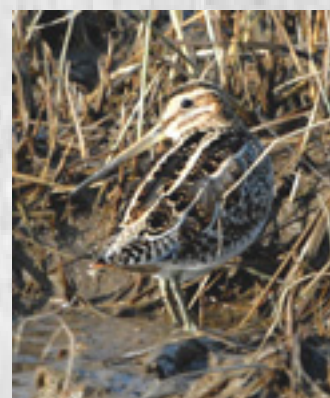
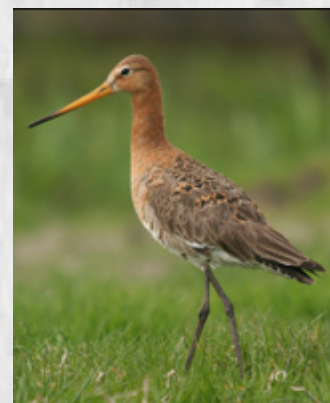
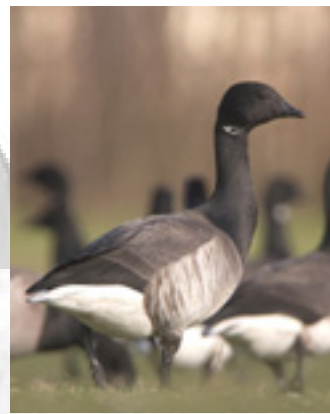


Caves Marsh Study

February - March 2007

*Spatial distribution of wintering
wader and wildfowl and the effects
of human activity on the site*

Prepared for
Fingal County Council
April 2007



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Prepared by:

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April 2007

Table of Contents

1. Introduction.....	1
2. Location and Study Area	2
2.1 Study area	2
2.2 Site status.....	3
3. Survey Methodology	4
4. Results.....	6
4.1 Survey results by section.....	6
4.1.1 Section A.....	6
4.1.2 Section B.....	7
4.1.3 Section C	8
4.1.4 Section D	9
4.1.5 Section E.....	10
4.1.6 Section R1	11
4.1.7 Section R2	12
4.1.8 Section R	13
4.2 Bird species recorded within Caves Marsh.....	14
4.2.1 Historical data	15
4.3 Spatial importance of sub-sections for bird species within Caves Marsh.....	16
4.4 Movement of bird species within Caves Marsh.....	18
4.4.1 Overview.....	18
4.4.2 Distribution and movement of key bird species within Caves Marsh.....	18
5. Human Activities and Impact	22
6. Conclusions	26
7. Recommendations	27
Bibliography and References	28

APPENDICES

Appendix 1: Bird species recorded in the Caves Marsh study area	29
Appendix 2: Photographs of human activity at Caves Marsh	32
Appendix 3: Map of FCC proposed developments at Caves Marsh.....	36

1. Introduction

Over the last ten years Fingal County Council has developed a series of public amenity pathways that fringe the Broadmeadow Estuary. They are part of the greater plan to provide Fingal with a series of coastal walking routes to promote amenity, health and recreational benefits for the public at large.

Caves Marsh is at present the only section of the southern shore of the Broadmeadow Estuary that is not linked into the existing pathway routes between Swords and Malahide.

Caves Marsh is an SPA and consequently important for birdlife. Fingal County Council's proposal to provide a pedestrian bridge across Caves Marsh linking the existing public pathways prompted this survey to be undertaken.

Fingal County Council commissioned the present study in January 2007. The overall aims were:

- To record the spatial distribution of all water bird species within the Caves Marsh boundaries.
- To record and monitor the human impact and disturbance on the site at each count visit.
- To record other significant bird species especially Annex 1 or birds of prey present at Caves Marsh at each count visit.
- To collect and collate any anecdotal, historical and published data relevant to this Caves Marsh survey.

2. Location and Study Area

2.1 Study area

Caves Marsh is located at O215467 on the southern shore of the Broadmeadow Estuary, Malahide, Co. Dublin. The site name describes a mosaic of habitat types around the Gaybrook River that drains into the area forming a small narrow subsidiary estuary. The area is bounded on its western edge by a public pathway that originates at Seatown East, Swords. This pathway follows the southern shore of the Broadmeadow Estuary and enters Caves Marsh at its northwest corner. The pathway is presently unfinished and terminates midway along the western boundary. The Sea Road, Malahide forms the eastern boundary of the Caves Marsh area. A range of habitats including salt marsh, areas of rank grassland, wet grassland, scrub, pebble foreshore, brackish pools and freshwater marsh are located between the Sea Road and the Gaybrook River estuary.

A public path leads from the Sea Road, Malahide along the southwestern edge of the site to allow pedestrian access to the Milford Estate.

Malahide Yacht Club has its premises, boatyard and slipways at the northeast boundary of Caves Marsh on the foreshore with an entrance off Sea Road, Malahide.

Figure 1. Map of Caves Marsh Survey Area



2.2 Site status

The Broadmeadow Estuary is internationally important for birds and has a designated SPA status. It is also listed as a Ramsar Site (Crowe 2005). The estuary has been the focus of systematic water birds monitoring since the early 1980's (Hutchinson 1989), Sheppard (1993). Monthly counts from September to March have been conducted since 1994 under I-WeBS (Irish Wetland Bird Survey)¹. Caves Marsh is one of a group of sub-sites within the inner Broadmeadow Estuary that is regularly counted as part of that systematic study. Caves Marsh has been shown to be an important feeding and roosting site for waders and wildfowl within the Broadmeadow complex (I-WeBS, Black, Nolan, and McNally in litt.).

¹ I-WeBS (Irish Wetland Bird Survey) is the national monitoring project for non-breeding waterbirds, wintering in Ireland, organised by BirdWatch Ireland, National Parks & Wildlife of the Department of the Environment, Heritage & Local Government and the Wildfowl and Wetlands Trust, and supported by The Heritage Council.

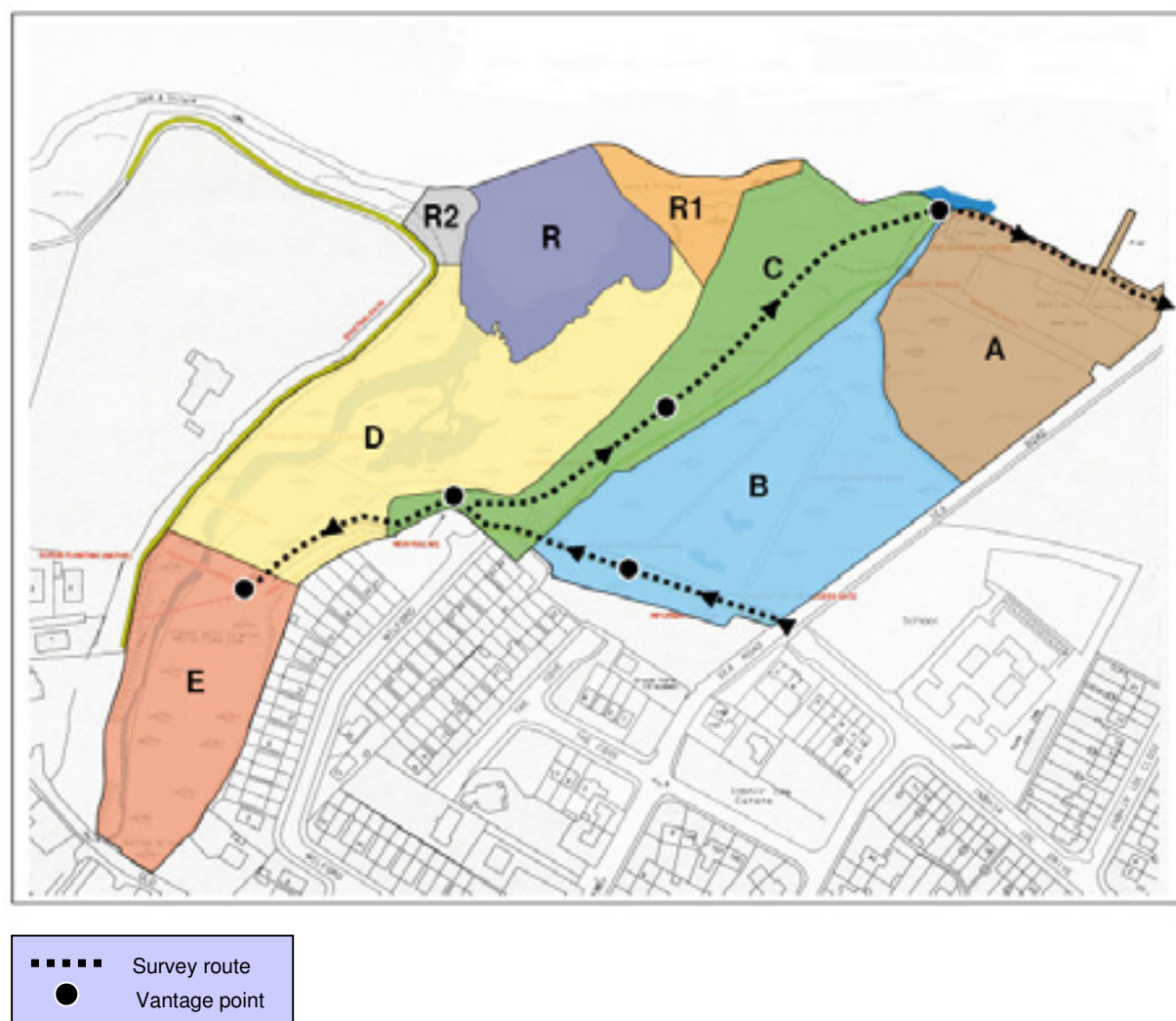
3. Survey Methodology

The Caves Marsh survey was undertaken between the dates 01 February - 31 March 2007. Visits were organised to provide an intensive survey of the “wintering bird” usage of the area. Visits were timed to occur at varying stages of the diurnal day and at varying times in the tidal cycle.

Each member of the survey team was issued with a set of large-scale maps of the area. Observations were carried out from suitable vantage points along an agreed and definite survey route. Each surveyor followed this route for each timed visit. In order to compare results the Caves Marsh system was divided into sections (see Figure 2).

The study site was subdivided into eight sections in order to map accurately the location and density of bird species and human disturbance within the Caves Marsh complex. The section divisions followed closely the dominant habitat types occurring within the study site. Species present were recorded by mapping onto the maps. Numbers present at specific locations were recorded, as was any significant movement of species from section to section. Priority was given to winter wading and wildfowl species and their distribution within the area. A new map was used for each site visit. Human presence, activities and disturbance factors were recorded and mapped for each site visit.

