BTO Research Report No. 505

COLNE ESTUARY LOW TIDE COUNTS 2007/08

Authors

N.A. Calbrade, A.J. Musgrove & M.M. Rehfisch

Report of work carried out by the British Trust for Ornithology
under contract to Natural England

June 2008

British Trust for Ornithology, The Nunnery, Thetford, Norfolk, IP24 2PU
Registered Charity No. 216652

British Trust for Ornithology

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Published in April 2010 by the
British Trust for Ornithology, The Nunnery, Thetford, Norfolk IP24 2PU, U.K.

ISBN 978-1-906204-72-3

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EXECUTIVE SUMMARY

1. The Colne Estuary is a site of national and international importance for its wader and wildfowl populations, supporting c. 38,600 waterbirds during the winter and passage periods. It has been designated as a Special Protection Area (The Colne Estuary SPA) for 12 species of waterbird.

2. The Wetland Bird Survey (WeBS) is a long-running survey that records the number of all waterbird species on different geographical count units (sectors) of the Colne Estuary (as well as many other sites nationally) at monthly intervals. A distinct element of WeBS is the Low Tide Count scheme, the aim of which is to describe the relative feeding distribution of estuarine birds at low tide. Historically, the Colne Estuary has tended to be less well counted for WeBS than other wetland SPAs.

3. This study aimed to assess the distributions of waterbird species in different parts of the estuary at low tide, in order to identify areas where species occur across the estuary as a whole.

4. 'Dot density' maps have been generated for the 12 waterbird species for which the site is designated along with six more numerous species.

5. We suggest how the Colne Estuary SPA could be counted in the future.

1. INTRODUCTION

1.1 Background

The Colne Estuary is located on the coast of Essex in eastern England. It is a comparatively short and branching estuary, with five tidal arms that flow into the main channel of the River Colne. The estuary has a narrow intertidal zone predominantly composed of flats of fine silt with mud-flat communities typical of southeastern English estuaries. There is a wide variety of coastal habitats which include mud-flat, saltmarsh, grazing marsh, sand and shingle spits, disused gravel pits and reedbeds which provide feeding and roosting opportunities for the large numbers of waterbirds that use the site. The Colne Estuary is an integral component of the phased Mid-Essex Coast SPA (Stroud *et al.* 2001).

Potential threats to this SPA and surrounding areas are posed by disturbance caused by air activities such as paragliding, the development of a wharf, sea defences, homes and shops, car parks, marinas, holiday parks and an airport, and saltmarsh loss caused by sea-level rise (BirdLife International 2003). Specific potential threats to this site include erosion of saltmarsh, sediment-flats and eel-grass, changes in water quality, deliberate goose scaring on adjacent farmland and recreational disturbance.

1.2 Designation

The Colne Estuary was designated as an SPA in 1994 and covers 2701.43 ha (Stroud *et al.* 2001). The area qualifies under article 4.2 of the Wild Birds Directive (79/409/EEC) for its internationally important assemblage of waterbirds. Over the winter, the area regularly supports over 38,600 waterbirds (5 year peak mean 1991/92-1995/96) including Dark-bellied Brent Goose *Branta bernicla bernicla,* Shelduck *Tadorna tadorna*, Great Crested Grebe *Podiceps cristatus*, Cormorant *Phalacrocorax carbo*, Avocet *Recurvirostra avosetta*, Ringed Plover *Charadrius hiaticula*, Golden Plover *Pluvialis apricaria,* Grey Plover *Pluvialis squatarola*, Lapwing *Vanellus vanellus*, Dunlin *Calidris alpina*, Black-tailed Godwit *Limosa limosa islandica* and Redshank *Tringa totanus*.

1.3 WeBS Alerts

The WeBS Alerts System identifies species that have undergone major declines in numbers and flags these species by issuing an Alert. Trends are assessed over the short-, medium-, and long-terms (5, 10 and up to 25 years respectively) and also since site-designation. If declines exceed 50%, then a High-Alert is issued and if declines exceed 25% then a Medium-Alert is issued. The 12 species for which the site was designated were evaluated up to 2004/05. Medium Alerts have been triggered for four species – Dark-bellied Brent Goose (medium), Shelduck (short, medium and long-term), Ringed Plover (long-term), and Dunlin (medium and long-term) (Maclean & Austin 2008).

1.4 WeBS Low Tide Counts

Despite involving only a relatively small number of sites, estuaries collectively represent the most important habitat for wintering waterbirds in the UK. They are also inherently different from the thousands of inland sites counted for WeBS. The influence of the tide means that the birds have to be much more mobile, both within and between sites. The WeBS Low Tide Counts scheme, which was initiated in the winter of 1992-93, aims to monitor, assess and regularly update information on the relative importance of intertidal feeding areas of UK estuaries for wintering waterbirds and thus to complement the information gathered by WeBS Core Counts on estuaries. WeBS Core Counts on estuaries have, in general, been based around high tide roosts and they are important for determining and monitoring bird numbers, they provide little information on the way waterbirds make use of a site for feeding. Therefore, information gathered about these sites at high tide will only provide part of the picture.

WeBS Low Tide Counts provide crucial information needed to assess the potential effects on waterbird populations of a variety of human activities which affect the extent or quality of intertidal

habitats, such as dock developments, recreational activities, tidal power barrages, marinas and housing schemes. The data gathered contribute greatly to the conservation of waterbirds by providing supporting information for the establishment and management of the UK network of Ramsar sites and Special Protection Areas (SPAs), other site designations and whole estuary conservation plans. In addition, WeBS Low Tide Counts enhance our knowledge of the low water distribution of waterbirds and provide the data that highlight regional variations in habitat use (Musgrove *et al.* 2003).

1.5 WeBS Coverage of the Colne Estuary

For such an important site, WeBS coverage on the Colne Estuary has been disappointing. The Colne Estuary has only been covered previously under the WeBS Low Tide Counts scheme in the winter of 1994/95. During that winter, only the area to the north of Mersea Island was counted as illustrated by Figure 1.5.i.

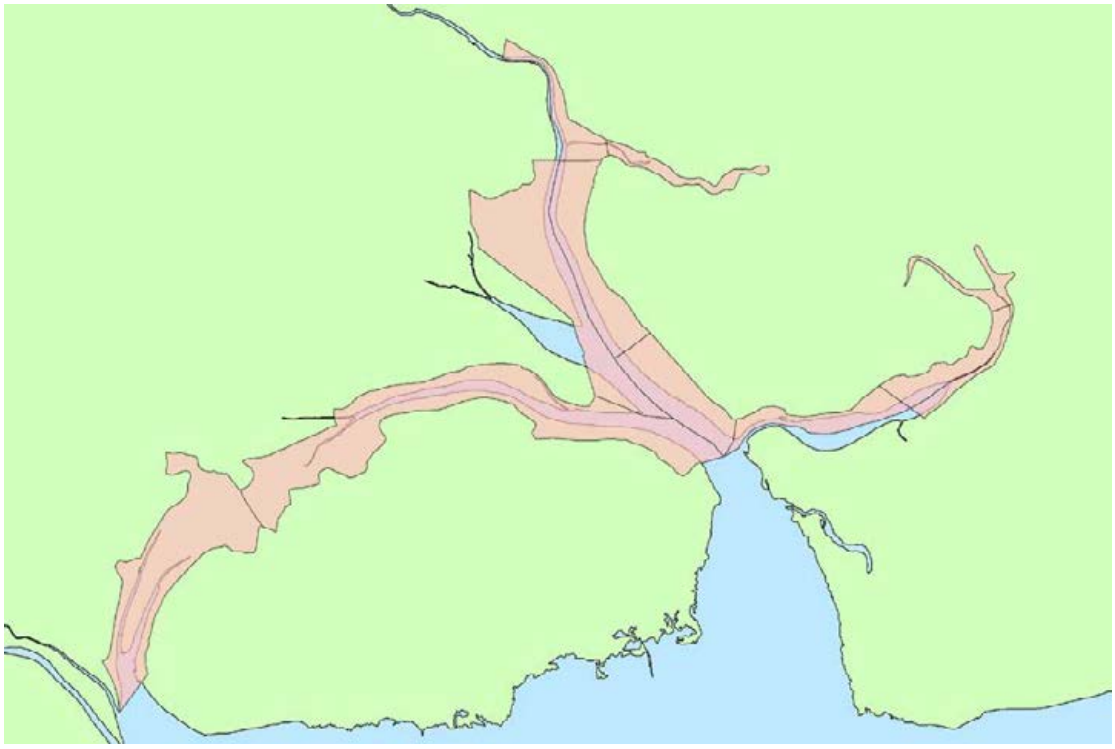


Figure 1.5.i The area of the Colne counted at Low Tide in 1994/95 (area counted in pink).

For the Core Counts, the estuary is split into seven sections, although counts for Colne Point and Flag Creek are generally submitted as one (see Figure 1.5.ii). The frequency of counts on these sections is very variable, even though there are several well-watched sites within them such as Fingringhoe Wick and Colne Point.

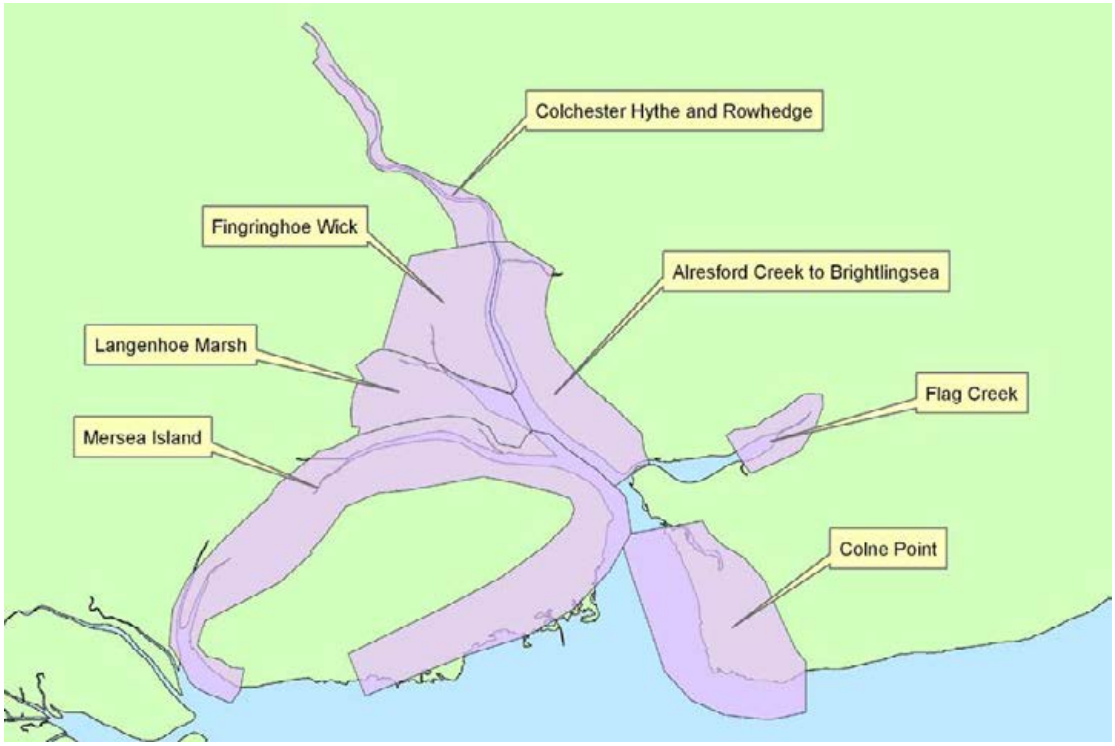


Figure 1.5.ii Core sections on the Colne Estuary.

