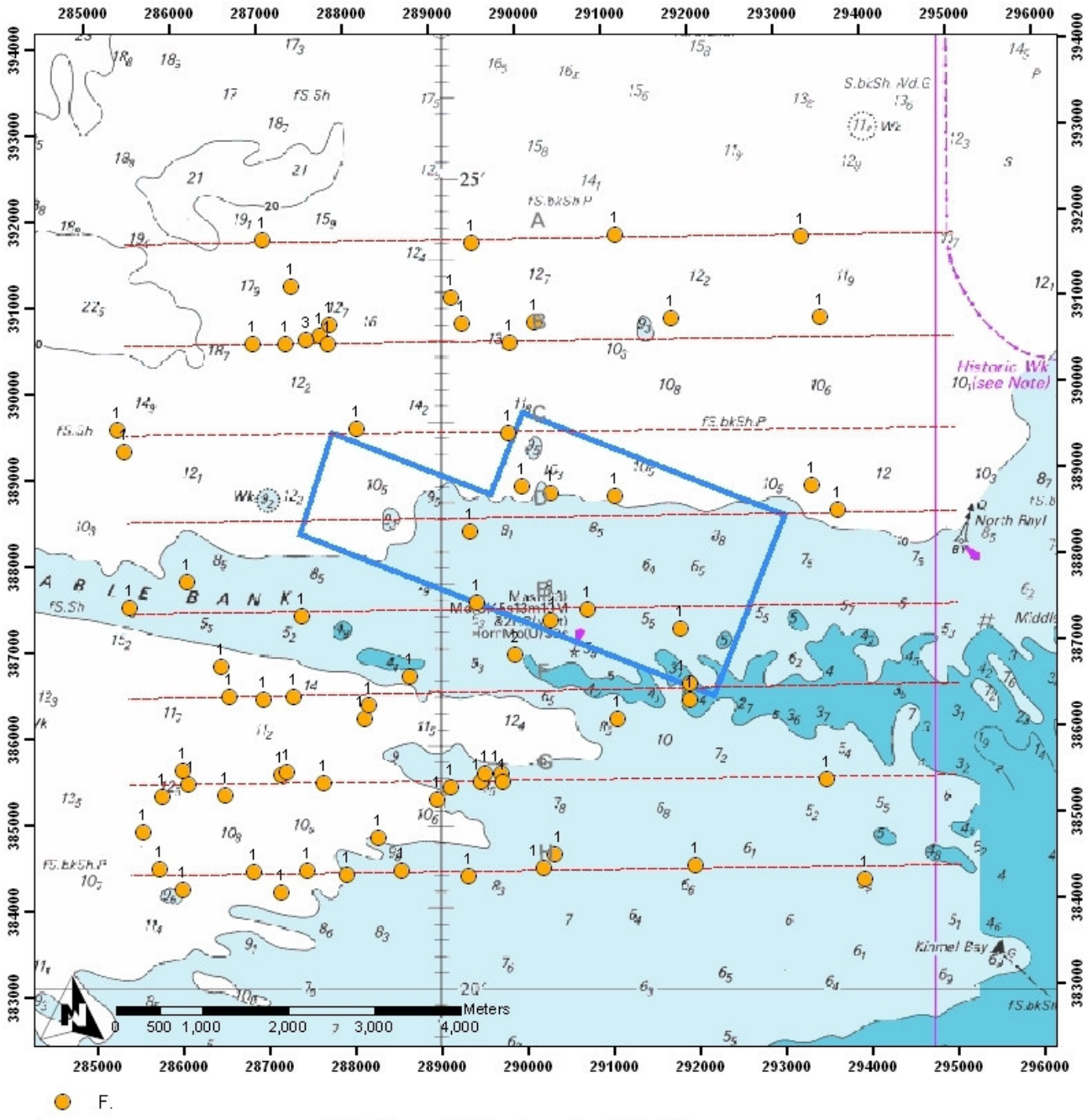
Boat transect survey summary of birds August 2005 to November 2006: Divers & Grebes

10.4.3.2 Fulmar

Table 4 Fulmar density estimates

	Density Estimates			Standard Errors		
Date	Wind Farm	Buffer	Control	Wind Farm	Buffer	Control
09/08/2005	0.00	0.22	-	0.11	0.09	-
18/09/2005	0.00	0.20	-	0.11	0.08	-
16/03/2006	0.00	0.06	0.00	0.05	0.04	-
22/04/2006	0.00	0.19	0.00	0.14	0.10	-
23/04/2006	0.00	0.03	0.00	0.03	0.02	-
04/05/2006	0.00	0.05	0.00	0.04	0.03	-
14/06/2006	0.05	0.02	0.00	0.14	0.10	-
05/07/2006	0.21	0.13	0.00	0.31	0.22	-
12/09/2006	0.05	0.00	0.00	0.14	0.10	-
08/11/2006	0.00	0.03	0.00	0.03	0.02	-

Figure 7 Fulmar



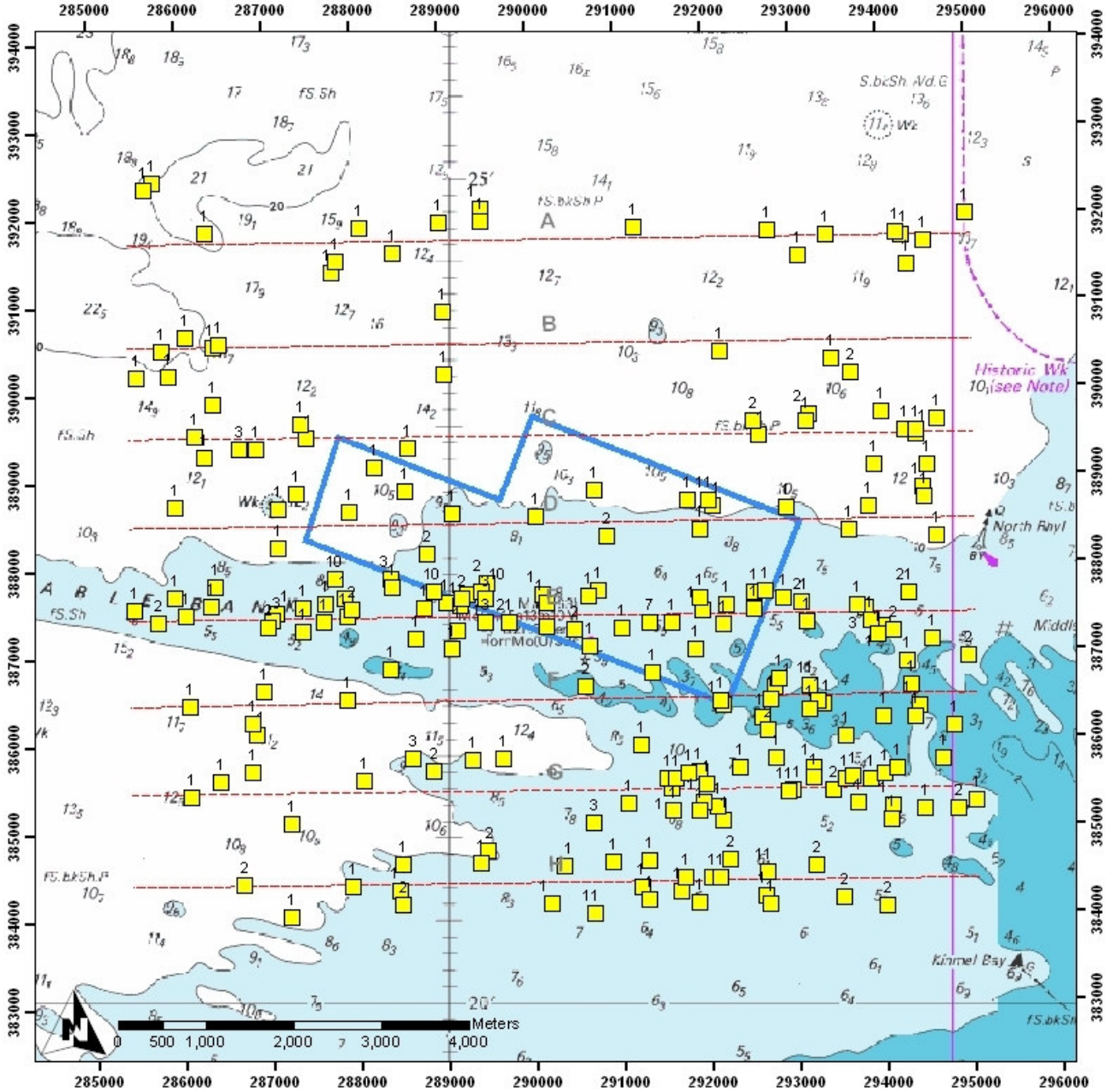
Boat transect survey summary of birds August 2005 to November 2006: Fulmar

10.4.3.3 Gannet

Table 5 Gannet density estimates

	Density Estimates			Standard Errors		
Date	Wind Farm	Buffer	Control	Wind Farm	Buffer	Control
09/08/2005	0.11	0.07	-	0.31	0.25	-
18/09/2005	0.10	0.00	-	0.28	0.22	-
30/10/2005	2.50	0.45	-	6.62	5.19	-
14/11/2005	0.00	0.06	-	0.06	0.05	-
22/04/2006	0.05	0.00	0.00	0.14	0.10	-
23/04/2006	0.10	0.07	0.09	0.29	0.20	0.09
04/05/2006	2.70	0.26	0.79	4.09	2.89	0.25
14/06/2006	1.42	0.53	0.54	0.96	0.68	0.28
05/07/2006	1.20	0.94	0.51	1.83	1.29	0.18
12/09/2006	0.00	0.05	0.00	0.04	0.03	-
27/09/2006	0.10	0.10	0.13	0.20	0.14	0.10
04/10/2006	0.10	0.10	0.13	0.20	0.14	0.09

