BTO Research Report No. 648

Review and analysis of changes in water-bird use of the Mersey Estuary SPA, Mersey Narrows & North Wirral Foreshore SPA and Ribble & Alt Estuaries SPA

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SUMMARY

1. The Ribble and Alt Estuaries, Mersey Estuary and The Dee Estuary are sites of national and international importance for their wader and wildfowl populations (Holt *et al.* 2012). The entire area is important for bird life, and therefore has received various levels of protection. Several sites in particular are designated as Special Protection Areas including the Ribble and Alt Estuaries SPA, the Mersey Estuary SPA and the recently designated Mersey Narrows and North Wirral Foreshore SPA.

2. The Wetland Bird Survey (WeBS) is a long-running survey that records the number of all water-bird species on different geographical count units (sectors) of the Ribble and Alt Estuaries SPA, the Mersey Estuary SPA and the Mersey Narrows and North Wirral Foreshore SPA (as well as many other sites in the UK) at monthly intervals. These data can be used to assess how water-birds use different parts of the region.

3. This study aimed: to identify current water-bird roost and feeding sites in the project area and describe the relationships between these sites and to identify which sites are of the most importance and which are under the greatest threat; to identify changes in popularity of roosting and feeding locations over the last 15 years and identify/suggest reasons that may be driving observed changes and highlight those needing further investigation; to identify whether significant use is being made by birds of non-count sector parts of the SPA and or supporting adjacent habitats that may not have been recorded in the past, e.g. areas that are adjacent to the SPA that are currently being significantly used or areas that were historically not known to be used by the target species within the SPA, but may be being used now and/or sites with restricted access; and to identify any critical gaps in the understanding of use of the project area by water-birds that need to be addressed.

4. In order to collate local knowledge on water-bird use, habitat-type and pressures within the project area, a questionnaire was produced and circulated to individuals within the local WeBS counter network and other relevant groups. This information was supplemented with 15 years of WeBS data and a review of the relevant EIA and research literature.

5. The study area was found to contain internationally important roosts of Knot (*Calidris canuta*), Sanderling (*Calidris alba*), Dunlin (*Calidris alpina*), Black-tailed Godwit (*Limosa limosa*) and Bar-tailed Godwit (*Limosa lapponica*), in addition to nationally important roosts of Shelduck (*Tadorna tadorna*), Wigeon (*Anas penelope*), Teal (*Anas crecca*), Pintail (*Anas acuta*), Common Scoter (*Melanitta nigra*), Cormorant (*Phalacrocorax carbo*), Oystercatcher (*Haematopus ostralegus*), Grey Plover (*Pluvialis squatarola*), Ringed Plover (*Charadrius hiaticula*), Sanderling, Dunlin, Black-tailed Godwit, Bar-tailed Godwit and Curlew (*Numenius arquata*).

6. Comparisons were made between roost sites and feeding distributions within and close to the boundaries of the Liverpool City Region SPAs. Several potential pressures were identified, including human disturbances, the continued spread of saltmarsh vegetation, and sediment erosion / accretion.

7. Gaps in the current knowledge were identified and recommendations were made for improved WeBS sector coverage within the Liverpool City Region SPAs.

1 INTRODUCTION

1.1 Background

The rivers Ribble, Alt, Mersey and Dee form major waterways and estuaries draining into Liverpool Bay. The entire area is important for bird life, and therefore has received various levels of protection. Several sites in particular are designated as Special Protection Areas (SPAs) under the European Birds Directive (Directive 2009/147/EC - the codified version of Directive 79/409/EEC as amended), including the Ribble and Alt Estuaries SPA, the Mersey Estuary SPA and the recently designated Mersey Narrows and North Wirral Foreshore SPA. This report analyses water-bird use at these protected sites, hereafter collectively referred to as the Liverpool City Region SPAs. Together, these SPAs form part of a chain of SPAs on the northwest coast of England, fringing the Irish Sea. Many wintering water-birds move readily between the three SPA sites considered in this report and other SPAs in the region such as Morecambe Bay and Martin Mere. In addition, these sites are particularly important for wader populations that migrate along the west coast of Britain during spring and autumn (Stroud *et al.* 2001).

One of the core duties of Natural England is to ensure protection and management of sites which have been given special protection under the European Union's Habitats Directive, that provide increased protection for habitats, birds, plants and animals and are a vital part of global efforts to conserve the world's biodiversity.

Monthly counts of water-birds are undertaken across the Liverpool City Region SPAs as part the Wetland Bird Survey (WeBS). The aim of this proposed work is to provide an analysis of the water-bird usage for each of the Wetland Bird Survey (WeBS) sectors in the Liverpool City Region in order to underpin and strengthen Natural England's statutory conservation advice in the region when assessing the potential impact of activities and developments.

This study will:

- Inform the review and revision of Natural England's Regulation 35 conservation advice for the Mersey Estuary, Mersey Narrows & North Wirral Foreshore and Ribble & Alt Estuaries Special Protection Area (SPA) sites.

- Bring together, review and improve the evidence baseline for bird use of the above SPAs as a contribution to strengthening the environmental baseline as a part of the Liverpool City Region Pilot.

- Inform Natural England's condition assessment of the three sites.

- Inform the consenting of operations and appropriate assessments of plans and projects within these SPAs.

1.2 Project Area

The project area is defined as the Ribble & Alt Estuaries SPA, the Mersey Narrows & North Wirral Foreshore SPA and the Mersey Estuary SPA. In this report, some consideration is also given to areas that are adjacent to the Liverpool City Region SPAs.

1.2.1 Ribble & Alt Estuaries SPA

The Ribble and Alt Estuaries SPA is the northernmost of the three SPAs considered here, lying between the Mersey Estuary and Morecambe Bay. The Ribble is by far the larger of the two estuaries within the SPA, and the SPA also encompasses a considerable stretch of sandy foreshore along the Sefton Coast. Other habitats include extensive areas of sandflats, mudflats and saltmarsh, as well as some coastal grazing marsh. This SPA is the second most important site for water-birds in the UK (its water-bird numbers are surpassed only by The Wash), supporting a peak of around 235,700 birds during winter and passage periods (Holt *et al.* 2012). It supports internationally important numbers of 14 species (Holt *et al.* 2012) and nationally important numbers of several others (Stroud *et al.* 2001, Cook *et al.* 2013). For the purposes of WeBS monitoring, this SPA is split into 21 count sectors (Figure 1.2.1).

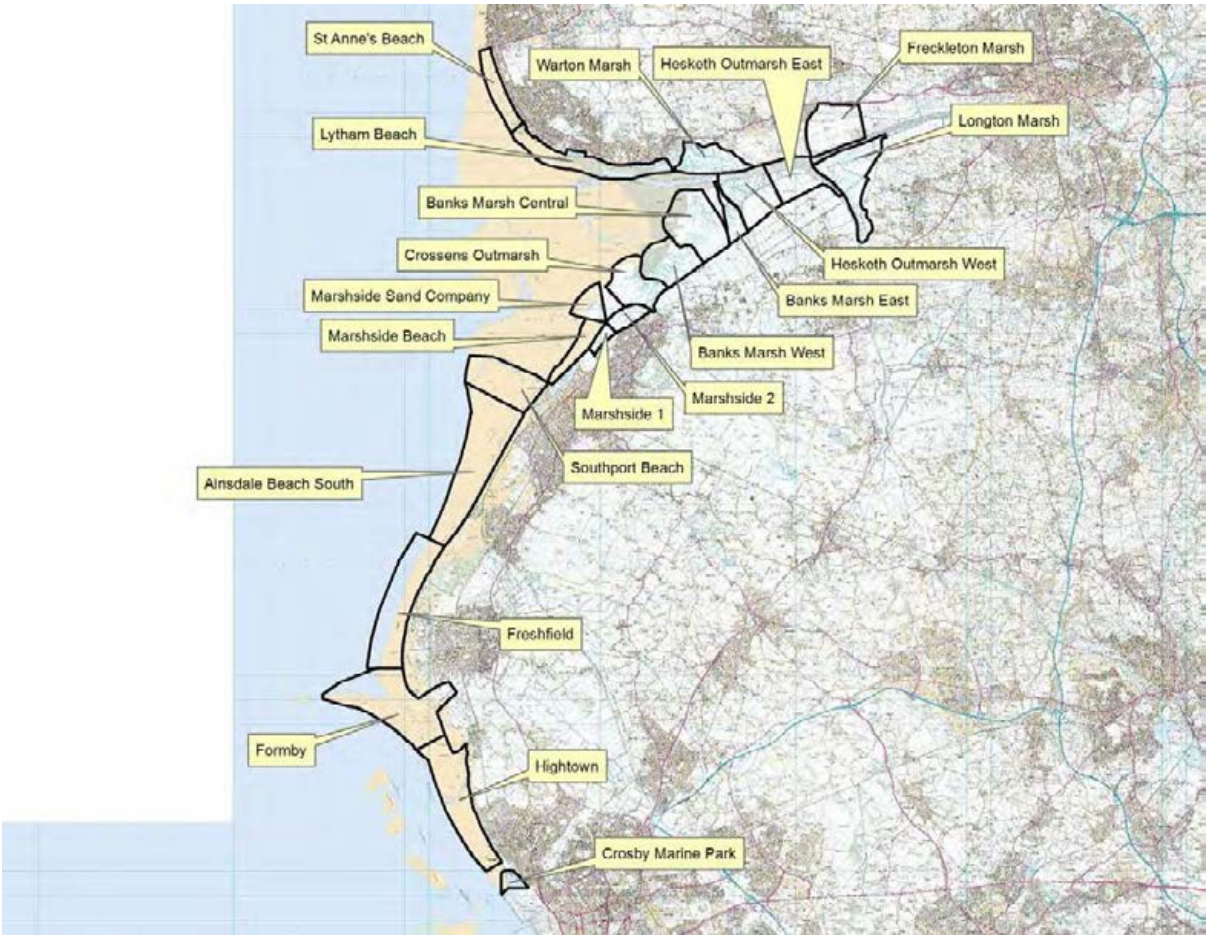

Figure 1.2.1 Locations of each count sector on the Ribble and Alt Estuaries SPA.

