Environmentally
Sustainable Systems Ltd

KENTISH FLATS WIND FARM FIFTH ORNITHOLOGICAL MONITORING REPORT

Report to Kentish Flats Ltd

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1 EXECUTIVE SUMMARY

This Fifth and Final Ornithological Monitoring report which covers Year 6 of the bird monitoring programme, presents and analyses the results of the 17 boat surveys from 10th December 2006 to 21st November 2007 for the Kentish Flats offshore wind farm, and aerial data collected during two surveys flown on 3rd and 18th February 2007 in the area surrounding the wind farm. The purpose of this report is to meet the FEPA license monitoring requirements determined by DEFRA (following advice from English Nature, now Natural England) as a planning consent condition for the construction of the Kentish Flats project.

Population estimates with means and standard errors for the wind farm site and buffer zone and for the control site have been calculated using the data collected during each of the 108 boat surveys since October 2001. Standard errors have been updated and improved by the larger (6-year) dataset. Relative abundance indices have been calculated with standard errors for all WWT aerial surveys covering Kentish Flats.

The statistical comparisons of the boat and aerial survey data have not revealed any statistically significant changes (at the 5% level of statistical significance) in the abundances of bird populations (FEPA Objective 1) between the preconstruction, construction and operational periods. In particular the aerial data analyses provided no evidence of displacement of birds from the region that includes the Kentish Flats wind farm. As in previous years the statistical analysis of the boat data are somewhat restricted by the lack of comparable data from the control area for a proportion of the surveys, especially during the peak diver period, and the lack of consistency in the period within which surveys were completed, together with the natural and in some cases extensive seasonal and inter-annual variation in the numbers and distributions of bird populations. Patterns of use and passage in and around the Kentish Flats wind farm, revealed by the mapped distributions of birds seen, do show some changes between years but in most cases it is not possible through statistical analysis to attribute these changes to the construction or operation of the wind farm.

Eight red-throated divers were seen from the boat within the operational turbine array during 2007 (see Figure 134). Although no divers were seen during the aerial surveys within the Kentish Flats wind farm area (Figure 137 and 139) there were six records of ten individuals - all red-throated divers. Divers had not been seen within the wind farm site during the previous reporting period (Year 5), and together these results indicate some displacement of divers from the Kentish Flats wind turbine array. This conclusion is supported by the impressions of the surveyors that divers are avoiding the area in the main. Aerial data covering the wider Thames estuary has shown areas out with the wind farm site to be more important for divers in the main. A review of aerial data in the outer Thames and evidence of diver behaviour in operational sites is included in section 6.2.

Even though there were no changes in bird abundance within the wind farm site and buffer zone in relation to the control area that were statistically significant, the quantitative density comparisons between the pre-construction, construction and operational phases did suggest that red-throated diver numbers within the wind farm area are lower during the operational phase.

Numbers of lesser black-backed gull estimated in February were lower in the construction and operational phases (and possibly also in other winter months). Common guillemot numbers appear to be lower from January to March (2 each in 2006 and 2007) since the wind farm became operational Gannet, cormorant, great black-backed gull, herring gull and common tern numbers show no evidence of changes.

Objective 2 of the FEPA license sought to establish whether there has been a disruption to bird flight lines. This primarily concerns terns, and possibly also wildfowl and waders. Waders and geese have flown though the turbine array in the previous year, but none were seen doing so in this reporting period. The pattern of common tern flights, recorded in previous years, regularly passing through the southern part of the turbine area carrying fish to their breeding Medway colonies, was less pronounced from 2005 to 2007 than previously. This is the only example of a regularly used flight line detected by boat surveys before construction at Kentish Flats commenced. While there is no evidence that any other species used regular flight lines through the boat survey area, or that the common tern flight line has been disrupted, there is an indication that terns are now flying north and south of the turbines (see

Figures 107 & 136). Upon request by Natural England some consideration of effects on tern colonies has been incorporated in this report (see section 6.3) though it is important to note that the study methodology was not developed to detect correlations between potential barrier effects, flight behaviour, and breeding success in the Medway tern colonies. In terms of a barrier effect, given that the distance between these colonies and the feeding areas off the north coast of Thanet is circa 40km, flight line divergence to the north or the south of the wind farm would seem unlikely to be of significance in case of the Kentish Flats wind farm. Some consideration has been given to the overall effects on tern breeding success in section 6.3.

Objective 3 is primarily met by maps showing accumulated diver distributions (Figures 134, 137 & 139) along with wildfowl and wader records within this reporting period. Both boat and aerial survey data have been used to address Objective 3, and continue to suggest a minor importance of the wind farm site and buffer zone for wintering wildfowl and other species qualifying the coastal SPA sites surrounding the Thames Estuary. The most frequently seen wildfowl during the boat surveys in Year 6 were again common scoter, with 28 seen within the boat survey area, including 12 inside the turbine array (see Figure 135). Figure 135 shows that goose flights seen during the boat surveys were less frequent in this reporting year than previously, with 15 dark-bellied Brent, two unidentified Brent and one greylag goose seen within the buffer zone, and one greylag goose seen within the control site. As in the previous year no geese were seen from the air near the wind farm.

Objective 4 relates to the rate of bird collision. No formal assessment of collision risk has been made in this report as agreed with Natural England. Very few divers, gannets, wildfowl, waders and terns have been seen at rotor height above 20m asl (see Tables 27 and 28). Following discussion of the 2006 bird monitoring data with Natural England, the possible effect of storm conditions on flight height has been considered in section 6.1.

INTRODUCTION

This Fifth Monitoring Report analyses the results of the 12 months of boat data collected from December 2005 to November 2006 for the Kentish Flats offshore wind farm project, and aerial data collected from 13th November 2005 to 18th February 2006 over the area immediately surrounding the Kentish Flats wind farm site. The aerial surveys cover a much greater area extending far beyond the Kentish Flats site, and are part of the wider aerial bird survey regime that covers the Thames strategic offshore wind farm area.

The purpose of this report is to meet the monitoring requirements set out by DEFRA (with advice from English Nature, now Natural England) as a condition for the FEPA consent for the Kentish Flats project. The objectives of the pre-, during and post-construction monitoring program are quoted below from Annex 2 of the Schedule to FEPA Licence No. 31780/03/0, dated March 7th, 2003:

1. **Determine whether there is change in bird use and passage through the wind farm site, measured by species, abundance and behaviour**
2. **Determine whether there is disruption to bird flight lines**
3. **Determine the distribution of wildfowl and divers in the Thames Estuary, covering the Kentish Flats study area. This will include movements of wildfowl to and from the coastal SPA sites surrounding the Thames Estuary**
4. **Determine the rate of bird collision at the Kentish Flats site**
5. **Determine the effectiveness of mitigation measures implemented during wind farm construction**

In this report, Objective 1 is addressed by statistical and visual comparisons of birds detected by boat and aerial surveys during the "Pre-construction Period" from October 2001 to July 2004, the "Construction Period" from August 2004 to August 2005 and the "Operational Period" after late August 2005. Installation of the Kentish Flats monopile foundations extended from August to November 2004. The last turbine was erected on 22nd August 2005, and the largest installation vessel left the area shortly thereafter. Accordingly, boat surveys 1-51 (named A to AX) have been assigned as being pre-construction (last 29th July 2004) and visits 52-69 (AY to BP) as being during the construction phase (26th August 2004 to 1st August 2005). The remaining thirty nine visits BQ to DC (70-108) have been assigned to the site being in operation. The use of the data in this way has permitted a Before-After-Control-Impact (BACI) analysis.

Objective 2 is addressed by examination of the patterns of SPA wildfowl, wader and tern flights (see Figures 135, 138 & 140) by interrogating the database and checking flight directions.

Objective 3 is addressed by the mapping and description of birds seen during the surveys (see Figures 117-140). All Figures referred to in the report, including Figures 1-116 from previous monitoring reports are on the CD inserted at the back of this report.

Objective 4 can in principle be addressed by monitoring bird collisions directly, and/or by modelling collision risk through the monitoring and analysis of bird flight heights and directions during the operational phase of the wind farm, as well as during construction and pre-construction phases (on the unlikely assumption that bird flight behaviour is unaffected by the presence of turbines). There has been no attempt to apply the former approach at any UK offshore wind farm, and few proven technologies exist at present. No formal assessment of collision risk has been made in this report since the number of divers, gannets, wildfowl, waders and terns seen flying at rotor height through the wind farm continues to be very low and no divers have been seen within the wind farm at all (see Figure 105). However the number of birds recorded above 20 above sea level (asl) (i.e. at rotor height) has been tabulated in Tables 27 and 28.

Objective 5 is to determine the effectiveness of mitigation measures to reduce potential impacts upon wintering birds during monopiling operations. This was fully discussed as part of the Second Monitoring Report (Gill, Sales & Beasley 2005) and briefly referred to in the Third Monitoring Report (Gill, Sales & Beasley 2006). It was concluded that disturbance to populations of divers at the Kentish Flats site had been avoided by scheduling pile-driving operations to avoid the peak diver period. No further ornithological mitigation was considered necessary following consultation with English Nature and DEFRA so this objective should be removed from future FEPA license reporting requirements.

2 METHODOLOGY

2.1 BOAT SURVEY METHODOLOGY

During the Kentish Flats ornithological boat surveys, two surveying techniques are used simultaneously:

- A continuous 90 degree scan with a 300m band transect of birds on-sea and in-flight
- A 90 degree snapshot every 2 minutes of birds in-flight.

The details of the boat survey methodology used have remained as presented in the Third Monitoring Report (Gill, Sales & Beasley 2006).

The survey boat used at the Kentish Flats is an 18m former beam trawler, now a full time survey vessel. Using its Differential GPS (DGPS) Track Plotter, the boat travels accurately along pre-determined transects at an average speed of 8 knots.

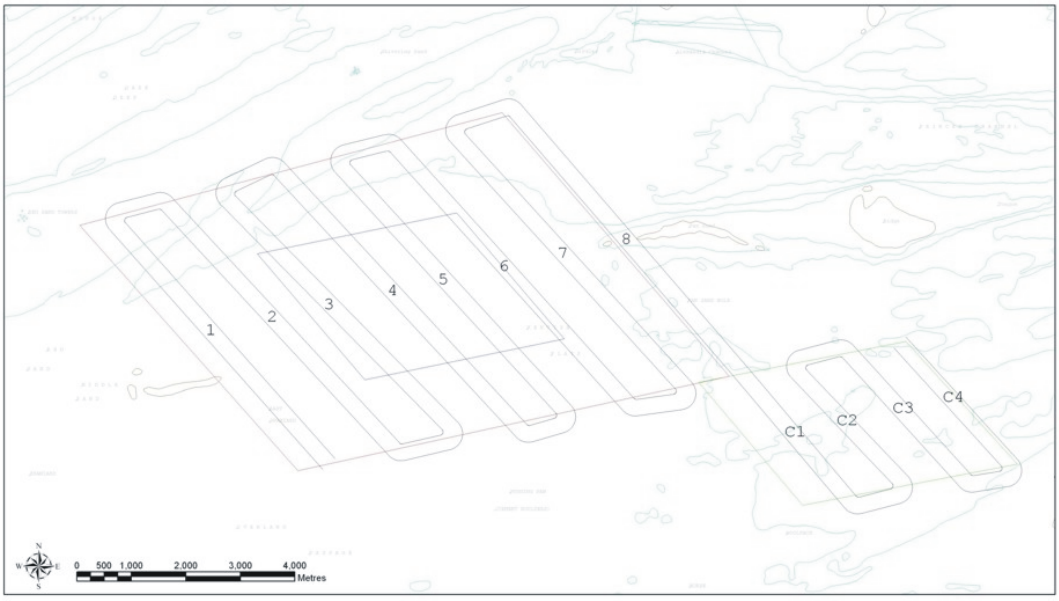
Two surveyors are employed during the Kentish Flats surveys, both JNCC-accredited seabird surveyors who have each logged 1000+ hours surveying seabirds at sea.

The surveyors sit on a purpose built platform at the front of the survey vessel. The platform raises the surveyors' eye-height to 5m above sea level. When on transect, one surveyor observes continuously, while the other acts as scribe, writing down what is seen. When not writing (which is most of the time), the scribe also observes.

2.1.1 Study Areas and Transects

The wind farm and buffer study area and control site, shown below in Figure 1, have remained identical throughout the Kentish Flats ornithological survey program, having been agreed with English Nature and DEFRA. These have been previously described in the Potential Ornithological Impact Report (Gill, Kemsley & Sales 2002) and the First Monitoring Report (Gill, Sales & Pullinger 2004).

Figure 1: Positions of Wind Farm, Buffer Zone and Control Areas within Study Area



Eight transects cover the main survey area (*i.e.* the main Kentish Flats wind farm area and a suitable buffer area around this) and four transects cover the smaller control site, which lies to the southeast of the main survey area (see Figures 1-24, 31-50, 59-78, 89-107). All of the transects are orientated in a southeast - northwest and northwest - southeast direction.

The main survey area transects are 6000m long and 1000m apart. The control area transects are 3000m long and are 875m apart.

2.1.2 Survey Programme

Seventeen surveys were conducted in Year 5 between 10th December 2006 and 21st November 2007. These surveys are referred to as surveys CM to DC, following on from the boat surveys reported on the in the Fourth Monitoring Report (surveys BW to CL). The dates, start times and finish times and tidal conditions of all surveys are given in Table 1 below.

Table 1 Boat Survey Details

Date	Survey	Time		Start from	Control Studied	Wind Dir	Wind Force	High Tide 1		High Tide 2	
		Start	End					Time	M	Time	m
15/11/2002	U	7.58	12.05	N/K	No	S	1-2	08:50	3.9	21:34	4.1
14/12/2002	V	8.26	13.50	N/K	Yes	E-NE	2-3	07:48	3.9	21:38	4.0
22/01/2003	W	8.07	12.29	N/K	No	NW	3	02:42	5.3	15:13	5.2
10/02/2003	X	8.52	14.03	N/K	Yes	S	2-3	05:43	4.1	18:24	3.9
21/02/2003	Y	6.48	11.21	N/K	No	SE	0-1	03:09	5.6	15:39	5.3
06/03/2003	Z	12.26	16.29	N/K	No	W	0-3	02:05	5.1	14:28	5.0
23/03/2003	AA	6.40	11.56	N/K	Yes	SE	0-2	03:34	5.4	16:00	5.0
07/04/2003	AB	7.59	12.23	N/K	No	E	3-4	04:12	4.7	16:31	4.5
15/04/2003	AC	10.20	14.32	N/K	No	SE	2	-	-	12:12	5.1
06/05/2003	AD	8.17	14.15	N/K	Yes	W	1-3	03:49	4.7	16:05	4.6
19/05/2003	AE	5.41	10.41	N/K	No	SW	3	03:13	5.4	15:34	5.2
04/06/2003	AF	7.47	12.40	N/K	No	NW	0-1	03:35	4.7	15:49	4.7
22/06/2003	AG	10.10	15.37	N/K	Yes	SW	2-4	07:16	4.1	19:26	4.1
22/08/2003	AH	6.41	10.36	N/K	No	SW	4-5	08:09	3.7	20:37	3.8
08/09/2003	AI	9.31	13.30	N/K	No	SE-E	1-3	11:26	4.4	-	-
22/09/2003	AJ	12.15	18.43	N/K	Yes	SW-NE	4-8	09:49	3.9	22:32	4.1
12/10 2003	AK	7.00	11.39	N/K	No	SE	4-5	02:07	5.1	14:18	5.1
26/10/2003	AL	13.04	16.47	N/K	No	N	3-4	00:16	5.6	12:32	5.7
06/11/2003	AM	10.51	16.42	N/K	Yes	S-E	2	10:28	4.4	22;58	4.6
08/12/2003	AO	10:46	15:08	N/K	No	SE	4-3	11:51	4.6	-	-
18/12/2003	AP	09:35	14:45	N/K	Yes	SE	3	06:44	4.3	19:37	4.3
03/01/2004	AQ	10:19	14:51	N/K	No	SW	2	08:59	4.1	21:40	4.2
06/02/2004	AR	10:26	16:00	N/K	Yes	W	4-5	00:11	4.8	12:37	4.9
05/03/2004	AS	09:55	14:00	N/K	No	E	1-2	11:33	4.7	23:45	4.9
07/04/2004	AT	12:07	17:45	N/K	Yes	NW	4	02:18	5.8	14:44	5.7
12/05/2004	AU	05:09	09:10	N/K	No	N	4	07:30	4.3	19:48	4.3
28/05/2004	AV	10:29	15:16	N/K	No	S	3	07:41	4.2	19:50	4.3
08/06/2004	AW	08:46	14:40	N/K	Yes	S	1-3	05:06	5.0	17:22	4.9
29/07/2004	AX	08:29	12:41	N/K	No	SE	3	10:44	4.7	23:17	4.8
26/08/2004	AY	10:19	16:24	N/K	Yes	NW	3-4	09:15	4.3	21:59	4.4
03/09/2004	AZ	07:07	11:57	N/K	No	SW	<1	03:48	5.3	16:00	5.3
29/09/2004	BA	06:52	11:44	N/K	No	NW	1-2	01:30	5.3	13:41	5.5
15/10/2004	BB	11:56	16:13	N/K	No	W-NW	3	01:39	5.5	13:51	5.7
27/10/2004	BC	10:15	13:34	N/K	No	SE	4-7	00:24	5.1	12:35	5.2
14/11/2004	BD	11:00	15:17	N/K	No	NW	2-3	01:54	5.6	13:15	5.7
26/11/2004	BE	10:25	15:54	N/K	Yes	SW; W	4-5; 2-3	11:46	5.0	-	-
11/12/2004	BF	08:26	12:43	East	No	SW	1	11:20	5.3	23:49	5.4
19/01/2005	BG	09:34	15:14	East	Yes	W	3-5	07:00	4.2	19:48	4.1
07/02/2005	BH	08:51	13:10	East	No	SW	1-3	10:55	4.9	23:19	5.1
08/03/2005	BI	10:06	15:23	West	Yes	NW	2-4	10:48	4.9	23:08	5.0
03/04/2005	BJ	10:33	15:07	East	No	S	1-3	07:43	4.3	20:13	4.2
22/04/2005	BK	09:58	14:20	East	No	SE	2-4	12:06	4.8	-	-
10/05/2005	BL	05:39	09:44	West	No	N	3-4	02:11	5.3	14:30	5.2
29/05/2005	BM	07:00	12:42	West	Yes	N	0-1	05:19	4.9	17:34	4.9
15/06/2005	BN	10:31	14:47	East	No	S	4-5	06:51	4.2	18:56	4.3
08/07/2005	BO	05:42	11:23	West	Yes	N	4	02:11	4.8	14:24	4.9
01/08/2005	BP	10:24	14:33	West	No	E	3-4	10:24	4.1	22:49	4.1
06/09/2005	BQ	08:27	13:39	East	Yes	E-NE	0-1	02:38	5.2	14:44	5.3
27/09/2005	BR	11:04	15:18	East	No	W	3-4	07:51	3.7	20:50	3.8

03/10/2005	BS	11:22	15:33	West	No	N-NW	2	01:01	5	13:09	5.1
14/10/2005	BT	08:28	12:37	East	No	NE	3	10:15	4.6	23:01	4.8
12/11/2005	BU	10:08	15:29	West	Yes	W	2-3	08:48	4.6	21:36	4.8
17/11/2005	BV	11:00	15:16	West	No	NW	5	00:34	5.3	12:51	5.3
07/12/2005	BW	07:28	12:15	East	No	NW	2-3	04:00	4.9	16:55	4.9
13/01/2006	BX	08:06	13:09	East	Yes	S	3	12:09	4.9	-	-
17/02/2006	BY	12:19	16:24	West	No	W	2-3	02.41	5.1	15.02	5.1
02/03/2006	BZ	06:52	12:10	East	Yes	NW	3	01:57	5.6	14:37	5.5
13/04/2006	CA	09:02	13:08	West	No	W	3-5	13:49	5.0	-	-
19/04/2006	CB	14:43	18:44	East	No	W	4	04:41	4.9	16:52	4.7
02/05/2006	CC	07:10	11:23	West	No	S	2	04:19	5.2	16:33	4.9
23/05/2006	CD	11:08	16:45	East	Yes	W-SW	2-3	10:13	4.9	22:17	4.9
02/06/2006	CE	08:08	12:18	West	No	SW	0-1	05:30	4.7	17:35	4.7
21/07/2006	CF	11:40	17:21	East	Yes	SE	1-2	10:05	4.6	22:30	4.6
07/08/2006	CG	11:48	16:56	West	Yes	N	1-2	11:40	4.8	-	-
18/09/2006	CH	07:56	12:03	East	No	W	3	10:39	4.5	23:32	4.7
29/09/2006	CI	07:36	13:03	East	No	SW	1-4	04:46	4.8	17:10	4.8
09/10/2006	CJ	12:04	17:17	West	Yes	SW	2	02:44	5.5	14:47	5.7
04/11/2006	CK	08:28	12:34	East	No	W-NW	3-4	11:04	5.3	23:50	5.3
01/12/2006	CL	10:32	14:46	West	No	S-SW	4-5	08:31	4.9	21:31	4.9
10/12/2006	CM	08:58	14:07	East	Yes	SW	3-5	03:33	5	16:12	4.80
15/01/2007	CN	10:38	15:03	East	No	SW	3	09:17	4.5	21:51	4.80
02/02/2007	CO	09:41	15:18	West	Yes	W-N	1-2	00:40	5.5	13:06	5.60
02/03/2007	CP	13:16	17:31	East	No	W	1-2	12:11			
06/04/2007	CQ	13:16	17:31	East	No	N	1	03:26	5.5	15:43	5.6
29/04/2007	CR	10:10	13:57	East	No	NE	3	12:08	5.2		
04/05/2007	CS	10:03	15:30	W - E	Yes	NE	4	02:30	5.5	14:46	5.6
21/05/2007	CT	07:04	11:30	W - E	No	NE	4	04:33	5.7	16.49	5.3
08/06/2007	CU	09:40	14:17	E - W	No	NE	2-3	06:38	5.2	18:45	5.1
13/07/2007	CV	10:11	14:25	E-W	No	SW	3	00:03	5.3	12:38	5.3
30/08/2007	CW	10:40	16:24	E-W	Yes	NW	3	02:46	6	14:53	6
10/09/2007	CX	11:07	16:13	W-E	Yes	N-NW	4-5	00:50	5.7	13:04	5.6
02/10/2007	CY	09:03	13:31	E-W	No	N	2-3	04:58	5.4	17:16	5.6
10/10/2007	CZ	08:46	13:54	E-W	Yes	NE	2-4	01:06	5.7	13:16	5.7
31/10/2007	DA	06:48	11:24	E-W	No	W	2	03:41	5.4	16:09	5.6
05/11/2007	DB	09:31	13:47	E-W	No	W	3	09:21	5	22:02	5.3
21/11/2007	DC	09:48	15:11	W-E	Yes	SW	3	06:28	4.4	19:25	4.3

N/K = Not known

Each transect within the main survey area takes approximately 25 minutes whilst every control area transect takes approximately 10 minutes to complete. The time taken to travel between the end of one transect and start of the next is approximately five minutes. Data are not systematically collected during these transect tails. Surveying the main area therefore takes approximately 4 hours whilst the control area takes approximately one hour.

Generally 16-17 surveys are undertaken per year. Over the six year survey period the cumulative number of surveys completed in each month are: 5 in January; 6 in February; 6 in March; 9 in April; 10 in May; 6 in June; 4 in July; 5 in August; 9 in September; 10 in October; 9 in November; and 7 in December.

Whenever possible, surveys are scheduled so as to vary factors such as time of day, state of tide, sea state, weather, and the sequence in which transects are surveyed *i.e.* west to east or east to west, corresponding to transect 1 or transect 8/control transect 4 first (see Table 1 and Figure 1 above).

2.1.3 Influence of Weather, Sun Glare, Tides, Vessels and Fishing Gear

Surveys are not undertaken in thick fog, continuous heavy rain, or sea states greater than 5, nor are surveys ever undertaken before sunrise or after sunset. The dates and timings of surveys are carefully scheduled to avoid unsuitable weather.

COWRIE Guidelines (NIOZ 2004) recommend that no bird survey data should be analysed in sea states of 5 or above, due to the unsuitability of such data for assessment and statistical comparisons. Consequently, any sustained force 5-6 winds, which would produce a sea state of 5, have been avoided. No such conditions occurred during the current reporting period. The forecast for 10th September was NW 4-5 gusting to 6 (see Appendix A3), which could have led to a sea state of 5, but this remained at 4 throughout the survey.

On those occasions when conditions deteriorate after a survey has started, the survey would either halt temporarily until conditions improve, or would be abandoned completely and repeated. In Year 6, due to careful scheduling, no survey attempts had to be abandoned due to deteriorating weather, visibility or sea state. Surveys have not been continued over more than one day.

On 10th December 2006, 21st May and 5th November 2007 slight deviations were required in transect 8 to navigate shallow water. Transect 8 also had to be cut approximately 300m short due to shipping on 15th January 2007. On 5th November, detours from the line were necessary to navigate shallow water on transect 1 and to give clearance to a vessel working in the array on 21st November in transect 3. Detours from the line were also necessary to navigate shallow water on transects 1 and 8 on 31st October.

Sun glare was a slight problem on transects 2 and 4 on 10th September, and on transects 6 and 8 on 5th November (see Appendix A3).

2.1.4 Direction of Scan and of Survey

Observations are always made to the eastern side of the boat - *i.e.* when the boat is travelling NW along a transect, the 90 degree scan is NW to NE and when the boat is travelling SE along a transect, the 90 degree scan is SE to NE.

This protocol was decided upon at the start of the Kentish Flats ornithological monitoring program and agreed with English Nature. It has remained unchanged to ensure the consistency of the long term data sets.

The wind farm and buffer zone may be surveyed from west to east or vice versa. The end of this area at which transects started and therefore the direction of survey is stated in the fifth column of Table 1 above. The control site may have been surveyed before or after this.

2.1.5 Sampling Method

Field methods used during the Year 5 monitoring surveys were identical to those agreed with English Nature and described previously in the Potential Ornithological Impact Report (Gill, Kemsley & Sales 2002) with the following exceptions:

- The method for distance estimation was as described in 2.3.1 of the Third Monitoring Report (Gill, Sales & Beasley 2006)

- Height estimates were no longer calibrated after survey AA on 23rd March 2003

Birds are scanned for using the naked eye. Once a bird has been detected, binoculars may be used to assist with identification of species and age. The one exception to this is the special case of scanning for divers. Divers, especially red-throated divers, frequently flush from the sea at distances too far ahead of the approaching survey vessel to be reliably seen by the naked eye. Therefore, whenever divers are in the area the approach adopted is to quickly, and frequently, scan ahead with binoculars, with less frequent rapid scans through 180 degrees for any divers. For divers, the distance bands A-D are considered to continue up to the estimated edge of the study area whether seen on sea or in flight. Only divers are treated as a special case in this way, in light of their behaviour and their importance within the planned Thames SPA.

When a bird is seen, details of where it was seen and what it was doing at the moment it was first detected are recorded. Any birds associating with the survey boat are ignored or recorded in the Notes field of the field forms indicating that they are "ship associated".

The information recorded for each observation is as follows:

TIME
SPECIES
AGE
NUMBER
DISTANCE BAND
DIRECTION
IN-FLIGHT
ON-SEA
HEIGHT
IN-TRANSECT
NOTES

TIME is documented over a recording interval of 2 minutes

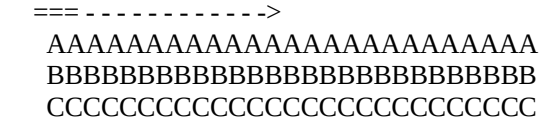
SPECIES has been recorded using two letter BTO codes since 29th May 2005 (up to 10th May 2005 five letter European ESAS codes were used). If a precise identification of the species cannot be made then the most precise identification possible is written down (*e.g.* auk, gul, sea; prior to 29th May 2005 Auk, Gull or Seal).

AGE is recorded as adult or immature or left blank if not obvious.

NUMBER is the number of birds the record refers to. It is almost always a precise count of the individuals. However, when there are a large number of birds to be recorded quickly, *e.g.* a flyby flock of 250 starlings, then it is an estimate and entered as *e.g.* c250.

DISTANCE BAND is either A B C D or E. Distance bands run parallel to the direction of travel of the vessel.
A is 0-50m (measured perpendicular to the direction of travel of the vessel)
B is 50-100m
C is 100-200m
D is 200-300m
E is >300m

When recording birds on-sea or in snapshot each band is considered to be 480m in length (when travelling at 8 knots). When recording birds in-flight each band is considered to continue ahead to the edge of the survey area.



CCCCCCCCCCCCCCCCCCCCCCCCCC
DDDDDDDDDDDDDDDDDDDDDDDDD
DDDDDDDDDDDDDDDDDDDDDDDDD
<---------- L ---------->

Where === is the boat
- -> is the direction of travel of the boat
L is 480m (at 8 knots) when recording birds on-sea or in snapshot
and edge of survey area when recording birds for birds recorded in-flight
A is 50m wide
B is 50m wide
C is 100m wide
D is 100m wide

DIRECTION of flight is recorded for birds in-flight.
Direction has been recorded as either: *e.g.* N, NE, E, SE, S, SW, W, NW *etc* or as compass points in degrees *e.g.* 0, 45, 90, 135 *etc.*, with CIRC (circling), F (following), H (hovering) or V (variable).

IN-FLIGHT is ticked if the bird was in flight.

ON-SEA is ticked if the bird was on the sea, on a buoy or other structure, though feeding birds have both boxes ticked if they were observed in flight and touching or entering the water. Whenever the first sighting of a bird is of it taking off and it is judged to be taking off because of the approach of the survey boat, that bird is recorded as being on the sea and “Flushed” is written in the Notes field. Apart from this, no note is made of birds taking off or alighting.

HEIGHT is recorded for birds in-flight. It is estimated in metres.

IN-TRANSECT is ticked if either the bird was on-sea in band A B C or D and no further ahead than 480m (at 8 knots), or at snapshot time the bird was in-flight in band A B C or D and no further ahead than 480m (at 8 knots). Note this protocol applies to all birds except the special case of divers (see above), in which case the distance bands A-D are considered to continue up to the estimated edge of study area whether seen on sea or in flight.

NOTES records any additional information such as "bird feeding" or "bird flushed" or the presence of other vessels, especially fishing boats. It is also used to indicate any association between individual records. This is done by placing brackets around the relevant records to group them together. Concentrations of fish seen on the boat's fish finder are also noted, as are any marine mammal sightings.

Priority is given to both the order in which information is recorded and to the order in which different species are recorded. However, in practice, the order in which information and different species are recorded is rarely an issue since two observers almost always have sufficient time to write down the required information.

In addition, the surveyors carry a hand-held GPS which logs (with a 1 minute recording interval) the approximate course taken by the boat on each survey. This GPS is switched on before the start of each survey, and at the start and end of each transect the surveyors enter a waypoint marker into its log. At the beginning of each transect, the time and environmental data such as wind speed and direction, wave height, cloud cover, sun glare, precipitation, and temperature are recorded. At the end of each transect the time is also recorded.

In addition to the constant 90 degree scanning of the transects described above, snapshot observations of birds in-flight are undertaken every 2 minutes. These snapshots are scheduled using a digital alarm that sounds for 10 seconds every 2 minutes. On hearing the alarm the surveyors use the 10 seconds for which the alarm sounds to scan for flying birds in the 90 degree scan sector. On the instant the alarm

stops sounding they record as "being in snapshot" those birds that were observed flying in sector at that instant. Birds that are recorded in snapshot are recorded by ticking the In-transect column.

Combining the "continuous 90 degree scan with a 300m band transect of birds on-sea and in-flight" and the "90 degree snapshot of birds in-flight every 2 minutes", produces the following short ruleset for the surveyors:

AT ANY TIME, WHEN ON A TRANSECT ...
Rule 1: Any bird in-flight or on-sea in 90 degree scan
-> record it

Rule 2: If bird is on-sea in band A B C or D
and no further ahead than 480m (at 8 knots)
-> tick In-transect column of record produced by rule 1

AT SNAPSHOT TIME, WHEN ON A TRANSECT ...
Rule 3: If bird is in-flight in band A B C or D
and no further ahead than 480m (at 8 knots)
-> tick In-transect column of record produced by rule 1

ANYTIME, ANYWHERE ...
Rule 4: Anything of interest, that wouldn't otherwise be recorded
-> record as an "incidental record", such as birds of conservation interest on the non-transect side.

Surveyor's reports (see Appendix A3) are produced immediately after each survey to summarise the main findings of each survey. These are used to inform the description of bird movements, and in the description and assessment of boat survey data (see 4.1).

2.1.6 Mapping of Location of Birds

The time of observation of each bird/species group seen is recorded during each survey. Use of a Differential Global Positioning System (DGPS) from the vessel ensures the vessel stays on the pre-determined transect whilst a handheld GPS device as backup provides a track of the boat's route which records its position at least at one minute intervals

The time of each bird observation can subsequently be linked to the position of the vessel at that instant, and using trigonometric calculations on the perpendicular distance of the bird from the path of the boat at the time of recording, the bird's approximate position can be located. Use of ESS' in-house database facilitates this procedure, generating OSGB coordinates for all of the birds and mammals observed which are then plotted in using ArcView 8.3.

It should be noted that birds are only approximately located. This is for two reasons. Firstly, the distance of the bird from the path of travel of the boat is known, as is the position of the boat, but the distance the bird is ahead of the boat remains unknown. This distance could be 1-480m, or in the case of divers, it could be even further ahead. Hence the plotted locations of birds are only indicative and are more likely to be accurate for birds seen on the water. Secondly, there may be discrepancies between the numbers of birds visible on the maps and the data, since some records overlie others.

2.2 AERIAL SURVEY METHODOLOGY

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 Thames strategic offshore wind farm area. Only data potentially relevant to monitoring changes in bird abundance have been analysed and

mapped. Thus data from more than 10km east or west of the wind farm are likely to diminish the statistical power of the analyses have not been included.

Aerial survey methods applied by the Wildfowl and Wetland Trust (WWT) have broadly remained the same as those described as in the First Monitoring Report (Gill, Sales & Pullinger 2004). However, since large scale surveys of strategic wind farm areas have been organised by WWT with the assistance of the Department of Trade and Industry (DTI), protocols have been clarified (*e.g.* WWT 2005) and are summarised below.

A programme of aerial surveys has been undertaken by the WWT's Wetlands Advisory Service (WAS) from winter 2004/05 through to February 2006 with financial contributions from offshore wind farm developers, and with financial assistance from the Department of Trade and Industry (DTI). This programme has been designed to provide large-scale survey data covering the nearshore waters in Northwest England (from Anglesey to the Solway Firth), 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 Kentish Flats, and to aid marine SPA identification.

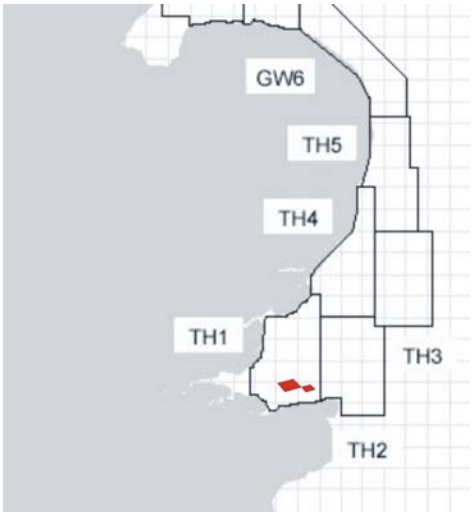


Illustration 1: Thames strategic offshore wind farm survey area in relation to Kentish Flats wind farm, and control site

Apart from survey 1 on 10th-11th January 2002, carried out by the Joint Nature Conservation Committee (JNCC), all the aerial surveys have been conducted by the WWT using north-south transects, divided into four standard distance bands. 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, aerial survey number 2 (see table 2 below) may have slightly higher numbers of some birds, since the current band C (and D) data has been excluded from the population analyses.

2.2.1 Study Areas and Transects

A series of north-south transects spaced 2 km apart are orientated perpendicular to the major environmental gradients within the Thames strategic offshore wind farm area (primarily water depth). This flight path orientation also reduces the effect of 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 during the turns between the end of one transect and the start of the next, though 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 east-west positions (with aerial transects themselves running north-south) throughout the study, although some have varied in length. In some years the overall Thames region study area has varied, but the Kentish Flats study area and control site have been sampled by very similar transects since August 2002.

2.2.2 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 9 to 14 for Thames Area TH1, conducted during Year 4 of the Kentish Flats monitoring program, are presented in Figures 57, 58, and 79-88. The dates of all of the aerial surveys conducted to date are presented in Table 2 below.

Table 2 Aerial Survey Details for Years 1 to 4

Date	Surveyed By	Survey	Survey Start Time	Survey Finish Time	First High Tide Time	Second High Tide Time	Tide Range (low to high) Herne Bay datum (m)
11/01/2002	JNCC	1	10.55	15.08	N/K	N/K	N/K
21/08/2002	WWT	2	10.10	15.09	N/K	N/K	N/K
18/01/2003	WWT	3	10.56	14.47	-	12.18	4.0
19/01/2003	WWT	3 continued	11.48	14.43	0.36	13.02	4.5
28/08/2003	WWT	4	11.05	14.20	1.24	13.37	4.7
29/08/2003	WWT	4 continued	9.49	13.46	2.05	14.18	4.9
27/11/2003	WWT	5	11.03	14.46	2.10	14.37	5.1
17/12/2003	WWT	6	10:18	14:30	05:40	18:30	4.3
15/02/2004	WWT	7 (west)	11:35	15:34	06:50	19:35	4.3
16/02/2004	WWT	7 (central)	10:55	14:59	08:12	20:56	4.2
26/02/2004	WWT	7 (east)	11:30	16:31	03:49	16:15	4.8
30/10/2004	WWT	8	11:06	15:06	02:08	14:21	5.1
05/12/2004	WWT	9	10:05	13:49	05:18	18:09	4.1
15/01/2005	WWT	10	10:27	14:14	03:36	16:11	5.0
06/03/2005	WWT	11	11:42	15:31	08:14	20:51	2.7
13/03/2005	WWT	12	10:13	14:02	02:06	14:31	5.6
31/07/2005	WWT	13	10:10	14:00	09:21	21:46	2.5
13/11/2005	WWT	14	10:23	14:12	09:48	22:27	4.3
11/12/2005	WWT	15	10:48	14:35	04:00	16:55	4.9
14/01/2006	WWT	16	10:51	14:42	-	12:09	4.9
18/02/2006	WWT	17	10:42	14:16	02:41	15:02	5.1
03/02/2007	WWT	18	10:17	14:52	00:50	13:17	4.4
18/02/2007	WWT	19	10:59	14:36	00:27	12:58	5.6

Note: For ease of data comparisons surveys undertaken in years 2, 4 and 6 are shaded. N/K = not known

2.2.3 Sampling Methods

The methodology used for the Thames strategic offshore wind farm 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 aircraft is used, flying at an altitude of 250 ft 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.

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. The survey method assumes that all birds in distance Band A are detected, and effort is concentrated on this band. 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.

A cautionary approach is taken with regard to species identification, such that only those individuals that are observed clearly are identified to species level; otherwise, birds are identified as being in a species group. Many divers and gulls can be identified to species from the air, but auks are very difficult to distinguish except using binoculars.

2.3 POPULATION ASSESSMENT METHODOLOGY

2.3.1 Distance Estimation

The 'calliper' method was used periodically by surveyors to check or calibrate the distance estimate for birds and marine mammals seen, the distance band parallel to the path of the survey vessel during boat surveys (Komdeur *et al* 1992, Heineman 1981) in which it was first seen.

2.3.2 Distance Band Correction

During bird surveys at sea, some birds furthest from the boat or aeroplane are less visible and inevitably missed.

For boat surveys the visibility 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 upon the sea state. The tendency to under-record the numbers of birds in the distance bands furthest from the boat therefore means that population estimates could be under-estimated. This potential error is rectified using correction factors applicable to these furthest distance bands (C and D) (as in Table 3.5 of Stone *et al* 1995). These published correction factors continue to be used in this Monitoring Report, as they have in previous Kentish Flats reports.

Once sufficient distance band data have been collected (possibly by the sixth year of the monitoring program), dedicated correction factors may be estimated and applied to all the boat survey data collected specifically at the Kentish Flats site.

For the aerial surveys, 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 plane, and upon the sea state and as such birds seen farther from the plane may also tend to be under-recorded. However, no correction factors have yet been produced by WWT. Therefore, to compensate for these potential under-recording effects, as in all previous reports, the population estimates for Years 4 and 5 have been presented as numbers of

birds per transect rather than densities, and are based solely on data from bands A and B. This is justified since data collected within bands C and D reveals significant under-recording as evidenced by comparisons of numbers of birds recorded in bands C and D in relation to the numbers of birds recorded in bands A and B.

2.3.3 Distance Band Compensation

The caliper method was used in an unconventional way during the first 41 boat surveys up to and including the 8th December 2003 survey AO. In this period surveyors were assigning records of birds on the sea to radial distance bands rather than to distance bands parallel to the path of the boat. The effect of this approach to distance estimation has been taken account of in analysing the Year 1-3 data sets from the previous surveys at Kentish Flats through a process of scaling population estimates by 2.04 to compensate for the difference in areas within which distances were estimated (see Section 2.3.3 below). This assumes that a single compensation factor is appropriate.

All surveys since then have used the conventional approach (Komdeur *et al* 1992, Heineman 1981) to distance estimation, assigning all birds seen on the water into distance bands running parallel to the path of the boat.

2.4 BIRD ABUNDANCE ESTIMATES

As in the previous Kentish Flats monitoring reports, the scan and snapshot boat survey data have been analysed to produce bird species and group abundances. The other birds recorded out of transect have not been used in the extrapolated bird population estimates, but have been used in the description and visual analyses of the diver, seaduck, other wildfowl, wader, tern and other bird data (see section 4.1).