Figure 8 Gannet



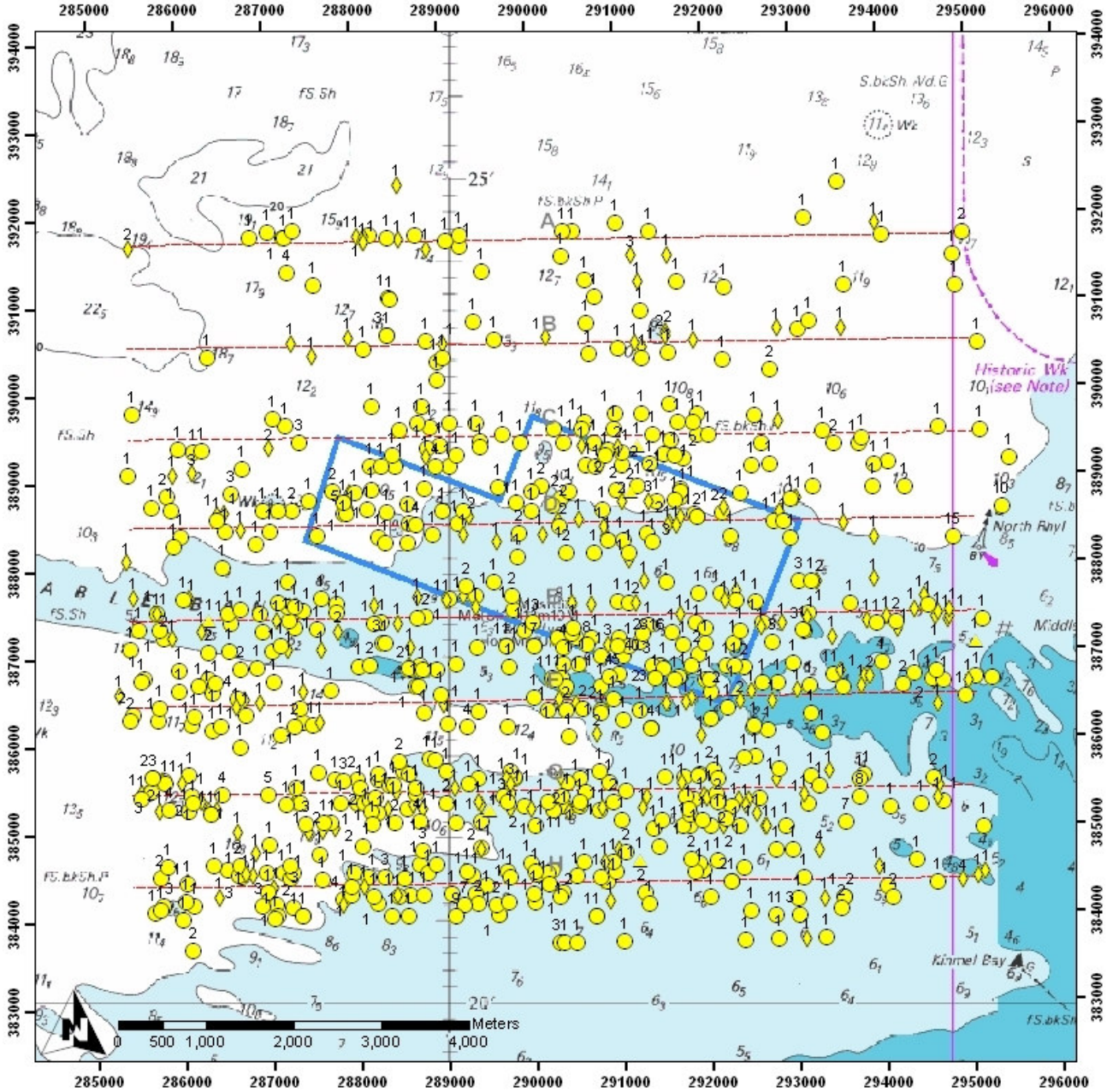
Boat transect survey summary of birds August 2005 to November 2006: Gannet

10.4.3.4 Cormorant

Table 6 Cormorant density estimates

	Density Estimates			Standard Errors		
Date	Wind Farm	Buffer	Control	Wind Farm	Buffer	Control
09/08/2005	2.64	0.77	-	2.78	2.27	-
18/09/2005	6.99	0.53	-	16.50	12.94	-
30/10/2005	0.33	0.18	-	0.45	0.35	-
14/11/2005	4.32	1.62	-	8.81	6.91	-
10/12/2005	0.22	0.00	-	0.38	0.29	-
18/01/2006	0.00	0.22	-	0.15	0.12	-
19/02/2006	0.55	0.20	-	0.77	0.61	-
16/03/2006	0.64	0.20	0.15	0.86	0.74	0.15
22/04/2006	0.39	0.08	0.00	0.41	0.29	-
23/04/2006	2.22	0.67	0.20	4.89	3.46	0.20
04/05/2006	2.66	1.11	0.29	5.74	4.06	0.24
14/06/2006	0.88	0.36	3.21	0.80	0.57	2.52
05/07/2006	0.67	0.95	0.52	0.88	0.62	0.40
12/09/2006	3.33	0.44	1.37	6.68	4.72	0.91
27/09/2006	0.50	0.24	0.20	0.58	0.41	0.14
04/10/2006	0.39	1.34	0.79	0.94	0.66	0.36
08/11/2006	0.33	0.32	0.00	0.76	0.54	-

Figure 9 Cormorant



Boat transect survey summary of birds August 2005 to November 2006: Cormorants and Shags

10.4.3.5 Shag

Table 7 Shag density estimates

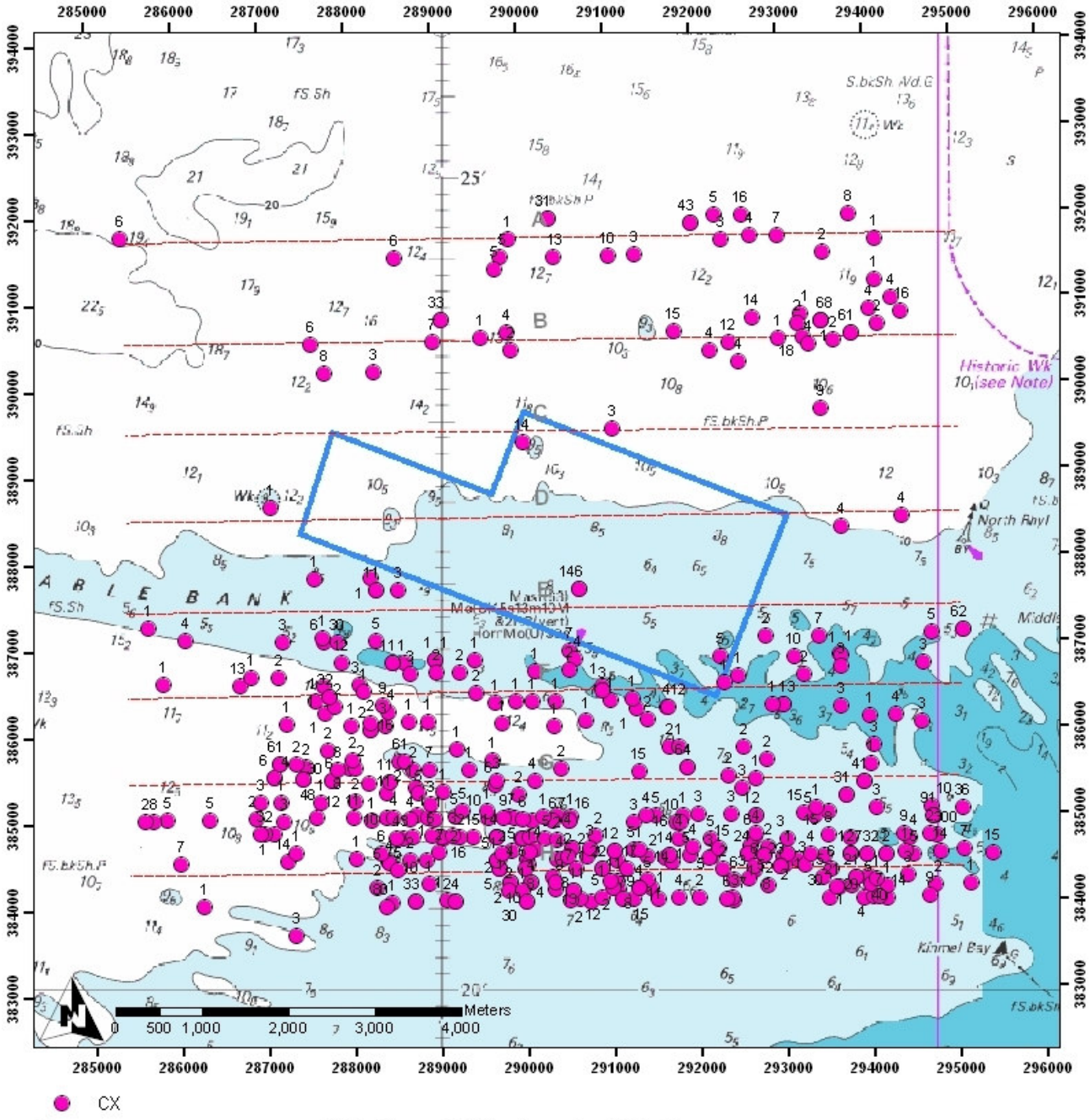
	Density Estimates			Standard Errors		
Date	Wind Farm	Buffer	Control	Wind Farm	Buffer	Control
18/09/2005	0.89	0.50	-	1.42	1.12	-
30/10/2005	0.00	0.26	-	0.15	0.12	-
14/11/2005	0.55	1.01	-	0.84	0.66	-
10/12/2005	1.55	0.55	-	1.49	1.13	-
18/01/2006	1.22	1.24	-	1.17	0.95	-
19/02/2006	0.00	0.07	-	0.07	0.05	-
16/03/2006	0.37	0.28	0.35	0.46	0.39	0.29
22/04/2006	0.67	0.03	0.00	0.83	0.59	-
23/04/2006	0.06	0.00	0.00	0.15	0.10	-
04/05/2006	0.06	0.00	0.12	0.15	0.10	0.12
14/06/2006	0.17	0.04	0.05	0.31	0.22	0.05
05/07/2006	0.06	0.03	0.00	0.15	0.11	-
12/09/2006	0.06	0.45	0.20	0.32	0.23	0.15
27/09/2006	0.06	0.16	0.21	0.17	0.12	0.21
04/10/2006	0.11	0.12	0.09	0.21	0.15	0.09
08/11/2006	0.00	0.44	0.58	0.52	0.37	0.39

10.4.3.6 Common Scoter

Table 8 Scoter density estimates

	Density Estimates			Standard Errors		
Date	Wind Farm	Buffer	Control	Wind Farm	Buffer	Control
18/09/2005	0.00	0.14	-	0.14	0.11	-
30/10/2005	0.00	3.35	-	2.29	1.80	-
14/11/2005	1.50	0.43	-	3.99	3.13	-
10/12/2005	3.47	8.58	-	9.89	7.48	-
18/01/2006	0.35	7.32	-	2.89	2.36	-
19/02/2006	0.00	6.98	-	6.09	4.78	-
16/03/2006	1.70	6.85	0.99	3.48	2.97	0.83
05/07/2006	0.00	0.06	0.00	0.07	0.05	-
12/09/2006	1.04	0.00	0.05	1.82	1.29	0.05
27/09/2006	0.35	0.34	0.00	0.80	0.56	-
04/10/2006	0.17	0.38	0.31	0.42	0.30	0.31
08/11/2006	0.00	0.03	0.00	0.03	0.02	-

