

Report to Inform an Appropriate Assessment for the Forth Islands and Imperial Dock Lock, Leith SPAs

Appendix B – Survey Methods and Survey Effort

November 2009

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1.1 Introduction

- 1.1.1 This section provides details of the survey methods and the coverage achieved in terms of visit dates, sample sizes and summaries of raw data which are not provided elsewhere in the report.

1.2 Tern Distribution Counts

Aim

- 1.2.1 The aim of the surveys was to provide baseline data to describe the potential impact of the proposed scheme on the behaviour and distribution of terns within the Firth of Forth.
- 1.2.2 Tern spatial distribution counts were carried out by Jacobs Arup in 2008 and by Jacobs et al. (2007b) in 2007.

Survey methods 2008

- 1.2.3 Tern spatial distribution counts were carried out between June and September 2008 within an area extending from St Margaret's Marsh (north shore) and Hopetoun Bank (south shore) in the west to east of Forth Rail Bridge (north shore) and Long Craig Pier (south shore) in the east (see Figure 6 of the main report). The survey area covered approximately 8.3km², extending between 0.5 – 1.4km upstream of the proposed scheme alignment to 0.8 - 1km downstream of the Forth Rail Bridge. It included the main crossing and the survey grid developed for the 2007 study, as well as the area between the existing Forth Road and Rail bridges and wider areas to the west of the proposed new bridge and the east of the rail bridge. It was considered that this wider area would provide a more complete picture of tern distribution, and associated behaviour, in the vicinity of the existing Firth of Forth bridges and the proposed new bridge footprint.
- 1.2.4 The wider survey area was divided into six survey sectors (Figure 6). Surveyors took 'visual sweeps' of each area from its corresponding vantage point (VP1 to VP6) (Table 1) at intervals of a minimum of 5 minutes. Tern location, activity and flight height was recorded onto a map of the relevant survey area (Figure 1). Density counts at VPs were carried out for a period of 1-3 hours at a time. Data for each survey sweep was recorded onto separate maps resulting in up-to 12 completed maps per hour. Tern records were mapped using standard BTO bird species codes (BTO, undated), with the number of each species recorded in superscript and the related behaviour (Table 1) indicated in subscript text. Flight heights were recorded in categories of 0-2m, 2-10m, 10-50m and >50m above the water level. In addition, weather (wind speed and direction, rainfall, cloud cover and visibility) was recorded. The VP locations and survey effort for tern spatial distribution counts are shown in Table 1 and 2.

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- 1.2.5 The 2008 survey was designed to ensure that the survey effort at the core areas (sectors 1 and 2), which include the survey grid utilised by Jacobs et al. (2007b) (see below) was equivalent to the survey effort achieved in 2007. In 2008, the core VP for survey sector 1, the North Queensferry Lifeboat Station, was the same as that used the previous year. However, the VP on the south shore was moved from the 2007 location west of Port Edgar to the west breakwater of Port Edgar Harbour in 2008. This was done because this VP was considered to afford a better view of the estuarine waters within sector 2.

Table 1: Vantage Point Locations for Tern Spatial Distribution Counts

Vantage Point (VP)	Grid Reference (6 figure)	Core / Wider	Relation to VPs used in 2007
VP 1: West of Road Bridge, N Shore, IRB Station N Queensferry	NT 125 805	Core	VP also used in 2007 study
VP 2: W of Road Bridge, South Shore Port Edgar Harbour Breakwater	NT 119 793	Core	Different VP used in 2007 study on south shore approximately 500m west of Port Edgar
VP 3: Between Bridges, North Shore N Queensferry Town Pier	NT 131 803	Wider	Not used in 2007
VP 4: Between Bridges, South Shore S Queensferry Harbour Breakwater	NT 131 786	Wider	Not used in 2007
VP 5: East of Rail Bridge, North Shore At north landfall of Rail Bridge	NT 134 802	Wider	Not used in 2007
VP 6: East of Rail Bridge, S Shore, Long Craig Pier	NT 144 788	Core	Not used in 2007

Core VPs overlook areas common to the tern distribution surveys in 2007 and 2008; wider VPs overlook areas which were covered only in 2008.

Methods 2007

- 1.2.6 The 2007 study focused on an area of the Forth estuary 500m either side of the alignment of the proposed replacement bridge (see '2007 Survey Grid' in Figure 6 for the main report). Survey work was carried out from two VPs: one on the north shore close to the North Queensferry Lifeboat Station (NT 12551 80514) and one on the south shore about 500m west of Port Edgar (NT 11281 78804). A survey grid of 36 squares, each 200 x 350m, was mapped out and the distribution and flight heights of terns within the survey grid were recorded at five-minute intervals during hour-long watches (Figure 6, main report). In addition, when in operation, tidal races associated with Beamer Rock during ebbing and flooding tides were treated as additional counting units for the purposes of recording terns.
- 1.2.7 In 2007, the numbers of different species of tern and flight heights were recorded against grid squares at 5 minute intervals rather than onto field maps (see recording form in Jacobs et al., 2007c). The use of maps to record tern distribution in 2008 was considered to provide greater flexibility in subsequent analysis and interpretation of data.

Survey Effort

- 1.2.8 In total, 175.25 hours of tern distribution surveys hours were carried out by Jacobs Arup from the six VPs in 2008. The survey effort per vantage point is shown in Table 2.
- 1.2.9 In 2007 a total of 106.35 hours of tern distribution surveys was carried out at two vantage points (Table 3; Jacobs et al., 2007c).

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Table 2: Survey effort for tern distribution counts at vantage points 1-6 during 2008 (location of vantage points shown in Figure 1)

Week starting	Vantage Point 1		Vantage Point 2		Vantage Point 3		Vantage Point 4		Vantage Point 5		Vantage Point 6	
	Survey date	Hours	Survey date	Hours	Survey date	Hours	Survey date	Hours	Survey date	Hours	Survey date	Hours
2/06/08	05/06/2008	3.75	05/06/2008	2	04/06/2008	2	06/06/2008	1.5	06/06/2008	2	06/06/2008	2
9/06/08	11/06/2008	3	10/06/2008	3	10/06/2008	2	11/06/2008	1.5	12/06/2008	2	11/06/2008	2
16/06/08	17/06/2008 19/06/2008	1.5 4.5	17/06/2008 20/06/2008	4 3	18/06/2008	2	18/06/2008	2	18/6/2008 20/6/2008	2 2	18/06/2008	2
23/06/08	25/06/2008 27/06/2008	3.5 3	23/06/2008 24/06/2008	3 3.5	23/06/2008	2	No survey		25/06/2008	2	25/06/2008	2
30/06/08	1/07/2008 2/07/2008	3 4	01/07/2008 02/07/2008	3 3	30/06/2008	2	30/06/2008 03/07/2008	2 2	30/06/2008 03/07/2008	2 2	02/07/2008	2
7/07/08	09/07/2008 10/07/2008	3 3	10/07/2008	3	07/07/2008	2	10/07/2008	2	09/07/2008	2	11/07/2008	2
14/07/08	14/07/2008	3	14/07/2008 16/07/2008	3 3	18/07/2008	2	18/07/2008	2	15/07/2008	2	18/07/2008	2
21/07/08	24/07/2008 25/07/2008	3 3	23/07/2008 25/07/2008	3 3	25/07/2008	2	22/07/2008	2	23/07/2008	2	21/07/2008	2
28/07/08	28/07/2008	6	30/07/2008 1/08/2008	3 2.5	29/07/2008	2	30/07/2008	2	28/07/2008	2	30/07/2008	2
4/08/08	6/08/2008 8/08/2008	3 3	5/08/2008 8/08/2008	3 3	07/08/2008	2	08/08/2008	2	07/08/2008	2	06/08/2008	2
11/08/08	12/08/2008 14/08/2008	2 3	12/08/2008 13/08/2008	3 2	14/08/2008	2	12/08/2008	2	13/08/2008	2	11/08/2008	2
18/08/08	18/08/2008 22/08/2008	3 3	19/08/2008	3	20/08/2008	2	21/08/2008	2	21/08/2008	2	21/08/2008	2
25/08/08	25/08/2008	2	26/08/2008	2	25/08/2008	1	No Survey		25/08/2008	1	No Survey	
Total hours	44.25		36		25		21		25		24	

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Table 3: Survey effort for tern distribution counts (survey grid) at two vantage points in 2007 (from Jacobs et al., 2007b); Appendix H)

Vantage Point 1		Vantage Point 2	
Survey date	Hours	Survey date	Hours
02/06/2007	4.25	03/06/2007	4
06/06/2007	5	07/06/2007	5
14/06/2007	5	15/06/2007	3
25/06/2007	5	16/06/2007	2
03/07/2007	5.10	26/06/2007	4
10/07/2007	4	27/06/2007	1
16/07/2007	1	04/07/2007	4
17/07/2007	4	05/07/2007	1
24/07/2007	5	11/07/2007	3
01/08/2007	5	12/07/2007	2
06/08/2007	1	18/07/2007	4
07/08/2007	3	25/07/2007	4
08/08/2007	1	02/07/2007	4
13/08/2007	2	03/08/2007	1
14/08/2007	3	08/08/2007	4
		09/08/2007	2
		14/08/2007	1
		15/08/2007	3
		16/08/2007	1
Total: 53.35		Total: 53	

1.3 Tern Flight Activity Surveys

Aims

1.3.1 The aims of the surveys were:

- to record flight patterns and flight heights of terns using the Forth Estuary in the vicinity of the proposed replacement bridge and the existing Forth Road and Railway Bridges; and
- to provide baseline data to inform the potential impact of the proposed replacement bridge on tern flight patterns.

1.3.2 Flight activity surveys were carried out to identify the flight paths of terns using the breeding colony at Long Craig Island and roosting areas at Port Edgar and also the behaviour of terns crossing the existing Forth Road and Rail Bridges.

Survey method 2008

1.3.3 Tern flight activity surveys were carried out from VPs 1, 2, 3 and 5 (Figure 6). Surveyors stationed at a VP selected an individual tern (or a small flock of terns of single species) and watched them in flight, using binoculars or a telescope, until they were lost from view or landed. Common, Sandwich and roseate terns were selected for flight activity surveys. The tern species involved was noted and during the flight event, the tern(s) flight height was recorded every 15 seconds and the timing of notable events such as feeding dives was recorded. After the flight event, the flight path was drawn onto a map of the study area. Flight height was recorded in the following categories: 0-2m, 2-10m, 10-50m and above 50m above the water level. Weather variables were also noted. A copy of the recording sheet is shown in Figure B2.

1.3.4 Two methods were used in the selection of terns for flight activity surveys:

- select and follow the first tern flying past a nominated 'start-line' in a nominated direction at 15 minute intervals; and
- focal animal sampling for Roseate terns.

1.3.5 The start-line approach was employed at VPs 1 and 2 (Figure 1). For example at VP 1, close to the Lifeboat Station at North Queensferry, the start line was taken as an imaginary line between the VP and the pier of the north cable tower of the Forth Road Bridge. At 15 minute intervals the first tern (or group of terns) seen flying upstream past this line towards the proposed alignment of the new bridge options was selected for flight activity recording. At VP 2, terns flying upstream across a start-line between the end of the breakwater and the southern tower of the Forth Road Bridge were selected. At VP 3, terns were selected flying upstream (towards the Road Bridge) and downstream (towards the Rail Bridge) on an alternate basis. Where terns crossed either of these bridges, the crossing height and any behaviour change was recorded. At VP 5 terns flying towards the Rail Bridge were selected. Flight activity surveys were not carried out from VPs 4 and 6 due to low numbers of terns sighted in these count sectors.