Figure 2. Map of study section divisions for Caves Marsh, Malahide February - March 2007



A total of 18 counts were undertaken. These comprised of 6 dawn, 6 midday and 6 dusk counts. (See Table 1)

Table 1: Dates and count times at Caves Marsh, Malahide. February-March 2007

Dawn	Midday	Dusk
18/02/2007 (0750-0850 hrs)	04/02/2007 (1520-1645 hrs)	02/02/2007 (1655-1800 hrs)
24/02/2007 (0730-0830 hrs)	03/03/2007 (1200-1300 hrs)	09/02/2007 (1650-1800 hrs)
09/03/2007 (0630-0735 hrs)	13/03/2007 (1300-1400 hrs)	02/03/2007 (1730-1840 hrs)
11/03/2007 (0715-0815 hrs)	21/03/2007 (1300-1400 hrs)	13/03/2007 (1700-1840 hrs)
25/03/2007 (0645-0745 hrs)	23/03/2007 (1200-1300 hrs)	21/03/2007 (1740-1840 hrs)
29/03/2007 (0635-0735 hrs)	24/03/2007 (1150-1300 hrs)	30/03/2007 (1830-1930 hrs)

4. Results

4.1 Survey results by section

4.1.1 Section A

Is located in the northeastern corner of the study site. The Sea Road forms its eastern boundary. The Malahide Sailing Club's premises, boatyards, pier and slipway dominate it. The premises extend along the foreshore area where this zone joins the Broadmeadow Estuary. An area of open wet grassland and freshwater marsh vegetation are found along its southern and western boundaries.

Ten bird species were recorded in Section A during the course of the survey (see Tables 2 and 3).

Table 2: Overview of bird species recorded in Section A

	Species	Visits recorded/ number survey visits	Peak count
1.	Black-headed Gull	1/18	3
2.	Common Gull	1/18	1
3.	Greenshank	1/18	1
4.	Little Egret	3/18	2
5.	Mallard	3/18	3
6.	Moorhen	3/18	2
7.	Oystercatcher	2/18	40
8.	Redshank	1/18	1
9.	Snipe	4/18	35
10.	Turnstone	3/18	6



Wet grassland area of Section A

Table 3: Survey results – Section A

Count date:	02/2	04/2	09/2	18/2	24/2	02/3	03/3	09/3	11/3	13/3	13/3	21/3	21/3	23/3	24/3	25/3	29/3	30/3
Black-headed Gull									3									
Common Gull							1											
Greenshank									1									
Little Egret						1			2							1		
Mallard					3				2								2	
Moorhen		1				1			2									
Oystercatcher							1		40									
Redshank							1											
Snipe	11			1												1	35	
Turnstone					1		1		6									
Total birds /visit	11	1	0	1	4	2	4	0	56	0	0	0	0	0	0	2	37	0

4.1.2 Section B

This section adjoins Section A and is divided from it by a freshwater stream outflow. The area is mix of both freshwater and saltwater marshes. It has areas of open freshwater and saline pools with a similar mix of vegetation types. It is low lying overall and is bounded by the Sea Road on its eastern side and the public pathway running from the Sea Road to the Milford Estate on its southern side. A raised embankment divides it from Section C along its western edge.

Seven bird species were recorded in Section B during the course of the survey (see Tables 4 and 5).

Table 4: Overview of bird species recorded in Section B

Species	Visits recorded/ number survey visits	Peak count
1. Grey Heron	3/18	1
2. Jack Snipe	1/18	1
3. Little Egret	5/18	3
4. Mallard	3/18	2
5. Moorhen	4/18	3
6. Snipe	12/18	31
7. Water Rail	2/18	1



Section B looking northwards

Table 5: Survey results – Section B

Count date:	02/2	04/2	09/2	18/2	24/2	02/3	03/3	09/3	11/3	13/3	13/3	21/3	21/3	23/3	24/3	25/3	29/3	30/3
Grey Heron												1				1	1	
Jack Snipe									1									
Little Egret			1				2					3			1			1
Mallard							2				2	1						
Moorhen					3			2			1							1
Snipe	5		15	3	1	15	1	11	15			2		31		10	3	
Water Rail			1														1	
Total birds /visit	5	0	17	3	4	15	5	13	16	0	3	7	0	31	1	11	5	2

4.1.3 Section C

This area is dominated by rough grassland, brambles some hawthorn scrub and low trees. The area has some salt marsh vegetation at its northern edge where it joins the pebble foreshore of the Broadmeadow Estuary. It is an area that does not flood and extends from the Milford Estate on its southern edge to the estuary. Its western side flanks the main saltmarsh zone Section D and shingle spit at R1.

Fifteen bird species were recorded in Section C during the course of the survey (see Tables 6 and 7).

Table 6: Overview of bird species recorded in Section C

	Species	Visits recorded/ number survey visits	Peak count
1.	Black-headed Gull	2/18	3
2.	Black-tailed Godwit	1/18	1
3.	Brent Goose	2/18	5
4.	Common Gull	1/18	35
5.	Greenshank	2/18	2
6.	Herring Gull	1/18	4
7.	Knot	1/18	60
8.	Mallard	1/18	2
9.	Oystercatcher	2/18	40
10.	Red-breasted Merganser	1/18	5
11.	Redshank	7/18	8
12.	Snipe	1/18	1
13.	Sparrowhawk	1/18	1
14.	Teal	1/18	1
15.	Turnstone	2/18	12



Section C: typical habitat

Table 7: Survey results – Section C

Count date:	02/2	04/2	09/2	18/2	24/2	02/3	03/3	09/3	11/3	13/3	13/3	21/3	21/3	23/3	24/3	25/3	29/3	30/3
Black-headed Gull					3				2									
Black-tailed Godwit				1														
Brent Goose					2				5									
Common Gull							35											
Greenshank					1											2		
Herring Gull									4									
Knot				60														
Mallard				2														
Oystercatcher				40												2		
Red-breasted Merganser				5														
Redshank				1	3		1	2	3						1	8		
Snipe																1		
Teal			1															
Turnstone				13							12							
Sparrowhawk						1												
Total birds /visit	0	0	1	122	9	1	36	2	14	0	12	0	0	0	1	13	0	0

4.1.4 Section D

This area dominates the main intertidal zone of Caves Marsh. It is composed entirely of saltmarsh vegetation and some brackish pools. It extends to both sides of the Gaybrook River estuary although the southern side has much more extensive vegetation. At periods of spring high tides the whole area can be submerged. For the purposes of this study its southern boundary follows the line of an old fence running across the salt marsh where the floodplain begins to narrow. The public pathway from Swords runs along the western edge of this section it becomes increasingly raised above the marsh as it extends southwards towards the Barrack Bridge. This pathway at present remains unfinished and peters out just south of the above-mentioned southern boundary of this section.

Fourteen bird species were recorded in Section D during the course of the survey (see Tables 8 and 9).

Table 8: Bird species recorded – Section D

Species	Visits recorded/ number survey visits	Peak count
1. Black-headed Gull	3/18	4
2. Black-tailed Godwit	4/18	12
3. Curlew	1/18	2
4. Greenshank	7/18	4
5. Grey Heron	1/18	1
6. Herring Gull	1/18	1
7. Kingfisher	1/18	1
8. Little Egret	8/18	2
9. Mallard	2/18	2
10. Mute Swan	1/18	2
11. Oystercatcher	1/18	2
12. Redshank	9/18	12
13. Shelduck	1/18	2
14. Snipe	4/18	4



Saltmarsh edge, Section D

Table 9: Survey results – Section D

Count date:	02/2	04/2	09/2	18/2	24/2	02/3	03/3	09/3	11/3	13/3	13/3	21/3	21/3	23/3	24/3	25/3	29/3	30/3
Black-headed Gull				1				4	1									
Black-tailed Godwit				2			7		12							1		
Curlew																2		
Greenshank		1		3	2		4	1			2					1		
Grey Heron	1																	
Herring Gull																1		
Kingfisher		1																
Little Egret		2	1	2	2		1		1	2				1				
Mallard								2						1				
Mute Swan														2				
Oystercatcher				2														
Redshank				3	2		8	4	2		12				2	1		3
Shelduck				2														
Snipe	1						1				2			3				
Total birds /visit	2	4	1	15	6	0	21	11	16	2	16	0	0	7	2	6	0	3

4.1.5 Section E

This is the southernmost corner of the Caves Marsh study site. The Gaybrook River enters the area under the Barrack Bridge and follows the western side of the small floodplain. The vegetation at the southern end of this sector is dominated by freshwater species that are gradually replaced by saltmarsh species as one approaches the boundary with Section D. The sector's eastern edge beside the Milford Estate comprises of thick hedges and scrub dominated by whitethorn and hawthorn. The western edge is an elevated embankment with grasses and winter heliotrope. The section's extreme southwestern corner would appear to cross private property.

Six bird species were recorded in Section E during the course of the survey (see Tables 10 and 11).

Table 10: Bird species recorded – Section E

Species	Visits recorded/ number survey visits	Peak count
1. Grey Heron	1/18	1
2. Kingfisher	1/18	1
3. Little Egret	2/18	1
4. Mallard	1/18	2
5. Snipe	1/18	1
6. Sparrowhawk	1/18	1



Freshwater marsh in Section E

Table 11: Survey results – Section E

Count date:	02/2	04/2	09/2	18/2	24/2	02/3	03/3	09/3	11/3	13/3	13/3	21/3	21/3	23/3	24/3	25/3	29/3	30/3
Grey Heron												1						
Kingfisher	1																	
Little Egret							1									1		
Mallard																	2	
Snipe							1											
Sparrowhawk															1			
Total birds /visit	1	0	0	0	0	0	2	0	0	0	0	1	0	0	1	1	2	0

4.1.6 Section R1

This section is an area of saltmarsh and shingle spit that extends northwestwards into the Broadmeadow Estuary. The extent of shingle spit and associated inter-tidal zones vary with the height of the tides. The spit however never covers completely and thus provides a safe and reliable roost site for birds. It is generally the least disturbed area within the Caves Marsh study site. At times of very low tide some areas of mud become available for feeding birds along its northern edge.