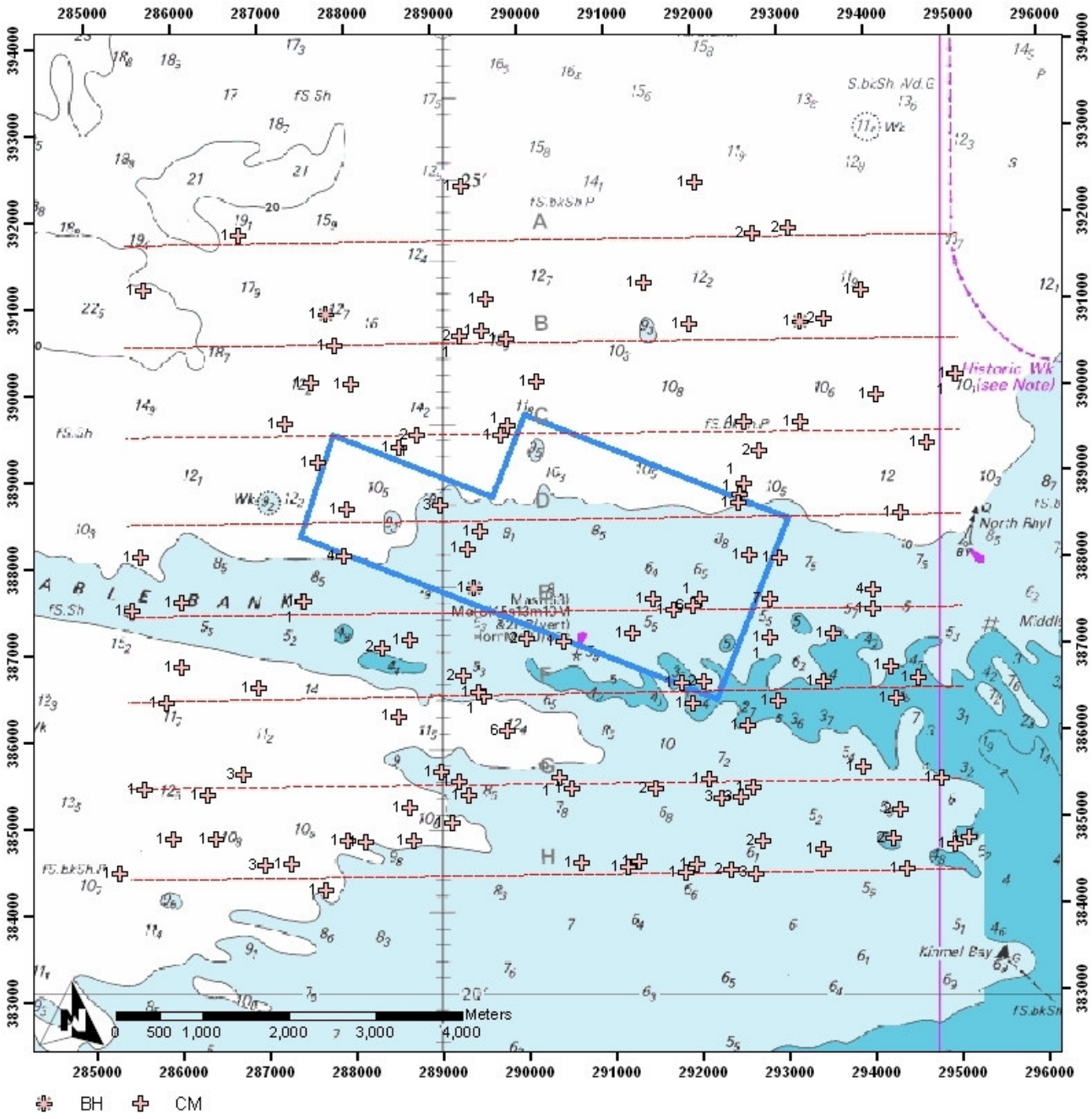
Figure 10 Common scoter



Boat transect survey summary of birds August 2005 to November 2006: Common scoter

10.4.3.7 Mediterranean gull

Figure 11 Common, black-headed & Mediterranean gulls



Boat transect survey summary of birds August 2005 to November 2006: Black headed and Common gulls

10.4.3.8 Black-headed gull

Mapped in Figure 11 Common, black-headed & Mediterranean gulls

10.4.3.9 Common gull

Table 9 Common gull density estimates

	Density Estimates			Standard Errors		
Date	Wind Farm	Buffer	Control	Wind Farm	Buffer	Control
30/10/2005	0.00	0.28	-	0.16	0.12	-
14/11/2005	0.61	0.35	-	1.01	0.79	-
10/12/2005	3.31	1.23	-	4.16	3.14	-
18/01/2006	0.25	0.16	-	0.66	0.54	-
19/02/2006	0.61	1.36	-	1.04	0.82	-
16/03/2006	0.18	0.91	0.06	0.45	0.38	0.06
22/04/2006	0.00	0.06	0.00	0.07	0.05	-
04/05/2006	0.00	0.13	0.05	0.10	0.07	0.05
08/11/2006	0.74	0.55	0.00	1.03	0.73	-

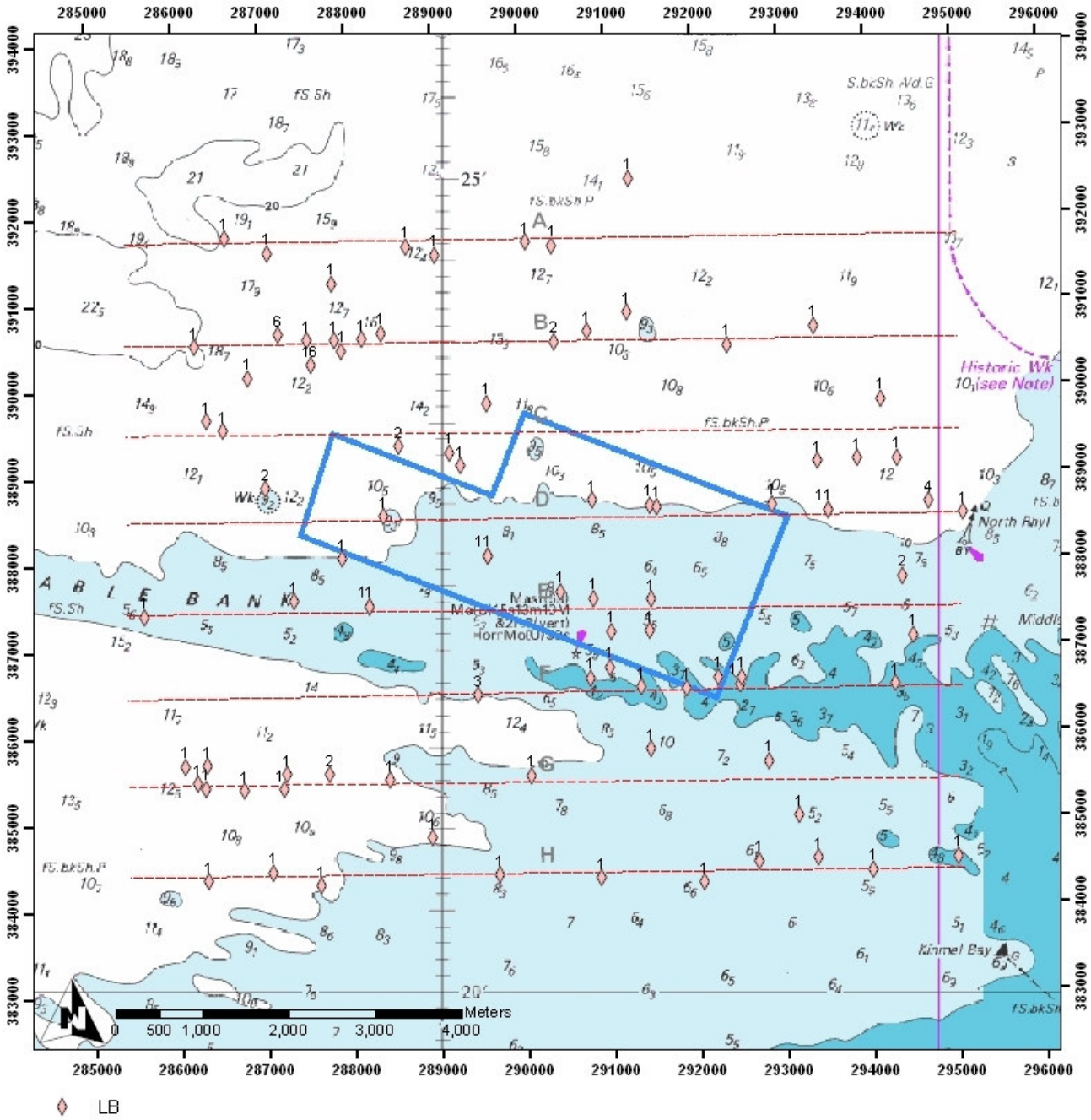
Mapped in Figure 11 Common, black-headed & Mediterranean gulls

10.4.3.10 Lesser black-backed gull

Table 10 Lesser black-backed gull density estimates

	Density Estimates			Standard Errors		
Date	Wind Farm	Buffer	Control	Wind Farm	Buffer	Control
09/08/2005	0.25	0.08	-	0.43	0.35	-
30/10/2005	0.12	0.15	-	0.36	0.28	-
14/11/2005	0.00	0.23	-	0.17	0.13	-
18/01/2006	0.00	0.08	-	0.08	0.06	-
19/02/2006	0.00	0.12	-	0.12	0.10	-
16/03/2006	0.00	0.18	0.00	0.12	0.10	-
22/04/2006	0.00	0.12	0.00	0.08	0.06	-
23/04/2006	0.06	0.03	0.00	0.17	0.12	-
04/05/2006	0.25	0.03	0.47	0.35	0.25	0.24
14/06/2006	0.07	0.05	0.22	0.19	0.13	0.14
05/07/2006	0.12	0.88	0.05	0.84	0.59	0.05
12/09/2006	0.00	0.37	0.23	0.35	0.25	0.12
27/09/2006	0.00	0.00	0.23	-	-	0.15

Figure 12 Lesser black-backed gull



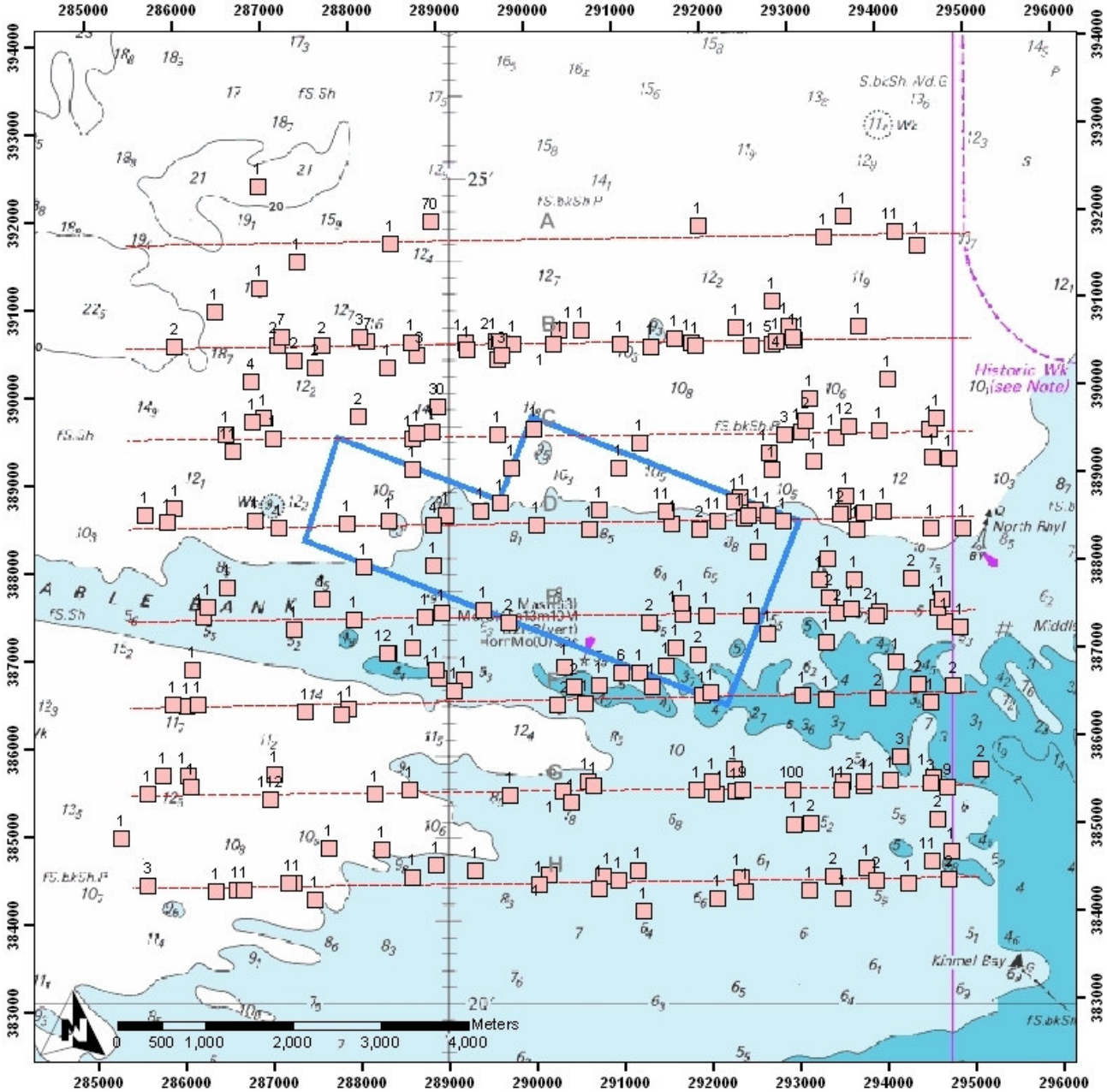
Boat transect survey summary of birds August 2005 to November 2006: Lesser black-backed gull