1.2.2 Mersey Narrows & North Wirral Foreshore SPA

The Mersey Narrows and North Wirral Foreshore SPA (Figure 1.2.2) is located at the mouths of the Mersey and Dee Estuaries. Habitats include man-made lagoons at Seaforth Nature Reserve, intertidal habitat at Egremont foreshore and large areas of intertidal flats at North Wirral Foreshore. The site supports large numbers of waders and is particularly important for Turnstone *Arenaria interpres* (Stroud *et al.* 2001), though numbers of this species have declined considerably at the site in recent years (Cook *et al.* 2013). For the purposes of WeBS monitoring, this SPA is split into five count sectors (Figure 1.2.3).

Figure 1.2.2 Locations of each count sector on the Mersey Narrows and North Wirral Foreshore SPA.

1.2.3 Mersey Estuary SPA

The Mersey Estuary SPA (Figure 1.2.3) is a large, sheltered estuary with large areas of sandflats, mudflats and saltmarsh. It is one of the top 20 sites in the UK for water-birds, supporting a peak of around 60,000 birds during winter and passage periods (Holt et al 2012). It supports internationally important numbers of four species (Holt *et al.* 2012) and nationally important numbers of several others (Stroud *et al.* 2001, Cook *et al.* 2013). For the purposes of WeBS monitoring, this SPA is split into seven count sectors (Figure 1.2.2).

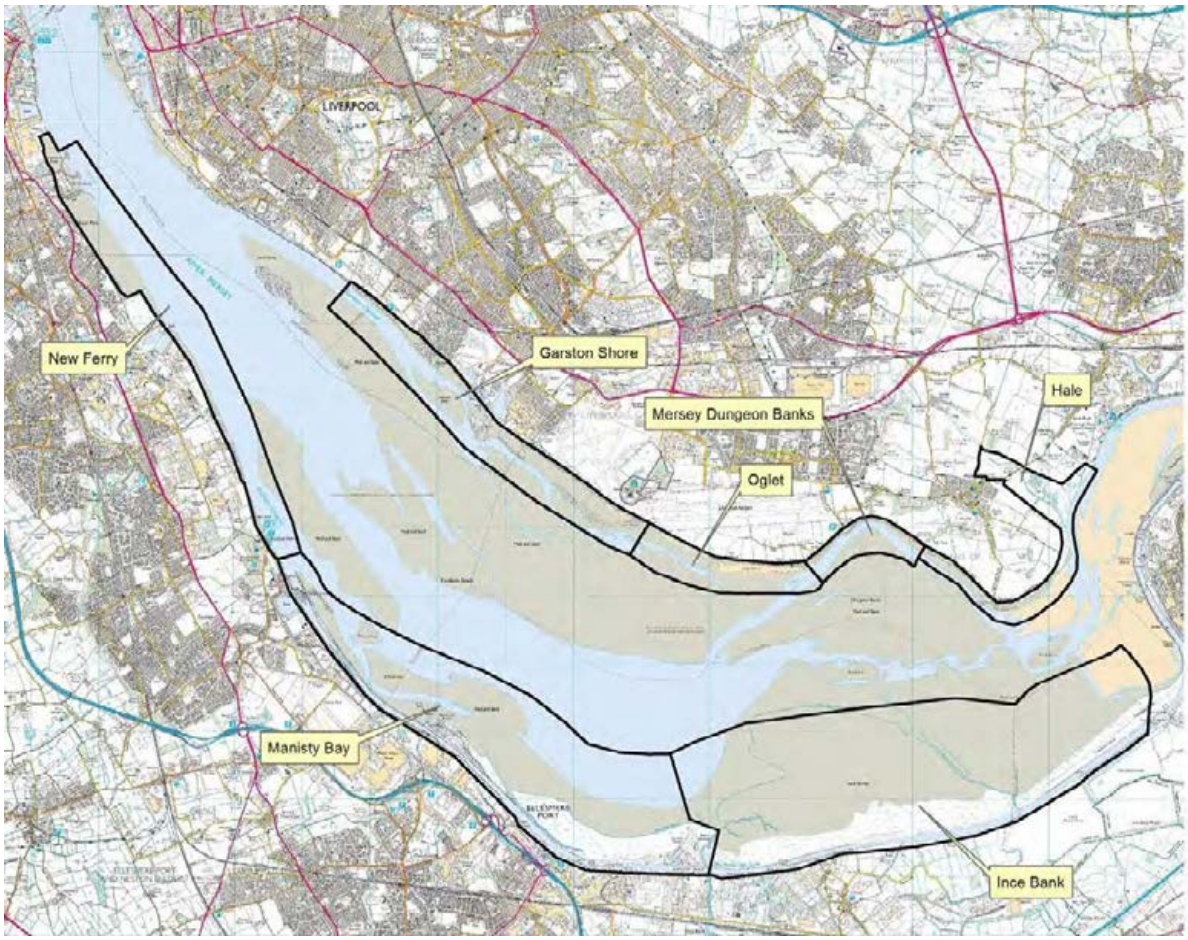

Figure 1.2.3 Locations of each count sector on the Mersey Estuary SPA.

1.3 Objectives

The objectives of this study were:

- To identify water-bird roost sites and feeding sites in the project area and describe the relationships between these sites and to identify which sites are of the most importance and which are under the greatest threat.

- To identify changes in popularity of roosting and feeding locations and identify/suggest reasons that may be driving observed changes and highlight those needing further investigation.

- To identify whether significant use is being made by birds of non-count sector parts of the SPA and or supporting adjacent habitats that may not have been recorded in the past, e.g. areas that are adjacent to the SPA that are currently being significantly used or areas that were historically not known to be used by the target species within the SPA, but may be being used now and/or sites with restricted access.

- To identify any critical gaps in the understanding of use of the project area by water-birds that need to be addressed.

The species analysed, where data allowed, included all those species relevant to each site designation (listed below). Where species are listed for only one or two of the sites, but numbers on the remaining site(s) are sufficient to support an analysis, this was also undertaken so as to enhance interpretation across the project area.

Ribble & Alt Estuaries SPA	Mersey Estuary SPA	Mersey Narrows and North Wirral Foreshore SPA
Bewick's Swan	Shelduck	Cormorant
Whooper Swan	Wigeon	Oystercatcher
Shelduck	Teal	Grey Plover
Wigeon	Pintail	Knot
Teal	Golden Plover	Sanderling
Pintail	Grey Plover	Dunlin
Common Scoter	Lapwing	Bar-tailed Godwit
Cormorant	Dunlin	Redshank
Oystercatcher	Black-tailed Godwit	Common Tern
Golden Plover	Curlew	Turnstone
Grey Plover	Redshank	
Ringed Plover	Great Crested Grebe	
Lapwing		
Knot		
Sanderling		
Dunlin		

Ribble & Alt Estuaries SPA	Mersey Estuary SPA	Mersey Narrows and North Wirral Foreshore SPA
Black-tailed Godwit		
Bar-tailed Godwit		
Curlew		
Redshank		
Common Tern		

Table 1.1 Species for which trends and analyses were undertaken

*The Mersey Narrows and North Wirral Foreshore was first proposed for designation as an SPA in 2000 and became a full SPA in July 2013. Due to the length of time since the original consultation, the data supporting the justification for designation was reviewed. As a result, the list of qualifying species for this site has changed. For the purpose of this study, all qualifying species from both the original consultation and the review will be included.

If there were sufficient and reliable data, the work also included analysis of the following three species (for the sites shown in brackets):

- Pink-footed Goose (on Ribble & Alt Estuaries SPA)
- Black-headed Gull (on Ribble & Alt Estuaries SPA)
- Little Gull (on Mersey Narrows & North Wirral Foreshore SPA)

Specific aims were to:

- Use interviews/questionnaires with WeBS counters and other local bird experts to gain access to local knowledge on bird use within the project area, including information on important supporting terrestrial habitats, bird usage of non-count sectors of the SPA and of non-SPA habitats within the project area, and of significant roost/feeding sites potentially located close to but outside of the SPA boundaries. These interviews were also carried out to identify pressures that may be driving changes in bird use at the sector, SPA level.

- Use the knowledge gained via the interviews/questionnaires to compile maps of the key roost sites of the target species across the WeBS sectors within the project area and adjacent supporting terrestrial habitat, and identify international/national and local significance of roost sites for individual qualifying species and identify which roost sites (if any) are under threat. Maps will be compiled in a comparable style and format to those produced from a similar study performed in the Morecambe Bay area (Marsh *et al* 2012) to ensure that evidence gathered from across the North West region can be easily compared and contrasted.