Table 12: Bird species recorded – Section R1

	Species	Visits recorded/ number survey visits	Peak count
1.	Bar-tailed Godwit	1/18	50
2.	Black-headed Gull	14/18	100
3.	Black-tailed Godwit	5/18	35
4.	Brent Goose	4/18	23
5.	Common Gull	5/18	5
6.	Curlew	2/18	1
7.	Dunlin	1/18	100
8.	Great black-backed Gull	3/18	1
9.	Greenshank	6/18	6
10.	Grey Plover	2/18	10
11.	Herring Gull	7/18	13
12.	Knot	1/18	1
13.	Little Egret	1/18	2
14.	Mute Swan	1/18	1
15.	Oystercatcher	10/18	60
16.	Redshank	15/18	60
17.	Shelduck	1/18	2
18.	Turnstone	6/18	80
19.	Sparrowhawk	1/18	1

Nineteen bird species were recorded in Section R1 during the course of the survey (see Tables 12 and 13).



Section R1

Table 13: Survey results – Section R1

Count date:	02/2	04/2	09/2	18/2	24/2	02/3	03/3	09/3	11/3	13/3	13/3	21/3	21/3	23/3	24/3	25/3	29/3	30/3
Bar-tailed Godwit								50										
Black-headed Gull	50	100	100	80	70		24	80	12		3	8	1			6	10	3
Black-tailed Godwit			2		15			35			6							
Brent Goose					23			5	18							2		
Common Gull		2		3		2									1		5	
Curlew				1				1										
Dunlin			100															
Great Black-backed Gull				1					1				1					
Greenshank	1		4		1	4		6									2	
Grey Plover			10	1														
Herring Gull		4		13				2		2		3			2		6	
Knot								1										
Little Egret																	2	
Mute Swan														1				
Oystercatcher	1	40	26	60	50	6	15	30		60						6	30	
Redshank	1		50	13	10	4	5	25	5		38	9	3		6	20	60	7
Shelduck																		2
Sparrowhawk								1										
Turnstone				2		80		4		2					2	4		
Total birds /visit	53	146	292	174	169	94	46	240	36	64	47	20	5	1	11	38	115	12

4.1.7 Section R2

This is a small spit land containing elevated saltmarsh and muddy intertidal margins that extends into the Broadmeadow Estuary on the extreme northwestern corner of the study site. It and Section R1 together combine to enclose a small sheltered bay. At periods of very low tides muddy margins extend into the Broadmeadow Estuary off this point to provide useful feeding areas for birds. Birds roost and feed here but the area is very prone to disturbance as it lies alongside the Swords public pathway.

Twelve bird species were recorded in Section R2 during the course of the survey (see Tables 14 and 15).

Table 14: Bird species recorded – Section R2

Species	Visits recorded/ number survey visits	Peak count
1. Bar-tailed Godwit	1/18	20
2. Black-headed Gull	4/18	10
3. Black-tailed Godwit	3/18	2
4. Brent Goose	3/18	270
5. Greenshank	3/18	2
6. Grey Heron	1/18	1
7. Grey Plover	2/18	8
8. Herring Gull	1/18	1
9. Oystercatcher	2/18	130
10. Redshank	6/18	6
11. Shelduck	2/18	2
12. Turnstone	2/18	4



Section R2

Table 15: Survey results – Section R2

Count date:	02/2	04/2	09/2	18/2	24/2	02/3	03/3	09/3	11/3	13/3	13/3	21/3	21/3	23/3	24/3	25/3	29/3	30/3
Bar-tailed Godwit								20							3			
Black-headed Gull					10		2	5	1									
Black-tailed Godwit					1									2				
Brent Goose								270	2	4								
Greenshank					1			1	2									
Grey Heron														1				
Grey Plover							1				8							
Herring Gull				1														
Oystercatcher									130									2
Redshank					1		2	2	2				6	3				
Shelduck								1					2					
Turnstone									2		4							
Total birds /visit	0	0	0	0	13	0	275	31	141	0	12	0	8	6	3	0	0	2

4.1.8 Section R

This describes the small bay and intertidal area lying between Sections R1, R2 and D. For most tidal ranges the area is under water but gets shallow enough for birds to feed in. At times of very low water it dries to give exposed muddy estuarine conditions ideal for many species to feed in.

Eleven bird species were recorded in Section R during the course of the survey (see Tables 16 and 17).

Table 16: Bird species recorded – Section R

	Species	Visits / number survey visits	Peak count
1.	Bar-tailed Godwit	1/18	4
2.	Black-headed Gull	3/18	20
3.	Black-tailed Godwit	1/18	10
4.	Brent Goose	3/18	205
5.	Cormorant	1/18	1
6.	Great Crested Grebe	3/18	4
7.	Greenshank	4/18	6
8.	Mute Swan	3/18	7
9.	Red-breasted Merganser	4/18	10
10.	Redshank	4/18	114
11.	Shelduck	4/18	5



Section R

Table 17: Survey results – Section R

Count date:	02/2	04/2	09/2	18/2	24/2	02/3	03/3	09/3	11/3	13/3	13/3	21/3	21/3	23/3	24/3	25/3	29/3	30/3
Bar-tailed Godwit															4			
Black-headed Gull							12			20				10				
Black-tailed Godwit										10								
Brent Goose											2	205					30	
Cormorant													1					
Great Crested Grebe	2							4									2	
Greenshank									1	5	6				1			
Mute Swan						7			2				2					
Red-breasted Merganser					10			4	1								2	
Redshank										90	114				22			12
Shelduck					5	2		2									4	
Total birds /visit	2	0	0	0	15	9	12	10	4	125	122	205	3	10	27	0	38	12

4.2 Bird species recorded within Caves Marsh

A total of 30 “wintering” species were recorded at Caves Marsh during the survey (see Table 18). It is interesting to see that this number is consistent with the overall number of species regularly occurring at the Broadmeadow Estuary during I-WeBS counts (Crowe 2005). The most frequently recorded species were Redshank, Black-headed Gull, Little Egret and Greenshank.

Table 18: Species Recorded during Caves Marsh Survey, Feb. – Mar. 2007

	Species	Scientific name	Visits recorded/ survey visits	Peak count (entire site)
1.	Great Crested Grebe	<i>Podiceps cristatus</i>	3/18	4
2.	Cormorant	<i>Phalacrocorax carbo</i>	1/18	1
3.	Little Egret ¹	<i>Egretta garzetta</i>	14/18	4
4.	Grey Heron	<i>Ardea cinerea</i>	6/18	1
5.	Mute Swan	<i>Cygnus olor</i>	4/18	7
6.	Light-bellied Brent Goose ²	<i>Branta bernicla hrota</i>	8/18	270
7.	Shelduck	<i>Tadorna tadorna</i>	7/18	5
8.	Teal	<i>Anas crecca</i>	1/18	1
9.	Mallard	<i>Anas platyrhynchos</i>	9/18	4
10.	Red-breasted Merganser	<i>Mergus serrator</i>	5/18	10
11.	Moorhen	<i>Gallinula chloropus</i>	7/18	3
12.	Water Rail	<i>Rallus aquaticus</i>	2/18	1
13.	Oystercatcher	<i>Haematopus ostralegus</i>	13/18	170
14.	Grey Plover ³	<i>Pluvialis squatarola</i>	4/18	10
15.	Knot ³	<i>Calidris canutus</i>	2/18	60
16.	Dunlin	<i>Calidris alpina</i>	1/18	100
17.	Snipe ³	<i>Gallinago gallinago</i>	13/18	38
18.	Jack Snipe	<i>Lymnocyptes minimus</i>	1/18	1
19.	Black-tailed Godwit ³	<i>Limosa limosa</i>	10/18	55
20.	Bar-tailed Godwit ³	<i>Limosa lapponica</i>	2/18	50
21.	Curlew	<i>Numenius arquata</i>	3/18	2
22.	Redshank	<i>Tringa totanus</i>	17/18	164
23.	Greenshank ³	<i>Tringa nebularia</i>	14/18	8
24.	Turnstone ³	<i>Arenaria interpres</i>	10/18	80
25.	Black-headed Gull	<i>Larus ridibundus</i>	16/18	100
26.	Common Gull	<i>Larus canus</i>	5/18	38
27.	Herring Gull	<i>Larus argentatus</i>	9/18	14
28.	Great Black-backed Gull	<i>Larus marinus</i>	3/18	1
29.	Kingfisher ¹	<i>Alcedo atthis</i>	2/18	1
30.	Sparrowhawk	<i>Accipiter nisus</i>	3/18	1

¹ Species included in Annex I of the EU Birds Directive

² Species of international importance

³ Species of regional significance

Broadmeadow Estuary is internationally important for Brent Geese and Black-tailed Godwit and nationally important for a further 12 species. (Crowe 2005).

This study had shown that Caves Marsh is a significant sub-site within the greater Broadmeadow estuarine network.

The study found regionally important numbers of five species of waders occurring within Caves Marsh. The peak numbers for four of the species, Knot, Black-tailed Godwit, Bar-tailed Godwit and Greenshank are not altogether surprising. These species occur in nationally important numbers within the Broadmeadow Estuary. Nevertheless they are significant given the small size of Caves Marsh relative to the main estuary. The peak number of Turnstone recorded is of particular interest as it is regionally important and this species is not listed of significance for the Broadmeadow Estuary.

The methodology used in this survey recorded a peak count for Snipe of 38 birds. All the survey team commented that this species was under recorded. Caves Marsh is well known to hold 50+ birds as well as small numbers of Jack Snipe. They consistently and annually can be found in Sections A and B but require a different survey technique. (Nolan, Black, Mc Nally *pers comms*). Little Egret, Grey Heron, Mallard, Moorhen, Water Rail and Kingfisher were recorded in these sections. The freshwater marsh has good species diversity albeit in low numbers at present. The site is of regional significance and with controlled access and sympathetic habitat management it could be enhanced further to develop its importance.