1.3.6 A focal animal sampling approach was employed for roseate terns because of the conservation importance of this species and the small numbers present in the study area. Roseate terns were rarely picked up in flight using the start-line approach but were frequently seen loafing on Long Craig Island. During focal sampling a surveyor watched loafing roseate terns until they flew and then recorded flight activity as described above. Focal animal sampling was therefore mainly employed from VP1, but if a roseate tern was picked up in flight from any other VP, surveyors immediately gave priority to following the bird and recording flight activity.

1.3.7 Flight activity surveys were normally carried out in combination with tern density counts by two surveyors working together. During flight events, one surveyor selected and followed a

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tern or terns, while the second surveyor prompted at 15 second intervals and recorded flight height data. The second surveyor also carried out density sweeps at five minute intervals, pausing when required to record flight data during flight activity events.

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Survey methods 2007

1.3.8 In 2007 flight activity surveys were carried out from two vantage points at North Queensferry and Port Edgar using the same methods as in 2008. VP 1 was the same as used in the 2008 surveys, whereas VP 2 was approximately 500m west of Port Edgar on the south shore (see Table 1).

Survey Effort

1.3.9 In 2008, Jacobs Arup conducted 143 hours of flight activity surveys from VPs ,1, 2, 3 and 5 (Table 4).

1.3.10 About 42 hours of flight activity surveys were undertaken in 2007 from VPs 1 and 2 (Table 5).

Table 4: Survey effort for tern flight activity counts at vantage points 1, 2, 3 and 5 during 2008

Week starting	VP1		VP2		VP3		VP5	
	Survey date	Hours	Survey date	Hours	Survey date	Hours	Survey date	Hours
2/06/08	05/06/2008	2.25	05/06/2008	3	No Survey		No Survey	
9/06/08	11/06/2008	4	10/06/2008	3.75	No Survey		No Survey	
16/6/08	17/6/2008	1.5	17/6/2008	6	No Survey		No Survey	
	19/6/2008	2.5	19/6/2008	2				
23/6/08	25/6/2008	3	23/6/2008	3	No Survey		No Survey	
	27/6/2008	3	24/6/2008	3				
30/6/08	1/07/2008	6	2/7/2008	6	No Survey		No survey	
	2/07/2008	3						
7/07/08	09/7/2008	3	10/7/2008	2.5	No Survey		No survey	
	10/7/2008	3						
14/07/08	14/07/2008	2	14/07/2008	2.5	No survey		No survey	
			16/07/2008	3				
21/07/08	24/07/2008	3	23/7/2008	3	25/7/2008	2	23/7/2008	2
	25/07/2008	3	25/7/2008	3				
28/07/08	28/07/2008	2	30/07/2008	3	28/07/2008	1	28/07/2008	1
	30/07/2008	3	01/08/2008	2	29/07/2008	1		
4/08/08	8/08/2008	3	8/08/2008	3	7/8/2008	2	7/8/2008	2
11/08/08	12/08/2008	3	12/08/2008	3	13/8/2008	1	13/8/2008	2
	14/08/2008	3			14/08/2008	1		
18/08/08	18/08/2008	3	19/08/2008	3	20/8/2008	2	21/8/2008	2
	22/08/2008	3						
25/08/08	25/08/2008	3	26/08/2008	3	25/08/2008	2	25/08/2008	2
Total hours	62.25		57.75		12		11	

Table 5: Survey effort for tern flight line surveys in 2007 (from Jacobs et al., 2007b); Appendix H)

Vantage Point 1		Vantage Point 2	
Survey date	Hours	Survey date	Hours
02/06/2007	1.5	04/07/2007	1.5
14/06/2007	2.5	11/07/2007	1.5
15/06/2007	3	26/07/2007	2
24/06/2007	1.5		
25/06/2007	1.5		
26/06/2007	1.5		
27/06/2007	1.55		
02/07/2007	1.5		
03/07/2007	1.5		
05/07/2007	1.5		
10/07/2007	4.5		
17/07/2007	3		
18/07/2007	1.5		
19/07/2007	1.5		
24/07/2007	2.5		
01/08/2007	2.5		
02/08/2007	2		
03/08/2007	1.5		
10/08/2007	+	+	
36.55 (+)		5 (+)	

+ No details of times or VPs for flight line surveys provided in Jacobs / Faber Maunsell / AECOM (2007c)

1.4 Tern Roost Counts

Aim

- 1.4.1 The aim of the surveys was to determine the numbers of terns using roosting areas in the vicinity of the proposed new bridge.

1.4.2 Tern roost surveys were carried out by Jacobs Arup in 2008 and by Jacobs et al. (2007b).

Survey methods 2008

1.4.3 Counts of tern aggregations at dusk and dawn were carried out at Long Craig Island from VP1 and at a floating tyre raft at Port Edgar Harbour entrance from VP 2. These areas were selected based on reconnaissance surveys in the summer of 2007 (Jacobs et al., 2007b) which identified Long Craig Island and Port Edgar as the key roost sites for terns in the vicinity of the Forth Road and Rail Bridges and the proposed Main.

1.4.4 Surveyors carrying out roost counts arrived at VP1 or VP2 30-45 minutes before sunset and made regular counts of the number of terns present until approximately 30 minutes after sunset or until it was too dark to see. Dawn surveys were conducted the morning after a dusk survey, beginning 30 – 45 minutes before sunrise and continuing until 30 minutes after sunrise. The peak dusk and dawn count for each species was recorded for each VP and each survey. Counts were conducted weekly and continued until no terns were recorded (during dusk and dawn surveys and coastal bird counts).

Survey methods 2007

1.4.5 The same tern roost survey methods were employed in 2007 (Jacobs et al., 2007b).

Survey effort and raw data

1.4.6 Twelve dusk and dawn surveys at Port Edgar and Long Craig Island were carried out between August and November 2008 and seven survey visits between August and September 2007 (Table 6 and Table 7).

1.4.7 The peak dusk and dawn counts of different tern species at Long Craig Island and Port Edgar for each survey visit are also shown in Table 6 and Table 7.

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Table 6: Counts of roosting terns at Long Craig Island in 2008 and 2007

Dates	Long Craig Island																
	Dusk								Dawn								
	Common Tern		Sandwich Tern		Roseate tern		Arctic tern		Common tern		Sandwich tern		Roseate tern		Arctic tern		
	Adult	Juv	Adult	Juv	Adult	Juv	Adult	Juv	Adult	Juv	Adult	Juv	Adult	Juv	Adult	Juv	
12-13.08.08	49	0	124	0	0	0	0	0	0	34	0	96	0	0	0	0	0
25-26.08.08	14	0	98	0	0	0	0	0	134 unidentified terns								
3-4/.09.08	1	0	83	0	0	0	0	0	0	0	127	0	0	0	0	0	
11-12/.09 .08	0	0	23	0	0	0	0	0	0	0	116	0	0	0	0	0	
17-18.09 .08	0	0	75	0	0	0	0	0	-	-	-	-	-	-	-	-	
23-24.09 .08	0	0	6	4	0	0	0	0	0	0	180	0	0	0	0	0	
30.09 – 1.10.08	0	0	0	0	0	0	0	0	0	0	92	0	0	0	0	0	
6-7.10 .08	0	0	35	0	0	0	0	0	0	0	107	0	0	0	0	0	
14-15.10.08	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	
20-21.10 .08	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	
27-28.10 .08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3-4.11.08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
23 – 24.08.07	200+	0	500+	0	0	0	0	0	0	200+	0	500+	0	0	0	0	
29.08.07	c.25	0	c.110	0	0	0	0	0	-	-	-	-	-	-	-	-	
31.08.07	-	-	-	-	-	-	-	-	-	c.8	c.90	0	0	0	0	0	
3.09.07	50+	0	c.540	0	1+	0	0	0	-	-	-	-	-	-	-	-	
12-13.09.07	1	2	2	0	0	0	0	0	30+	0	400+	0	1+	0	0	0	
17.09.07	25	0	340+	0	0	0	0	0	-	-	-	-	-	-	-	-	
27.09.07	6	0	65	0	0	0	0	0	-	-	-	-	-	-	-	-	
28.09.07*	5	0	95	0	0	0	0	0	-	-	-	-	-	-	-	-	

* 17 unidentified terns flew upstream at 0635

- No count undertaken

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Table 7: Counts of Roosting Terns at Port Edgar in 2007 and 2008

Dates	Port Edgar															
	Dusk								Dawn							
	Common Tern		Sandwich Tern		Roseate tern		Arctic tern		Common tern		Sandwich tern		Roseate tern		Arctic tern	
	Adult	Juv	Adult	Juv	Adult	Juv	Adult	Juv	Adult	Juv	Adult	Juv	Adult	Juv	Adult	Juv
12-13.08.08	31	1	1	0	0	0	0	0	0	19	0	0	0	0	0	0
25-26.08.08	91	36	127	19	0	0	0	0	92	24	34	15	0	0	0	0
3-4.09.08	27	13	75	4	0	0	0	0	13	10	20	12	0	0	0	0
11-12.09 .08	1	1	103	6	0	0	0	0	1	1	145	9	0	0	0	0
17-18.09 .08	0	0	92	17	0	0	0	0	0	0	105	20	0	0	0	0
23-24.09 .08	0	0	238	0	0	0	0	0	0	0	249	0	0	0	0	0
30.09 – 1.10.08	0	0	40	0	0	0	0	0	0	0	62	0	0	0	0	0
6-7.10 .08	0	0	62	0	0	0	0	0	-	-	-	-	0	0	0	0
14-15.10.08	0	0	42	0	0	0	0	0	0	0	33	0	0	0	0	0
20-21.10 .08	0	0	17	0	0	0	0	0	0	0	17	0	0	0	0	0
27-28.10 .08	0	0	9	0	0	0	0	0	0	0	4	0	0	0	0	0
3-4.11.08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30.08.07	150	30+	1	0	2	1	0	0	-	-	-	-	-	-	-	-
5.09.07	98	18+	3	0	0	0	0	1	-	-	-	-	-	-	-	-
13.09.07	142	69	69	15+	0	0	0	2	-	-	-	-	-	-	-	-
18.09.07	89	0	256	0	0	0	0	0	-	-	-	-	-	-	-	-
28.09.07	8	20	12	0	0	0	0	1	-	-	-	-	-	-	-	-

1.5 Disturbance

Aims

- 1.5.1 To record disturbance events that result in a dread response by terns.

Methods

- 1.5.2 Disturbance events which resulted in dreading flights by terns (where a flock of birds takes flight simultaneously) were recorded opportunistically during tern distribution counts, flight activity surveys and roost counts, along with details of the likely source of disturbance.

1.6 Estuarine bird through the tide counts – low, high and mid tide

Aims

- 1.6.1 The aims of the surveys were:
- to describe the distribution of qualifying bird species of the Forth Islands SPA within the survey area affected by the proposed replacement crossing; and
 - to provide baseline data for predicting the potential impact of the Main Crossing on the qualifying species of the Forth Islands SPA.
- 1.6.2 Estuarine bird through the tide counts began in September 2007 and were completed at the end of April 2009. Between September 2007 and the end of April 2008, counts were carried out by MBEC (2007, 2008). From May 2008 until the end of April 2009, counts were conducted by Jacobs Arup.