The boat survey analyses used published distance band correction factors. Published correction factors (Stone *et al* 1995) have been used to allow for the reduced visibility of birds on the water at distances of more than 100m as described previously under Section 3.3.2. For the boat survey data, the total numbers of birds seen within the 300m wide transects were scaled according to the proportion of the overall areas surveyed to produce population estimates as the appropriate measure of bird abundance. Standard errors were based on a regression model relating the variance to the mean.

The analysis of aerial data did not use band correction factors. Such correction factors are not necessary for monitoring changes over time provided data are collected and analysed consistently between years. They are only needed for an unbiased estimate of numbers present, which is desirable for an initial assessment of what is present within planned wind farm sites for EIA purposes. However, there is never enough data collected within small areas such as the Kentish Flats wind farm study area to estimate correction factors. Thus the total numbers of birds seen in aerial survey transect distance bands A and B, extending 44-163m and 163-282m from the plane have been consistently analysed for transects traversing the wind farm and buffer to give indices of bird abundance relative to the reference transects to the east and west of the wind farm and buffer. It is important to appreciate however, that these relative abundance indices include birds seen outside the wind farm buffer, both to the north and south of the boat survey area.

2.4.1 Bird Population Estimates from the Boat Data

Each survey visit records birds on eight transects at the wind farm and buffer and an additional four transects when the control site is surveyed. For each species, the count for a single transect is taken as the sampling unit. Sample means and standard deviations of these were calculated. These are related to each other: higher sample means are associated with higher standard deviations. There is now sufficient data to build reasonable models for the relationship between the mean and the standard deviation for the frequently observed species. These species are red-throated diver, cormorant,

common tern, guillemot and four gull species (great black-backed, lesser black-backed, herring and common). This modelling is necessary to obtain realistic standard errors for the population estimates.

The population estimates for all 90 surveys conducted to date at the Kentish Flats site (up to survey CL) are presented. Estimates of population size and standard errors are included for all species that were recorded on more than 25% of surveys. Population estimates have been used for consistency with previous monitoring reports. To produce population densities, both the estimated totals and their standard errors should be scaled by dividing by the area of the wind farm and buffer (43.91 km^2) or of the control site (10.43 km^2).

These population estimates differ from those presented in the Potential Ornithological Impact Technical Addendum Report (Gill, Sales, Pullinger & Durwood, 2002) and the First, Second and Third Monitoring Reports (Gill, Sales & Pullinger 2004 and Gill, Sales & Beasley 2005, 2006). This is both because of compensation for the distance estimation differences (see Section 3.3.3), and because the standard errors are derived from the variance model which now includes all five years of data.

Means of the data collected are also presented in Tables 13 to 20 as monthly means for all species that were recorded during at least a quarter of the boat surveys. These are presented in a similar way to those used in the Second and Third Monitoring Reports (Gill, Sales & Beasley 2005 & 2006). These monthly estimates are not ideal as they ignore inter-annual variation, which appears to be important for some species (including divers).

A total of ten surveys have been completed in the months of December and January over the five year monitoring period, the peak period for divers. In addition a further fourteen surveys have been completed during the months of February and March. The highest population estimate has been 918 (± 299.5) red-throated divers made on 7th February 2005. This differs from the population estimate presented in previous reports because the standard errors are derived from the variance model which now includes all four years of data. The surveys in Year 5 produced much lower population estimates (see Table 5).

In spite of restricted access to the site during winter months when wave activity or visibility can limit the safety and effectiveness of boat surveys, a total of 35 surveys have now been completed that cover the broad period of diver presence from November to March over Years 1 to 5 of the Kentish Flats monitoring period.

2.4.2 Abundance Estimates from the Aerial Data

Aerial data from Thames strategic offshore wind farm area TH1 were compared statistically as described below. It would be possible to obtain population estimates for the wind farm site and buffer zone, and control site areas from the information available, but without standard errors. The numbers would be very low, and without standard errors no comment on their accuracy could be made.

The survey data from Thames strategic offshore wind farm area TH1 covering the Kentish Flats site, used in the Third Monitoring Report (Gill *et al* 2006) has been analysed. All the aerial surveys since 30th October 2004 for Thames survey area TH1 have covered the same 16 transects.

For the purposes of the current analyses, the TH1 survey area has been subdivided into three sections (see Figures 110 to 116):

1. wind farm and buffer area
2. a reference area to the west of the wind farm
3. a reference area to the east of the wind farm (which includes the control site surveyed by the boat surveys)

The subdivision of the aerial data sets into these three comparative areas means that, over time, any changes in bird populations within the wind farm site can be reasonably assessed following the standard Before-After-Control-Impact (BACI) approach, as further data become available during the operational phase.

Four of the TH1 transects are west of the wind farm site, seven include sections over the wind farm site/buffer zone and five are to the east over the boat control site (see Figures 110 to 116). The westerly transects are rather shorter than the others and all of the transects cover a significant area outside of the wind farm (both to the south and more extensively to the north). This means that birds many kilometres to the north, unlikely to be affected by the wind farm, have been included in the relative abundance indices.

The analyses have used transects as sampling units and produced means and standard errors for the number of birds seen in bands A and B per transect within the three areas described above. The results from earlier years have been reanalysed to ensure that consistent groupings of transects are used.

The means and standard errors have been calculated for each species group with summary results presented for divers, cormorant, seaduck, waders, other wildfowl, gulls, terns and auks. These are based on numbers in bands A (all of which are assumed in distance sampling to have been detected) and B (some birds will have been missed), with no corrections applied for band B birds. Band C and D records were omitted from the calculations to reduce the effect of missing birds at greater distances. The omission of these records, together with the lack of correction factors for distance band B (163-282 metres from the flight line) may result in an under-estimate of numbers of diver and scoter (which flush readily in front of the plane). However for monitoring purposes this underestimation is unimportant, as long as the Bands A and B are consistently sampled.

2.4.3 Methodology used to analyse differences between development phases

Any evidence of changes in numbers/densities between the different phases of the development was examined using two different analyses for the boat surveys, and one of these analyses was also used for the aerial surveys.

The first boat method looked at the estimates of densities for all 108 visits for which data was available. The data for each month was analysed separately. Means and standard errors were calculated for each of the three phases of the development: pre-construction, construction and operation. For each species, tests for statistically significant changes were carried out comparing the construction phase with the pre-construction phase and the operational phase with the pre-construction.

A second analysis was carried out by comparing the wind farm site with the control area. This should eliminate most of the variation in numbers between different years, so should be more satisfactory for studying wind farm effects. There is less information available for this analysis because the control site was visited on only 38 of the 108 site surveys. The control site is also smaller, so estimates for it are less precise than those for the wind farm site and buffer zone.

The analysis used only those visits on which a species was recorded at both wind farm/buffer zone and control site. The logarithm of the ratio (a standard way to deal with ratios) of the estimated densities was analysed using analysis of variance (ANOVA). The number of visits available are given in Table 3 below; no other species had more than three visits on which they were recorded at both sites and buffer zone with the control area.

Table 3 Number of available visits for analysis

	Pre-construction	Construction	Operation
Red-throated Diver	5	2	4
Lesser Black-backed Gull	7	1	6
Herring Gull	10	4	9
Common Gull	3	3	5

For all four species, F tests were used to compare the three phases of the development.

As in the previous report the aerial transects were divided into three groups: those that included part of the wind farm or passed near to it; transects to the west and transects to the east. Table 4 below gives the number of flights on which the six species groups were recorded in both the first group of transects and in transects away from the wind farm site.

Table 4 No. of flights recorded in both first group of transects and transects away from site

	Pre-construction	Construction	Operation
Diver	4	5	4
Cormorant	5	4	5
Seaduck	3	3	5
Wader	2	4	3
Gull	6	6	6
Auk	3	3	1
All Birds	7	6	6

The estimated densities for the first group were compared with those from the other two groups. The logarithm of the ratio was analysed using the analysis of variance (ANOVA), as was done for the second boat analyses of wind farm/buffer and control site data.

Maps showing bird locations were also visually analysed by comparisons between years to assess whether there were any apparent changes in relation to the FEPA licence monitoring requirements 1 and 3 (see section 2). These comparisons were intended to determine whether there has been any change in the use or passage of diver, seaduck, wildfowl, wader or tern through the wind farm site (see Figures 25-31, 51-58, 79-88, 110-116, 134-140).

Visual analyses of the boat data have included an assessment of the movements of wildfowl, potentially to and from the coastal SPA sites surrounding the Thames Estuary. However, it is not possible to determine SPA bird movements from the aerial data, since flight direction is invariably not recorded during the aerial surveys.

During Year 6 aerial surveys were only conducted within TH1 on 3rd and 18th February 2007.

3 STATISTICAL RESULTS OF SURVEYS

As in previous monitoring reports, the bird species recorded may be divided into those species qualifying the four North Kent Special Protection Areas (SPAs) which have been termed Kent SPA species, and those not qualifying these sites as SPAs (Non Kent SPA species). Generally, this means that SPA species occur within the four nearest North Kent SPAs in nationally important numbers (greater than 1% of the British population), but also include species included within an assemblage of species whose total numbers within a wintering SPA exceed 20,000. Red-throated divers qualify the Thames SPA. These SPA species have formed the focus of this and previous monitoring reports.

The main non-statistical results of the surveys are the behaviours and locations of all birds seen, which have been plotted on the visit maps. In addition, records of the most important SPA species seen during boat surveys in each reporting period have been accumulated into species maps (Figures 22-24, 48-50, 76-78, 105-107, and 134-140).

The results of the statistical analyses are presented and discussed below. The boat survey maps and observations are described in Chapter 5 for the main SPA species, and the aerial maps and data described in Chapter 6. Discussion of issues of particular concern to Natural England is presented in Chapter 7. Conclusions are made in Chapter 8, including a discussion of the FEPA monitoring objectives.

3.1 NUMBERS OF BIRDS ESTIMATED FROM BOAT SURVEYS, 2001-2007

Estimates of bird abundance are presented for the wind farm site and buffer zone (in Section 3.1.1) and the control site (in Section 3.1.2). These population estimates are based only on the number of birds seen within transect or during the "snapshots", and are extrapolated to the whole study area with corrections for birds missed with increasing distance from the boat.

The total number of birds and marine mammals recorded during the Year 5 surveys, by species, are presented in Appendix A1. The totals seen in transect (*i.e.* those seen within 300m from the boat path) or during snapshots are presented alongside these figures.

To comment upon the accuracy of measures of abundance it is essential that standard errors are also estimated. The standard errors presented in the sections below are statistical limits within which 95% of records would be expected to fall. For example, for the highest estimate of the numbers of red-throated divers in Year 6, on 3 March 2007 (see Table 5 below); the range within which 95% of estimates would be expected to lie is 221 ± 87 (*i.e.* between 134 and 308). These estimates are based on the number of birds seen within transect, corrected using the correction factors.

3.1.1 Wind Farm Site and Buffer Zone

Year 6 data are presented in such a way as to reveal any change in bird populations through the pre-construction, construction and operational periods. The tables below (Tables 5 to 8) present the estimated number of each species in the study area (including both wind farm site and buffer zone) for all 108 boat visits, A to DC, up to and including the 21st November 2007.

Standard errors have been revised and updated to include all of the boat survey data collected to date at the Kentish Flats boat survey area. These have changed because the variance-mean relationships have been recalculated because more data is available now. This particularly affects species that are observed less often.

3.1.1.1 Divers and Cormorant

Population estimates and standard errors for red-throated divers, gannets and great cormorants are shown below.

Table 5 Population Estimates for Divers, Gannet and Cormorant

					Red-throated diver		Gannet		Cormorant	
Month	**Year**	**Timing**	**Visit**	**Date**	**Population estimate**	**Standard Error**	**Population estimate**	**Standard Error**	**Population estimate**	**Standard Error**
January	2003	Pre-Constr.	W	22/01/03	841	343.4	0	0.7	0	0.7
	2004	Pre-Constr.	AQ	03/01/04	425	153.4	0	0.3	38	22.7
	2005	Construction	BG	19/01/05	189	76.0	0	0.3	18	11.6
	2006	Operation	BX	13/01/06	120	51.0	0	0.3	0	0.3
	2007	Operation	CN	15/01/07	128	54.2	0	0.3	9	6.4
February	2002	Pre-Constr.	F	17/02/02	0	1.0	0	1.1	0	1.2
	2003	Pre-Constr.	X	10/02/03	118	62.3	0	0.7	6	5.5
	2003	Pre-Constr.	Y	21/02/03	213	104.2	0	0.7	0	0.7
	2004	Pre-Constr.	AR	06/02/04	79	35.5	0	0.3	9	6.6
	2005	Construction	BH	07/02/05	918	299.5	0	0.3	6	4.7
	2006	Operation	BY	17/02/06	17	9.4	0	0.3	0	0.3
	2007	Operation	CO	02/02/07	15	8.4	0	0.3	9	6.4
March	2002	Pre-Constr.	G	19/03/02	12	8.5	0	0.7	24	18.4
	2003	Pre-Constr.	Z	06/03/03	27	17.5	0	0.7	6	5.5
	2003	Pre-Constr.	AA	23/03/03	77	43.0	0	0.7	0	0.7
	2004	Pre-Constr.	AS	05/03/04	16	8.7	0	0.3	0	0.3
	2005	Construction	BI	08/03/05	3	2.0	0	0.3	0	0.3
	2006	Operation	BZ	02/03/06	0	0.3	0	0.3	0	0.3
	2007	Operation	CP	02/03/07	221	87.0	0	0.3	9	6.6
April	2002	Pre-Constr.	H	05/04/02	0	0.6	0	0.7	0	0.7
	2002	Pre-Constr.	I	18/04/02	0	0.6	0	0.7	13	10.9
	2003	Pre-Constr.	AB	07/04/03	18	12.0	0	0.7	6	5.5
	2003	Pre-Constr.	AC	15/04/03	0	0.6	0	0.7	0	0.7
	2004	Pre-Constr.	AT	07/04/04	9	5.5	0	0.3	0	0.3
	2005	Construction	BJ	03/04/05	35	17.6	0	0.3	12	8.0
	2005	Construction	BK	22/04/05	0	0.3	0	0.3	6	4.5
	2006	Operation	CA	13/04/06	0	0.3	0	0.3	0	0.3
	2006	Operation	CB	19/04/06	0	0.3	0	0.3	0	0.3
	2007	Operation	CQ	06/04/07	24	12.6	0	0.3	0	0.3
	2007	Operation	CR	29/04/07	0	0.3	0	0.3	3	2.4
May	2002	Pre-Constr.	J	01/05/02	0	0.6	0	0.7	13	10.9
	2002	Pre-Constr.	K	30/05/02	0	0.6	0	0.7	0	0.7
	2003	Pre-Constr.	AD	06/05/03	0	0.6	47	40.7	6	5.5
	2003	Pre-Constr.	AE	19/05/03	0	0.6	12	11.1	18	14.3
	2004	Pre-Constr.	AU	12/05/04	0	0.3	17	13.5	3	2.6
	2004	Pre-Constr.	AV	28/05/04	0	0.3	0	0.3	16	10.4
	2005	Construction	BL	10/05/05	0	0.3	0	0.3	0	0.3
	2005	Construction	BM	29/05/05	0	0.3	0	0.3	6	4.5
	2006	Operation	CC	02/05/06	0	0.3	0	0.3	0	0.3
	2006	Operation	CD	23/05/06	0	0.3	0	0.3	6	4.6
	2007	Operation	CS	04/05/07	0	0.3	0	0.3	0	0.3
	2007	Operation	CT	21/05/07	0	0.3	0	0.3	3	2.5

					Red-throated diver		Gannet		Cormorant	
Month	**Year**	**Timing**	**Visit**	**Date**	**Population estimate**	**Standard Error**	**Population estimate**	**Standard Error**	**Population estimate**	**Standard Error**
June	2002	Pre-Constr.	L	19/06/02	0	0.6	0	0.7	18	14.7
	2003	Pre-Constr.	AF	04/06/03	0	0.6	6	5.8	6	5.5
	2004	Pre-Constr.	AW	08/06/04	0	0.3	0	0.3	15	10.2
	2005	Construction	BN	15/06/05	0	0.3	3	2.5	44	25.7
	2006	Operation	CE	02/06/06	0	0.3	0	0.3	15	10.0
	2007	Operation	CU	08/06/07	0	0.3	3	2.5	28	17.1
July	2002	Pre-Constr.	M	22/07/02	0	0.6	0	0.7	44	31.9
	2003	Pre-Constr.	AG	22/07/03	0	0.6	0	0.7	53	37.4
	2004	Pre-Constr.	AX	29/07/04	0	0.3	3	2.5	42	24.7
	2005	Construction	BO	08/07/05	0	0.3	0	0.3	0	0.3
	2006	Operation	CF	21/07/06	0	0.3	0	0.3	62	34.6
	2007	Operation	CV	13/07/07	0	0.3	0	0.3	9	6.6
August	2002	Pre-Constr.	N	12/08/02	0	0.6	0	0.7	41	30.0
	2002	Pre-Constr.	O	22/08/02	0	0.6	0	0.7	77	51.6
	2003	Pre-Constr.	AH	22/08/03	0	0.6	0	0.7	0	0.7
	2004	Construction	AY	26/08/04	0	0.3	0	0.3	21	13.5
	2005	Construction	BP	01/08/05	0	0.3	12	9.2	25	15.6
	2006	Operation	CG	07/08/06	0	0.3	9	7.0	25	15.5
	2007	Operation	CW	30/08/07	0	0.3	3	2.5	15	10.3
September	2002	Pre-Constr.	P	11/09/02	0	0.6	12	11.1	50	35.2
	2002	Pre-Constr.	Q	24/09/02	8	5.8	0	0.7	30	22.3
	2003	Pre-Constr.	AI	09/09/03	0	0.6	0	0.7	77	51.6
	2003	Pre-Constr.	AJ	22/09/03	0	0.6	0	0.7	59	41.0
	2004	Construction	AZ	03/09/04	0	0.3	0	0.3	9	6.4
	2004	Construction	BA	29/09/04	0	0.3	9	7.0	6	4.5
	2005	Operation	BQ	06/09/05	0	0.3	0	0.3	41	24.4
	2005	Operation	BR	27/09/05	0	0.3	3	2.5	0	0.3
	2006	Operation	CH	18/09/06	0	0.3	0	0.3	46	26.8
	2006	Operation	CI	29/09/06	0	0.3	3	2.5	25	15.5
	2007	Operation	CX	10/09/07	0	0.3	0	0.3	74	40.6
October	2001	Pre-Constr.	A	13/10/01	0	1.1	0	1.2	10	10.4
	2001	Pre-Constr.	B	25/10/01	0	2.0	0	2.2	15	18.8
	2002	Pre-Constr.	R	15/10/02	0	0.6	18	16.2	19	15.1
	2002	Pre-Constr.	S	24/10/02	45	27.0	0	0.7	13	10.9
	2003	Pre-Constr.	AK	12/10/03	0	0.6	0	0.7	20	15.5
	2003	Pre-Constr.	AL	26/10/03	6	4.6	0	0.7	0	0.7
	2004	Construction	BB	15/10/04	0	0.3	0	0.3	9	6.2
	2004	Construction	BC	27/10/04	0	0.4	19	18.3	8	6.9
	2005	Operation	BS	03/10/05	0	0.3	0	0.3	3	2.6
	2005	Operation	BT	14/10/05	0	0.3	0	0.3	0	0.3
	2006	Operation	CJ	09/10/06	0	0.3	3	2.5	34	20.5
	2007	Operation	CY	02/10/07	0	0.3	0	0.3	15	10.2
	2007	Operation	CZ	10/10/07	0	0.3	0	0.3	15	10.2
	2007	Operation	DA	31/10/07	0	0.3	0	0.3	204	98.4
November	2001	Pre-Constr.	C	18/11/01	0	0.8	0	0.8	0	0.9
	2001	Pre-Constr.	D	30/11/01	0	1.9	0	2.0	0	2.2
	2002	Pre-Constr.	T	04/11/02	0	0.6	0	0.7	30	22.7
	2002	Pre-Constr.	U	15/11/02	14	9.9	0	0.7	0	0.7
	2003	Pre-Constr.	AM	06/11/03	66	37.8	0	0.7	18	14.7
	2003	Pre-Constr.	AN	27/11/03	196	96.9	0	0.7	30	22.3

					Red-throated diver		Gannet		Cormorant	
Month	**Year**	**Timing**	**Visit**	**Date**	**Population estimate**	**Standard Error**	**Population estimate**	**Standard Error**	**Population estimate**	**Standard Error**
	2004	Construction	BD	14/11/04	15	8.2	0	0.3	29	17.8
	2004	Construction	BE	26/11/04	0	0.3	0	0.3	29	17.8
	2005	Operation	BU	12/11/05	0	0.3	0	0.3	0	0.3
	2005	Operation	BV	17/11/05	0	0.3	0	0.3	6	4.4
	2006	Operation	CK	04/11/06	0	0.3	0	0.3	49	28.3
	2006	Operation	CL	01/12/06	3	2.3	0	0.3	68	37.4
	2007	Operation	DB	21/11/07	27	14.2	0	0.3	120	61.7
December	2001	Pre-Constr.	E	19/12/01	0	3.3	0	3.7	0	3.8
	2002	Pre-Constr.	V	14/12/02	574	246.3	0	0.7	26	20.0
	2003	Pre-Constr.	AO	08/12/03	368	167.3	0	0.7	0	0.7
	2003	Pre-Constr.	AP	18/12/03	812	332.9	0	0.7	18	14.3
	2004	Construction	BF	11/12/04	1185	373.7	0	0.3	43	25.3
	2005	Operation	BW	07/12/05	3	2.3	0	0.3	3	2.5
	2006	Operation	CL	01/12/06	3	2.3	0	0.3	68	37.4
	2006	Operation	CM	10/12/06	3	2.3	0	0.3	49	28.3

3.1.1.2 Gulls

Population estimates and standard errors for larger gulls by species are shown in Table 6 below:

Table 6 Population Estimates for larger Gulls

					Great Black-Backed Gull		Lesser Black-Backed Gull		Herring Gull	
Month	**Year**	**Timing**	**Visit**	**Date**	**Population estimate**	**Standard Error**	**Population estimate**	**Standard Error**	**Population estimate**	**Standard Error**
January	2003	Pre-Constr.	W	22/01/03	8	7.4	66	33.2	59	35.3
	2004	Pre-Constr.	AQ	03/01/04	0	0.5	27	12.6	9	5.8
	2005	Construction	BG	19/01/05	0	0.5	10	6.1	13	7.6
	2006	Operation	BX	13/01/06	3	2.8	3	2.6	6	4.2
	2007	Operation	CN	15/01/07	0	0.5	17	9.0	48	23.7
February	2002	Pre-Constr.	F	17/02/02	0	1.7	8	8.1	20	16.5
	2003	Pre-Constr.	X	10/02/03	0	1.1	0	0.9	12	8.9
	2003	Pre-Constr.	Y	21/02/03	0	1.1	14	10.3	27	18.1
	2004	Pre-Constr.	AR	06/02/04	0	0.5	37	15.8	9	5.5
	2005	Construction	BH	07/02/05	4	3.2	0	0.4	17	9.9
	2006	Operation	BY	17/02/06	0	0.5	3	2.6	25	13.6
	2007	Operation	CO	02/02/07	0	0.5	3	2.6	31	16.3
March	2002	Pre-Constr.	G	19/03/02	69	34.4	6	5.3	65	38.4
	2003	Pre-Constr.	Z	06/03/03	8	7.4	6	5.3	39	24.7
	2003	Pre-Constr.	AA	23/03/03	0	1.1	14	10.3	46	28.5
	2004	Pre-Constr.	AS	05/03/04	0	0.5	6	3.9	3	2.5
	2005	Construction	BI	08/03/05	0	0.5	4	3.0	101	44.6
	2006	Operation	BZ	02/03/06	0	0.5	0	0.4	23	12.7
	2007	Operation	CP	02/03/07	0	0.5	0	0.4	3	2.1
April	2002	Pre-Constr.	H	05/04/02	0	1.1	18	12.4	6	5.0
	2002	Pre-Constr.	I	18/04/02	6	5.8	28	17.4	30	19.5
	2003	Pre-Constr.	AB	07/04/03	0	1.1	7	6.1	24	16.1
	2003	Pre-Constr.	AC	15/04/03	0	1.1	6	5.3	130	69.2
	2004	Pre-Constr.	AT	07/04/04	6	4.2	3	2.6	37	18.7
	2005	Construction	BJ	03/04/05	0	0.5	8	5.0	9	5.5
	2005	Construction	BK	22/04/05	0	0.5	0	0.4	3	2.1
	2006	Operation	CA	13/04/06	3	2.8	3	2.3	3	2.1
	2006	Operation	CB	19/04/06	0	0.5	27	12.6	28	15.0
	2007	Operation	95	06/04/07	3	2.5	12	6.8	56	27.1
	2007	Operation	96	29/04/07	20	10.4	84	29.7	95	42.2
May	2002	Pre-Constr.	J	01/05/02	0	1.1	12	8.9	69	40.0
	2002	Pre-Constr.	K	30/05/02	0	1.1	0	0.9	50	30.4
	2003	Pre-Constr.	AD	06/05/03	6	5.8	0	0.9	22	15.4
	2003	Pre-Constr.	AE	19/05/03	0	1.1	6	5.3	19	13.3
	2004	Pre-Constr.	AU	12/05/04	0	0.5	9	5.3	6	3.9
	2004	Pre-Constr.	AV	28/05/04	0	0.5	10	6.1	79	36.3
	2005	Construction	BL	10/05/05	0	0.5	3	2.3	3	2.1
	2005	Construction	BM	29/05/05	0	0.5	0	0.4	10	6.1
	2006	Operation	CC	02/05/06	0	0.5	3	2.3	20	11.3
	2006	Operation	CD	23/05/06	0	0.5	0	0.4	25	13.4
	2007	Operation	97	04/05/07	6	4.2	10	5.8	6	4.2

					Great Black-Backed Gull		Lesser Black-Backed Gull		Herring Gull	
Month	**Year**	**Timing**	**Visit**	**Date**	**Population estimate**	**Standard Error**	**Population estimate**	**Standard Error**	**Population estimate**	**Standard Error**
	2007	Operation	98	21/05/07	0	0.5	9	5.5	22	12.3
June	2002	Pre-Constr.	L	19/06/02	0	1.1	0	0.9	30	19.5
	2003	Pre-Constr.	AF	04/06/03	0	1.1	6	5.3	7	5.7
	2004	Pre-Constr.	AW	08/06/04	0	0.5	0	0.4	27	14.6
	2005	Construction	BN	15/06/05	3	2.5	12	6.6	137	57.9
	2006	Operation	CE	02/06/06	7	4.7	0	0.4	88	39.7
	2007	Operation	99	08/06/07	3	2.8	7	4.4	84	38.1
July	2002	Pre-Constr.	M	22/07/02	0	1.1	0	0.9	12	8.9
	2003	Pre-Constr.	AG	22/07/03	18	12.8	50	26.7	69	40.0
	2004	Pre-Constr.	AX	29/07/04	0	0.5	0	0.4	8	5.2
	2005	Construction	BO	08/07/05	3	2.5	9	5.3	145	60.8
	2006	Operation	CF	21/07/06	10	6.3	22	10.9	74	34.0
	2007	Operation	100	13/07/07	0	0.5	3	2.3	34	17.8
August	2002	Pre-Constr.	N	12/08/02	6	5.8	0	0.9	36	22.8
	2002	Pre-Constr.	O	22/08/02	0	1.1	14	10.3	0	0.7
	2003	Pre-Constr.	AH	22/08/03	0	1.1	13	9.6	0	0.7
	2004	Construction	AY	26/08/04	6	4.2	4	3.0	0	0.3
	2005	Construction	BP	01/08/05	3	2.9	12	6.6	4	2.9
	2006	Operation	CG	07/08/06	0	0.5	3	2.3	0	0.3
	2007	Operation	101	30/08/07	13	7.3	36	15.7	15	8.7
September	2002	Pre-Constr.	P	11/09/02	0	1.1	12	8.9	0	0.7
	2002	Pre-Constr.	Q	24/09/02	0	1.1	27	16.9	6	4.9
	2003	Pre-Constr.	AI	09/09/03	0	1.1	8	6.8	0	0.7
	2003	Pre-Constr.	AJ	22/09/03	0	1.1	81	38.5	18	12.6
	2004	Construction	AZ	03/09/04	0	0.5	76	27.6	12	7.3
	2004	Construction	BA	29/09/04	16	8.8	149	45.9	22	12.1
	2005	Operation	BQ	06/09/05	0	0.5	3	2.3	4	2.9
	2005	Operation	BR	27/09/05	0	0.5	34	15.0	12	7.0
	2006	Operation	CH	18/09/06	0	0.5	12	6.8	16	9.0
	2006	Operation	CI	29/09/06	10	6.3	12	6.8	29	15.3
	2007	Operation	102	10/09/07	20	10.4	20	10.2	3	2.5
October	2001	Pre-Constr.	A	13/10/01	38	27.5	0	1.6	0	1.2
	2001	Pre-Constr.	B	25/10/01	0	3.1	0	2.7	0	2.1
	2002	Pre-Constr.	R	15/10/02	0	1.1	46	25.2	0	0.7
	2002	Pre-Constr.	S	24/10/02	14	10.9	53	28.1	15	11.1
	2003	Pre-Constr.	AK	12/10/03	67	33.8	66	33.2	14	10.4
	2003	Pre-Constr.	AL	26/10/03	6	5.8	371	122.8	18	12.6
	2004	Construction	BB	15/10/04	0	0.5	63	24.0	6	3.9
	2004	Construction	BC	27/10/04	5	4.3	13	8.9	0	0.5
	2005	Operation	BS	03/10/05	0	0.5	13	7.1	3	2.1
	2005	Operation	BT	14/10/05	3	2.5	18	9.2	20	11.3
	2006	Operation	CJ	09/10/06	0	0.5	38	16.4	0	0.3
	2007	Operation	103	02/10/07	14	7.7	23	11.2	3	2.5
	2007	Operation	104	10/10/07	26	12.3	23	11.1	3	2.1
	2007	Operation	105	31/10/07	9	5.8	6	3.9	13	7.5
November	2001	Pre-Constr.	C	18/11/01	14	11.5	42	24.8	21	15.2
	2001	Pre-Constr.	D	30/11/01	0	3.0	14	14.9	0	2.0
	2002	Pre-Constr.	T	04/11/02	8	7.4	108	48.0	44	27.3

					Great Black-Backed Gull		Lesser Black-Backed Gull		Herring Gull	
Month	**Year**	**Timing**	**Visit**	**Date**	**Population estimate**	**Standard Error**	**Population estimate**	**Standard Error**	**Population estimate**	**Standard Error**
	2002	Pre-Constr.	U	15/11/02	111	48.6	71	35.0	12	8.9
	2003	Pre-Constr.	AM	06/11/03	0	1.1	117	51.2	118	63.8
	2003	Pre-Constr.	AN	27/11/03	6	5.8	33	19.6	14	10.4
	2004	Construction	BD	14/11/04	0	0.5	21	10.3	9	5.8
	2004	Construction	BE	26/11/04	0	0.5	7	4.5	24	12.9
	2005	Operation	BU	12/11/05	0	0.5	40	16.9	15	8.5
	2005	Operation	BV	17/11/05	3	2.5	32	14.4	9	5.5
	2006	Operation	CK	04/11/06	30	13.8	203	58.1	21	11.6
	2007	Operation	106	05/11/07	3	2.8	6	4.2	6	4.2
	2007	Operation	107	21/11/07	0	0.5	13	7.3	9	5.5
December	2001	Pre-Constr.	E	19/12/01	0	4.9	20	24.8	0	3.5
	2002	Pre-Constr.	V	14/12/02	0	1.1	31	18.5	53	32.2
	2003	Pre-Constr.	AO	08/12/03	0	1.1	78	37.6	18	12.6
	2003	Pre-Constr.	AP	18/12/03	0	1.1	40	22.7	31	20.2
	2004	Construction	BF	11/12/04	0	0.5	13	7.1	0	0.3
	2005	Operation	BW	07/12/05	6	4.4	3	2.3	22	12.0
	2006	Operation	CL	01/12/06	0	0.5	3	2.3	12	7.0
	2006	Operation	CM	10/12/06	6	4.2	37	15.9	25	13.6

Population estimates and standard errors for smaller gulls by species are shown in Table 7 below:

Table 7 Population Estimates for smaller Gulls

					Common Gull		Kittiwake	
Month	**Year**	**Timing**	**Visit**	**Date**	**Population estimate**	**Standard Error**	**Population estimate**	**Standard Error**
	2003	Pre-Constr.	W	22/01/03	18	11.9	41	29.7
	2004	Pre-Constr.	AQ	03/01/04	0	0.3	3	2.1
January	2005	Construction	BG	19/01/05	15	7.9	9	5.9
	2006	Operation	BX	13/01/06	18	9.3	6	4.3
	2007	Operation	CN	15/01/07	6	3.7	0	0.2
	2002	Pre-Constr.	F	17/02/02	0	1.2	0	0.9
	2003	Pre-Constr.	X	10/02/03	0	0.7	12	9.2
	2003	Pre-Constr.	Y	21/02/03	36	20.9	0	0.6
February	2004	Pre-Constr.	AR	06/02/04	0	0.3	0	0.2
	2005	Construction	BH	07/02/05	46	20.2	580	294.7
	2006	Operation	BY	17/02/06	21	10.5	0	0.2
	2007	Operation	CO	02/02/07	32	15.0	0	0.2
	2002	Pre-Constr.	G	19/03/02	0	0.8	0	0.6
	2003	Pre-Constr.	Z	06/03/03	62	32.7	0	0.6
	2003	Pre-Constr.	AA	23/03/03	0	0.7	0	0.6
March	2004	Pre-Constr.	AS	05/03/04	3	2.5	0	0.2
	2005	Construction	BI	08/03/05	34	15.6	0	0.2
	2006	Operation	BZ	02/03/06	60	24.8	0	0.2
	2007	Operation	CP	02/03/07	18	9.3	0	0.2

					Common Gull		Kittiwake	
Month	**Year**	**Timing**	**Visit**	**Date**	**Population estimate**	**Standard Error**	**Population estimate**	**Standard Error**
April	2002	Pre-Constr.	H	05/04/02	0	0.8	0	0.6
	2002	Pre-Constr.	I	18/04/02	0	0.7	0	0.6
	2003	Pre-Constr.	AB	07/04/03	0	0.7	0	0.6
	2003	Pre-Constr.	AC	15/04/03	0	0.7	0	0.6
	2004	Pre-Constr.	AT	07/04/04	15	7.9	0	0.2
	2005	Construction	BJ	03/04/05	18	9.4	0	0.2
	2005	Construction	BK	22/04/05	3	2.1	0	0.2
	2006	Operation	CA	13/04/06	0	0.3	0	0.2
	2006	Operation	CB	19/04/06	0	0.3	0	0.2
	2007	Operation	CQ	06/04/07	135	48.3	0	0.2
	2007	Operation	CR	29/04/07	3	2.1	0	0.2
May	2002	Pre-Constr.	J	01/05/02	0	0.7	0	0.6
	2002	Pre-Constr.	K	30/05/02	0	0.7	0	0.6
	2003	Pre-Constr.	AD	06/05/03	0	0.7	0	0.6
	2003	Pre-Constr.	AE	19/05/03	0	0.7	0	0.6
	2004	Pre-Constr.	AU	12/05/04	0	0.3	0	0.2
	2004	Pre-Constr.	AV	28/05/04	0	0.3	0	0.2
	2005	Construction	BL	10/05/05	0	0.3	0	0.2
	2005	Construction	BM	29/05/05	0	0.3	0	0.2
	2006	Operation	CC	02/05/06	0	0.3	0	0.2
	2006	Operation	CD	23/05/06	0	0.3	0	0.2
	2007	Operation	CS	04/05/07	0	0.3	0	0.2
	2007	Operation	CT	21/05/07	0	0.3	0	0.2
June	2002	Pre-Constr.	L	19/06/02	0	0.7	0	0.6
	2003	Pre-Constr.	AF	04/06/03	0	0.7	0	0.6
	2004	Pre-Constr.	AW	08/06/04	0	0.3	0	0.2
	2005	Construction	BN	15/06/05	0	0.3	0	0.2
	2006	Operation	CE	02/06/06	0	0.3	0	0.2
	2007	Operation	CU	08/06/07	0	0.3	0	0.2
July	2002	Pre-Constr.	M	22/07/02	0	0.7	0	0.6
	2003	Pre-Constr.	AG	22/07/03	0	0.7	0	0.6
	2004	Pre-Constr.	AX	29/07/04	0	0.3	0	0.2
	2005	Construction	BO	08/07/05	0	0.3	0	0.2
	2006	Operation	CF	21/07/06	43	19.0	0	0.2
	2007	Operation	CV	13/07/07	0	0.3	0	0.2
August	2002	Pre-Constr.	N	12/08/02	0	0.7	0	0.6
	2002	Pre-Constr.	O	22/08/02	0	0.7	0	0.6
	2003	Pre-Constr.	AH	22/08/03	0	0.7	0	0.6
	2004	Construction	AY	26/08/04	0	0.3	0	0.2
	2005	Construction	BP	01/08/05	0	0.3	0	0.2
	2006	Operation	CG	07/08/06	0	0.3	0	0.2
	2007	Operation	CW	30/08/07	0	0.3	0	0.2
September	2002	Pre-Constr.	P	11/09/02	0	0.7	0	0.6
	2002	Pre-Constr.	Q	24/09/02	0	0.7	0	0.6
	2003	Pre-Constr.	AI	09/09/03	0	0.7	0	0.6
	2003	Pre-Constr.	AJ	22/09/03	0	0.7	0	0.6
	2004	Construction	AZ	03/09/04	0	0.3	0	0.2
	2004	Construction	BA	29/09/04	0	0.3	0	0.2
	2005	Operation	BQ	06/09/05	0	0.3	0	0.2

					Common Gull		Kittiwake	
Month	**Year**	**Timing**	**Visit**	**Date**	**Population estimate**	**Standard Error**	**Population estimate**	**Standard Error**
	2005	Operation	BR	27/09/05	0	0.3	0	0.2
	2006	Operation	CH	18/09/06	0	0.3	0	0.2
	2006	Operation	CI	29/09/06	0	0.3	0	0.2
	2007	Operation	CX	10/09/07	0	0.3	0	0.2
October	2001	Pre-Constr.	A	13/10/01	0	1.3	0	1.0
	2001	Pre-Constr.	B	25/10/01	0	2.3	0	1.9
	2002	Pre-Constr.	R	15/10/02	0	0.7	6	4.8
	2002	Pre-Constr.	S	24/10/02	14	9.9	0	0.6
	2003	Pre-Constr.	AK	12/10/03	0	0.7	6	4.8
	2003	Pre-Constr.	AL	26/10/03	0	0.7	0	0.6
	2004	Construction	BB	15/10/04	0	0.3	0	0.2
	2004	Construction	BC	27/10/04	0	0.5	15	12.3
	2005	Operation	BS	03/10/05	0	0.3	0	0.2
	2005	Operation	BT	14/10/05	3	2.1	0	0.2
	2006	Operation	CJ	09/10/06	0	0.3	0	0.2
	2007	Operation	CY	02/10/07	0	0.3	0	0.2
	2007	Operation	CZ	10/10/07	0	0.3	0	0.2
	2007	Operation	DA	31/10/07	24	11.7	0	0.2
November	2001	Pre-Constr.	C	18/11/01	7	5.9	0	0.7
	2001	Pre-Constr.	D	30/11/01	0	2.2	0	1.7
	2002	Pre-Constr.	T	04/11/02	19	12.6	25	18.4
	2002	Pre-Constr.	U	15/11/02	34	20.4	6	4.8
	2003	Pre-Constr.	AM	06/11/03	67	35.3	0	0.6
	2003	Pre-Constr.	AN	27/11/03	0	0.7	7	5.7
	2004	Construction	BD	14/11/04	0	0.3	0	0.2
	2004	Construction	BE	26/11/04	20	10.3	7	4.8
	2005	Operation	BU	12/11/05	0	0.3	0	0.2
	2005	Operation	BV	17/11/05	16	8.4	3	2.1
	2006	Operation	CK	04/11/06	6	3.7	3	2.1
	2007	Operation	DB	05/11/07	12	6.5	0	0.2
	2007	Operation	DC	21/11/07	16	8.3	3	2.5
December	2001	Pre-Constr.	E	19/12/01	0	3.7	0	3.1
	2002	Pre-Constr.	V	14/12/02	24	15.0	0	0.6
	2003	Pre-Constr.	AO	08/12/03	0	0.7	6	4.8
	2003	Pre-Constr.	AP	18/12/03	0	0.7	0	0.6
	2004	Construction	BF	11/12/04	15	7.9	7	4.8
	2005	Operation	BW	07/12/05	6	3.7	6	4.0
	2006	Operation	CL	01/12/06	0	0.3	15	9.4
	2006	Operation	CM	10/12/06	3	2.1	10	6.5

3.1.1.3 Terns and Guillemot

Population estimates and standard errors for common tern and guillemot are shown in Table 8 below:

Table 8 Population Estimates for Common Tern and Guillemot

					Common Tern		Guillemot	
Month	**Year**	**Timing**	**Visit**	**Date**	**Population estimate**	**Standard Error**	**Population estimate**	**Standard Error**
January	2003	Pre-Constr.	W	22/01/03	0	0.5	30	14.8
	2004	Pre-Constr.	AQ	03/01/04	0	0.2	0	0.6
	2005	Construction	BG	19/01/05	0	0.2	19	7.4
	2006	Operation	BX	13/01/06	0	0.2	3	2.7
	2007	Operation	CN	15/01/07	0	0.2	3	2.7
February	2002	Pre-Constr.	F	17/02/02	0	0.8	0	2.2
	2003	Pre-Constr.	X	10/02/03	0	0.5	0	1.5
	2003	Pre-Constr.	Y	21/02/03	0	0.5	0	1.5
	2004	Pre-Constr.	AR	06/02/04	0	0.2	6	4.0
	2005	Construction	BH	07/02/05	0	0.2	0	0.6
	2006	Operation	BY	17/02/06	0	0.2	0	0.6
	2007	Operation	CO	02/02/07	0	0.2	0	0.6
March	2002	Pre-Constr.	G	19/03/02	0	0.5	0	1.5
	2003	Pre-Constr.	Z	06/03/03	0	0.5	6	5.7
	2003	Pre-Constr.	AA	23/03/03	0	0.5	0	1.5
	2004	Pre-Constr.	AS	05/03/04	0	0.2	7	4.2
	2005	Construction	BI	08/03/05	0	0.2	0	0.6
	2006	Operation	BZ	02/03/06	0	0.2	0	0.6
	2007	Operation	CP	02/03/07	0	0.2	0	0.6
April	2002	Pre-Constr.	H	05/04/02	0	0.5	0	1.5
	2002	Pre-Constr.	I	18/04/02	0	0.5	0	1.5
	2003	Pre-Constr.	AB	07/04/03	12	10.2	0	1.5
	2003	Pre-Constr.	AC	15/04/03	0	0.5	0	1.5
	2004	Pre-Constr.	AT	07/04/04	0	0.2	0	0.6
	2005	Construction	BJ	03/04/05	0	0.2	0	0.6
	2005	Construction	BK	22/04/05	0	0.2	0	0.6
	2006	Operation	CA	13/04/06	0	0.2	0	0.6
	2006	Operation	CB	19/04/06	0	0.2	0	0.6
	2007	Operation	CQ	06/04/07	0	0.2	0	0.6
	2007	Operation	CR	29/04/07	0	0.2	0	0.6
May	2002	Pre-Constr.	J	01/05/02	0	0.5	7	6.4
	2002	Pre-Constr.	K	30/05/02	18	15.3	0	1.5
	2003	Pre-Constr.	AD	06/05/03	12	10.2	0	1.5
	2003	Pre-Constr.	AE	19/05/03	0	0.5	0	1.5
	2004	Pre-Constr.	AU	12/05/04	3	2.7	15	6.6
	2004	Pre-Constr.	AV	28/05/04	0	0.2	0	0.6
	2005	Construction	BL	10/05/05	0	0.2	0	0.6
	2005	Construction	BM	29/05/05	0	0.2	0	0.6
	2006	Operation	CC	02/05/06	0	0.2	0	0.6
	2006	Operation	CD	23/05/06	3	2.2	0	0.6
	2007	Operation	CS	04/05/07	0	0.2	0	0.6
	2007	Operation	CT	21/05/07	0	0.2	0	0.6

					Common Tern		Guillemot	
Month	**Year**	**Timing**	**Visit**	**Date**	**Population estimate**	**Standard Error**	**Population estimate**	**Standard Error**
June	2002	Pre-Constr.	L	19/06/02	12	10.2	8	7.0
	2003	Pre-Constr.	AF	04/06/03	12	10.2	0	1.5
	2004	Pre-Constr.	AW	08/06/04	6	4.5	0	0.6
	2005	Construction	BN	15/06/05	23	17.8	0	0.6
	2006	Operation	CE	02/06/06	3	2.2	0	0.6
	2007	Operation	CU	08/06/07	0	0.2	0	0.6
July	2002	Pre-Constr.	M	22/07/02	77	66.3	0	1.5
	2003	Pre-Constr.	AG	22/07/03	0	0.5	0	1.5
	2004	Pre-Constr.	AX	29/07/04	4	3.1	0	0.6
	2005	Construction	BO	08/07/05	23	17.8	0	0.6
	2006	Operation	CF	21/07/06	6	4.5	0	0.6
	2007	Operation	CV	13/07/07	12	8.9	0	0.6
August	2002	Pre-Constr.	N	12/08/02	0	0.5	0	1.5
	2002	Pre-Constr.	O	22/08/02	50	43.4	0	1.5
	2003	Pre-Constr.	AH	22/08/03	0	0.5	0	1.5
	2004	Construction	AY	26/08/04	9	6.7	0	0.6
	2005	Construction	BP	01/08/05	35	26.6	0	0.6
	2006	Operation	CG	07/08/06	75	57.6	0	0.6
	2007	Operation	CW	30/08/07	6	4.5	0	0.6
September	2002	Pre-Constr.	P	11/09/02	6	5.1	0	1.5
	2002	Pre-Constr.	Q	24/09/02	0	0.5	0	1.5
	2003	Pre-Constr.	AI	09/09/03	52	44.9	0	1.5
	2003	Pre-Constr.	AJ	22/09/03	0	0.5	0	1.5
	2004	Construction	AZ	03/09/04	35	26.6	0	0.6
	2004	Construction	BA	29/09/04	0	0.2	0	0.6
	2005	Operation	BQ	06/09/05	522	397.9	0	0.6
	2005	Operation	BR	27/09/05	6	4.5	0	0.6
	2006	Operation	CH	18/09/06	3	2.2	0	0.6
	2006	Operation	CI	29/09/06	258	196.8	0	0.6
	2007	Operation	CX	10/09/07	3	2.2	0	0.6
October	2001	Pre-Constr.	A	13/10/01	0	0.9	0	2.4
	2001	Pre-Constr.	B	25/10/01	0	1.8	0	3.8
	2002	Pre-Constr.	R	15/10/02	0	0.5	0	1.5
	2002	Pre-Constr.	S	24/10/02	0	0.5	8	7.0
	2003	Pre-Constr.	AK	12/10/03	0	0.5	0	1.5
	2003	Pre-Constr.	AL	26/10/03	0	0.5	0	1.5
	2004	Construction	BB	15/10/04	0	0.2	0	0.6
	2004	Construction	BC	27/10/04	0	0.4	0	0.9
	2005	Operation	BS	03/10/05	0	0.2	0	0.6
	2005	Operation	BT	14/10/05	0	0.2	0	0.6
	2006	Operation	CJ	09/10/06	0	0.2	0	0.6
	2007	Operation	CY	02/10/07	7	5.2	3	2.7
	2007	Operation	CZ	10/10/07	0	0.2	0	0.6
	2007	Operation	DA	31/10/07	0	0.2	0	0.6
November	2001	Pre-Constr.	C	18/11/01	0	0.6	10	8.4
	2001	Pre-Constr.	D	30/11/01	0	1.6	0	3.8
	2002	Pre-Constr.	T	04/11/02	0	0.5	6	5.7
	2002	Pre-Constr.	U	15/11/02	0	0.5	0	1.5
	2003	Pre-Constr.	AM	06/11/03	0	0.5	0	1.5

					Common Tern		Guillemot	
Month	**Year**	**Timing**	**Visit**	**Date**	**Population estimate**	**Standard Error**	**Population estimate**	**Standard Error**
	2003	Pre-Constr.	AN	27/11/03	0	0.5	0	1.5
	2004	Construction	BD	14/11/04	0	0.2	6	4.0
	2004	Construction	BE	26/11/04	0	0.2	7	4.2
	2005	Operation	BU	12/11/05	0	0.2	0	0.6
	2005	Operation	BV	17/11/05	0	0.2	3	2.5
	2006	Operation	CK	04/11/06	0	0.2	14	6.2
	2006	Operation	CL	01/12/06	0	0.2	17	7.1
	2007	Operation	DB	05/11/07	0	0.2	0	0.6
	2007	Operation	DC	21/11/07	0	0.2	0	0.6
December	2001	Pre-Constr.	E	19/12/01	0	3.0	0	5.8
	2002	Pre-Constr.	V	14/12/02	0	0.5	32	15.5
	2003	Pre-Constr.	AO	08/12/03	0	0.5	0	1.5
	2003	Pre-Constr.	AP	18/12/03	0	0.5	13	9.1
	2004	Construction	BF	11/12/04	0	0.2	36	11.0
	2005	Operation	BW	07/12/05	0	0.2	0	0.6
	2006	Operation	CL	01/12/06	0	0.2	17	7.1
	2006	Operation	CM	10/12/06	0	0.2	38	11.3

3.1.2 Control Site

The tables below (Tables 9 to 12) present the estimated number of each species in the control site over the 5 year period surveyed. Data was recorded in this area on 31 surveys, up to and including 9 October 2006.

3.1.2.1 Divers and Cormorants

Table 9 Population Estimates for Divers, Gannet and Cormorant

					Red-throated diver		Gannet		Cormorant	
Month	**Year**	**Timing**	**Visit**	**Date**	**Population estimate**	**Standard Error**	**Population estimate**	**Standard Error**	**Population estimate**	**Standard Error**
January	2005	Construction	BG	19/01/05	38	24.1	0	1.4	3	3.3
	2006	Operation	BX	13/01/06	3	3.0	0	1.4	0	1.4
February	2003	Pre-Constr.	X	10/02/03	98	68.4	0	3.3	0	3.1
	2004	Pre-Constr.	AR	06/02/04	13	9.5	0	1.4	3	3.0
	2007	Operation	CO	02/02/07	47	29.2	0	1.4	0	1.4
March	2002	Pre-Constr.	G	19/03/02	0	2.6	0	3.2	0	3.1
	2003	Pre-Constr.	AA	23/03/03	12	10.8	0	3.3	0	3.1
	2005	Construction	BI	08/03/05	3	2.6	0	1.4	0	1.4
	2006	Operation	BZ	02/03/06	0	1.2	0	1.4	6	5.6
April	2003	Pre-Constr.	AB	07/04/03	0	1.2	0	1.4	0	1.4
May	2002	Pre-Constr.	K	30/05/02	0	2.7	0	3.3	0	3.1
	2003	Pre-Constr.	AD	06/05/03	0	2.7	0	3.3	0	3.1
	2005	Construction	BM	29/05/05	0	1.2	0	1.4	0	1.4
	2006	Operation	CD	23/05/06	0	1.2	0	1.4	0	1.4
	2007	Operation	CS	04/05/07	0	1.2	3	3.3	0	1.4
June	2004	Pre-Constr.	AW	08/06/04	0	1.2	0	1.4	0	1.4
July	2002	Pre-Constr.	M	22/07/02	0	2.7	0	3.3	0	3.1
	2003	Pre-Constr.	AG	22/07/03	0	2.7	12	14.8	0	3.1
	2005	Construction	BO	08/07/05	0	1.2	37	37.2	0	1.4
	2006	Operation	CF	21/07/06	0	1.2	14	15.2	0	1.4
August	2004	Construction	AY	26/08/04	0	1.2	3	3.3	0	1.4
	2006	Operation	CG	07/08/06	0	1.2	0	1.4	0	1.4
	2007	Operation	CW	30/08/07	0	1.2	0	1.4	0	1.4
September	2002	Pre-Constr.	P	11/09/02	0	2.7	0	3.3	0	3.1
	2003	Pre-Constr.	AJ	22/09/03	0	2.7	0	3.3	0	3.1
	2005	Operation	BQ	06/09/05	0	1.2	0	1.4	0	1.4
	2007	Operation	CX	10/09/07	0	1.2	3	3.3	0	1.4
October	2002	Pre-Constr.	S	24/10/02	0	2.7	0	3.3	0	3.1
	2006	Operation	CJ	09/10/06	0	1.2	3	3.3	0	1.4
	2007	Operation	CZ	10/10/07	0	1.2	0	1.4	0	1.4
November	2003	Pre-Constr.	AM	06/11/03	0	2.7	0	3.3	0	3.1
	2004	Construction	BE	26/11/04	7	5.9	0	1.4	0	1.4
	2005	Operation	BU	12/11/05	0	1.2	0	1.4	0	1.4
	2007	Operation	DC	21/11/07	7	5.4	0	1.4	0	1.4
December	2001	Pre-Constr.	E	19/12/01	0	2.9	0	3.6	0	3.4
	2002	Pre-Constr.	V	14/12/02	25	20.5	0	3.3	0	3.1
	2003	Pre-Constr.	AP	18/12/03	13	12.2	0	3.3	0	3.1
	2006	Operation	CM	10/12/06	3	3.0	0	1.4	0	1.4

4.1.2.2 Gulls

Population estimates and standard errors for larger gulls seen within the control site are shown below:

Table 10 Population Estimates for larger Gulls

					Great Black-Backed Gull		Lesser Black-Backed Gull		Herring Gull	
Month	**Year**	**Timing**	**Visit**	**Date**	**Population estimate**	**Standard Error**	**Population estimate**	**Standard Error**	**Population estimate**	**Standard Error**
January	2005	Construction	BG	19/01/05	0	1.5	0	1.3	0	1.2
	2006	Operation	BX	13/01/06	0	1.5	0	1.3	3	2.7
February	2003	Pre-Constr.	X	10/02/03	0	3.4	8	8.0	6	6.2
	2004	Pre-Constr.	AR	06/02/04	0	1.5	10	7.2	0	1.2
	2007	Operation	CO	02/02/07	0	1.5	0	1.3	3	2.7
March	2002	Pre-Constr.	G	19/03/02	0	3.4	0	3.1	6	6.1
	2003	Pre-Constr.	AA	23/03/03	6	6.7	16	13.6	12	11.2
	2005	Construction	BI	08/03/05	0	1.5	0	1.3	3	2.7
	2006	Operation	BZ	02/03/06	0	1.5	3	2.7	12	9.1
April	2003	Pre-Constr.	AB	07/04/03	0	1.5	0	1.3	0	1.2
May	2002	Pre-Constr.	K	30/05/02	7	7.6	0	3.1	6	6.2
	2003	Pre-Constr.	AD	06/05/03	0	3.4	0	3.1	25	21.2
	2005	Construction	BM	29/05/05	0	1.5	8	5.9	33	21.6
	2006	Operation	CD	23/05/06	0	1.5	0	1.3	6	4.9
	2007	Operation	CS	04/05/07	0	1.5	0	1.3	0	1.2
June	2004	Pre-Constr.	AW	08/06/04	0	1.5	0	1.3	52	31.9
July	2002	Pre-Constr.	M	22/07/02	0	3.4	0	3.1	41	32.7
	2003	Pre-Constr.	AG	22/07/03	0	3.4	0	3.1	6	6.2
	2005	Construction	BO	08/07/05	0	1.5	0	1.3	3	2.7
	2006	Operation	CF	21/07/06	0	1.5	6	4.9	3	2.7
August	2004	Construction	AY	26/08/04	0	1.5	0	1.3	0	1.2
	2006	Operation	CG	07/08/06	0	1.5	0	1.3	6	4.9
	2007	Operation	CW	30/08/07	0	1.5	0	1.3	0	1.2
September	2002	Pre-Constr.	P	11/09/02	0	3.4	0	3.1	0	2.8
	2003	Pre-Constr.	AJ	22/09/03	6	6.7	39	26.2	0	2.8
	2005	Operation	BQ	06/09/05	0	1.5	0	1.3	0	1.2
	2007	Operation	CX	10/09/07	0	1.5	6	4.9	3	2.7
October	2002	Pre-Constr.	S	24/10/02	0	3.4	7	7.2	0	2.8
	2006	Operation	CJ	09/10/06	7	5.4	9	6.5	0	1.2
	2007	Operation	CZ	10/10/07	0	1.5	3	2.7	3	2.7
November	2003	Pre-Constr.	AM	06/11/03	0	3.4	15	12.9	0	2.8
	2004	Construction	BE	26/11/04	3	2.9	21	12.1	13	9.6
	2005	Operation	BU	12/11/05	3	2.9	3	2.7	0	1.2
	2007	Operation	DC	21/11/07	0	1.5	0	1.3	17	12.5
December	2001	Pre-Constr.	E	19/12/01	0	3.8	0	3.4	0	3.1
	2002	Pre-Constr.	V	14/12/02	0	3.4	40	26.8	134	90.6
	2003	Pre-Constr.	AP	18/12/03	0	3.4	8	8.0	111	76.9
	2006	Operation	CM	10/12/06	0	1.5	22	12.8	9	7.2

Population estimates and standard errors for smaller gulls seen within the control site are shown below:

Table 11 Population Estimates for smaller Gulls

					Common Gull		Kittiwake	
Month	**Year**	**Timing**	**Visit**	**Date**	**Population estimate**	**Standard Error**	**Population estimate**	**Standard Error**
January	2005	Construction	BG	19/01/05	3	2.6	0	1.2
	2006	Operation	BX	13/01/06	26	15.7	9	7.8
February	2003	Pre-Constr.	X	10/02/03	0	2.8	20	20.1
	2004	Pre-Constr.	AR	06/02/04	0	1.2	0	1.2
	2007	Operation	CO	02/02/07	3	2.6	0	1.2
March	2002	Pre-Constr.	G	19/03/02	0	2.8	0	2.7
	2003	Pre-Constr.	AA	23/03/03	14	12.2	0	2.7
	2005	Construction	BI	08/03/05	17	11.1	0	1.2
	2006	Operation	BZ	02/03/06	14	9.6	0	1.2
April	2004	Pre-Constr.	AB	07/04/04	6	4.5	0	1.2
May	2002	Pre-Constr.	K	30/05/02	0	2.8	0	2.7
	2003	Pre-Constr.	AD	06/05/03	0	2.8	0	2.7
	2005	Construction	BM	29/05/05	0	1.2	0	1.2
	2006	Operation	CD	23/05/06	0	1.2	0	1.2
	2007	Operation	CS	04/05/07	0	1.2	0	1.2
June	2004	Pre-Constr.	AW	08/06/04	0	1.2	0	1.2
July	2002	Pre-Constr.	M	22/07/02	0	2.8	0	2.7
	2003	Pre-Constr.	AG	22/07/03	0	2.8	0	2.7
	2005	Construction	BO	08/07/05	0	1.2	0	1.2
	2006	Operation	CF	21/07/06	0	1.2	0	1.2
August	2004	Construction	AY	26/08/04	0	1.2	0	1.2
	2006	Operation	CG	07/08/06	0	1.2	0	1.2
	2007	Operation	CW	30/08/07	0	1.2	0	1.2
September	2002	Pre-Constr.	P	11/09/02	0	2.8	0	2.7
	2003	Pre-Constr.	AJ	22/09/03	0	2.8	0	2.7
	2005	Operation	BQ	06/09/05	0	1.2	0	1.2
	2007	Operation	CX	10/09/07	0	1.2	13	11.4
October	2002	Pre-Constr.	S	24/10/02	6	6.0	0	2.7
	2006	Operation	CJ	09/10/06	0	1.2	0	1.2
	2007	Operation	CZ	10/10/07	0	1.2	0	1.2
November	2003	Pre-Constr.	AM	06/11/03	6	6.0	0	2.7
	2004	Construction	BE	26/11/04	3	2.6	15	13.5
	2005	Operation	BU	12/11/05	0	1.2	0	1.2
	2007	Operation	DC	21/11/07	3	2.6	0	1.2

4.1.2.3 Terns and Guillemot

Table 12 Population Estimates for Common Tern and Guillemot

					Common Tern		Guillemot	
Month	**Year**	**Timing**	**Visit**	**Date**	**Population estimate**	**Standard Error**	**Population estimate**	**Standard Error**
January	2005	Construction	BG	19/01/05	0	1.2	0	1.5
	2006	Operation	BX	13/01/06	0	1.2	3	2.9
February	2003	Pre-Constr.	X	10/02/03	0	2.9	0	3.5
	2004	Pre-Constr.	AR	06/02/04	0	1.2	0	1.5
	2007	Operation	CO	02/02/07	0	1.2	0	1.5
March	2002	Pre-Constr.	G	19/03/02	0	2.8	0	3.5
	2003	Pre-Constr.	AA	23/03/03	0	2.9	0	3.5
	2005	Construction	BI	08/03/05	0	1.2	0	1.5
	2006	Operation	BZ	02/03/06	0	1.2	0	1.5
April	2004	Pre-Constr.	AB	07/04/04	0	1.2	0	1.5
May	2002	Pre-Constr.	K	30/05/02	0	2.9	0	3.5
	2003	Pre-Constr.	AD	06/05/03	0	2.9	0	3.5
	2005	Construction	BM	29/05/05	0	1.2	0	1.5
	2006	Operation	CD	23/05/06	0	1.2	0	1.5
	2007	Operation	CS	04/05/07	0	1.2	0	1.5
June	2004	Pre-Constr.	AW	08/06/04	0	1.2	0	1.5
July	2002	Pre-Constr.	M	22/07/02	6	7.1	0	3.5
	2003	Pre-Constr.	AG	22/07/03	0	2.9	0	3.5
	2005	Construction	BO	08/07/05	0	1.2	0	1.5
	2006	Operation	CF	21/07/06	6	6.2	0	1.5
August	2004	Construction	AY	26/08/04	0	1.2	0	1.5
	2006	Operation	CG	07/08/06	0	1.2	0	1.5
	2007	Operation	CW	30/08/07	0	1.2	0	1.5
September	2002	Pre-Constr.	P	11/09/02	0	2.9	0	3.5
	2003	Pre-Constr.	AJ	22/09/03	0	2.9	0	3.5
	2005	Operation	BQ	06/09/05	0	1.2	0	1.5
	2007	Operation	CX	10/09/07	0	1.2	0	1.5
October	2002	Pre-Constr.	S	24/10/02	0	2.9	0	3.5
	2006	Operation	CJ	09/10/06	0	1.2	0	1.5
	2007	Operation	CZ	10/10/07	0	1.2	0	1.5
November	2003	Pre-Constr.	AM	06/11/03	0	2.9	7	6.7
	2004	Construction	BE	26/11/04	0	1.2	0	1.5
	2005	Operation	BU	12/11/05	0	1.2	0	1.5
	2007	Operation	DC	21/11/07	0	1.2	0	1.5
December	2001	Pre-Constr.	E	19/12/01	0	3.1	6	6.6
	2002	Pre-Constr.	V	14/12/02	0	2.9	41	18.9
	2003	Pre-Constr.	AP	18/12/03	0	2.9	0	3.5
	2006	Operation	CM	10/12/06	0	1.2	7	4.3

3.1.3 Monthly Mean Population Estimates

Monthly population estimates have been calculated for the Wind Farm Site (including buffer) and Control Site based on the data collected over the 90 surveys conducted to date over the five years of monitoring at the Kentish Flats site. These monthly means are presented in Tables 13 to 20 to below.

3.1.3.1 Divers and Cormorant

Monthly means for divers have changed slightly from previous reports with the inclusion of data from Year 4. These are shown below.

Table 13 Population Estimates for Red-throated Diver, Gannet and Cormorant – Wind Farm and Buffer

		Red-throated Diver		Gannet		Cormorant	
Month	**Number of Visits**	**Population Estimate**	**Standard Error**	**Population Estimate**	**Standard Error**	**Population Estimate**	**Standard Error**
January	5	337	78.0	0	0.2	13	5.3
February	7	194	46.5	0	0.2	4	1.7
March	7	51	14.2	0	0.2	6	2.9
April	11	8	2.3	0	0.1	4	1.4
May	12	0	0.1	6	3.7	6	1.9
June	6	0	0.2	2	1.1	21	6.2
July	6	0	0.2	1	0.5	33	10.9
August	7	0	0.2	3	1.7	29	9.4
September	11	1	0.5	2	1.2	38	8.8
October	14	4	2.0	3	1.8	26	7.6
November	13	24	8.1	0	0.2	31	7.2
December	8	369	72.8	0	0.5	26	7.4

Table 14 Population Estimates for Red-throated Diver, Gannet and Cormorant – Control Site

		Red-throated Diver		Gannet		Cormorant	
Month	**Number of Visits**	**Population Estimate**	**Standard Error**	**Population Estimate**	**Standard Error**	**Population Estimate**	**Standard Error**
January	2	21	12.1	0	1.0	2	1.8
February	3	53	25.0	0	1.3	1	1.5
March	4	4	2.9	0	1.3	1	1.8
April	1	0	1.2	0	1.4	0	1.4
May	5	0	0.9	1	1.2	0	1.0
June	1	0	1.2	0	1.4	0	1.4
July	4	0	1.0	16	10.7	0	1.2
August	3	0	0.7	1	1.3	0	0.8
September	4	0	1.0	1	1.5	0	1.2
October	3	0	1.0	1	1.6	0	1.2
November	4	4	2.1	0	1.0	0	1.0
December	4	10	6.0	0	1.5	0	1.4

4.1.3.2 Gulls

Table 15 Population Estimates for larger Gulls – Wind Farm and Buffer

		Great Black-backed Gull		Lesser Black-backed Gull		Herring Gull	
Month	**Number of Visits**	**Population Estimate**	**Standard Error**	**Population Estimate**	**Standard Error**	**Population Estimate**	**Standard Error**
January	5	2	1.6	25	7.4	27	8.7
February	7	1	0.6	9	3.0	20	5.1
March	7	11	5.0	5	1.9	40	10.2
April	11	4	1.2	18	3.7	38	8.4
May	12	1	0.6	5	1.3	28	5.8
June	6	2	1.0	4	1.6	62	14.0
July	6	5	2.4	13	4.9	58	13.8
August	7	4	1.5	12	3.2	8	3.5
September	11	4	1.4	39	6.5	11	2.5
October	14	13	3.4	52	9.8	7	1.8
November	13	14	4.1	54	8.2	23	5.8
December	8	2	1.0	28	7.1	20	5.6

Table 16 Population Estimates for larger Gulls – Control Site

		Great Black-backed Gull		Lesser Black-backed Gull		Herring Gull	
Month	**Number of Visits**	**Population Estimate**	**Standard Error**	**Population Estimate**	**Standard Error**	**Population Estimate**	**Standard Error**
January	2	0	1.1	0	1.0	1	1.5
February	3	0	1.3	6	3.6	3	2.3
March	4	1	1.9	5	3.6	8	4.0
April	1	0	1.5	0	1.3	0	1.2
May	5	1	1.7	2	1.5	14	6.3
June	1	0	1.5	0	1.3	52	31.9
July	4	0	1.3	2	1.7	13	8.4
August	3	0	0.9	0	0.8	2	1.7
September	4	1	1.9	11	6.7	1	1.2
October	3	2	2.2	6	3.4	1	1.4
November	4	1	1.4	10	4.5	7	4.0
December	4	0	1.6	17	7.7	64	29.8

Table 17 Population Estimates for smaller Gulls – Wind Farm and Buffer

		Common Gull		Kittiwake	
Month	**No. of Visits**	**Population Estimate**	**Standard Error**	**Population Estimate**	**Standard Error**
January	5	11	3.5	12	6.1
February	7	19	4.9	85	42.1
March	7	25	6.4	0	0.2
April	11	16	4.5	0	0.1
May	12	0	0.1	0	0.1
June	6	0	0.2	0	0.2
July	6	6	3.2	0	0.2
August	7	0	0.2	0	0.2
September	11	0	0.2	0	0.1
October	14	3	1.1	2	1.0
November	13	15	3.6	4	1.6
December	8	6	2.2	5	1.8

Table 18 Population Estimates for smaller Gulls – Control Site

		Common Gull		Kittiwake	
Month	**No. of Visits**	**Population Estimate**	**Standard Error**	**Population Estimate**	**Standard Error**
January	2	15	8.0	4	3.9
February	3	1	1.3	7	6.7
March	4	11	4.8	0	1.1
April	1	6	4.5	0	1.2
May	5	0	0.9	0	0.9
June	1	0	1.2	0	1.2
July	4	0	1.1	0	1.1
August	3	0	0.7	0	0.7
September	4	0	1.1	3	3.0
October	3	2	2.1	0	1.1
November	4	3	1.8	4	3.5
December	4	1	1.4	7	6.3

4.1.3.3 Terns and Guillemot

Table 19 Population Estimates for Common Tern and Guillemot – Wind Farm and Buffer

		Common Tern		Guillemot	
Month	**No. of Visits**	**Population Estimate**	**Standard Error**	**Population Estimate**	**Standard Error**
January	5	0	0.1	11	3.4
February	7	0	0.2	1	0.7
March	7	0	0.1	2	1.1
April	11	1	0.9	0	0.3
May	12	3	1.6	2	0.8
June	6	9	3.9	1	1.2
July	6	19	11.6	0	0.4
August	7	25	11.0	0	0.4
September	11	80	40.6	0	0.3
October	14	0	0.4	1	0.7
November	13	0	0.2	4	1.1
December	8	0	0.4	17	3.2

Table 20 Population Estimates for Common Tern and Guillemot – Control Site

		Common Tern		Guillemot	
Month	No. of Visits	Population Estimate	Standard Error	Population Estimate	Standard Error
January	2	0	0.9	2	1.6
February	3	0	1.1	0	1.4
March	4	0	1.1	0	1.3
April	1	0	1.2	0	1.5
May	5	0	0.9	0	1.1
June	1	0	1.2	0	1.5
July	4	3	2.5	0	1.3
August	3	0	0.7	0	0.9
September	4	0	1.1	0	1.3
October	3	0	1.1	0	1.4
November	4	0	0.9	2	1.8
December	4	0	1.3	13	5.2

3.1.4 Effects of Weather

On all dates in Year 6 weather conditions were ideal for surveying seabirds from the boat, with a sea state of 4 occurring only on 4th May (survey CS) and 10th September 2007 (survey CX). Boat surveys were otherwise conducted in sea states of 3 or less, which permit adequate sampling of marine mammals.

3.1.5 Effects of Construction and Operation as Revealed by Boat Surveys

Section 3.5 describes the methodology for assessing changes to the populations of birds in and around the Kentish Flats relative to the control site that may be attributable to the effects of construction (FEPA monitoring objective 1).

The results of the quantitative density comparisons between the pre-construction, construction and operational phases suggested that:

- red-throated diver numbers were lower during the operational phase than during the pre-construction and construction phases
- gannet and cormorant numbers show no evidence of change.
- lesser black-backed gull numbers in February were lower in the construction and operational phases. There was some evidence that the numbers of this species were also lower in these phases in other winter months –October to March
- great black-backed gull, herring gull show no evidence of changes
- common tern numbers show no evidence of changes.
- guillemot numbers appear to be lower from January to March since the wind farm became operational

These results must be treated cautiously for several reasons. The total number of birds in British waters can vary enormously between different years as can their distribution around the coasts. Furthermore, the tests carried out for each month are not independent of each other[1].

[1] Independent of each other. Birds that are present in one month may still be present in the following month(s). The simpler statistical methods assume that information from one month tell you nothing about the next; more sophisticated methods should be used if this is not the case, as here.

The second analysis compared the wind farm site and buffer zone with the control area and is more satisfactory for detecting changes, since it eliminated most of the variation in numbers between different years. However, the control site was visited on only 38 of the 108 surveys and is of smaller size.

This second analytic approach used only those visits and for the four species which were recorded at both wind farm sites/buffer zone and control area on more than three visits. For all four species, red-throated diver, lesser black-backed gull, herring gull and common gull, the F tests comparing the three phases of the development were not statistically significant at the 5% level.

This second analysis indicates that there is no evidence of a direct effect on the numbers of birds using the wind farm site and buffer zone when comparing the pre and post construction data. This suggests that the differences found in the first analyses were due to changes in the overall numbers visiting the general area, rather than birds being displaced from the Kentish Flats wind farm site. However, this conclusion must also be treated with some caution due to the rather low power of the second statistical analyses and as a result of the data limitations noted above.

3.2 NUMBERS AND DISTRIBUTION OF BIRDS FROM AERIAL SURVEYS

Aerial data provided by WWT from survey area TH1 has been analysed statistically to produce numbers of birds per transect. As described in Section 3.4.2, population estimates (as mean numbers per transect) for the wind farm, boat survey buffer zone and boat survey control site produced from the aerial survey data available would have produced very low figures, and it would not have been possible to calculate standard errors for them so there could be no indication of their precision. It is therefore not possible to obtain satisfactory population estimates directly for the wind farm, buffer or control areas because they are so small in relation to the scale and transect spacing of the aerial surveys.

In order to assess possible construction effects, numbers of birds seen within the TH1 aerial transects over the wind farm and buffer zone (termed the "Wind Farm" area) may be compared to those passing immediately to the west (termed the "Western" area), and with those passing through the control site, immediately to the east (termed the "Eastern" area). Section 3.4.2 includes a detailed methodology. The first aerial survey conducted by the JNCC has been omitted from the analyses, since the flight transects used on that occasion cannot be readily compared with the WWT transect data.

The aerial results within 8-10km of the Kentish Flats wind farm are mapped in Figures 51-58, 79-88, 110-116 and 137-140.

3.2.1 Aerial Survey Data - Numbers

Table 21 below presents the results for the 'Wind farm and buffer zone area"; Table 22 presents the results for the 'Western Area'; and Table 23 presents the results for the 'Eastern Area'. Units presented are all birds per transect recorded within bands A and B with the corresponding standard errors.

Although the dates of surveys do not correspond between years, the highest estimated numbers of divers per transect within the "Wind Farm" area (see Table 21 below) were seen on 18th January 2003 (Mean 27.3; S.E. 5.2 see Table 21 and Figure 27), on 5th December 2004 (Mean 28.3; S.E. 5.3), on 15th January 2005 (Mean 33.6; S.E. 6.2), on 11th December 2005 (Mean 27.1; S.E. 4.8) and on 3rd February 2007 (Mean 32.1; S.E. 14.6).

The aerial data suggests that the peak month for divers for the 'Wind Farm' area (including wind farm site and boat survey buffer zone) appears to be mid-December to mid-January, though relatively high numbers may also be detected in February.

In Year 6 on February 18th the Mean (8.1; S.E. 4.5) diver numbers had reduced since 3rd February (32.1; S.E. 14.6) in the wind farm/buffer area. The mean diver numbers in the East reference area increased between 3rd and 18th February from 16.4 (S.E. 17.3) to 18.4 (S.E. 5.3).

In Year 5 the mean number of divers per wind farm and buffer aerial transect remained between 27.1 (S.E. 4.8) and 22.1 (S.E. 4.4) between December and February, while the numbers at the Eastern reference area increased from 23.8 (S.E. 5.7) to 33.0 (S.E. 8.31).

In Year 4, the December 2004 Mean (28.3; S.E. 5.3) increased to a January 2005 Mean of 33.6 (S.E. 6.2) in the "Wind Farm" area, while in the Eastern reference area the December 2004 Mean of 13.8 (S.E. 6.3), increased to a January 2005 Mean of 24.2 (S.E. 7.3), and had reached a Mean of 80.6 (S.E. 26.4) by 6th March 2005. On this date the numbers within the "Wind Farm" area (Mean 2.4; S.E. 22.3) were much lower, rising slightly by 13th March 2005 (Mean 7.1; S.E. 5.7).

In Year 3, February 2004 numbers of divers in the "Wind Farm" area (Mean 10.0; S.E. 7.2) had declined from December 2003 numbers (Mean 14.6; S.E. 3.6), but much higher numbers per transect were recorded in that month in the Eastern reference area (over the same period Mean 31.6; S.E. 8.5 up from Mean 20.2; S.E. 4.2).

Table 21 Area Means and Standard Errors for Wind Farm and buffer zone area from Aerial Survey data

Date	Transect	diver	cormorant	sea duck	wader	other wildf.	gull	tern	auk	Total
11/01/02	Means	7.7	0.0	0.7	0.0	0.0	0.0	0.0	0.0	8
	S.E.	2.0	0.0	4.7	0.0	0.0	0.0	0.0	0.0	5
21/08/02	Means	0.0	0.3	0.0	0.0	0.0	0.7	10.0	0.0	11
	S.E.	0.0	2.5	0.0	0.0	0.0	0.4	5.4	0.0	6
18/01/03	Means	27.3	0.0	0.0	0.0	0.0	47.7	0.0	15.0	103
	S.E.	5.2	0.3	0.0	0.0	0.0	12.6	0.0	6.2	17
30/08/03	Means	0.0	0.4	0.0	0.0	0.0	0.6	2.0	0.0	4
	S.E.	0.0	0.5	0.0	0.0	0.0	0.4	1.1	0.0	1
27/11/03	Means	6.3	0.8	2.3	0.3	0.0	11.7	0.0	0.2	22
	S.E.	1.8	0.5	1.0	0.2	0.0	5.4	0.0	0.5	6
17/12/03	Means	14.6	1.3	0.0	0.0	0.0	24.4	0.0	4.0	44
	S.E.	3.6	0.6	0.0	1.5	0.0	18.4	0.0	1.7	20
15/02/04	Means	10.0	13.3	7.0	147.1	0.9	271.7	0.0	0.0	454
	S.E.	7.2	6.4	3.2	133.6	9.2	81.9	0.0	0.0	212
30/10/04	Means	1.1	2.6	2.1	0.0	3.6	22.7	0.0	0.1	39
	S.E.	0.4	1.1	1.2	0.3	2.4	5.0	0.0	0.2	7
05/12/04	Means	28.3	8.7	65.1	39.6	37.4	164.6	0.0	4.1	354
	S.E.	5.3	2.5	31.7	72.5	19.7	61.6	0.0	1.3	143
15/01/05	Means	33.6	3.0	94.4	3.6	0.0	46.9	0.0	2.7	189
	S.E.	6.2	5.6	61.2	97.7	0.3	9.8	0.0	0.7	109
06/03/05	Means	2.4	0.3	7.7	11.1	0.0	67.3	0.0	0.0	92
	S.E.	22.3	1.5	4.3	128.0	3.8	22.9	0.0	0.0	142
13/03/05	Means	7.1	0.6	0.0	112.1	4.3	30.1	0.0	0.0	155
	S.E.	5.7	0.2	0.0	125.5	2.8	18.0	0.0	0.0	132
31/07/05	Means	0.0	3.7	0.0	0.0	0.0	13.3	4.1	0.3	22
	S.E.	0.0	1.4	0.0	101.2	0.0	18.9	1.3	0.1	110
13/11/05	Means	1.1	2.3	0.0	35.9	0.0	38.6	0.0	0.1	79
	S.E.	0.4	0.6	0.0	109.4	11.2	84.8	0.4	0.1	193
11/12/05	Means	27.1	3.6	7.4	25.1	6.0	407.9	0.0	0.0	485
	S.E.	4.8	1.3	4.6	178.9	8.9	191.3	0.0	0.0	365
14/01/06	Means	22.1	1.7	3.6	0.0	0.0	58.0	0.0	0.0	88
	S.E.	4.4	0.7	23.5	138.4	1.3	18.7	0.0	0.0	138
18/02/06	Means	24.6	54.1	3.1	60.0	0.0	125.3	0.0	0.0	268
	S.E.	7.0	31.6	3.1	302.6	19.6	35.9	0.0	0.0	358
03/02/07	Means	32.1	1.9	2.0	0.0	0.0	28.7	0.0	0.0	65
	S.E.	14.6	7.0	1.5	85.1	2.7	27.5	0.0	0.0	98
18/02/07	Means	8.1	23.7	47.4	0.0	1.0	38.7	0.0	0.0	119
	S.E.	4.5	15.2	24.9	336.0	11.0	66.4	0.0	0.0	417

Table 22 Area Means and Standard Errors for the Western Area derived from Aerial Survey data

Date	Transect	diver	cormorant	sea duck	wader	other wildf.	gull	tern	auk	Total
11/01/02	Means	4.0	0.0	13.0	0.0	0.0	0.0	0.0	0.0	18
	S.E.	2.4	0.0	5.8	0.0	0.0	0.0	0.0	0.0	6
21/08/02	Means	0.0	7.5	0.0	0.0	0.0	1.0	0.0	0.0	9
	S.E.	0.0	3.1	0.0	0.0	0.0	0.5	6.6	0.0	7
18/01/03	Means	35.0	0.0	0.0	0.0	0.0	42.0	0.0	1.5	98
	S.E.	6.9	0.3	0.0	0.0	0.0	16.7	0.0	8.2	22
30/08/03	Means	0.0	0.5	0.0	0.0	0.0	2.0	5.0	0.0	8
	S.E.	0.0	0.9	0.0	0.0	0.0	0.7	1.8	0.0	2
27/11/03	Means	1.0	0.3	0.0	0.3	0.0	30.0	0.0	0.0	32
	S.E.	2.5	0.6	1.4	0.3	0.0	7.6	0.0	0.6	8
17/12/03	Means	5.5	0.5	0.0	0.0	0.0	20.0	0.0	0.5	30
	S.E.	6.7	1.2	0.0	2.8	0.0	34.5	0.0	3.2	36
15/02/04	Means	2.0	5.3	0.5	368.3	24.5	273.8	0.0	0.0	675
	S.E.	9.5	8.5	4.2	176.7	12.2	108.4	0.0	0.0	280
30/10/04	Means	0.5	0.5	0.0	0.5	0.8	15.0	0.0	0.0	18
	S.E.	0.5	1.5	1.6	0.4	3.1	6.6	0.0	0.3	9
05/12/04	Means	4.3	0.8	0.3	215.0	17.3	327.3	0.0	0.0	565
	S.E.	7.1	3.3	41.9	96.0	26.1	81.5	0.0	1.8	189
15/01/05	Means	11.8	1.0	6.3	361.8	0.0	30.3	0.0	1.0	413
	S.E.	8.2	7.4	81.0	129.3	0.4	12.9	0.0	0.9	144
06/03/05	Means	0.3	0.0	6.5	437.8	10.0	146.8	0.0	0.0	602
	S.E.	29.5	2.0	5.6	169.3	5.0	30.3	0.0	0.0	188
13/03/05	Means	15.8	0.0	0.0	292.8	0.3	105.8	0.0	0.0	415
	S.E.	7.6	0.3	0.0	166.1	3.7	23.7	0.0	0.0	175
31/07/05	Means	0.0	0.0	0.0	267.8	0.0	75.0	1.3	0.0	344
	S.E.	0.0	1.8	0.0	133.9	0.0	25.0	1.7	0.2	146
13/11/05	Means	0.3	1.3	0.0	372.3	32.3	474.5	0.0	0.0	881
	S.E.	0.6	0.8	0.0	144.7	14.8	112.2	0.5	0.2	255
11/12/05	Means	8.5	0.8	7.3	512.8	22.0	654.3	0.0	0.0	1207
	S.E.	6.4	1.8	6.0	236.7	11.8	253.0	0.0	0.0	483
14/01/06	Means	14.0	0.5	8.8	428.3	3.5	34.5	0.0	0.0	490
	S.E.	5.8	1.0	31.0	183.1	1.8	24.7	0.0	0.0	182
18/02/06	Means	7.8	57.8	0.0	853.3	56.5	224.0	0.0	0.0	1202
	S.E.	9.2	41.9	4.1	400.3	25.9	47.5	0.0	0.0	474
03/02/07	Means	10.8	0.3	2.3	225.3	7.3	152.0	0.0	0.0	398
	S.E.	19.4	9.3	2.0	112.6	3.6	36.4	0.0	0.0	129
18/02/07	Means	3.3	0.8	17.5	889.0	32.8	225.0	0.0	0.0	1168
	S.E.	6.0	20.2	32.9	444.5	14.6	87.9	0.0	0.0	551

Table 23 Area Means and Standard Errors for the Eastern Area derived from Aerial Survey data

Date	Transect	diver	cormorant	sea duck	wader	other wildf.	gull	tern	auk	Total
11/01/02	Means	7.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7
	S.E.	1.5	0.0	3.7	0.0	0.0	0.0	0.0	0.0	4
21/08/02	Means	0.0	0.2	0.0	0.0	0.0	0.4	1.4	0.0	2
	S.E.	0.0	1.9	0.0	0.0	0.0	0.3	4.2	0.0	4
18/01/03	Means	11.6	0.6	0.0	0.0	0.0	23.0	0.0	33.5	67
	S.E.	5.6	0.3	0.0	0.0	0.0	13.6	0.0	6.7	18
30/08/03	Means	0.0	1.0	0.0	0.0	0.0	1.0	1.8	0.0	5
	S.E.	0.0	0.6	0.0	0.0	0.0	0.5	1.3	0.0	2
27/11/03	Means	4.0	0.5	0.8	0.0	0.0	3.3	0.0	1.2	10
	S.E.	1.8	0.5	1.0	0.2	0.0	5.4	0.0	0.5	6
17/12/03	Means	20.2	1.0	0.0	3.0	0.0	65.4	0.0	7.2	107
	S.E.	4.2	0.7	0.0	1.8	0.0	21.8	0.0	2.1	23
15/02/04	Means	31.6	0.2	0.0	0.0	0.0	59.0	0.0	0.0	96
	S.E.	8.5	7.6	3.8	158.1	10.9	97.0	0.0	0.0	250
30/10/04	Means	0.6	0.4	0.0	0.6	0.0	25.0	0.0	0.6	31
	S.E.	0.4	1.3	1.5	0.4	2.8	5.9	0.0	0.3	8
05/12/04	Means	13.8	0.6	0.0	0.0	0.0	35.2	0.0	5.2	56
	S.E.	6.3	3.0	37.5	85.8	23.3	72.9	0.0	1.6	169
15/01/05	Means	24.2	13.8	1.2	0.0	0.6	29.4	0.0	0.4	71
	S.E.	7.3	6.6	72.4	115.6	0.3	11.6	0.0	0.8	129
06/03/05	Means	80.6	3.2	0.0	0.0	0.0	18.8	0.0	0.0	106
	S.E.	26.4	1.8	5.0	151.4	4.5	27.1	0.0	0.0	168
13/03/05	Means	17.0	0.0	0.0	0.0	0.0	11.8	0.0	0.0	30
	S.E.	6.8	0.3	0.0	148.5	3.3	21.2	0.0	0.0	157
31/07/05	Means	0.0	0.0	0.0	0.0	0.0	20.2	5.8	0.0	27
	S.E.	0.0	1.6	0.0	119.7	0.0	22.4	1.6	0.2	130
13/11/05	Means	0.8	0.6	0.0	0.0	0.0	21.8	0.8	0.2	35
	S.E.	0.5	0.7	0.0	129.4	13.3	100.4	0.4	0.2	228
11/12/05	Means	23.8	2.6	0.0	0.0	0.0	127.4	0.0	0.0	161
	S.E.	5.7	1.6	5.4	211.7	10.5	226.3	0.0	0.0	432
14/01/06	Means	31.6	0.0	51.8	0.0	0.0	33.2	0.0	0.0	131
	S.E.	5.2	0.9	27.8	163.7	1.6	22.1	0.0	0.0	163
18/02/06	Means	33.0	0.0	6.0	0.0	0.0	65.4	0.0	0.0	106
	S.E.	8.3	37.4	3.7	358.0	23.2	42.4	0.0	0.0	424
03/02/07	Means	16.4	16.0	0.0	0.0	0.6	13.8	0.0	0.0	47
	S.E.	17.3	8.3	1.8	100.7	3.2	32.6	0.0	0.0	115
18/02/07	Means	18.4	0.6	14.2	0.0	0.0	12.4	0.0	0.0	47
	S.E.	5.3	18.0	29.4	397.6	13.0	78.6	0.0	0.0	493

These numbers of birds seen per aerial transect include many waders and others seen at northern and southern ends on the transects, far from Kentish Flats Wind Farm (see section 3.2.3 below).