4.2.1 Historical data

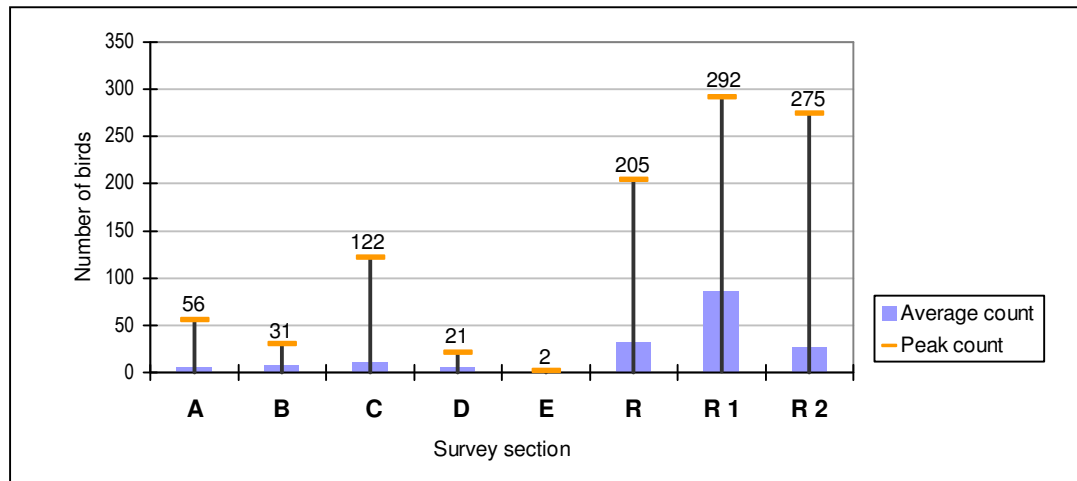
The birdlife of Caves Marsh is well known and has been the focus of several site-specific studies. Nolan (2000) compiled a species list indicating the wide diversity of birds both breeding and wintering on site. He also clearly outlined the disturbance threats to the area. An intensive monthly study of Caves Marsh was undertaken in 2005 (Black 2005). Counts were of one-hour duration with random start times. This provided very useful baseline data of the breeding species and important data on species not included in I-WeBS. The report mapped all species present on each site visit. Both reports mirror closely the results of the present study. Both reports Nolan (2000) and Black (2005) were copied to Fingal County Council.

A list of species recorded at the Caves Marsh study site is presented in Appendix 1.

4.3 Spatial importance of sub-sections for bird species within Caves Marsh

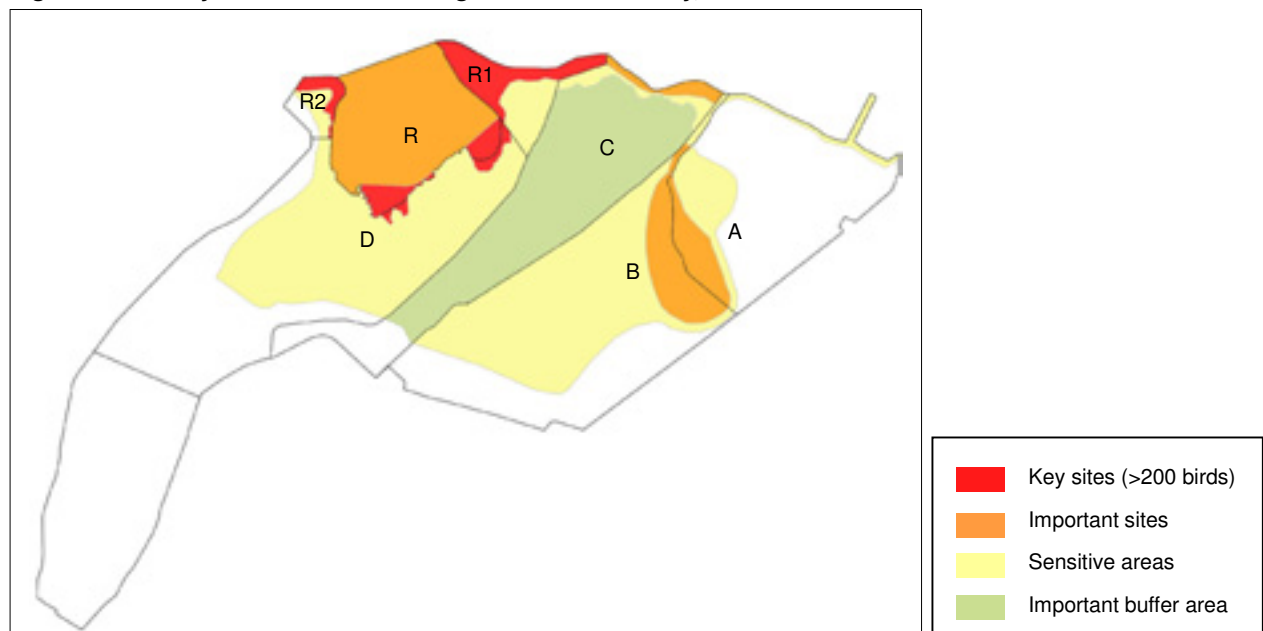
The survey results indicate the importance of Sections R1, R2, R and C for birds. These areas consistently held the most amounts of bird species both feeding and roosting. Of the three, R1 is the most significant section within the whole Caves Marsh complex (see Figure 3). It is the main roost site and at most full tide periods when enough of the spit remains exposed to provide safe roosting for birds. Its position within the Marsh allows birds to roost and feed if walkers do not directly approach the area.

Figure 3. Average count and peak densities by section



Section R2 is a smaller roost location and while birds do use the site it is very prone to disturbance from walkers and dogs on the Swords pathway. Section R at most stages of the tide is covered by water but does dry at times of extreme low water to give large areas of mudflat on which birds can feed. This also occurs at Sections R1, R2, D and C giving increased muddy foreshore areas for birds to feed in. Birds were observed moving between Sections R1, R2, R and D. Numbers however were small. In Section C the birds found were concentrated along its foreshore edge with the Broadmeadow Estuary. Bird numbers varied with the tide levels and disturbance factors. When disturbed birds filtered towards the main roost at R1.

Figure 4. Key sites identified during Caves Marsh study, Feb. - Mar. 2007



Section D during the course of this study held few birds overall. The saltmarsh and foreshore areas could be expected to hold more feeding birds. Limited movement of very small numbers of birds like Redshank, Black-headed Gull and Greenshank were observed to move from Sections R1, R2, R to D and vice versa. However it is clear that Section D at present is too open; is totally unscreened and consequently very easily disturbed. Birds attempting to feed here are not given sufficient time to settle. The small and rather enclosed nature is already a deterrent to many species; this coupled with frequent disturbance explains the low numbers occurring in this section.

Section E has very little feeding or roosting importance for wildfowl or wading birds in its present state. The Gaybrook River is blocked with debris and over grown with plant life. However, Kingfisher, Little Egret and Sparrowhawk were recorded and Mallard displaying signs of breeding activity were noted during the survey period. It is at present very heavily used by walkers, dogs, cyclists and children playing or crossing the Caves Marsh estuary. The area could be managed to diversify the habitat potential with work on river clearance the provision of freshwater pools and control of pedestrian traffic.

4.4 Movement of bird species within Caves Marsh

4.4.1 Overview

The amount of movement of birds moving between the various sections of the marsh was found to be low. Limited movement of small numbers of bird species was recorded. Redshank, Black-headed Gull, Greenshank were observed moving between Sections R1, R2, R, C and D. Black-tailed Godwit were observed to move from R1 to D and vice versa, from R1 to R2 and from C to R1. Grey Heron, Little Egret and Kingfisher were the only species recorded that were found to move between Sections A, B, C, D, E, and R1. The vast majority of species were found at Sections R1, R2 or R.

Two counts during the course of this survey found internationally important numbers of Brent Geese present within the Caves Marsh study area. Over the course of the study Brent Geese were found predominantly in Sections R1, R2, R with very small numbers at the foreshore of C. Birds were found to be feeding along the shoreline and on the edge of the saltmarsh vegetation of R2 in particular. When disturbed birds moved from R1 to R2 and vice versa or were forced to leave the area.

Peak counts of Knot, Black-tailed Godwit, Bar-tailed Godwit, Greenshank and Turnstone recorded during this survey are close to being half the national importance threshold value (Crowe 2005). In practically all cases these birds were found in Sections R1, R, R2, D or on the Broadmeadow shoreline of C.

Turnstones were found almost exclusively at R1 with smaller numbers recorded at C and A, but always concentrated on the Broadmeadow Estuary shoreline edges. Birds were observed to fly in to roost after dark at R1 on one occasion.

Snipe were most frequently recorded at dawn and dusk counts as birds flew from Sections A and B out to feed. In nearly all observations Snipe flew west or northwest out of the Caves Marsh area. The methodology used in this survey gave a peak count for Snipe of 38.

Little Egret was one of the few species that was recorded in nearly all sections of Caves Marsh. Although only small numbers were recorded, it was remarkably consistent in its presence. Birds were recorded feeding in Sections A, B, C, D, E and R1 and were observed to move within the marsh when disturbed. Birds were observed to fly from the area towards Malahide Demesne at dusk to roost (Nolan *pers obs*) and also to return at dawn from the same roost site to feed.

Kingfisher was recorded on two occasions in Sections E and B while Water Rail was recorded on two occasions also in Section B.

The effects of human activities to the site caused much of the movement observed. When disturbance was from the east birds were observed flying along the foreshore areas of A and C to R1. At times when disturbance was from the western side birds moved from R2, D and E to R1. At times when disturbance was from both directions birds filtered firstly to R1 and remained there unless it too was approached which forced birds to leave the area. All sectors would benefit from fewer disturbances.

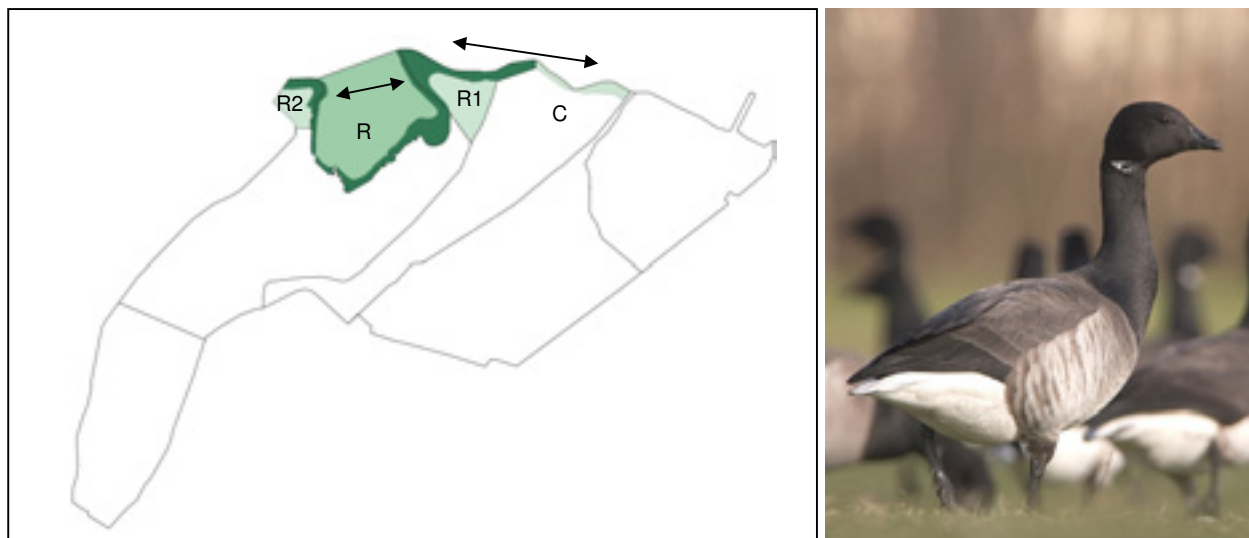
4.4.2 Distribution and movement of key bird species within Caves Marsh

The following section illustrates the distribution and the movement of six key species between survey sections.