10.4.3.11 Herring gull

Table 11 Herring gull density estimates

	Density Estimates			Standard Errors		
Date	Wind Farm	Buffer	Control	Wind Farm	Buffer	Control
09/08/2005	0.74	0.00	-	1.95	1.59	-
18/09/2005	0.12	0.12	-	0.35	0.27	-
30/10/2005	0.00	7.54	-	7.64	6.00	-
14/11/2005	0.12	0.55	-	0.46	0.36	-
10/12/2005	0.37	0.53	-	0.61	0.46	-
18/01/2006	0.25	0.14	-	0.45	0.36	-
19/02/2006	0.00	0.08	-	0.08	0.06	-
16/03/2006	0.07	0.09	0.33	0.19	0.16	0.22
22/04/2006	0.12	2.76	1.08	2.76	1.95	0.58
23/04/2006	0.12	0.43	1.92	0.29	0.20	1.14
04/05/2006	1.34	0.35	0.22	1.16	0.82	0.17
14/06/2006	0.00	0.15	0.76	0.10	0.07	0.64
05/07/2006	0.00	0.37	0.27	0.32	0.23	0.18
12/09/2006	0.00	0.16	0.05	0.15	0.11	0.05
27/09/2006	0.25	0.47	0.11	0.59	0.41	0.11
04/10/2006	0.00	0.12	0.60	0.14	0.10	0.31
08/11/2006	0.00	0.13	0.05	0.15	0.11	0.05

Figure 13 Herring gull



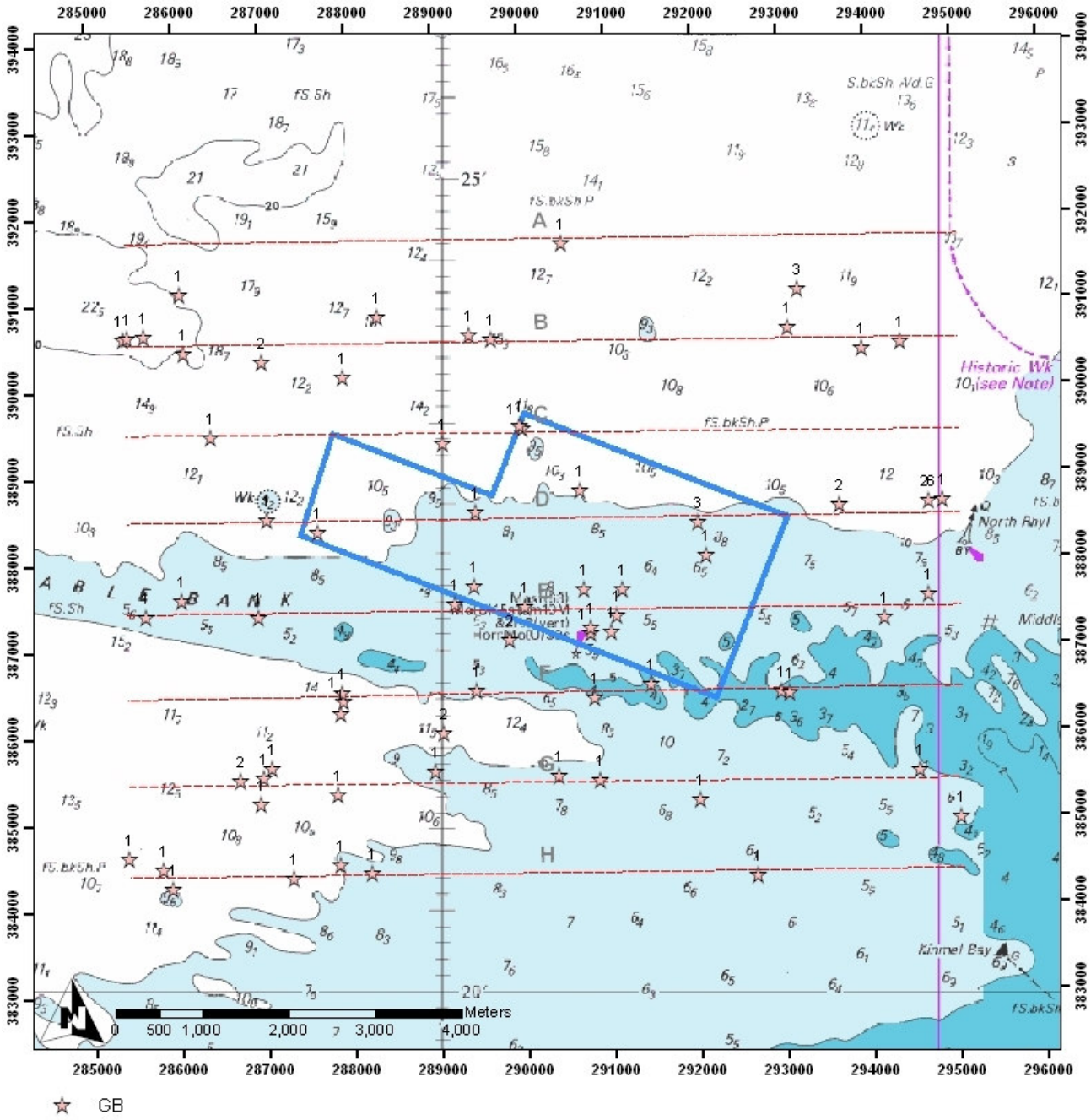
Boat transect survey summary of birds August 2005 to November 2006: Herring gulls

10.4.3.12 Great black-backed gull

Table 12 Great black-backed gull density estimates

	Density Estimates			Standard Errors		
Date	Wind Farm	Buffer	Control	Wind Farm	Buffer	Control
09/08/2005	0.49	0.00	-	0.69	0.57	-
18/09/2005	0.00	0.15	-	0.10	0.08	-
30/10/2005	0.00	0.15	-	0.10	0.08	-
19/02/2006	0.37	0.00	-	0.97	0.76	-
22/04/2006	0.06	0.23	0.15	0.24	0.17	0.11
23/04/2006	0.00	0.16	0.05	0.15	0.11	0.05
04/05/2006	0.06	0.03	0.06	0.17	0.12	0.06
14/06/2006	0.12	0.00	0.00	0.32	0.23	-
05/07/2006	0.06	0.00	0.00	0.16	0.11	-
12/09/2006	0.06	1.65	0.16	1.85	1.31	0.12
27/09/2006	0.18	0.12	0.71	0.49	0.35	0.42
04/10/2006	0.06	0.32	0.05	0.34	0.24	0.05

Figure 14 Great black-backed gull



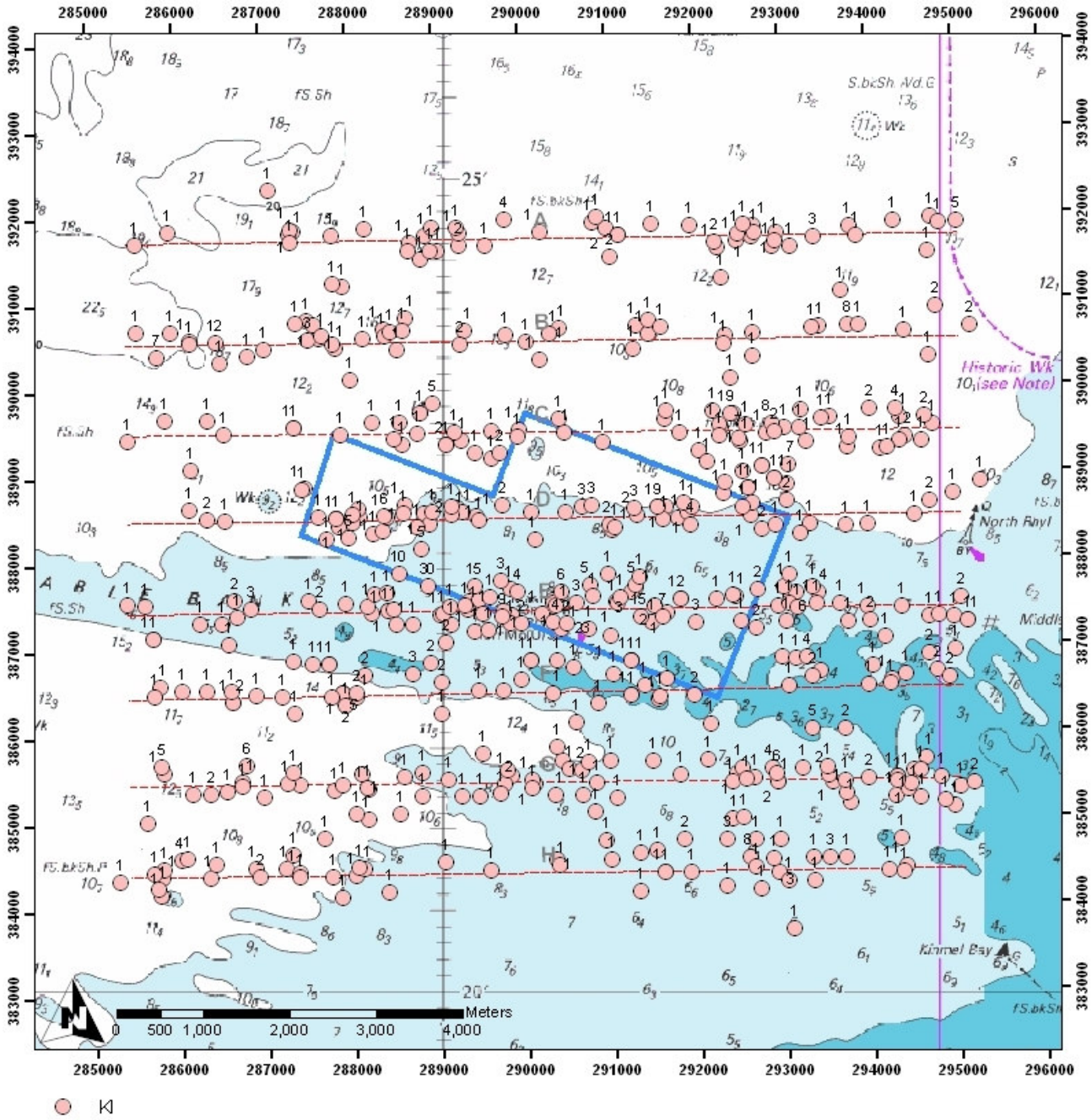
Boat transect survey summary of birds August 2005 to November 2006: Great black-backed gull