Methods

- 1.6.3 The survey methods were based on the Wetland Bird Survey (WeBS) core (high tide) and low tide counts (as described in Bibby et al., 2000). Within the survey area, regular counts of birds using the shoreline and the waters of the estuary were carried out at low, high and mid-tide. Wetland birds which were recorded included: gulls, terns, divers, grebes, cormorants, herons, swans, geese, ducks, rails, waders and kingfisher, as defined by Wetlands International (Rose & Scott, 1997).
- 1.6.4 The survey area for through the tide counts is shown in Figure 3. This was divided into a wider survey area, extending between Limekilns and Dalgety Bay on the north shore of the Forth Estuary, and Abercorn Point and Hound Point on the south shore, and a core survey area extending between St Margaret's Marsh and Inverkeithing Bay on the north shore and Society Point and the Forth Rail Bridge on the south shore.
- 1.6.5 The basic methodology involved four replicates of high and low tide counts throughout the core and wider survey area each month and four replicates of mid tide counts within the core survey area only. Counts covered a range of spring and neap tidal conditions.
- 1.6.6 During each count birds were viewed with the assistance of binoculars and telescopes from specific vantage points (VP) along the shoreline, thus enabling the entire shoreline within the survey area to be covered. Surveyors took 'snapshot' scans and recorded the numbers their locations and behaviour of birds on the relevant count sector map. Count sectors used by MBEC are shown in Figure 4. When taking over the estuarine bird surveys, Jacobs Arup amended the boundaries of the count sectors to remove overlap between adjacent sectors (Figure 3). The open water sectors used by MBEC (C1-C3) were also removed and replaced with count sectors (N2 – N5 and N7, and S2 - S5) which extend into open water

areas roughly half-way across the estuary from the north and south shore respectively using visible features to demarcate areas.

- 1.6.7 Data were recorded on maps using standard BTO bird species codes (BTO, 2008), with the number of each species recorded in superscript and the related behaviour indicated in subscript text. Behaviour codes are listed Table 8 below. In addition to bird data, weather (wind speed and direction, rainfall, cloud cover and visibility) and sources of potential or actual disturbance to birds were recorded during the counts. A sample field map is shown in Figure 5 and a recording sheet in Figure 6. To avoid observer bias, surveyors rotated between areas on a monthly basis.

Table 8: Species Behaviour Codes

Behaviour to be Recorded	Associated Code
Loafing	L
Roosting	R
Feeding/Foraging	F
Flying	Y
Carrying Food	O

- 1.6.8 Jacobs Arup carried out one complete high and low tide count of the core and wider survey and one mid tide count of the core area each week between May 2008 and April 2009. Where daylight hours and tidal patterns allowed, high, low and mid-tide counts were synchronised so as to be completed within one tidal cycle on a given day using four surveyors to cover the entire survey area. This provided a ‘snapshot’ estimate of the total number of birds within the survey area on a given day and tide. Also where possible within each week, high, low and mid tide counts were carried out on different days to avoid pseudo-replication (counts carried out on the same day are less-independent for the purposes of data (statistical) analysis than counts separated by longer periods of time). Within the survey area, surveyors varied the locations at which they began counting on different days so that over the survey period each given count section was visited at a range of different times in relation to the turn of the tide. The mid tide counts were extended to cover the core and wider survey area between November 2008 and January 2009 (ie the periods when migration period flight activity surveys – see next section - were not ongoing). High tide counts were carried out over a three hour period, 1.5 hours either side of high water, and low tide counts over four hours, two hours either side of low water. Mid-tide counts were carried out up to 1.5 hours either side of the time half-way between high and low water (depending on the timing of tides on a particular day).
- 1.6.9 Surveys carried out by MBEC (2008) between September 2007 and April 2008 were timed so that the mid-point of the survey coincided with the turn of the tide (high or low water). MBEC aimed to survey the whole area four times per calendar month at each tidal state (for full details of MBECs survey effort and timings refer to MBEC (2008)).

Survey effort

- 1.6.10 A survey schedule for high, low and mid tide counts between September 2007 and April 2008 is provided in Appendix 8 of MBEC (2008).
- 1.6.11 Jacobs Arup schedules of estuarine bird surveys are shown in Tables 9 – 12 below.

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Table 9: Schedule of Estuarine Bird Surveys: North Shore Count Sectors N1 – N4

Wk Starting:	N1 Survey Date & Tide Time*						N2 Survey Date & Tide Time*						N3 Survey Date & Tide Time*						N4 Survey Date & Tide Time*					
	Low		Mid		High		Low		High		Low		Mid		High		Low		Mid		High			
5 May 08	09/05/2008	10:55	-	-	-	-	09/05/2008	10:55	-	-	09/05/2008	10:55	09/05/2008	14:23	-	-	09/05/2008	10:55	09/05/2008	14:23	-	-		
12 May 08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
19 May 08	21/05/2009	08:36	-	-	20/05/2008	15:07	21/05/2008	08:36	21/05/2008	15:43	21/05/2008	15:43	20/05/2008	10:35	20/05/2008	15:07	22/05/2008	09:08	20/05/2008	10:35	20/05/2008	15:07		
26 May 08	28/05/2008	13:18	-	-	28/05/2008	08:10	29/05/2008	15:41	29/05/2008	09:10	28/05/2008	13:18	28/05/2008	10:44	28/05/2008	08:10	28/05/2008	13:18	28/05/2008	10:44	28/05/2008	08:10		
2 June 08	05/06/2008	09:35	-	-	04/06/2008	14:59	05/06/2008	09:35	05/06/2008	15:52	05/06/2008	09:35	05/06/2008	12:44	04/06/2008	14:59	05/06/2008	09:35	06/06/2008	13:30	04/06/2008	14:59		
9 June 08	11/06/2008	14:49	-	-	12/06/2008	09:45	11/06/2008	14:49	12/06/2008	09:45	12/06/2008	09:45	10/06/2008	11:48	12/06/2008	09:45	12/06/2008	16:06	10/06/2008	11:48	12/06/2008	09:45		
16 June 08	19/06/2008	08:17	-	-	17/06/2008	14:04	19/06/2008	08:17	17/06/2008	14:04	19/06/2008	08:17	18/06/2008	12:11	17/06/2008	14:04	19/06/2008	08:17	18/06/2008	11:11	17/06/2008	14:04		
23 June 08	25/06/2008	11:53	-	-	24/06/2008	06:15	-	-	27/06/2008	08:37	25/06/2008	11:53	26/06/2008	10:16	24/06/2008	18:45	25/06/2008	11:53	26/06/2008	10:16	24/06/2008	18:45		
30 June 08	03/07/2008	08:44	-	-	02/07/2008	13:49	01/07/2008	06:35	01/07/2008	12:48	03/07/2008	08:44	01/07/2008	09:42	02/07/2008	13:49	03/07/2008	08:44	01/07/2008	09:42	02/07/2008	13:49		
7 July 08	09/07/2008	12:51	-	-	08/07/2008	06:30	09/07/2008	12:51	10/07/2008	08:03	09/07/2008	12:51	10/07/2008	10:44	08/07/2008	18:54	09/07/2008	12:51	10/07/2008	10:44	08/07/2008	18:54		
14 July 08	17/07/2008	07:20	-	-	16/07/2008	13:40	-	-	-	-	17/07/2008	07:20	15/07/2008	09:38	16/07/2008	13:40	17/07/2008	07:20	15/07/2008	09:38	16/07/2008	13:40		
21 July 08	23/07/2008	10:53	-	-	25/07/2008	07:17	-	-	-	-	23/07/2008	10:53	24/07/2008	15:25	25/07/2008	07:17	23/07/2008	10:53	24/07/2008	15:25	25/07/2008	07:17		
28 July 08	30/07/2008	06:37	-	-	29/07/2008	11:28	-	-	-	-	30/07/2008	06:37	31/07/2008	11:42	29/07/2008	11:28	30/07/2008	06:37	31/07/2008	11:42	29/07/2008	11:28		
4 August 08	04/08/2008	10:43	-	-	07/08/2008	06:36	-	-	-	-	04/08/2008	10:43	05/08/2008	15:25	07/08/2008	06:36	04/08/2008	10:43	05/08/2008	15:25	07/08/2008	06:36		
11 August 08	14/08/2008	06:27	-	-	11/08/2008	10:18	13/08/2008	06:00	11/08/2008	10:18	14/08/2008	06:27	13/08/2008	15:16	11/08/2008	10:18	14/08/2008	06:27	13/08/2008	15:16	11/08/2008	10:18		
18 August 08	20/08/2008	09:00	-	-	23/08/2008	06:51	24/08/2008	12:36	21/08/2008	05:24	20/08/2008	10:01	20/08/2008	14:36	23/08/2008	06:51	20/08/2008	10:01	20/08/2008	14:36	23/08/2008	06:51		
25 August 08	-	-	-	-	26/08/2008	10:01	28/08/2008	06:41	27/08/2008	11:23	-	-	25/08/2008	11:10	26/08/2008 29/08/2008	10:01 13:33	-	-	25/08/2008	11:10	26/08/2008	10:01		
1 Sept 08	05/09/2008	10:55	-	-	03/09/2008	16:59	02/09/2008	10:06	-	-	02/09/2008	10:06	01/09/2008	12:42	03/09/2008	16:59	02/09/2008	10:06	01/09/2008	12:42	03/09/2008	16:59		
8 Sept 08	09/09/2008	15:54	-	-	10/09/2008	11:02	-	-	09/09/2008	09:19	09/09/2008	15:54	11/09/2008	14:40	10/09/2008	11:02	09/09/2008	15:54	11/09/2008	14:40	10/09/2008	11:02		
15 Sept 08	16/09/2008	08:32	-	-	17/09/2008	16:01	15/09/2008	07:56	17/09/2008	16:01	16/09/2008	08:32	18/09/2008	13:08	17/09/2008	16:01	16/09/2008	08:32	18/09/2008	13:08	17/09/2008	16:01		
22 Sept 08	23/09/2008	14:46	-	-	24/09/2008	09:58	22/09/2008	12:24	25/09/2008	11:24	23/09/2008	14:46	22/09/2008	09:58	24/09/2008	09:58	23/09/2008	14:46	22/09/2008	09:58	24/09/2008	09:58		
29 Sept 08	02/10/2008	09:42	-	-	30/09/2008	15:20	30/09/2008	09:05	01/10/2008	15:52	02/10/2008	09:42	01/10/2008	12:39	30/09/2008	15:20	02/10/2008	09:42	01/10/2008	12:39	30/09/2008	15:20		
6 October 08	10/10/2008	17:06	-	-	08/10/2008	08:25	07/10/2008	11:53	-	-	10/10/2008	17:06	07/10/2008	09:41	08/10/2008	08:25	10/10/2008	17:06	07/10/2008	09:41	08/10/2008	08:25		
13 October 08	16/10/2008	08:33	-	-	14/10/2008	14:13	15/10/2008	08:00	13/10/2008	13:35	16/10/2008	08:33	15/10/2008	11:27	14/10/2008	14:13	16/10/2008	08:33	15/10/2008	11:27	14/10/2008	14:13		
20 October 08	21/10/2008	12:28	-	-	22/10/2008	08:25	-	-	-	-	21/10/2008	12:28	23/10/2008	13:37	22/10/2008	08:25	21/10/2008	12:28	23/10/2008	13:37	22/10/2008	08:25		
27 October 08	28/10/2008	08:07	-	-	28/10/2008	14:20	-	-	-	-	28/10/2008	08:07	31/10/2008	12:27	28/10/2008	14:20	28/10/2008	08:07	31/10/2008	12:27	28/10/2008	14:20		
3 Nov 08	04/11/2008	10:47	05/11/2008	09:14	07/11/2008	08:59	05/11/2008	11:31	04/11/2008	18:22	04/11/2008	10:47	05/11/2008	09:14	07/11/2008	08:59	04/11/2008	10:47	05/11/2008	09:14	07/11/2008	08:59		
10 Nov 08	14/11/2008	08:07	12/11/2008	10:16	11/11/2008	12:56	13/11/2008	07:28	12/11/2008	13:42	13/11/2008	07:28	12/11/2008	10:16	11/11/2008	12:56	13/11/2008	07:28	12/11/2008	10:16	11/11/2008	12:56		
17 Nov 08	18/11/2008	11:44	19/11/2008	09:40	20/11/2008	08:13	20/11/2008	13:50	20/11/2008	08:13	18/11/2008	11:44	19/11/2008	09:40	20/11/2008	08:13	18/11/2008	11:44	19/11/2008	09:40	20/11/2008	08:13		
24 Nov 08	27/11/2008	07:57	26/11/2008	10:46	25/11/2008	13:13	25/11/2008	07:05	25/11/2008	13:13	27/11/2008	07:57	26/11/2008	10:46	25/11/2008	13:13	28/11/2008	08:03	26/11/2008	10:46	25/11/2008	13:13		
Week start changed to Wednesday to fit tide times in during restricted daylight hours																								
3 Dec 08	05/12/2008	12:06	08/12/2008	13:18	09/12/2008	11:22	03/12/2008	10:34	-	-	05/12/2008	12:06	08/12/2008	13:18	09/12/2008	11:22	05/12/2008	12:06	08/12/2008	13:18	09/12/2008	11:22		
10 Dec 08	16/12/2008	10:39	15/12/2008	13:27	11/12/2008	13:13	16/12/2008	10:39	-	-	16/12/2008	10:39	15/12/2008	13:27	10/12/2008	12:18	16/12/2008	10:39	15/12/2008	13:27	10/12/2008	12:18		
17 Dec 08	17/12/2008	11:24	22/12/2008	13:57	23/12/2008	11:47	-	-	-	-	17/12/2008	11:24	22/12/2008	13:57	23/12/2008	11:47	17/12/2008	11:24	22/12/2008	13:57	23/12/2008	11:47		
24 Dec 08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
31 Dec 08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Week start returns to Monday																								
5 Jan 09	05/01/2009	13:24	06/01/2009	12:15	08/01/2009	11:49	06/01/2009	14:51	08/01/2009	11:49	05/01/2009	13:24	06/01/2009	12:16	08/01/2009	11:49	05/01/2009	13:24	06/01/2009	12:16	08/01/2009	11:49		
12 Jan 09	15/01/2009	11:19	14/01/2009	13:59	12/01/2009	15:34	14/01/2009	11:19	13/01/2009	16:24	15/01/2009	11:19	14/01/2009	14:30	12/01/2009	15:34	15/01/2009	11:19	14/01/2009	14:30	12/01/2009	15:34		
19 Jan 09	19/01/2009	13:57	21/01/2009	14:30	20/01/2009	09:55	20/01/2008	15:30	-	-	19/01/2009	13:57	21/01/2009	16:35	20/01/2009	09:55	19/01/2009	13:57	21/01/2009	16:35	20/01/2009	09:55		
26 Jan 09	27/01/2009	08:38	28/01/2009	12:44	26/01/2009	15:03	29/01/2009	09:48	29/01/2009	16:49	27/01/2009	08:38	28/01/2009	12:46	26/01/2009	15:03	28/01/2009	09:15	27/01/2009	12:08	26/01/2009	15:03		
2 Feb 09	03/02/2009	12:43	-	-	05/02/2009	10:13	04/02/2009	13:57	04/02/2009	09:06	03/02/2009	12:43	04/02/2009	11:41	05/02/2009	10:13	03/02/2009	12:43	04/02/2009	11:41	05/02/2009	10:13		
9 Feb 09	-	-	-	-	11/02/2009	16:05	-	*	-	-	-	-	11/02/2009	12:57	10/02/2009	15:19	-	-	11/02/2009	12:57	10/02/2009	15:19		
16 Feb 09	18/02/2009	14:56	-	-	20/02/2009	11:36	18/02/2009	14:56	-	-	18/02/2009	14:56	19/02/2009	13:23	20/02/2009	11:36	18/02/2009	14:56	19/02/2009	13:23	20/02/2009	11:36		