Light-bellied Brent Goose

Are the most important species found within the Caves Marsh system. They are found predominantly along the foreshore areas of R1, R2, R and C. The species was found to feed in good numbers in the saltmarsh zone of Section R2 but surprisingly not in the larger saltmarsh zone of Section D. The enclosed nature of Section D and frequent disturbance may be a factor.

Figure 5. Light-bellied Brent Goose distribution and movement

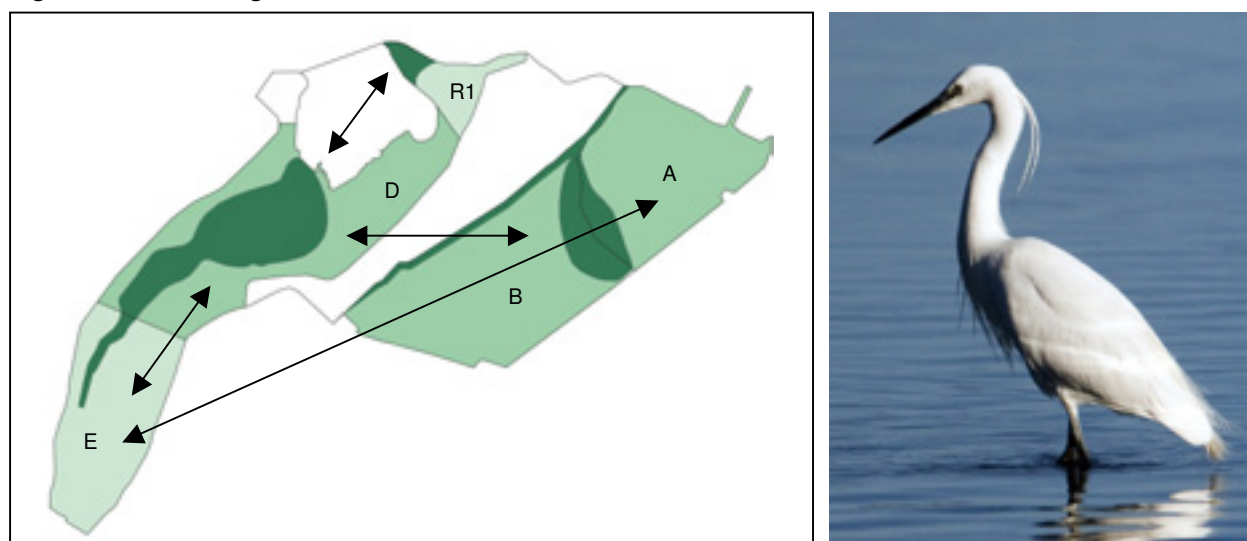


Light-bellied Brent Goose *Branta bernicla hrota*

Little Egret

This species was another of the most frequently recorded species during the survey. Caves Marsh is an important feeding area for Little Egret. It was found to feed in most of the sectors but especially favoured Sections D, B, A, and occasionally E. It was found to favour the freshwater margins and once disturbed would fly to R1 and return as soon as possible to those areas once the source of initial disturbance ceased. The species was recorded flying from Caves Marsh to roost in the nearby Malahide Demense at dusk and return to the area at dawn.

Figure 6. Little Egret distribution and movement

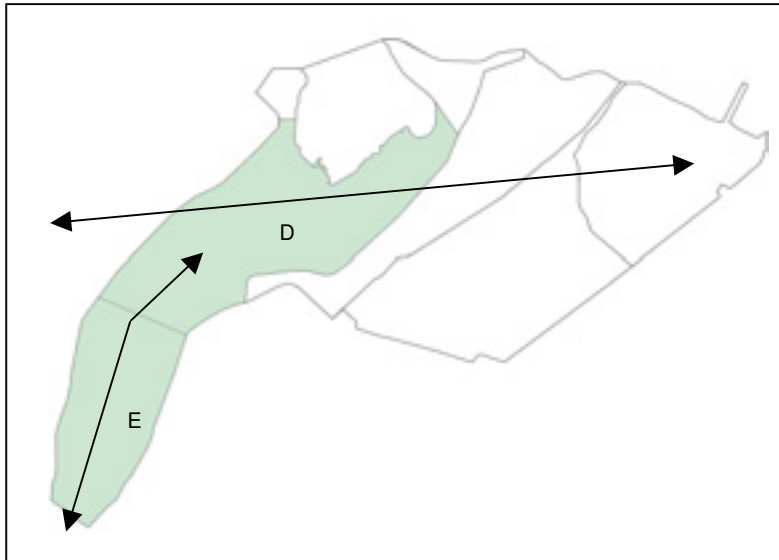


Little Egret *Egretta garzetta*

Kingfisher

This species was only recorded twice during the course of the study. On both occasions it was found on the freshwater habitats of Section E and Section D. Although scarce, the species is known to be regular at Caves Marsh (Nolan, Black, Mc Nally, *pers comms*).

Figure 7. Kingfisher distribution and movement

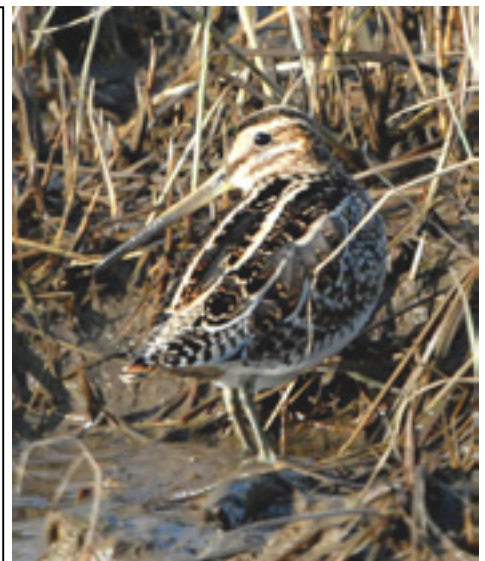


Kingfisher *Alcedo atthis*

Snipe

This species is one of the most frequently recorded during the survey. It is the most numerous bird within the freshwater marsh areas and occurs in regionally significant numbers. Highest concentrations were found in Sections A and B. Snipe fly out of the area both dawn and dusk to feed on surrounding farmland and other parts of the Broadmeadow Estuary.

Figure 8. Snipe distribution and movement

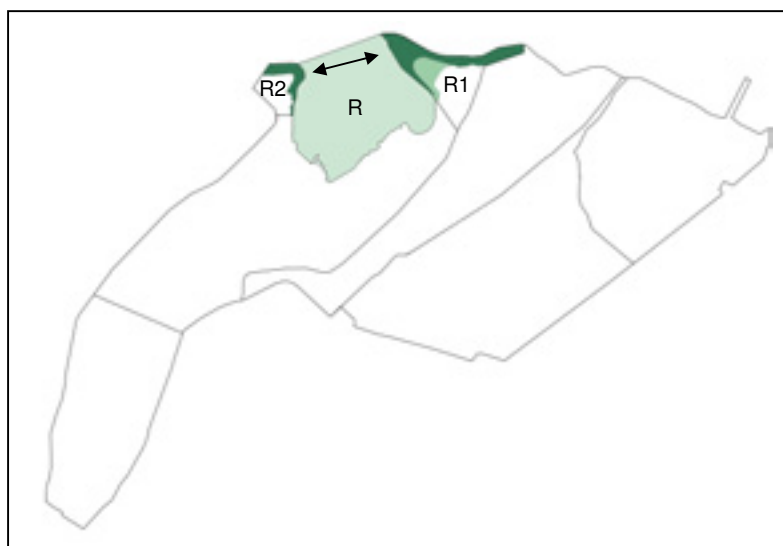


Snipe *Gallinago gallinago*

Bar-tailed Godwit

This species is found in nationally important numbers on the Broadmeadow Estuary and thus not surprisingly occurs in good numbers at Caves Marsh. The muddy texture to the substrate at Caves Marsh is not ideal for the species and in most cases records refer to roosting birds. The numbers at peak counts are of regional importance.

Figure 9. Bar-tailed Godwit distribution and movement

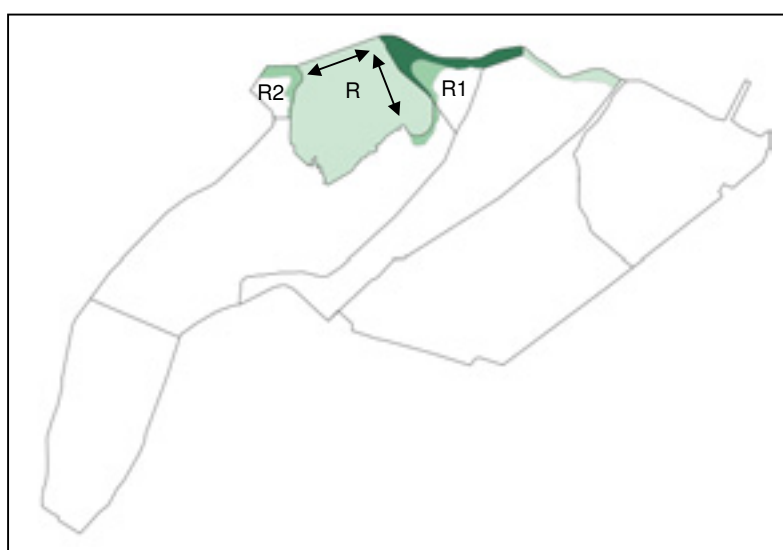


Bar-tailed Godwit *Limosa lapponica*

Black-tailed Godwit

Broadmeadow Estuary is internationally important for this species so its occurrence in regionally important numbers at Caves Marsh is predictable. Birds both feed and roost at Caves Marsh with peak numbers generally coinciding with periods of spring low tides that expose larger areas of muddy foreshore to exploit.