- Describe the sites giving details on:
  a) habitat characteristics of the site (*i.e.* is it a saltmarsh, shingle bank, pier, rock groyne, *etc.*);
  b) evidence of disturbance and likely influences (*e.g.* how far the roost is from people/dogs /public access pathways, *etc.*).

- Compile and analyse 5-year peak mean figures from WeBS to allow an assessment of the relative importance of each roost site alone and in-combination:
    a) to different species;
    b) as an assemblage;
    c) seasonally;
    d) temporally by height of tides.

- Using the WeBS Low Tide Counts from the last 15 years for which these data were available, including the most recent counts from 2012/13 (counts are not available over a longer period than this as the earliest that Low Tide Counts were carried out for any of the sites in the project area was 1996/97), compile maps identifying location of key water-bird feeding areas for the target species within the project area to give a visual representation of changes in usage of feeding sites for each of the target species within each SPA across this period.

- Explain/describe the relationship between the high tide roost sites to the low tide feeding sites. Where possible, we utilised local knowledge to identify key flyways of target species.

- Review previous research or Environmental Impact Assessment (EIA) studies of bird use within the project area to inform the current study and, where appropriate, to compare with the findings of the current study. We looked to use this and all best available information to investigate and compile possible drivers of change.

- Present recommendations for further studies.

2 METHODS

Data were collected using the following approaches:

1. Questionnaires and interviews
2. WeBS database extraction
3. A review of relevant literature

2.1 Questionnaires and Interviews

In order to gain local knowledge on water-bird use and pressures within the project area, a questionnaire was produced and circulated to individuals within the local WeBS counter network, as well as to Natural England, the RSPB and other relevant groups in the project area. Questions within the questionnaire addressed the key objectives of this study, i.e.

- Identifying important supporting terrestrial habitats and bird usage of non-count sectors of the SPA and of non-SPA habitats within the project area;
- Identifying the location of key roost sites, including significant roost/feeding sites potentially located close to but outside of the SPA boundaries;
- Identifying pressures that may be driving changes in bird use at the sector and SPA level;
- Identifying key flyways of target species between low tide foraging areas and roost sites.

To ensure consistency of approach, the questionnaire was developed using similar previous studies, *e.g.* for the Morecambe Bay Wader Roost Study (Marsh *et al.* 2012) and a previous country-wide review of activities potentially affecting water-bird populations in SPAs (Armitage *et al.* 2004).

The questionnaires had two components:

1. An impact-related questionnaire at SPA-level: This was used to gather information on any changes that have occurred in each SPA over the last 30 years which may have impacted on wintering bird populations either directly (*e.g.* pollution incidents or very cold winters), or indirectly (*e.g.* changes in sediments leading to changes in habitat quality). An example of the questionnaire can be found in Appendix 1a.

2. Mapping roosts at count sector-level: A map was produced for each sector covered by the WeBS core counters. The counters were asked to plot the locations of key roosts, feeding areas and flight lines (e.g. in and out of roosting areas) that birds use. For each roost, counters were asked to indicate the species, the average monthly count and the expected annual peak count. They were also asked to categorise the habitat type (e.g. saltmarsh, shingle beach etc.) at each roost and any observed disturbance (e.g. dogs off lead on intertidal, kitesurfing, etc). The counters were asked to note the frequency of disturbance (roughly how many counts the disturbance has been noted in) and the season which the disturbance applied to. An example of the questionnaire can be found in Appendix 1b.

In addition to the questionnaires, one-to-one interviews were carried out with many of the individuals and organisations concerned, in order to gather collective input from the local birdwatchers and WeBS count teams. These took place through four workshops.

Using the results of the questionnaires and one-to-one interviews, the species assemblage and the habitat characteristics of the roost sites identified are summarised below, together

with evidence of disturbance and other influences likely to affect bird populations in the local WeBS sectors.

2.2 WeBS Database

WeBS data were used to supplement the data collected through questionnaires and interviews. Mean densities were calculated for all sector/species pairs for each of the three 5-year periods spanning the most recent 15 years (note that sector level data are only available post-1993). Means were calculated using the peak core count from each winter. In addition low tide count densities were mapped for each selected species using WeBS low tide count data from 2008/09 for areas in the Mersey Narrows and North Wirral Foreshore SPA, 2012/13 for areas in the Mersey Estuary SPA, and 2012/13 & 2008/09 for areas in the Ribble & Alt Estuaries SPA. All the information was collated in GIS using ArcMap™ (ESRI) for map production.

2.3 Review of Relevant Literature

To further inform the current study, a review of the relevant literature was carried out. An internet search was conducted in order to find any relevant research or EIA reports on water-bird use within and close to the boundaries of the Liverpool City Region SPAs.

3. RESULTS

3.1 Questionnaire and Interview Return

Of the 54 questionnaires sent to WeBS counters, questionnaires regarding 24 count sectors were returned to BTO Headquarters. Figures 3.1.1 to 3.1.3 identify the sectors within each SPA for which questionnaires were received. In addition, one questionnaire was received for Frodsham Sludge Lagoons, a sector lying outside the SPA.

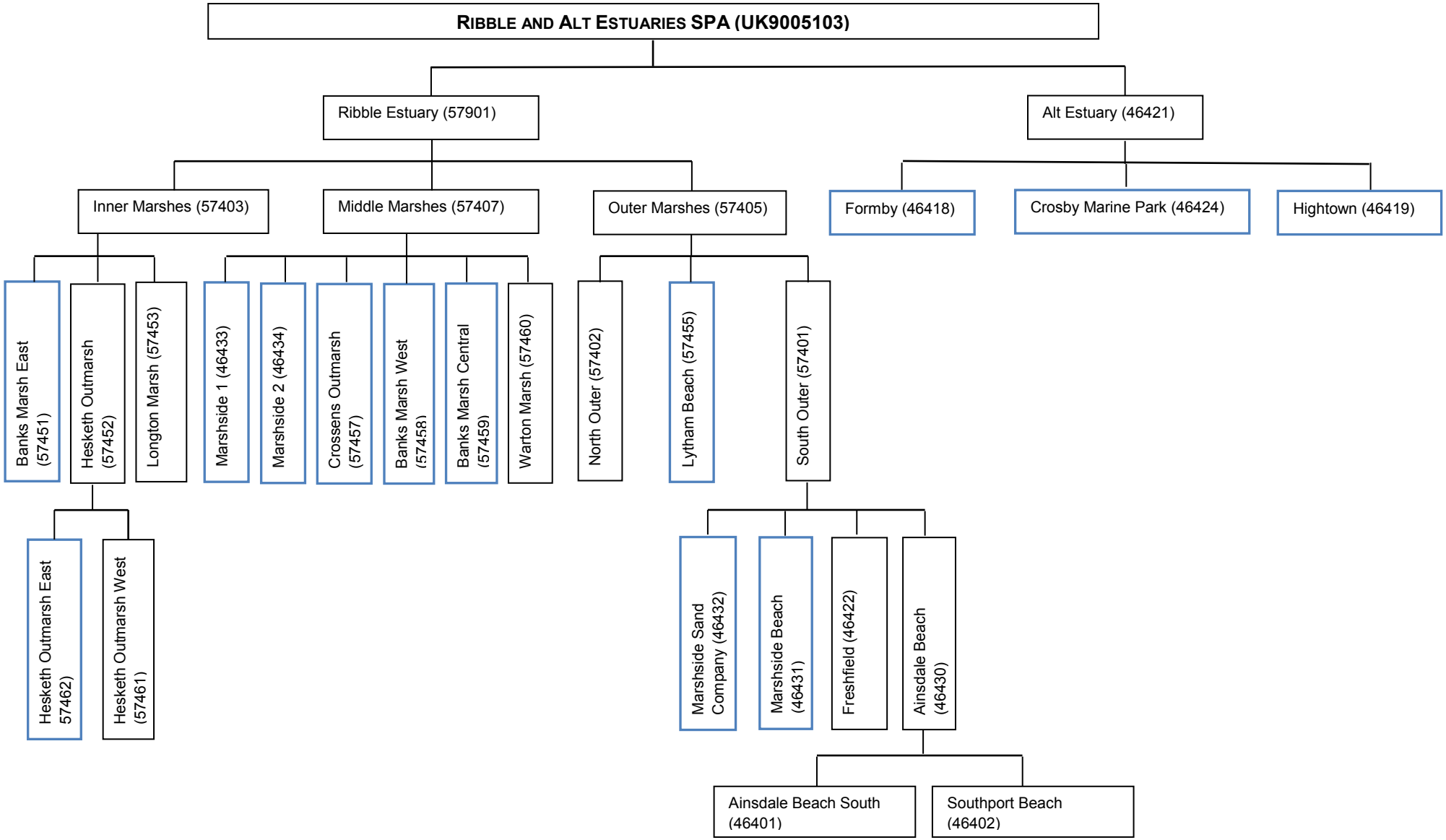

Figure 3.1.1 Structural hierarchy of WeBS count sectors on the Ribble and Alt Estuaries SPA. Boxes with a blue border identify sectors for which questionnaire data was returned for.