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Wk Starting:	N1 Survey Date & Tide Time*						N2 Survey Date & Tide Time*						N3 Survey Date & Tide Time*						N4 Survey Date & Tide Time*					
	Low		Mid		High		Low		High		Low		Mid		High		Low		Mid		High			
23 Feb 09	27/02/2009	09:29	-	-	25/02/2009	15:15	26/02/2009	08:55	25/02/2009	15:15	25/02/2009	08:17	26/02/2009	12:03	25/02/2009	15:15	25/02/2009	08:17	26/02/2009	12:03	25/02/2009	15:15		
2 Mar 09	04/03/2009	12:21	-	-	05/03/2009	08:40	04/03/2009	12:21	-	-	04/03/2009	12:21	03/03/2009	15:36	05/03/2009	08:40	04/03/2009	12:21	03/03/2009	15:36	05/03/2009	08:40		
9 Mar 09	12/03/2009	09:23	-	-	10/03/2009	14:14	12/03/2009	09:23	12/03/2009	15:43	12/03/2009	09:23	11/03/2009	11:54	10/03/2009	14:14	12/03/2009	09:23	11/03/2009	11:54	10/03/2009	14:14		
16 Mar 09	18/03/2009	11:49	-	-	19/03/2009	07:56	17/03/2009	11:11	16/03/2009	18:18	18/03/2009	11:49	17/03/2009	15:07	19/03/2009	07:56	18/03/2009	11:49	17/03/2009	15:07	19/03/2009	07:56		
23 Mar 09	25/03/2009	07:13	-	-	24/03/2009	13:29	26/03/2009	07:52	23/03/2009	12:48	25/03/2009	07:13	25/03/2009	10:41	24/03/2009	13:29	25/03/2009	07:13	25/03/2009	10:41	24/03/2009	13:29		
30 Mar 09	01/04/2009	11:20	-	-	02/04/2009	07:25	01/04/2009	11:20	31/03/2009	18:10	01/04/2009	11:20	31/03/2009	14:48	02/04/2009	07:25	01/04/2009	11:20	03/04/2009	11:	02/04/2009	08:25		
6 Apr 09	09/04/2009	08:22	08/04/2009	10:37	08/04/2009	13:54	08/04/2009	07:43	-	-	09/04/2009	08:22	08/04/2009	10:49	08/04/2009	13:54	09/04/2009	08:22	08/04/2009	10:49	08/04/2009	13:54		
13 Apr 09	15/04/2009	10:48	16/04/2009	09:07	16/04/2009	06:37	15/04/2009	10:48	-	-	15/04/2009	10:48	16/04/2009	09:07	16/04/2009	06:37	15/04/09	10:48	16/04/2009	09:07	16/04/2009	06:37		
20 Apr 09	23/04/2009	06:45	21/04/2009	09:42	22/04/2009	12:47	22/04/2009	06:05	20/04/2009	11:09	26/04/2009	08:43	21/04/2009	09:42	21/04/2009	12:02	24/04/2009	07:25	22/04/2009	09:26	22/04/2009	12:47		
27 Apr 09																								

* Tide times represent the time of high or low tide at Rosyth (based on Admiralty Charts), or for mid tide, the time half-way between high and low tide. All times are GMT.

Table 10: Schedule of Estuarine Bird Surveys: North Shore Count Sectors N5 – N7

Wk Starting:	N5 Survey Date & Tide Time*						N6 Survey Date & Tide Time*						N7 Survey Date & Tide Time*						N8 Survey Date & Tide Time*					
	Low		Mid		High		Low		Mid		High		Low		Mid		High		Low		Mid		High	
5 May 08	09/05/2008	10:57	09/05/2008	14:23	-	-	09/05/2008	10:57	09/05/2008	14:23	-	-	09/05/2008	10:55	-	-	-	-	09/05/2008	10:55	-	-	-	-
12 May 08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
19 May 08	22/05/2008	09:08	21/05/2008	12:09	20/05/2008	15:07	22/05/2008	09:08	20/05/2008	11:35	21/05/2008	15:43	22/05/2008	09:08	-	-	20/05/2008	15:07	22/05/2008	09:08	-	-	20/05/2008	15:07
26 May 08	28/05/2008	13:18	28/05/2008	10:44	28/05/2008	08:10	28/05/2008	13:18	28/05/2008	10:44	28/05/2008	08:10	28/05/2008	13:18	-	-	28/05/2008	08:10	28/05/2008	13:18	-	-	28/05/2008	08:10
2 June 08	05/06/2008	09:36	06/06/2008	13:40	04/06/2008	14:59	05/06/2008	09:36	06/06/2008	13:40	04/06/2008	14:59	05/06/2008	09:36	-	-	04/06/2008	14:59	05/06/2008	09:36	-	-	04/06/2008	14:59
9 June 08	11/06/2008	14:46	10/06/2008	10:48	12/06/2008	09:46	11/06/2008	14:46	10/06/2008	10:48	12/06/2008	09:46	11/06/2008	14:46	-	-	12/06/2008	09:46	11/06/2008	14:46	-	-	12/06/2008	09:46
16 June 08	19/06/2008	08:17	18/06/2008	12:11	17/06/2008	14:04	19/06/2008	08:17	18/06/2008	12:11	17/06/2008	14:04	19/06/2008	08:17	-	-	17/06/2008	14:04	19/06/2008	08:17	-	-	16/06/2008	13:20
23 June 08	25/06/2008	11:53	24/06/2008	15:59	23/06/2008	18:02	25/06/2008	11:53	24/06/2008	15:59	23/06/2008	18:02	25/06/2008	11:53	-	-	23/06/2008	05:32	25/06/2008	11:53	-	-	23/06/2008	05:32
30 June 08	03/07/2008	08:45	04/07/2008	12:38	02/07/2008	13:49	03/07/2008	08:45	04/07/2008	12:38	02/07/2008	13:49	03/07/2008	08:44	-	-	02/07/2008	13:49	03/07/2008	08:44	-	-	02/07/2008	13:49
7 July 08	07/07/2008	11:49	08/07/2008	09:56	10/07/2008	08:03	07/07/2008	11:49	08/07/2008	09:56	10/07/2008	08:03	07/07/2008	11:49	-	-	10/07/2008	08:03	07/07/2008	11:49	-	-	10/07/2008	08:03
14 July 08	15/07/2008	06:24	17/07/2008	10:52	15/07/2008	12:52	16/07/2008	06:46	17/07/2008	10:52	15/07/2008	12:52	16/07/2008	06:46	-	-	15/07/2008	12:52	16/07/2008	06:46	-	-	15/07/2008	12:52
21 July 08	22/07/2008	10:25	24/07/2008	15:25	23/07/2008	05:52	27/07/2008	14:09	24/07/2008	15:25	23/07/2008	05:52	22/07/2008	10:25	-	-	23/07/2008	05:52	22/07/2008	10:25	-	-	23/07/2008	05:52
28 July 08	31/07/2008	07:45	30/07/2008	09:37	29/07/2008	11:28	31/07/2008	07:45	30/07/2008	09:37	29/07/2008	11:28	31/07/2008	07:45	-	-	29/07/2008	11:28	31/07/2008	07:45	-	-	29/07/2008	11:28
4 August 08	08/08/2008	12:20	06/08/2008	15:17	-	-	08/08/2008	12:20	06/08/2008	15:17	07/08/2008	06:36	08/08/2008	12:20	-	-	07/08/2008	06:36	08/08/2008	12:20	-	-	07/08/2008	06:36
11 August 08	14/08/2008	06:27	13/08/2008	15:16	11/08/2008	10:18	14/08/2008	06:27	13/08/2008	15:16	11/08/2008	10:18	14/08/2008	06:27	-	-	11/08/2008	10:18	14/08/2008	06:27	-	-	11/08/2008	10:18
18 August 08	19/08/2008	09:33	20/08/2008	13:36	18/08/2008	15:52	19/08/2008	09:33	20/08/2008	13:36	18/08/2008	15:52	19/08/2008	09:33	-	-	18/08/2008	15:52	19/08/2008	09:33	-	-	18/08/2008	15:52
25 August 08	29/08/2008	07:41	26/08/2008	13:22	25/08/2008	08:42	29/08/2008	07:41	25/08/2008	11:10	25/08/2008	08:42	29/08/2008	07:41	-	-	27/08/2008	11:23	29/08/2008	07:41	-	-	27/08/2008	11:23
1 Sept 08	01/09/2008	09:39	04/09/2008	14:04	03/09/2008	16:59	01/09/2008	09:39	04/09/2008	14:04	09/09/2008	09:19	01/09/2008	09:39	-	-	03/09/2008	16:59	01/09/2008	09:39	-	-	03/09/2008	16:59
8 Sept 08	09/09/2008	15:54	11/09/2008	14:40	12/09/2008	12:53	09/09/2008	15:54	11/09/2008	14:40	12/09/2008	12:53	09/09/2008	15:54	-	-	12/09/2008	12:53	09/09/2008	15:54	-	-	12/09/2008	12:53
15 Sept 08	18/09/2008	09:33	17/09/2008	12:33	16/09/2008	15:22	18/09/2008	09:33	17/09/2008	12:33	15/09/2008	14:46	18/09/2008	09:33	-	-	16/09/2008	15:22	18/09/2008	09:33	-	-	16/09/2008	15:22
22 Sept 08	23/09/2008	14:46	25/09/2008	14:45	24/09/2008	09:58	23/09/2008	14:46	25/09/2008	14:45	24/09/2008	09:58	23/09/2008	14:46	-	-	24/09/2008	09:58	23/09/2008	14:46	-	-	24/09/2008	09:58
29 Sept 08	01/10/2008	09:26	01/10/2008	12:39	30/09/2008	15:20	01/10/2008	09:26	01/10/2008	12:39	30/09/2008	15:20	01/10/2008	09:26	-	-	30/09/2008	15:20	01/10/2008	09:26	-	-	30/09/2008	15:20
6 October 08	07/10/2008	11:53	08/10/2008	11:52	09/10/2008	10:10	07/10/2008	11:53	08/10/2008	11:52	09/10/2008	10:10	07/10/2008	11:53	-	-	09/10/2008	11:10	07/10/2008	11:53	-	-	09/10/2008	11:10
13 October 08	16/10/2008	08:33	15/10/2008	11:27	14/10/2008	14:13	16/10/2008	08:33	15/10/2008	11:27	14/10/2008	14:13	16/10/2008	08:33	-	-	14/10/2008	14:13	16/10/2008	08:33	-	-	14/10/2008	14:13
20 October 08	21/10/2008	12:28	23/10/2008	13:16	22/10/2008	08:25	21/10/2008	12:28	23/10/2008	13:56	22/10/2008	08:25	21/10/2008	12:28	-	-	22/10/2008	08:25	21/10/2008	12:28	-	-	22/10/2008	08:25
27 October 08	28/10/2008	08:07	30/10/2008	11:58	27/10/2008	13:42	28/10/2008	08:07	30/10/2008	11:58	27/10/2008	13:42	28/10/2008	08:07	-	-	27/10/2008	13:42	29/10/2008	08:30	-	-	27/10/2008	13:42