Figure 10. Black-tailed Godwit distribution and movement



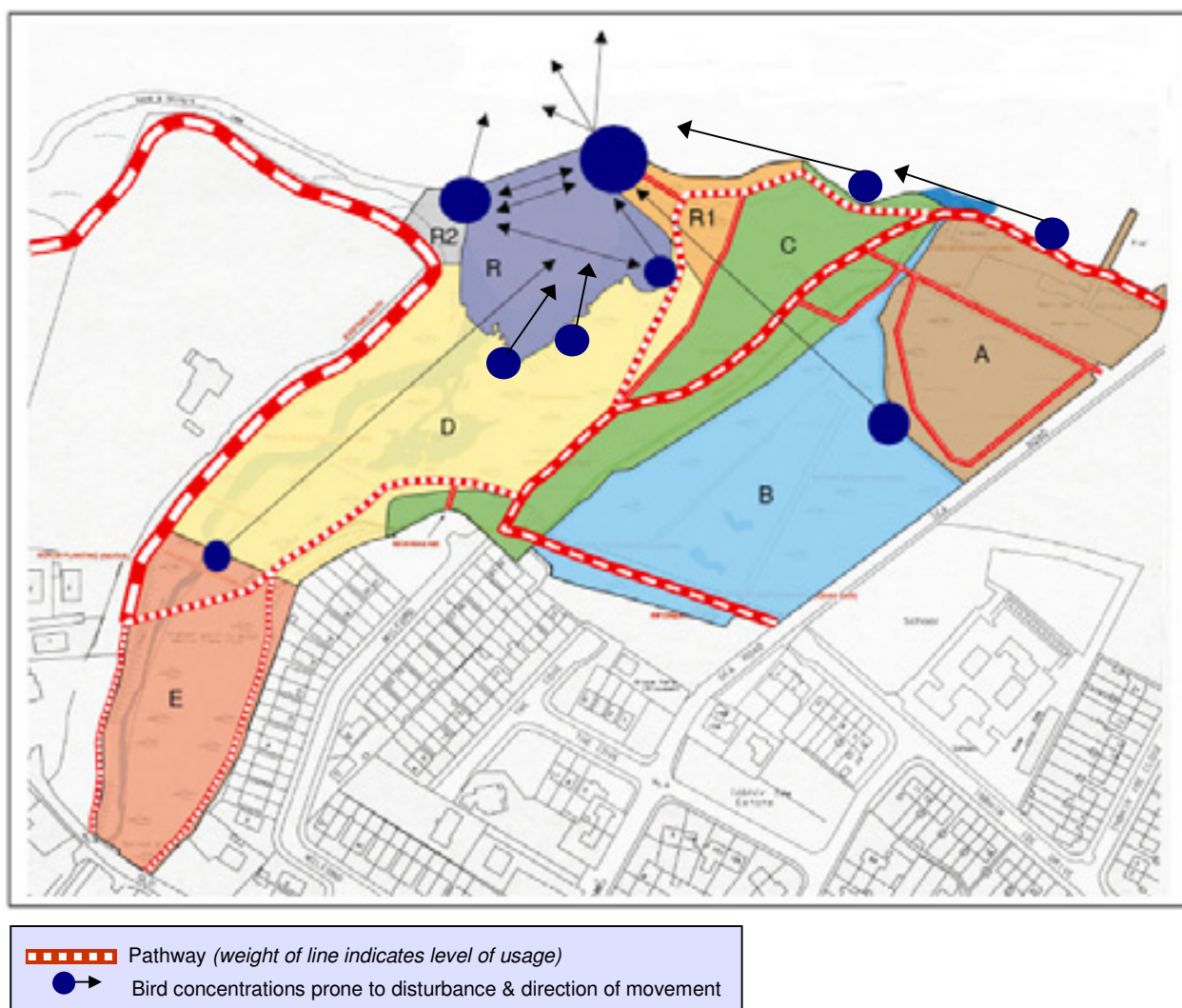
Black-tailed Godwit *Limosa limosa*

5. Human Activities and Impact

The most frequently recorded usage is people walking through the area generally accompanied by dogs. In all cases, observed by the survey team, dogs were unleashed and allowed to roam freely throughout the area. Evidence of a wide range of human impact activities on the marsh was recorded during the survey period. These included, cycling, motorbike scrambling, vegetation burning, children's play camps and drinking party zones (see Appendix 2). In most of these cases the disturbance impact on the wildlife was considerable. It was obvious to the survey team that human disturbance to the wildlife is inevitable at present in Caves Marsh. The site is relatively small and the inter-visibility between each section is very high. In addition to the random access issues both the formal pathways, Swords and Milford, are well raised above the surrounding marsh levels. Both are completely unscreened and unfenced allowing entry at any point onto the sections they border. All pedestrians utilising the pathways are highly visible to the birdlife.

The results of this survey indicate that Caves Marsh is heavily utilised by the public and that the disturbance impact on the birdlife is regular, frequent and significant. At present pedestrian access to the area is unlimited and uncontrolled. The whole area is criss-crossed by random pathways. Figure 11 illustrates this network of pathways and the flight direction of birds as a result of disturbance.

Figure 11. Network of pathways through Caves Marsh, February-March 2007



The Sections D, R2 and E are particularly affected by human traffic. The Swords pathway is popular and follows the western edge of Caves Marsh. Birds attempting to roost or feed in these sections are flushed as soon as people and especially dogs enter the marsh area. Birds fly to Section R1 or the foreshore edge of Section D if there is no disturbance there. People entering Caves Marsh from the eastern routes cause birds to fly from Sections A, B and C to R1. People who continue towards R1 force the birds to depart the area completely (see Figure 11). At times of multiple or sustained human presence all birds depart the Caves Marsh area.



Walker with dog in saltmarsh, Section D

During this survey the construction of rough bridges to aid crossing over the Gaybrook River in Section E was recorded (see Appendix 2). The crossing of Caves Marsh via these rough bridges result in people following the eastern edge of D moving east or using the Swords pathway moving west. All crossings increase the impact time on the birds trying to feed or roost in Sections D, E or R2 and push the birds towards R1.

The repeated disturbances to the birdlife in Caves Marsh is imperceptible to most people using the area. Very few see the effects of the multiple incursions by people and dogs. However the effects on the feeding and roosting birds is cumulative and on some occasions almost continuous.

Section C is an important area within the whole Caves Marsh structure. It provides the only cover for birds feeding and roosting along the eastern edge of D and R1. Its raised aspect, trees and scrub break the intervisibility between people and the birds very successfully. It acts as a “buffer zone”² between much of the human activity and the foreshore areas. It has a key role to play in the future management of the area.

Examples of human activity on site:

- Cyclists were recorded on Swords pathway. Further evidence was found of people cycling from Swords pathway to eastern side of Marsh on several occasions.
- Joggers were regularly recorded on Swords pathway.
- Evidence of heavy scrambling on motorbikes was recorded through Sections D, R1, A and C.
- Rough bridges are located across the Gaybrook River and obvious human tracks leading onto both western and eastern sides of marsh indicate that people regularly walk through and across the marsh.
- The children from local housing estates regularly play at the edges of the saltmarsh Section D especially near Milford Estate.
- Evidence of burning of scrub vegetation obvious at Section C.
- Teenagers observed having bulrush fight in Section B and playing and messing at freshwater culvert outlet Section C.
- Teenagers seen to cross through the coming from school (2 occasions crossing from Malahide side through Sections A, C, D and cutting through hedge on Swords side).
- Informal drinking takes place at Malahide Yacht Club and in Sections C and D.
- Some disturbance caused by Sailing Club dinghies and people on foreshore at C.
- Evidence of play camps and cycle tracks is common.

Photographs of human activity taken during the course of the study are presented in Appendix 2.

² An area (human-made or natural) that helps to protect a habitat from damage, disturbance or pollution. It is managed to protect the ‘integrity’ of the valued habitat and/or the conservation status of species that it supports. *Institute of Ecology and Environmental Management*

Figures 12 – 15 illustrate the level of human activity and number of birds recorded for each site visit.