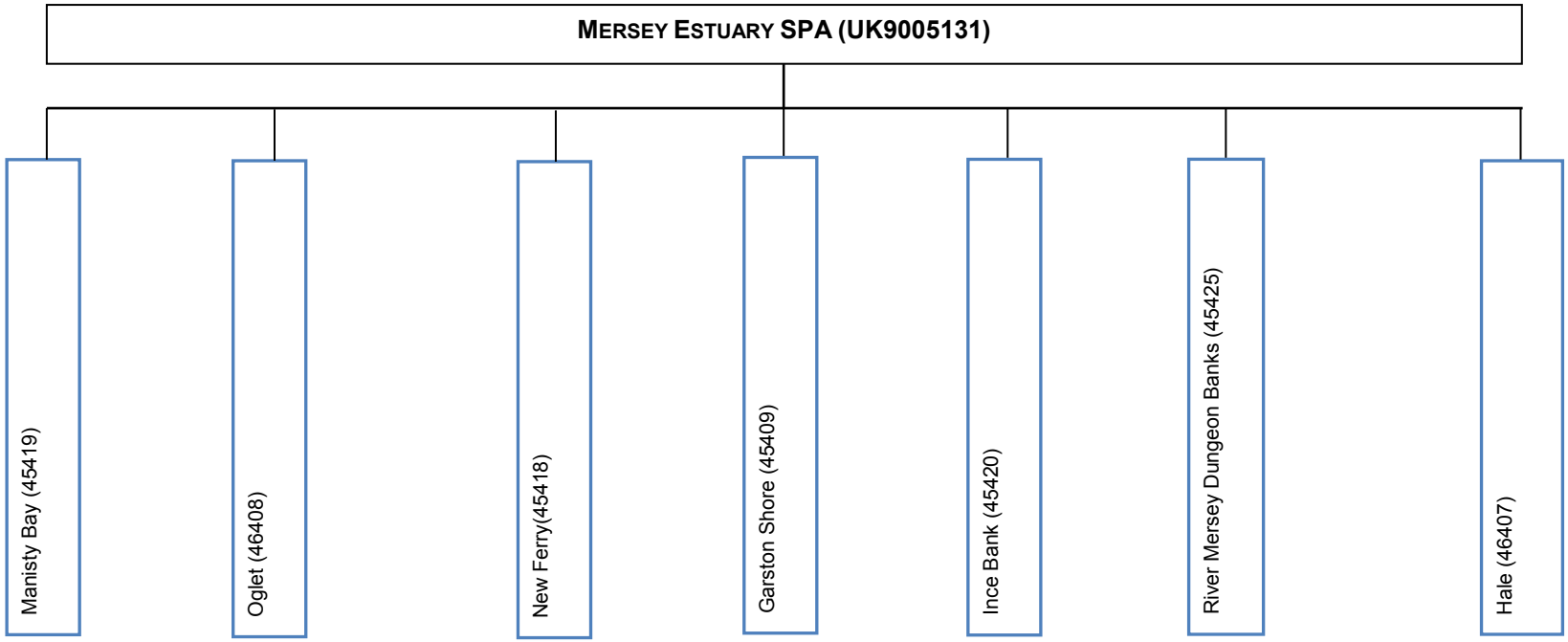

Figure 3.1.2 Structural hierarchy of WeBS count sectors on the Mersey Estuary SPA. Boxes with a blue border identify sectors for which questionnaire data was returned for. Greyed out boxes identify sectors for which WeBS data for at least the most recent five winters are unavailable.

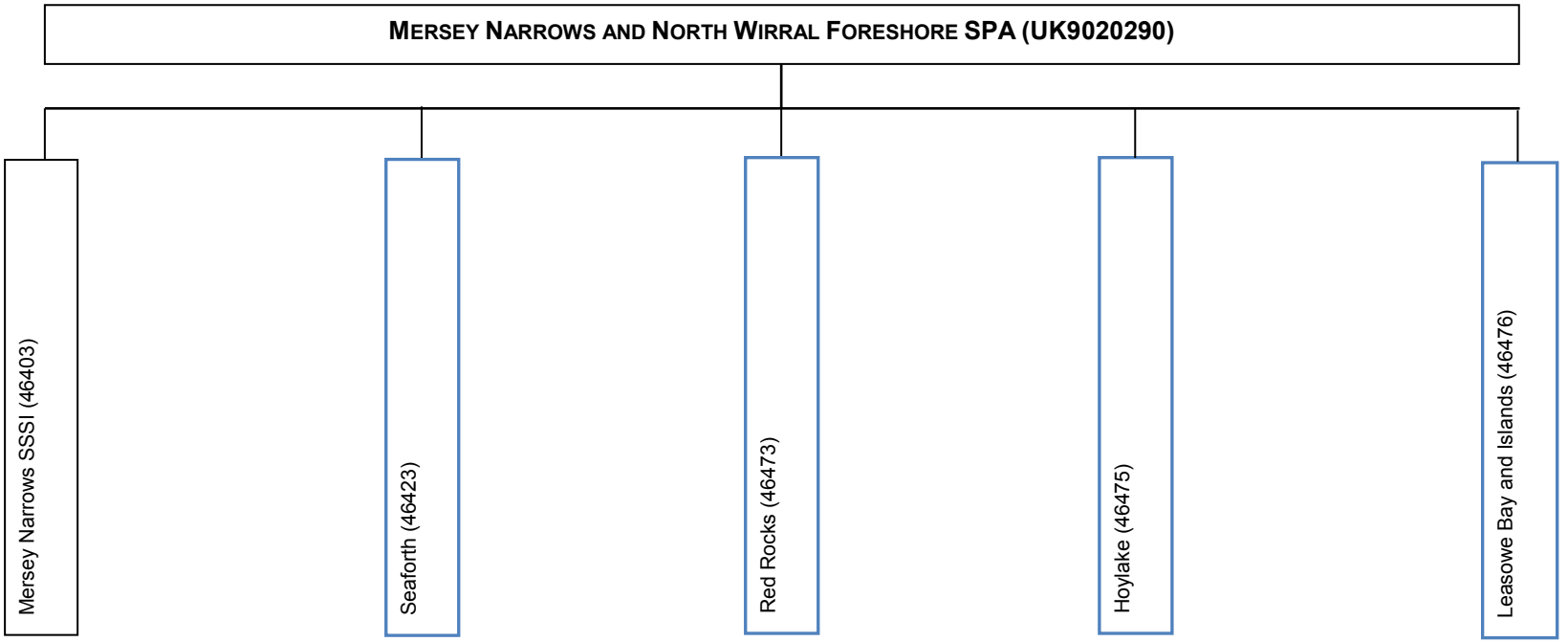

Figure 3.1.3 Structural hierarchy of WeBS count sectors on the Mersey Narrows & North Wirral Foreshore SPA. Boxes with a blue border identify sectors for which questionnaire data was returned for. Greyed out boxes identify sectors for which WeBS data for at least the most recent five winters are unavailable. Sectors at the finest spatial scale for which a sufficiently long time series is available for analysis (in bold) are those primarily considered for interpretation in this report.

3.2 Water-bird use of the Liverpool City Region SPAs

3.2.1 Overview of water-bird Assemblage in the Liverpool City Region SPAs

A mean peak count of over 313,000 water-birds was calculated for the Liverpool City Region SPAs between 2007/08 and 2011/12. An overview of water-bird numbers using the Liverpool City Region SPAs is shown in Figure 3.2. The largest assemblages (over 10,000 birds) occurred between Formby and Banks Marsh Central in the Ribble and Alt Estuaries SPA WeBS Sectors; in Hoylake in the Mersey Estuary SPA sectors; and in Ince Bank in the Mersey Narrows and North Wirral Foreshore SPA sectors.