3.2.2 Aerial Survey Data - Distribution

In year 6 there were five records of eight individuals within the buffer zone, and none were seen within the wind farm. Even though no changes in bird abundance were statistically significant, the density estimates within the area including transects traversing the wind farm and buffer zone (see table 21 above) and the mapped distributions (see Figures 137 and 139) suggest that the numbers of red-throated divers were lower during the operational phase than during pre-construction.

Waders seen on 3rd February 2007 included 150 oystercatchers south of the boats control site and one unidentified wader to the northeast (see Figure 138), both records lying within the Eastern reference area. On 18th February 2007 no waders were seen within the areas mapped (see Figure 140).

In Year 6 diver numbers within the transects traversing the wind farm and buffer zone were higher on 3rd than 18th February (see Figures.137 and 139). In Year 5 diver numbers built up from the very few seen on 13th November 2005, and more were seen in the buffer zone on 11th December than on 14th January or 18th February 2006 (see Figures 86, 110, 112 and 114).

On 3rd February 2007 divers were concentrated to the east and south-west of the wind farm, while on 18th February there was an aggregation over the sand banks to the south-east. The previous year on 6th March 2005 in Year 4 most divers were seen at least 5km north and northwest of the wind farm and control sites. On 13th March 2005 most of the divers observed were not seen within the wind farm site or buffer zone, but rather to the south closer to the coast (see Figure 83). On this later date, the Eastern reference area had higher numbers (Mean 17.0; S.E. 6.8), especially over 10km northwest of the wind farm, as did the Western reference area on the north side of the Inner Thames.

Waders were more numerous in the Western reference area than other areas in February 2004. These peaks were exceeded in December 2004, November and December 2005. Wader numbers recorded per Western reference area increased through the winter of Year 4, peaking at 853.3 (S.E. 400.3).

3.2.3 Aerial Survey Data - Monthly Analysis

This section examines the ratios of relative abundance measures between the wind farm and buffer and the two other areas. Pooling data over several years reduces the influence of unusually good or bad years for a particular species.

Table 24 Average number of birds per transect by region for the Wind farm and buffer zone area

Date	Transect	diver	cormorant	sea duck	wader	other wildf.	gull	tern	auk	Total
January	Means	22.7	1.2	24.7	0.9	0.0	38.1	0.0	4.4	97
	S.E.	2.4	1.4	16.4	42.4	0.3	6.1	0.0	1.6	44
February	Means	18.7	23.3	14.9	51.8	0.5	116.1	0.0	0.0	226
	S.E.	4.6	9.1	6.3	119.8	6.1	28.7	0.0	0.0	149
March	Means	4.8	0.4	3.9	61.6	2.1	48.7	0.0	0.0	123
	S.E.	11.5	0.8	2.1	89.6	2.4	14.6	0.0	0.0	97
July	Means	0.0	3.7	0.0	0.0	0.0	13.3	4.1	0.3	22
	S.E.	0.0	1.4	0.0	101.2	0.0	18.9	1.3	0.1	110
August	Means	0.0	0.4	0.0	0.0	0.0	0.6	6.0	0.0	7
	S.E.	0.0	1.3	0.0	0.0	0.0	0.3	2.8	0.0	3
October	Means	1.1	2.6	2.1	0.0	3.6	22.7	0.0	0.1	39
	S.E.	0.4	1.1	1.2	0.3	2.4	5.0	0.0	0.2	7
November	Means	3.7	1.6	1.2	18.1	0.0	25.1	0.0	0.2	50
	S.E.	0.9	0.4	0.5	54.7	5.6	42.5	0.2	0.2	96
December	Means	23.3	4.5	24.2	21.6	14.5	199.0	0.0	2.7	294
	S.E.	2.7	1.0	10.7	64.4	7.2	67.3	0.0	0.7	131

Table 25 Average number of birds per transect by region for the Western Area

Date	Transect	diver	cormorant	sea duck	wader	other wildf.	gull	tern	auk	Total
January	Means	16.2	0.4	7.0	197.5	0.9	26.7	0.0	0.6	255
	S.E.	3.1	1.9	21.7	56.0	0.4	8.1	0.0	2.1	58
February	Means	5.9	16.0	5.1	583.9	30.3	218.7	0.0	0.0	861
	S.E.	6.1	12.0	8.4	158.4	8.1	38.0	0.0	0.0	197
March	Means	8.0	0.0	3.3	365.3	5.1	126.3	0.0	0.0	508
	S.E.	15.2	1.0	2.8	118.6	3.1	19.3	0.0	0.0	128
July	Means	0.0	0.0	0.0	267.8	0.0	75.0	1.3	0.0	344
	S.E.	0.0	1.8	0.0	133.9	0.0	25.0	1.7	0.2	146
August	Means	0.0	4.0	0.0	0.0	0.0	1.5	2.5	0.0	8
	S.E.	0.0	1.6	0.0	0.0	0.0	0.4	3.4	0.0	4
October	Means	0.5	0.5	0.0	0.5	0.8	15.0	0.0	0.0	18
	S.E.	0.5	1.5	1.6	0.4	3.1	6.6	0.0	0.3	9
November	Means	0.6	0.8	0.0	186.3	16.1	252.3	0.0	0.0	457
	S.E.	1.3	0.5	0.7	72.4	7.4	56.2	0.3	0.3	128
December	Means	6.1	0.7	2.5	242.6	13.1	333.8	0.0	0.2	601
	S.E.	3.9	1.3	14.1	85.1	9.5	89.3	0.0	1.2	173

Table 26 Average number of birds per transect by region for the Eastern Area

Date	Transect	diver	cormorant	sea duck	wader	other wildf.	gull	tern	auk	Total
January	Means	18.7	3.6	13.3	0.0	0.2	21.4	0.0	8.5	69
	S.E.	2.7	1.7	19.4	50.1	0.4	7.1	0.0	1.7	52
February	Means	24.9	4.2	5.1	0.0	0.2	37.7	0.0	0.0	74
	S.E.	5.4	10.8	7.5	141.7	7.2	34.0	0.0	0.0	176
March	Means	48.8	1.6	0.0	0.0	0.0	15.3	0.0	0.0	68
	S.E.	13.6	0.9	2.5	106.1	2.8	17.2	0.0	0.0	115
July	Means	0.0	0.0	0.0	0.0	0.0	20.2	5.8	0.0	27
	S.E.	0.0	1.6	0.0	119.7	0.0	22.4	1.6	0.2	130
August	Means	0.0	0.6	0.0	0.0	0.0	0.7	1.6	0.0	4
	S.E.	0.0	1.0	0.0	0.0	0.0	0.3	2.2	0.0	2
October	Means	0.6	0.4	0.0	0.6	0.0	25.0	0.0	0.6	31
	S.E.	0.4	1.3	1.5	0.4	2.8	5.9	0.0	0.3	8
November	Means	2.4	0.6	0.4	0.0	0.0	12.6	0.4	0.7	22
	S.E.	0.9	0.4	0.5	64.7	6.6	50.3	0.2	0.2	114
December	Means	19.3	1.4	0.0	1.0	0.0	76.0	0.0	4.1	108
	S.E.	3.2	1.1	12.6	76.1	8.5	79.6	0.0	0.9	155

Average diver numbers peaked in the "Wind Farm" area (containing the transects which traverse the Kentish Flats Wind farm and buffer) in December and January. In January average numbers of divers seen in the Western reference area were highest. Within the Eastern reference area, including the boat survey control site, average numbers per transect were highest in February and March.

Waders peaked in March in the "Wind Farm" area but were much higher in the Western reference area peaking in February. Seaduck numbers were highest in "Wind Farm" area in January and December, when they were higher than elsewhere in any month. Other wildfowl numbers peaked in the Western reference area in February, remaining low in all other areas except December in the "Wind Farm" area.

Gull numbers were highest in all aerial study areas in December. Tern numbers detected by the aerial surveys peaked in July and August.

3.2.4 Effects of Construction and Operation as Revealed by Aerial Surveys

Seven of the aerial surveys were carried out during the pre-construction part of the study, six during the construction period (22 August 2004 – 22 August 2005), and six since the Kentish Flats wind farm has been operational.

As described in section 2.4.3 the ratios of the mean number of birds per aerial transect for the "Wind Farm" area to the two other "Eastern" (including boat survey control site) and "Western" reference areas were calculated. Thus eight species groups: divers, cormorant, seaduck, other wildfowl, waders, gulls, terns, auks, and all birds, were recorded in both the group of transects that included part of the wind farm or passed near to it, and in transects away from the wind farm site. The estimated densities for the first group of transects were compared with those from the other two groups for all these groups except "other wildfowl" and terns, for which insufficient data exist. The logarithm of the ratio was analysed using the analysis of variance (ANOVA). The only F test that was significant at the 5% level was for the overall total[2].

Examination of the individual transect totals suggested that there has been an increase in gull and wader numbers on one transect (transect 4) immediately to the west of those grouped as wind farm transects (5 to 11 inclusive). This has increased the variability between transects which has partially masked any changes in means. Thus the aerial surveys have not provided any clear evidence of changes in numbers

[2] This means that if the number of birds outside the site has remained constant, the estimates imply that numbers on the wind farm site have declined from 100% pre-construction to 58% during construction and 32% during operation.

of any of the nine groups of species examined that have been caused by the construction and operation of the wind farm.

4 DESCRIPTION OF BOAT SURVEY DATA

4.1 BIRD GROUPS

This section describes the observations of birds of conservation importance including the qualifying Kent SPA species recorded during the boat surveys in Year 6. The following sections describe observations of the various species recorded during the Kentish Flats boat surveys based upon the surveyors' reports. Surveyors' reports including their descriptions of birds seen in Year 6 can be viewed in full in Appendix A3.

For comparison, descriptions of bird populations recorded during the previous years of monitoring, and reproduced from the previous monitoring reports, are included in order to provide a longer term view of bird populations and behaviour across the area.

Measures of abundance in the form of population are then included for those species with sufficient sample sizes for realistic standard errors to be calculated.

The bird observations and descriptions are discussed below, particularly in relation to FEPA objectives 1 to 4 (see also Section 7.3 FEPA Monitoring Objectives).

Conclusions on the boat survey data are made in section 7.1.

It is important to note that the numbers of birds referred to in the surveyors' reports are sometimes incorrect because they are anecdotal and therefore implicitly less accurate than the data sheets.

Results and figures presented in this report have been plotted from data imported into ESS's in-house database after checking and in some cases correcting raw data sheets, rather than from surveyors' reports.

4.1.1 Divers

On 10th December 2006 there were 27 divers recorded within the boat survey area: eight black-throated diver, eight red-throated and 11 that were too distant to be recorded to species. Approximately 35 further divers, most thought to be red-throated divers, were seen just to the north of the northwest corner of the survey area.

By 15th January 2007 diver numbers had increased, with 78 red-throated diver recorded, most to the east or west of the wind farm. One black-throated diver was identified at the southern end of transect 4. Many of the divers were first observed when flushed by the survey vessel often several hundred metres ahead. Around 30 more red-throated divers were seen just to the north of the site along the southern edge of the shipping channel. One diver was seen flying through the wind farm at one metre asl and although no divers were recorded on the water in the wind farm area itself, three were seen just on the periphery.

Fewer divers were seen on 2nd February 2007 with 30 recorded in total: 28 red-throated, one black-throated and one that could not be identified to species. Most divers were recorded in the control area and in the eastern-most transect 8.

On 2nd March 2007 a total of 89 divers were recorded on site: 80 red-throated divers, four black-throated divers and five that could not be identified to species. Most divers were flushed by the survey vessel near the north end of transect 2. Twelve red-throated divers were also recorded in eastern-most transect 8. Around 50 further red-throated divers and 11 black-throated divers were seen during the outbound journey on the water, fairly evenly spread along a band one to two km south of the study area.

On 6th April 2007 eight red-throated divers were recorded –six were flushed by the survey vessel and all were recorded to the east or west of the wind farm.

Seventeen red-throated divers and three black-throated divers were recorded on 21st November 2007. Most were flushed off the water by the survey boat and most were seen to the north of the turbine array.

On 7th December 2005 there were 11 red-throated and three black-throated divers. Five red-throated divers were also seen in between the northern ends of transects 2 and 3. In Year 4 on 11th December 2004 a total of 450 had been recorded.

On 13th January 2006 there was the highest diver count in Year 5, of 157 red-throated diver and 5 black-throated divers. In addition a group of around 40 divers was seen just to the north of the northwestern corner of the buffer zone. A number of fish marks, thought to be shoals of sprats was noted on the echo-sounder towards the northern ends of transects 1 and 2. No divers were seen within the operational wind farm but a number were seen in flight or on the water very close to the outside edge of the wind farm, (some sitting less than 100m from a turbine). It appeared to the surveyors that the lines of turbines may act as a barrier to divers entering or passing through the turbine array, as opposed to them being troubled by individual rotating turbines. The population estimate for red-throated diver on this date was 99 (± 43.4). On 19th January 2005, 245 divers were recorded, of which 226 were identified as red-throated diver, which is below the total count, suggesting that the divers were aggregating, as has occurred during some previous surveys.

On 17th February 2006 only four red-throated divers were recorded (plus two seen between transects). The population estimate on this date was 17 (± 9.4) whose 95% probable range was above the total count. This is probably a record low count for divers in the recognized diver season and very surprising for February considering the quantity seen in this month in the past. On 7th February 2005, 683 divers were recorded (see Figure 61).

As in February there was an exceptionally low diver-count on 2nd March 2006 with only four red-throated and four black-throated divers recorded. On 8th March 2005 17 red-throated divers had been seen.

On 4th November 2006 the first diver of the season was recorded: a black-throat flying quite high at 20m asl, to the south-west in transect 7 and not on course for the turbines. There were still only a few divers on the site on 01/12/06 with three red-throated divers and two black-throated divers recorded, all flushed by the survey vessel.

More black-throated divers (11 shown on Figure 105) were detected in Year 5 than Year 4 (when six were seen) but fewer than in some previous years. The highest numbers of black-throated divers (25 in Year 3) is striking, with only two seen in Year 1 and none of this species recorded in Year 2.

On 8th March 2005 one black-throated diver was seen (see Figure 62) in the control site; three black-throated divers were recorded on 3rd April 2005 (see Figure 63), on 12th November 2005 a black-throated diver was seen on the control site (see figure 74), and on 17th November a black-throated diver was seen at the south of transect 1 in the southwest corner of the buffer (see Figure 75).

In Year 3 on 7th April 2004 eight black-throated divers were seen, some of which were in summer plumage. Incidentally while travelling to the survey site, approximately four kilometres north of Hampton pier, around 30 divers, at least six of which were identified as black-throated diver, were seen in a feeding over an area approximately 100-200m^2. On 15th October 2004 two black-throated divers were seen flying over the wind farm site, plus one just to the south of the site. The previous year on 12th October 2003 the first divers of the autumn were thought likely to be black-throated divers (although identification was not certain) supporting the view that black-throats are generally seen in this part of the Thames Estuary earlier in the year than red-throats. On 26th November 2004, the highest number, 15 black-throated divers were observed.

Comparisons using data from all boat surveys when red-throated divers were recorded suggested that there were lower numbers during the operational phase than during the pre-construction and construction phases. However, comparisons with the control site (on those dates when divers were recorded on the control site) suggest that the differences found in the first analyses were due to changes in the overall numbers visiting the general area, rather than birds being displaced from the wind farm site (see section 3.1.5). However, the rather low power of the second analyses, because of the data limitations noted above, imply that a more direct effect cannot be discounted.

The population estimated for 2006-07 differed greatly between months, with January, March and November 2007 showing increases in the population estimates in relation to previous years, while a reduction was recorded in February. December 2006 figures have remained relatively stable for past three years. None of these changes are statistically significant.

In Year 6 population estimates of divers in the wind farm and buffer had increased since Year 5 though were still reduced compared with previous years. In December 2006 the population estimate was 3 (±2.3) and peaked in March at 221 (± 87.0). Much lower population estimates and numbers were recorded during the Year 5 monitoring, compared to records for Year 4 and other previous years. On survey dates in November and December 2005 the population estimates were 3 (± 2.3) and in March and April 2006 were zero.
During the Year 5 surveys no divers were seen either in the air or on the water within the Kentish Flats wind farm area.

In Year 6 observations of divers totalled 256, of which 157 were sighted in transect (see Figure 134). In Year 5 observations of divers totalled 194, of which 51 were in transect or snapshot. In Year 4 observations of divers totalled 1,404, of which 704 were in transect/snapshot. In Year 3 1,005 divers were recorded of which 366 were seen in transect/snapshot. In Year 2 total of 1,811 divers (311 in transect/snapshot). In Year 1, 62 divers were detected (28 in transect/snapshot). Diver numbers are displayed on a monthly basis in Graphs 1-3 in Appendix 4.

4.1.2 Cormorants

In Year 6 there were 411 cormorants sighted, of which 210 were in transect.

Consistent numbers of cormorants were seen within the turbine array area during pre-construction, construction and operation. The statistical analyses over the full period of boat surveys showed no significant changes although averages show an increase within the turbine array during operation.

4.1.3 Grebes

In Year 6 there were three great-crested grebes recorded, of which two were in transect. On 10th December 2006 a great-crested grebe was recorded in the control area flying to the west and another was seen on the water in transect 4, possibly the same bird as it was seen flying in approximately this direction. On 15th January 2007 a great crested grebe was recorded near the southern end of transect 4.

In Year 5 three great-crested grebes were recorded. One was on the sea on 17th February 2006 at the southern end of transect 2 in the buffer zone, and two were flying in the control site on 2nd March 2006. The two seen in flight were on the second and fourth transects flying east at a height of 2m and west at a height of 1m respectively. For most of January and February 2006 there were 250+ great crested grebes wintering off the Kent coast south of the wind farm off Reculver, Minnis Bay, and especially Greham Bay.

No great-crested or any other grebes had been seen in Year 4. In each previous year only small numbers had been seen; this very coastal species would not be expected as far from the coast as the wind farm. However, on 3rd January 2004 eight great-crested grebes were recorded (see Figure 33), the highest number recorded yet for surveys on this site.

Too few of this species were recorded for meaningful population estimation.

4.1.4 Geese

As in previous years the most frequently seen wildfowl were dark-bellied Brent geese (see Figure 135). On 2nd October 2007 flocks of 13 and two dark-bellied Brent geese were recorded heading southwest and northwest respectively. The flock of 13 were recorded near the southern end of transect 8 (and kept to the south of the turbine array as they flew on), and the flock of two were near the southern end of transect 1 (and also appeared to have kept to the south of the turbine array). On 31st October 2007 two dark-bellied Brent geese were seen flying low over the water to the west, skirting the north of the wind farm but probably not deviating from their flight-path. In addition, on 2nd October 2007, as the boat left the survey area three flocks of Brent geese, totalling 100 birds, were observed flying west towards the wind farm and headed for Ramsgate.

During Year 5 21 dark-bellied Brent and two greylags had been recorded compared to the 99 geese recorded in Year 4.

In Year 5 the behaviour of geese near turbines was recorded. On 13th April 2006 two greylag geese flew low northwest past the boat on transect 6 at 10:13 (see Figure 106). The line they were taking took them straight through the turbine array so they were watched very carefully by the surveyors. As the geese approached to within about 200m of the array they hesitated, almost stalling in the air. They then flew a few tens of metres east, then west, then gained height, hesitated some more then headed northwest again equidistant between two rows of turbines, flying at about 60m asl each time they passed between pairs of turbines, and at about 20m asl in between pairs. They appeared not to take notice of the turbine array until they were almost upon it.

On 9th October 2006 eight Brent geese were seen on the 'non-transect' side of the vessel in transect 8 (see Figure 106). These birds were seen to fly through the wind farm below the turbines behaving as if they were uneasy, starting at a height of 1m asl then up to 20m before flying at varying heights of between 1m and 15m asl, fragmenting as a group and reforming a number of times. They appeared to fly through the full east to west width of the wind farm, though remained below rotor height.

On 4th November 2006, eight Brent geese were seen. One group of three was skirting the southern edge of the wind farm, and a group of five skirting the northern edge (see Figure 106). It is not known if these geese altered their flight path to avoid the wind farm as they were not seen until already alongside the turbines.

In Year 4 on 3rd October 2005 two groups of ten and two Brent geese had been recorded (see Figures 72 and 77) while groups of five and seven were seen on 14th October 2005 (see Figures 73 and 77). Approximately 75 Brent geese were seen to the west of the wind farm on 7th February 2005 (see Figures 61 and 77). In Year 3 on 14th November 2004, 21 Brent geese had been seen flying in an approximately westerly direction, up the estuary (see Figures 46 and 49). No other Brent geese were seen in Year 3. In Year 2, on 12th October 2003, three groups of Brent geese (see Figure 18) comprising 43 birds were all seen flying southwest, (except for four geese which were heading north). All would have passed through the turbine area, though only the skein of 23 were flying near rotor height (flight height estimated at 20m asl) and therefore would have been at potential risk of collision if such a flight were repeated during the operational phase. In Year 1 six Brent geese were seen within the buffer zone and eight flew within the wind farm site on 13th October 2001. On 4th November 2002 32 Brent geese were seen, all flying west, 20 through transect 1 and twelve through transect 2.

Sixteen pink-footed geese had been seen in the buffer zone on 13th October 2001. None were seen later in Year 1, nor were any seen in Years 2-5.

Too few geese were recorded for meaningful population estimation. In the context of Essex and Kent it is important to note that coastal observations over many years have shown that in early November many thousands of Brent geese fly southwest along and off the Essex coast, some heading up the Thames, north of Sheppey, others heading up the Swale, south of Sheppey. During the winter season smaller numbers of birds move back and forth along the North Kent coast between roosting and feeding areas (*pers. comm.* I. Harding).

4.1.5 Dabbling ducks

On 10th December 2006 a shelduck was seen flying north in the control area. A shelduck was recorded flying to the west near the southern end of transect 2 on 21st November 2007.

No dabbling ducks were seen in Year 5. During the surveys conducted in previous years, a number of dabbling duck species had been seen including shelduck, wigeon, gadwall and teal. The ten shelducks seen in Year 4 on 3rd October 2005 were flying northwest at 45m asl. It is possible that these ducks may have flown through the wind farm site *en route* to one of the coastal SPA sites surrounding the Thames Estuary, but it is not possible to be certain of this based on the available observation (see Figures 72 and 77) since they were not seen to fly near the turbines.

During the previous reporting period in Year 4, ten wigeon were seen on 14th October 2005 flying at a height of 60m were recorded heading in a northerly direction through transect 7 (see Figures 73 and 77) and would probably have flown at rotor height through the wind farm, but were not observed to do so.

On 5th March 2004 in Transect 5, four gadwalls were seen sitting on the water. A shelduck was seen sitting on the sea on 6th November 2003 in the control site, and on 18th December 2003 another was recorded flying over transect 3. On 12th May 2004 a pair of shelduck was seen flying towards the Swale in transect 7.

In Year 3, on 3rd September 2004, eleven teal were seen, probably migrating, and in Year 2 a pair of teal were also recorded on 8th September 2003, probably also in migration. In Year 2 a group of approximately 80 teal were recorded heading west on 14th December 2002 at the south of transect 6 and were probably flying in from the continent. They may have spent the early part of the winter in the Low Countries and were heading into the UK as temperatures on the continent dropped.

Too few dabbling ducks were recorded for meaningful population estimation. In the context of the Outer Thames area, the wind farm site seems of limited importance, though coastal observations over many years indicate that large numbers of wildfowl of various species head in and out of the Thames mouth when they are migrating with the predominant direction of movement east to northeast in spring and west to southwest in autumn. Large numbers do fly parallel to the coast south of the wind farm past Reculver, Whitstable and Heme Bay though further out to sea very distant flocks of wildfowl can typically be seen migrating as well (pers. comm. I. Harding).

4.1.6 Seaducks

In Year 6 there were 28 common scoter recorded, of which 12 were in transect on the sea and 16 were in flight out of transect.

A very spectacular sight was witnessed on 10th December 2006 during the return journey to the Essex coast – between 1000 and 2000 common scoter were flushed from the water by the survey vessel over the edge of the Foulness Sands approximately seven miles north of the wind farm. Scoter numbers of this magnitude are unprecedented in the Thames. Eleven common scoters were seen on the 10th October 2007 just to the south of the study site, flying in a westerly direction.

On 2nd October 2007 a flock of four common scoters flew southeast near the northern end of transect 8. They could have been migrants or local birds. On 5th November seven common scoters were seen flying in a westerly direction. Twelve common scoter were flushed off the sea just north of the wind farm before flying through the array at one metre asl on 21st November 2007 (see Figure 135). On 10th December 2006 two common scoters were recorded flying in the control area.

138 common scoters were seen in Year 5, 48 of which were in transect on the sea out of a total of 88 seen on the water; 50 were recorded in flight.

The first scoters seen in Year 5 were a flock of five common scoters was seen on 13th January 2006, flying to the west in the control area (see Figure 106). On 2nd June 2006 around 40 common scoters were seen on the water north of the wind farm in transect 4, probably summering in the area. They were observed to take off and land nearby a number of times. On 9th October 2006 a tight group of 45

common scoters was seen flying low to the southeast in transect 6 to the north of the turbines. A flock of 40 common scoters were seen on the sea between transects 4 and 5 on the 2nd of June 2006. On 1st December 2006 a group of eight common scoters was flushed about 400m ahead of the survey vessel in transect 1 through the western part of the buffer zone.

The total of 200 common scoters recorded during Year 4 was substantially greater than the 36 common scoters, 26 velvet scoters and six eiders recorded in Year 3, and the 17 common scoters recorded in Year 2.

4.1.7 Waders

Prior to starting the survey on 29th April 2007 and twice between transects, just to the south of the study area, groups of bar-tailed godwit, totalling circa 75 birds, were seen migrating in an easterly direction at one metre asl along the southern edge of the boat survey area. On 4th May 2007 a tight flock of five bar-tailed godwit were recorded near the northern end of transect 7, migrating through to the northeast.

On 10th September 2007 two dunlins flew west low over the water. The dunlins were likely to have been birds coming in off the continent and heading up the Thames. On 31st October 2007 three dunlins were seen on the 'non-transect' side of the boat flying to the southwest, south of the wind farm and it appeared that no deviation was required to avoid the wind farm.

A flock of six golden plovers were seen heading southwest low over the water on 2nd October 2007, also probably migrants coming in off the Continent.

In Year 5 a single curlew was recorded flying at a height of 3m to the northwest in transect 7 (see Figure 106) on 2nd March 2006 on a trajectory that would have passed through the wind farm site.

A grey plover was seen in transect 6 flying at a height of 1m on the 18th of September 2006. No other wader species were seen in the study area within Year 5.

Three oystercatchers had been recorded in Year 4 on 8th July 2005 heading to the north across the estuary (see Figures 68 and 77) with a further one seen incidentally doing the same on the other side of the survey vessel. Twelve bar-tailed godwits were seen to the south of the wind farm on 6th September 2005, flying at 20m height and in a westerly direction (see Figures 70 and 77), probably migrating into the estuary for the winter. If they continued flying in the same direction, they would probably not have flown through the turbine area, and were therefore not at potential risk of collision.

In Year 3, on 12th May 2004, three common sandpipers were recorded flying in a northerly direction in Transect 6, on migration through the area on their way to breeding grounds in the north. On 26th August 2004 a small flock of four unidentified medium-sized waders was recorded in the control site, plus a solitary knot, all flying in a southwesterly direction. On 3rd September 2004 a mixed flock of waders, identified as 30 dunlins and one knot, was recorded in the buffer zone on Transect 7 flying in a southwesterly direction, probably on migration. On 29th September 2004 two knot and eight dunlin were recorded incidentally just after the end of the survey, heading in an approximately westerly direction. On 27th October 2004 a flock of seven dunlins was recorded flying in a southwesterly direction.

In Year 2 waders seen included common sandpiper, dunlin, turnstone, knot and unidentified medium-sized waders. Dunlin were recorded flying east at 5 m height in Transect 4 on 6th March 2003, and a turnstone nearly landed on the bow of the boat in Transect 5 near the centre of the wind farm site on 27th November 2003.

In Year 1 five dunlins flew through the wind farm site on 30th November 2001. Thirteen lapwings were seen in Year 2 and one was recorded in Year 1. Two single curlews had been seen in Year 1. The single redshank recorded in migration in Year 2 was the only record of this species over the four year study so far.

4.1.8 Terns

On 4th May 2007 one Sandwich tern was recorded although they were seen in considerable numbers flying and feeding along the coast, outwith the study area. One Sandwich tern was also recorded on 21st May 2007. On 8th June 2007 six Sandwich terns were recorded, all east or west of the wind farm. None appeared to have flown through the wind farm.

Thirteen Sandwich terns and five common terns were recorded on 13th July 2007, all but two of which were flying in an approximately easterly or westerly direction. Four of the westerly-flying Sandwich terns were carrying fish, presumably back to chicks in the colony in the Medway. Three Sandwich terns also made quite marked deviations to fly to the south or north of the wind farm.

On 30th August 2007 15 Sandwich terns and eight common terns were recorded, most seen flying in an approximately easterly or westerly direction. A group of eight Sandwich terns was seen feeding near the southeastern corner of the wind farm. On 10th September 2007 one common tern was recorded on transect 5, two on transect 6 and one on transect 7. A single Sandwich tern was recorded on transect 8 and another on control 4.

On 2nd October 2007 four Sandwich terns were seen, one flying east midway along transect 7, one flying northwest midway along Transect 2, and two circling at the northern end of transect 1. Also at the northern end of transect 1 were the only common tern seen on the survey: a juvenile and an adult bathing in the sea. Both the Sandwich and common terns will have been migrants, and like the little gulls, they will have slowly been making their way south out of the North Sea. On 10th October 2007 two Sandwich tern were recorded, the last of the year.

The first terns seen in Year 5 were two Sandwich terns flying west at 0910 on 2nd May 2006, just before the start of the survey. On 23rd May 2006 11 common terns and seven Sandwich terns were recorded. The great majority were seen to the south of the wind farm, flying in a westerly direction. Some were seen foraging but none were observed carrying fish. Surprisingly few terns, (only four common terns), were seen on 2nd June 2006 either on the study site or during the outward and returning journeys to and from Whitstable harbour. Five of the eight common terns recorded on 21st July 2006 appeared to actively avoid the wind farm by veering north or south from a westward flight. Five Sandwich terns were also recorded, one of which was seen flying through the wind farm. On 7th August 2006 36 common terns, (plus a group of 21 on the 'non-transect' side of the vessel), two Sandwich terns, and two black terns were recorded. Black terns have been recorded in the past on this site in the late summer but these were the first in Year 5. They will probably have been in migration from the Baltic to the West African coast. Twenty two of the common terns recorded, the two black terns, and three gannets were seen feeding together at the now regularly observed summer feeding area near the southern end of Transect 8. Four common terns, (plus a group of seven feeding to the north of transect 2), and five Sandwich terns were recorded on 18th September 2006.

On 29th September 2006 there was a high count of common terns with a tight group of 82 birds seen dip-feeding near the Spaniard buoy at the southern end of transect 1. A further 25 common terns were seen flying in generally eastern or western directions through the site including five that were seen flying through the wind farm (see Figures 101 and 107). The Medway breeding terns are thought to have migrated south and these birds are likely to be from further north, on their way south, opportunistically feeding on the way. Three Sandwich terns and one black tern were also recorded. Just one common tern was recorded on 09th October 2006, very different to the survey eleven days before when over 100 were recorded.

In Year 4 on 6th September 2005 a large group of terns (by far the largest seen so far) was recorded within the study area. Approximately 180 common terns and 10 Sandwich terns were seen moving near the southern end of transect 1 in bands A-D (see Figure 70; population estimate 522 ± 397.9, see Table 8). Some were feeding but not in a 'feeding frenzy' (as had been seen during the previous three surveys) that can be seen when a tight shoal of small fish such as sandeel are forced near the surface. They appeared to be 'milling about', back and forth across the transect line, sometimes sitting on the water. Three arctic skuas were also seen almost continually harassing the terns which kept the terns on the move. It is known that on their southern migration terns regularly cross the land from this north facing

Kent coast to the English Channel, effectively cutting the corner by flying over the 'neck' of Kent. It had been postulated by the surveyors that these terns were collecting here, possibly over several days before migrating over the land as a large group, a phenomenon that is supported by observations made on numerous occasions at nearby Oare Marshes where flocks of terns will build up during late autumn afternoons, take off, gain altitude, circle and set off south or southwest inland (pers. comm. I. Harding).

In Year 4 two little terns were recorded flying northeast, the first and only time the species was seen during the monitoring programme. Whether these were birds on migration or breeding birds from the colonies in the Swale remains unknown.

In the final monitoring year more Sandwich terns were recorded during the boat surveys in comparison to Year 5. A total of 52 individuals was noted down, with two groups of eight seen in September making up the biggest concentrations. Twenty-one of these were seen during the breeding season, with the remaining 31 seen during autumn migration, from August into early October.

Similar to previous survey years during the July survey Sandwich terns were seen carrying fish, presumably on their way back to the breeding colonies on the Medway.

The majority of Sandwich terns were observed in the buffer zone, in particular to the east or the west of the wind farm, with only two individuals seen whilst flying through the wind farm.

Compared to previous years very few common terns were recorded during the boat surveys in 2007: a total of 23 individuals, of which the majority was seen during autumn migration. The majority of common terns were either seen in the wind farm or in the buffer zone along transect 1 and 2.

Two Sandwich terns and eight common terns were seen within the wind farm in 2007, a near similar number to the eleven terns observed within the wind farm in the previous survey year.

No 'feeding frenzies' were observed in Year 6. In Year 5 there was less repetition of 'feeding frenzies', which occurred in Year 4 near transect 8 from 8th July 2005 to 1st August 2005 and on 6th September 2005. However, on 29th September 2006 82 common terns were seen dip-feeding in a tight group near the Spaniard buoy at the southern end of transect 1.

In light of all monitoring data collected since 2002 fewer Sandwich and particularly common terns appear to be flying through the turbine array of the Kentish Flats Wind farm compared to the same area during the pre-construction phase (see Figures 50, 78, 107 & 136). This seems to indicate that the wind farm acts as a barrier to terns using the study area and its surroundings. However, comparing the average common tern population estimates for each development phase for the wind farm/buffer area (April to September inclusive) actually shows an increased mean for the operational phase. This seems to be due to somewhat larger numbers of common terns having been recorded in the buffer zone since 2005, in particular during August and September. In conclusion, the monitoring results seem to indicate both a change in (flight) behaviour and a possible increase in numbers during late summer/autumn migration. Without further monitoring it is not possible to establish the validity of this apparent increase, particularly since it is skewed by a few large tern aggregations, leading to high population estimates for those surveys.

Neither tern species' numbers showed any evidence of statistically significant changes. Graphs showing monthly tern records are available in Appendix 4 (see Graphs 4-6).

4.1.9 Passerines and swifts

A total of 3,384 passerines were recorded in Year 6, most of which were starlings (3,345). In Year 5 a total of 237 passerines were recorded (see From Appendix A1).

On 2nd March 2007 the first two migrants of the year were recorded, a meadow pipit and a pied wagtail, both of which flew in a westerly direction. On 21st May 2007 one swallow was seen flying through the site in a northwesterly direction. Five swifts and two starlings were recorded on 8th June 2007. On 13th

July 2007 two swifts were recorded flying to the west. Six sand martins were also recorded flying to the west, possibly early migrants passing through.

On 2nd October 2007 31 passerines were recorded: two meadow pipits, two blackbirds, one redwing, four starlings, a robin, 17 swallows, a house martin, a brambling, and two finch species. All except the robin were heading south, southwest or west. The robin, after it had landed on the survey boat for a few minutes, then circled the boat several times, headed off north, appearing lost. On 10th October 2007 one meadow pipit and two unidentified passerines were recorded flying to the north. There was a broad westerly movement of starling through the study site on 31st October 2007 from 08:30 and through the morning. These were presumably birds that left the Continent at first light to migrate into the UK for the winter. A total of approximately 1,785 starlings were recorded. Most were seen flying low over the water although one flock of around 235 was seen flying at around 30m asl through the wind farm. Regarding other migrating passerines, 13 chaffinches, 11 skylarks, one blackbird, and five unidentified small passerines were all seen flying in a westerly direction.

Again on 5th November 2007 there was a broad westerly movement of starling through the study site presumably of birds migrating into the UK from the Continent. A total of circa 1,550 starlings were recorded. Most were seen flying low over the water. Regarding other migrating passerines, three skylark with a flock of starlings, two redwings, and three fieldfares were all seen migrating in a westerly direction.