2. METHODS

2.1 WeBS Low Tide Counts Overview

The WeBS Low Tide Counts scheme provides information on the numbers of waterbirds feeding on subdivisions of the intertidal habitat within estuaries. The Low Tide Counts aim to cover most individual estuaries about once every six years rather than on an annual basis, although on some sites more frequent counts are made. Counts of all feeding and roosting waterbirds are made by counters on pre-established subdivisions of the intertidal habitat in the period two hours either side of low tide each month between November and February (Musgrove *et al.* 2007). The Low Tide Counts take place during these four months partly because waterbird numbers on estuaries are at their highest then, partly to minimise between month variation in counts and partly because this is the time of year when feeding constraints are likely to be at their greatest. A key objective of the scheme is to record feeding distributions and studies have shown that, for many of the specialist estuarine species, a high proportion of birds feed during this four hour period across the low tide. Also since the position of the tideline (and thus the availability of food) is relatively stable during this period, changes in the numbers and distribution of waterbirds are consequently relatively small.

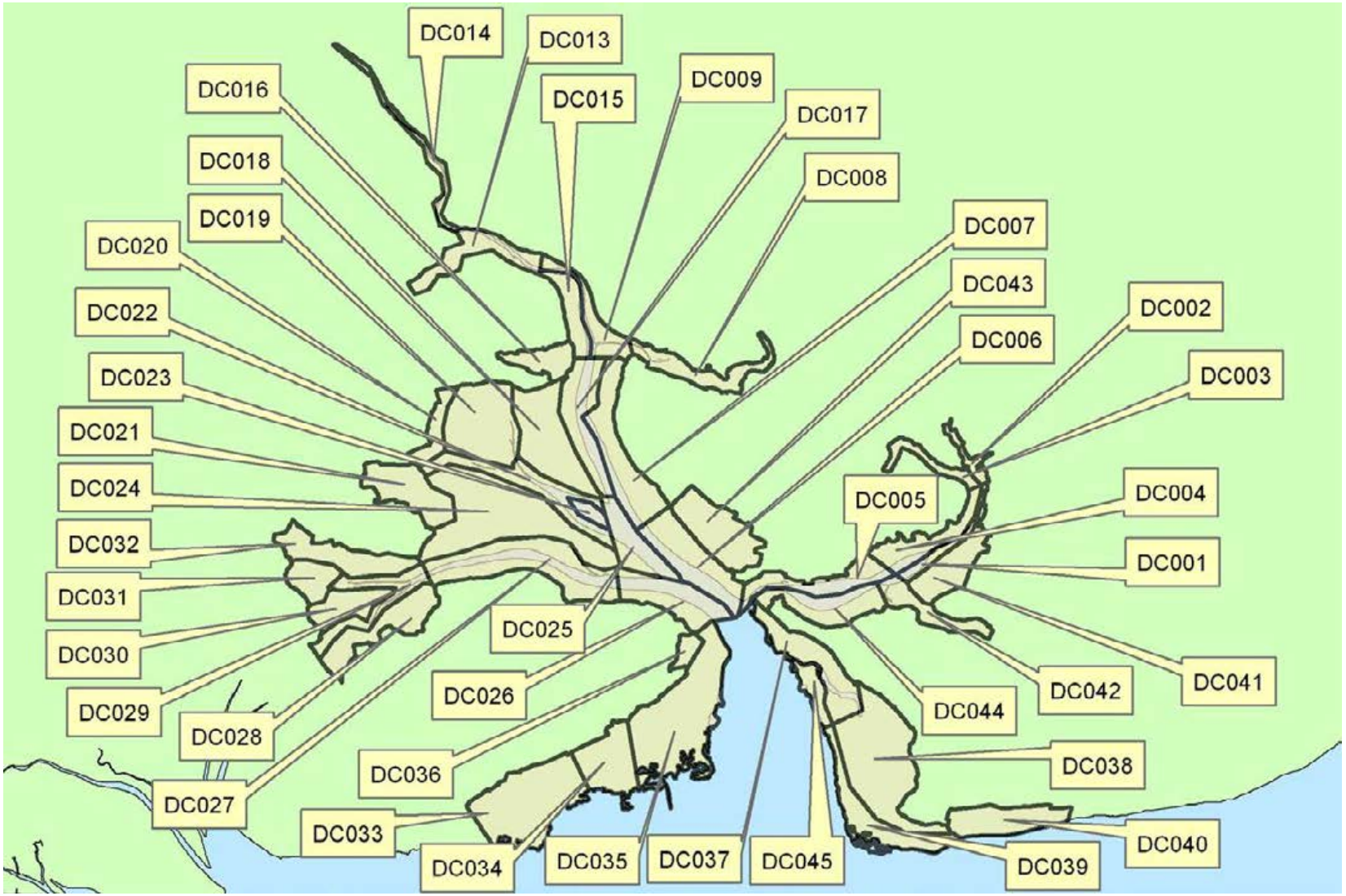
Estuaries form some of the largest sites covered by WeBS. As such, although co-ordinated counts are preferred, many sites are too large or complex to allow this approach and so counts may be undertaken over several days. The recording of waterbirds for Low Tide Counts differs from that of Core Counts in that Low Tide Counts look at the distribution of birds across a site rather than absolute numbers, and so birds moving between sectors may be counted twice or more.

2.2 Low Tide Counts 2007/08

Low tide counts were carried out on the Colne Estuary each month from November 2007 to February 2008. Much of the fieldwork was carried out by BTO staff, although local birdwatchers or reserve staff contributed when they were able to make time.

For the 2007/08 Low Tide Counts, the estuary was split up into 42 counts sectors (see Figure 2.2). For the 1994/95 counts, the estuary was split into just ten count sections. It should be noted that the numbers go up to 45 due to some of the sectors used (numbers DC010-012) in the 1994/95 counts being split into smaller sections for the purposes of these counts. The coincidence of the WeBS Low Tide Count sectors in relation to the boundary of the Colne Estuary SPA is given in Appendix A.

Figure 2.2 Sectors used for the 2007/08 Low Tide Counts.



For the November counts, a Natural England boat was used to count some of the sectors that were thought to be difficult if not impossible to cover from land. However, due to poor weather conditions on the day of that count, and the channel being much deeper than expected, counting from a boat was not feasible. As a result of this experience and having gained a better idea of the geography of the site during the November visit, all the subsequent counts were carried out from land.

For birds such as Red-breasted Mergansers and Great Crested Grebes that are found offshore, sections are drawn out to an arbitrary 500m, but it can't be assumed that the birds were definitely in this zone, given the difficulties of assessing distances offshore.

The aim was to get as much volunteer coverage as possible. This was in part to save on costs but primarily to build up the WeBS resource on this important wetland that has historically suffered from incomplete counts. This proved difficult. Although assurances of coverage were received from the counters approached, the counts were not delivered at short notice due to unsuitable weather conditions or due to personal commitments.

3. RESULTS

Unfortunately, and despite several emails and phone calls to the counter and promises that the counts would be sent, we didn't receive counts from Fingringhoe (sections DC015-017). However BTO staff counting neighbouring sections made some partial counts of these sections and these have been incorporated into this report.

3.1 Coverage

Sectors DC018 to DC024 lie within a military firing range, which is also used for wildfowl shooting. Two volunteer counters who have permits to get into this area offered to carry out monthly counts. However a full count of the main channel that runs through the area was only possible in February. It did not prove possible to count the area at low tide between November and January. No daylight low tide period coincided with the narrow time window available during which neither military activities nor wildfowling or game shooting was occurring.

Although the Pyefleet Channel (DC027 and DC029) itself was counted, due to access difficulties, the saltmarsh areas at the west end (DC028 and DC030-DC032) were not counted.

Figures 3.1.i to 3.1.iv show the level of coverage for each month. The improved coverage over the months is due to BTO staff being used to count areas where volunteers were unable to carry out the counts they had offered. This is also reflected in Table 3.1, which shows the increased level of coverage by BTO staff.

Figure 3.1 Coverage for each month. Sectors fully, partially and not counted are represented in green, orange and pink respectively.

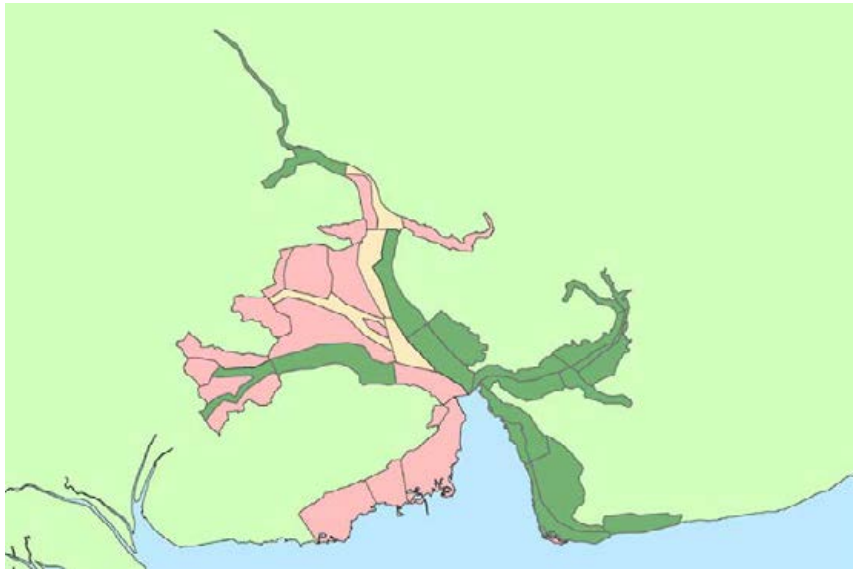


Figure 3.1.i November 2007 coverage.

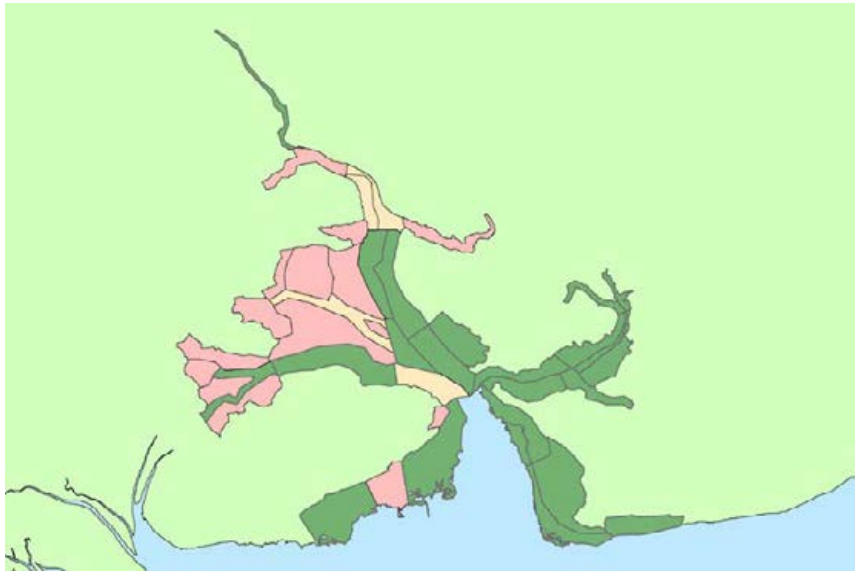


Figure 3.1.ii December 2007 coverage.