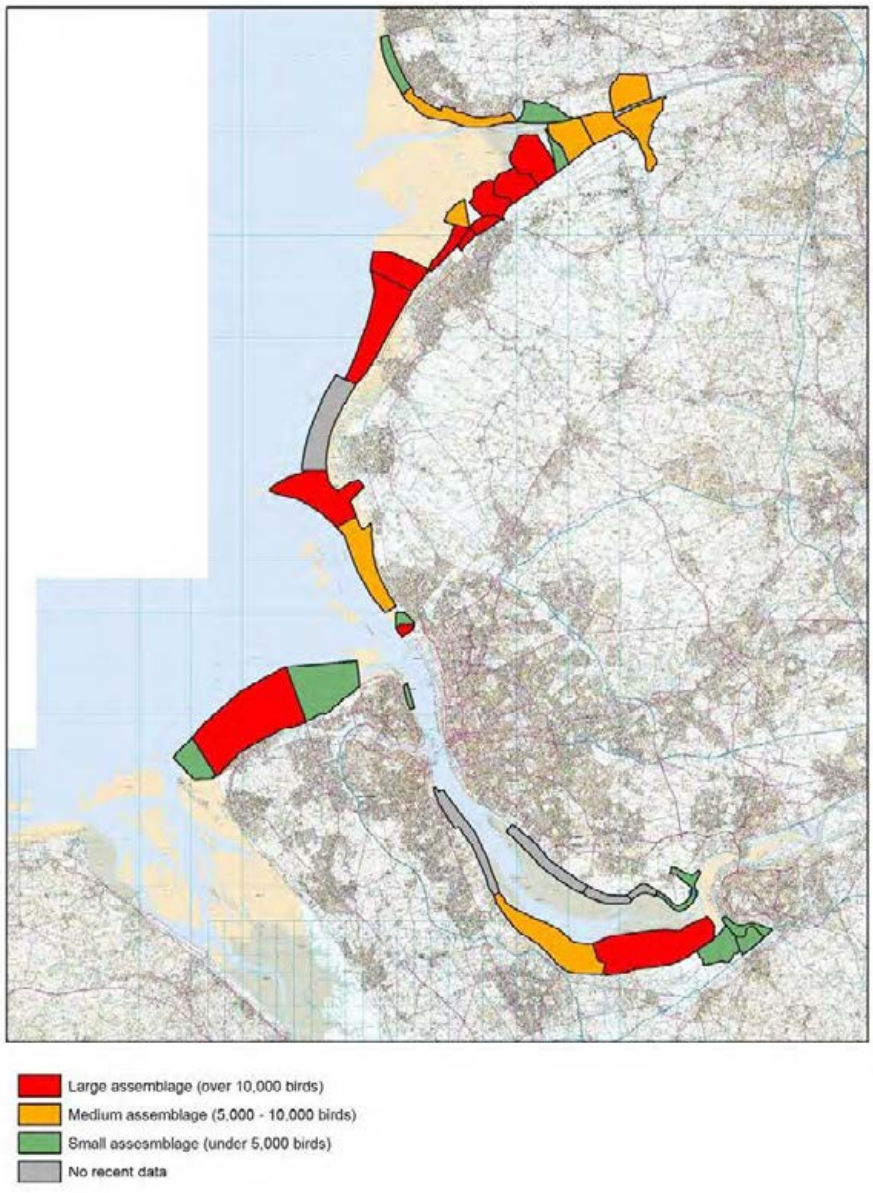

Figure 3.2.1 The WeBS count sectors within the Liverpool City Region SPAs. The map shows the five year average number of all selected water-bird species between 2007/08 and 2011/12, counted within each sector.

3.2.2 Species Accounts

The most current water-bird roosts, feeding distributions and five year mean densities (covering a 15 year period), within or close the boundaries of the Liverpool City Regions SPAs, are presented in the following appendices:

- **Species-specific Roosts -** Appendix 2 contains figures for water-bird species for which data was obtained from WeBS counts, site meetings and the results of questionnaires. Each map shows the location of each roost inside and on the boundaries of the Liverpool City Region SPAs. Colours indicate where roosts are nationally or internationally important.

- **Roost locations at sector level -** Appendix 3 contains figures for water-bird species for which data was obtained from WeBS counts site meetings and the results of questionnaires. Each map shows the areas taken up by each roost inside and on the boundaries of the Liverpool City Region SPAs. Colours indicate three categories of roost: Wader, Wildfowl or Cormorant.

- **Low tide feeding distributions and roost locations -** Appendix 4 combines the roost locations shown in Appendix 1 with low tide feeding distributions for species for which low tide count data was available. Each figure shows the entire Liverpool City Region.

- **Five year mean densities -** Appendix 5 contains figures showing the mapped 5-year mean densities for each of the selected species across the WeBS sectors in the Liverpool City Region SPAs. Means are calculated using the peak winter WeBS high tide counts for each year. Not all the sectors in the Liverpool City Region SPAs had data available for analysis. Figure 3.2.2 shows the WeBS sectors currently lacking in coverage for each of the selected species. Note, however, that some species are unlikely to occur in some sectors due to specific habitat requirements.

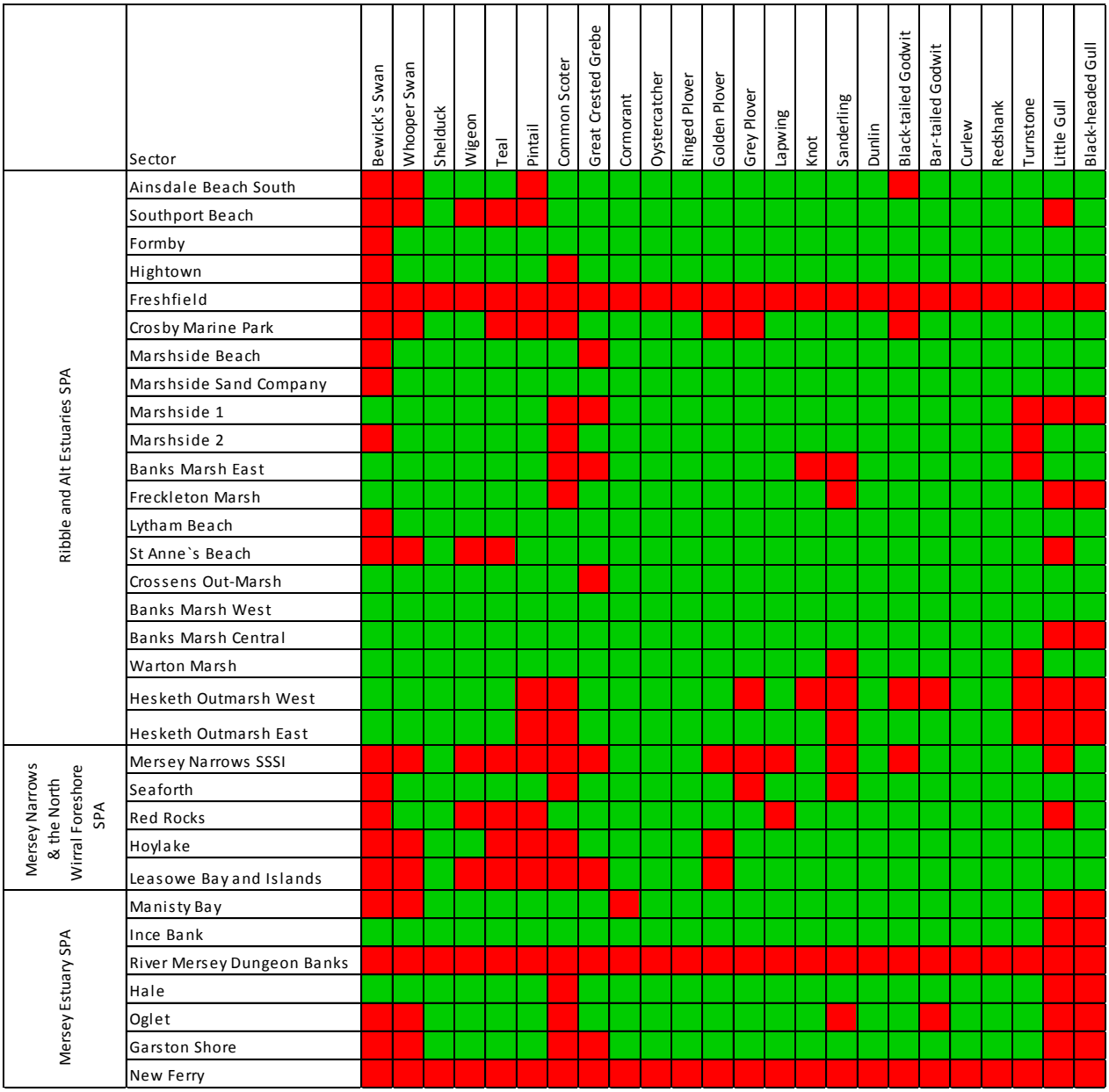

Figure 3.2.2 WeBs sectors currently not lacking (green) or lacking coverage (red) for the selected species**.**

Using this report's appendices, current roost and feeding sites have been identified for the selected water-bird species. Here, EIA and other relevant research literature have been reviewed to fill knowledge gaps and identify changes in the roost and feeding distributions of the following species:

3.2.2.1 Great Crested Grebe *Podiceps cristatus*

No roosts were reported within or close to the boundaries of the Liverpool City Region SPAs. Five year mean densities calculated for the count sectors within the Liverpool City Region SPAs indicate that the Ainsdale Beach WeBS count sector holds the highest numbers, with a mean of 30 birds counted between 2007/08 and 2011/12 (Figure A.5.3). On the river Mersey, other reports indicate that the largest feeding numbers of Great Crested Grebes occur off Stanlow Banks and Ince Banks (Armitage *et al.* 2004). The same authors reported that at high tide, Ince Banks and Stanlow held the greatest concentrations of Great Crested Grebe in the Mersey Estuary.

3.2.2.2 Bewick's Swan *Cygnus columbianus*

No roosts were reported within or close to the boundaries of the Liverpool City Region SPAs. Five year mean densities calculated for the count sectors within the Liverpool City Region SPAs indicate that the Hesketh Outmarsh WeBS count sector holds the highest numbers, with a mean of 9 birds counted between 2007/08 and 2011/12 (Figures A.5.4 and A5.5). Previous research has shown that Bewick's Swan prefer the inner estuary of the Ribble for feeding at low tide (Armitage et al 2004) and the same authors described large high tide concentrations at Longston Marsh, Hesketh Outmarsh and on the south outer marshes (Armitage *et al.* 2004). Other studies have shown that Bewick's Swan regularly use nearby sites including Martin Mere and Foulridge Reservoir where 20-30 birds roost regularly (Robinson *et al.* 2004).

3.2.2.3 Whooper Swan *Cygnus cygnus*

Roosts were reported in the Banks Marsh West and Ince Bank count sectors within the Ribble and Alt Estuaries SPA and the Mersey Estuary SPA, respectively (Figure A.2.1). These were not reported to contain internationally or nationally important numbers. Five year mean densities calculated for the count sectors within the Liverpool City Region SPAs indicate that the Hesketh Outmarsh count sectors and the Longton Marsh count sector hold the highest numbers, with a mean of 154 and 95 birds counted between 2007/08 and 2011/12, respectively. Previous research indicates that, within the Ribble and Alt Estuaries, this species principally feeds on Warton Marsh on the north side of the river and at Hesketh Bank and Hesketh Marshes on the south side. If no feeding is available on the Ribble Estuary then the birds will move to Martin Mere where the species is increasing (Cranswick *et al.* 2002). The majority of the birds present on the Ribble roost at Martin Mere but there are signs that roost sites may be becoming increasingly dispersed (Youngs and Shackleton 2008).