Forth Replacement Crossing
Report to Inform an Appropriate Assessment for the Forth Islands and Leith Docks SPAs

Wk Starting:	N5 Survey Date & Tide Time*						N6 Survey Date & Tide Time*						N7 Survey Date & Tide Time*						N8 Survey Date & Tide Time*					
	Low		Mid		High		Low		Mid		High		Low		Mid		High		Low		Mid		High	
3 Nov 08	04/11/2008	10:12	05/11/2008	09:17	07/11/2008	08:59	04/11/2008	10:47	05/11/2008	09:17	07/11/2008	08:59	04/11/2008	10:47	-	-	07/11/2008	08:59	04/11/2008	10:47	-	-	07/11/2008	08:59
10 Nov 08	13/11/2008	07:28	12/11/2008	10:16	11/11/2008	12:56	13/11/2008	07:28	12/11/2008	10:16	11/11/2008	12:56	14/11/2008	08:07	12/11/2008	10:16	11/11/2008	12:56	14/11/2008	08:07	12/11/2008	10:16	11/11/2008	12:56
17 Nov 08	18/11/2008	11:44	19/11/2008	09:49	21/11/2008	09:24	18/11/2008	11:44	19/11/2008	09:49	20/11/2008	08:13	18/11/2008	11:14	19/11/2008	09:49	20/11/2008	08:13	18/11/2008	11:14	18/11/2008	14:54	20/11/2008	08:13
24 Nov 08	27/11/2008	07:57	26/11/2008	10:47	25/11/2008	13:13	27/11/2008	07:57	26/11/2008	10:47	25/11/2008	13:13	28/11/2008	08:03	26/11/2008	10:47	25/11/2008	13:13	28/11/2008	08:03	26/11/2008	10:47	25/11/2008	13:13
Week start changed to Wednesday to fit tide times in during restricted daylight hours																								
3 Dec 08	04/12/2008	11:15	08/12/2008	13:28	09/12/2008	11:22	04/12/2008	11:15	08/12/2008	13:28	09/12/2008	11:22	04/12/2008	11:15	08/12/2008	13:28	09/12/2008	11:22	04/12/2008	11:15	08/12/2008	13:28	09/12/2008	11:22
10 Dec 08	16/12/2008	10:39	15/12/2008	13:36	11/12/2008	13:13	16/12/2008	10:39	15/12/2008	13:36	11/12/2008	13:13	16/12/2008	10:39	15/12/2008	13:36	11/12/2008	13:13	16/12/2008	10:39	15/12/2008	13:36	11/12/2008	13:13
17 Dec 08	17/12/2008	11:24	22/12/2008	13:57	23/12/2008	11:47	17/12/2008	11:24	22/12/2008	13:57	23/12/2008	11:47	17/12/2008	11:24	22/12/2008	13:57	23/12/2008	11:47	17/12/2008	11:24	22/12/2008	13:57	23/12/2008	11:47
24 Dec 08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31 Dec 08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Week start returns to Monday																								
5 Jan 09	05/01/2009	13:24	06/01/2009	12:15	07/01/2009	10:44	05/01/2009	13:24	06/01/2009	12:15	07/01/2009	10:44	05/01/2009	13:24	06/01/2009	12:15	07/01/2009	10:44	05/01/2009	13:24	06/01/2009	12:15	07/01/2009	10:44
12 Jan 09	15/01/2009	11:19	14/01/2009	13:59	12/01/2009	15:34	15/01/2009	11:19	14/01/2009	13:59	12/01/2009	15:34	15/01/2009	11:19	14/01/2009	13:59	12/01/2009	15:34	15/01/2009	11:19	14/01/2009	13:59	13/01/2009	16:24
19 Jan 09	19/01/2009	13:57	21/01/2009	14:30	20/01/2009	09:55	19/01/2009	13:57	21/01/2009	14:30	20/01/2009	09:55	19/01/2009	13:57	21/01/2009	14:30	20/01/2009	09:55	19/01/2009	13:57	21/01/2009	14:30	20/01/2009	09:55
26 Jan 09	27/01/2009	08:38	27/01/2009	12:08	26/01/2009	15:03	27/01/2009	08:38	27/01/2009	12:08	26/01/2009	15:03	28/01/2009	09:15	27/01/2009	12:08	26/01/2009	15:03	28/01/2009	09:15	27/01/2009	12:08	26/01/2009	15:03
2 Feb 09	03/02/2009	12:43	04/02/2009	10:41	05/02/2009	10:13	03/02/2009	12:43	04/02/2009	10:41	05/02/2009	10:13	03/02/2009	12:43	-	-	05/02/2009	10:13	03/02/2009	12:43	-	-	05/02/2009	10:13
9 Feb 09	-	-	-	-	10/02/2009	15:19	-	-	-	-	10/02/2009	15:19	-	-	-	-	-	-	-	-	-	-	-	-
16 Feb 09	18/02/2009	14:56	19/02/2009	13:23	20/02/2009	11:36	18/02/2009	14:56	19/02/2009	13:23	20/02/2009	11:36	18/02/2009	14:56	-	-	20/02/2009	11:36	18/02/2009	14:56	-	-	20/02/2009	11:36
23 Feb 09	25/02/2009 27/02/2009	08:17 09:29	26/02/2009	12:03	25/02/2009	15:15	25/02/2009 27/02/2009	08:17 09:29	26/02/2009	12:03	25/02/2009	15:15	27/02/2009	09:29	-	-	25/02/2009	15:15	27/02/2009	09:29	-	-	25/02/2009	15:15
2 Mar 09	04/03/2009	12:21	03/03/2009	15:36	05/03/2009	08:40	04/03/2009	12:21	03/03/2009	15:36	05/03/2009	08:40	04/03/2009	12:21	-	-	05/03/2009	08:40	04/03/2009	12:21	-	-	05/03/2009	08:40
9 Mar 09	12/03/2009	09:23	11/03/2009	11:54	10/03/2009	14:14	12/03/2009	09:23	11/03/2009	11:54	10/03/2009	14:14	12/03/2009	09:23	-	-	10/03/2009	14:14	12/03/2009	09:23	-	-	10/03/2009	14:14
16 Mar 09	18/03/2009	11:49	17/03/2009	15:07	19/03/2009	07:56	18/03/2009	11:49	17/03/2009	15:07	19/03/2009	07:56	18/03/2009	11:49	-	-	19/03/2009	07:56	18/03/2009	11:49	-	-	19/03/2009	07:56
23 Mar 09	26/03/2009	07:52	25/03/2009	10:41	24/03/2009	13:29	26/03/2009	07:52	25/03/2009	10:41	24/03/2009	13:29	25/03/2009	07:13	-	-	24/03/2009	13:29	25/03/2009	07:13	-	-	24/03/2009	13:29
30 Mar 09	01/04/2009	11:20	31/03/2009	14:48	02/04/2009	07:25	01/04/2009	11:20	31/03/2009	14:48	02/04/2009	07:25	01/04/2009	11:20	-	-	02/04/2009	07:25	01/04/2009	11:20	-	-	02/04/2009	07:25
6 Apr 09	09/04/2009	08:22	08/04/2009	11:49	08/04/2009	13:54	09/04/2009	08:22	08/04/2009	11:49	08/04/2009	13:54	09/04/2009	08:22	08/04/2009	11:49	08/04/2009	13:54	09/04/2009	08:22	08/04/2009	11:49	08/04/2009	13:54
13 Apr 09	15/04/2009	10:48	15/04/2009	14:39	16/04/2009	06:37	15/04/2009	10:48	15/04/2009	14:39	16/04/2009	06:37	15/04/2009	10:48	16/04/2009	09:07	16/04/2009	06:37	15/04/2009	10:48	16/04/2009	09:07	16/04/2009	06:37
20 Apr 09	20/04/2009	17:09	22/04/2009	09:26	21/04/2009	12:02	20/04/2009	17:09	22/04/2009	09:26	21/04/2009	12:02	20/04/2009	17:09	22/04/2009	09:26	21/04/2009	12:02	20/04/2009	17:09	22/04/2009	09:26	21/04/2009	12:02
27 Apr 09																								

* Tide times represent the time of high or low tide at Rosyth (based on Admiralty Charts), or for mid tide, the time half-way between high and low tide. All times are GMT.