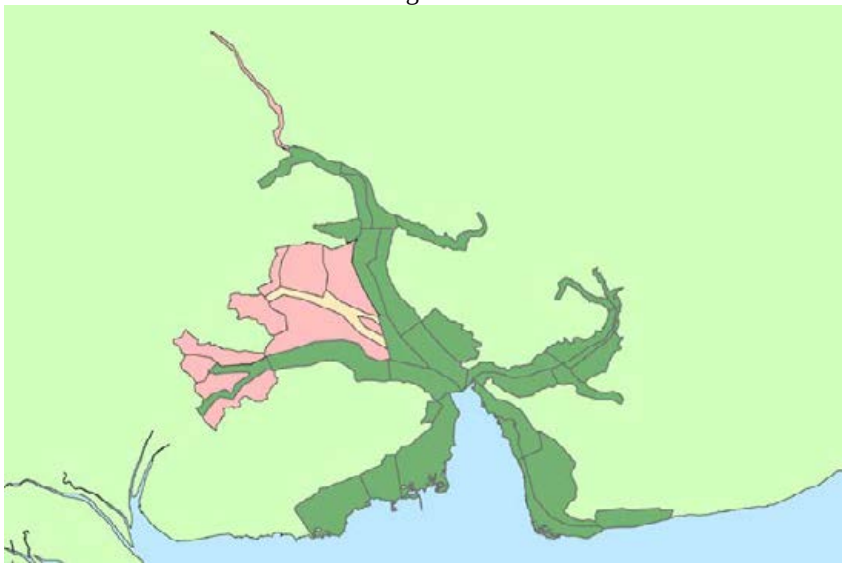


Figure 3.1.iii January 2008 coverage.

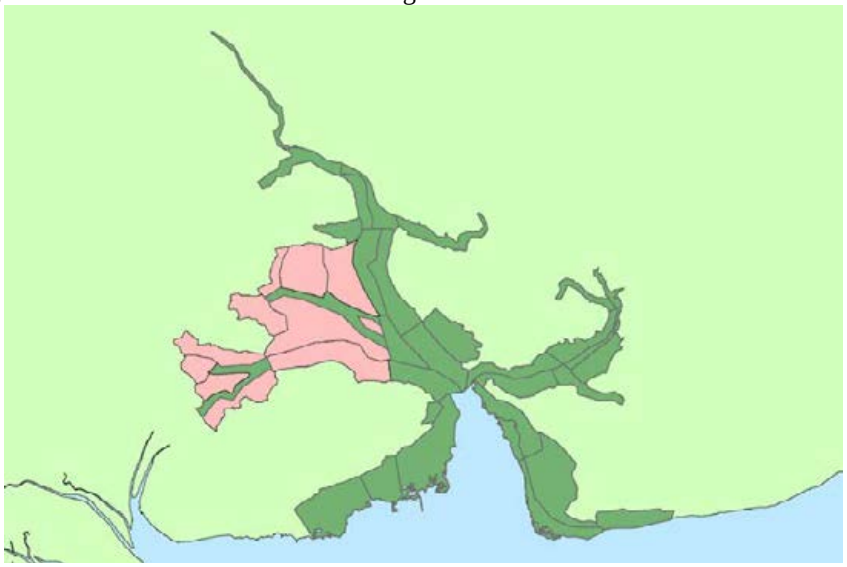


Figure 3.1.iv February 2008 coverage.

	November	December	January	February
DC001	BTO	BTO	BTO	BTO
DC002	BTO	BTO	BTO	BTO
DC003	BTO	BTO	BTO	BTO
DC004	BTO	BTO	BTO	BTO
DC005	BTO	BTO	BTO	BTO
DC006	BTO	BTO	BTO	BTO
DC007	BTO	BTO	BTO	BTO
DC008	X	X	BTO	BTO
DC009	BTO Partial	BTO Partial	BTO	BTO
DC013	Volunteer	X	BTO	Volunteer
DC014	Volunteer	Volunteer	X	Volunteer
DC015	X	X	BTO	BTO
DC016	X	X	Volunteer	Volunteer
DC017	BTO Partial	Volunteer	Volunteer	Volunteer
DC018	X (firing range)	X (firing range)	X (firing range)	X (firing range)
DC019	X (firing range)	X (firing range)	X (firing range)	X (firing range)
DC020	X (firing range)	X (firing range)	X (firing range)	X (firing range)
DC021	X (firing range)	X (firing range)	X (firing range)	X (firing range)
DC022	X (firing range)	BTO Partial	BTO Partial	Volunteer
DC023	X (firing range)	X (firing range)	X (firing range)	X (firing range)
DC024	X (firing range)	X (firing range)	X (firing range)	X (firing range)
DC025	BTO Partial	BTO	BTO	BTO
DC026	X	BTO Partial	BTO Partial	Volunteer
DC027	Volunteer	Volunteer	Volunteer	X
DC028	X	X	X	X
DC029	Volunteer	Volunteer	Volunteer	Volunteer
DC030	X	X	X	X
DC031	X	X	X	X
DC032	X	X	X	X
DC033	X	Volunteer	BTO	BTO
DC034	X	X	BTO	BTO
DC035	X	Volunteer	BTO	BTO
DC036	X	X	BTO	BTO
DC037	BTO	BTO	BTO	BTO
DC038	BTO	BTO	BTO	BTO
DC039	BTO	BTO	BTO	BTO
DC040	BTO	BTO	BTO	BTO
DC041	BTO	BTO	BTO	BTO
DC042	BTO	BTO	BTO	BTO
DC043	BTO	BTO	BTO	BTO
DC044	BTO	BTO	BTO	BTO
DC045	BTO	BTO	BTO	BTO

Table 3.1 Coverage by count sector. X = No count made; Volunteer = Count made by volunteer; BTO = Count made by BTO staff member.

3.2 'Dot Density' Distribution Maps

Low Tide Count data can be assigned to well-defined geographical areas. The presentation of results in map form has many advantages over a simple tabulation of statistics since it enables an appreciation of the relationship between different count sections. We chose to present the results in the form of 'dot density' maps. Using GIS technology, the production of maps depicting bird distribution has been a major theme from the beginning of the Low Tide Counts (Musgrove *et al.* 2003).

Since the mean numbers of waterbirds are used for plotting the results, there is a continuous depiction of relative densities (as opposed to a discrete set of abundance bands, for example). For some species (e.g. Dunlin), there may be such large numbers of birds on some count sections that it is not possible to differentiate between densities in different sections. In such a case, the GIS can be instructed to display, for example, one dot for every five Dunlin. Species-specific habitat associations have been applied in production of the distribution maps and so, for example, Knot are plotted only on intertidal parts of a count section. Similarly, Great Crested Grebes are plotted in the subtidal zone. Other species, less specialised in habitat use, have been assigned to more than one zone for mapping purposes (e.g. Curlew on both saltmarsh and mudflats).

The dot density distribution maps of eighteen species are given in Appendix B. The species presented include the twelve species for which the Colne Estuary is designated (see section 1.2) plus six other numerous species (Wigeon *Anas penelope*, Teal *Anas crecca*, Oystercatcher *Haematopus ostralegus*, Knot *Calidris canutus*, Bar-tailed Godwit *Limosa lapponica* and Curlew *Numenius arquata*).

3.3 Species Counts and Densities

A summary of the mean counts and densities for each species across the whole site is given in Appendix C. Please note that gulls have not been included in the totals as counting of gulls is optional for WeBS.

4. DISCUSSION AND SUMMARY

4.1 Overview of the 2007/08 Low Tide Counts

The use of professional fieldworkers to do the Low Tide Counts resulted in better coverage of the site than on previous surveys. Although some volunteer counters were able to carry out the counts, the number of volunteers we were able to recruit was disappointing. However, the volunteer counters who were able to carry out these counts did a very thorough job in sometimes adverse weather and it is hoped that they will continue to contribute to WeBS counts, both Core and Low Tide. There were occasions when volunteer counters made promises of counts, which due to time constraints on the volunteer, were then not subsequently carried out. In some cases, we were informed of these issues early enough to be able to send professional counters to do the counts.

The military firing range proved to be the biggest logistical problem as access to this area was not possible and so a large area of the site went uncounted. Saltmarsh areas present a different problem. They are difficult to cover as many birds feed in narrow creeks and so many of these areas of saltmarsh may have been undercounted.

4.2 Species Accounts

See Appendix A for a map of the sites referred to in the species accounts. Species followed by a "D" are designated features of the Colne SPA.

4.2.1 **Brent Goose (Dark-bellied)** *Branta bernicla bernicla* **D**

Brent Geese are present in large numbers with a mean count of 1715 birds across the winter. They are distributed widely across the site, utilising all habitats from sub-tidal to the non-tidal fields and saltmarsh. Their habit of using fields makes counting them difficult as they may be found well away from the standard estuarine count sections. Their highest concentration was along the main channel to the northeast of Mersea Island where they were recorded at densities of 2.76 birds per hectare.

4.2.2 **Shelduck** *Tadorna tadorna* **D**

Shelduck favour the more sheltered waters of the inner estuary as opposed to the open estuary mouth, including many of the creeks, with the majority of birds being found north of Mersea Island. At their highest densities along the east side of the main channel, Shelduck were found at 4 birds per hectare with a mean count of 438 birds.

4.2.3 **Wigeon** *Anas penelope*

Wigeon tend to favour the creeks off the main channel, and in some areas favoured the saltmarshes where they may be undercounted amongst the channels. The highest numbers were found along the Pyefleet Channel on the north side of Mersea Island where the peak count was 838 birds. The small area of non-tidal grassland on the east side of Mersea Island (DC036) attracted the highest densities of the species with a mean of 22.87 birds per hectare recorded.

4.2.4 **Teal** *Anas crecca*

Although not found in such large numbers as Wigeon, Teal also favoured the narrower creeks where they tended to roost over the low tide period. The main sector for Teal was DC042 where numbers peaked at 305 birds with a mean density of 3.89 birds per hectare.

4.2.5 **Great Crested Grebe** *Podiceps cristatus* **D**

The distribution and numbers of Great Crested Grebes counted, as with all species which are found in the subtidal areas, are hugely affected by the weather. Visibility and calmness of the water play a big part in the recording of these species. Small numbers were found in the main channel of the estuary throughout the winter and the largest numbers off the south side of Mersea Island in calm weather in January when nearly 400 birds were counted offshore.

4.2.6 **Cormorant** *Phalacrocorax carbo* **D**

Although found in small numbers across the site, Cormorants favoured the mouth of the estuary, in particular the section around Colne Point where a peak count of 195 was recorded in February.

4.2.7 **Oystercatcher** *Haematopus ostralegus*

Oystercatchers were found throughout the site with the main concentrations being along the eastern side of the main channel and along the western end of the Pyefleet Channel to the north of Mersea Island and along South Geedon Creek. Very few made use of the narrowest innermost sections however.

4.2.8 **Avocet** *Recurvirostra avosetta* **D**

The main concentration of Avocets was of over 340 birds, mostly roosting birds, at the north end of the main channel where the mean density of birds was 5.21 birds per hectare. Another roost of up to 94 birds was present in the Brightlingsea Creek and birds were also present along the South Geedon Creek.