3.2.2.4 Pink-footed Goose *Anser brachyrhynchus*

Two roosts were reported within the Crossens Outmarsh count sector (Figure A.2.2). These were not reported to contain internationally or nationally important numbers. Low tide counts indicate feeding activity occurs at the mouth of the Ribble and further south, within the Hightown count sector (Figure A.4.1). Five year mean densities could not be calculated with the data available for this study. Internationally important numbers of pink-footed geese use the Ribble and Alt Estuaries SPA during the winter. However, the surrounding farmland areas, outside the SPA, are known to be of particular importance for the feeding and roosting activities of this species (Forshaw, 1983).

3.2.2.5 Shelduck *Tadorna tadorna*

This species had two nationally important roosts reported within or close to the boundaries of the Liverpool City Region SPAs: one within the Manisty Bay count sector and a second on the western boundaries of the Ince Bank count sector (Figure A.2.3). Other, smaller roosts were reported within or close to the boundaries of the Mesrey Estuary SPA and the Ribble and Alt Estuaries SPA. Figure A.3.2 indicates that the feeding distribution of this species is in relatively close proximity to the roost sites. Feeding was also reported to occur on the North Wirral Foreshore (Figure A.4.2). Five year mean densities calculated for the count sectors within the Liverpool City Region SPAs indicate that the sectors containing highest concentrations are typically those on the southern edges of the Mersey Estuary SPA and on the southern banks of the mouth of the Ribble (Figures A.5.10 to A.5.12). Previous research indicates that, within the Ribble and Alt Estuaries SPA, low tide feeding occurred in the inner Ribble Estuary, though their distribution also extended out on to Bank Sands and along the channel of the Alt (Armitage *et al.* 2004). The same authors noted that high tide distribution within the Ribble and Alt SPA mainly occurred at Banks Marsh (57459), the outer marshes (57402, 57401) and Hesketh Outmarsh.

3.2.2.6 Wigeon *Anas Penelope*

This species had two nationally important roosts (Marshside 1 and Hesketh Outmarsh East) and one internationally important roost (Banks Marsh Central) reported within the boundaries of the Ribble and Alt Estuaries SPA (Figure A.2.4). Other, smaller roosts were reported within or close to the boundaries of the Mersey Estuary SPA. The majority of low tide feeding activity was reported to occur at the mouth of the Ribble; although smaller numbers was reported within or close to the boundaries of the Mersey Estuary SPA (Figure A.4.3). Five year mean densities calculated for the count sectors within the Liverpool City Region SPAs indicate that the sectors containing highest concentrations are typically those on the southern edges of the Mersey Estuary SPA and on the southern banks of the mouth of the Ribble. High concentrations also exist in the Freshfield count sector (Figures A.5.13 to A.5.15).

3.2.2.7 Teal *Anas crecca*

This species had one nationally important roost reported in the Mersey Estuary SPA (on the boundary of Manisty Bay and Ince Bank) and another reported in the Ribble and Alt Estuaries SPA (Marshside 1) (Figure A.2.5). Other, smaller roosts were reported within or close to the boundaries of the Mersey Estuary SPA and the Ribble and Alt Estuaries SPA. The majority of low tide feeding activity was reported to occur along the courses of the Ribble (between Longton and Lytham) and within the Mersey Estuary SPA boundaries; although smaller numbers were reported further up the river Mersey, and within or close to the boundaries of the Hoylake, Hightown and Formby count sectors (Figure A.4.4). Five year mean densities calculated for the count sectors within the Liverpool City Region SPAs indicate that the sectors containing highest concentrations are typically those on the southern edges of the Mersey Estuary SPA and on the southern banks of the mouth of the Ribble. High concentrations also exist in the Freshfield count sector (Figures A.5.16 to A.5.18).

3.2.2.8 Pintail *Anas acuta*

This species had one nationally important roost reported in Marshside 1, within the Ribble and Alt Estuaries SPA. A smaller roost was also reported in Manisty Bay, within the Mersey Estuary SPA (Figure A.2.6). The majority of low tide feeding activity was reported to occur within the northern half of the Ribble Estuary and within and close to the New Ferry count sector of the Mersey Estuary

SPA (Figure A.4.5). Five year mean densities calculated for the count sectors within the Liverpool City Region SPAs indicate that the sectors containing highest concentrations are typically those on the mouth of the Ribble and on the southern edges of the Mersey Estuary (Figure A.5.19 – A.5.21). Other reports suggest that within the Mersey Estuary SPA, populations are mostly concentrated at Eastham Locks (the outflow of the Manchester Ship Canal) at low tide. At high tide Stanlow was also reported to be an important area for roosting and feeding (Armitage *et al.* 2004). Within the Ribble and Alt Estuaries, the same authors reported that the highest low tide feeding distribution occurred at Salter's Bank, and the highest high tide distributions occurred at Banks Marsh and the south outer marshes.

3.2.2.9 Common Scoter *Melanitta nigra*

This species had one nationally important roost reported offshore, west of the Formby and Freshfield count sectors, outside the Ribble and Alt Estuaries SPA (Figure A.2.7). Other, smaller roosts were reported within or close to the boundaries of the three SPAs. Five year mean densities calculated for the count sectors within the Liverpool City Region SPAs indicate that the Formby sector typically holds the highest concentrations of this species (Figure A.5.22 – A.5.24). Other studies also indicate that within the Ribble and Alt SPA, the most important offshore area used by this species lies close to Formby (NE & CCW 2006, Hi Def and WWT Consulting 2011).

3.2.2.10 Cormorant *Phalacrocorax carbo*

This species had three nationally important roosts reported within or close to the boundaries of the Liverpool City Region SPAs. One was reported on the boundary of the Formby count sector, one between the Seaforth and Crosby Marine Park count sectors, and one close to the eastern boundaries of Ince Bank. Other, smaller roosts were reported within or close to the boundaries of all three SPAs (Figure A.2.8). The majority of low tide feeding activity was reported to occur within or close to the Formby and Hightown count sectors (Figure A.4.6). Five year mean densities calculated for the count sectors within the Liverpool City Region SPAs indicate that the Formby count sector typically holds the highest concentrations of this species (Figure A.5.25 – A.5.27).

3.2.2.11 Oystercatcher *Haematopus ostralegus*

This species had two nationally important roosts reported within or close to the boundaries of the Liverpool City Region SPAs. One was reported on the northern boundaries of Banks Marsh Central and the other was reported on the south-western edges of Hoylake. Other, smaller roosts were reported within or close to the boundaries of all three SPAs. In addition, several others were reported to exist in count sectors lying inland of the North Wirral Foreshore (Figure A.2.6). The majority of low tide feeding activity was reported to occur on the southern foreshore of the Ribble Estuary and on the North Wirral Foreshore. (Figure A.4.7). Five year mean densities calculated for the count sectors within the Liverpool City Region SPAs indicate that the sectors surrounding the mouth of the Ribble, particularly Ainsdale Beach South / Southport Beach, typically hold the highest concentrations of this species. The lower southern sectors of the Ribble ad Alt Estuaries and the Mersey Narrows and North Wirral Foreshore SPA also contain high concentrations (Figure A.5.28 – A.5.30).

3.2.2.12 Ringed Plover *Charadrius hiaticula*

This species had two nationally important roosts reported within or close to the boundaries of the Liverpool City Region SPAs. One was reported on the south-western edges of Hoylake and the other was reported on boundary between Hale and Oglet. Other, smaller roosts were reported within or close to the boundaries of the Mersey Estuary SPA and the Ribble and Alt Estuaries SPA. (Figure A.2.10). The majority of low tide feeding activity was reported to occur within or close to the boundaries of the Mersey Narrows SSSI and within the New Ferry count sector. Smaller concentrations of feeding activity were also reported in the northern half of the Ribble Estuary, on the Alt Estauary, on the North Ribble Foreshore, and on the northern and southern edges of the Mersey Estuary SPA (Figure A.4.8). Five year mean densities calculated for the count sectors within the Liverpool City Region SPAs indicate that the count sectors on the North Wirral Foreshore typically contain the highest concentrations of this species (Figure A.5.31 – A.5.33). Previous research indicates that, within the Ribble and Alt Estuaries, Ringed Plover feeding distributions concentrate at Seaforth, with smaller numbers at St. Anne's beach, Lytham beach, Hightown and Ainsdale beach (Armitage *et al.* 2004).