10.4.3.13 Kittiwake

Table 13 Kittiwake density estimates

	Density Estimates			Standard Errors		
Date	Wind Farm	Buffer	Control	Wind Farm	Buffer	Control
09/08/2005	0.49	0.00	-	0.69	0.57	-
18/09/2005	0.12	0.23	-	0.36	0.29	-
30/10/2005	0.74	0.65	-	2.00	1.57	-
14/11/2005	0.12	0.30	-	0.35	0.27	-
10/12/2005	0.37	0.59	-	0.58	0.44	-
18/01/2006	0.37	0.33	-	0.51	0.41	-
19/02/2006	0.12	0.30	-	0.38	0.30	-
16/03/2006	0.75	0.14	0.00	0.74	0.63	-
22/04/2006	0.74	1.92	2.55	0.80	0.56	0.82
23/04/2006	1.10	0.46	0.88	1.43	1.01	0.45
04/05/2006	10.26	3.23	2.74	10.63	7.52	0.93
14/06/2006	0.44	0.70	1.02	0.76	0.54	0.40
05/07/2006	2.51	0.58	2.14	2.62	1.85	0.82
12/09/2006	0.61	1.34	0.55	1.35	0.96	0.24
27/09/2006	0.55	0.03	0.84	1.29	0.91	0.40
04/10/2006	0.12	0.36	0.00	0.44	0.31	-
08/11/2006	0.06	0.03	0.35	0.17	0.12	0.30

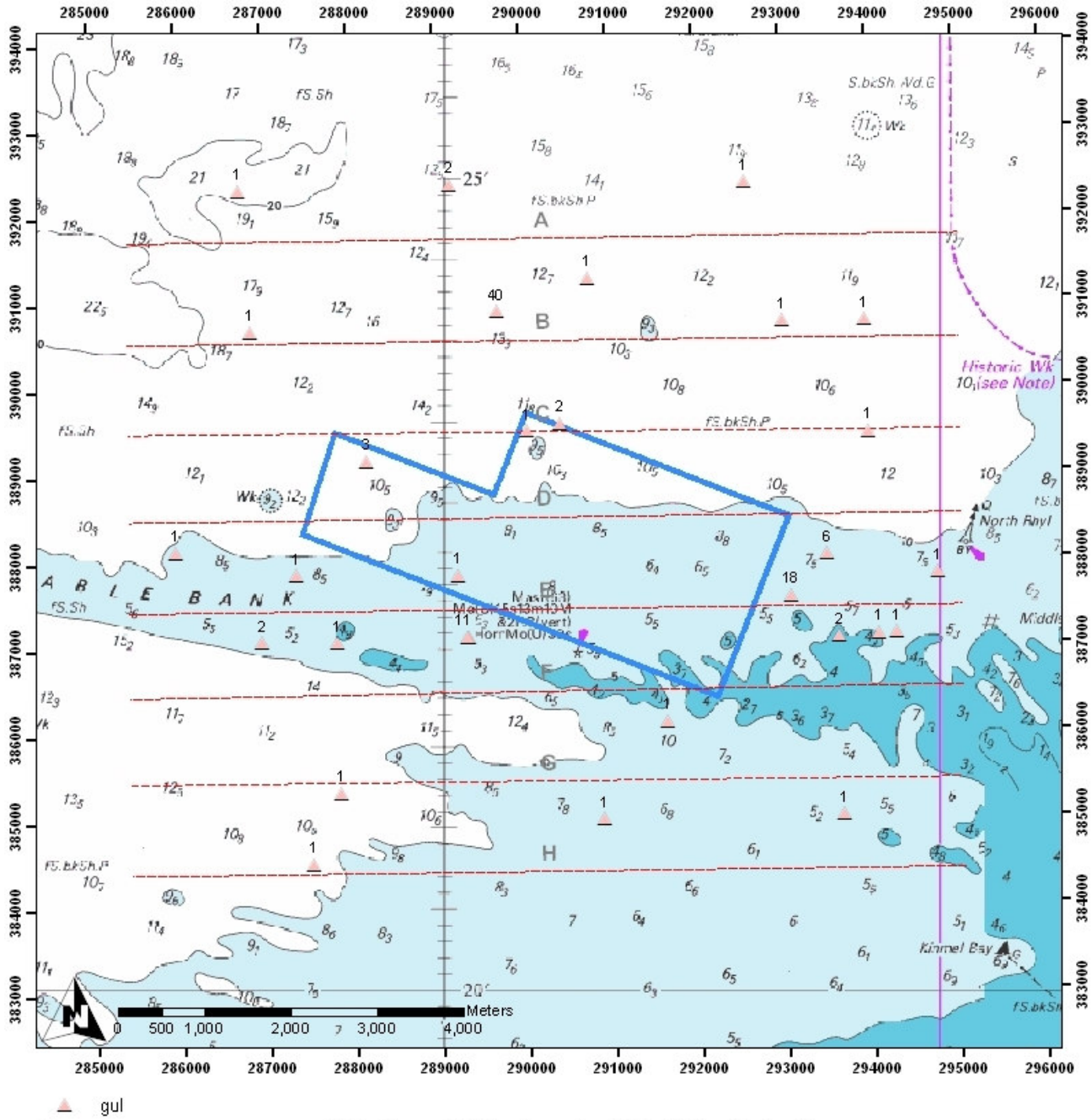
Figure 15 Kittiwake



Boat transect survey summary of birds August 2005 to November 2006: Kittiwake

10.4.3.14 Unidentified gulls

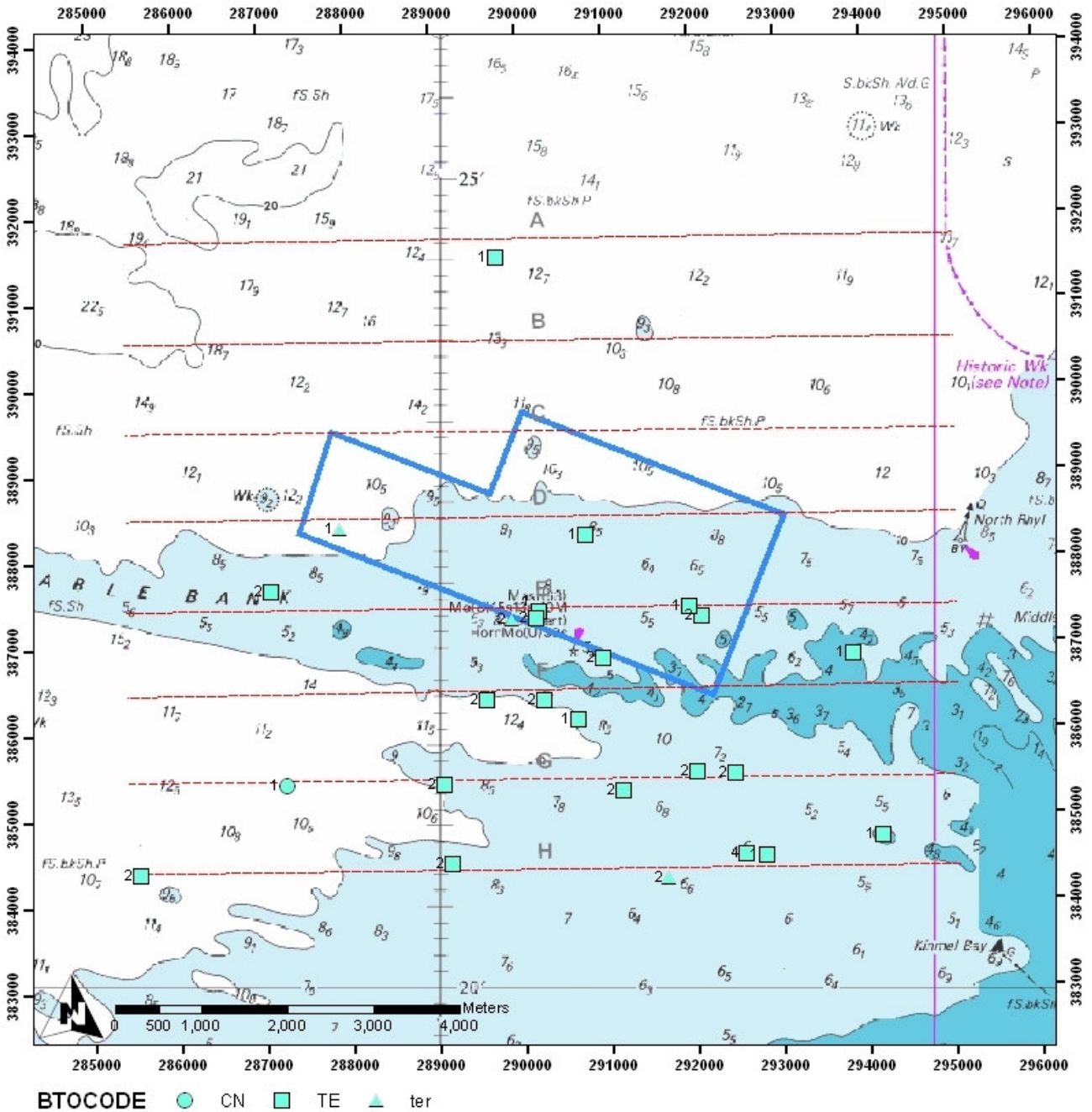
Figure 16 Unidentified gulls



Boat transect survey summary of birds August 2005 to November 2006: Unidentified gulls