4.2.9 **Ringed Plover** *Charadrius hiaticula* **D**

Ringed Plovers were distributed thinly across the site. The highest concentrations were at the east end of the Pyefleet Channel where a mean count of 78 birds was recorded over the winter.

4.2.10 **Golden Plover** *Pluvialis apricaria* **D**

One of the more numerous species present, with a mean of 2,143 birds counted. The main concentration of Golden Plovers was at the east end of the Pyefleet Channel although smaller numbers of birds were present around the south shore of Mersea Island and between Colne Point and Brightlingsea Creek.

4.2.11 **Grey Plover** *Pluvialis squatarola* **D**

A mean count of 595 birds was present, distributed widely across the site with the east side of the main channel supporting the largest concentration. Smaller numbers of birds were present along the smaller channels compared to the apparently preferable mudflats of the main channel.

4.2.12 **Lapwing** *Vanellus vanellus* **D**

Lapwings were present in similar numbers to Golden Plover mostly in several large roosts: at the east end of the Pyefleet Channel, along Brightlingsea Creek and at the north end of the main channel.

4.2.13 **Knot** *Calidris canutus*

The largest concentration of Knot was along the Pyefleet Channel with 35 birds per hectare recorded along the narrow intertidal area. The north end of the main channel near Fingringhoe Wick was also favoured with smaller numbers along Brightlingsea and Alresford Creeks.

4.2.14 **Dunlin** *Calidris alpina*

By far the most numerous species present with a mean count of 7,332 birds counted across the winter, resulting in a mean site density of 6.19 birds per hectare. Although present in large numbers throughout the site, the Pyefleet Channel and along the east side of the main channel were found to hold the main concentrations of birds.

4.2.15 **Black-tailed Godwit** *Limosa limosa islandica*

Although the highest concentration of birds was held by section DC007 along the main channel where there was a mean count of 156 birds, Black-tailed Godwits were also widely distributed along the smaller channels. Of interest, a colour-ringed bird, which was ringed as an adult male in Iceland in 2003, was seen in two consecutive months along the Brightlingsea Channel.

4.2.16 **Bar-tailed Godwit** *Limosa lapponica*

Bar-tailed Godwits were found in much lower numbers than Black-tailed Godwits, with a mean of 185 birds compared with 488 of Black-tailed Godwits. Unlike Black-tailed Godwits, the Bar-tailed Godwits favoured the more open intertidal areas of the main estuary channel and the south shore of Mersea Island, compared to the smaller channels.

4.2.17 **Curlew** *Numenius arquata*

Curlews were widely distributed across the whole site. Each sector counted held birds, with no distinct concentrations of the birds.

4.2.18 **Redshank** *Tringa totanus*

Like Curlew, Redshanks were widely distributed throughout the site, although in much greater numbers. The highest numbers were recorded along the smaller channels rather than along the main channel.

4.3 Summary

A mean count of over 25,000 birds of 45 species (not including gulls) was recorded during the four Low Tide Counts. This estimate is based on the average count made in each count section; and so it makes allowance for the number of counts made of each section. Birds were distributed widely across the site, although many species favoured particular areas depending on their feeding niches.

We would aim to carry out Low Tide Counts on the Colne Estuary again in six or seven years time. Although the use of volunteer counters would be preferable, given the difficulty in finding enough counters to carry out these counts, any future counts would most likely require professional counters to complete any survey gaps. For the 2007/08 counts, we relied on volunteers to arrange access to the firing range for themselves. For future counts, it may be worth approaching the firing range officer directly and see if there are any on site staff who would be interested and able to carry out counts. Ideally, we would have got counts for all four months of the winter on every sector, though due to problems with coverage discussed earlier, this was not possible. For instance, some sectors were only covered in January and February. Across the UK as a whole, January tends to be the month with the highest overall numbers of wintering waterbirds and so, although a more complete set of counts would have been preferable, it is felt that the distributions recorded by the counts were broadly representative of the pattern for the whole winter.

The majority of species were actively feeding over the low tide period; however, Avocets, Lapwings and Golden Plovers were largely roosting at this time.

Acknowledgements

Special thanks are due to volunteer counters Dougal Urquhart, Richard Allen, Andy Field, Ian Black, Hugh Owen, Martin Cock, Michael Thorley and Richard Brown who gave up their time to carry out the counts. We also thank BTO staff Rachel Coombes, Chas Holt and Mark Collier for assisting with the counts and also Heidi Mellan who finalised this report.

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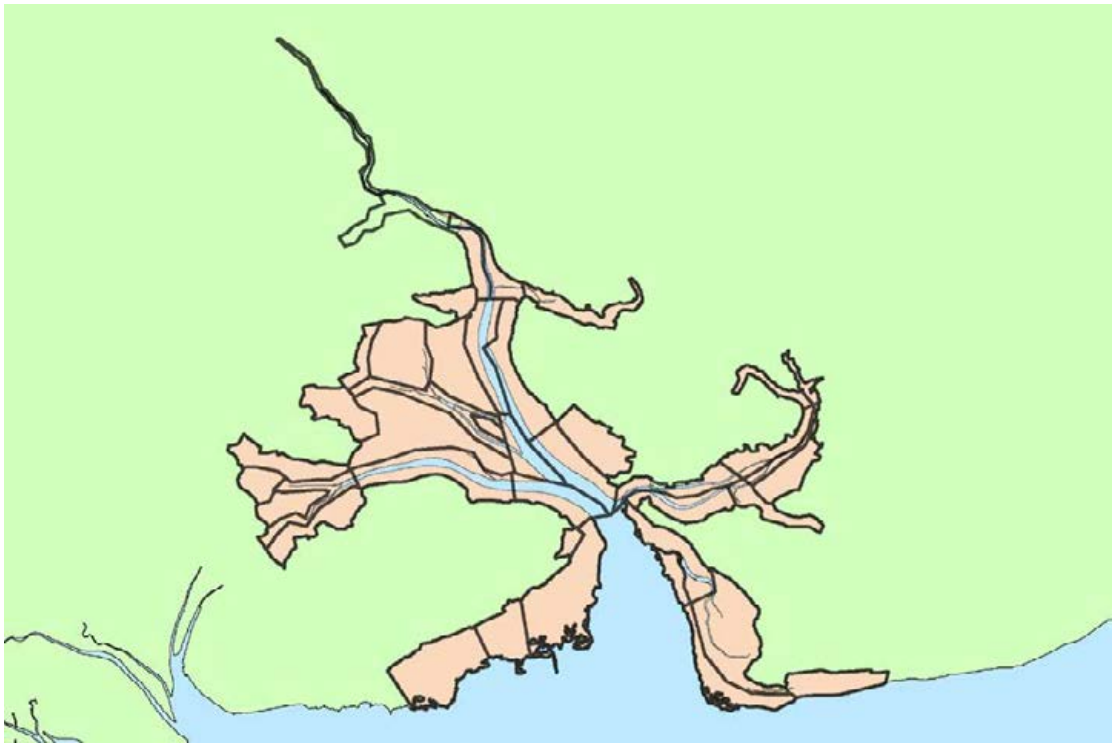
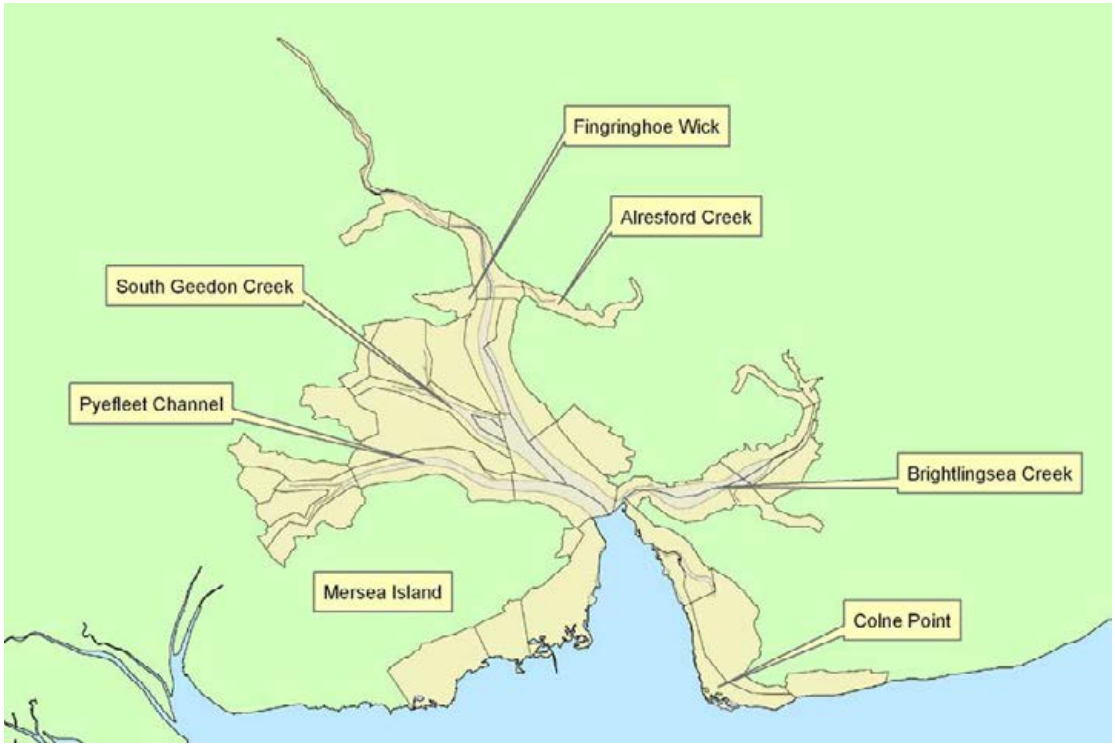
Appendix A **i)** WeBS Low Tide Count sectors on the Colne Estuary (black outline) in relation to the Colne Estuary SPA (in red shading) and **ii)** map of the Colne Estuary with key locations marked.

i)



ii)



Appendix B Dot density distribution maps of a selection of species on the Colne Estuary SPA. Maps are presented in taxonomic order.