On 21st November 2007 three passerines were recorded, all heading in an approximately westerly direction, two chaffinches and one starling.

In Year 5 a total of 237 passerines had been recorded, of which 21 were in snapshot counts. On 2nd March 2006 dove species were seen flying northwest. Of a total of 124 birds of eight species recorded on 13th April 2006, 49 were passerines (including three meadow pipits, two linnets and a house martin, all of which will have been migrants). On 2nd May 2006 three swifts flew west, and six swallows flew west on transect 6. The 19 swifts, 60 swallows, two house martins and two meadow pipits seen in the previous year on the survey of 10th May 2005, compared with only three swifts, six swallows and no martins or pipits on this survey may have been attributable to the northerly wind direction on the earlier date, which is ideal for migrants. On 23rd May 2006 one swallow was seen flying through the site, probably a late returning migrant. Two swallows were recorded flying on 2nd June 2006. On 18th September 2006, a number of passerines were seen migrating through the site, all in a generally western direction: 28 swallows in groups of two to eight throughout the day (including some flying through the wind farm); and one group of four house martins; five meadow pipits; and five unidentified finch species. On 29th September 2006 flocks of seven and eight starlings were recorded flying low and to the west through the site. Two unidentified small passerines were seen flying to the southwest, just north of the buffer zone between transects. On 09th October 2006 48 starlings were seen migrating through the site in a westerly or southwesterly direction. On 4th November 2006 13 chaffinches, 138 starlings, two fieldfares and one unidentified small passerine were recorded, all flying in a generally western direction. All were flying alone or in small groups apart from one tight flock of around 110 starlings.

In Year 4 on 3rd April 2005 16 meadow pipits, and six sand martins were the first passerines seen. One swallow was recorded flying through the site on 22nd April 2005, migrating into the UK to breed. On 10th May 2005 there was a relatively large number of land birds (19 swifts, 60 swallows, two house martins; and two meadow pipits) migrating through the survey area, all flying strongly north. The only passerines seen on 29th May 2005 were 5 swallows, all heading north, they will have been late migrants. On 15th June, 19 swifts were seen, all flying in a southwesterly direction, probably in response to a weather system. On 8th July five starlings were recorded, probably early migrants into the UK. On 6th September four swallows were recorded flying across the estuary to the south, probably in migration to Africa. A number of small passerines were recorded on 3rd October, presumably in migration. Seven wagtails that could not be identified to species flying to the north-west, (three of these were seen on the 'non-transect side' of the vessel); two meadow pipits flying to the north-west; one starling flying west; and three unidentified small passerines heading to the north-west. Two small flocks of small passerines were seen on 14th October 2005.

4.1.10 Raptors

A total of three raptors were recorded in Year 6.

Only the peregrine falcon seen on 8th June 2007 was recorded in transect. The peregrine was seen to stoop on a starling, miss its target and fly back off towards the wind farm. It is not clear if this bird landed on the nacelle of one of the turbines (as was seen on 2nd June 2006 when a peregrine was seen actively looking around on the top of the nacelle of turbine F3; as the wind was so light the rotor was not rotating.

On 10th December 2006 two sparrowhawks were seen between transects 6 and 7 being harassed by a lesser black-backed gull.

In Year 5 on 4th November 2006 a merlin had been observed stooping on a group of starlings.

In Year 4 no raptors had been seen. In Year 3 on 26th August 2004 a female marsh harrier was seen near the northwest corner of the turbine area, and on 18th April 2002 a marsh harrier was seen within the buffer zone. On 15th October 2004, a peregrine falcon was recorded flying in a northerly direction. It had been speculated that once the wind farm was operational, it might benefit falcons preying on tired birds towards the end of migration across the sea to the coast, but any such pattern has yet to be detected. In Year 2 a merlin was seen with a dead bird in its talons, feeding on it while it flew.

4.1.11 Rarer Gulls and notable gull observations

In Year 6 a total of 996 gulls were recorded. No rarer gulls were seen in Year 6.

On the 2nd October 2007 four little gulls were recorded. One juvenile and an adult were seen dip feeding over floating weed patches midway along transect 8. Then two further birds were seen on the non-transect side during transect 4: one at the southern end; one near the northern end. They will all have been migrants, slowly making their way south out of the North Sea.

On 13th January 2006 there was a sighting of a possible 1st winter bird Mediterranean gull but this had to be recorded as 'unidentified gull sp' as there was no absolute species identification. In Year 2 on 14th December 2002 a Mediterranean gull was recorded. None were seen in Years 6, 4, 3 or 1.

In Year 4 a number of gulls were seen within the operational wind farm and surveyors noted this occurrence (see Figure 89-91 & 93).

On 2nd March 2006 a feeding frenzy' of approximately 100 gulls was observed just to the south of the south-east corner of the main study-site. A 'feeding frenzy' was also witnessed on 21st June 2006 during the outward journey near the southern end of transect 8, (as was several times in Year 5).

On 22nd April 2005 17 little gulls were seen in two groups on the western side of the site migrating through the area, probably on their way to breeding grounds in the Baltic. During the 3rd January 2004 survey (AO), 14 little gulls were recorded moving through the study-site in two groups. Incidentally, another group of six little gulls was seen whilst returning from the survey area to port. These gulls were probably in migration from the North Sea to winter in the Atlantic. On 15th October 2004 a total of 84 gulls were recorded and little gull made up a surprisingly high percentage at 32%. On 27th October 2004 two little gulls were recorded in one flock in transect 5. On 26th November 2004 one little gull was recorded

4.1.12 Skuas

In Year 6 there were 3 arctic skuas recorded. Two of which were in flight in transect.

On 29th September 2007 an arctic skua was recorded on transect C4.

In Year 5 an arctic skua had been seen outside the survey area on 9th October 2006.

Five arctic skuas were recorded in Year 4, slightly more than in Year 3. The largest numbers were seen on 6th September 2005 when three arctic skuas were almost continually harassing a feeding frenzy of terns. On 14th October 2005 an arctic skua was seen between the northern ends of transects 1 and 2, whilst three arctic skuas were seen amongst the terns on 6th September 2005 just inside the study area. The previous year on 3rd September 2004 three arctic skuas were also recorded, including one juvenile and one seen harassing terns. An arctic skua was seen flying towards the feeding frenzy on Transect 8, attracted by the abundant terns within it. Another arctic skua was recorded in Transect 1. On 29th September 2004 one great skua was recorded, heading in an approximately westerly direction. On 27th October 2004 four great skuas were recorded in one flock in Transect 5.

4.2 MARINE MAMMALS

In Year 6 there were 10 seals recorded of which eight were in transect. One harbour porpoise was also sighted in transect.

4.2.1 Seals

On 15th January 2007 one common seal was recorded at the northern end of transect 1 and on 2nd February 2007 a seal that could not be identified to species was recorded in the control area.

A common seal was recorded in transect 8 near the edge of the submerged Margate Sands on 29th April 2007.

On 4th May 2007 two common seals were recorded. One was seen in transect 1, and one in the control area.

There was a brief glimpse of a seal within the wind farm in transect 5 on 21st May 2007 but it did not allow identification to species. A common seal was seen eating a fish on the non-transect side of the vessel on 8th June 2007. On 2nd October 2007 one common seal was seen in-transect midway along Transect 2. One harbour porpoise was recorded in the control area on 10th October 2007. On 21st November 2007 two common seal were recorded near the southern end of transect 7.

In Year 5 on 13th January 2006 a common seal had been seen in transect 8 on the eastern edge of the buffer zone. One common seal was seen 7th December 2005 between the northern ends of transects 3 and 4, again in the buffer. On 17th February 2006 a seal was recorded in transect 8 along the edge of the Pan Sands, too distant and fleeting a view to identify to species. On 2nd March 2006 an unidentified seal was recorded in transect 1. On 23rd May 2006 one common seal was seen in transect and two others were noted on the 'non-transect' side of the boat. On 7th August 2006 a common seal was seen within the wind farm.

Two common seals were recorded on 9th October 2006. A common seal was recorded on 1st December 2006 just to the south of the wind farm in transect 5.

On 11th December 2004 two common seals were recorded at the northern ends of transects 1 and 3 (see Figure 59). On 7th February 2005, a single common seal was recorded in transect 7. On 3rd April 2005 a lone common seal was seen and on 6th September 2005 two common seals were recorded within the study area between the buffer and control site (see Figure 70). One common seal was recorded just to the east of the buffer zone (see Figure 71) on 27th September 2005. On 12th May 2004 a single common seal was seen in transect 5 just to the south of the turbine area.

During the previous year, on 5th March 2004, a single unidentified seal was recorded within the south-eastern margin of the buffer near the control on transect 8. Five seals were also seen incidentally on the outward trip from the port to the survey area. On 7th April 2004 two seals were recorded on transect 8 at the east of the buffer, one being identified as a common seal. On 8th June 2004 two seals were seen in transect 8 close to the Pan Sands to the east of the buffer but were too distant to be able to identify to species.

4.2.2 Cetaceans

In Year 6 one harbour porpoise was recorded in the control area on 10th October 2007.

The first of the Year 5 cetacean observations was a harbour porpoise seen very briefly in the control area on 2nd March 2006. On 23rd May 2006 a harbour porpoise was seen between the southern ends of transects 3 and 4. On 7th August 2006 three harbour porpoises were recorded to the north of the wind

farm in transect 4 and a further porpoise was recorded in transect 8. One harbour porpoise and two common seals were recorded on 9th October 2006.

In Year 4, on 19th January 2005 a harbour porpoise that appeared to be actively chasing fish was recorded in transect 3, and another was recorded in transect 2. In Year 2, on 27th November 2003, one or possibly two harbour porpoises were seen swimming in a southeasterly direction between the northern ends of transects 3 and 4. On 7th April 2004, while travelling to the survey site and approximately four kilometres north of Hampton pier, two harbour porpoises were seen. In Year 1 no harbour porpoises were detected during the boat surveys.

On 13th and 19th April and 2nd May 2006 no cetaceans or seals were seen. Although conditions were perfect on 2nd June and 21st July 2006 no marine mammals were recorded. No marine mammals were recorded on 18th or 29th September or on 4th November 2006.

The majority of these observations have been recorded outside the wind farm site, with some at the edge of the buffer near the shallows to the east and southeast.

5 DESCRIPTION OF AERIAL SURVEY DATA

The following sections describe the distribution and characteristic behaviour of birds seen near the Kentish Flats wind farm based upon the observations from the aerial surveys. The descriptions focus on the data gathered during Year 6 of the monitoring program, but also refer to the findings of the surveys conducted in Years 1 to 5 in order to provide the appropriate context to this data.

5.1 DIVERS

Two aerial surveys were undertaken in February 2007, on 3rd and 18th (see Figures 137, 138, 139 and 140). Neither survey found any divers within the turbine array or closer than the southern ends of transects F and G. Both surveys found diver accumulations to the west and east of the site, the vast majority outwith the areas surveyed by boats during the same period.

To the southwest of the site on 3rd February there was a large accumulation of divers on the edge of the Four Fathoms Channel closely associated with shallow areas of Red and Middle Sands, and the out flow of the Swale Estuary. This is possibly due to strength of tidal currents and huge volume of water that rushes in and out of the Swale with each tide. This accumulation also occurred on 14th January 2006.

On 18th February there were large aggregations to the southeast of the site on the edge of the control site. These congregations occurred on the edge of the Woolpack and Margate Sands. Large numbers of divers were probably attracted to the feeding conditions resulting from overflows formed by the ebb and flow of the tide. This occurrence can be seen in the boat surveys undertaken in Year 5 (2005-06), with the majority of divers observed at the eastern end of the boat survey area (transects G and H) and on the control site.

A single great-crested grebe was recorded on the aerial survey which took place on 18th February 2007 to the north of the site between Knob and North Knob.

Differences in survey dates between each year's aerial surveys (by approximately one month) make drawing firm conclusions from the data more difficult. The closest survey corresponding dates between years were on 11th January 2002, 18th/19th January 2003, 15th January 2005, and 14th January 2006.

The aerial surveys undertaken on 26th February 2004 (see Figure 53), 6th and 13th March 2005 (see Figures 81 & 83), 18th February 2006 (see Figure 114), 3rd and 18th February 2007 (see Figures 137 & 139) are also sufficiently close to permit visual as well as statistical comparisons. However, the difficulty in comparing data is compounded by the likely natural, inter-annual variations in the monthly patterns of diver distribution across the survey area and indeed across the whole Thames Estuary.

In Year 5 no divers had been seen within the Kentish Flats Wind Farm site (see Figures 108-116). There also appeared to be slightly fewer divers seen with the boat survey buffer zone than in previous years. Much smaller numbers have been counted from the air and boat within the Kentish Flats Wind Farm site and buffer zone in Years 5 and 6.

The changes in aerial counts of divers between the 6th and 13th March 2005 indicated that there may be substantial changes in distributions of divers within the Thames Estuary in over a single week at this time of year (see Figures 81 and 83).
On 11th December 2005 divers were seen to the west and south of the buffer zone (see Figure 110) whereas on 14th January 2006 divers were recorded more to the southwest, north and northeast (see Figure 112). On 18th February the main distribution within the area plotted had shifted to the east (see Figure 114). The aggregated diver distribution shown in Figure 116 reveals the absence of divers from the wind farm and fewer seen within the buffer zone than elsewhere. This indicates that the most important areas for divers are elsewhere in the Thames.

In Year 4 diver distribution both within the buffer zone, and elsewhere within the TH1 survey area was at its most dispersed on 15th January 2005 (see Figure 79), when numbers within the buffer zone were

greatest, though again none were seen within the turbine area (as was the case for all of the five aerial surveys conducted in Year 4). Diver numbers and distribution recorded within the TH1 area have fluctuated between the aerial surveys conducted during Year 4. On 6th March, single divers only were seen to the south of the wind farm site, whilst greater numbers were recorded over 5km to the northeast, including a group of 534 over 20km away (see Figure 81). By contrast one week later more divers were detected between the wind farm and the coast (only one in the buffer zone), to the west, and to the northeast (see Figure 83). Very few divers were seen in the TH1 survey area during the survey conducted on 13th November 2005 (only 16 divers are shown on Figure 86).

Year 3 locations mapped in Figure 30 indicate that on 27th November 2003 there were very few divers within the boat study area (two were identified within the wind farm site and three (one red-throat) within the buffer), with larger numbers to the north and east. Just to the west of the buffer zone (by a few hundred metres) a group of divers (some identified as red-throated diver) were recorded feeding on the edge of the deeper water. On 26th February 2004 (see Figure 53) no divers were recorded within the wind farm site and only six were noted within the buffer, though much higher numbers were again seen to the east and northeast. The survey flown on 30th October 2004 (see Figure 55) revealed a marked absence of divers from the boat survey area and only 12 divers to the north of the wind farm, buffer and control. Numbers of divers built up through the winter so that at the start of Year 4 there were substantial numbers of divers seen around (though none within) the wind farm on 5th December 2004 (see Figure 57).

Comparison between the 27th November 2003 (see Figure 30) and 17th December 2003 (see Figure 51) aerial survey data indicates that in December 2003 much higher numbers of divers were seen from the air within the boat survey buffer, and several were within the wind farm site. Considerable numbers of divers were seen on 5th December 2004 immediately to the north of the wind farm site (and some were detected to the west, south and east), but none were seen within the wind farm site and only six were within the buffer area. In the previous year, on 27th November 2003, a broadly similar pattern of diver numbers building up was seen, though by 17th December 2003 divers were utilising much of the area surveyed including the wind farm site and buffer (compare Figures 30 and 51). This demonstrates the build up of diver numbers in December, and emphasises the importance of avoiding such peak diver periods for monopiling operations, as was achieved in Year 3 and in compliance with the conditions set out by the FEPA licence as Objective 5.

In Year 2 large numbers of diver were recorded during the aerial surveys conducted on 18th and 19th January 2003. Of the 21 divers recorded within the wind-farm area, six were identified as red-throated diver. Within the buffer zone 20 out of 45 divers recorded were identified as red-throated diver. Three unidentified divers were recorded within the control area. Two high-density areas were recorded within the wind-farm/buffer zone, at densities as comparably high as anywhere within the aerial survey area examined at that time. There may of course be higher densities elsewhere within the outer Thames Estuary. Large numbers of unidentified divers (all those identified specifically were red-throated diver) were recorded throughout the area surveyed.

In Year 1 small numbers of divers were recorded on 11th January 2002 within the wind-farm site, buffer zone and the control area. All were either red-throated diver (two in the wind farm site and three in the buffer zone) or unidentified diver species (one in the wind-farm site and one in the control area). Elsewhere in the area surveyed, larger numbers of divers were recorded and at greater densities. All were recorded as red-throated diver or unidentified diver species, except one great northern diver identified in the outer Swale Estuary, off the north coast of Kent.

There were differences between the methods and transects of January surveys in Years 1 and 3 which confounded any differences between years. These were discussed in the First Monitoring Report (Gill, Sales & Pullinger 2004).

The Year 2 to 5 January survey methods and transects flown were identical so the comparisons are more valid than those in relation to Years 1 and 2. Indeed the aerial transects have largely remained the same since 30th October 2004 (see 55-58, 79-88, 110-116). There were no statistically significant changes revealed by the analyses.

5.2 GREBES

During the aerial survey on 3rd February 2007 no grebes were seen (see Figure 138). A single great-crested grebe was seen about 7.5km north of the study area during the aerial survey carried out on 18th February 2007 (see Figure 140).

No grebes were recorded within 5km of the Kentish Flats wind farm site during the aerial surveys in Year 5. On 5th December 2004 one great-crested grebe was seen to the north of the buffer zone (see Figure 58). Since this species tends to feed close in to shore this is an unusual record. On 17th December 2003 one unidentified grebe was seen within the wind farm site (see Figure 52).

5.3 SEADUCKS

Common scoters were recorded on both aerial surveys in Year 6 (2006-07). A single bird was noted on the 3rd February east of the Isle of Sheppey near Ham Gat. There were four records on 18th February, three east of the Isle of Sheppey, a single, a flock of 30 and a flock of 250. A flock of 60 was observed south of the wind farm just north-east of the Clite Hole Bank. Unidentified seaducks were observed on 18th February with records, all to the south-west of the wind farm, a single was counted in the Four Fathoms Channel. Two flocks (of 2 and 50) were seen at the north-eastern end of the the Swale Estuary.

Common scoter were seen on 18th February 2006 in five small flocks (numbering 6, 9, 1, 5, 1, and totalling 22) over 2.5km from the nearest turbine to the north and west of the boat survey buffer zone, along with one eider (see Figure 115).

The Year 4 and 5 aerial survey data continues to show the low importance of the wind farm for seaduck. In Year 4 the aerial surveys detected large numbers (for the Thames) of common scoter over 10km to the north of the wind farm.

In Year 4 on 5th December 2004 four groups of common scoter, in groups of 27 to 60 were seen over 10km to the north of the wind farm, and a single bird over 10km to the north-east. Seven eider ducks were seen to the south of the buffer zone near the coast on 5th December 2004 (see Figure 58). On 15th January 2005 two flocks of common scoter were seen, also over 10km to the north (650) and north-east (25). The group of 650 were seen in band B and should therefore have been fairly accurately counted. No behaviour was noted. Ten red-breasted mergansers were seen to the south off the Kent coast (see Figure 80). On 6th March 2005 fewer numbers of seaducks were recorded; nine common scoter were within 10km of the wind farm to the north-east, and three around 4km to the south, with six eiders seen to the southeast (see Figure 82). A week later no scoter were recorded, and five eiders were noted in the same location as the six seen previously. No seaduck were seen on 13th March or 13th November 2005.

In Years 1-3 the aerial surveys recorded small numbers of seaduck near the boat study area. On 27th November 2003 two common scoter were recorded within the buffer zone, whilst a small loose group of 13 common scoter was recorded just off the north Kent coast near Thanet, the closest of these being 3 km to south of the buffer zone. None were seen in December 2003, whilst 64 common scoters and two eiders were to the south of the buffer zone in February 2004 and 24 common scoters were seen to the southwest of the buffer zone on 30th October 2004.

In Year 2, during the 18th and 19th January 2002 surveys, large numbers of seaduck were recorded in the Swale Estuary (480 common eider, an extraordinarily high count for Eider in the Swale, and 120+ common scoter) and off Foulness (small numbers of common scoter and common eider, plus 10 velvet scoter). In Year 3, no comparably large aggregations of scoter or common eider were seen nearby, though 58 common scoters were seen off the Essex coast. Scoter and common eider feed on shellfish and being restricted to shallow feeding areas may be more likely to be recorded feeding over the shellfish beds close inshore off the Essex and Kent coasts.

In Year 1, the first JNCC aerial survey on 11th January 2002 revealed three small flocks totalling 42 individuals of common scoter off the Essex coast over 10km to the north of the wind farm, and another flock of 25 common scoters was recorded approximately 6km west of the Kentish Flats buffer zone. No seaducks were recorded near the wind farm by the WWT on 21st August 2002 (also in Year 1) though this is not surprising during the summer period. In Year 2, on 30th August 2003, a group of three common scoters were seen to the north of the mouth of the Swale, northwest of Whitstable, and over 10 km to the southwest of the wind farm site. It is possible that these ducks were moulting, though this was not indicated by the aerial data.

5.4 OTHER KENT SPA SPECIES

During the aerial survey on 3rd February 2007 (see Figure 138) three Brent geese were observed on the water just south of the control area. A further 300 Brent geese were seen flying close to the Kent coastline, to the southeast of the study area. The only waders of note seen were a flock of 150 oystercatchers just off the Kentish coastline.

A group of seven greylag geese were seen flying just north of the boat survey buffer zone during the aerial survey carried out on 18th February 2007 (see Figure 140). To the west of the study area, off Minster on the Isle of Sheppey, a group of seven wigeon were seen in flight.

No waders were recorded near the Kentish Flats wind farm in Year 5 during the aerial surveys. In Year 4 very few Kent SPA species had been recorded from the air anywhere near the boat study area. The only notable observation in Year 4 was of 30 waders off the Isle of Sheppey on 13th March 2005 (see Figure 84). On 6th March 2005 40 Brent geese were seen from the air off the Essex coast 15km from the nearest turbine (see Figure 82), and three geese were even further away on 15th January (see Figure 80) and on 13th March 2005 (see Figure 84).

In Year 3, Kent SPA species recorded during the aerial surveys included 60 waders along the Kent coast on 17th December 2003, and one dark-bellied Brent goose to the northeast of the wind farm on 15th February 2004. There were 35 dark-bellied Brent geese to the north of the wind farm and 3 lapwings seen within the control site on 30th October 2004, when there were 25 teal and one dark-bellied Brent goose off the Kent coast. On 5th December 2004 almost 300 dabbling ducks (including flocks of 200, 6 and 35 wigeon) were recorded off the Kent coast. On the first Year 2 survey in January 2003, 175 wigeon were recorded on the edge of the Swale Estuary.

It is not possible to draw any conclusions with regard to SPA bird movements from a visual review of aerial data, since flight direction is only rarely recorded during aerial surveys.

5.5 TERNS

No terns were recorded in Years 4, 5 or 6 as aerial surveys were restricted to the winter months.

5.6 MARINE MAMMALS

In Year 6, on 3rd February 2007 a seal was seen within 3km of the southern margin of the boat survey buffer zone. A harbour porpoise was seen also within 3km of the boat survey zone to the northwest, and another was recorded much further to the northeast (see Figure 138). On 18th February an unidentified small cetacean species was seen approximately 2km to the west of the buffer zone, and a harbour porpoise was seen to the north. Five other harbour porpoises and two seals were also seen within 10km of the buffer zone.

In Year 5, on 13th November, a seal was seen in the northeast corner of the buffer zone. On 14th January seals were seen in the southern part of the buffer, and to the north (see Figures 111, 113 & 115).

In Year 4 no marine mammals were seen within the boat survey area. A substantial number of unidentified seals, and occasional harbour porpoises were seen during aerial surveys in area TH1. All seals were more than 3km (and all but two were 10km or more) from the Kentish Flats wind farm site.

On 13th March 2005 a porpoise was seen around 3km north of the wind farm site (see Figure 84). On 27th November 2003 a single harbour porpoise was recorded just outside the control area.

6 ISSUES OF PARTICULAR CONCERN TO NATURAL ENGLAND

In response to specific requests from Natural England, additional information has been reviewed in the sections below with regard to:

i) the (likely) effect of storm conditions on bird behaviour and flight height,

ii) idiver population trends in the wider Thames aerial survey area (from publicly-available WWT reports) and diver responses to offshore wind farms from Danish studies,

iii) (possible) long-term effects of the Kentish Flats wind farm on tern breeding success,

6.1 FLIGHT HEIGHT IN RELATION TO STORM CONDITIONS

Collision risk assessment and flight height analysis have not been undertaken for this or any previous monitoring report. Flight heights of birds flying above 20m in Years 5 and 6 are summarised by species in Tables 27 and 28 below. These results show that very few SPA species of conservation concern were at potential risk of collision when recorded; one red-throated diver, one merlin and two common terns in Year 5; two black-throated divers, four red-throated divers and one Sandwich tern in Year 6 (all are shown in bold type in Tables 27 and 28).

There is no data on bird abundance, passage rates or direction during storm conditions within the study area between Years 1 to 6. Boat and aerial surveys are generally not undertaken in sea states of 5 or over (with the exception of one transect during the boat survey on 19th January 2005, at sea state 5). During strong northwesterly, northerly and northeasterly gales from late summer to late December pelagic seabirds (*e.g.* fulmar, gannet and kittiwake) are found in higher than average numbers within the Thames Estuary. Pelagic seabirds move around and away from storm fronts and appear in the Thames when they have been moving ahead of strong northerly winds and been pushed along the north coast of Kent. When this happens they stream along the coast, usually as far west as Whitstable. There the estuary ahead noticeably narrows and that seems to prompt most to turn back east to open sea again. A few though push on further west (presumably thinking they can reach open sea again that way) and some end up as far upriver as the Dartford Bridge or even as far west as the west London Reservoirs.
(Jon Ford and Ian Harding, *pers. comm.*).

Low numbers of birds are recorded at times of high precipitation when it thought that birds may roost on the sea (e.g. skuas and shearwaters) and are therefore be less visible to surveyors, although this hypothesis may be exaggerated by the difficulties of surveying in rainy conditions. It is not thought that there is any correlation between birds avoiding the wind farm and poor visibility due to precipitation (Jon Ford and Ian Harding, *pers. comm.*) although no statistical study of this has been undertaken.

Storm conditions could have effects on bird movements around the turbine array. Desholm *et a*l (2004) state that "storm-driven movements of birds could potentially increase the risk of collision", although the reduced performance of their radar system in storm conditions did not allow this to be investigated during their study.

There is no data related to storm conditions on bird abundance, passage rates or direction within the study area over the period of the study. Boat and aerial surveys have generally not been undertaken in sea states over 4, with a limit applied of sea state 5 as described in the method section. During strong northeasterly gales pelagic seabirds such as fulmar, gannet and kittiwake are found in higher than average numbers with in the Thames Estuary, it is thought that these birds are moving to the relatively sheltered coastal areas (Jon Ford, *pers. comm.*). Low numbers of birds are recorded at times of high precipitation when it thought that birds may roost on the sea and are therefore be less visible to surveyors. It is not thought that there is any correlation between birds avoiding the wind farm and poor visibility due to precipitation (Jon Ford, *pers. comm.*) although no statistical study of this has been undertaken.

Studies undertaken on the East Friesian island, Germany in 1999 (Kruger & Garthe 2001) found that bird flight height was altered with wind speed with some species flying lower in higher speeds e.g. red-throated diver and some flying higher e.g. Sandwich, Arctic and common terns. Tail winds caused the birds to fly at higher altitudes than head winds. It is reasonable to assume that birds around the north Kent coast would behave similarly in stormy weather.

Table 27 Number of birds seen in flight and different height bands in Year 5

Species	Total	In flight	Height < = 1 m	Height >1<=20 m	Height >20 m
Auk sp.	2	1	1	0	0
Black Headed Gull	94	72	1	61	10
Black Tern	3	3	0	3	0
Black-throated Diver	15	9	2	7	0
Chaffinch	13	13	10	3	0
Common Gull	219	203	1	151	51
Common Scoter	138	50	45	5	0
Common Tern	195	182	4	176	**2**
Cormorant	187	35	20	13	2
Curlew	2	2	1	1	0
Dark-bellied Brent Goose	21	21	13	8	0
Fieldfare	3	3	3	0	0
Gannet	30	29	6	19	4
Great Black-backed Gull	48	26	2	23	1
Great-crested Grebe	3	2	1	1	0
Grey Plover	1	1	1	0	0
Greylag Goose	2	2	0	2	0
Guillemot	15	4	2	2	0
Gull sp.	29	11	0	10	1
Herring Gull	509	447	41	320	80
House Martin	8	8	3	5	0
Kittiwake	41	40	0	38	1
Lesser Black Backed Gull	297	218	13	172	33
Linnet	2	2	0	2	0
Meadow Pipit	8	8	0	8	0
Merlin	1	1	0	0	**1**
Peregrine	1	0	0	0	0
Razorbill	3	0	0	0	0
Red-throated Diver	176	135	26	108	**1**
Sandwich Tern	22	22	5	17	0
Starling	201	201	168	33	0
Swallow	46	46	6	38	2
Swift	3	3	0	3	0
Woodpigeon	43	43	0	0	43
Unidentified finch	5	5	0	5	0
Unidentified passerine	4	4	1	2	1
Unidentified pigeon	1	1	0	1	0

Table 28 Number of birds seen in flight and different height bands in Year 6.

Species	Total	In flight	Height < = 1m	Height >1<= 20m	Height > 20m
Arctic Skua	3	3	2	1	0
Auk sp.	7	5	3	2	0
Bar-tailed Godwit	5	5	5	0	0
Black Headed Gull	42	40	10	32	0
Blackbird	3	3	1	2	0
Black-throated Diver	19	13	1	10	**2**
Brambling	1	1	0	1	0
Brent Goose	15	15	2	13	0
Chaffinch	15	15	0	15	0
Common Gull	184	138	5	103	30
Common Scoter	28	16	7	9	0
Common Tern	23	21	1	20	0
Cormorant	411	64	26	36	2
Dark-bellied Brent Goose	2	2	0	2	0
Diver sp.	17	6	2	4	0
Dunlin	5	5	5	0	0
Fieldfare	3	3	3	0	0
Gannet	30	30	5	25	0
Golden Plover	6	6	6	0	0
Great Black-backed Gull	62	36	4	25	7
Great-crested Grebe	3	1	1	0	0
Guillemot	19	4	3	1	0
Gull sp.	21	10	0	6	4
Herring Gull	416	346	17	241	88
House Martin	1	1	1	0	0
Kittiwake	42	36	1	35	0
Lesser Black Backed Gull	224	157	3	106	48
Little Gull	5	3	3	0	0
Meadow Pipit	3	3	0	2	1
Northern Fulmar	3	3	2	1	0
Peregrine	1	1	0	1	0
Pied Wagtail	1	1	1	0	0
Razorbill	1	0	0	0	0
Red-throated Diver	217	65	28	33	**4**
Redwing	3	3	2	1	0
Robin	1	1	0	1	0
Sand Martin	7	7	1	6	0
Sandwich Tern	52	52	7	44	**1**
Shelduck	2	2	1	1	0
Skylark	14	14	5	9	0
Sparrowhawk	2	2	0	2	0
Starling	3345	3345	1810	1267	268
Swallow	24	24	19	5	0
Swift	7	7	0	7	0
Unidentified finch	2	2	0	2	0
Unidentified passerine	7	7	0	7	0
Unidentified wader	1	1	1	0	0
Whimbrel	1	1	1	0	0
Woodpigeon	1	1	0	1	0

6.2 DIVER POPULATION TRENDS IN THAMES AND AROUND OFFSHORE WIND FARMS

During the aerial surveys undertaken on 14th January 2006 and 3rd February 2007, on 3rd February there was a large accumulation of divers on the edge of the Four Fathoms Channel to the southwest of the wind farm site near Red and Middle Sands and the outflow of the Swale Estuary. They may have been attracted by fronts created by fresh water mixing with seawater produce good diver feeding conditions.

On 18th February 2007 there were also large aggregations on the edge of the control site near the Woolpack and Margate Sands. Large numbers of divers were probably attracted to the feeding conditions resulting from overflows formed by the ebb and flow of the tide. This occurrence can be seen in the boat surveys undertaken in Year 5 (2005-06) with the majority of divers observed from boats at the eastern end of the site (transects G and H) and on the control site.

All the divers recorded during the 2007 aerial surveys were either red-throated or not identified to species. Boat-based surveys that were undertaken at the same time found that most of the divers observed around the site were red-throated and it is sensible to assume that the majority of the unidentified birds were this species. Anecdotal information from the boat surveyors suggests that close to the north of the Kentish Flats wind farm site divers are feeding on the edge of the shipping lane, on the Shivering Sands and the Princes Channel (Jon Ford, pers. comm.). It is postulated that diver abundance in the Thames Estuary may be linked, in part, to arrival of sprats, which congregate in the shallow areas to spawn. Sprat and diver populations in the Thames both occur at the same time of the year with arrivals in October and November and departure in late March.

In Year 6 (2006-07), as in Year 5, there were fewer divers recorded than previously to the north of the wind farm site, towards the Essex coast and their distribution was more scattered with no aggregations noted.

At the wind farm sites of Rhyl Flats and North Hoyle in Liverpool Bay, boat surveys have shown that red-throated divers and common scoters have been found to move through the wind farm study areas at dawn and dusk, moving from their roosting areas further out to sea to their feeding areas closer to the coast. , Along the north Kent coast there's no evidence of divers moving to or from roosting areas (or even having roosting areas at all) at dawn or dusk. Movement of divers around dawn along the north Kent coast is probably due to divers relocating themselves after being drifted by the tide overnight. There is no evidence at all of divers making any special movements at dusk (Ian Harding, *pers comm.*).

Common scoter are seen so infrequently from the boat it is difficult to draw any conclusions. Although at Reculver (approximately 5 miles south of the windfarm) the local flock of common scoter are usually present on the sea at first light giving no indication that they've just flown in from some roosting area further out to sea (Ian Harding, *pers comm*.).

During the 2004-05 aerial survey programme undertaken across the Thames Strategic Offshore Wind Farm Area divers were found to be "present in large numbers from Period 2 onwards in the Thames, with consistently around 1,000 birds (combining all species and unidentified birds). The vast majority are believed to have been red-throated divers. The number of divers increased in the inner part of the survey area (TH1 and TH2) and decreased in the outer survey area (TH4 and TH5) through Periods 2-4." (WWT 2005). Although some concentrations appeared to be found close to shore and around the mouths of estuaries in some survey blocks, birds were consistently encountered a long way from shore in all Strategic Areas, and over 40 km from shore in the Thames, even if only in low densities. The highest densities were in mid channel in the outer part of the Thames Estuary, and off the Suffolk coast. These two areas were characterised by the presence of sizeable flocks, often comprising groups of tens of birds, and appeared to show clumped patterns associated with the channels and sand banks in the waters between Kent and Essex" (WWT 2005).

"Numbers of divers in the Thames in 2004/05 were lower than in previous winters. Fewer divers were encountered in the mid Thames channel (survey blocks TH1 and TH2) than during previous surveys; the peak count in those two blocks alone has normally exceeded 1,500 in late winter (eg Hall *et al* 2003 cited

in WWT 2005), whereas total numbers in all six Thames survey blocks reached only about 1,000 in 2004/05".

Previous WWT aerial surveys noted marked changes in the number and distribution of divers in the Thames between months (Hall *et al* 2003, WWT). In some winters, a large influx has been noted, whilst in others, a more gradual build up of numbers has occurred. Peak numbers usually occur in late winter, although the precise timing has varied. Large movements of birds have even been noted during the course of an individual survey (WWT).

WWT reasoned that "a widespread and mobile distribution of divers may be expected due to the mobility of their prey; and it might be speculated that the numbers and timing of arrival of divers in the Thames is related to the seasonal occurrence of fish species, particularly if spawning. Lower numbers in 2004/05 may reflect differences in fish stocks within the main channel of the Thames, differing use of other nearby areas in UK waters, a smaller influx into UK waters from the near Continent or other factors."

WWT also pointed out that "large numbers of red-throated divers are occasionally recorded off the south Kent coast, eg off Lade Sands, near Dungeness (eg Cranswick *et al* 2005). In the absence of aerial survey, it is not clear whether birds in this area represent an extension or satellite of the 'flock' using the Thames Strategic Area, or represents infrequent aggregations during passage".

Small numbers of divers were recorded in the Thames in the early part of the winter 2005-06, with numbers recorded during the aerial survey programme rising rapidly through mid winter then stabilising with almost identical counts in Periods 3 and 4 of around 1,360. The increase in numbers during the latter two Periods was partially due to increased coverage during this time, though numbers increased dramatically in TH2 (WWT Consulting 2007).

WWT Consulting (2007) described "the highest concentrations of divers in the Thames occurred in mid channel, often up to 30 km offshore and in inshore areas off Great Yarmouth. Smaller numbers were found widely distributed throughout the area, extending to the outer limits of the survey area. Birds often occurred in flocks of more than ten birds near channels and sand banks mid way between Kent and Essex. Although the main concentrations were in roughly the same areas throughout the winter, there was some variation in distribution between months. In mid to late winter fewer birds were found in the south and in offshore parts of the north of the survey area, as birds appeared to concentrate in central areas, and move inshore in the north."

"Winter maxima for red-throated divers in the Thames during 2002/03 to 2005/06 were 11,100, 7,700, 5,600 and 8,000 (WWT Wetlands Advisory Service 2005, Webb *et al* 2005, cited in WWT Consulting 2007). The latter two figures are in fact estimates for the English East coast, from Kent to Yorkshire, but only a small number of divers occur outside the Thames. These figures demonstrate the regular and continued presence of large numbers of red-throated divers in the Thames. Peak numbers of divers in the Thames usually occur in late winter, although the precise timing varies between years. The peak is reached either with a large influx in mid or late winter, such as in 2005/06, or as a gradual increase in numbers throughout the winter."

Numbers of divers detected from the air in the Thames in 2005/06 were higher than in 2004/05, but were not as high as those recorded in 2002/03. WWT Consulting speculated that this may be due to more favourable conditions in other wintering grounds, perhaps as a result of mild winters or high food availability.

They found high concentrations of divers occurred mid-channel between Essex and Kent, and in the north of the Strategic Area, as noted in previous years. Birds appeared to be distributed near sand banks despite turbid and very shallow water, which would appear to make foraging difficult for these visual feeders which dive for their food. It is possible that divers in such waters have switched their diet in late winter/early spring, perhaps to spawning fish/eggs as has been noted in other areas (Guse *et al* in Press, cited in WWT Consulting 2007).

WWT consulting concluded that “large-scale changes in the distribution of divers between periods are unsurprising for a species that feeds on fish, a widespread and mobile food resource. It might be speculated that the timing and distribution of arrival of the winter influx of divers may be driven by seasonal occurrence of fish species, particularly spawning fish. Lower numbers of divers in recent years may be as a result of reduced fish stocks in the western North Sea, or due to improved food resources in other wintering areas.”

6.3 LONG-TERM EFFECTS OF WIND FARM ON TERN BREEDING SUCCESS

It is well known that wind turbines can have a negative impact on bird populations. Several field studies have shown that birds can experience disturbance in their breeding, roosting and foraging areas or during migration or collide with turbines during local and seasonal migration movements (Langston & Pullan 2003; Kingsley & Whittam 2005).

Terns travel widely during the breeding season to exploit prey resources that fluctuate both temporally and spatially and as such are expected to be potentially vulnerable to offshore developments. Apart from direct impacts, such as collision, offshore wind farms are thought to potentially have an effect on flight and feeding behaviour through disturbance, resulting in loss of foraging habitat (ICES 2002), and on prey availability through altering sediment composition, sand bank profiles or water flows in particular. Loss of foraging habitat could result in longer forage distances, potentially leading to a decrease in breeding success.

Research on a wind farm on the Belgian coast showed that collision-induced mortality amongst terns can be quite high (Everaert & Stienen 2006). This study did find that flight lines and flight behaviour seemed mostly unaltered. However part of this wind farm is situated in extreme close proximity to a large colony of Sandwich, common and little terns, significantly increasing collision risk. In a somewhat similar situation in the Netherlands linear turbine arrays did not seem to affect feeding flights of gulls and tern species during the breeding season either (Van den Bergh *et al* 2002). Both wind farms are examples of coastal onshore developments and as such give merely an indication of what factors influence tern populations in an offshore scenario.

Although various studies have focussed on the potential impact of offshore wind farms on tern populations (Allcorn *et al* 2003, Perrow *et al* 2006) relatively little direct evidence of effects is available.

The Sandwich tern colony on Burntwick Island has mostly increased between 1998, when monitoring began, and 2005 when a record high number of breeding pairs was reached (Mavor *et al* 2006). The Kent Ornithological Society reported 155 pairs for 1999 (KOS 2001) and Mavor et al (2006) report 602 and 632 breeding pairs in 2004 and 2005 respectively. In 2006 and 2007 numbers declined somewhat, with 524 and circa 450 pairs respectively (*pers. comm.* I. Harding). In 2008 the number of breeding pairs increased to 480 pairs (RSPB unpublished data).

Common tern numbers are harder to assess since in most years censuses do not cover the whole of the Medway. Colonies on Burntwick Island and Greenborough Island consisted of 106 to 120 breeding pairs in 1999 and 2000 respectively (KOS 2001). In 2004 181 pairs were counted on Burntwick Island (*pers. comm.* I. Harding). In recent years this colony has hosted somewhat smaller numbers: 127 and 143 pairs in 2007 and 2008 respectively (RSPB unpublished data). The whole population in the Medway is currently estimated at circa 350 pairs (*pers. comm.* I. Harding).