10.4.3.15 Terns

Figure 17 Terns



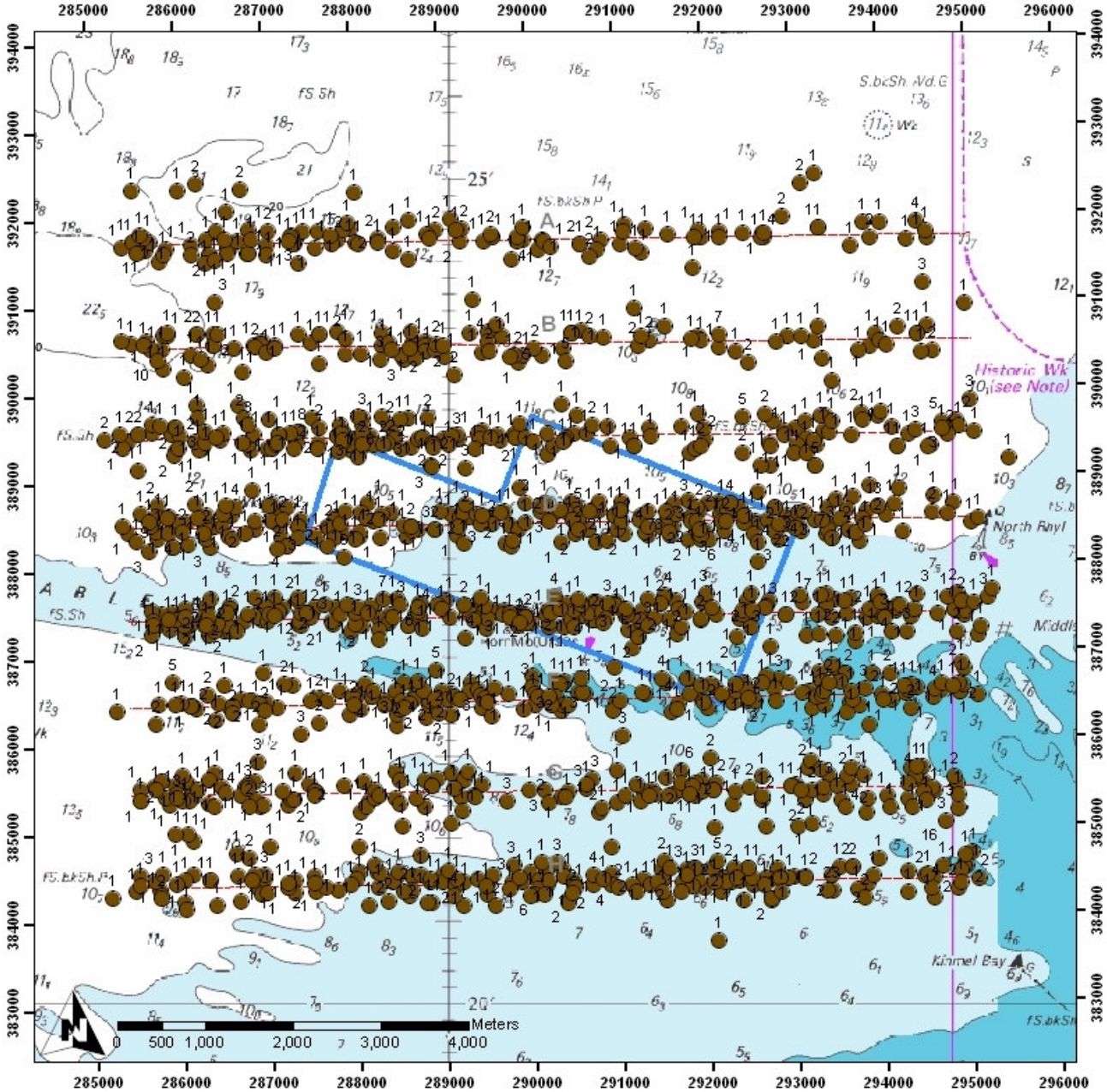
Boat transect survey summary of birds August 2005 to November 2006: Terns

10.4.3.16 Guillemots

Table 14 Guillemot density estimates

	Density Estimates			Standard Errors		
Date	Wind Farm	Buffer	Control	Wind Farm	Buffer	Control
09/08/2005	0.12	0.16	-	0.36	0.29	-
18/09/2005	0.37	5.37	-	2.33	1.83	-
30/10/2005	3.31	1.28	-	4.25	3.33	-
14/11/2005	2.45	1.38	-	2.29	1.79	-
10/12/2005	2.58	2.94	-	2.25	1.70	-
18/01/2006	2.82	0.99	-	2.45	2.00	-
19/02/2006	3.68	3.78	-	4.11	3.23	-
16/03/2006	2.83	1.48	1.82	1.94	1.65	0.61
22/04/2006	15.76	4.83	5.72	12.67	8.96	1.58
23/04/2006	15.64	7.47	3.25	11.84	8.37	0.64
04/05/2006	3.91	2.95	1.91	1.83	1.29	0.44
14/06/2006	4.07	2.98	1.77	3.39	2.40	0.90
05/07/2006	5.76	4.70	22.42	2.52	1.78	9.81
12/09/2006	1.23	1.89	4.54	1.09	0.77	1.24
27/09/2006	0.43	0.03	0.40	0.52	0.37	0.25
04/10/2006	1.66	1.91	3.11	1.41	1.00	0.91
08/11/2006	0.61	6.03	2.71	4.01	2.84	0.80

Figure 18 Guillemots



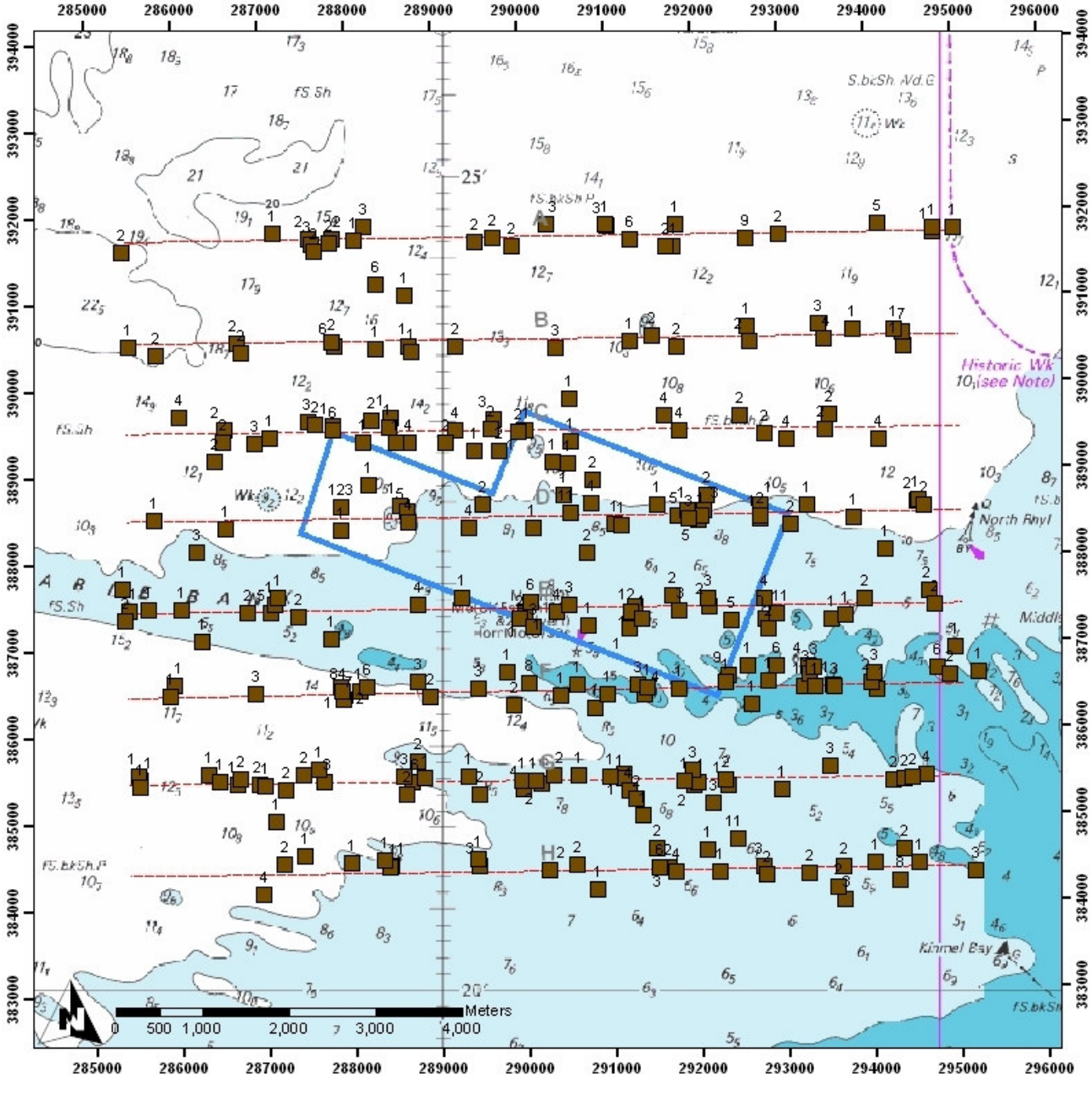
Boat transect survey summary of birds August 2005 to November 2006: Guillemot

10.4.3.17 Razorbills

Table 15 Razorbill density estimates

	Density Estimates			Standard Errors		
Date	Wind Farm	Buffer	Control	Wind Farm	Buffer	Control
18/09/2005	0.00	0.46	-	0.47	0.37	-
30/10/2005	3.00	2.76	-	4.54	3.56	-
14/11/2005	2.37	1.93	-	3.02	2.37	-
10/12/2005	3.12	2.49	-	2.68	2.02	-
18/01/2006	1.00	1.39	-	2.14	1.74	-
19/02/2006	2.00	1.00	-	3.24	2.54	-
16/03/2006	3.45	0.23	4.42	2.47	2.11	1.62
22/04/2006	0.87	0.60	2.79	1.13	0.80	1.14
23/04/2006	1.19	0.19	2.69	1.74	1.23	1.57
04/05/2006	0.19	0.64	0.34	0.48	0.34	0.28
05/07/2006	0.06	0.00	0.00	0.17	0.12	-
12/09/2006	1.44	1.10	1.22	2.10	1.48	0.49
27/09/2006	2.94	1.22	1.77	4.92	3.48	0.80
04/10/2006	0.44	0.26	0.72	0.56	0.39	0.52
08/11/2006	0.12	0.29	1.89	0.28	0.20	0.47