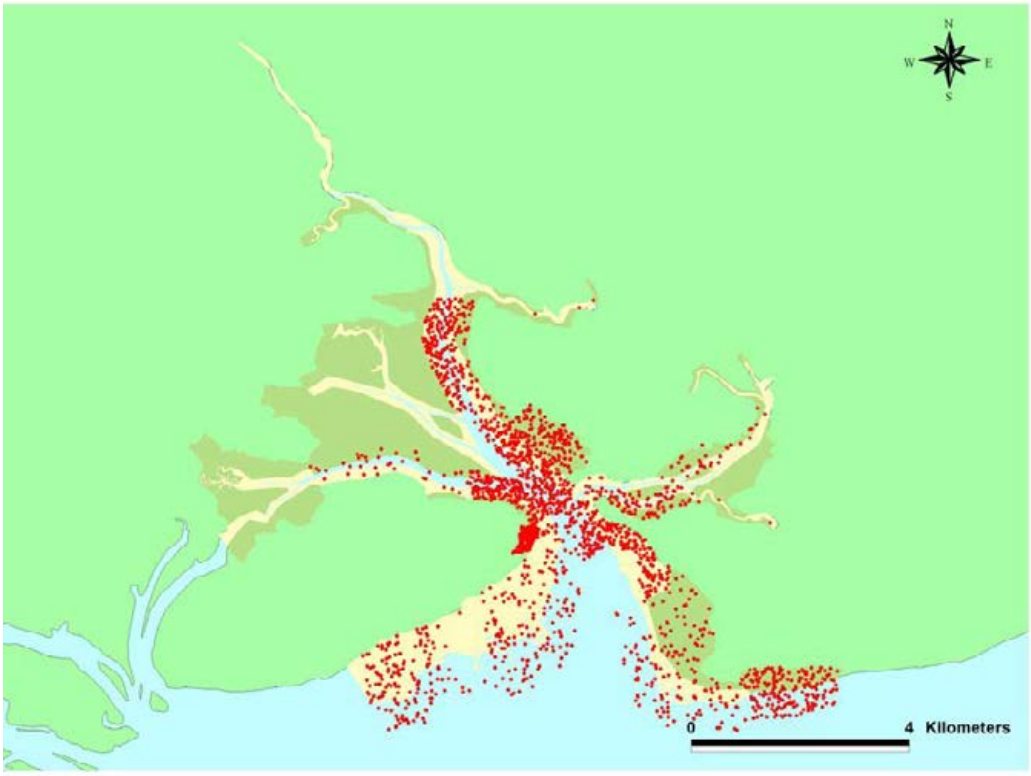


Figure B1 Brent Goose (Dark-bellied) *Branta bernicla bernicla* (1 dot =2 birds).

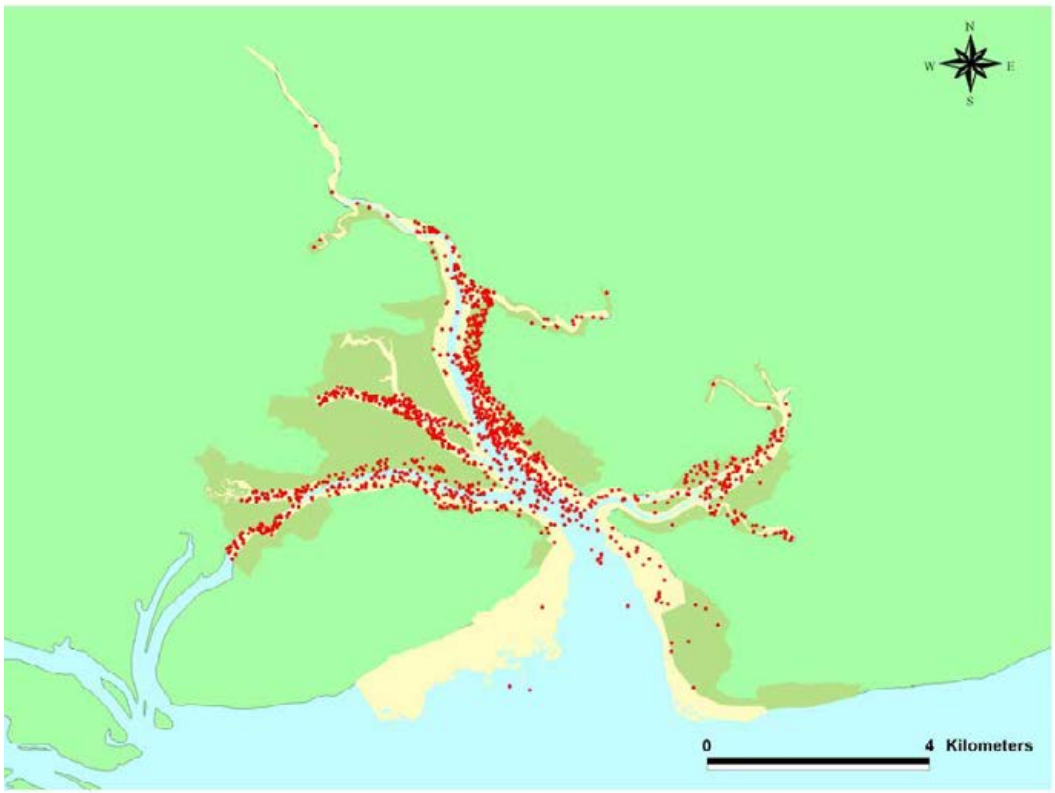


Figure B2 Shelduck *Tadorna tadorna* (1 dot = 2 birds).

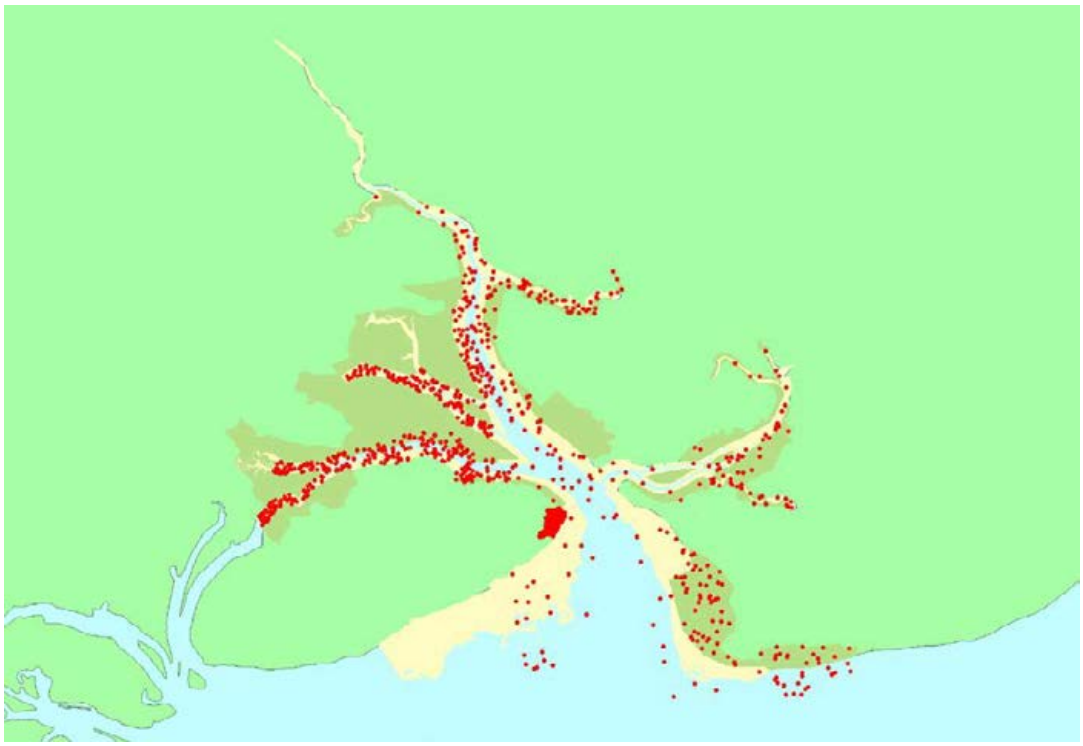


Figure B3 Wigeon *Anas penelope* (1 dot = 3 birds).

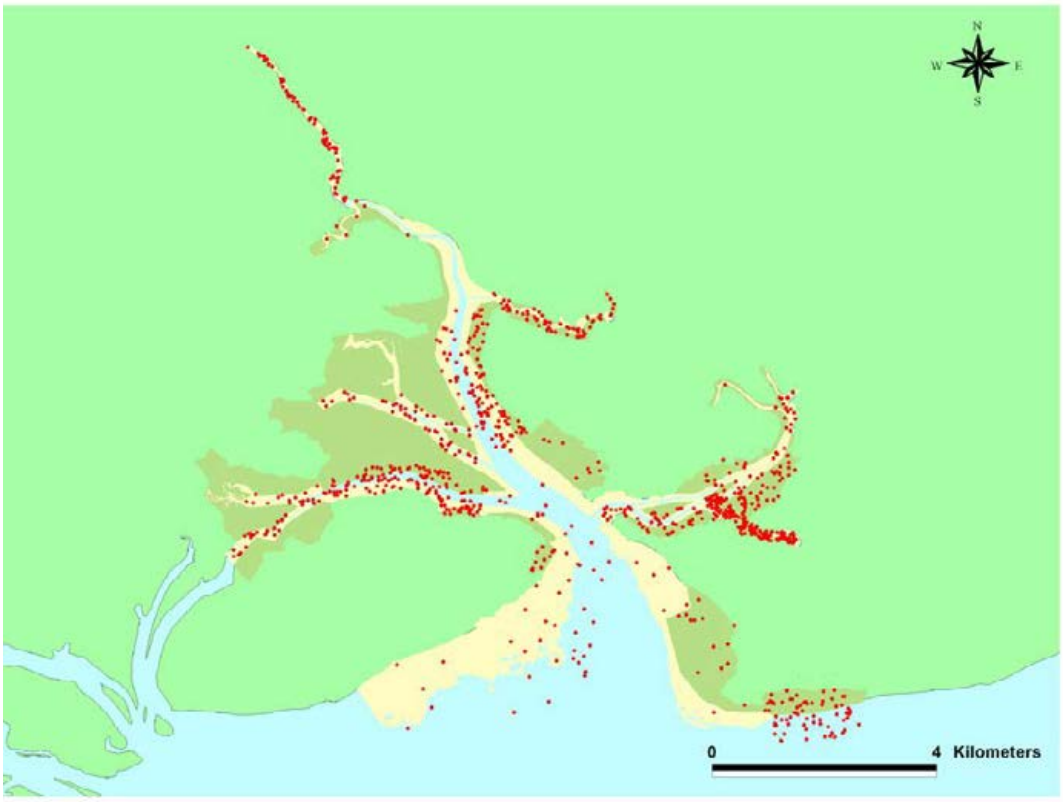


Figure B4 Teal *Anas crecca* (1 dot = 2 birds)

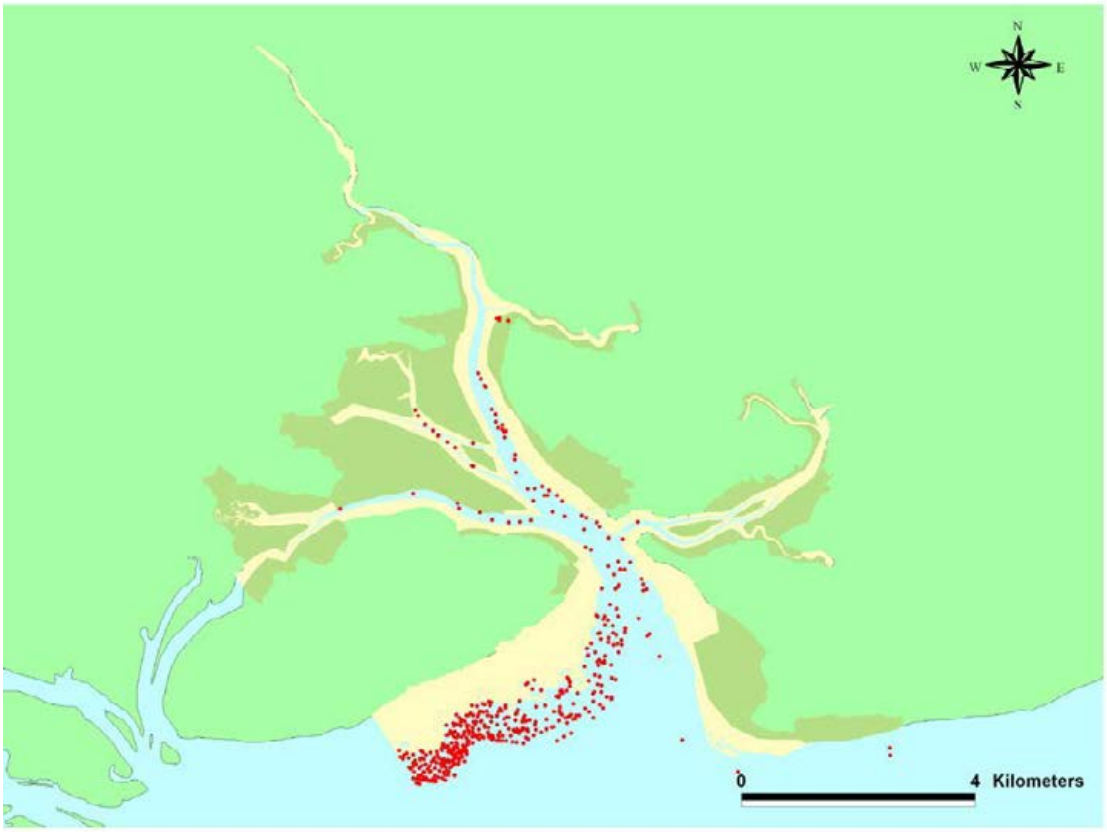


Figure B5 Great Crested Grebe *Podiceps cristatus* (1 dot = 1 bird).