Figure 12. Human impact on birdlife in Section A

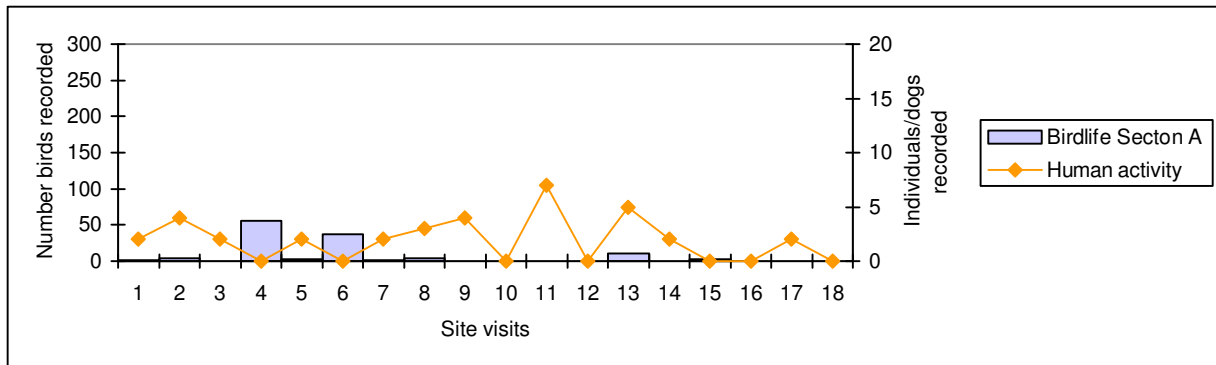


Figure 13. Human impact on birdlife in Section B

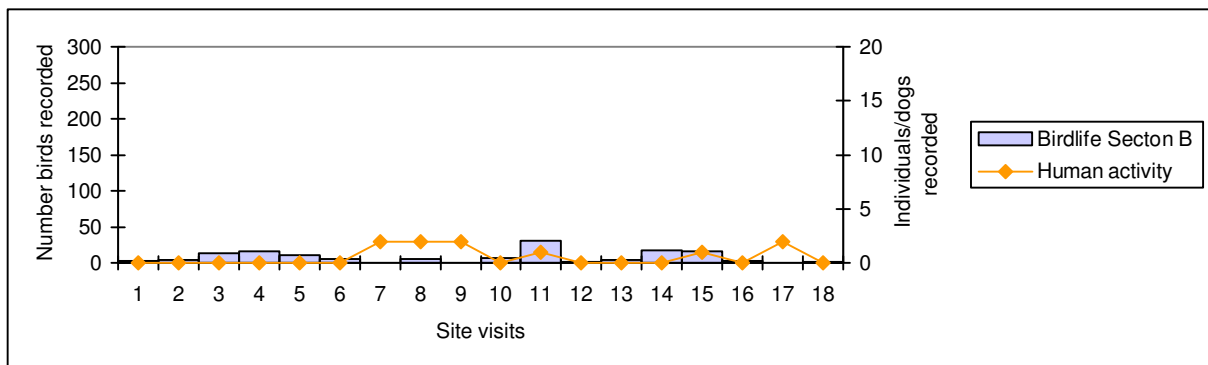


Figure 14. Human impact on birdlife in Section C

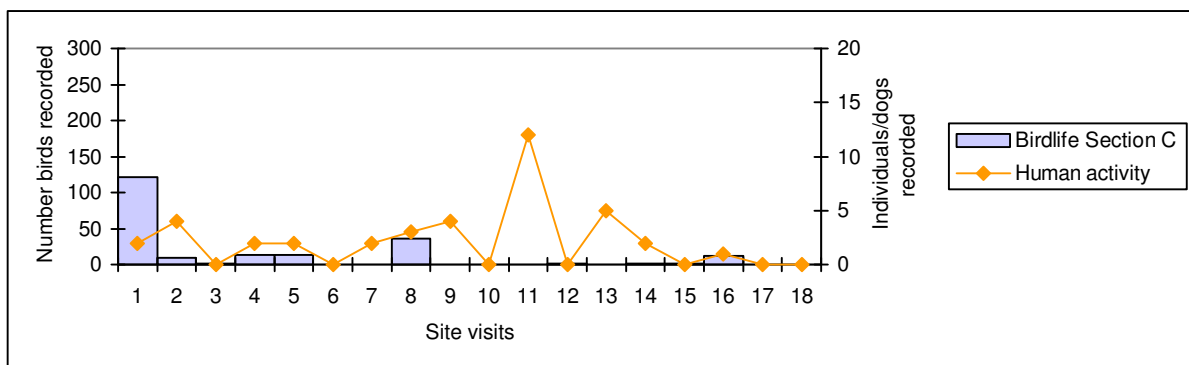
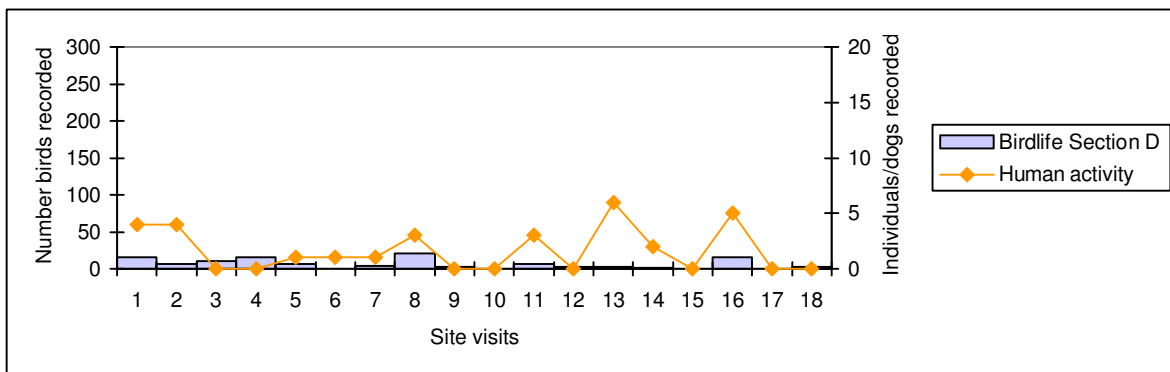
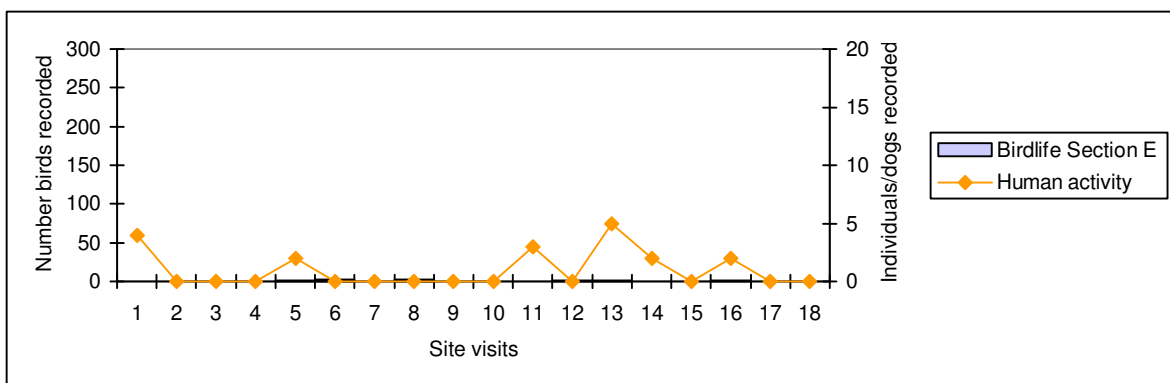
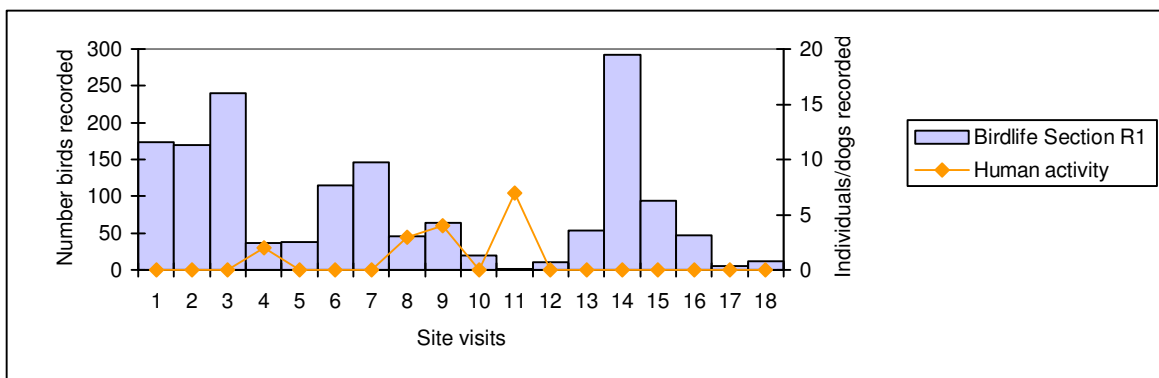
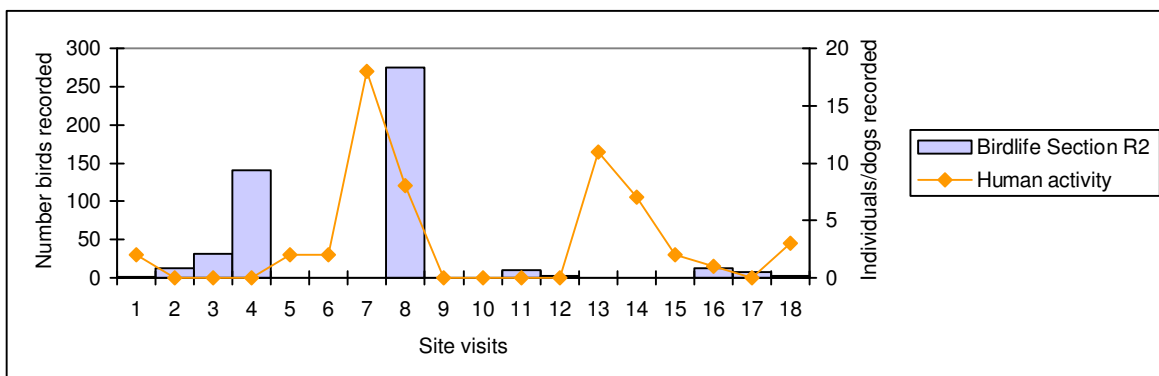


Figure 15. Human impact on birdlife in Section D**Figure 16. Human impact on birdlife in Section E****Figure 17. Human impact on birdlife in Section R1****Figure 18. Human impact on birdlife in Section R2**

6. Conclusions

Caves Marsh is an important area for wildlife within the greater Broadmeadow Estuary. Its designation as an SPA is well researched, and the proposed changes and increasing public access to the site need to be responsibly planned.

Caves Marsh is an attractive area for both wildlife and people. Its wildlife, its variety of habitats and visual scenery make it an attractive area to walk and enjoy. However it is an area at present whose habitats and wildlife are under pressure from increased demands as a leisure and recreational zone. There is a real need for the area to be sensitively managed to attempt to enhance and develop both its recreational and wildlife potential. The unrestricted nature of the access into the area is in direct conflict with the wildlife needs at present.

Main conclusions are as follows:

1. The spatial distribution of the majority of bird species at Caves Marsh was found to be heavily concentrated in Sections R, R1, R2 and C.
2. Of these R1 is the most important section within the Caves Marsh complex.
3. There was very little inter-section movement of species from the outer marsh Sections R, R1, R2 and C to inner marsh Sections of E, D.
4. Movement between Sections A, B, and the remaining section areas of the marsh was in very small numbers.
5. Sections R2, C, E and D are the most regularly walked areas and disturbance to wild birds is frequent and sometimes sustained.
6. Section C is a most important “buffer zone” that currently allows the birds species some relief from the frequent disturbance levels.
7. Human traffic through and across all sections of Caves Marsh is very regular.
8. Disturbance to Section R1 results in all birds leaving the Caves Marsh area.
9. The wildbird populations utilising Caves Marsh are very prone to disturbance due to the following factors; its small size, its relatively enclosed nature, the unrestricted access, no secure buffer zone, lack of signage and the insensitivity on part of users to the problem.

7. Recommendations

1. Pedestrians and dogs should not be allowed to enter Caves Marsh in an unrestricted way via the foreshore at Sections A and C.
2. The Sections A, B, C, D and R1 to be securely fenced off and screened by sympathetic planting where appropriate to provide a secure buffer zone for the wildlife to feed, roost and breed.
3. Restricted access to Sections A, B, C and D should be allowed for educational, natural history and environmental groups.
4. Section C should be considered an important wildlife buffer zone, it should be planted, fenced and managed to reduce human activity and disturbance levels to the sensitive areas of Sections D, R, R1 and C. It should not be used as a regular walkway.
5. The proposed footbridge plan to cross Caves Marsh should be located as far south into Section D as possible.
6. The proposed bridge should link up via a new path directly to/from the Milford pathway.
7. Extensive screening to be provided/planted at the intersection zone of the proposed link up area between feeder path from Milford pathway to footbridge.
8. The provision of screening and fencing is urgently required along Swords pathway to restrict uncontrolled dog access into Section R2 and the saltmarsh zones.
9. Screening and planting to be provided along the Milford pathway to help reduce the disturbance caused by pedestrian traffic overlooking the freshwater and saltwater marshes on birdlife in Sections A and B.
10. Sympathetic and careful management of the freshwater marsh areas in Sections E and B. This to include new pools and regeneration of aquatic vegetation.
11. Caves Marsh to be developed as a wildlife reserve with provision of restricted access to local schools and interested groups to help develop and study the area.
12. Clear signage to indicate the provision of the Nature Reserve in the area and Codes of Conduct essential.