Figure 19 Razorbills

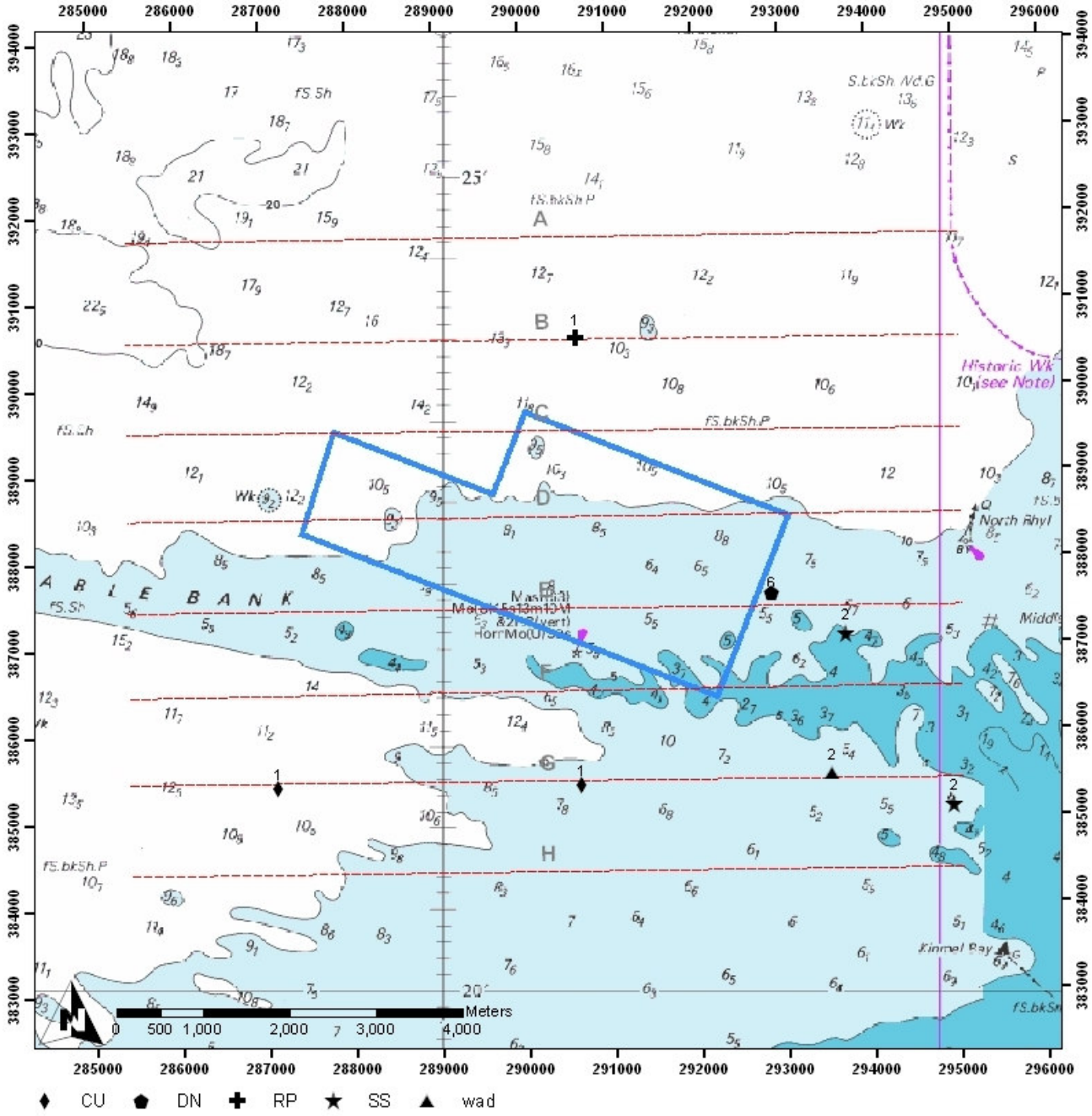


Boat transect survey summary of birds August 2005 to November 2006: Razorbills

10.4.3.18 Auks

10.4.3.19 Waders

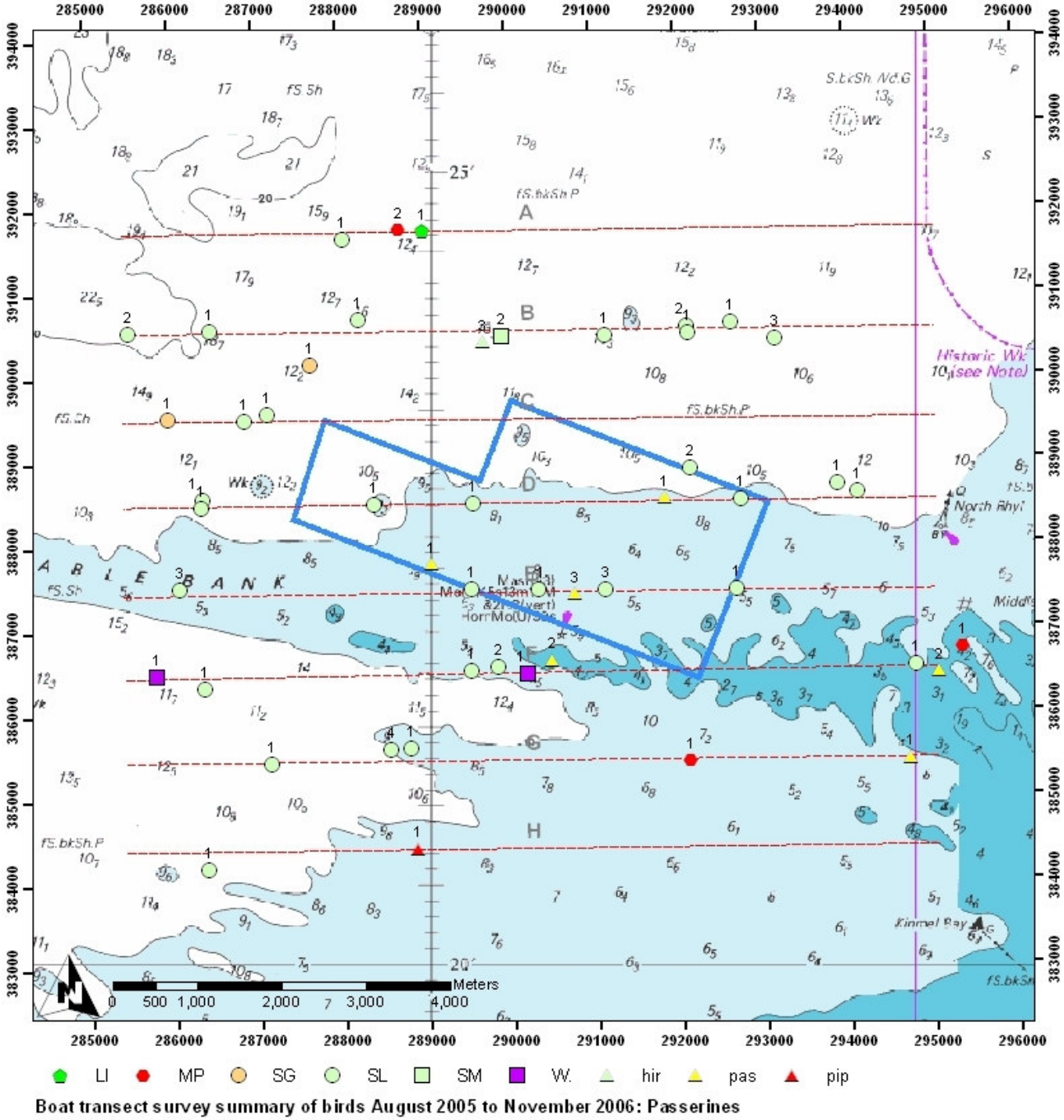
Figure 20 Waders



Boat transect survey summary of birds August 2005 to November 2006: Waders

10.4.3.20 Passerines

Figure 21 Passerines



Boat transect survey summary of birds August 2005 to November 2006: Passerines

10.4.4 Bird flight heights

Table 16 Birds flying at collision risk heights

Species	Number
AC	1
BH	1
CA	13
CM	23
CX	3
GB	18
GU	1
gul	2
GX	51
HG	73
KI	83
LB	24
lgu	12
RH	1
SI	1
SU	3
TE	9
uni	2

10.5 ASSESSMENT AGAINST MONITORING OBJECTIVES

10.5.1 Introduction

10.5.2 Objective 1

Bird numbers vary both seasonally within and between years, so to detect changes in site preferences, it is essential to use one or more control or reference sites in the same area, surveyed on the same time day. Since it did not prove to be especially helpful at NH to compare boat transect data from the two northern and two southern transects within the NH study area, with the three transects traversing NH, this approach is unlikely to be useful at RF (four transects traverse RF) either. In March 2007 there will be a full year of pre-construction control data, plus nine months of baseline data lacking such data. The control site should ensure that this objective is met.

Analyses will be undertaken of changes over time in critical bird densities within the same 4 km^2 'tetrad' grid used in the RF ES, and the basis of WWT aerial survey analyses and the plotting the WWT aerial data. It had previously been proposed that all data collection, analysis and reporting would follow the model previously agreed with CCW for NH. This approach attempted to look for changes in density i.e. interaction estimates between three concentric rectangular bands for <100m, 100m – 500m, 500m to 4km over time, with time to be separated into pre-construction, construction and operational periods. While this could in principle be done, such an approach would be less likely to detect any statistically significant changes than a Before-After-Control-Impact (BACI) approach outlined above.

10.5.3 Objective 2

<CC Awaiting MSR study

10.5.4 Objective 3

The methods of analysis and the magnitude of change that should trigger the benthic survey has yet to be clarified with CCW and was not discussed at the meeting with CCW on 17th May 2006. It is not clear that anyone has so far taken view on what would be a "critical change" for scoter. It is currently difficult to propose a threshold, but this should be discussed with CCW.

10.5.5 Objective 4

Cross ref to CMACS benthic sampling (see Appendix 4 Map showing Benthic Sampling Locations).

10.5.6 Objective 5

No programme of work for this Objective is proposed at this time.

10.6 SUMMARY OF RECOMMENDATIONS

<To follow in draft 2007 RF FEPA Final Report

References

<To follow

Appendices

Appendix 1 Aerial Surveys - Species Distribution Maps

See attached JPEGs

Appendix 2 Boats Surveys - Species Distribution Maps

See attached JPEGs

Appendix 3 Boat Surveyors Reports

September 2005 Survey Summary for Rhyl Flats

Survey conditions were good (westerly force 2 – 3, sea state 2) for bird observations and good to fair for marine mammals.
Unusually low gull numbers were recorded with great black-backed gull being the most numerous. Cormorants were numerous, which included 56 roosting on the met mast. A number could be seen to be immature birds. 28 shag were also recorded – locally a higher than expected percentage of shag to cormorant
The first 'winter visitors' were recorded with 11 divers and 11 common scoter recorded (although there is a small local over-summering population of scoter). Most of these were observed in the southern most transects. It is thought that at least two different species were observed. A surprisingly high number of auks recorded. Some were obviously seen to be immature birds and the great majority were now in winter plumage. The majority of auks were seen on the water, usually in groups of two to six. A migratory tern was also sighted.
One grey seal was seen just to the east of the study area while in transit between transects 3 and 4.

October 2005 Survey Summary for Rhyl Flats

Survey conditions were fair (southerly, becoming south-westerly force 5 – 7, sea state 3 - 4) with very good visibility.
Generally survey conditions were quite good but spray was a minor problem and some birds on the water are likely to have been missed in the C to D bands, especially in the more southerly transect. There was a quite low gull count apart from one 'feeding frenzy' of c100 herring gulls near the south-east corner of the study site. Cormorant were not as numerous as last month. Shags are regularly present on this site but only rarely on North Hoyle, with 6 shag recorded during the survey. 63 common scoter were recorded, most in the southerly transects. At 369 there was high number of auks recorded, and surprisingly, of those identified to species, razor-bill outnumbered guillemot. There were some definite auk 'hot spots' especially in the southerly transects. A 'feeding frenzy' of auks, gulls, and gannet was witnessed near the south-east corner of the study site and another close by with auks the herring gulls mentioned above.
Two Sanderling were seen flying to the east and one Starling was seen heading to the south as they migrated through the site.