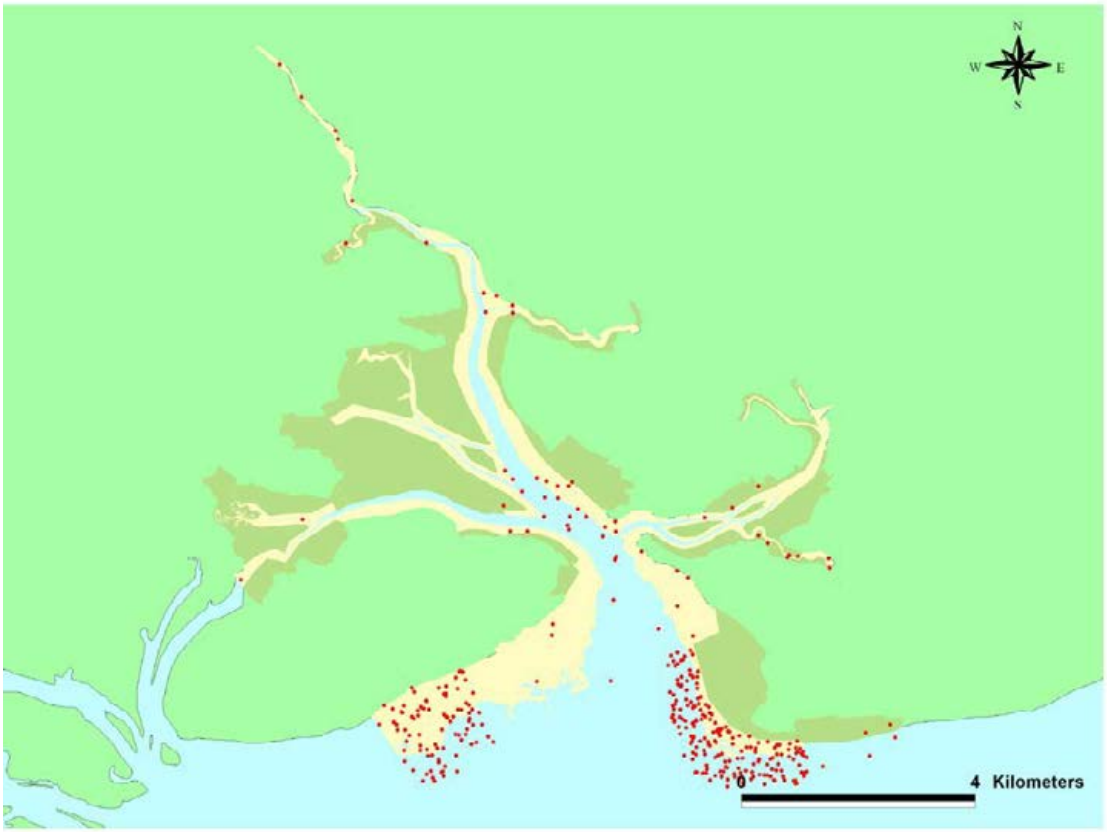


Figure B6 Cormorant *Phalacrocorax carbo* (1 dot = 1 bird).

Figure B7 Oystercatcher *Haematopus ostralegus* (1 dot = 1 bird).

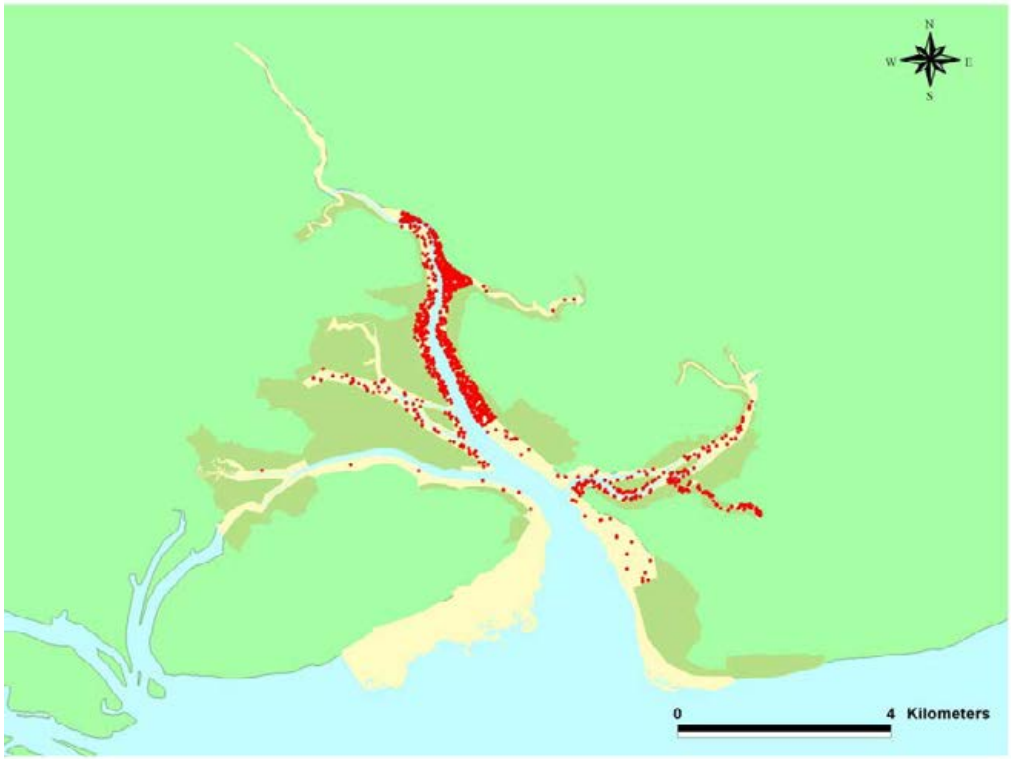


Figure B8 Avocet *Recurvirostra avosetta* (1 dot = 1 bird).

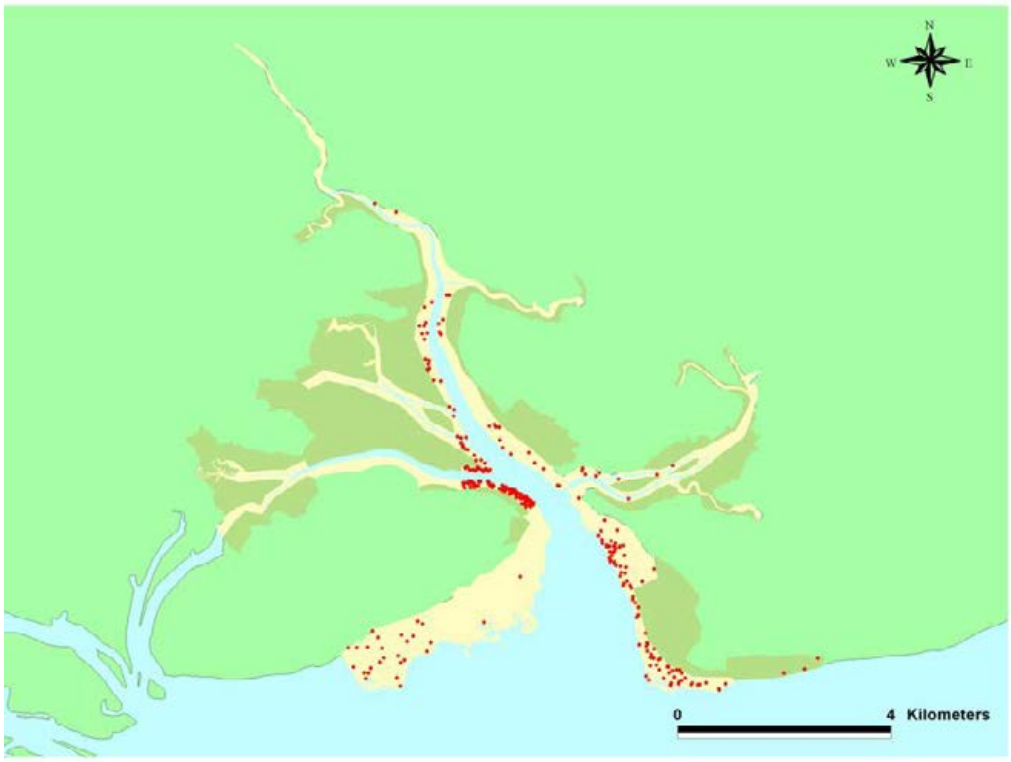


Figure B9 Ringed Plover *Charadrius hiaticula* (1 dot = 1 bird).

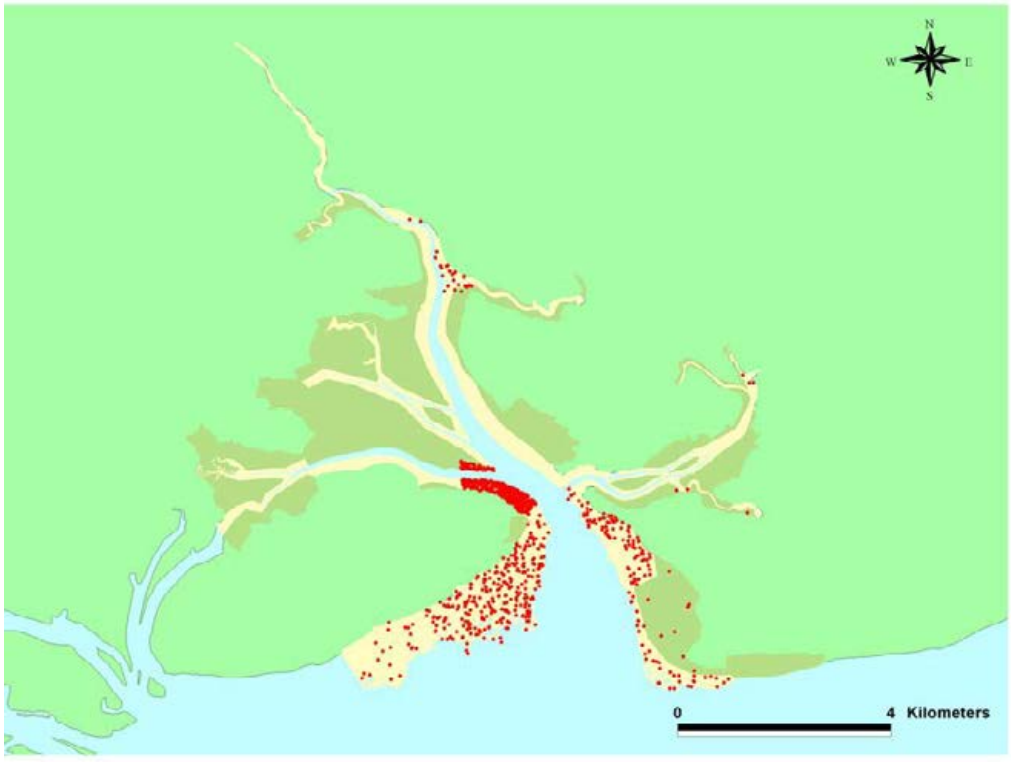


Figure B10 Golden Plover *Pluvialis apricaria* (1 dot = 5 birds).