3.2.2.13 Grey Plover *Pluvialis squatarola*

This species had five nationally important roosts reported within or close to the boundaries of the Mersey Narrows and North Wirral Foreshore SPA and the Ribble and Alt Estuary SPA. These were reported to be within the Lytham Beach, Crossens Out-Marsh, Formby and Hoylake count sectors, and close to the northern boundary of Marshside Beach (Figure A.2.11). Another, smaller roost was also reported on the boundary of the Hightown count sector. The majority of low tide feeding activity was reported to occur in the southern parts of the Ribble Estuary and on the North Wirral Foreshore; although other feeding activity occurred in the southern areas of the Mersey Estuary SPA and on the Alt Estuary (Figure A.4.9). Five year mean densities calculated for the count sectors within the Liverpool City Region SPAs indicate that this species has a relatively even distribution throughout the Liverpool City Region SPAs; however, the largest concentrations of Grey Plover typically exist in the Formby and Ainsdale Beach South / Southport Beach count sectors of the Ribble and Alt Estuaries SPA (Figure A.5.34 – A.5.36). Previous research on Grey Plover in the Alt Estuary showed that this species fed mostly on the muddy areas to the south-east of Formby Pool. Other reports of the Mersey Estuary, indicate that the greatest feeding concentrations are found at Stanlow, with smaller aggregations at Dungeon Banks and off Frodsham Score (Armitage *et al*. 2004). The same authors reported that at high tide, Ince Banks and Stanlow held the greatest concentrations of this species within the Mersey Estuary.

3.2.2.14 Golden Plover *Pluvialis apricaria*

Roosts were reported within or close to the boundaries of five sectors in the Ribble and Alt Estuaries SPA and three sectors in the Mersey Estuary SPA. Seven others were reported inland of the North Wirral Foreshore. No roosts reported were nationally or internationally important in number (Figure A.2.12). The majority of low tide feeding activity was reported to occur on the stretch of the Ribble, from Lytham to Longton, and on the stretch of the Mersey, from Hale to the Runcorn – Widnes Bridge. Smaller concentrations of feeding activity were also reported further up the river Mersey, and within the Formby and Hightown count sectors (Figure A.4.10). Five year mean densities calculated for the count sectors within the Liverpool City Region SPAs indicate that the highest concentrations of this species typically occur within the sectors on the southern edges of the Ribble Estuary and within the western sectors of the Mersey Estuary SPA (Figure A.5.37 – A.5.39).

3.2.2.15 Lapwing *Vanellus vanellus*

Roosts were reported within or close to the boundaries of eight sectors in the Ribble and Alt Estuaries SPA and one sector in the Mersey Estuary SPA. Two others were reported inland of the North Wirral Foreshore. No roosts reported were nationally or internationally important in number (Figure A.2.12). The majority of low tide feeding activity was reported to occur on the stretch of the Ribble, from Lytham to Longton, and on the course of the river Mersey. Smaller concentrations of feeding activity were also reported on the edges of the Mersey and Alt Estuaries, and on the North Wirral Foreshore (Figure A.4.11). Five year mean densities calculated for the count sectors within the Liverpool City Region SPAs indicate that the highest concentrations of this species typically occur within the sectors on the southern edges of the Ribble Estuary and within the western sectors of the Mersey Estuary SPA (Figure A.5.40 – A.5.42).

3.2.2.16 Turnstone *Arenaria interpres*

Roosts were reported on the boundaries of Lytham Beach, in the Ribble and Alt Estuaries SPA; on the boundaries of Leasowe Bay and Islands and within or near to the boundaries of the Mersey Estuary SSSI, in the Mersey Narrows and North Wirral Foreshore SPA; and within or close to the boundaries of Garston Shore and New Ferry, in the Mersey Estuary SPA. No roosts reported were nationally or internationally important in number (Figure A.2.14). The majority of low tide feeding activity was reported to occur on the North Wirral Foreshore, on the Alt Estuary, and within or close to the boundaries of the Mersey Estuary SSSI (Figure A.4.12). However, turnstone have been shown to occupy other areas of the region as five year mean densities calculated for the count sectors within the Liverpool City Region SPAs indicate that the highest concentrations of this species typically occur in the Ribble Estuary and within the southern sectors of Mersey Estuary SPA (Figure A.5.43 – A.5.45). Turnstone distribution has previously been recorded on the Alt Estuary. Kirby et al (1988) showed that this species mostly occurred on the stony revetment in within the Hightown count sector. However, there have been some reported changes to Turnstone roost and feeding site preferences over the last 20 year. One study has indicated that habitat change caused by the groynes on the Mersey river may have a caused a shift in turnstone from the Egrement Ferry to Seacombe Ferry. The same report showed that Turnstone now use the small rocks at the base of the groynes to feed, and stay there to roost rather than fly to Seaforth or Leasowe (Clee & Cross 2000).

3.2.2.17 Knot *Calidris canuta*

This species has five internationally important roosts within or close to the boundaries of four sectors in the Ribble and Alt Estuaries SPA (Banks Marsh West, Marshside Beach, Formby and Hightown) and the Mersey Narrows and North Ribble Foreshore SPA (Hoylake) Other, smaller roosts were reported within or close to the boundaries of all three SPAs in the Liverpool City Region (Figure A.2.15). The majority of low tide feeding activity was reported to occur on the North Wirral Foreshore and in the southern half of the Ribble Estuary (Figure A.4.13). Five year mean densities calculated for the count sectors within the Liverpool City Region SPAs indicate that the highest concentrations of this species typically occur in the southern sectors of the Ribble Estuary, within the Formby count sector of the Alt Estuary, and within the sectors in on the North Wirral Foreshore (Figure A.5.46 – A.5.48). The roosts used throughout the region have not changed considerably since the 1980's as Kirby *et al.* (1988) reported higher numbers roosting in the Ribble and Alt Estuaries than the other estuaries in the Liverpool City Region SPAs. The same authors reported that within the Alt Estuary, the highest concentrations occurred in the Formby sector on a rising tide and in Hightown as the tide went down. At a low tide the majority of Knot fed between Hightown and Seaforth. A more recent study indicates that large numbers of feeding knot are particularly found at Foulnaze (Armritage *et al.* 2004). The same authors indicated that at high tide, Knot show the

highest concentrations at Ainsdale Beach, Formby and Marshside Beach. Significant tidal movements of waders occur within the north-west estuaries surrounding Liverpool Bay (Mitchell *et al.* 1988). Daily movements of Knot occur between the Ribble & Alt estuaries and the North Wirral Shore, Dee Estuary and probably the Mersey (Kirby *et al.* 1988).

3.2.2.18 Sanderling *Calidris alba*

This species was reported to have two internationally important roosts within or near to the boundaries of two sectors in the Ribble and Alt Estuaries SPA (Formby and Hightown). Furthermore, two nationally important roosts were identified within or near to the boundaries of one sector of the Ribble and Alt Estuaries SPA (Lytham Beach) and one nationally important roost was identified in the in the Mersey Narrows and North Wirral Foreshore SPA (Hoylake) (Figure A.2.16). The majority of low tide feeding activity was reported to occur in the northern areas of the Ribble Estuary, within the Alt Estuary, and on the North Wirral Foreshore, on the boundary between Hoylake and Leasowe Bay and Islands (Figure A.4.14). Five year mean densities calculated for the count sectors within the Liverpool City Region SPAs indicate that the highest concentrations of this species typically occur in the Ainsdale Beach South / Southport Beach and Formby count sector (Figure A.5.49 – A.5.51). Sanderling distribution has previously been recorded on the Alt Estuary when Kirby *et al.* (1988) showed that feeding mostly occurred on the tide edge of the Formby count sector.

3.2.2.19 Dunlin *Calidris alpina*

This species was reported to have three internationally important roosts within or near to the boundaries of three sectors in the Ribble and Alt Estuaries SPA (Banks Marsh Central, Banks Marsh West ad Marshside Beach) and one sector in the Mersey Estuary SPA (Ince Bank). Furthermore, two nationally important roosts were identified within or near to the boundaries of two sectors of the Ribble and Alt Estuaries SPA (Formby and Hightown) and one nationally important roost was identified in the in the Mersey Narrows and North Wirral Foreshore SPA (Hoylake) (Figure A.2.17). The majority of low tide feeding activity was reported to occur throughout the Ribble Estuary, the Alt Estuary, on the North Ribble Foreshore and on the southern shore of the Mersey Estuary (Figure A.4.15). Five year mean densities calculated for the count sectors within the Liverpool City Region SPAs indicate that the sectors lying on the southern edges of the Ribble, Alt and Mersey Estuaries and on the North Wirral Foreshore typically hold the highest concentrations of this species (Figure A.5.52 – A.5.54). Kirby et al (1988) previously reported a higher percentage of this species roosting on the Mersey and Dee Estuaries, than on the Alt and Ribble Estuaries. This indicates a regional shift in roost site preference. The same authors noted that the distribution on the Alt Estuary mostly occurred on the mudflats between Formby Pool and Seaforth. A more recent study indicates that large numbers of feeding Knot are particularly found at Foulnaze and Southport Sands, in the Ribble and Alt Estuaries SPA (Armitage *et al.* 2004). The same authors indicated that at high tide, Dunlin show the highest concentrations at Ainsdale Beach, Formby and Marshside Beach. Significant tidal movements of waders occur within the north-west estuaries surrounding Liverpool Bay (Mitchell *et al.* 1988). Daily movements of Dunlin occur between the Ribble & Alt estuaries and the North Wirral Shore, Dee Estuary and probably the Mersey (Kirby *et al.* 1988).

3.2.2.20 Redshank *Tringa totanus*

Roosts were reported within and on the boundaries of all three SPAs. Additional roosts further from the SPA boundaries were reported inland of the North Wirral Foreshore and south-west of the Mersey Estuary SPA count sector, Ince Bank. No roosts reported were nationally or internationally important in number (Figure A.2.18). Low tide feeding activity was reported throughout the region's intertidal zone; although higher concentrations appear to occur in the south of the region (Figure A.4.16). Five year mean densities calculated for the count sectors within the Liverpool City Region SPAs indicates a relatively even distribution throughout the region (Figures A.5.55 – A.5.57). Within the Alt Estuary, Redshank have previously been reported to be evenly dispersed (Kirby *et al.* 1988).