November 2005 Survey Summary for Rhyl Flats

A stiff westerly breeze (force 4 – 6, westerly) resulted in a sea state of 4 to 5 for much of the survey which is higher than the recommended JNCC guidelines for marine mammal surveying, (none were seen), but within the guidelines for birds. Although not ideal, visibility was good and generally surveying conditions were reasonable, although a few birds may have been lost from sight in the swell troughs in the C to D bands.
Gull counts werelow, with 41 recorded. Herring gull and kittiwake were the most numerous. The 144 auks recorded were fairly evenly distributed throughout the site and of those identified to species, there was an approximate even split in numbers between guillemot and razorbill. Cormorant and shag were numerous and fairly evenly distributed although a few more were recorded in the southern transects and 29 cormorant were recorded on the meteorological mast.

69 common scoter were recorded in small groups, all on or over the shallower water in transects 6, 7, and 8. It was unusual to see a pair of shelduck flying though the site. 10 red-throated divers were recorded today – presumably 'resident' over-wintering birds.

December 2005 Survey Summary for Rhyl Flats

<AM Still awaited from ERM

- ERM were still waiting for the boat track data to be forwarded from VTC Marine, which we should receive during the first week in January 2006. It is therefore anticipated that the December survey data will be completed and forwarded to Npower by the second week in January 2006.
- *On 24 February December 2005 and January 2006 survey data is currently at Stage 3 and 2 respectively.*

January 2006 Survey Summary for Rhyl Flats

The survey was carried out between 10:24 and 15:40 on the 18th January 2006. Survey conditions were good (westerly force 3, sea state 2/3) for bird observations and good to fair for marine mammals.

An overcast day with occasional light drizzle and a slight sea resulted in good survey conditions. Although it appeared that very few birds on the water will have been missed in the A to D bands, the predominance of birds in the A and B bands would suggest otherwise. Being overcast, sun glare was never a problem but contrast, or lack of it, between sea and sky seemed to make picking birds out difficult.

There was a very low gull-count with only 39 recorded showing no real pattern in their movements. Kittiwake were the most numerous gull, with 17 recorded, followed by herring gull and common gull. Only two lesser black-backed gull were recorded and no great black-backs. This site always seems to be more popular with shag than the North Hoyle site which always has a predominance of cormorant. 39 shag were recorded today and 27 cormorant. Most of the cormorant were roosting on the met mast. Shag are only very rarely seen on the masts in the area.

At 104 there was an average number of auks recorded, fairly evenly distributed about the site. Of those identified to species, guillemot outnumbered razorbill by approximately two to one. 12 red-throated diver were identified. Six Goldeneye were seen flying through the site; from recollection the first recorded here.

At 1700 there was a very high common scoter count, virtually all seen in the two southern-most transects. C600 were seen beyond the southern boundary of the site and a number of these may have been double counted within the large group of c750 birds that flew north across the bow.

No marine mammals were seen.

February 2006 Survey Summary for Rhyl Flats

The survey was carried out between 11.09 and 16.04 on the 19th February 2006. Survey conditions were good (north-easterly force 3/4, sea state 3) for bird observations and good to fair for marine mammals.

A temporary problem with the autopilot in parts of transects 5 and 6 resulted in parts of these lines not being run quite as straight as expected.

A bright cold day with a moderate sea resulted in quite good survey conditions. As on most offshore bird surveys, although it appeared that very few birds on the water will have been missed in the A to

D bands, the predominance of birds in the A and B bands would suggest otherwise. It is unlikely that many flying birds will have been missed within 300m.
64 gulls were recorded in total with common gull being the most numerous. On previous surveys this site has been more popular with shag than the North Hoyle site which always has a predominance of cormorant. However today 39 cormorant were recorded, most roosting on the met mast, and only two shag.
At 127 there was an average number of auks recorded, fairly evenly distributed about the site. Of those identified to species, guillemot outnumbered razorbill by approximately three to one. 15 red-throated diver were recorded and one black-throated diver was identified. Unusually, several of the divers were disturbed quite close to the vessel, probably catching them unawares while feeding underwater. It was interesting to record two red-breasted mergansers with three more seen while travelling between transects 7 and 8.
As has become expected, virtually all the common scoter were recorded in the southern-most transect. Some of the 229 scoter were definitely seen to be flushed by the survey vessel and many that were not recorded as such may well have been missed taking off from the water because of the long distance that they are sometimes disturbed by a vessel.
No marine mammals were seen today.

ORNITHOLOGICAL AND MARINE MAMMAL SURVEY MARCH 2006				
RHYL FLATS SURVEYORS' REPORT				
GENERAL				
Site		**Rhyl Flats**		
Client		**RWE NPower**		
Survey Number		**1**	**Survey Date**	**16/03/06**
Report Date		23/03/06		
Report Author(s)		Simon Pinder		
PERSONNEL				
Surveyor(s)		Paul Gill , Simon Pinder, and Stuart Thomas		
Survey Vessel		*MV Aora*		
Skipper **Crew**		Michael Parker Duncan Fraser, Stuart Cockbain, Fraser Hamilton, Jason Fraser		
TIMING (15/01/06 – 17/03/06)				
Departure Port		Largs (on 15/03/06)	**Return Port**	Largs (on 17/03/06)
	Departure	10:00 (15/03/06)	**Start Survey**	06:11
	Return	10:45 (17/03/06)	**End Survey**	10:46
Tides	**Tide Port**	Liverpool	**HW(ht.m.) 15/03/06**	11:35 (9.2m) and 23:52 (9.0m)
	Cycle	Neaps	**HW(ht.m.) 16/03/06**	12:04 (9.3m)
			HW(ht.m.) 17/03/06	00:21 (9.1m) and 12:34 (9.4m)
WEATHER				

Transect	Start	End	Wind dir	Wind speed	Swell ht (m)	Swell dir	Wave ht (m)	Sea state	Temp	Vis (km)	Sun glare	Precipitation
A	06:11	06:39	E	5			1.5	3	Very	1-5	No	None
B	06:43	07:11	E	5			1.5	3	Cold	>8	No	None
C	07:14	07:38	E	5			1.5	3	Cold	>8	No	None
D	07:43	08:13	E	5			1.5	3	Cold	>8	No	None
E	08:15	08:41	E	5			1.5	3	Cold	>8	No	None
F	09:18	09:44	E	5			1.5	3	Cold	>8	No	None
G	09:48	10:13	E	6			1.5	3	Cold	>8	No	None
H	10:19	10:46	E	6			1.5	3	Cold	>8	No	None

Description

The wind was a fairly constant force 5, this made surveying difficult on the west-east transects, but was no problem on the east-west transects.

There was no swell, but the waves were around 1.5m in height. The sea state was not a problem for observing birds, but borderline for recording sea mammal data.

There was no precipitation.

Visibility was good throughout.

It was cold throughout, especially on the west-east transects.

AIMS & METHODS

Aims:

- To establish which bird species use or pass through the study area in March.
- To estimate the abundance of bird species using the study area in March.
- To note any migratory species passing through the study area in March.

Methods:

The standard ESS survey methodology was adapted to accommodate two surveyors, as recommended by the COWRIE NIOZ (2004) report. Birds were detected with the naked eye, with identification being confirmed using Swarovski EL 8.5 x 42, Leica Ultravid 10 x 42, Swarovski EL 10 x 42 or Swarovski EL 8 x 32 binoculars. Every minute (just after the snapshot count of flying birds) the area in front of the boat was scanned with binoculars to detect divers, auks and seaducks on the water. The surveyors alternated sides to avoid possible bias.

GENERAL COMMENTS

Transects surveyed. A to H, north to south.

BIRD ACTIVITY SUMMARY – STANDARD METHODOLOGY (species, numbers, etc.)

Common Name	*Species*	*Total Number Sighted*				*Total Number In Transect*			
		Total	Flying*	On Sea*	Feeding	**Total**	Flying*	On Sea*	Feeding
Divers & Grebes									
Red-throated Diver	*Gavia stellata*	**37**	37	13	0	**21**	21	11	0
Diver sp.	*Gavia sp.*	**1**	1	1	0	**1**	1	1	0
		38	**38**	**14**	**0**	**22**	**22**	**12**	**0**
Procellariforme									
Northern Fulmar	*Fulmarus glacialis*	**3**	3	0	0	**1**	1	0	0
		3	**3**	**0**	**0**	**1**	**1**	**0**	**0**

Cormorants									
Cormorant	*Phalacrocorax carbo*	**40**	32	14	0	**15**	14	7	0
Shag	*Phalacrocorax aristotelis*	**18**	7	13	0	**13**	2	13	0
Cormorant/shag	Phalacrocorax sp.	**11**	11	0	0	0	0	0	0
		58	**39**	**27**	**0**	**28**	**16**	**20**	**0**
Diving Ducks									
Common Scoter	*Melanitta nigra*	**568**	562	68	0	**188**	182	68	0
		568	**562**	**68**	**0**	**188**	**182**	**68**	**0**
Sawbills									
Red Breasted Merganser	*Mergus serrator*	**22**	22	0	0	**14**	14	0	0
		22	**22**	**0**	**0**	**14**	**14**	**0**	**0**
Gulls									
Black Headed Gull	*Larus ridibundus*	**2**	2	0	0	**1**	1	0	0
Common Gull	*Larus canus*	**23**	22	6	3	**13**	12	6	1
Lesser Black Backed Gull	*Larus fuscus*	**11**	10	3	0	**3**	2	3	0
Herring Gull	*Larus argentatus*	**17**	17	2	0	**3**	3	2	0
Great Black-backed Gull	*Larus marinus*	**4**	4	0	0	**0**	0	0	0
Kittiwake	*Rissa tridactyla*	**24**	19	9	0	**15**	10	9	0
Gull sp.		**1**	1	0	0	**0**	0	0	0
		82	**75**	**20**	**3**	**35**	**28**	**20**	**1**
Auks									
Guillemot	*Uria aalgae*	**100**	55	59	0	**72**	29	56	0
Razorbill	*Alca torda*	**70**	37	57	1	**55**	22	54	1
Auk sp.		**26**	18	10	0	**9**	2	9	0
		196	**110**	**126**	**1**	**136**	**53**	**119**	**1**
Total for all birds		**978**	**860**	**255**	**4**	**424**	**316**	**239**	**2**

* Occasionally in this summary the same bird may be shown both in the flight and on sea columns. These birds took off or landed. Such records will be partitioned prior to analysis.

BIRD ACTIVITY COMMENTS

Thirty-seven red-throated divers were recorded, this is the highest number observed in the winter 2005/2006. The records were spread across all transects from B to H, with a third seen on transect F (which travels over the shallowest water, less than four metres deep at the eastern end).

Approximately average numbers of cormorants and shags were observed, although there is much variation between months, this is perhaps due to variations in prey availability (the same is probably true for all predatory bird species, e.g. divers and auks).

568 common scoter were counted. There has been a steady build up from September to December, with a big leap in numbers in January.

Twenty-two red-breasted merganser were observed. This is the first record for the winter.

Small numbers of gulls were seen, with most species just above average.

Large numbers of auks were observed, with both guillemots and razorbills recorded in their highest numbers this winter, although in October a very large number of auks were unidentified. The rise in numbers of auks in March is probably due to birds returning to their breeding colonies on the north Wales coast.

No gannets were recorded.

MARINE MAMMAL SUMMARY (species, numbers, etc.)

No marine mammals were recorded on the survey.
MARINE MAMMAL ACTIVITY COMMENTS
No marine mammals were recorded on the survey.

Appendix 4 Map showing Benthic Sampling Locations