Bibliography and References

Crowe, O. 2005 *Ireland's Wetlands and their Waterbirds: Status and Distribution*. Birdwatch Ireland, Newcastle, Co. Wicklow.

Hutchinson, C. D. 1979. *Ireland's Wetlands and Their Birds*. Irish Wildbird Conservancy, Dublin

Sheppard, R. 1993. *Ireland's Wetland Wealth*. Irish Wildbird Conservancy, Dublin.

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Appendix 1: Bird species recorded in the Caves Marsh study area

A total of 91 species have been recorded in the Caves Marsh study area.

Table 19: Bird species recorded in the Caves Marsh study area

	Species	Scientific Name	Breeding Status	Source
1.	Great Crested Grebe	<i>Podiceps cristatus</i>		Nolan 2000
2.	Slavonian Grebe	<i>Podiceps auritus</i>		Nolan 2000
3.	Cormorant	<i>Phalacrocorax carbo</i>		Nolan 2000
4.	Little Egret	<i>Egretta garzetta</i>		Nolan 2000
5.	Grey Heron	<i>Ardea cinerea</i>		Nolan 2000
6.	Mute Swan	<i>Cygnus olor</i>		Nolan 2000
7.	Brent Goose	<i>Branta bernicla hrota</i>		Nolan 2000
8.	Shelduck	<i>Tadorna tadorna</i>		Nolan 2000
9.	Teal	<i>Anas crecca</i>		Nolan 2000
10.	Mallard	<i>Anas platyrhynchos</i>	Bred 2000 (Nolan)	Nolan 2000
11.	Pochard	<i>Aythya ferina</i>		Nolan 2000
12.	Tufted Duck	<i>Aythya fuligula</i>		Nolan 2000
13.	Goldeneye	<i>Bucephala clangula</i>		Nolan 2000
14.	Red-breasted Merganser	<i>Mergus serrator</i>		Nolan 2000
15.	Sparrowhawk	<i>Accipiter nisus</i>		Nolan 2000
16.	Kestrel	<i>Falco tinnunculus</i>		Nolan 2000
17.	Peregrine	<i>Falco peregrinus</i>		Black 2005
18.	Pheasant	<i>Phasianus colchicus</i>		Pierce et al 2007
19.	Water Rail	<i>Rallus aquaticus</i>	Possible	Black 2005
20.	Moorhen	<i>Gallinula chloropus</i>	Bred 2000 (Nolan)	Nolan 2000
21.	Oystercatcher	<i>Haematopus ostralegus</i>		Nolan 2000
22.	Ringed Plover	<i>Charadrius hiaticula</i>		Nolan 2000
23.	Golden Plover	<i>Pluvialis apricaria</i>		Nolan 2000
24.	Grey Plover	<i>Pluvialis squatarola</i>		Nolan 2000
25.	Lapwing	<i>Vanellus vanellus</i>		Nolan 2000
26.	Knot	<i>Calidris canutus</i>		Nolan 2000
27.	Dunlin	<i>Calidris alpina</i>		Nolan 2000
28.	Ruff	<i>Philomachus pugnax</i>		Nolan 2000
29.	Jack Snipe	<i>Lymnocyptes minimus</i>		Nolan 2000
30.	Snipe	<i>Gallinago gallinago</i>	Possible	Nolan 2000
31.	Black-tailed Godwit	<i>Limosa limosa</i>		Nolan 2000
32.	Bar-tailed Godwit	<i>Limosa lapponica</i>		Nolan 2000
33.	Whimbrel	<i>Numenius phaeopus</i>		Nolan 2000
34.	Curlew	<i>Numenius arquata</i>		Nolan 2000
35.	Spotted Redshank	<i>Tringa erythropus</i>		Nolan 2000
36.	Redshank	<i>Tringa totanus</i>		Nolan 2000
37.	Greenshank	<i>Tringa nebularia</i>		Nolan 2000
38.	Common Sandpiper	<i>Actitis hypoleucos</i>		Nolan 2000
39.	Turnstone	<i>Arenaria interpres</i>		Nolan 2000
40.	Black-headed Gull	<i>Larus ridibundus</i>		Nolan 2000
41.	Common Gull	<i>Larus canus</i>		Nolan 2000
42.	Herring Gull	<i>Larus argentatus</i>		Nolan 2000
43.	Glaucous Gull	<i>Larus hyperboreus</i>		Black 2005
44.	Great-black-backed Gull	<i>Larus marinus</i>		Nolan 2000

(Continued overleaf)

Table 20 (contd.) Bird species recorded in the Caves Marsh study area

	Species	Scientific Name	Breeding Status	Source
45.	Sandwich Tern	<i>Sterna sandvicensis</i>		Nolan 2000
46.	Arctic Tern	<i>Sterna paradisaea</i>		Nolan 2000
47.	Common Tern	<i>Sterna hirundo</i>		Nolan 2000
48.	Stock Dove	<i>Columba oenas</i>		Nolan 2000
49.	Woodpigeon	<i>Columba palumbus</i>	Bred 2000 (Nolan)	Nolan 2000
50.	Collared Dove	<i>Streptopelia decaocto</i>	Bred 2000 (Nolan)	Nolan 2000
51.	Swift	<i>Apus apus</i>		Nolan 2000
52.	Kingfisher	<i>Alcedo atthis</i>		Nolan 2000
53.	Skylark	<i>Alauda arvensis</i>		Nolan 2000
54.	Swallow	<i>Hirundo rustica</i>		Nolan 2000
55.	House Martin	<i>Delichon urbica</i>		Nolan 2000
56.	Meadow Pipit	<i>Anthus pratensis</i>	Bred 2000 (Nolan)	Nolan 2000
57.	Grey Wagtail	<i>Motacilla cinerea</i>		Nolan 2000
58.	Pied Wagtail	<i>Motacilla alba yarrellii</i>	Possible	Nolan 2000
59.	Wren	<i>Troglodytes troglodytes</i>	Bred 2000 (Nolan)	Nolan 2000
60.	Dunnock	<i>Prunella modularis</i>	Bred 2000 (Nolan)	Nolan 2000
61.	Robin	<i>Erithacus rubecula</i>	Bred 2000 (Nolan)	Nolan 2000
62.	Wheatear	<i>Oenanthe oenanthe</i>		Nolan 2000
63.	Stonechat	<i>Saxicola torquata</i>	Bred 2000 (Nolan)	Nolan 2000
64.	Blackbird	<i>Turdus merula</i>	Bred 2000 (Nolan)	Nolan 2000
65.	Fieldfare	<i>Turdus pilaris</i>		Nolan 2000
66.	Song Thrush	<i>Turdus philomelos</i>	Bred 2000 (Nolan)	Nolan 2000
67.	Redwing	<i>Turdus iliacus</i>		Nolan 2000
68.	Mistle Thrush	<i>Turdus viscivorus</i>	Probable	Nolan 2000
69.	Sedge Warbler	<i>Acrocephalus schoenobaenus</i>	Bred 2000 (Nolan)	Nolan 2000
70.	Chiffchaff	<i>Phylloscopus collybita</i>	Possible	Nolan 2000
71.	Willow Warbler	<i>Phylloscopus trochilus</i>	Bred 2000 (Nolan)	Nolan 2000
72.	Goldcrest	<i>Regulus regulus</i>	Probable	Nolan 2000
73.	Long-tailed Tit	<i>Aegithalus caudatus</i>	Possible	Nolan 2000
74.	Coal Tit	<i>Parus ater</i>	Probable	Nolan 2000
75.	Blue Tit	<i>Parus caeruleus</i>	Bred 2000 (Nolan)	Nolan 2000
76.	Great Tit	<i>Parus major</i>	Bred 2000 (Nolan)	Nolan 2000
77.	Rook	<i>Corvus frugilegus</i>		Nolan 2000
78.	Hooded Crow	<i>Corvus cornix</i>		Nolan 2000
79.	Jackdaw	<i>Corvus monedula</i>	Probable	Nolan 2000
80.	Magpie	<i>Pica pica</i>	Bred 2000(Nolan)	Nolan 2000
81.	Starling	<i>Sturnus vulgaris</i>	Probable	Nolan 2000
82.	House Sparrow	<i>Passer domesticus</i>	Bred 2005 (Black)	Nolan 2000
83.	Tree Sparrow	<i>Passer montanus</i>		Nolan 2000
84.	Chaffinch	<i>Fringilla coelebs</i>	Bred 2005 (Black)	Nolan 2000
85.	Goldfinch	<i>Carduelis carduelis</i>	Probable	Nolan 2000
86.	Linnet	<i>Carduelis cannabina</i>	Bred 2000 (Nolan)	Nolan 2000
87.	Redpoll	<i>Carduelis flammea</i>		Pierce et al 2007
88.	Bullfinch	<i>Pyrrhula pyrrhula</i>		Nolan 2000
89.	Greenfinch	<i>Carduelis chloris</i>	Bred 2000 (Nolan)	Nolan 2000
90.	Reed Bunting	<i>Emberiza schoeniclus</i>	Bred 2000 (Nolan)	Nolan 2000
91.	Yellowhammer	<i>Emberiza citrinella</i>		Nolan 2000

Appendix 2: Photographs of human activity at Caves Marsh

Network of pathways



Walkers' route, Section C



Milford Pathway



Saltmarsh edge, Section D



Walker with dog, Swords Pathway



Walker with dog, Section D



Walker with dog, Section A



Section D

Motorcycle scrambling



Looking toward Section R1



Section C



Section D

Temporary bridges



Section E



Section B



Section C

Littering and dumping



Section C



Litter from drinking parties,
Section C



Dumping at outflow of freshwater stream,
Section A / B



Debris in freshwater pool, Section A / B



Gaybrook River, Section E

Other activities



Burnt out bramble, Section C



Play area, edge of Section D

Appendix 3: Map of FCC proposed developments at Caves Marsh