Litte tern, a species recorded only once during the monitoring programme (May 2005) breeds in two colonies about 12km southwest of the wind farm at the eastern end of the Swale. The Shellness colony is the larger one with circa 40 birds present during the last couple of breeding seasons. The Castle Coote colony comprised of about 6 birds in the last two years. Both colonies seem in terminal decline with neither colony successfully fledging chicks in 2006 or 2007 (*pers. comm.* I. Harding).

With extremes of 67 km measured as a foraging distance in Sandwich terns (Cramp 1985) at approximately 25 km the Kentish Flats wind farm lies well within the foraging range of the colonies in the Medway, albeit above the average distances found by Fasola & Bogliani (1990) and Brenninkmeijer & Stienen (1994), at an average of 13.1 km and 16 km respectively.

Although the wind farm seemingly lies outwith the average foraging range for common terns, (10 to 15 km), distances up to 30 km have been found (Cramp 1985, Newton & Crowe 2000). This assertion is supported by direct observational evidence of common terns flying inland off the Medway across Sheppey, out to sea on the other side of the island towards the wind farm and returning via the same route carrying fish (*pers. comm.* I. Harding). That at least a portion of the terns breeding in the Medway

use the study area and its surroundings to forage is further supported by regular observations during boat surveys of Sandwich and common terns flying from or through the site carrying prey in June and July. Both the Pan Sand hole and the Margate Sand seem to be used regularly. Survey data seem to indicate the Kentish Flats wind farm forms, to an extent, an obstacle to common terns with the species by-passing the turbine area to the north and south.

The Kentish Flats wind farm lies outwith the average foraging ranges known for little terns with most breeding individuals found to forage within 2 to 3km offshore (Cramp 1985; Perrow *et al* 2006) although larger foraging distances (>3km) are not uncommon.

Compared to the current size of the Medway breeding population the number of Sandwich terns observed during the breeding season is relatively small. This serves as an indication that any impact of the wind farm on the Sandwich tern breeding populations present is likely to be limited.

There have been some quite high counts of common terns flying through the study area during the breeding season, making it likely that most of these birds are from the Medway colonies. However with an estimated Medway population size of circa 350 pairs the portion of common terns using the site during the breeding season to forage seems relatively small.

With only one little tern observation during the boat survey programme it seems likely that the wind farm area is of little significance as foraging area for the breeding colonies on the Swale.

In fact, the data collected so far shows a much higher proportion of tern observations to have been made during the migration period. It is possible that any effect that the Kentish Flats wind farm might have on terns is of more significance for migrating terns than it is for the Medway breeding population. However without a dedicated, long term study on terns in the area, including detailed insight in the annual and spatial food availability on potential feeding grounds, intensive flight line tracking and ongoing collision (risk) monitoring relatively little can be said about any influence the wind farm might have on tern flight lines, feeding behaviour, mortality and breeding success. Boat (and aerial) surveys alone, albeit vital for the purpose of gathering density estimates and distribution data, provide not much more than an illustration of complex ecological patterns in tern populations.

7 CONCLUSIONS

7.1 BOAT SURVEY DATA

Between 10th December 2006 and 21st November 2007, a total of seventeen boat surveys of birds and mammals have been carried out. Over 41% of these covered the wind farm site, the buffer and the control area, whilst the remainder covered the wind farm site and buffer only. Population estimates for the wind farm, buffer and control site calculated for the 107 boat surveys since October 2001 permit comparisons of changes in abundance, as required by Objective 1 of the FEPA license. However, this remains difficult even after six years of boat survey data, in part because survey dates do not match between years but also due to natural and in some cases extensive seasonal variation between years.

Two statistical comparisons of boat survey data have been made, namely density change analysis over time and analysis of logarithms of density ratios between windfarm/buffer and control area. The more reliable of the two methods, comparing density ratios between the pre-construction, construction and operational periods, has not revealed any statistically significant changes for red-throated diver, lesser black-backed gull, herring gull and common gull. These are the only species which were recorded at both wind farm/buffer and control sites on more than three visits. There is no evidence of a direct effect on the numbers of birds using the wind farm site when comparing the three phases of the wind farm.

However, the rather low power of the control site analyses, because of the size and infrequency of sampling of the control site, imply that a more direct effect on red throated diver can not be discounted. The density analyses suggest that red-throated diver numbers were lower during the operational phase than during the pre-construction and construction phases, that lesser black-backed gull numbers in February were lower in the construction and operational phases (and possibly also in other winter months - October to March), and that guillemot numbers were lower from January to March since the wind farm became operational.

The mapped data in Figure 134 shows a small number of diver records from boat-based surveys within the turbine layout during the Year 6 (2006-07) aerial surveys (see Figures 136 and 137). All records related to red-throated divers and all were observed on the same boat survey on 15th January 2007. This is contrary to the results of the previous Year 5 (2005-06) surveys which did not record any divers within the wind farm (see Figure 105). Because the boat surveys last much longer than aerial surveys, the finding that no divers were seen from the boat within the wind farm in Year 5 at all is very notable.

In Year 6 (2006-07) diver numbers seen within the boat survey area were 256, of which 157 were recorded in transect (see Appendix A1 and section 5.1.1). In Year 5 fewer divers (194, of which 51 were in transect or snapshot) had been seen within the boat survey area (all within the buffer zone or control site) than in previous years (see Figure 105). By contrast, over the whole of Year 4, divers were regularly seen within the wind farm site (see Figure 76). That year, a total of 1,435 divers were detected during the boat surveys, with 704 recorded in transect/snapshot. Monthly numbers of divers in Years 4, 5 and 6 are displayed in Graphs 1-3 in Appendix 4.

A higher proportion (61.3%) were seen in transect or snapshot in Year 6 than in any previous year. This could suggest that population estimates may have been too high, because some divers were behaving unusually in aggregating within an area 300m wide adjacent to the boat. A similar situation arose in Year 4 when 49% of divers were seen in transect, and the possibility of aggregation near the vessel was particularly suggested by the December 2004 and February 2005 data. The proportion seen out of transect has varied in all years, with the greatest numbers observed in Year 2. It was concluded in the previous monitoring report that this finding may indicate some displacement of divers from the Kentish Flats wind turbine array.

In Year 6 only 28 common scoters were recorded (see Figure 135) compared with 138 common scoters seen in Year 5 (see Figure 106), more than in any previous year except Year 4 when 200 scoter were seen (see Figure 77).

There have continued to be some movements of wildfowl and a few waders seen possibly flying to and from the Thames coastal SPAs.

Few geese were recorded in Year 6, with Brent geese numbering only 17 distributed over three flocks, resulting in lower numbers than in Year 4 and 5. All flight movements seemed to skirt the edges of the wind farm, either to the north or the south. In the past years several observations of such "skirting" behaviour have been recorded. In addition in 2006 some occasions of active avoidance were noticed. Such behaviour seemed to be a result of the geese not noticing the turbines until up close.

Two greylag geese seen on 13th April 2006 flew between two rows of turbines and varied in height between 60m and 20m asl (see 7.3.2 and 7.3.4 below). On 9th October 2006 eight Brent geese appeared to fly through the wind farm below rotor height and a further five were thought to have flown from the control area to the south of the turbines. Also in Year 5, on 4th November 2006 eight Brent geese were seen in two groups skirting the southern and northern edges of the wind farm. On 31st October 2007 two Brent geese were seen flying low over the water to the west, skirting the north of the wind farm but probably not deviating from their flight-path. However, these records are few and involve low numbers of geese, providing only anecdotal behavioural observations.

Only two common shelducks were seen at two separate occasions in Year 6, one along the southern edge of the study area and one over the control site. Although in the past monitoring years a variety of dabbling duck species were observed, numbers were generally low and, similarly to geese such numbers are too low for population estimation or any meaningful conclusions regarding the impact of the wind farm on flight behaviour.

Numbers of waders seen in Year 5 were fewer than in Year 4, though the numbers seen are far too low to comment upon whether such a change is statistically significant. During the final monitoring year (Year 6) three wader species were recorded in relatively low numbers: bar-tailed godwit, golden plover and dunlin. With such low numbers seen even in previous years, no conclusions can currently be drawn as to whether any barrier effect has arisen or if waders have been discouraged from flying to or from one of the coastal SPAs (Objective 3). Indeed on 2nd March 2006 one curlew was recorded flying to the northwest at a height of 3m in transect 7 (see Figure 106) and would have flown through the wind farm site so the wind farm has not presented a barrier to this species. On 9th October 2006 another curlew was recorded flying low to the southwest in transect 2, possibly migrating into the Swale for the winter. Overall numbers of waders detected during the boat surveys were too low to draw any meaningful conclusions regarding possible barrier effects, collision risk or flight line disruption.

The pattern of common tern flights passing regularly through the southern part of the turbine area carrying fish back to their breeding colonies in the Medway, detected by boat surveys in previous years, was less pronounced in 2005 (see Figures 66, 68 and 70), 2006 (see Figure 107) and 2007 (see Figure 136), but terns were seen flying through the turbine array in slightly smaller numbers. However, the difference in numbers between those recorded in the operational phase (Years 4-6) and previous years is not statistically significant. As suggested in the third Monitoring Report (Gill *et al* 2006) the flight line for terns identified in previous years appears to have diverged north and south of the turbines with birds flying slightly further. Field observations indicate that a lot of Medway common terns forage on the Margate Sand and have to by-pass the wind farm to either the north or the south on their way to and from the colonies. The tern 'feeding frenzies' witnessed in Year 4 were again in evidence in Year 5 on 29th September 2006 when common terns were seen dip-feeding in a tight group of 82 birds near the Spaniard buoy at the southern end of transect 1. The monthly numbers of terns observed from boat surveys in Years 4 to 6 are displayed in Graphs 4-6 in Appendix 4.

Passerine migrant species were recorded during boat surveys conducted during Year 6, but as in previous years there is no evidence of a regular flight line through the wind farm any more than any other part of the Thames Estuary away from the coast. However there is considerable broad front movement of passerines through the windfarm, heading north in spring and south west and southwest in autumn.

The surveyors' reports suggest that gulls in general seem not to be have been influenced by the Kentish Flats wind farm and continue to use the wind farm site after construction. This is supported by the

population estimates for the four gull species most frequently seen in snapshot or transect. There appear to be no statistically significant changes in the densities of three of these species at the wind farm and buffer zone, though lesser black-backed gull density estimated in February was lower in the construction and operational phases, with some evidence also in other winter months from October to March. Guillemot numbers appear to be lower from January to March since the wind farm became operational (J. Ford *pers. comm.*).

Patterns of use and passage revealed by the mapped distributions of birds seen indicate some changes between years but in the majority of examples it is not possible to attribute these to any effects that might have arisen from the construction of the Kentish Flats wind farm.

7.2 AERIAL SURVEY DATA

Two surveys were undertaken in Year 6 covering the TH1 area and extending beyond the wind farm site, as part of the wider Thames Strategic Offshore Wind Farm aerial bird survey programme. During the aerial survey on 3rd February 2007 three Brent geese were observed on the water just south of the control area (see Figure 138). A further 300 Brent geese were seen flying close to the Kent coastline, to the southeast of the study area. A flock of 150 oystercatchers was seen flying similarly to the coast. A group of seven greylag geese were seen flying just north of the buffer area during the aerial survey carried out on 18th February 2007. To the west of the study area, off Minster on the Isle of Sheppey, a group of seven wigeon were seen in flight. Three groups of red-breasted merganser, consisting of 450, 25 and 6 individuals respectively, were seen in the Whitstable Bay (see Figure 140).

Four aerial surveys had been carried out in Year 5. As in previous years the Year 5 aerial surveys revealed only small numbers of seaduck within the boat study area (see Figures 111, 113 & 115). In Year 4 seven eiders were seen to the south of the buffer zone on 5th December 2004 (see Figure 58). No eiders or scoters were seen within the boat study area. On 15th January 2005 ten red-breasted mergansers were seen south and east of the study area close to the shore. Approximately 650 scoters were seen to the north in the middle of the estuary, and a further 25 off the Essex coast, both groups around 15km from the wind farm site (see Figure 80). On 6th March 2005 there were six eiders over 5km southeast of the wind farm site as shown in Figure 82 (also there on 13th March – see Figure 84), a party of nine common scoter were seen around 9 km to the northwest, 45 over 10km to the north, and three common scoter were within 5km of the south of the wind farm (see Figure 82). Very few SPA bird species were seen on 13 November 2005, except waders off the Essex coast and four tern species seen 4-8km to the east and north of the wind farm. On 31st July 2005 waders were only seen off the Essex coast and 30 waders were recorded off the Isle of Sheppey on 13th March 2005 (see Figure 84).

In Year 3, SPA species seen from the air included 60 waders along the coast on 17th December 2003, one Brent goose to the northeast of the wind farm on 15 February 2004, 35 dark-bellied Brent geese to the north of the wind farm and 3 lapwing seen within the control site on 30 October 2004, as were 25 teal and one Brent goose off the Kent coast. Common scoter and two eiders had been seen to the south of the buffer zone in February 2004 (when cormorants were the commonest species around but not within the wind-farm/buffer zone). A total of 24 common scoters were seen to the southwest of the buffer zone on 30 October 2004. These aerial data cannot be conclusive but could suggest that the larger aggregations of scoter (120+ in Year 2) or common eider (480 in Year 2) had avoided the wind farm area in Year 3 but the boat data (see 7.1) suggests that any such avoidance did not occur in Years 4 or 5.

The British Trust for Ornithology (BTO) review of aerial survey and analytic methods as part of the COWRIE programme concluded that detection of changes in common scoter and red-throated diver populations near small offshore wind farms was unlikely to be achievable from aerial survey data collected under the current DTI-subsidised programme, providing only "restrained means of detecting changes in regions in which these species are particularly abundant" (Maclean, Skov, Rehfisch & Piper 2006). The authors surprisingly concluded that the size of the reference area has little predictable effect on the likelihood of detecting changes in numbers.

In this study, data collected from the aerial transects which pass through the wind farm and buffer were compared with reference areas to the east and west. The data subjected to statistical analysis includes large sections far to the north of the boat survey area so is not ideal. The ratio of the mean number of birds per aerial transect for the wind farm and buffer area together with the east and west reference areas were calculated and the log (ratio) was analysed using ANOVA to look for any changes in bird numbers that might be attributable to the effect of construction and operation. The only F test that was significant at the 5% level was for the overall total.

Examination of the individual transect totals suggested that there has been an increase in gull and wader numbers on one transect (transect 4) immediately to the west of those grouped as wind farm transects (5 to 11 inclusive). This has increased the variability between transects which has partially masked any changes in means. It is possible that these gulls could include birds displaced from the wind farm area, but rather few waders have been observed within the wind farm itself.

Thus the aerial surveys have not provided any clear evidence of changes in numbers caused by the construction and operation of the Kentish Flats wind farm.

7.3 FEPA MONITORING OBJECTIVES

7.3.1 Objective 1

FEPA Objective 1 is to determine whether there has been any change in bird species, abundance and behaviour using and/or passing through the wind farm site.

The most apparent change in Year 6, based on qualitative observations represented by Figures 22, 48, 76, 105 and 134, was the detection of some divers within the turbine array, following the absence of divers from the Kentish Flats wind farm site in Year 5. No statistically significant change in diver densities was detected during the analysis of the Year 5 monitoring data. In Year 6 there also no statistically significant change in diver densities either, though ten divers were seen within the wind farm/buffer zone. Although the wind farm area is of relatively low importance for red-throated divers in the context of the whole Thames Estuary, both the surveyors agree that there has been displacement from the site. (John Ford and Ian Harding pers.comm.).

It is apparent that the numbers of divers recorded within the turbine area have fluctuated both seasonally and between years. For example, a comparison of Figures 22, 48, 76, 105 and 134, reveals that diver numbers within the turbine area were greatest in Year 3 before construction (Figures 51 and 53, which show large numbers of divers to the northeast and northwest of the wind farm site) and lowest in Year 5. Nonetheless, it remains the case that the Kentish Flats and the immediate surrounds are of relatively low importance for red throated diver in comparison to other parts of the Thames estuary.

There appears to have been little other change in bird use and passage through the Kentish Flats wind farm, as measured by comparing species, abundance and behaviour between the pre-construction, construction and operational periods.

There were no statistically significant changes revealed by the analyses of aerial data for the six groups examined. There was a finding that overall numbers of birds recorded had declined relative to the areas east and west of the wind farm as evidenced by the only F test that was significant at the 5% level was for the overall total.

7.3.2 Objective 2

FEPA Objective 2 is to determine whether there is disruption to bird flight lines. In Year 5 several goose flights were recorded during the boat surveys, more than in previous years of Year 6. Several observations of goose “skirting” behaviour have been recorded. In addition in 2006 some occasions of

active avoidance were noticed. Such behaviour seemed to be a result of the geese not noticing the turbines until up close.

The pattern of common tern flights regularly passing through the southern part of the turbine area carrying fish back to their breeding colonies in the Medway, recorded in previous years, was also apparent in 2005, 2006 and 2007, but less pronounced than previously and terns appeared to fly to the north or south of the turbines. This is the only example of a regularly used flight line detected by boat surveys prior to construction. It is possible that this flight line may have been split during 2005 since in some cases a higher proportion of common tern flights passed to the north or south of the turbine area, than was the case during the equivalent surveys during 2003 or 2004. This result suggests that the wind farm has presented an obstacle (though not an absolute barrier) to terns, leading to apparent disruption to the tern flight lines first noted during pre-construction monitoring surveys. There is an indication that mean tern numbers in the wind farm/buffer zone have increased since the pre-construction phase, but this development seems skewed by a few large tern aggregations recorded in August and September.

The study methodology was not developed in order to assess a barrier effect on tern breeding success and as such it has to be noted that without a dedicated, long term study on terns in the area including detailed insight in the annual and spatial food availability on potential feeding grounds, intensive flight line tracking and ongoing collision (risk) monitoring relatively little can be said about any influence the wind farm might have on tern flight lines and feeding behaviour and ultimately, mortality and breeding success of the Medway breeding populations.

Only for common terns is there a suggestion of any change in use (for passage rather than feeding) within the wind farm site. There is little indication from the data available that Objective 2 is relevant for any other species.

Passerine migrants were recorded during the boat surveys, but there is no evidence of a regular or specific flight line through the wind farm any more than the rest of the Thames Estuary.

7.3.3 Objective 3

Both boat and aerial survey data have been used to address Objective 3, which is to determine the distribution and any movements of wildfowl and divers in the boat survey area, and movements to and from the coastal SPA sites surrounding the Thames Estuary. These data continue to suggest minor importance of the wind farm site and buffer zone for wintering divers, which qualify the Thames SPA, and for Kent SPA wildfowl species.

Diver numbers and distribution recorded within the aerial survey area subjected to statistical analysis fluctuated between surveys in each year of survey. The changes in aerial counts of divers in Year 4 between 6th and 13th March 2005 (see Figures 81 and 83), and to a lesser extent in Year 6 between 3rd and 18th February 2007 (see Figures 137 and 139) illustrate the scale of some changes in distributions of divers in the Thames at this time of year, and perhaps indicate an influx of divers into parts of the outer Thames in some years. Changes were not as dramatic in Year 5. At the start of the winter (in Year 4) very few divers were seen in TH1 on 13th November 2005, with just nine seen between the wind farm and buffer and the North Kent coast (see Figure 86, and Figure 108 which plots the same data but does not show the divers seen far to the north of the Kentish Flats Wind Farm). By 11th December 2005 many more were seen, particularly to the west and south of the buffer zone (see Figure 110) whereas on 14th January 2006 divers were recorded more to the southwest, north and northeast (see Figure 112). On 18th February the main distribution within the area plotted had shifted to the east (see Figure 114).

The Year 5 aggregated diver distribution shown in Figure 116, showed that no divers had been recorded within the wind farm itself in Year 5 and fewer were seen within the buffer zone than elsewhere or previously. In that year divers appeared to the surveyors to be reluctant to go within the wind farm area once the 30 monopiles were in place. For example, on 19th January and 7th February 2005 no divers were seen on the water within this area and only a very few were seen to fly through it. In Year 6 diver have not been recorded either on the water within the array or flying through it, although they have been

observed feeding with 100m of the turbine bases it thought that the lines of turbines act as barrier to movements not individual turbines (John Ford *pers. comm*.).

A comparison of Figures 22, 48, 76, 105 and 134 reveals that diver numbers and their distribution within the turbine area were greatest in Year 3 (see also Figure 51 which shows large numbers of divers to the northeast and northwest of the wind farm site), lower in Year 4 (see Figure 76, when turbine foundations had been installed but before the turbines had been erected), and fewest in Year 5 (zero seen).

The shortage of control data from boat surveys during the peak diver period from December to February limits the power of the statistical tests. No significant changes have been proven. The ratio of the estimated number of red-throated divers on the wind farm and buffer to those on the control site was calculated for all occasions on which red-throated divers were recorded on both sites, but the logarithm of the ratios compared using a t-test revealed no statistically significant changes. Because there were only a few observations for divers, the power of these statistical tests is very low. The results of the density comparisons between the construction phase with the pre-construction phase and the operational phase with the pre-construction phase suggest that the numbers of red-throated divers had gone down within the study area during the operational period.

The recorded movements of wildfowl in Year 6 included fewer geese (the skeins numbering only 17 Brent geese). Two common shelducks were seen at two separate occasions. Three wader species, bar-tailed godwit, golden plover and dunlin were seen, with a higher number of bar-tailed godwits (c. 80) than in previous years.

In Year 5 goose observations included four groups of Brent geese totalling 21, two greylag geese and waders (see Figure 106). Twelve of the Brent geese were flying in a south westerly direction and the two greylag geese were flying northwest. The remaining nine Brent geese were flying west. All could possibly have been flying towards the coastal SPA sites surrounding the Thames estuary. There were more flights by geese (five groups, all Brent, totalling 99) within the boat survey area in Year 4 than in any previous year.

Two common shelducks were recorded in Year 6. No dabbling ducks were seen in Year 5. The main dabbling duck species seen in Year 4 were wigeon and shelduck. There was a flock of ten wigeon flying north on 14th October 2004 at 60m in a northerly direction through Transect 7, and possibly passing through the turbine array, and a single shelduck flying southwest on 29th May. These could have been cross-estuary movements.

In Year 6 common scoter were recorded on boat surveys in mid-December 2006 and August to November 2007. A total of 28 were observed with one group of twelve flushed by the vessels track within the wind farm on the 21st November 2007. Larger numbers of common scoter were seen in the boat survey area during Year 4 than in any previous year. A total of 200 common scoters were seen, though only eight were within the wind farm site (see Figure 77). None were seen during the aerial surveys. There were a total of 138 common scoters seen during boat surveys in Year 5. Thirty-six common scoters, 26 velvet scoters and six eiders recorded in Year 3. Only 17 common scoters were recorded in Year 2.

For the last 10 years, there have been 50-200 common scoter wintering along the North Kent coast between Whitstable and Margate. Typically they are to be seen on or over the sea between a half and four or so miles offshore. Many of the sightings of common scoter on the windfarm over the 5 years of study may therefore probably represent these same birds ranging just a little further out to sea than normal. The population of common scoter on the north Kent coast is thought to be approximately 50 year round, probably non-breeding birds during the summer months, passage takes place in September and November with several hundred passing through at these times (Ian Harding *pers.comm.).*

In Year 6 common scoter were recorded on the aerial survey which was undertaken on the 18th February 2007, four groups totalling 311 individuals, the largest group was a flock of 250, all were observed close to the mouth of the Swale estuary.

In Year 5 no seaducks were seen during the aerial surveys within the boat survey area, though six scoter were seen just to the north of the buffer zone on 18th February 2006 (see Figure 115). In Year 4 the aerial surveys had revealed small numbers of seaduck within the boat study area. No eider or scoter were seen within the boat survey area, though on 15th January 2005 ten mergansers and a grebe were seen to the south and east of the wind farm site. On 5th December 2004 seven eiders were seen to the south of the buffer zone. On 6th March 2005 three common scoter and six eider were observed to the south and west, a further nine common scoter to the northwest. On 13th March 2005 five eiders were seen to the southeast.

Numbers of waders seen from the air around the wind farm in Year 5 and 6 were higher than in previous years, but too few waders are seen during aerial or boat surveys to draw any conclusions about changes from year to year. Figures 113 and 115 show several hundred oystercatchers and unidentified waders seen on 14th January and 18th February 2006 in flight (direction unspecified on the aerial data obtained from the WWT) over 5km to the west of the buffer zone. They could have flown closer to the wind farm, but it is not possible to determine this from the available data. Four oystercatchers were recorded from the boat on 8th July 2005 heading to the north across the estuary. This is unusual behaviour for the few waders seen within the boat study area, as the surveyors note that most appear to fly in an easterly or westerly direction. Twelve bar-tailed godwits were seen to the south of the wind farm on 6th September 2005, flying at 20m height to the west, probably migrating into the estuary for the winter. They would not have flown through the turbine area, and were therefore not at potential risk of collision. It is not possible to conclude whether waders have been discouraged from flying to or from the coastal SPAs by disruption to bird flight lines, but the available evidence suggests that this is not the case.

Previous aerial observations relevant to Objective 3 are that on 5th December 2004 one great-crested grebe was seen to the north of the buffer zone, and almost 300 dabbling ducks (mostly wigeon) were recorded off the north Kent coast. On 6th March 2005 three common scoter and six eider were observed to the south and west, a further nine common scoter to the northwest (see Figure 82) and on 13th March five eider were seen to the southeast (see Figure 84). On 15th January 2005 ten mergansers and a grebe were seen to the south and east of the wind farm site (see Figure 80). On 31st July 2005 there were no aerial survey records of wildfowl and waders near the wind farm. The latest aerial data reinforces the suggestion that the wind farm site and buffer zone are of very minor importance of the for these SPA species.

In conclusion, although there have been some movements of wildfowl (dark-bellied Brent geese and common scoter) and waders (grey plover and curlew) during Year 5, these appear to be more frequent after construction commenced for common scoter and for geese when compared to pre-construction patterns.

The aerial data continues to demonstrate that the importance of the Kentish Flats Wind Farm for wintering divers is low in relation to the boat survey buffer zone, and even lower in relation to other parts of the TH1 aerial survey area (see Figures 76, 88, 116, 137 and 139).

7.3.4 Objective 4

FEPA Objective 4 seeks to determine the rate of bird collision but does not specify how this should be achieved. No formal assessment of collision risk has been made in any of the Monitoring Reports as none has been requested by Natural England (or previously by English Nature). However, examination of the number of birds of each species seen at rotor height (see Tables 27 and 28) suggests a very low collision risk for SPA species. The vast majority of species seen above 20m asl were gulls, and herring gull was the most frequently observed species recorded at rotor height in both Years 5 and 6 (2005-07).

As described in the previous Fourth Monitoring report (Gill *et al* 2007), the recorded behaviours of birds may indicate a risk of collision. On 13th April 2006 two greylag geese flew low northwest past the boat in the buffer zone on transect 6 at 10:13 (see Figure 106). They were observed by the surveyors to approach to within 200m of the turbine array, hesitate almost stalling in the air, and then gaining height, fly northwest through the wind farm equidistant between two rows of turbines. They were estimated to be flying at about 60m asl each time they passed between pairs of turbines, and at about 20m asl in between pairs. Alarmingly they appeared not to take notice of the turbine array until they were almost upon it. In Year 4 on 7th February 2005 a group of 75 Brent geese would have flown directly through the wind farm, and may have been at rotor height further away from the wind farm (though were seen at 10m asl). Previous goose flights with the potential for collision were seen on 12th October 2003, when three flocks of Brent geese comprising 43 birds in total were seen in migration. No such flights were recorded in Year 6.

In Year 4, ten wigeon were seen on 14th October 2005 flying at a height of 60m were recorded heading in a northerly direction through transect 7 (see Figures 73 and 77) and would probably have flown at rotor height through the wind farm, but were not observed to do so. In Year 4 ten shelduck were seen on 3rd October 2005 to the south of the wind farm heading west at 45m asl. No dabbling ducks were seen during the Year 5 boat surveys.

The number of Kent SPA and Thames SPA-qualifying species and other bird species of conservation concern which might be potential collision victims remains very low. In Year 5 and 6 a total of three terns were recorded as flying at collision risk height: one Sandwich tern and two common terns.

7.3.5 Objective 5

FEPA Objective 5 concerns the effectiveness of mitigation measures during the construction period, which was considered in the Second Monitoring report (Gill, Sales & Beasley 2006). The suggested mitigation measures to reduce disturbance to divers during construction appeared to have been fully effective by avoiding the peak diver season as recommended prior to consent and in line with the FEPA consent condition. There is no evidence that monopile-driving and increased boat traffic which inevitably increased disturbance levels during construction had any significant long term effects on bird populations.

No other mitigation was employed in relation to potential effects on bird species at the Kentish Flats site during the construction period.

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9 APPENDICES

A1.SUMMARY OF SPECIES OBSERVED IN AND OUT OF TRANSECT, BOAT SURVEYS BW – CL

Survey Summary – Birds Site:KF Survey Period: 10/12/2006-21/11/2007

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*	**217**	65	152	0	**141**	9	132	0
Black-throated Diver	*Gavia arctica*	**19**	13	6	0	**7**	1	6	0
Diver sp.	*Gavia sp.*	**17**	6	11	0	**7**	1	6	0
Great-crested Grebe	*Podiceps cristatus*	**3**	1	2	0	**2**	0	2	0
		256	**85**	**171**	**0**	**157**	**11**	**146**	**0**
Procellariforme									
Northern Fulmar	*Fulmarus glacialis*	**2**	2	0	0	**0**	0	0	0
		2	**2**	**0**	**0**	**0**	**0**	**0**	**0**
Gannets									
Gannet	*Morus bassanus*	**30**	30	0	3	**4**	4	0	0
		30	**30**	**0**	**3**	**4**	**4**	**0**	**0**
Cormorants									
Cormorant	*Phalacrocorax carbo*	**411**	64	347	23	**210**	16	194	23
		411	**64**	**347**	**23**	**210**	**16**	**194**	**23**
Geese									
Brent Goose	*Branta bernicla*	**15**	15	0	0	**0**	0	0	0
Dark-bellied Brent Goose	*Branta bernicla*	**2**	2	0	0	**0**	0	0	0
Shelduck	*Tadorna tadorna*	**2**	2	0	0	**0**	0	0	0
		19	**19**	**0**	**0**	**0**	**0**	**0**	**0**
Diving Ducks									
Common Scoter	*Melanitta nigra*	**28**	16	12	0	**12**	0	12	0
		28	**16**	**12**	**0**	**12**	**0**	**12**	**0**
Raptors									
Sparrowhawk	*Accipiter nisus*	**2**	2	0	0	**0**	0	0	0
Peregrine	*Falco peregrinus*	**1**	1	0	0	**1**	1	0	0
		3	**3**	**0**	**0**	**1**	**1**	**0**	**0**
Waders									
Golden Plover	*Pluvialis apricaria*	**6**	6	0	0	**0**	0	0	0
Dunlin	*Calidris alpina*	**5**	5	0	0	**2**	2	0	0
Bar-tailed Godwit	*Limosa lapponica*	**5**	5	0	0	**0**	0	0	0
Whimbrel	*Numenius phaeopus*	**1**	1	0	0	**1**	1	0	0
Unidentified wader		**1**	1	0	0	**0**	0	0	0
		18	**18**	**0**	**0**	**3**	**3**	**0**	**0**
Skuas									
Arctic Skua	*Stercorarius*	**3**	3	0	0	**2**	2	0	0
		3	**3**	**0**	**0**	**2**	**2**	**0**	**0**

Common Name	*Species*	*Total Number Sighted*				*Total Number In Transect*			
		Total	Flying*	On Sea*	Feeding	**Total**	Flying*	OnSea*	Feeding
Gulls									
Little Gull	*Larus minutus*	**5**	3	2	3	**3**	3	0	3
Black Headed Gull	*Larus ridibundus*	**42**	40	2	0	**14**	12	2	0
Common Gull	*Larus canus*	**184**	138	46	0	**81**	39	42	0
Lesser Black Backed Gull	*Larus fuscus*	**224**	157	67	2	**107**	45	62	1
Herring Gull	*Larus argentatus*	**416**	346	84	14	**158**	90	82	14
Great Black-backed Gull	*Larus marinus*	**62**	36	26	4	**38**	12	26	4
Kittiwake	*Rissa tridactyla*	**42**	36	6	1	**9**	3	6	0
Gull sp.		**21**	10	11	0	**4**	3	1	0
		996	**766**	**244**	**24**	**414**	**207**	**221**	**22**
Terns									
Sandwich Tern	*Sterna sandvicensis*	**52**	52	0	11	**16**	16	0	8
Common Tern	*Sterna hirundo*	**23**	21	2	4	**9**	7	2	4
		75	**73**	**2**	**15**	**25**	**23**	**2**	**12**
Auks									
Guillemot	*Uria aalge*	**19**	4	15	0	**15**	0	15	0
Razorbill	*Alca torda*	**1**	0	1	0	**1**	0	1	0
Auk sp.		**7**	5	2	0	**3**	1	2	0
		27	**9**	**18**	**0**	**19**	**1**	**18**	**0**
Pigeons etc.									
Woodpigeon	*Columba palumbus*	**1**	1	1	0	**1**	1	1	0
		1	**1**	**1**	**0**	**1**	**1**	**1**	**0**
Swifts									
Swift	*Apus apus*	**7**	7	0	0	**0**	0	0	0
		7	**7**	**0**	**0**	**0**	**0**	**0**	**0**
Larks									
Sky Lark	*Alauda arvensis*	**14**	14	0	0	**1**	1	0	0
		14	**14**	**0**	**0**	**1**	**1**	**0**	**0**
Hirundines									
Sand Martin	*Riparia riparia*	**7**	7	0	0	**0**	0	0	0
Swallow	*Hirundo rustica*	**24**	24	0	0	**2**	2	0	0
House Martin	*Delichon urbica*	**1**	1	0	0	**0**	0	0	0
		32	**32**	**0**	**0**	**2**	**2**	**0**	**0**
Passerines									
Meadow Pipit	*Anthus pratensis*	**3**	3	0	0	**1**	1	0	0
Pied Wagtail	*Motacilla alba*	**1**	1	0	0	**0**	0	0	0
Robin	*Erithacus rubecula*	**1**	1	0	0	**0**	0	0	0
Blackbird	*Turdus merula*	**3**	3	0	0	**0**	0	0	0
Fieldfare	*Turdus pilaris*	**3**	3	0	0	**0**	0	0	0
Redwing	*Turdus iliacus*	**3**	3	0	0	**0**	0	0	0
Starling	*Sturnus vulgaris*	**3345**	3345	0	0	**676**	676	0	0
Chaffinch	*Fringilla coelebs*	**15**	15	0	0	**0**	0	0	0
Brambling	*Fringilla*	**1**	1	0	0	**0**	0	0	0
Unidentified finch		**2**	2	0	0	**0**	0	0	0
Unidentified paserine		**7**	7	0	0	**2**	2	0	0
		3384	**3384**	**0**	**0**	**679**	**679**	**0**	**0**
Total for all birds		**5306**	**4526**	**795**	**65**	**1530**	**951**	**594**	**57**

Survey Summary – Mammals Site: KF Survey Period: 10/12/2006-21/11/2007

Common Name	*Species*	*Total Number Sighted*		*Total Number In Transect*	
		Total	Feeding	**Total**	Feeding
Pinnipeds					
Common seal	*Phoca vitulina*	**8**	0	**7**	0
Seal sp.		**2**	0	**1**	0
		10	**0**	**8**	**0**
Phocoenidae					
Harbour porpoise	*Phocoena phocoena*	**1**	0	**1**	0
		1	**0**	**1**	**0**
Total for all animals		**11**	**0**	**9**	**0**

SINGLE SURVEY SUMMARIES

Survey Summary - Birds Site: KF Survey Period: 10/12/2006

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*	**9**	7	2	0	**2**	0	2	0
Black-throated Diver	*Gavia arctica*	**9**	4	5	0	**6**	1	5	0
Diver sp.	*Gavia sp.*	**11**	5	6	0	**6**	0	6	0
Great-crested Grebe	*Podiceps cristatus*	**2**	1	1	0	**1**	0	1	0
		31	**17**	**14**	**0**	**15**	**1**	**14**	**0**
Cormorants									
Cormorant	*Phalacrocorax carbo*	**26**	4	22	0	**16**	2	14	0
		26	**4**	**22**	**0**	**16**	**2**	**14**	**0**
Geese									
Shelduck	*Tadorna tadorna*	**1**	1	0	0	**0**	0	0	0
		1	**1**	**0**	**0**	**0**	**0**	**0**	**0**
Diving Ducks									
Common Scoter	*Melanitta nigra*	**2**	2	0	0	**0**	0	0	0
		2	**2**	**0**	**0**	**0**	**0**	**0**	**0**
Raptors									
Sparrowhawk	*Accipiter nisus*	**2**	2	0	0	**0**	0	0	0
		2	**2**	**0**	**0**	**0**	**0**	**0**	**0**
Gulls									
Black Headed Gull	*Larus ridibundus*	**2**	2	0	0	**0**	0	0	0
Common Gull	*Larus canus*	**4**	4	0	0	**2**	2	0	0
Lesser Black Backed Gull	*Larus fuscus*	**40**	32	8	0	**19**	11	8	0
Herring Gull	*Larus argentatus*	**33**	28	5	0	**11**	6	5	0
Great Black-backed Gull	*Larus marinus*	**7**	7	0	0	**2**	2	0	0
Kittiwake	*Rissa tridactyla*	**9**	7	2	0	**4**	2	2	0
		95	**80**	**15**	**0**	**38**	**23**	**15**	**0**
Auks									
Guillemot	*Uria aalge*	**14**	1	13	0	**13**	0	13	0
Auk sp.		**7**	5	2	0	**3**	1	2	0
		21	**6**	**15**	**0**	**16**	**1**	**15**	**0**
Total for all birds		**178**	**112**	**66**	**0**	**85**	**27**	**58**	**0**

Survey Summary - Birds

Site: KF Survey Period: 15/01/2007

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*	**76**	31	45	0	**38**	3	35	0
Black-throated Diver	*Gavia arctica*	**1**	0	1	0	**1**	0	1	0
Great-crested Grebe	*Podiceps cristatus*	**1**	0	1	0	**1**	0	1	0
		78	**31**	**47**	**0**	**40**	**3**	**37**	**0**
Cormorants									
Cormorant	*Phalacrocorax carbo*	**9**	5	4	0	**3**	1	2	0
		9	**5**	**4**	**0**	**3**	**1**	**2**	**0**
Gulls									
Black Headed Gull	*Larus ridibundus*	**3**	3	0	0	**0**	0	0	0
Common Gull	*Larus canus*	**10**	10	0	0	**2**	2	0	0
Lesser Black Backed Gull	*Larus fuscus*	**13**	13	0	0	**6**	6	0	0
Herring Gull	*Larus argentatus*	**19**	10	9	0	**15**	6	9	0
Great Black-backed Gull	*Larus marinus*	**1**	1	0	0	**0**	0	0	0
Kittiwake	*Rissa tridactyla*	**3**	3	0	0	**0**	0	0	0
Gull sp.		**2**	2	0	0	**0**	0	0	0
		51	**42**	**9**	**0**	**23**	**14**	**9**	**0**
Auks									
Guillemot	*Uria aalge*	**2**	1	1	0	**1**	0	1	0
		2	**1**	**1**	**0**	**1**	**0**	**1**	**0**
Total for all birds		**140**	**79**	**61**	**0**	**67**	**18**	**49**	**0**

Survey Summary - Mammals

Site: KF Survey Period: 15/01/2007

Common Name	*Species*	*Total Number Sighted*		*Total Number In Transect*	
		Total	Feeding	**Total**	Feeding
Pinnipeds					
Common seal	*Phoca vitulina*	**1**	0	**1**	0
		1	**0**	**1**	**0**
Total for all animals		**1**	**0**	**1**	**0**

Survey Summary - Birds

Site: KF Survey Period: 02/02/2007

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*	**28**	7	21	0	**19**	4	15	0
Black-throated Diver	*Gavia arctica*	**1**	1	0	0	**0**	0	0	0
Diver sp.	*Gavia sp.*	**1**	1	0	0	**1**	1	0	0
		30	**9**	**21**	**0**	**20**	**5**	**15**	**0**
Cormorants									
Cormorant	*Phalacrocorax carbo*	**8**	3	5	0	**3**	1	2	0
		8	**3**	**5**	**0**	**3**	**1**	**2**	**0**
Gulls									
Black Headed Gull	*Larus ridibundus*	**4**	4	0	0	**1**	1	0	0
Common Gull	*Larus canus*	**18**	12	6	0	**11**	5	6	0

Lesser Black Backed Gull	*Larus fuscus*	**8**	6	2	0	**1**	0	1	0
Herring Gull	*Larus argentatus*	**74**	70	4	0	**11**	7	4	0
Great Black-backed Gull	*Larus marinus*	**1**	1	0	0	**0**	0	0	0
Gull sp.		**2**	2	0	0	**0**	0	0	0
		107	**95**	**12**	**0**	**24**	**13**	**11**	**0**
Total for all birds		**145**	**107**	**38**	**0**	**47**	**19**	**28**	**0**

Survey Summary – Mammals

Site: KF Survey Period: 02/02/2007

Common Name	*Species*	*Total Number Sighted*		*Total Number Transect*	
		Total	Feeding	**Total**	Feeding
Pinnipeds					
Seal sp.		**1**	0	**1**	0
		1	**0**	**1**	**0**
Total for all animals		**1**	**0**	**1**	**0**