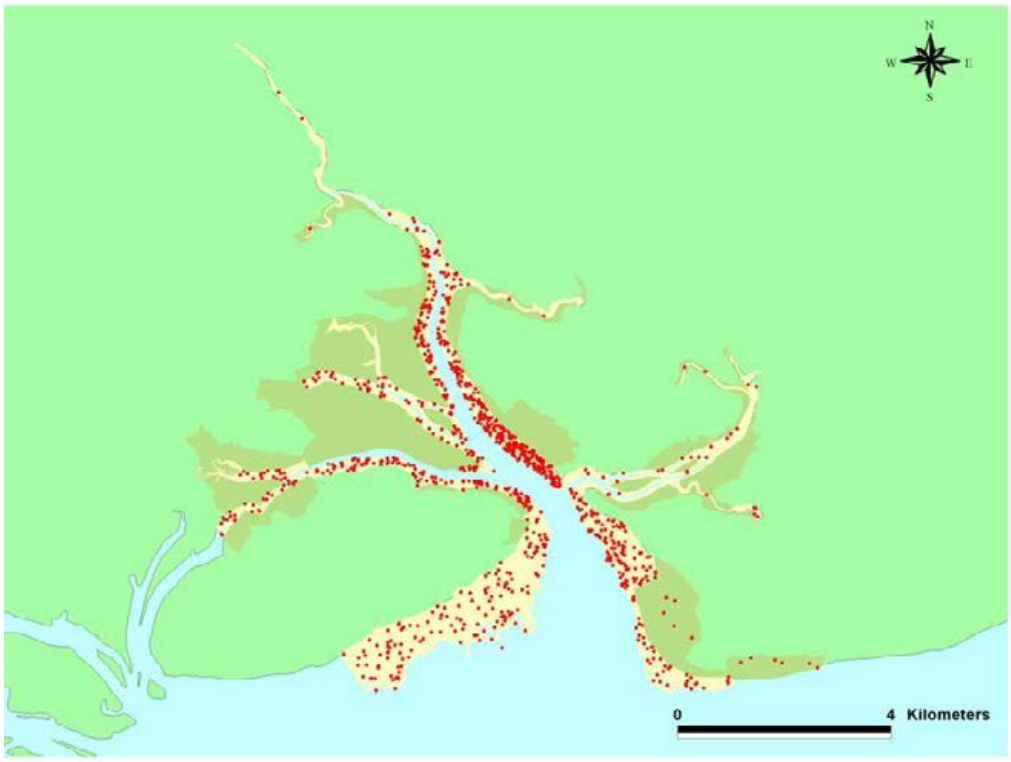


Figure B11 Grey Plover *Pluvialis squatarola* (1 dot = 1 bird).

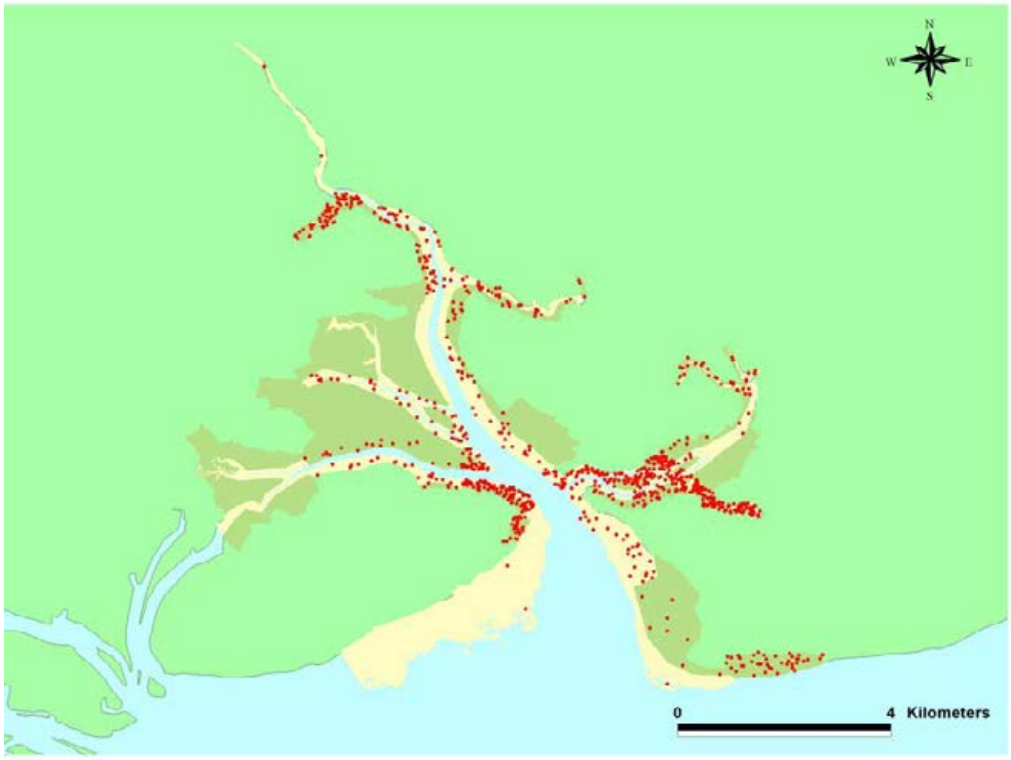


Figure B12 Lapwing *Vanellus vanellus* (1 dot = 5 birds).

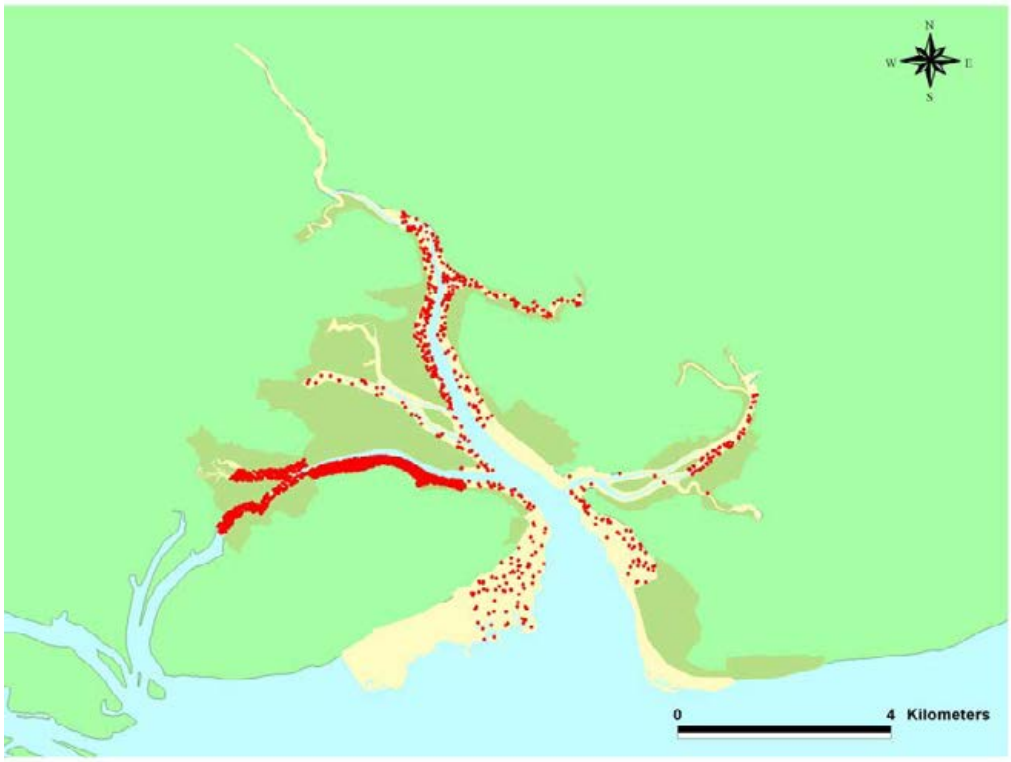


Figure B13 Knot *Calidris canutus* (1 dot = 2 birds).

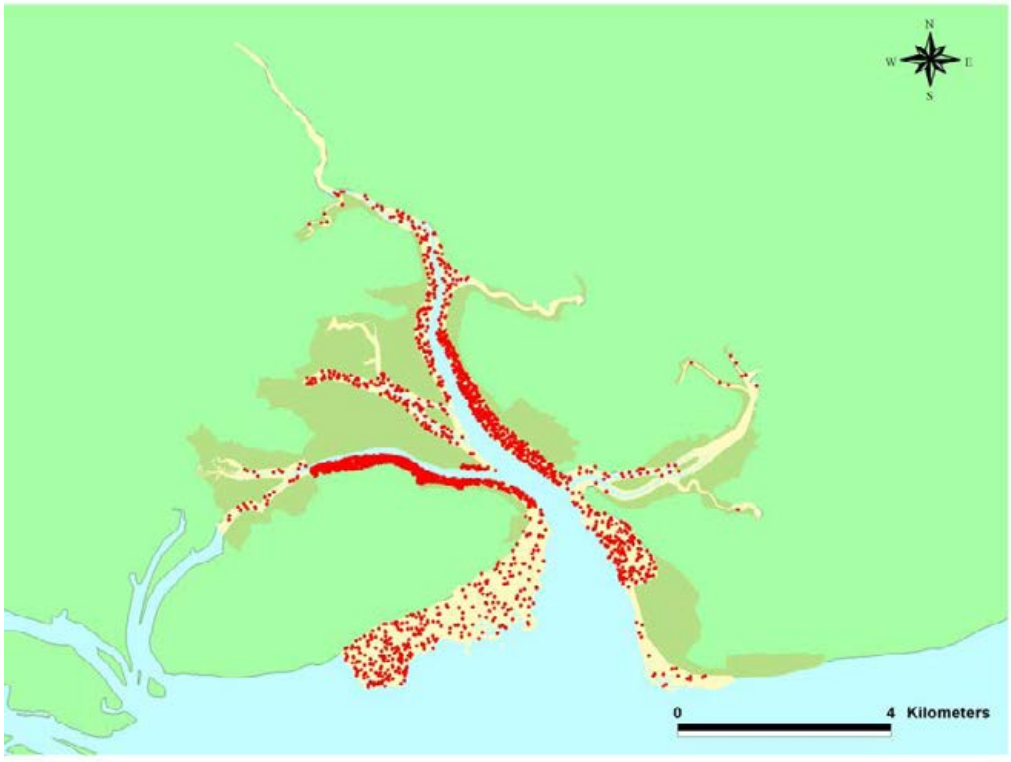


Figure B14 Dunlin *Calidris alpina* (1 dot = 5 birds).