Forth Replacement Crossing
Report to Inform an Appropriate Assessment for the Forth Islands and Leith Docks SPAs

Table 11: Schedule of Estuarine Bird Surveys: South Shore Count Sectors S1 – S3

Wk Starting:	S1 Survey Date & Tide Time*						S2 Survey Date & Tide Time*						S3 Survey Date & Tide Time*					
	Low		Mid		High		Low		Mid		High		Low		Mid		High	
5 May 08	09/05/2008	10:57	-	-	-	-	09/05/2008	10:57	09/05/2008	15:23	-	-	09/05/2008	10:57	09/05/2008	15:23	-	-
12 May 08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19 May 08	21/05/2008	08:36	-	-	21/05/2008	15:43	21/05/2008	08:36	21/05/2008	12:09	21/05/2008	15:43	22/05/2008	09:08	21/05/2008	12:09	21/05/2008	15:43
26 May 08	28/05/2008	13:19	-	-	28/05/2008	08:10	28/05/2008	13:19	-	-	28/05/2008	08:10	28/05/2008	13:19	-	-	28/05/2008	08:10
2 June 08	05/06/2008	09:35	-	-	04/06/2008	14:59	05/06/2008	09:35	04/06/2008	11:54	04/06/2008	14:59	05/06/2008	09:35	04/06/2008	11:54	04/06/2008	14:59
9 June 08	09/06/2008	12:58	-	-	11/06/2008	08:45	09/06/2008	12:58	10/06/2008	10:48	11/06/2008	08:45	09/06/2008	12:58	10/06/2008	10:48	11/06/2008	08:45
16 June 08	17/06/2008	07:08	-	-	16/06/2008	13:20	17/06/2008	07:08	-	-	16/06/2008	13:20	17/06/2008	13:20	18/06/2008	11:11	16/06/2008	13:20
23 June 08	24/06/2008	11:12	-	-	26/06/2008	07:45	24/06/2008	11:12	25/06/2008	09:32	26/06/2008	07:45	24/06/2008	11:12	25/06/2008	09:32	26/06/2008	07:45
30 June 08	02/07/2008	07:43	-	-	30/06/2008	11:44	02/07/2008	07:43	01/07/2008	09:42	30/06/2008	11:44	02/07/2008	07:43	01/07/2008	09:42	30/06/2008	11:44
7 July 08	09/07/2008	12:51	-	-	11/07/2008	08:55	09/07/2008	12:51	10/07/2008	10:44	11/07/2008	08:55	09/07/2008	12:51	10/07/2008	10:44	11/07/2008	08:55
14 July 08	14/07/2008	18:01	-	-	16/07/2008	13:40	14/07/2008	18:01	15/07/2008	09:48	16/07/2008	13:40	14/07/2008	18:01	15/07/2008	09:48	16/07/2008	13:40
21 July 08	23/07/2008	10:53	-	-	25/07/2008	07:17	23/07/2008	10:53	23/07/2008	14:44	25/07/2008	07:17	23/07/2008	10:53	24/07/2008	09:01	25/07/2008	07:17
28 July 08	30/07/2008	06:37	-	-	01/08/2008	14:34	30/07/2008	06:37	29/07/2008	08:26	31/07/2008	13:39	30/07/2008	06:37	29/07/2008	08:26	31/07/2008	13:39
4 August 08	04/08/2008	10:43	-	-	07/08/2008	06:36	04/08/2008	10:43	-	-	07/08/2008	06:36	04/08/2008	10:43	06/08/2008	08:47	07/08/2008	06:36
11 August 08	14/08/2008	06:27	-	-	12/08/2008	11:30	14/08/2008	06:27	13/08/2008	15:16	12/08/2008	11:30	14/08/2008	06:27	13/08/2008	15:16	12/08/2008	11:30
18 August 08	19/08/2008	09:33	-	-	18/08/2008	15:52	19/08/2008	09:33	20/08/2008	13:36	18/08/2009	15:52	19/08/2008	09:33	20/08/2008	13:36	18/08/2008	15:52
25 August 08	28/08/2008	06:41	-	-	27/08/2008	11:23	28/08/2008	06:41	26/08/2008 29/08/2008	13:22 16:40	25/08/2008	08:42	28/08/2008	06:41	26/08/2008	13:22	28/08/2008	12:34
1 Sept 08	02/09/2008	10:06	-	-	03/09/2008	16:59	02/09/2008	10:06	05/09/2008	08:25	03/09/2008	16:59	02/09/2008	10:06	05/09/2008	08:25	03/09/2008	16:59
8 Sept 08	09/09/2008	15:54	-	-	10/09/2008	11:02	09/09/2008	15:54	11/09/2008	14:52	10/09/2008	11:02	09/09/2008	15:54	11/09/2008	14:52	10/09/2008	11:02
15 Sept 08	15/09/2008	07:56	-	-	17/09/2008	16:01	16/09/2008	08:32	-	-	17/09/2008	16:01	16/09/2008	08:32	-	-	17/09/2008	16:01
22 Sept 08	22/09/2008	12:24	-	-	24/09/2008	09:58	22/09/2008	12:24	25/09/2008	14:48	24/09/2008	09:58	22/09/2008	12:24	25/09/2008	14:48	24/09/2008	09:58
29 Sept 08	01/10/2008	09:26	-	-	30/09/2008	15:20	01/10/2008	09:26	02/10/2008	13:27	30/09/2008	15:20	01/10/2008	09:26	02/10/2008	13:27	30/09/2008	15:20
6 October 08	06/10/2008	11:09	-	-	08/10/2008	08:25	06/10/2008	11:09	09/10/2008	13:15	08/10/2008	08:25	06/10/2008	11:09	09/10/2008	13:15	08/10/2008	08:25
13 October 08	16/10/2008	08:33	-	-	14/10/2008	14:13	16/10/2008	08:33	15/10/2008	11:27	14/10/2008	14:13	16/10/2008	08:33	15/10/2008	11:27	14/10/2008	14:13
20 October 08	21/10/2008	12:28	-	-	22/10/2008	08:25	21/10/2008	12:28	23/10/2008	13:06	22/10/2008	08:25	21/10/2008	12:28	23/10/2008	13:06	22/10/2008	08:25
27 October 08	29/10/2008	08:30	-	-	27/10/2008	13:42	28/10/2008	08:07	30/10/2008	12:03	27/10/2008	13:42	28/10/2008	08:07	30/10/2008	12:03	27/10/2008	13:42
3 Nov 08	04/11/2008	10:47	-	-	06/11/2008	07:54	04/11/2008	10:47	05/11/2008	09:17	06/11/2008	07:54	04/11/2008	10:47	05/11/2008	09:17	06/11/2008	07:54
10 Nov 08	13/11/2008	07:28	12/11/2008	10:16	11/11/2008	12:56	13/11/2008	07:28	12/11/2008	10:17	11/11/2008	12:56	14/11/2008	08:07	12/11/2008	10:17	11/11/2008	12:56
17 Nov 08	18/11/2008	11:14	19/11/2008	09:53	20/11/2008	08:13	18/11/2008	11:44	19/11/2008	09:49	20/11/2008	08:13	18/11/2008	11:44	19/11/2008	09:49	21/11/2008	08:13
24 Nov 08	27/11/2008	07:57	26/11/2008	10:47	25/11/2008	13:13	28/11/2008	08:03	26/11/2008	10:47	25/11/2008	13:13	28/11/2008	08:03	26/11/2008	10:47	25/11/2008	13:13
Week start changed to Wednesday to fit tide times in during restricted daylight hours																		
3 Dec 08	04/12/2008	11:15	08/12/2008	13:28	09/12/2008	11:22	04/12/2008	11:15	08/12/2008	13:18	09/12/2008	11:22	04/12/2008	11:15	08/12/2008	13:28	09/12/2008	11:22
10 Dec 08	16/12/2008	10:39	15/12/2008	13:16	11/12/2008	13:13	16/12/2008	10:39	15/12/2008	13:16	11/12/2008	13:13	16/12/2008	10:39	15/12/2008	13:16	11/12/2008	13:13
17 Dec 08	17/12/2008	11:24	22/12/2008	13:57	23/12/2008	11:47	17/12/2008	11:24	22/12/2008	13:57	23/12/2008	11:47	17/12/2008	11:24	22/12/2008	13:57	23/12/2008	11:47
24 Dec 08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31 Dec 08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Week start returns to Monday																		
5 Jan 09	05/01/2009	13:24	06/01/2009	12:15	08/01/2009	11:49	05/01/2009	13:24	06/01/2009	12:15	08/01/2009	11:49	05/01/2009	13:24	06/01/2009	12:15	08/01/2009	11:49
12 Jan 09	15/01/2009	11:19	14/01/2009	13:59	12/01/2009	15:34	15/01/2009	11:19	14/01/2009	13:59	12/01/2009	15:34	15/01/2009	11:19	14/01/2009	13:59	12/01/2009	15:34
19 Jan 09	19/01/2009	13:57	21/01/2009	14:30	20/01/2009	09:55	19/01/2009	13:57	21/01/2009	14:30	20/01/2009	09:55	19/01/2009	13:57	21/01/2009	14:30	20/01/2009	09:55
26 Jan 09	28/01/2009	09:15	27/01/2009	12:08	26/01/2009	15:03	27/01/2009	08:38	28/01/2009	12:44	26/01/2009	15:03	27/01/2009	08:38	28/01/2009	12:44	26/01/2009	15:03
2 Feb 09	03/02/2009	11:51	-	-	05/02/2009	10:13	03/02/2009	12:43	04/02/2009	11:41	05/02/2009	10:13	03/02/2009	12:43	04/02/2009	11:41	05/02/2009	10:13
9 Feb 09	-	-	-	-	11/02/2009	16:05	-	-	11/02/2009	12:57	10/02/2009	15:19	-	-	11/02/2009	12:57	10/02/2009	15:19
16 Feb 09	19/02/2009	16:35	-	-	-	-	18/02/2009	14:56	19/02/2009	13:23	20/02/2009	11:36	18/02/2009	14:56	19/02/2009	13:23	24/02/2009	14:39

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Wk Starting:	S1 Survey Date & Tide Time*						S2 Survey Date & Tide Time*						S3 Survey Date & Tide Time*					
	Low		Mid		High		Low		Mid		High		Low		Mid		High	
23 Feb 09	27/02/2009	09:29	-	-	25/02/2009	15:15	27/02/2009	09:29	26/02/2009	12:23	25/02/2009	15:15	27/02/2009	09:29	26/02/2009	12:23	25/02/2009	15:15
2 Mar 09	04/03/2009	12:21	-	-	05/03/2009	08:40	04/03/2009	12:21	03/03/2009	15:36	05/03/2009	08:40	04/03/2009	12:21	03/03/2009	15:36	05/03/2009	08:40
9 Mar 09	12/03/2009	09:23	-	-	10/03/2009	14:14	12/03/2009	09:23	11/03/2009	11:54	10/03/2009	14:14	12/03/2009	09:23	11/03/2009	11:54	10/03/2009	14:14
16 Mar 09	18/03/2009	11:49	-	-	19/03/2009	07:56	18/03/2009	11:49	17/03/2009	15:07	19/03/2009	07:56	18/03/2009	11:49	17/03/2009	15:07	14/03/2009	17:02
23 Mar 09	26/03/2009	07:52	-	-	24/03/2009	13:29	25/03/2009	07:13	26/03/2009	10:49	24/03/2009	13:29	25/03/2009	07:13	25/03/2009	10:46	24/03/2009	13:29
30 Mar 09	01/04/2009	11:20	-	-	02/04/2009	07:25	01/04/2009	11:20	31/03/2009	14:48	02/04/2009	07:25	01/04/2009	11:20	31/03/2009	14:48	02/04/2009	07:25
6 Apr 09	09/04/2009	08:22	08/04/2009	10:49	08/04/2009	13:54	09/04/2009	08:22	08/04/2009	10:49	08/04/2009	13:54	09/04/2009	08:22	08/04/2009	10:49	08/04/2009	13:54
13 Apr 09	15/04/2009	10:48	16/04/2009	09:05	16/04/2009	06:37	15/04/2009	10:48	16/04/2009	09:05	16/04/2009	06:37	15/04/2009	10:48	16/04/2009	09:05	16/04/2009	06:37
20 Apr 09	20/04/2009	17:09	22/04/2009	09:26	21/04/2009	12:02	20/04/2009	17:09	21/04/2009	09:42	21/04/2009	12:02	20/04/2009	17:09	21/04/2009	09:42	21/04/2009	12:02
27 Apr 09																		

* Tide times represent the time of high or low tide at Rosyth (based on Admiralty Charts), or for mid tide, the time half-way between high and low tide. All times are GMT.