Survey Summary - Birds

Site: KF Survey Period: 02/03/2007

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*	**80**	16	64	0	**65**	2	63	0
Black-throated Diver	*Gavia arctica*	**5**	5	0	0	**0**	0	0	0
Diver sp.	*Gavia sp.*	**5**	0	5	0	**0**	0	0	0
		90	**21**	**69**	**0**	**65**	**2**	**63**	**0**
Cormorants									
Cormorant	*Phalacrocorax carbo*	**5**	1	4	0	**3**	0	3	0
		5	**1**	**4**	**0**	**3**	**0**	**3**	**0**
Gulls									
Black Headed Gull	*Larus ridibundus*	**7**	5	2	0	**5**	3	2	0
Common Gull	*Larus canus*	**17**	16	1	0	**6**	5	1	0
Lesser Black Backed Gull	*Larus fuscus*	**3**	2	1	0	**0**	0	0	0
Herring Gull	*Larus argentatus*	**6**	6	0	0	**1**	1	0	0
		33	**29**	**4**	**0**	**12**	**9**	**3**	**0**
Passerines									
Meadow Pipit	*Anthus pratensis*	**1**	1	0	0	**0**	0	0	0
Pied Wagtail	*Motacilla alba*	**1**	1	0	0	**0**	0	0	0
		2	**2**	**0**	**0**	**0**	**0**	**0**	**0**
Total for all birds		**130**	**53**	**77**	**0**	**80**	**11**	**69**	**0**

Survey Summary - Birds

Site: KF Survey Period: 06/04/2007

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*	**7**	0	7	0	**7**	0	7	0

		7	**0**	**7**	**0**	**7**	**0**	**7**	**0**
Gulls									
Common Gull	*Larus canus*	**62**	30	32	0	**41**	9	32	0
Lesser Black Backed Gull	*Larus fuscus*	**14**	12	2	1	**4**	3	1	0
Herring Gull	*Larus argentatus*	**57**	49	8	0	**18**	10	8	0
Great Black-backed Gull	*Larus marinus*	**4**	4	0	0	**1**	1	0	0
Gull sp.		**10**	2	8	0	**1**	1	0	0
		147	**97**	**50**	**1**	**65**	**24**	**41**	**0**
Total for all birds		**154**	**97**	**57**	**1**	**72**	**24**	**48**	**0**

Survey Summary - Birds

Site: KF Survey Period: 29/04/2007

Common Name	***Species***	***Total Number Sighted*** **Total** Flying* On Sea* Feeding				***Total Number in transect*** **Total** Flying* On Sea* Feeding			
Cormorants									
Cormorant	*Phalacrocorax carbo*	**4**	1	3	0	**1**	1	0	0
		4	**1**	**3**	**0**	**1**	**1**	**0**	**0**
Waders									
Whimbrel	*Numenius phaeopus*	**1**	1	0	0	**1**	1	0	0
		1	**1**	**0**	**0**	**1**	**1**	**0**	**0**
Gulls									
Common Gull	*Larus canus*	**1**	1	0	0	**1**	1	0	0
Lesser Black Backed Gull	*Larus fuscus*	**31**	8	23	0	**25**	3	22	0
Herring Gull	*Larus argentatus*	**50**	23	27	0	**28**	2	26	0
Great Black-backed Gull	*Larus marinus*	**9**	3	6	4	**6**	0	6	4
		91	**35**	**56**	**4**	**60**	**6**	**54**	**4**
Pigeons etc.									
Woodpigeon	*Columba palumbus*	**1**	1	1	0	**1**	1	1	0
		1	**1**	**1**	**0**	**1**	**1**	**1**	**0**
Hirundines									
Swallow	*Hirundo rustica*	**6**	6	0	0	**0**	0	0	0
		6	**6**	**0**	**0**	**0**	**0**	**0**	**0**
Total for all birds		**103**	**44**	**60**	**4**	**63**	**9**	**55**	**4**

Survey Summary - Mammals

Site: KF Survey Period: 29/04/2007

Common Name	***Species***	***Total Number Sighted*** **Total**	Feeding	***Total Number transect*** **Total**	Feeding
Pinnipeds					
Common seal	*Phoca vitulina*	**1**	0	**1**	0
		1	**0**	**1**	**0**
Total for all animals		**1**	**0**	**1**	**0**

Survey Summary - Birds

Site: KF Survey Period: 04/05/2007

Common Name	***Species***	***Total Number Sighted***	***Total Number in transect***

		Total	Flying*	On Sea*	Feeding	**Total**	Flying*	On Sea*	Feeding
Gannets									
Gannet	*Morus bassanus*	**1**	1	0	0	**1**	1	0	0
		1	**1**	**0**	**0**	**1**	**1**	**0**	**0**
Cormorants									
Cormorant	*Phalacrocorax carbo*	**3**	1	2	0	**0**	0	0	0
		3	**1**	**2**	**0**	**0**	**0**	**0**	**0**
Waders									
Bar-tailed Godwit	*Limosa lapponica*	**5**	5	0	0	**0**	0	0	0
		5	**5**	**0**	**0**	**0**	**0**	**0**	**0**
Gulls									
Common Gull	*Larus canus*	**4**	4	0	0	**0**	0	0	0
Lesser Black Backed Gull	*Larus fuscus*	**9**	7	2	0	**3**	1	2	0
Herring Gull	*Larus argentatus*	**12**	11	1	0	**2**	1	1	0
Great Black-backed Gull	*Larus marinus*	**2**	2	0	0	**2**	2	0	0
		27	**24**	**3**	**0**	**7**	**4**	**3**	**0**
Terns									
Sandwich Tern	*Sterna sandvicensis*	**1**	1	0	0	**1**	1	0	0
		1	**1**	**0**	**0**	**1**	**1**	**0**	**0**
Auks									
Guillemot	*Uria aalge*	**1**	1	0	0	**0**	0	0	0
		1	**1**	**0**	**0**	**0**	**0**	**0**	**0**
Total for all birds		**38**	**33**	**5**	**0**	**9**	**6**	**3**	**0**

Survey Summary – Mammals

Site: KF Survey Period: 04/05/2007

Common Name	*Species*	*Total Number Sighted* **Total**	Feeding	*Total Number in transect* **Total**	Feeding
Pinnipeds					
Common seal	*Phoca vitulina*	**2**	0	**2**	0
		2	**0**	**2**	**0**
Total for all animals		**2**	**0**	**2**	**0**

Survey Summary - Birds

Site: KF Survey Period: 21/05/2007

Common Name	*Species*	*Total Number Sighted* **Total**	Flying*	On Sea*	Feeding	*Total Number in transect* **Total**	Flying*	OnSea*	Feeding
Cormorants									
Cormorant	*Phalacrocorax carbo*	**1**	0	1	0	**1**	0	1	0
		1	**0**	**1**	**0**	**1**	**0**	**1**	**0**
Gulls									
Common Gull	*Larus canus*	**4**	0	4	0	**0**	0	0	0
Lesser Black Backed Gull	*Larus fuscus*	**9**	8	1	0	**3**	2	1	0
Herring Gull	*Larus argentatus*	**24**	20	4	0	**7**	3	4	0
		37	**28**	**9**	**0**	**10**	**5**	**5**	**0**
Terns									
Sandwich Tern	*Sterna sandvicensis*	**1**	1	0	0	**0**	0	0	0
		1	**1**	**0**	**0**	**0**	**0**	**0**	**0**

Hirundines									
Swallow	*Hirundo rustica*	**1**	1	0	0	**1**	1	0	0
		1	**1**	**0**	**0**	**1**	**1**	**0**	**0**
Total for all birds		**40**	**30**	**10**	**0**	**12**	**6**	**6**	**0**

Survey Summary - Mammals

Site: KF Survey Period: 21/05/2007

Common Name	*Species*	*Total Number Sighted*		*Total Number In Transect*	
		Total	Feeding	**Total**	Feeding
Pinnipeds					
Seal sp.		**1**	0	**0**	0
		1	**0**	**0**	**0**
Total for all animals		**1**	**0**	**0**	**0**

Survey Summary - Birds

Site: KF Survey Period: 08/06/2007

Common Name	*Species*	*Total Number Sighted*				*Total Number In Transect*			
		Total	Flying*	On Sea*	Feeding	**Total**	Flying*	On Sea*	Feeding
Procellariforme									
Northern Fulmar	*Fulmarus glacialis*	**1**	1	0	0	**0**	0	0	0
		1	**1**	**0**	**0**	**0**	**0**	**0**	**0**
Gannets									
Gannet	*Morus bassanus*	**2**	2	0	0	**1**	1	0	0
		2	**2**	**0**	**0**	**1**	**1**	**0**	**0**
Cormorants									
Cormorant	*Phalacrocorax carbo*	**26**	3	23	0	**9**	1	8	0
		26	**3**	**23**	**0**	**9**	**1**	**8**	**0**
Raptors									
Peregrine	*Falco peregrinus*	**1**	1	0	0	**1**	1	0	0
		1	**1**	**0**	**0**	**1**	**1**	**0**	**0**
Gulls									
Lesser Black Backed Gull	*Larus fuscus*	**4**	2	2	0	**2**	0	2	0
Herring Gull	*Larus argentatus*	**46**	46	14	14	**29**	29	14	14
Great Black-backed Gull	*Larus marinus*	**3**	2	1	0	**1**	0	1	0
Gull sp.		**2**	2	0	0	**1**	1	0	0
		55	**52**	**17**	**14**	**33**	**30**	**17**	**14**
Terns									
Sandwich Tern	*Sterna sandvicensis*	**6**	6	0	0	**0**	0	0	0
		6	**6**	**0**	**0**	**0**	**0**	**0**	**0**
Swifts									
Swift	*Apus apus*	**5**	5	0	0	**0**	0	0	0
		5	**5**	**0**	**0**	**0**	**0**	**0**	**0**
Passerines									
Starling	*Sturnus vulgaris*	**2**	2	0	0	**0**	0	0	0
		2	**2**	**0**	**0**	**0**	**0**	**0**	**0**

Total for all birds		**98**	**72**	**40**	**14**	**44**	**33**	**25**	**14**

Survey Summary - Mammals

Site: KF Survey Period: 08/06/2007

Common Name	*Species*	*Total Number Sighted*		*Total Number In Transect*	
		Total	Feeding	**Total**	Feeding
Pinnipeds					
Common seal	*Phoca vitulina*	**1**	0	**0**	0
		1	**0**	**0**	**0**
Total for all animals		**1**	**0**	**0**	**0**

Survey Summary - Birds

Site: KF Survey Period: 13/07/2007

Common Name	*Species*	*Total Number Sighted*				*Total Number In Transect*			
		Total	Flying*	On Sea*	Feeding	**Total**	Flying*	On Sea*	Feeding
Gannets									
Gannet	*Morus bassanus*	**5**	5	0	0	**0**	0	0	0
		5	**5**	**0**	**0**	**0**	**0**	**0**	**0**
Cormorants									
Cormorant	*Phalacrocorax carbo*	**23**	3	20	0	**3**	0	3	0
		23	**3**	**20**	**0**	**3**	**0**	**3**	**0**
Gulls									
Black Headed Gull	*Larus ridibundus*	**1**	1	0	0	**0**	0	0	0
Lesser Black Backed Gull	*Larus fuscus*	**1**	1	0	0	**1**	1	0	0
Herring Gull	*Larus argentatus*	**25**	20	5	0	**11**	6	5	0
		27	**22**	**5**	**0**	**12**	**7**	**5**	**0**
Terns									
Sandwich Tern	*Sterna sandvicensis*	**13**	13	0	1	**5**	5	0	0
Common Tern	*Sterna hirundo*	**5**	5	0	4	**4**	4	0	4
		18	**18**	**0**	**5**	**9**	**9**	**0**	**4**
Swifts									
Swift	*Apus apus*	**2**	2	0	0	**0**	0	0	0
		2	**2**	**0**	**0**	**0**	**0**	**0**	**0**
Hirundines									
Sand Martin	*Riparia riparia*	**6**	6	0	0	**0**	0	0	0
		6	**6**	**0**	**0**	**0**	**0**	**0**	**0**
Total for all birds		**81**	**56**	**25**	**5**	**24**	**16**	**8**	**4**

Survey Summary - Birds

Site: KF Survey Period: 30/08/2007

Common Name	*Species*	*Total Number Sighted*				*Total Number In Transect*			
		Total	Flying*	On Sea*	Feeding	**Total**	Flying*	On Sea*	Feeding
Gannets									
Gannet	*Morus bassanus*	**2**	2	0	0	**1**	1	0	0
		2	**2**	**0**	**0**	**1**	**1**	**0**	**0**
Cormorants									
Cormorant	*Phalacrocorax carbo*	**26**	3	23	0	**5**	0	5	0
		26	**3**	**23**	**0**	**5**	**0**	**5**	**0**

Diving Ducks									
Common Scoter	*Melanitta nigra*	**3**	3	0	0	**0**	0	0	0
		3	**3**	**0**	**0**	**0**	**0**	**0**	**0**
Skuas									
Arctic Skua	*Stercorarius*	**2**	2	0	0	**2**	2	0	0
		2	**2**	**0**	**0**	**2**	**2**	**0**	**0**
Gulls									
Lesser Black Backed Gull	*Larus fuscus*	**22**	19	3	1	**12**	9	3	1
Herring Gull	*Larus argentatus*	**7**	6	1	0	**5**	4	1	0
Great Black-backed Gull	*Larus marinus*	**5**	3	2	0	**4**	2	2	0
		34	**28**	**6**	**1**	**21**	**15**	**6**	**1**
Terns									
Sandwich Tern	*Sterna sandvicensis*	**23**	23	0	8	**9**	9	0	8
Common Tern	*Sterna hirundo*	**12**	12	0	0	**2**	2	0	0
		35	**35**	**0**	**8**	**11**	**11**	**0**	**8**
Total for all birds		**102**	**73**	**29**	**9**	**40**	**29**	**11**	**9**

Survey Summary - Birds

Site: KF Survey Period: 10/09/2007

Common Name	*Species*	*Total Number Sighted*				*Total Number In Transect*			
		Total	Flying*	On Sea*	Feeding	**Total**	Flying*	On Sea*	Feeding
Gannets									
Gannet	*Morus bassanus*	**6**	6	0	0	**1**	1	0	0
		6	**6**	**0**	**0**	**1**	**1**	**0**	**0**
Cormorants									
Cormorant	*Phalacrocorax carbo*	**26**	3	23	0	**22**	0	22	0
		26	**3**	**23**	**0**	**22**	**0**	**22**	**0**
Waders									
Dunlin	*Calidris alpina*	**2**	2	0	0	**2**	2	0	0
		2	**2**	**0**	**0**	**2**	**2**	**0**	**0**
Skuas									
Arctic Skua	*Stercorarius*	**1**	1	0	0	**0**	0	0	0
		1	**1**	**0**	**0**	**0**	**0**	**0**	**0**
Gulls									
Lesser Black Backed Gull	*Larus fuscus*	**17**	10	7	0	**8**	1	7	0
Herring Gull	*Larus argentatus*	**8**	7	1	0	**2**	1	1	0
Great Black-backed Gull	*Larus marinus*	**7**	1	6	0	**6**	0	6	0
Kittiwake	*Rissa tridactyla*	**26**	23	3	0	**4**	1	3	0
		58	**41**	**17**	**0**	**20**	**3**	**17**	**0**
Terns									
Sandwich Tern	*Sterna sandvicensis*	**2**	2	0	0	**0**	0	0	0
Common Tern	*Sterna hirundo*	**4**	4	0	0	**1**	1	0	0
		6	**6**	**0**	**0**	**1**	**1**	**0**	**0**
Hirundines									
Sand Martin	*Riparia riparia*	**1**	1	0	0	**0**	0	0	0
		1	**1**	**0**	**0**	**0**	**0**	**0**	**0**
Total for all birds		**100**	**60**	**40**	**0**	**46**	**7**	**39**	**0**

Survey Summary - Birds

Site: KF Survey Period: 02/10/2007

Common Name	*Species*	*Total Number Sighted*				*Total Number In Transect*			
		Total	Flying*	On Sea*	Feeding	**Total**	Flying*	On Sea*	Feeding
Procellariforme									
Northern Fulmar	*Fulmarus glacialis*	**1**	1	0	0	**0**	0	0	0
		1	**1**	**0**	**0**	**0**	**0**	**0**	**0**
Gannets									
Gannet	*Morus bassanus*	**4**	4	0	0	**0**	0	0	0
		4	**4**	**0**	**0**	**0**	**0**	**0**	**0**
Cormorants									
Cormorant	*Phalacrocorax carbo*	**28**	5	23	0	**5**	1	4	0
		28	**5**	**23**	**0**	**5**	**1**	**4**	**0**
Geese									
Brent Goose	*Branta bernicla*	**13**	13	0	0	**0**	0	0	0
		13	**13**	**0**	**0**	**0**	**0**	**0**	**0**
Diving Ducks									
Common Scoter	*Melanitta nigra*	**4**	4	0	0	**0**	0	0	0
		4	**4**	**0**	**0**	**0**	**0**	**0**	**0**
Waders									
Golden Plover	*Pluvialis apricaria*	**6**	6	0	0	**0**	0	0	0
		6	**6**	**0**	**0**	**0**	**0**	**0**	**0**
Gulls									
Little Gull	*Larus minutus*	**5**	3	2	3	**3**	3	0	3
Black Headed Gull	*Larus ridibundus*	**1**	1	0	0	**0**	0	0	0
Lesser Black Backed Gull	*Larus fuscus*	**13**	6	7	0	**7**	1	6	0
Herring Gull	*Larus argentatus*	**5**	4	1	0	**1**	0	1	0
Great Black-backed Gull	*Larus marinus*	**6**	2	4	0	**4**	0	4	0
Kittiwake	*Rissa tridactyla*	**2**	2	0	1	**0**	0	0	0
Gull sp.		**1**	0	1	0	**0**	0	0	0
		33	**18**	**15**	**4**	**15**	**4**	**11**	**3**
Terns									
Sandwich Tern	*Sterna sandvicensis*	**4**	4	0	2	**1**	1	0	0
Common Tern	*Sterna hirundo*	**2**	0	2	0	**2**	0	2	0
		6	**4**	**2**	**2**	**3**	**1**	**2**	**0**
Auks									
Guillemot	*Uria aalge*	**1**	0	1	0	**1**	0	1	0
Razorbill	*Alca torda*	**1**	0	1	0	**1**	0	1	0
		2	**0**	**2**	**0**	**2**	**0**	**2**	**0**
Hirundines									
Swallow	*Hirundo rustica*	**17**	17	0	0	**1**	1	0	0
House Martin	*Delichon urbica*	**1**	1	0	0	**0**	0	0	0
		18	**18**	**0**	**0**	**1**	**1**	**0**	**0**
Passerines									
Meadow Pipit	*Anthus pratensis*	**1**	1	0	0	**0**	0	0	0
Robin	*Erithacus rubecula*	**1**	1	0	0	**0**	0	0	0
Blackbird	*Turdus merula*	**2**	2	0	0	**0**	0	0	0
Redwing	*Turdus iliacus*	**1**	1	0	0	**0**	0	0	0
Starling	*Sturnus vulgaris*	**4**	4	0	0	**0**	0	0	0
Brambling	*Fringilla*	**1**	1	0	0	**0**	0	0	0
Unidentified finch		**2**	2	0	0	**0**	0	0	0
		12	**12**	**0**	**0**	**0**	**0**	**0**	**0**
Total for all birds		**127**	**85**	**42**	**6**	**26**	**7**	**19**	**3**

Survey Summary - Mammals

Site: KF Survey Period: 02/10/2007

Common Name	*Species*	*Total Number Sighted*		*Total Number In Transect*	
		Total	Feeding	**Total**	Feeding
Pinnipeds					
Common seal	*Phoca vitulina*	**1**	0	**1**	0
		1	**0**	**1**	**0**

Survey Summary - Birds

Site: KF Survey Period: 10/10/2007

Common Name	*Species*	*Total Number Sighted*				*Total Number In Transect*			
		Total	Flying*	On Sea*	Feeding	**Total**	Flying*	On Sea*	Feeding
Gannets									
Gannet	*Morus bassanus*	**10**	10	0	3	**0**	0	0	0
		10	**10**	**0**	**3**	**0**	**0**	**0**	**0**
Cormorants									
Cormorant	*Phalacrocorax carbo*	**32**	3	29	0	**5**	1	4	0
		32	**3**	**29**	**0**	**5**	**1**	**4**	**0**
Gulls									
Black Headed Gull	*Larus ridibundus*	**1**	1	0	0	**0**	0	0	0
Common Gull	*Larus canus*	**2**	2	0	0	**0**	0	0	0
Lesser Black Backed Gull	*Larus fuscus*	**21**	16	5	0	**8**	3	5	0
Herring Gull	*Larus argentatus*	**9**	9	0	0	**2**	2	0	0
Great Black-backed Gull	*Larus marinus*	**9**	4	5	0	**8**	3	5	0
Kittiwake	*Rissa tridactyla*	**1**	1	0	0	**0**	0	0	0
Gull sp.		**1**	1	0	0	**1**	1	0	0
		44	**34**	**10**	**0**	**19**	**9**	**10**	**0**
Terns									
Sandwich Tern	*Sterna sandvicensis*	**2**	2	0	0	**0**	0	0	0
		2	**2**	**0**	**0**	**0**	**0**	**0**	**0**
Passerines									
Meadow Pipit	*Anthus pratensis*	**1**	1	0	0	**1**	1	0	0
Unidentified paserine		**2**	2	0	0	**2**	2	0	0
		3	**3**	**0**	**0**	**3**	**3**	**0**	**0**
Total for all birds		**91**	**52**	**39**	**3**	**27**	**13**	**14**	**0**

Survey Summary - Mammals

Site: KF Survey Period: 10/10/2007

Common Name	*Species*	*Total Number Sighted*		*Total Number In Transect*	
		Total	Feeding	**Total**	Feeding
Phocoenidae					
Harbour porpoise	*Phocoena phocoena*	**1**	0	**1**	0
		1	**0**	**1**	**0**

Survey Summary - Birds

Site: KF Survey Period: 31/10/2007

Common Name	*Species*	*Total Number Sighted*				*Total Number In Transect*			
		Total	Flying*	On Sea*	Feeding	**Total**	Flying*	On Sea*	Feeding
Cormorants									
Cormorant	*Phalacrocorax carbo*	**97**	12	85	14	**66**	0	66	14
		97	**12**	**85**	**14**	**66**	**0**	**66**	**14**

Geese									
Dark-bellied Brent Goose	*Branta bernicla*	**2**	2	0	0	**0**	0	0	0
		2	**2**	**0**	**0**	**0**	**0**	**0**	**0**
Waders									
Dunlin	*Calidris alpina*	**3**	3	0	0	**0**	0	0	0
		3	**3**	**0**	**0**	**0**	**0**	**0**	**0**
Gulls									
Black Headed Gull	*Larus ridibundus*	**8**	8	0	0	**3**	3	0	0
Common Gull	*Larus canus*	**19**	18	1	0	**8**	7	1	0
Lesser Black Backed Gull	*Larus fuscus*	**7**	7	0	0	**2**	2	0	0
Herring Gull	*Larus argentatus*	**8**	5	3	0	**4**	2	2	0
Great Black-backed Gull	*Larus marinus*	**5**	4	1	0	**3**	2	1	0
Gull sp.		**1**	0	1	0	**1**	0	1	0
		48	**42**	**6**	**0**	**21**	**16**	**5**	**0**
Larks									
Sky Lark	*Alauda arvensis*	**11**	11	0	0	**1**	1	0	0
		11	**11**	**0**	**0**	**1**	**1**	**0**	**0**
Passerines									
Blackbird	*Turdus merula*	**1**	1	0	0	**0**	0	0	0
Starling	*Sturnus vulgaris*	**1785**	1785	0	0	**195**	195	0	0
Chaffinch	*Fringilla coelebs*	**13**	13	0	0	**0**	0	0	0
Unidentified paserine		**5**	5	0	0	**0**	0	0	0
		1804	**1804**	**0**	**0**	**195**	**195**	**0**	**0**
Total for all birds		**1965**	**1874**	**91**	**14**	**283**	**212**	**71**	**14**

Survey Summary - Birds

Site: KF Survey Period: 05/11/2007

Common Name	***Species***	***Total Number Sighted***				***Total Number In Transect***			
		Total	Flying*	On Sea*	Feeding	**Total**	Flying*	On Sea*	Feeding
Cormorants									
Cormorant	*Phalacrocorax carbo*	**52**	8	44	0	**29**	3	26	0
		52	**8**	**44**	**0**	**29**	**3**	**26**	**0**
Diving Ducks									
Common Scoter	*Melanitta nigra*	**7**	7	0	0	**0**	0	0	0
		7	**7**	**0**	**0**	**0**	**0**	**0**	**0**
Gulls									
Black Headed Gull	*Larus ridibundus*	**11**	11	0	0	**2**	2	0	0
Common Gull	*Larus canus*	**14**	14	0	0	**4**	4	0	0
Lesser Black Backed Gull	*Larus fuscus*	**5**	4	1	0	**2**	1	1	0
Herring Gull	*Larus argentatus*	**9**	8	1	0	**2**	1	1	0
Great Black-backed Gull	*Larus marinus*	**3**	2	1	0	**1**	0	1	0
Gull sp.		**2**	1	1	0	**0**	0	0	0
		44	**40**	**4**	**0**	**11**	**8**	**3**	**0**
Larks									
Sky Lark	*Alauda arvensis*	**3**	3	0	0	**0**	0	0	0
		3	**3**	**0**	**0**	**0**	**0**	**0**	**0**
Passerines									
Fieldfare	*Turdus pilaris*	**3**	3	0	0	**0**	0	0	0
Redwing	*Turdus iliacus*	**2**	2	0	0	**0**	0	0	0
Starling	*Sturnus vulgaris*	**1553**	1553	0	0	**481**	481	0	0
		1558	**1558**	**0**	**0**	**481**	**481**	**0**	**0**

Total for all birds		**1664**	**1616**	**48**	**0**	**521**	**492**	**29**	**0**

Survey Summary - Birds

Site: KF Survey Period: 21/11/2007

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*	**17**	4	13	0	**10**	0	10	0
Black-throated Diver	*Gavia arctica*	**3**	3	0	0	**0**	0	0	0
		20	**7**	**13**	**0**	**10**	**0**	**10**	**0**
Cormorants									
Cormorant	*Phalacrocorax carbo*	**45**	9	36	9	**39**	5	34	9
		45	**9**	**36**	**9**	**39**	**5**	**34**	**9**
Geese									
Shelduck	*Tadorna tadorna*	**1**	1	0	0	**0**	0	0	0
		1	**1**	**0**	**0**	**0**	**0**	**0**	**0**
Diving Ducks									
Common Scoter	*Melanitta nigra*	**12**	0	12	0	**12**	0	12	0
		12	**0**	**12**	**0**	**12**	**0**	**12**	**0**
Waders									
Unidentified wader		**1**	1	0	0	**0**	0	0	0
		1	**1**	**0**	**0**	**0**	**0**	**0**	**0**
Gulls									
Black Headed Gull	*Larus ridibundus*	**4**	4	0	0	**3**	3	0	0
Common Gull	*Larus canus*	**29**	27	2	0	**6**	4	2	0
Lesser Black Backed Gull	*Larus fuscus*	**7**	4	3	0	**4**	1	3	0
Herring Gull	*Larus argentatus*	**24**	24	0	0	**9**	9	0	0
Kittiwake	*Rissa tridactyla*	**1**	0	1	0	**1**	0	1	0
		65	**59**	**6**	**0**	**23**	**17**	**6**	**0**
Auks									
Guillemot	*Uria aalge*	**1**	1	0	0	**0**	0	0	0
		1	**1**	**0**	**0**	**0**	**0**	**0**	**0**
Passerines									
Starling	*Sturnus vulgaris*	**1**	1	0	0	**0**	0	0	0
Chaffinch	*Fringilla coelebs*	**2**	2	0	0	**0**	0	0	0
		3	**3**	**0**	**0**	**0**	**0**	**0**	**0**
Total for all birds		**148**	**81**	**67**	**9**	**84**	**22**	**62**	**9**

Survey Summary - Mammals

Site: KF Survey Period: 21/11/2007

Common Name	*Species*	*Total Number Sighted*		*Total Number In Transect*	
		Total	Feeding	**Total**	Feeding
Pinnipeds					
Common seal	*Phoca vitulina*	**2**	0	**2**	0
		2	**0**	**2**	**0**
Total for all animals		**2**	**0**	**2**	**0**

A2.SPECIES AND ACTIVITY CODE LISTS

These list the three-letter mammal and unspecified bird codes and the standard two letter BTO code (Marchant 1983, Gilbert *et al* 1998), together with the standard international ESAS five letter bird codes (Komdeur *et al* 1992). The three-letter mammal and unspecified bird codes and the standard two letter BTO codes are used in plotting the data.

Family	Common Name	Species Name	BTO Codes	5-Letter Species Code
Diver	**Red Throated Diver**	*Gavia stellata*	RH	GASTE
	Black Throated Diver	*Gavia arctica*	BV	GAARC
	Great Northern Diver	*Gavia immer*	ND	GAIMM
Grebe	**Little Grebe**	*Tachybaptus ruficollis*	LG	TARUF
	Great Crested Grebe	*Podiceps cristatus*	GG	POCRI
	Slavonian Grebe	*Podiceps auritis*	SZ	POAUR
Shearwater	**Northern Fulmar**	*Fulmarus glacialis*	F	FUGLA
	Great shearwater	*Puffinus gravis*	GQ	PUGRA
	Cory's shearwater	*Calonectris diomedea*	CQ	CADIO
	Sooty shearwater	*Puffinus griseus*	OT	PUGRI
	Manx shearwater	*Puffinus puffinus*	MX	PUPUF
	Balearic shearwater	*Puffinus mauretanicus*		PUMAU
Petrel	**European storm-petrel**	*Hydrobates pelagicus*	TM	HYPEL
	Leach's storm-petrel	*Oceanodroma leucorhoa*	TL	OCLEU
	Gannet	*Morus bassanus*	GX	MOBAS
	Cormorant	*Phalacrocorax carbo*	CA	PHCAR
	Shag	*Phalacrocorax arisotelis*	SA	PHARI
Swans	**Mute swan**	*Cygnus olor*	MS	CYOLO
	Bewick swan	*Cygnus colombianus*	BS	CYCOL
	Whooper swan	*Cygnus cygnus*	WS	CYCYG
Goose	**Pink-footed goose**	*Anser brachyrhynchus*	PG	ANBRA
	White-fronted goose	*Anser albifrons*	WG	ANALB
	Greylag goose	*Anser anser*	GJ	ANANS
	Barnacle goose	*Anser leucopsis*	BY	ANLEU
	Brent goose	*Branta bernicla*	BG	BRBER
	Dark-bellied Brent goose	*Branta bernicla*	DB	BRBER
Ducks	**Shelduck**	*Tadorna tadorna*	SU	TATOD
	Wigeon	*Anas penelope*	WN	ANPEN
	Gadwall	*Anas strepera*	GA	ANSTR
	Teal	*Anas crecca*	T	ANCRE
	Mallard	*Anas platyrhynchos*	MA	ANPLA
	Pintail	*Anas acuta*	PT	ANACU
	Shoveller	*Anas clypeata*	SV	ANCLY
	Common pochard	*Aythya ferina*	PO	AYFER
	Tufted duck	*Athyra fuligula*	TU	AYFUL
	Scaup	*Aythya marila*	SP	AYMAR
	Eider	*Somateria mollissima*	E	SOMOL
	Long-tailed duck	*Clangula hyemalis*	LN	CLHYE
	Common Scoter	*Melanitta nigra*	CX	MENIG
	Velvet Scoter	*Melanitta fusca*	VS	MEFUS
	Goldeneye	*Bucephala clangula*	GN	BUCLA
	Red Breasted Merganser	*Mergus serrator*	RM	MESER
	Goosander	*Mergus merganser*	G	MEMER

Family	Common Name	Species Name	BTO Codes	5-Letter Species Code
	Merlin	*Falco columbarius*	ML	FACOL
Harriers	**Marsh Harrier**	*Circus aeruginosus*	MR	CIAER
	Hen Harrier	*Circus cyaneus*	HH	CICYA
Waders	**Oystercatcher**	*Haematopus ostralegus*	OC	HAOST
	Ringed Plover	*Charadrius hiaticula*	RP	CHHIA
	Golden Plover	*Pluvialis apricaria*	GP	PLAPR
	Grey Plover	*Pluvialis squatarola*	GV	PLSQU
	Lapwing	*Vanellus vanellus*	L	VAVAN
	Knot	*Calidris canutus*	KN	CACAN
	Black-tailed Godwit	*Limosa limosa*	BW	LILIM
	Bar-tailed Godwit	*Limosa lapponica*	BA	LILAP
	Redshank	*Tringa totanus*	RK	TRTOT
	Greenshank	*Tringa nebularia*	GK	TRNEB
	Curlew	*Numenius arquata*	CU	NUARQ
	Ruff	*Philomachus pugnax*	RU	PHPUG
	Dunlin	*Calidris alpina*	DN	CAALP
	Turnstone	*Arenaria interpres*	TT	ARINT
Skuas	**Pomarine Skua**	*Stercorarius pomarinus*	PK	STPOM
	Arctic Skua	*Stercorarius parasiticus*	AC	STPAR
	Long-tailed Skua	*Stercorarius longicaudus*	OG	STLON
	Great Skua	*Catharacta skua*	NX	CASKU
Gulls	**Mediterranean Gull**	*Larus melanocephalus*	MU	LAMEL
	Little Gull	*Larus minutus*	LU	LAMIN
	Sabine's Gull	*Larus sabini*	AB	LASAB
	Black Headed Gull	*Larus ridibundus*	BH	LARID
	Common Gull	*Larus canus*	CM	LACAN
	Lesser Black Backed Gull	*Larus fuscus*	LB	LAFUS
	Herring Gull	*Larus argentatus*	HG	LAARG
	Iceland Gull	*Larus glaucoides*	IG	LAGLA
	Glaucous Gull	*Larus hyperboreus*	GZ	LAHYP
	Great Black-backed Gull	*Larus marinus*	GB	LAMAR
	Kittiwake	*Rissa tridactyla*	KI	RITRI
Terns	**Sandwich Tern**	*Sterna sandvicensis*	TE	STSAN
	Roseate Tern	*Sterna dougallii*	RS	STDOU
	Common Tern	*Sterna hirundo*	CN	STHIR
	Arctic Tern	*Sterna paradisaea*	AE	ATPAR
	Little Tern	*Sterna albifrons*	AF	STALB
	Black Tern	*Chlidonias niger*	BJ	CHNIG
Auk	**Guillemot**	*Uria aalgae*	GU	URAAL
	Razorbill	*Alca torda*	RA	ALTOR
	Black Guillemot	*Cepphus grylle*	TY	CEGRY
	Little Auk	*Alle alle*	LK	ALALL
	Puffin	*Fractercula arctica*	PU	FRARC
Passerines	**Feral pigeon**	*Columba livia*	COLIV	FP
	Blackbird	*Turdus merula*	B	TUMER
	Skylark	*Alauda arvensis*	S	ALARV
	Swift	*Apus apus*	SI	APAPU
	Swallow	*Hirundo rustica*	SL	HIVUL
	Meadow Pipit	*Anthus pratensis*	MP	ANPRA
	Pied Wagtail	*Motacilla alba*	PW	MOALB

Family	Common Name	Species Name	BTO Codes	5-Letter Species Code
	House martin	*Delichon urbica*	HM	DEURB
	Fieldfare	*Turdus pilaris*	FF	TUPIL
	Starling	*Sturnus vulgaris*	SG	STVUL
	Chaffinch	*Fringilla coelebs*	CH	FRCOE

*Where species not determined, genera indicated as below

General Birds

Common Name	Species Name	3L Codes	BTO codes used by WWT	Name Code
Diver sp.	*Gavia sp.*	div	UL	Diver
Grebe sp.	*Podiceps sp.*	gre	UV	Grebe
Cormorant/shag	*Phalacrocorax sp.*	c/s	XU	Phala
Unidentified goose sp.		goo		Goose
Unidentified duck		duc	UM	Duck
Unidentified seaduck		sdu		Duck
Scoter sp.	*Melanitta sp.*	sco		Scoter
Godwit sp.	*Limosa sp.*	god		Godwit
Small wader sp.			U.	
Unidentified wader		wad		Wader
Skua sp.		sku	UQ	Skua
Gull sp.		gul	UU	Gull
Large gull sp. (Herring or black-backs)		lgu	VU	L. Gull
Herring or common gull			XP	
Small gull sp. (Little, black-headed, common, kittiwake)		sgu		S. Gull
Greater/Lesser black-backed gull		bbg	XD	B-B Gull
Tern sp.		ter	UT	Tern
Common/Arctic tern		com	UI	Commic
Auk sp.		auk	AU	Auk
Unidentified thrush		thr		Thrush
Unidentified passerine		pas		Passerine
Unidentified finch		fin		Finch
Unidentified		uni		Unidentified

Mammals

Common Name	Species Name	3L Codes	BTO codes used by WWT	Name Code
Grey seal	*Halichoerus grypus*	GSE		G.Seal
Common seal	*Phoca vitulina*	CSE		C.Seal
Seal sp.		SEA	S2	Seal
Harbour porpoise	*Phocoena phocoena*	POR	C1	Porpoise
Unidentified seal sp		sea		Seal

Field Codes

Category	Category Abbreviation	Explanation
Age	*Age*	A=Adult I=Immature 1W=First Winter; 1S = First Summer U=Undetermined
Plumage	*Pl.*	D=Dark L=Light I=Intermediate M=Male F=Female
Numbers	*NOS.*	Number of individuals seen
Distance	*DIST.*	A=0-50 metres B=50-100 metres C=100-200 metres D=200-300 metres E= more than 300 metres
Direction	*Dim.*	F=Following = Associating H=Hovering / Variable spiral=Hovering=H N, NE, etc = North, Northeast, etc
Flying	*Fl.*	Y or ✔ =F for flying
Sea	*Se*	Y or ✔ =S for on the sea, even if only landing briefly
Feeding	*Fe*	Y or ✔ =Feeding
Radial	*Radial*	Distance from eye to bird in metres or VAR = variable
Height	*Height*	Estimate of bird's height in metres or VAR = variable
Graduation	*Grad*	Height in centimetres above horizon when ruler held at arms length
Transect?	*T*	Y or ✔ =For flying birds seen during snapshot and for birds on sea in transect

A3. SURVEYOR'S REPORTS

10 / 12 / 06

A south-westerly wind slowly increased though the day from a force 3 to a force 4 / 5 but the sea state did not build to more than a 2 / 3, which with very good visibility (apart from some sun glare in transects 8, C1, and C3), resulted in good surveying conditions. Some birds on the water may have been missed in the further bands but few flying sea birds will have been missed within the A to D bands. A small deviation from the line was required in transect 8 to navigate shallow water. The control area was also surveyed today. High tides occurred at 03.33 (5.0m) and 16.12 (4.8m).

A total of 95 gulls were recorded of six different species. 33 herring gull, 40 lesser black-backed gull, seven great black-backed gull, three common gull, three black-headed gull and nine kittiwake were recorded.

23 cormorant were observed, mostly on the familiar roosting structures of the met mast, Girdler Tripod and Spaniard buoy. 14 guillemot were recorded and seven auks that could not be identified to species but in all likelihood were either guillemot or razor-bill. A shellduck was seen flying north in the control area. A great crested grebe was also recorded in the control area flying to the west and another on the water in transect 4 – possibly the same bird as it was seen flying in approximately this direction. Two common scoter were recorded flying in the control area.

Diver numbers appear to be slowly increasing with 27 recorded on the site, eight black-throated diver, eight red-throated divers and 11 that were too distant to be recorded to species. A further c35 divers, most thought to be red-throats, were seen just to the north of the north-west corner of the site. Other surveys and sea-watches recently undertaken in the Thames show a predominance of black-throated diver over red-throats. Large shoals of sprats have been seen in the north of the estuary.

A very spectacular sight was witnessed on the return journey to the Essex coast – between 1000 and 2000 common scoter were flushed from the water by the survey vessel over the edge of the Foulness Sands approximately seven miles north of the wind farm. Scoter numbers of this magnitude are unprecedented in the Thames.

Two sparrow hawks were seen between transects 6 and 7 being harassed by a lesser black-backed gull. A sparrow hawk had not been observed before on these Kentish Flats surveys.

No marine mammals were recorded today.

15 / 01 / 07

A bright sunny day with a steady Force 3 south-westerly wind produced a sea state 2 – 3 and resulted in good surveying conditions. Some birds on the water in bands D and E and some distant divers may have been missed but few flying sea birds will have been missed within the A to D bands. Transect 8 had to be cut approximately 300m short due to shipping. High tides occurred at 09.17 (4.5m) and 21.51 (4.8m).

A total of 43 gulls were recorded of six different species. 12 herring gull, 12 lesser black-backed gull, one great black-backed gull, 10 common gull, three black-headed gull and two kittiwake were recorded. Most gulls were recorded as flying in a generally westerly direction

Nine cormorant were recorded within the site, mostly on the familiar roosting structures of the met mast and Girdler Tripod but a further c160 were observed while traveling to the site about 2 km south of the southern end of Transect 3 feeding over a small submerged sand bank. The echo sounder showed an extensive fish mark – probably sprats and /or herring. Two guillemot were recorded, both on the water in Transect 8. A great crested grebe was recorded near the southern end of Transect 4.

Diver numbers have increased with 78 red-throated diver recorded, most to the east and west of the wind farm. One black-throated diver was identified at the southern end of Transect 4. Many of the divers were first

observed when flushed by the survey vessel often several hundred metres ahead. A further c30 red-throated diver were seen just to the north of the site along the southern edge of the shipping channel. One diver was seen flying through the wind farm at one metre high and although no divers were recorded on the water in the wind farm area itself, three were seen just on the periphery.

One common seal was recorded at the northern end of Transect 1.