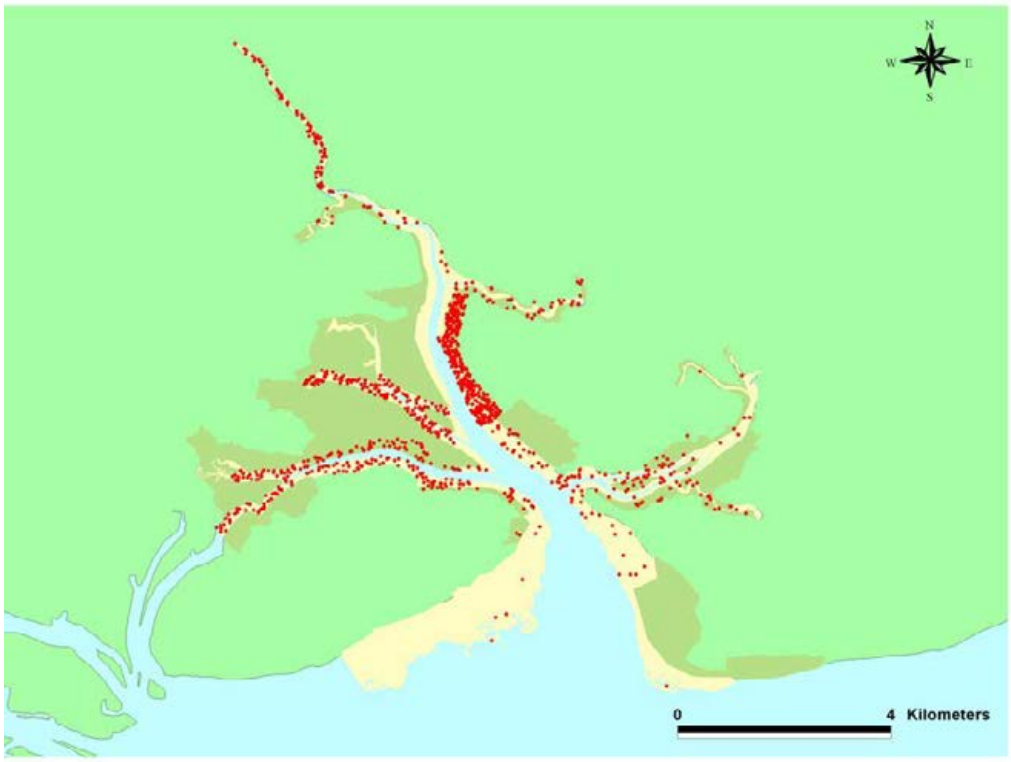


Figure B15 Black-tailed Godwit *Limosa limosa islandica* (1 dot = 1 bird).

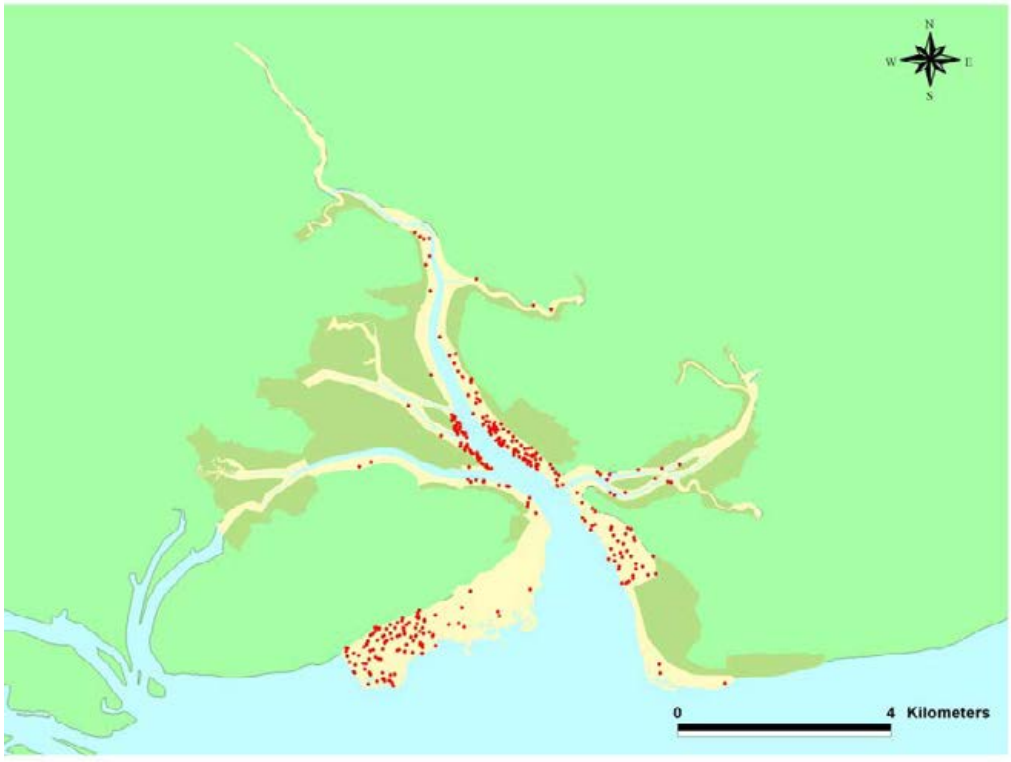


Figure B16 Bar-tailed Godwit *Limosa lapponica* (1 dot = 1 bird).

Figure B17 Curlew *Numenius arquata* (1 dot = 1 bird).

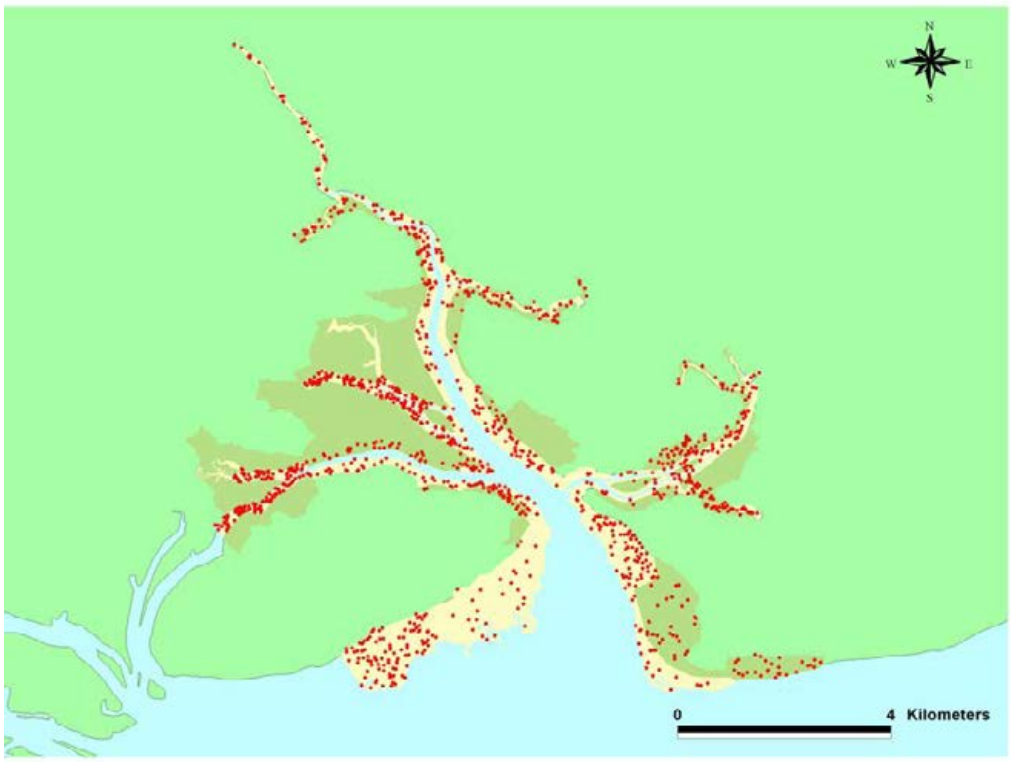


Figure B18 Redshank *Tringa totanus* (1 dot = 2 birds).

Appendix C Mean Count and Density for each species for the whole site. Densities in birds per hectare.

Species	Preferred habitat	Total area of preferred habitat	Peak site count	Mean site count	Mean site density
Red-throated Diver	Sub-tidal	1002	1	0	0.00
Little Grebe	Sub-tidal	1002	40	40	0.04
Great Crested Grebe	Sub-tidal	1002	411	183	0.18
Red-necked Grebe	Sub-tidal	1002	2	1	0.00
Slavonian Grebe	Sub-tidal	1002	3	1	0.00
Cormorant	All habitats	3012	248	106	0.04
Little Egret	Intertidal & non-tidal	2010	64	37	0.02
Grey Heron	Intertidal & non-tidal	2010	10	5	0.00
Mute Swan	Sub-tidal	1002	22	12	0.01
Greylag Goose	All habitats	3012	9	2	0.00
Canada Goose	All habitats	3012	66	45	0.01
Dark-bellied Brent Goose	All habitats	3012	2464	1715	0.57
Shelduck	All habitats	3012	1600	1334	0.44
Wigeon	All habitats	3012	1927	1583	0.53
Gadwall	All habitats	3012	8	4	0.00
Teal	All habitats	3012	1052	900	0.30
Mallard	All habitats	3012	188	173	0.06
Pintail	All habitats	3012	42	31	0.01
Shoveler	All habitats	3012	14	7	0.00
Eider	Sub-tidal	1002	1	1	0.00
Common Scoter	Sub-tidal	1002	1	1	0.00
Goldeneye	Sub-tidal	1002	13	5	0.00
Red-breasted Merganser	Sub-tidal	1002	50	47	0.05
Water Rail	Intertidal & non-tidal	2010	1	1	0.00
Moorhen	All habitats	3012	7	4	0.00
Coot	Sub-tidal	1002	8	5	0.01
Oystercatcher	Intertidal	1240	713	724	0.58
Avocet	Intertidal	1240	586	602	0.49
Ringed Plover	Intertidal	1240	177	179	0.14
Golden Plover	Intertidal & non-tidal	2010	2828	2143	1.07
Grey Plover	Intertidal	1240	575	595	0.48
Lapwing	Intertidal & non-tidal	2010	3329	2145	1.07

Species	Preferred habitat	Total area of preferred habitat	Peak site count	Mean site count	Mean site density
Knot	Intertidal	1240	3051	2612	2.11
Sanderling	Intertidal	1240	63	35	0.03
Dunlin	Intertidal	1240	6716	7332	5.91
Snipe	Non-tidal	770	6	5	0.01
Black-tailed Godwit	Intertidal & non-tidal	2010	617	488	0.24
Bar-tailed Godwit	Intertidal	1240	220	185	0.15
Curlew	Intertidal & non-tidal	2010	525	469	0.23
Redshank	Intertidal & non-tidal	2010	1442	1527	0.76
Greenshank	Intertidal & non-tidal	2010	1	0	0.00
Green Sandpiper	Intertidal & non-tidal	2010	3	2	0.00
Common Sandpiper	Intertidal & non-tidal	2010	2	2	0.00
Turnstone	Intertidal	1240	304	219	0.18
Kingfisher	All habitats	3012	3	3	0.00