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Table 12: Schedule of Estuarine Bird Surveys: South Shore Count Sectors S4 – S5

Wk Starting:	S4 Survey Date & Tide Time*						S5 Survey Date & Tide Time*					
	Low		Mid		High		Low		Mid		High	
5 May 08	09/05/2008	10:57	09/05/2008	14:23	-	-	09/05/2008	101:57	-	-	-	-
12 May 08	-	-	-	-	-	-	-	-	-	-	-	-
19 May 08	22/05/2008	09:08	21/05/2008	12:09	21/05/2008	15:43	22/05/2008	09:08	-	-	21/05/2008	15:43
26 May 08	28/05/2008	13:19	-	-	28/05/2008	08:10	28/05/2008	13:19	-	-	28/05/2008	08:10
2 June 08	05/06/2008	09:35	04/06/2008	11:54	04/06/2008	14:59	05/06/2008	09:35	-	-	04/06/2008	14:59
9 June 08	10/06/2008	13:48	11/06/2008	11:47	12/06/2008	09:45	10/06/2008	13:48	-	-	12/06/2008	09:45
16 June 08	19/06/2008	08:17	18/06/2008	11:11	19/06/2008	15:23	19/06/2008	08:17	-	-	19/06/2008	15:23
23 June 08	24/06/2008	11:12	25/06/2008	09:32	26/06/2008	07:45	24/06/2008	11:12	-	-	26/06/2008	07:45
30 June 08	03/07/2008	08:44	02/07/2008	10:46	30/06/2008	11:44	03/07/2008	08:44	-	-	30/06/2008	11:44
7 July 08	09/07/2008	12:51	10/07/2008	10:44	11/07/2008	08:55	09/07/2008	12:51	-	-	11/07/2008	08:55
14 July 08	18/07/2008	08:00	17/07/2008	10:52	14/07/2008	11:58	18/07/2008	08:00	-	-	14/07/2008	11:58
21 July 08	21/07/2008	09:55	24/07/2008	09:01	22/07/2008	17:39	21/07/2008	09:55	-	-	22/07/2008	17:39
28 July 08	31/07/2008	07:45	30/07/2008	09:37	29/07/2008	11:28	31/07/2008	07:45	-	-	29/07/2008	11:28
4 August 08	04/08/2008	10:43	05/08/2008	14:30	07/08/2008	06:36	04/08/2008	10:43	-	-	07/08/2008	06:36
11 August 08	14/08/2008	06:27	13/08/2008	15:16	11/08/2008	10:18	14/08/2008	06:27	-	-	11/08/2008	10:18
18 August 08	20/08/2008	10:01	23/08/2008	09:17	18/08/2008	15:52	20/08/2008	10:01	-	-	23/08/2008	06:51
25 August 08	28/08/2008	06:41	25/08/2008	11:20	26/08/2008	10:01	28/08/2008	06:41	-	-	26/08/2008	10:01
1 Sept 08	04/09/2008	10:44	05/09/2008	08:25	03/09/2008	16:59	04/09/2008	10:44	-	-	03/09/2008	16:59
8 Sept 08	09/09/2008	15:54	11/09/2008	14:40	10/09/2008	11:02	11/09/2008	17:36	-	-	10/09/2008	11:01
15 Sept 08	18/09/2008	09:33	18/09/2008	13:05	16/09/2008	15:22	18/09/2008	09:33	-	-	16/09/2008	15:22
22 Sept 08	23/09/2008	14:46	25/09/2008	14:36	24/09/2008	09:58	23/09/2008	14:46	-	-	24/09/2008	09:58
29 Sept 08	01/10/2008	09:26	02/10/2008	13:02	30/09/2008	15:25	01/10/2008	09:26	-	-	30/09/2008	15:25
6 October 08	06/10/2008	11:09	08/10/2008	11:51	-	-	06/10/2008	11:09	08/10/2008	11:51	-	-
13 October 08	09/01/2008	16:20	10/10/2008	14:17	-	-	16/10/2008	08:33	-	-	-	-
20 October 08	21/10/2008	12:28	23/10/2008	13:01	22/10/2008	08:25	21/10/2008	12:28	-	-	22/10/2008	08:25
27 October 08	28/10/2008	08:07	29/10/2008	11:47	27/10/2008	13:42	28/10/2008	08:07	-	-	27/10/2008	13:42
3 Nov 08	04/11/2008	10:47	05/11/2008	09:17	06/11/2008	07:54	04/11/2008	10:47	-	-	06/11/2008	07:54
10 Nov 08	13/11/2008	07:28	12/11/2008	10:17	11/11/2008	12:56	13/11/2008	07:28	12/11/2008	10:26	11/11/2008	12:56
17 Nov 08	18/11/2008	11:14	19/11/2008	09:53	20/11/2008	08:13	18/11/2008	11:14	19/11/2008	09:49	20/11/2008	08:13
24 Nov 08	28/11/2008	08:03	26/11/2008	10:47	25/11/2008	13:13	27/11/2008	07:57	26/11/2008	10:47	25/11/2008	13:13
Week start changed to Wednesday to fit tide times in during restricted daylight hours												
3 Dec 08	05/12/2008	12:06	08/12/2008	13:28	09/12/2008	11:22	05/12/2008	12:06	08/12/2008	13:28	09/12/2008	11:22
10 Dec 08	16/12/2008	10:39	15/12/2008	13:36	11/12/2008	13:13	16/12/2008	10:39	15/12/2008	13:36	11/12/2008	13:13
17 Dec 08	17/12/2008	11:24	22/12/2008	13:57	23/12/2008	11:47	17/12/2008	11:24	22/12/2008	13:57	23/12/2008	11:47
24 Dec 08	-	-	-	-	-	-	-	-	-	-	-	-
31 Dec 08	-	-	-	-	-	-	-	-	-	-	-	-
Week start returns to Monday												
5 Jan 09	05/01/2009	13:24	06/01/2009	12:15	08/01/2009	11:49	05/01/2009	13:24	06/01/2009	12:15	08/01/2009	11:49
12 Jan 09	15/01/2009	11:19	14/01/2009	13:59	12/01/2009	09:24	15/01/2009	11:19	14/01/2008	13:59	12/01/2009	15:34
19 Jan 09	19/01/2009	13:57	21/01/2009	14:30	20/01/2009	09:55	19/01/2009	13:57	21/01/2009	14:30	20/01/2009	09:55
26 Jan 09	27/01/2009	08:38	27/01/2009	12:08	26/01/2009	15:03	27/01/2009	08:38	27/01/2009	12:08	26/01/2009	15:03
2 Feb 09	03/02/2009	12:43	04/02/2009	11:41	05/02/2009	10:13	04/02/2009	13:57	-	-	05/02/2009	10:13
9 Feb 09	-	-	11/02/2009	12:57	-	-	-	-	-	-	11/02/2009	16:05
16 Feb 09	18/02/2009	14:56	19/02/2009	13:23	-	-	18/02/2009	14:56	19/02/2009	13:23	20/02/2009	11:36
23 Feb 09	25/02/2009	08:17	26/02/2009	12:22	24/02/2009	14:39	27/02/2009	09:29	-	-	25/02/2009	15:15
2 Mar 09	04/03/2009	12:21	03/03/2009	15:36	05/03/2009	08:40	04/03/2009	12:21	-	-	05/03/2009	08:40
9 Mar 09	13/03/2009	09:56	11/03/2009	11:54	09/03/2009	13:22	-	-	-	-	09/03/2009	13:22
16 Mar 09	18/03/2009	11:49	17/03/2009	15:07	19/03/2009	07:56	18/03/2009	11:49	-	-	19/03/2009	07:56
23 Mar 09	25/03/2009	07:13	25/03/2009	10:40	24/03/2009	13:29	25/03/2009	07:13	-	-	24/03/2009	13:29
30 Mar 09	01/04/2009	11:20	30/03/2009	13:19	02/04/2009	07:25	01/04/2009	11:20	-	-	02/04/2009	19:55
6 Apr 09	09/04/2009	08:22	08/04/2009	10:49	08/04/2009	13:54	09/04/2009	08:22	08/04/2009	10:49	08/04/2009	13:54
13 Apr 09	15/04/2009	10:48	16/04/2009	09:07	16/04/2009	06:37	15/04/2009	10:48	16/04/2009	09:07	16/04/2009	06:37
20 Apr 09	20/04/2009	17:09	21/04/2009	08:43	21/04/2009	12:02	20/04/2009	17:09	21/04/2009	08:436	21/04/2009	12:02
27 Apr 09												

* Tide times represent the time of high or low tide at Rosyth (based on Admiralty Charts), or for mid tide, the time half-way between high and low tide. All times are GMT.

1.7 Migration Period Flight Activity Surveys

Aims

- 1.7.1 The proposed new bridge falls in an area regularly used by waterbirds moving between feeding and roosting areas in the inner and outer Forth Estuary. In addition, this area is an important flyway for migrating seabirds (e.g. Henty, 1993; Griffin, 1998) as well as other species such as raptors and passage waterbirds (MBEC, 2007; 2008). The aim of the surveys was to record the flight patterns of targeted bird species and their behavioural interactions with the existing Forth Road and Rail Bridges.
- 1.7.2 Surveys were timed to coincide with the peak migration/passage periods for birds in the spring and autumn. Surveys in autumn 2007 and spring 2008 were carried out by MBEC (MBEC 2007, 2008) and in autumn 2008 and spring 2009 by Jacobs Arup.

Survey method 2008/09

- 1.7.3 Surveys took place at the same six VPs used by Jacobs Arup in 2008 for the tern surveys (Table 1, Figure 6 of main report). Only one of these, the Port Edgar Harbour Breakwater, was the same as vantage points used in 2007 by MBEC (MBEC, 2007; 2008, Table 13). The MBEC north shore VP to the east of the Forth Rail Bridge (Carlingnose Point) was moved to a site at North Queensferry immediately to the east of the landfall of the Forth Rail Bridge; and the MBEC south shore VP to the east of the Forth Rail Bridge was moved from Whitehouse Point to Long Craig Pier. In each case the rationale was that the proposed new VPs were closer to the Forth Rail Bridge and afforded a better view of the behaviour of birds in the vicinity of the bridge.
- 1.7.4 A total of 3 - 5 hours per week were spent surveying at each VP between the end of August and November 2008 and during February to March 2009. Survey periods were timed to coincide with peak migration / passage periods and scheduled (where possible) to cover all tidal states. Because of the need to timetable survey work in advance and coordinate flight activity surveys with tidal counts there was little provision for flexibility in the timings so that weather conditions favourable for seabird migration could be selected, as was done by MBEC (2007, 2008). As the survey effort was intensive, no more than three hours of recording were normally undertaken during a single watch.
- 1.7.5 During each survey period, weather and tide conditions were recorded on an hourly basis. Surveyors prioritised recording the flight paths of target species. During autumn 2008, primary target species comprised gannets, auks, cormorants, skuas, swans, geese, ducks, grebes, sandpipers and allies, plovers including lapwings, oystercatchers (i.e. qualifying species of the Forth Islands and Firth of Forth SPAs), as well as Schedule 1 raptors of the Wildlife and Countryside Act 1981 (e.g. goshawk, hen harrier, hobby, honey buzzard, red kite and osprey). Other secondary species (all other raptors, waders, wildfowl not listed above and 'notable' gull and tern movements (i.e. not localised foraging/commuting). During spring 2009, herring gull and lesser black-backed gull were added to the list of primary target species.
- 1.7.6 Once selected a bird was followed using binoculars or a telescope until it flew out of sight or landed. Once the flight survey watch was complete the flight path and other details were recorded on survey sheets. These details comprised: bird species, number of birds, sex, age, start time, length of time that the bird was followed, initial flight height and whether the target bird crosses the road and/or rail bridge. If the bird crossed a bridge, any height changes when approaching and leaving the bridge and the distance from the bridge at which this change took place were recorded in addition to the crossing height. Height was recorded in six categories: 0-2m, 2-10m, 10-30m, 30-170m, 170-250m and above 250m. Crossing behaviour was recorded in the following categories: no change (NA); height change (HC); direction change (DC); abort (AB); flare (FL); near collision (NC); and collision

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(C). In autumn 2008 and spring 2009, an aborted flight was recorded if a bird flying towards a bridge and, apparently intending to cross, made a 180 degree turn within approximately 500m of the bridge; in autumn 2007 and spring 2008 aborted flights were apparently recorded at greater distances (up to about 2km) from the bridge. Immediately after a flight path watch was completed, each flight path was recorded on a map of the survey area (horizontal plane) and a schematic diagram of the bridges (vertical plane). During survey watches, weather and tide conditions were recorded on an hourly basis. Copies of survey recording sheets are included in Figures 7a - c.