02 / 02 / 07

A Force 1 - 2 westerly wind that went northerly produced little more than ripples which, with good visibility resulted in near perfect viewing conditions for birds on the sea. It is unlikely that many, if any, birds in the A to D bands will have been missed. The control area was also surveyed today. High tides occurred at 00.40 (5.5m) and 13.06 (5.6m).

A total of 109gulls were recorded. Herring gull were the most numerous with 76 recorded, also eight lesser black-backed gull, one great black-backed gull, 18 common gull, four black-headed gull and two gulls that could not be identified to species. There appeared to be a north-westerly movement of herring gulls in transect 8.

Eight cormorant were recorded within the study site, two on the Girdler Tripod and one on the met mast and a further c100 were seen in a tight feeding group with some gulls approximately 1 ½ km to the south of line 2. Fewer divers were seen than last month with 30 recorded in total – 28 red-throats, one black-throat and one that could not be identified to species. Most divers were recorded in the control area and in the eastern-most transect 8.

A seal that could not be identified to species was recorded in the control area.

02 / 03 / 07

A Force 1 - 3 westerly wind produced a sea state 1 – 2 which, on a bright day with good visibility, resulted in excellent surveying conditions especially for divers on the sea. It is unlikely that many, if any, seabirds in the A to D bands within 500m ahead will have been missed, although small migrating passerines may have slipped by if flying close to the surface and not offering a silhouette. High tide occurred at 12.11 (5.5m).

Surprisingly few of the 33 gulls recorded were large gulls with only six herring gull and three lesser black-backed gull recorded. Common gull were the most numerous with 17 recorded. Seven black-headed gull were also seen. There did not appear to be any pattern to the gulls' movements.

Five cormorant were recorded within the study site, most now in breeding plumage. The first two migrants of the year were recorded – a meadow pipit and a pied wagtail, both of which flew in a westerly direction, close-by across the bow.

A total of 89 divers were recorded on site - 80 red-throats, four black-throats and five that could not be identified to species. Most divers were flushed by the survey vessel near the north end of Transect 2. 12 red-throated diver were also recorded in eastern-most Transect 8. A further c50 red-throats and 11 black-throats were seen during the outbound journey on the water, fairly evenly spread along a band one to two km south of the study area.

06 / 04 / 07

A very light north-westerly wind produced a sea state 1 which, on a bright day with good visibility, resulted in excellent surveying conditions especially for divers on the sea. It is unlikely that many, if any, seabirds in the A to D bands within 500m ahead will have been missed, although small migrating passerines may have slipped by if flying close to the surface and not offering a silhouette. It was surprising at this time of year with such good conditions that no migrants were recorded throughout the survey. High tides occurred at 03.26 (5.5m) and 15.42 (5.6).

A very low diversity of bird species was recorded today – just four gull species and red-throated diver. As last month, common gull were the most numerous with 62 recorded. 57 herring gull, 14 lesser black-backed gull, four great black-backed gull, and 10 gulls that could not be identified to species were also recorded. There appeared to be a general easterly / south-easterly movement of gulls throughout the day. A group of c300 gulls was seen scavenging around a fishing boat about two kilometres north of the site.

Eight red-throated divers were recorded – probably the last that will be recorded this season. Six were flushed by the survey vessel and all were recorded to the east or west of the wind farm.

29 / 04 / 07

A force 3, north-easterly wind produced a sea state 2 to 3, which on a dull day with visibility that averaged 5 km., gave reasonable surveying conditions. It is unlikely that many large seabirds in the A to D bands within 500m ahead will have been missed, although small migrating birds such as swallows may have slipped by if flying close to the surface and not offering a silhouette. High tide occurred at 12:12 (5.4m). Problems occurred with the hand held GPS today resulting in the track not being recorded. The Waypoints at the beginning and end of each transect were recorded. Waypoint 568, at the north end of Transect 7 was entered late.

Regarding gulls, herring gull were the most numerous species today with 60 recorded. 31 lesser black-backed gull, seven great black-backed gull, and one common gull were also recorded. There did not appear to be any pattern to the gulls movements throughout the day apart from the attraction of a small working trawler in Transect 2.

Four cormorant were recorded – three on the met mast. One whimbrel was seen flying to the north east near the southern end of Transect 8. A wood pigeon landed on the boat before heading off in a north-westerly direction. Prior to starting the survey and twice between transects, just to the south of the study area, groups of bar-tailed godwit, totaling c.75 birds, were seen migrating in an easterly direction at one metre high along the southern edge of the study area.

A common seal was recorded in transect 8 near the edge of the submerged Margate Sands.

04 / 05 / 07

A force 4, north-easterly wind produced an uncomfortable sea state 3, occasionally 4, which on a dull day gave only moderate surveying conditions. It is unlikely that many large seabirds in the A to D bands within 500m ahead will have been missed, although small migrating birds such as swallows may have slipped by if flying close to the surface and not offering a silhouette. High tide occurred at 02:30 (5.5m) and 14:46 (5.6m). For logistical reasons the survey was undertaken by leaving / returning to Walasea Marina.

Considering that the control area was surveyed today, remarkably few birds were recorded. Regarding gulls, a total of only 29 were recorded – 12 herring gull, 11 lesser black-backed gull, two great black-backed gull, and four common gull. There did not appear to be any pattern to the gulls movements throughout the day.

Three cormorant were recorded, two of which were drying wings on the met mast. One guillemot was seen flying to the north-west through the control area – the first auk we have seen on site for many months. An adult gannet was also seen flying through the control area, again, the first we have seen out here for many months. Only one Sandwich tern was recorded although they have been seen in considerable numbers flying and feeding along the coast. Interestingly, as last month, bar-tailed godwit were recorded migrating through to the north east, probably to Scandanavia. A tight flock of five was seen near the northern end of Transect 7

Two common seals were recorded. One in transect 1, one in the control area.

21 / 05 / 07

A steady and constant force 4 north-easterly wind produced a sea state 3, which with good visibility, gave reasonable surveying conditions. It is unlikely that many large seabirds in the A to D bands within 500m

ahead will have been missed, although small migrating birds such as swallows may have slipped by if flying close to the surface and not offering a silhouette. High tides occurred at 04.33 (5.7m) and 16.49 (5.3m). A slight deviation from the line was required in Transect 8 to navigate shallow water.

As during the first May survey, remarkably few birds were recorded. Regarding gulls, a total of 33 were recorded – 24 herring gull and 9 lesser black-backed gull. There did not appear to be any real pattern real to the gulls' movements although a seemingly disproportionate number were flying in an approximately northern direction. Five cormorant were recorded, four of which were roosting on the met mast. Also as on the last survey, only one Sandwich tern was recorded. One swallow was seen flying through the site in a north-westerly direction.

A brief glimpse of a seal in transect 5 did not allow identification to species.

08 / 06 / 07

Heavy rain was falling when leaving Whitstable but had subsided to a light drizzle by the time the survey was started then dried up altogether by the end of the first transect. A force 3 or 2 to 3 north or north-westerly wind produced a constant sea state 2, which with reasonable visibility, gave good surveying conditions. It is unlikely that many large seabirds in the A to D bands within 500m ahead will have been missed, although small passerines may have slipped by. High tides occurred at 06.38 (5.2m) and 18.45 (5.1m).

Regarding gulls, a total of 55 were recorded with herring gull being very much the most numerous. 46 herring gull, four lesser black-backed gull, three great black-backed gull and two gulls unidentified to species were recorded. There did not appear to be any real pattern real to the gulls' movements.

At 25 birds there was quite a high cormorant count; 13 of which were roosting on the met mast. A further two cormorant were seen (on the 'non-transect' side of the vessel roosting on the turbine rails. This is a relatively common occurrence on another operational wind farm but not so common here yet.

Six Sandwich tern were recorded, all east or west of the wind farm. None appeared to have flown through the wind farm. Two gannet and a fulmar were seen in Transect 8. The fulmar may possibly have come from the small colony at Thanet. Five swift and two starling were recorded. A peregrine was seen to stoop on one of the starlings, miss its target and fly back off towards the wind farm. It is unsure if it landed on the nacelle of one of the turbines (as was seen once before) to use it as a vantage point to view prey.

A common seal was seen eating a fish on the 'non-transect' side of the vessel.

13 / 07 / 07

A force 3 south-westerly wind off the land produced a sea state 2, which on a generally clear day with good visibility, gave very good surveying conditions. It unlikely that many seabirds in the A to D bands within 500m ahead will have been missed, although small passerines may have slipped by. High tides occurred at 00.03 (5.3m) and 12.38 (5.3m).

A total of only 27 gulls were recorded. All but two of these were herring gull. One lesser black-backed gull and one black-headed gull were also recorded. There did not appear to be any real pattern real to the gulls' movements.

As last month, there was quite a high cormorant count with 22 recorded, 16 of which were roosting on the met mast. Five gannet were seen flying in an easterly direction to the north-east of the wind farm. A further 11 gannet were seen, prior to stating the survey, approximately two km. to the south of the wind farm, flying to the west up to the Swale.

13 Sandwich tern and five common tern were recorded, all but two of which were flying in an approximately easterly or westerly direction. Four of the westerly-flying Sandwich tern were carrying fish, presumably back to chicks in the colony in the Medway. Three Sandwich tern also made quite marked deviations to fly to the south or north of the wind farm.

Two swift were recorded flying to the west – probably a local movement. Six sand martin were also recorded flying to the west – possibly early migrants passing through.

No marine mammals were recorded today.

30 / 08 / 07

A steady force 3 north-westerly wind off Sheppey and the Essex coast produced a sea state 2, which with good visibility, gave very good surveying conditions. It unlikely that many seabirds in the A to D bands within 500m ahead will have been missed, although small passerines may have slipped by. High tides occurred at 02.46 (6.0m) and 14.53 (6.0m).

Regarding gulls, 22 lesser black-backed gull, five great black-backed gull and six herring gull were recorded. These included eight lesser black-backed gull and two herring gull that were associated with a small fishing boat near the wind farm. There did not appear to be any real pattern to the gulls' movements.

15 Sandwich tern and eight common tern were recorded, most seen flying in an approximately easterly or westerly direction. A group of eight Sandwich terns was seen feeding near the south-eastern corner of the wind farm. Unusually some terns, of both species, were seen flying within the turbine array. Maybe they are becoming habituated to the wind farm as it has been suggested they have at the Scroby Sands site.

As last month, there was quite a high cormorant count with 26 recorded, most of which were seen roosting on the met mast or Girdler Tripod. Two gannet were seen flying in Transect 8, three scoter flying to the north in Transect 1, and two arctic skuas were recorded – possibly the same bird although seen 1 ½ hours apart.

Several very strong fish marks showed on the sounder just to the north of the wind farm in the shipping lane suggesting some large shoals of fish. It is unsure what, possibly early sprats, whiting or pouting.

No marine mammals were recorded today.

10 / 09 / 07

General

The survey started 1107 (sunrise 0623) on Transect 1 on the W side of the site and finished at 1627 (sunset 1923) on Transect C4 on the E side of the site. The survey covered the main area and the control area. Surveying conditions were good, visibility was excellent and there was no rain. Sun glare was a slight problem on Transects 2 and 4. Air temperature was 18C. Wind was NW 4-5 to start then veered N 4-5 on Transect 6. HW was 1215 (5.25m).

Birds

A total of 102 birds of 11 species were recorded.

By "family" ...

2 wader
1 skua
58 gull
6 tern
1 passerine
34 other

By species ...

6 Gannet - 6 records, 5.9% tot, 17.6% other tot

28 Cormorant - 7 records, 27.5% tot, 82.4% other tot
2 Dunlin - 1 records, 2.0% tot, 100.0% wader tot
1 Arctic Skua - 1 records, 1.0% tot, 100.0% skua tot
17 Lesser Black-backed Gull - 14 records, 16.7% tot, 29.3% gull tot
8 Herring Gull - 7 records, 7.8% tot, 13.8% gull tot
7 Great Black-backed Gull - 6 records, 6.9% tot, 12.1% gull tot
26 Kittiwake - 10 records, 25.5% tot, 44.8% gull tot
2 Sandwich Tern - 2 records, 2.0% tot, 33.3% tern tot
4 Common Tern - 4 records, 3.9% tot, 66.7% tern tot
1 Sand Martin - 1 records, 1.0% tot, 100.0% passerine tot

By transect ...

TRANSECT	1	2	3	4	5	6	7	8	9	10	11	12
Gannet	-	-	-	-	-	3	-	1	2	-	-	-
Cormorant	3	22	2	-	-	-	-	1	-	-	-	-
Dunlin	2	-	-	-	-	-	-	-	-	-	-	-
Arctic Skua	-	-	-	-	-	-	-	-	-	-	-	1
Lesser Black-backed Gull	-	1	-	-	-	-	5	4	-	3	2	2
Herring Gull	-	-	-	-	2	-	-	-	1	-	-	5
Great Black-backed Gull	-	-	-	-	-	3	-	3	-	-	-	1
Kittiwake	-	-	-	-	-	2	1	-	2	1	20	-
Sandwich Tern	-	-	-	-	-	-	-	1	-	-	-	1
Common Tern	-	-	-	-	1	2	1	-	-	-	-	-
Sand Martin	-	1	-	-	-	-	-	-	-	-	-	-

The forecast for the day was NW 4-5 gusting to 6. This was very interesting because a long standing question with the Kentish Flats has been what bird activity would we see if we could survey it on a day when there was a large seabird movement along the N Kent coast, and any N'ly wind of that strength at this time of year is likely to produce such a seabird movement.

Half a dozen or so such seabird movements occur each year between late summer and late autumn along the N Kent coast. Typically they consist of many hundreds of Skuas (mostly Great and Arctic), hundreds of Common and Sandwich Terns, hundreds of Kittiwakes, hundreds of Gannets, plus smaller numbers of many other birds, including Shearwaters.

On such days observers will position themselves at promontories all the way from N Foreland to Sheppey and up the Thames as far as Dartford. Handily, the greatest concentration of observers is, and has been for many years, along the section of coast nearest the windfarm.

The problem with surveying the Kentish Flats on such a day is partly due to the difficulty of arranging a boat at short notice, but largely it is due to the risk of having to abandon a survey because the seastate has risen too high to survey - as per JNCC guidelines for surveying seabirds at sea, we don't survey in seatates greater than 5 because of the difficulty of reliably observing birds in such conditions.

But this time we were in luck. A boat had already been organised for the day and the skipper was keen to at least attempt the survey, and while the wind and seastate were bad, they proved never sufficiently bad that at any time we should not have been surveying.

At the start of Transect 1, 3 Cormorant were on and around the Spaniard buoy. Soon after 2 Dunlin flew low W. The Dunlin were likely birds coming in off the continent and heading up the Thames.

Nothing more was seen for half an hour until 2 Sand Martin flew low NW not long

after the start of Transect 2. The Sand Martin were likely heading W by following the coast, and when observed they were likely cutting out NW to continue along the N side of Sheppey. Also seen on Transect 2 was the first gull of the day and 22 Cormorant (21 of them on the Met Mast).

Only birds seen on Transect 3 were 2 Cormorant.

No birds at all were seen on Transect 4.

A unexpected picture was now emerging. Not only were there no signs of any great seabird movement through the windfarm, but it actually appeared that the site contained rather less birds than it normally did - Cormorants excepted who were at about "average" levels.

Transect 5 provided the second and third gull of the day, plus 1 Common Tern.

On Transect 6 two things happened. The wind went round from NW to N and more birds were observed. There were 2 Common Tern, 3 Gannet, 2 Kittiwake and 3 Great Black-backed Gull. The Gulls were on and around the Girdler Tripod and were likely local birds. The others however, were likely the first signs of the anticipated seabird movement.

On Transect 7 things didn't really develop. 5 Gulls were seen but these again were likely to be local birds. A single Common Tern and a single Kittiwake were also seen and they hinted at something else.

Transect 8 was the same. Several gulls that were likely locals, a Cormorant that was almost guaranteed to have been a local, plus 1 Sandwich Tern and 1 Gannet.

Transect C1 was 2 Gannet, 2 Kittiwake, and 1 Herring Gull.

Transect C2 was 3 Lesser Black-backed Gull (likely locals in area waiting for sandbanks to appear with the ebbing tide) and 1 Kittiwake.

Transect C3 was 2 Lesser Black-backed Gull and 20 Kittiwake, inc 1 flock of 12 Kittiwake.

Transect C4 was 2 Lesser Black-backed Gull 5 Herring Gull 1 Great Black-backed Gull plus 1 Sandwich Tern and 1 Arctic Skua. The Gulls and possibly the Tern were likely waiting for the nearby sandbanks to emerge, and the Arctic Skua had possibly been drawn to the Gulls hoping for a feeding opportunity.

In contrast to the above, observers at Shellness (SE tip of Sheppey), Herne Bay and Minnis Bay, noon til late afternoon recorded the following ...

Shellness, PM:
1-3 Great Shearwater
2 Manx Shearwater
2 poss Balearic Shearwater
4 Pomarine Skua
117 Arctic Skua
1 Long-tailed Skua
26 Great Skua
1 juv Sabine's Gull
c230 Kittiwake

Herne Bay, PM:
2 Sooty
120 Arctic Skua
1 juv Sabine's Gull, W

Minnis Bay, PM:
7 Sooty, 6W 1E
1 prob Great Shearwater
40 Arctic Skua, W
4 Great Skua, W
8 Little Gull
60 Kittiwake
3 Arctic Tern
10 large Auk sp

So, an interesting day. But not for what was seen on the survey, but for what wasn't.

Cetaceans and Seals

No cetaceans or seals were seen.

02 / 10 / 07

General

The survey started 0903 (sunrise 0820) at the S end of Transect 8 on the E side of the site and finished at 1331 (sunset 1757) at the S end of Transect 1 on the W side of the site. The survey covered the main area only. With thick horizon to horizon cloud and a distant haziness the day had a deeply gloomy feel to it. Despite that, with no sun glare, no rain, and only a slight sea, surveying conditions were good. Air temperature was 14C. Wind was N 3 to start and N 2 to finish. HW was 0430 and 1700 (5.5m).

Birds

A total of 130 birds of 26 species were recorded.

By "family" ...

15 wildfowl
4 seaduck
6 wader
33 gull
6 tern
2 auk
31 passerine
33 other

By species ...

1 Fulmar - 1 records, 0.8% tot, 3.0% other tot
4 Gannet - 3 records, 3.1% tot, 12.1% other tot
28 Cormorant - 7 records, 21.5% tot, 84.8% other tot
15 Brent Goose - 2 records, 11.5% tot, 100.0% wildfowl tot
4 Common Scoter - 1 records, 3.1% tot, 100.0% seaduck tot
6 Golden Plover - 1 records, 4.6% tot, 100.0% wader tot
5 Little Gull - 4 records, 3.8% tot, 15.2% gull tot
1 Black-headed Gull - 1 records, 0.8% tot, 3.0% gull tot
13 Lesser Black-backed Gull - 10 records, 10.0% tot, 39.4% gull tot
5 Herring Gull - 5 records, 3.8% tot, 15.2% gull tot
6 Great Black-backed Gull - 5 records, 4.6% tot, 18.2% gull tot
2 Kittiwake - 2 records, 1.5% tot, 6.1% gull tot
1 gull sp - 1 records, 0.8% tot, 3.0% gull tot
4 Sandwich Tern - 3 records, 3.1% tot, 66.7% tern tot

2 Common Tern - 2 records, 1.5% tot, 33.3% tern tot
1 Guillemot - 1 records, 0.8% tot, 50.0% auk tot
1 Razorbill - 1 records, 0.8% tot, 50.0% auk tot
2 Meadow Pipit - 2 records, 1.5% tot, 6.5% passerine tot
2 Blackbird - 2 records, 1.5% tot, 6.5% passerine tot
1 Redwing - 1 records, 0.8% tot, 3.2% passerine tot
4 Starling - 2 records, 3.1% tot, 12.9% passerine tot
1 Robin - 1 records, 0.8% tot, 3.2% passerine tot
17 Swallow - 5 records, 13.1% tot, 54.8% passerine tot
1 House Martin - 1 records, 0.8% tot, 3.2% passerine tot
1 Brambling - 1 records, 0.8% tot, 3.2% passerine tot
2 finch sp - 1 records, 1.5% tot, 6.5% passerine tot

By transect ...

TRANSECT	1	2	3	4	5	6	7	8
	--	--	--	--	--	--	--	--
Fulmar	-	-	-	-	-	-	1	-
Gannet	-	-	4	-	-	-	-	-
Cormorant	1	21	1	1	-	4	-	-
Brent Goose	2	-	-	-	-	-	-	13
Common Scoter	-	-	-	-	-	-	-	4
Golden Plover	-	-	-	-	-	-	6	-
Little Gull	-	-	-	2	-	-	-	3
Black-headed Gull	1	-	-	-	-	-	-	-
Lesser Black-backed Gull	1	-	-	4	2	-	-	6
Herring Gull	-	-	-	1	1	-	-	3
Great Black-backed Gull	-	1	2	-	1	2	-	-
Kittiwake	1	-	-	-	-	-	-	1
gull sp	-	-	-	-	-	-	-	1
Sandwich Tern	2	1	-	-	-	-	1	-
Common Tern	2	-	-	-	-	-	-	-
Guillemot	1	-	-	-	-	-	-	-
Razorbill	1	-	-	-	-	-	-	-
Meadow Pipit	-	-	-	-	2	-	-	-
Blackbird	-	1	1	-	-	-	-	-
Redwing	-	-	-	-	-	-	1	-
Starling	-	-	4	-	-	-	-	-
Robin	1	-	-	-	-	-	-	-
Swallow	13	-	1	-	-	2	1	-
House Martin	1	-	-	-	-	-	-	-
Brambling	-	-	-	-	1	-	-	-
finch sp	-	-	-	-	2	-	-	-

The Fulmar was slightly surprising. Normally early autumn is the one time of year when Fulmars are not present off the N Kent coast.

The Gannets (2 juvs and 2 adults) all went through heading SW within a couple of minutes of each other. There was nothing unusual about their presence.

Cormorants were present in about their usual numbers. 4 were on the Girdler Tripod, 21 were on and around the Met Mast and 3 singles were in flight.
One of the birds on the Girdler Tripod was sporting a metal-ring on its right tarsus and possibly a colour-ring on its left tarsus. This was intriguing not only because ringed Cormorants are a not very common sight along the N Kent coast, but because in the last 2 weeks, 2 Cormorants colour-ringed in June this year as chicks on Puffin Island, North Wales, have been present on and off at Stodmarsh National Nature Reserve. Cormorants at Stodmarsh fly all day long back and

forth to the coast 5 miles to the N. It's just possible therefore the metal-ringed bird on the Girdler was one of the Puffin Island birds.

Flocks of 13 and 2 Brent Geese were recorded heading SW and NW respectively. The flock of 13 were near the S end of Transect 8 (and kept to the S of the turbine array as they flew on, and the flock of 2 were near the S end of Transect 1 (and looked to have kept to the S of the turbine array). Additionally, after the survey had finished the boat had to make for Ramsgate and this entailed heading E just S of the survey area. Therefore observing (but not recording) continued and at 1331 when just S of Transect 5, 46 Brent Geese flew W at 20m. Then, at 1537, when off Margate, a further 46 Brent flew W, followed a few minutes later by 8 Brent W.

1 flock of 4 Common Scoter shot by SE on the "other side" of the boat near the
N end of Transect 8. They could have been migrants or local birds.

1 flock of 6 Golden Plover were seen heading SW low over the water.
They will have been migrants coming in off the Continent.

4 Little Gulls were recorded. 1 juv and 1 adult were seen dip feeding over floating weed patches midway along Transect 8. Then 2 further birds were seen on the boat's "other side" on Transect 4: 1 at the S end; 1 near the N end. They will all have been migrants, slowly making their way S out of the North Sea.

1 Black-headed Gull, 13 Lesser Black-backed Gull, 5 Herring Gull, and 6 Great Black-backed Gull were seen. While any of them could have been in active migration through the site when seen, in all likelihood, all of them will have been local birds (i.e birds resident in the area for either all or part of the year).

2 Kittiwakes were seen (1 was "other side"). Like the Gannets they are great wanderers and their presence on the Kentish Flats at this time of year is not unusual.

4 Sandwich Tern were seen. 1 E midway along Transect 7. 1 NW midway along Transect 2 and 2 circling at N end of Transect 1. Also at the N end of Transect 1 were the only Common Tern seen on the survey. 1 juv and 1 adult were on the sea, vigorously splashing water over their backs with their wings and preening. Seeing Terns on the sea at all is unusual, but to see them on the sea and bathing is even more unusual. Both the Sandwich and Common Terns will have been migrants, and like the Little Gulls, they will have slowly been making their way S out of the North Sea.

Why 4 of the 6 Terns seen on the survey were in the same place is uncertain.
The presumption was that they had been feeding there just before the survey
boat passed. This was supported by the sighting a few seconds later of a Razorbill sitting on the sea, then a few minutes later a Guillemot sitting on the sea. These were the only auks seen during the whole survey.

31 passerines were recorded: 2 Meadow Pipit, 2 Blackbird, 1 Redwing, 4 Starling, 1 Robin, 17 Swallow, 1 House Martin, 1 Brambling, and 2 finch sp. All except the Robin were heading S, SW or W. The Robin, after it had landed on the survey boat for a few minutes, then circled the boat several times, headed off N, appearing lost.

Additionally, after the survey had finished and the survey boat was heading E along the S edge of the survey area, further passerines were seen: 1 Redwing S; 8 Swallow SE, and 1 flock of 28 Chaffinch S.

All the passerines were to be expected at this time of year. Only thing surprising was that so many were seen. This though became less surprising when later in the day the picture emerged from various sites along the N Kent coast of substantial arrivals of migrants that day.
Thousands of Swallows and Song Thrushes, hundreds of Redwings, Meadow Pipits, and Robins, and smaller numbers of Siskins, Ring Ouzels, Wheatears, Goldcrests, Firecrests, Skylarks, Redstarts, Flycatchers, Bramblings, Crossbills, Fieldfares, Woodcocks, Redpolls, and various Warblers, had been

recorded, and they will all have just been the tip of the iceberg of what actually arrived along the N Kent coast that day.

Cetaceans and Seals

1 Common Seal was seen in-transect midway along Transect 2.

10 / 10 / 07

The north-easterly wind increased through the survey from a force 2 to force 4 with the resultant sea state increasing from 2 to 3. Visibility dropped to 5 km at times but generally survey conditions were quite good. While it unlikely that many large seabirds in the A to D bands within 500m ahead will have been missed, some auks on the water or small passerines may have slipped by unrecorded. High tides occurred at 01:06 (5.7m) and 13:16 (5.7m).

A total of 43 gulls were recorded - 20 lesser black-backed gull, nine great black-backed gull, nine herring gull, two common gull, one kittiwake, one black-headed gull, and one gull that could not be identified to species. There did not appear to be any real pattern to the gulls' movements.

There was quite a high cormorant count with 32 recorded, most of which were seen roosting on the met mast . Ten gannet were recorded which is quite a high number for this site, some of which were seen plunge-diving. The high count was probably associated with the north-easterly wind. 11 common scoter were seen just to the south of the study site, flying in a westerly direction. Two Sandwich tern were recorded – possibly the last that will be recorded this year.

One meadow pipit and two unidentified passerines were recorded flying to the north. More passerines were expected to be seen on this survey.

One harbour porpoise was recorded in the control area.

31 / 10 / 07

A clear day with a Force 2 westerly wind and a sea-state of 1 – 2 gave very good surveying conditions. It unlikely that any large seabirds in the A to D bands within 500m ahead will have been missed, although some small passerines that did not offer a silhouette are likely to have slipped by unrecorded. Detours from the line were necessary to navigate shallow water on transects 1 and 8. High tides occurred at 03:41 (5.4m) and 16:09 (5.6m).

A total of 48 gulls were recorded. Common gull were the most numerous with 19 birds. 7 lesser black-backed gull, five great black-backed gull, eight herring gull, eight black-headed gull, and one gull that could not be identified to species were also recorded. There did not appear to be any real pattern to the gulls' movements although the majority were flying in an approximately westerly direction.

There was a very high cormorant count today with 97 recorded. Although many were recorded on the usual roosts of the met mast and Girdler Tripod, some were seen actively diving from tight groups on the water. However, no significant 'fish marks' were seen on the sounder.

Two Brent geese were seen flying low over the water to the west, skirting the north of the wind farm but probably not deviating from their flight-path. Three dunlin were seen on the 'non-transect' side of the boat flying to the south-west, south of the wind farm and it appeared that no deviation was required to avoid the wind farm.

A broad westerly movement of starling through the study site occurred from 08:30 and through the morning. These were presumably birds that left the Continent at first light to migrate into the UK for the winter. A total of c1785 starling were recorded including c415 that were seen between transects, behind, or on the 'non-transect' side of the boat. Most were seen flying low over the water although one flock of c235 was seen flying at around 30m through the wind farm.

Regarding other migrating passerines, 13 chaffinch, 11 skylark, one blackbird, and five unidentified small passerines were all seen flying in a westerly direction through the study sight.

No marine mammals were recorded today.

05 / 11 / 07

Good visibility and a Force 3 westerly wind resulting in sea-state 2 that gave good surveying conditions although sun-glare was a minor problem on lines 6 and 8. It unlikely that any large seabirds in the A to D bands within 500m ahead will have been missed, although some small passerines that did not offer a silhouette are likely to have slipped by unrecorded. Detours from the line were necessary to navigate shallow water on transect 1 and to give clearance to a vessel working in the array in transect 3. High tides occurred at 09:21 (5.0m) and 22:02 (5.3m).

A total of 44 gulls were recorded. As on the last survey, common gull were the most numerous with 14 birds. 5 lesser black-backed gull, three great black-backed gull, nine herring gull, eleven black-headed gull, and two gulls that could not be identified to species were also recorded. There did not appear to be any real pattern to the gulls' movements.

There was another high cormorant count today with 52 recorded. Many were recorded on the met mast, the Girdler Tripod, and Spaniard Buoy. Seven common scoter were seen flying in a westerly direction, unusually very close to the boat for this normally rather 'skittish' species.

Again, as on the last survey, there was a broad westerly movement of starling through the study site presumably of birds migrating into the UK from the Continent. A total of c1550 starling were recorded including c395 that were seen between transects, behind, or on the 'non-transect' side of the boat. Most were seen flying low over the water.Regarding other migrating passerines, three skylark with a flock of starling, two redwing, and three fieldfare were all seen migrating in a westerly direction.

No marine mammals were recorded today.

21 / 11 / 07

Good visibility and a Force 3 south-westerly wind resulting in sea-state 1 / 2 which gave good surveying conditions. It is unlikely that many large seabirds in the A to D bands within 500m ahead will have been missed. A detour from the line were necessary to navigate shallow water on transect 8. An intermittent problem with the hand-held GPS resulted in some waypoints being entered a little late and the waypoints at the southern end of transect 1 and the northern end of transect C3 were omitted. High tides occurred at 09:03 (5.2m) and 21:52 (5.4m).

A total of 65 gulls were recorded and as on the last two surveys common gull were the most numerous with 29 birds logged. Seven lesser black-backed gull, 24 herring gull, four black-headed gull, and a kittiwake were also recorded. There did not appear to be any real pattern to the gulls' movements.

45 cormorant were recorded, most on the water and a number clearly fishing. 12 common scoter were flushed off the sea just north of the wind farm before flying through the array at one metre high. One guillemot was seen flying to the west in the Control area and a shelduck was recorded flying to the west near the southern end of transect 2.

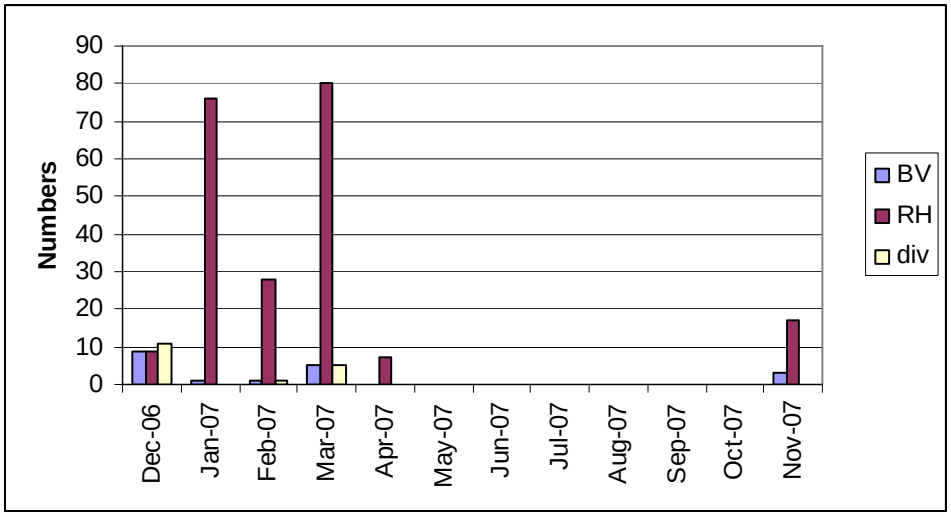
The first divers of the season were recorded today, 17 red-throated diver and three black-throats. Most were flushed off the water by the survey boat and most were seen north of the array.

Nearing the end of the migration season, three passerines were recorded, all heading in an approximately westerly direction – two chaffinch and one starling.

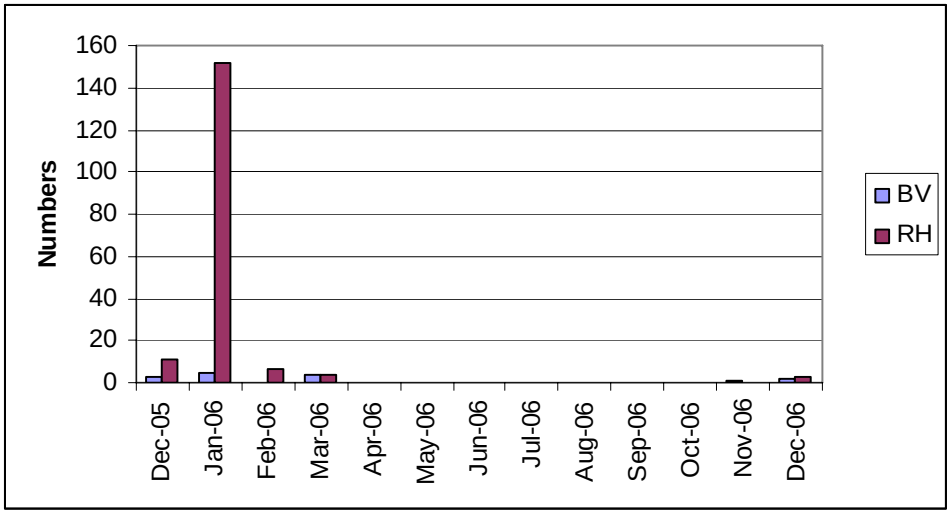
Two common seal were recorded near the southern end of transect 7.

A4.GRAPHS OF MONTHLY DIVER AND TERN NUMBERS IN YEARS 4, 5 & 6

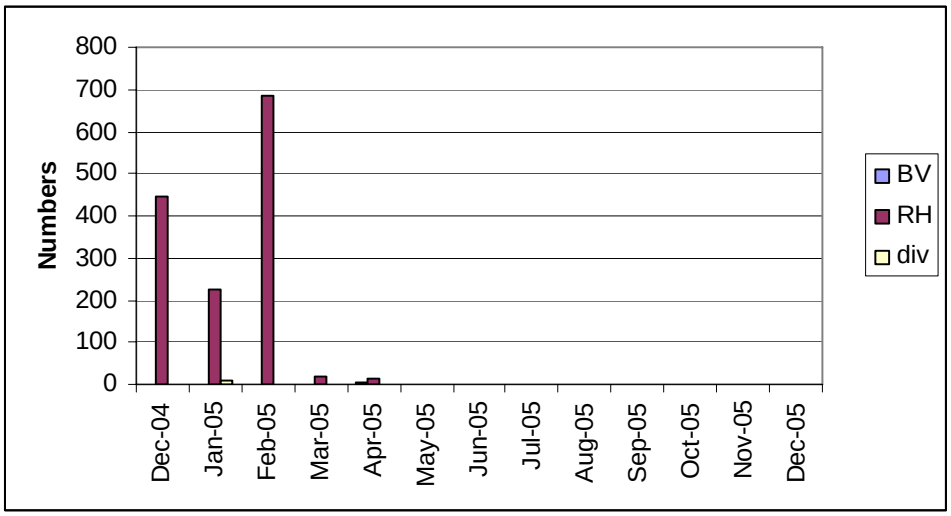
Graph 1 Monthly diver numbers from boat survey data in Year 6



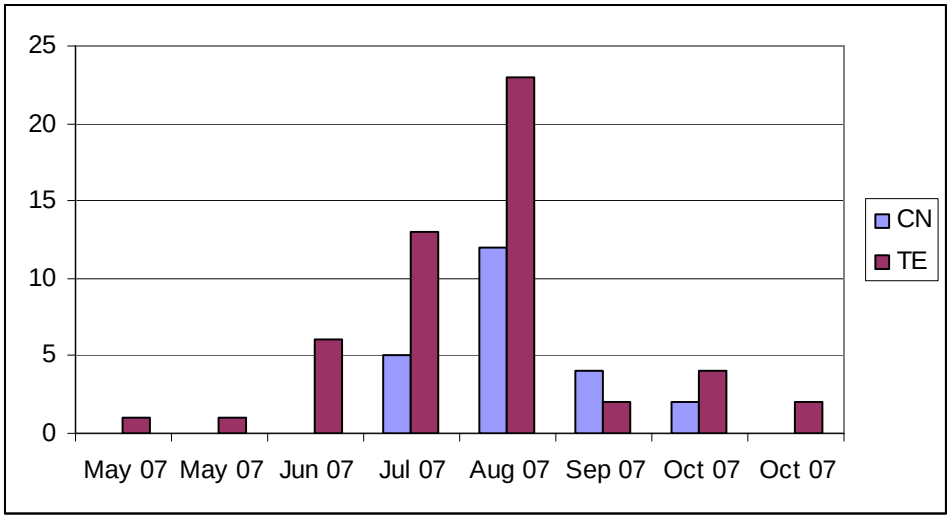
Graph 2 Monthly diver numbers from boat survey data in Year 5



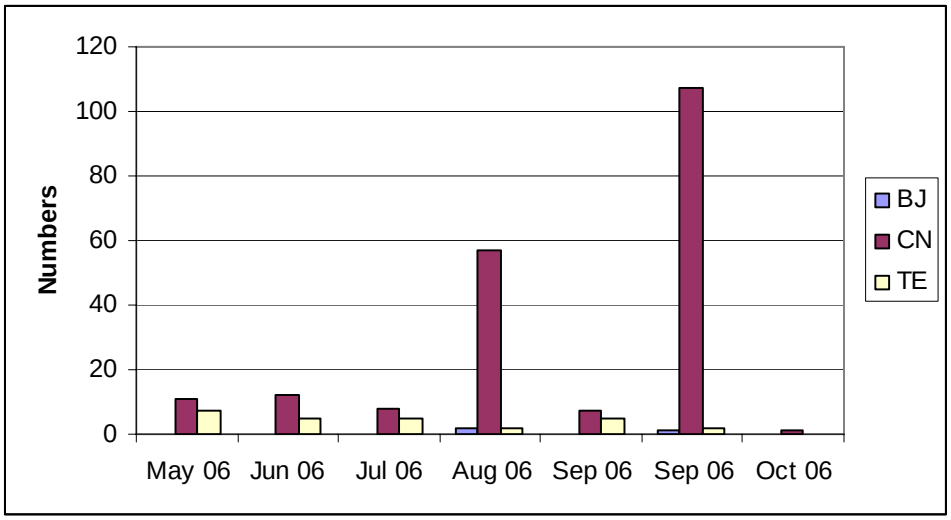
Graph 2 Monthly diver numbers from boat survey data in Year 4



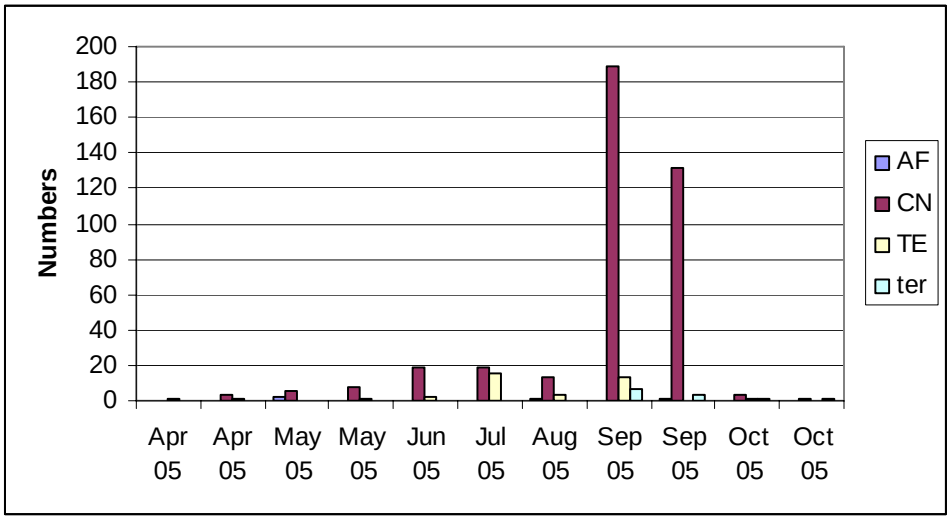
Graph 4 Monthly tern numbers from boat survey data in Year 6



Graph 5 Monthly tern numbers from boat survey data in Year 5



Graph 6 Monthly tern numbers from boat survey data in Year 4



A5. CD WITH FIGURES – 1 TO 140: SHOWING SITE LOCATION, VESSEL AND AERIAL OBSERVATIONS FROM 2002 TO 2007, COVERING MONITORING REPORTS YEARS 1 TO 5.