Survey methods 2007

- 1.7.7 MBEC (2008) carried out migration period flight activity surveys between August and November 2007 and February to April 2008 from three VPs shown in Table 13 below. MBEC recorded bird flight heights in five height bands these were; 0-10m (VL), 10-50m (L), 50-170m (M), 170-250m (H) and >250m (VH) (MBEC 2008, 2007).

Table 13: Vantage Point Locations for Estuarine Bird Migration Period Flight Activity Surveys in autumn 2007 and spring 2008 (MBEC 2007, 2008)

Vantage Point	Grid Reference (6 figure)	Core / Wider	Notes
MBEC 1 East of Rail Bridge, North Shore Carlingnose Point	NT 135 806	n/a	n/a
MBEC 2 East of Rail Bridge, South Shore Whitehouse Point	NT 119 793	n/a	n/a
MBEC 3 W of Road Bridge, South Shore Port Edgar Harbour Breakwater	NT 125 805	n/a	n/a

Survey effort

- 1.7.8 Survey effort for flight activity watches in autumn 2008 and spring 2009 is shown in Tables 14 and 15 below.
- 1.7.9 A summary of survey effort for flight activity watches in autumn 2007 and spring 2008 is included in Table 16 below (From MBEC, 2008).

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Table 14: Survey effort for migration flight activity period surveys in autumn 2008

Week Starting	Vantage Point 1		Vantage Point 2		Vantage Point 3		Vantage Point 4		Vantage Point 5		Vantage Point 6	
	Survey date	Hours	Survey date	Hours	Survey date	Hours	Survey date	Hours	Survey date	Hours	Survey date	Hours
25 th August 2008	28/08	3	27/08	5	27/08	3	26/08	3	27/08	3	26/08	3
					28/08	2						
	Total	3	Total	5	Total	5	Total	3	Total	3	Total	3
1 st Sept 2008	03/09	2.5	03/09	1	02/09	2.5	04/09	2.5	04/09	3	04/09	3.5
	05/09	1	05/09	2.33	03/09	2.5	05/09	1	05/09	2.5		
	Total	3.5	Total	3.33	Total	5	Total	3.5	Total	5.5	Total	3.5
8 th Sept 2008	10/09	2.5	09/09	2.5	09/09	2.5	10/09	1	09/09	3.5	09/09	3
	11/09	2.5	10/09	2.5	10/09	2.5	11/09	2.5			11/09	2.51
	Total	5	Total	5	Total	5	Total	3.5	Total	3.5	Total	5.5
15 th Sept 2008	16/09	2.5	16/09	2.5	16/09	1	17/09	2.5	17/09	2.5	15/09	2
			17/09	2.5	17/09	2.5			18/09	2.5	18/09	2.5
	Total	2.5	Total	5	Total	3.5	Total	2.5	Total	5	Total	4.5
22 nd Sept 2008	22/09	1	23/09	2.5	22/09	3.5	24/09	2.5	23/09	1	23/09	1
	23/09	1	24/09	1.5	23/09	5	25/09	2.5	25/09	2.5	24/09	2.5
	24/09	2.5	25/09	1								
	Total	4.5	Total	5	Total	8.5	Total	5	Total	3.5	Total	3.5
29 th Sept 2008	01/10	5	30/09	2.5	01/10	2.5	30/09	2.5	01/10	2.5	01/10	2.5
			02/10	2.5	02/10	2.5	01/10	2.5			02/10	5
	Total	5	Total	5	Total	5	Total	5	Total	2.5	Total	7.5
6 th October 2008	07/10	2.5	07/10	2.5	06/10	1	08/10/	2.5	06/10	2	06/10	1.5
	09/10	2.5	10/10	2.5	08/10	2	09/10	0.92	08/10	2.24	08/10	3.5
					09/10	1.5			09/10	2.5		

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Week Starting	Vantage Point 1		Vantage Point 2		Vantage Point 3		Vantage Point 4		Vantage Point 5		Vantage Point 6	
	Survey date	Hours	Survey date	Hours	Survey date	Hours	Survey date	Hours	Survey date	Hours	Survey date	Hours
	Total	5	Total	5	Total	4.5	Total	3.42	Total	6.74	Total	5
13 th October 2008	15/10	3.2008	14/10	2.5	14/10	2.5	13/10	2.5	16/10	1.33	15/10	2.5
	16/10	2.5	15/10	2.5	15/10	2.5	14/10	2.5			16/10	2.5
	Total	5.58	Total	5	Total	5	Total	5	Total	1.33	Total	5
20 th October 2008	20/10	2.25	21/10	2.5	20/10	2.5	21/10	2.5	20/10	2.5	21/10	2.5
	22/10	2.5			22/10	3.5	22/10	2.5	22/10	2.5	23/10	2.5
					21/10	2.5						
	Total	4.75	Total	2.5	Total	8.5	Total	5	Total	5	Total	5
27 th October 2008	27/10	0.75	28/10	2.5	28/10	2.5	28/10	5	30/10	2.5	28/10	1.5
	29/10	2.5	29/10	2.5	29/10	2.5	30/10	2.5			29/10	3
	Total	3.25	Total	5	Total	5	Total	7.5	Total	2.5	Total	4.5
3 rd Nov 2008	05/11	2.5	04/11	2.17	04/11	1.16	05/11	1	04/11	2.5	06/11	3.5
	06/11	1.25	09/11	2.5	05/11	1.25	06/11	2.5	05/11	2.5	07/11	1
	07/11	2.5					07/11	1.5				
	Total	6.25	Total	4.67	Total	2.41	Total	5	Total	5	Total	4.5
Accumulated Total	48.33		50.5		57.41		48.42		43.57		51.5	

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Table 15: Survey effort for migration flight activity period surveys in Spring 2009

Week Starting	Vantage Point 1		Vantage Point 2		Vantage Point 3		Vantage Point 4		Vantage Point 5		Vantage Point 6	
	Survey date	Hours	Survey date	Hours	Survey date	Hours	Survey date	Hours	Survey date	Hours	Survey date	Hours
02 February 2009 (Week 40)	03/02	2.5	04/02	3.3	03/02	1.8	03/02	2.5	04/02	2.5	03/02	2.5
	03/02	2	05/02	4	03/02	0.8	04/02	1.2			05/02	1.2
	05/02	0.9			04/02	1.5					05/02	1.3
					05/02	1.0						
					05/02	1.5						
	Total	5.4	Total	7.3	Total	6.5	Total	3.7	Total	2.5	Total	5
09 February 2009 (Week 41)	Total	0	Total	0	Total	0	Total	0	Total	0	Total	0
16 February 2009 (Week 42)	17/02	2	18/02	2.5	20/02	1	17/02	2.5	18/02	2.5	19/02	1.5
			20/02	2	20/02	1	20/02	1.25			19/02	2.5
							25/02	1.25			20/02	2.5
	Total	2	Total	4.5	Total	2	Total	5	Total	2.5	Total	6.5
23 February 2009 (Week 43)	25/02	1.75	25/02	3	26/02	2.5	25/02	2.5	25/02	2.5	24/02	2.5
	25/02	1	26/02	2.5	27/02	2.5	27/02	2.5	26/02	3.25	25/02	1
	27/02	1									25/02	1
	27/02	1.5									25/02	1
											27/02	3.2
	Total	5.3	Total	5.5	Total	5	Total	3.7	Total	5.75	Total	8.7
02 March 2009 (Week 44)	03/03	1	03/03	1	02/03	2.5	03/03	1.25	03/03	2.5	04/03	1.5
	03/03	1	03/03	1.5	04/03	1	03/03	1.25	04/03	1	04/03	1
	04/03	1.5	06/03	2.5	05/03	1.5			04/03	1	04/03	2.5
	04/03	1							04/03	0.5		

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Week Starting	Vantage Point 1		Vantage Point 2		Vantage Point 3		Vantage Point 4		Vantage Point 5		Vantage Point 6	
	Survey date	Hours	Survey date	Hours	Survey date	Hours	Survey date	Hours	Survey date	Hours	Survey date	Hours
	04/03	1.5										
	05/03	1										
	Total	7	Total	5	Total	5	Total	2.5	Total	5	Total	5
09 March 2009 (Week 45)	10/03	2.5	11/03	2.5	10/03	2.5	10/03	1	10/03	2.5	09/03	1
	12/03	2.5	11/03	2.5			10/03	1.5			09/03	1
							10/03	1.5			10/03	2.5
							11/03	2.5			11/03	2
											11/03	0.5
Total	5	Total	5	Total	2.5	Total	7.5	Total	2.5	Total	7	
16 March 2009 (Week 46)	17/03	2.5	16/03	2.5	17/03	1	16/03	2.5	17/03	2.5	18/03	2
	18/03	1	18/03	2.5	17/03	4.5	17/03	2.5	18/03	1	18/03	2.5
	18/03	1			17/03	1			18/03	1		
	19/03	2.5			18/03	1.5			19/03	1.75		
	19/03	2.5			19/03	3.5			19/03	1.5		
					20/03	2.5			20/03	2.5		
Total	9.5	Total	5	Total	14	Total	5	Total	10.25	Total	4.5	
23 March 2009 (Week 47)	23/03	2.5	25/03	1	24/03	2.5	24/03	2.5	24/03	2.5	24/03	3
	27/03	2.5	26/03	1.5	25/03	1.5	25/03	2.5	25/03	2.5	26/03	2.5
					25/03	1	27/03	2.5				
					26/03	0.5						
					26/03	2						
Total	5	Total	2.5	Total	7.5	Total	7.5	Total	5	Total	5.5	
30 March 2009	31/03	1.25	31/03	2.5	01/04	1.75	31/03	1.25	31/03	2.5	30/03	2.5
	31/03	1.25	01/04	0.5	01/04	0.75	31/03	1.25	01/04	1.5	31/03	1

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Week Starting	Vantage Point 1		Vantage Point 2		Vantage Point 3		Vantage Point 4		Vantage Point 5		Vantage Point 6	
	Survey date	Hours	Survey date	Hours	Survey date	Hours	Survey date	Hours	Survey date	Hours	Survey date	Hours
(Week 48)			01/04	1			01/04	2.5	01/04	1	01/04	1.5
			02/04	2.5					02/04	2.5		
	Total	2.5	Total	6.5	Total	2.5	Total	5	Total	7.5	Total	5
Accumulated Total	39.17		41.3		45		41.2		41		47.2	

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Table 16: Survey effort for migration flight activity period surveys in autumn 2008 (from MBEC, 2008)

VP no.	Aug	Sep	Oct	Nov	Total 2007	Feb	Mar	Apr	Total 2008	Total
1	9	27	9		45	3	15	17	35	80
2	6	58		9	73			7	7	80
3	18	27	3		48	6	15	11	32	80
Totals	33	112	12	9	166	9	30	35	74	240

1.8 References

- 1.8.1 References cited in the text of this appendix are included in the reference list of the main report.