3.2.2.21 Black-tailed Godwit *Limosa lapponica*

Two internationally important roosts were reported within the Marshside 1 and Marshside 2 count sectors of the Ribble and Alt Estuaries SPA and two others were reported within the Manisty Bay count sector of the Mersey Estuary SPA. An additional roost of international importance was reported outside the Mersey Estuary SPA, on the south-west boundaries of the Ince Bank count sector. One roost of national importance was reported inland of the North Wirral Foreshore, relatively close to four other small roosts. Two smaller roosts were also reported within or close to the boundaries of the Hale count sector of the Mersey Estuary SPA (Figure A.2.19). The majority of low tide feeding activity was reported to occur within the sectors on the southern edges of the Mersey Estuary SPA; although smaller concentrations were also reported throughout the Liverpool City SPAs (Figure A.4.17). Five year mean densities calculated for the count sectors within the Liverpool City Region SPAs indicate that the southern sectors of the Mersey Estuary and the sectors surrounding the Ribble Estuary typically hold the highest concentrations of this species (Figures A.5.58 – A.5.60).

3.2.2.22 Bar-tailed Godwit *Limosa lapponica*

This species had two internationally important roosts reported within or close to the boundaries of the Formby and Marshside Beach sectors of the Ribble and Alt SPA. In addition, two nationally important roosts were reported: two in the Lytham Beach count sector of Ribble and Alt Estuaries SPA, and one within the Seaforth count sector of the Mersey Narrows and North Wirral Foreshore SPA. One other, smaller roost was reported close to the boundaries of the Hightown count sector of the Ribble and Alt Estuaries SPA (Figure A.2.20). The majority of low tide feeding activity was reported to occur on the southern foreshore of the Ribble Estuary (smaller concentrations were also reported on the northern foreshore); within the Formby and Hightown count sectors; and within the Hoylake and Leosowe Bay and Islands count sectors (Figure A.4.18). Five year mean densities calculated for the count sectors within the Liverpool City Region SPAs indicate a similar distribution (Figures A.5.61 – A.5.63). The roosts used throughout the region have not changed considerably since the 1980's. Kirby *et al.* (1988) reported higher numbers roosting in the Ribble and Alt Estuaries than any of the other estuaries in the Liverpool City Region SPAs. The same authors noted that the feeding distribution on the Alt Estuary mostly occurred on the mudflats at Formby Pool and Taylor's Bank. On a rising and falling tide, however, a greater proportion was located on the Crosby mudflats. A more recent study indicates that large numbers of feeding Bar-tailed Godwit are particularly found at Foulnaze and north of the Formby channel, in the Ribble and Alt Estuaries SPA (Armritage *et al.* 2004). The same authors indicated that at high tide, Bar-tailed Godwit show the highest concentrations at Ainsdale Beach, Formby and Marshside Beach. Significant tidal movements of waders occur within the north-west estuaries surrounding Liverpool Bay (Mitchell *et al.* 1988). Daily movements of Bar-tailed Godwit occur between the Ribble & Alt estuaries and the North Wirral Shore, Dee Estuary and probably the Mersey (Kirby *et al.* 1988).

3.2.2.23 Curlew *Numenius arquata*

One nationally important roost was reported for this species, on the boundaries of the Hightown count sector of the Ribble and Alt Estuaries SPA (Figure A.2.21). Other, smaller roosts were reported throughout the Liverpool City SPAs - and outside the SPA boundaries, inland of the North Wirral Foreshore, and west of the Ince Bank count sector of the Mersey Estuary SPA. Low tide feeding activity was reported both within and outside the Liverpool City SPAs, including along the course of both the river Mersey and river Ribble (Figure A.4.19). Five year mean densities calculated for the count sectors within the Liverpool City Region SPAs indicate that the highest concentrations typically occur on the southern edges of the Ribble Estaury, throughout the Alt Estuary and on the southern edges of the Mersey Estuary (Figures A.5.65 – A.5.67). Within the Alt Estuary, Curlew have previously been reported to be evenly dispersed (Kirby *et al.* 1988).

3.2.2.24 Black-headed Gull *Chroicocephalus ridibundus*

There were no reports of roosts for this species, within or close to the Liverpool City Region SPAs. Five year mean densities calculated for the count sectors within the Liverpool City Region SPAs indicate that the highest concentrations typically occur in the Ainsdale Beach South / Southport Beach count sectors of the Ribble and Alt Estuaries SPA and on the North Wirral Foreshore (Figures A.5.67 - A.5.69).

3.2.2.25 Little Gull *Larus minutus*

There were no reports of roosts for this species, within or close to the Liverpool City Region SPA. Five year mean densities calculated for the count sectors within the Liverpool City Region SPAs indicate that the highest concentrations typically occur between the Formby and Seaforth count sectors (Figures A.5.70 - A.5.72). Previous research suggests that Little Gulls used to occupy three high-tide roosts at Seaforth, Formby Channel and the Alt Estuary (Smith 1987). Roosts started to occur after an increase in passage movement through British waters in the 1970s (Hutchinson & Neath 1978; Dunn & Lassey 1985; Smith 1987; Lassey 1995).

3.3 Overview of disturbance issues in the Liverpool City Region SPAs

WeBS counters noted several events or changes which have occurred within each sector over the last 30 years, with a range of potential impacts on water-bird usage within and outside the SPA network (Section 3.3). One of the most visible pressures to WeBS counters comes from the perceived disturbance generated from human activity. This section provides an overview of this at a regional and sector level.

Table 3.3 shows levels of perceived disturbance calculated using the frequency of occurrence reported during WeBS Core counts. The areas immediately north and west of Liverpool city are particularly susceptible to disturbances, with Crosby Marine Park (disturbance level = 37), Red Rocks (disturbance level = 32), Hoylake (disturbance level = 29), and High Town (disturbance level = 20) reported to have the highest disturbance levels.

The four most common categories of perceived disturbance noted in and around the Liverpool City Region SPAs were either from recreational activities on land or from boating activities on the water. Birdwatchers and walkers using the shore were reported to disturb birds within eight sectors, while dogs let off the lead on the intertidal zone and 'other boats' (including sailing boats and ferries) were reported to disturb birds within seven sectors (Figure 3.3). When combined with frequency of occurrence, walkers using the shore had the highest level of disturbance at a regional level.

Given that WeBS Core counts are carried out once per month, on weekend days, it is important to note that the results derived from the disturbance component of the questionnaire are only applicable to weekend activities.

	Sector	Dogs off lead on intertidal	Dog walking along shore	Walking along shore	Motor vehicles on intertidal	Bait digging	Cockling	Angling	Photographers	Wildfowling / Clay Pigeon Shoots	Joggers	Birdwatchers	Farming Practices	Horse riding	Kitesurfing	Windsurfing	Canoeing / kayaking	Small powerboat / jet skis	Rowing boats	Other boats (sail boats, ferries, etc)	Planes/helicopters/microlight	**Sector Disturbance Total**
Ribble & Alt Estuaries SPA	Formby	3	3	3		2		1				1			1						1	**15**
	Hightown	1	4	4	1			4									1			3	2	**20**
	Crosby Marine Park	4	4	4	1			1			4					3	3	3	2	4		**37**
	Marshside Beach																					**0**
	Marshside Sand Company																					**0**
	Marshside 1																					**0**
	Marshside 2																					**0**
	Lytham Beach	4	4	4	1	1						1		1				1				**17**
	Crossens Outmarsh											1	1								1	**3**
	Banks Marsh East											1										**1**
	Banks Marsh West			1								1								1	1	**4**
	Banks Marsh Central														1	1		1		3		**6**
	Hesketh Out Marsh East			1				2		1		1					1	1		1	3	**11**
	Red Rocks	4	4	4				4				4			4	4				4		**32**
	Hoylake	4	4	4					4			4			3	3				3		**29**
	Leasowe Bay and Islands																					**0**

	Sector	Dogs off lead on intertidal	Dog walking along shore	Walking along shore	Motor vehicles on intertidal	Bait digging	Cockling	Angling	Photographers	Wildfowling / Clay Pigeon Shoots	Joggers	Birdwatchers	Farming Practices	Horse riding	Kitesurfing	Windsurfing	Canoeing / kayaking	Small powerboat / jet skis	Rowing boats	Other boats (sail boats, ferries, etc)	Planes/helicopters/microlight	**Sector Disturbance Total**
Mersey Estuary SPA	New Ferry																					**0**
	Manisty Bay																					**0**
	Ince Bank																					**0**
	Hale	1								2									1			**4**
Outside SPAs	Frodsham Sludge Lagoons									3		1									4	**8**
Category of Disturbance Total		**21**	**23**	**25**	**3**	**3**	**0**	**12**	**4**	**6**	**4**	**15**	**1**	**1**	**9**	**11**	**5**	**6**	**3**	**19**	**12**	

Table 3.3 Levels of perceived disturbance calculated using frequency of occurrence reported during WeBS counts. The numbers correspond to the level of disturbance: 4 (red) = Very High disturbance i.e. every count; 3 (amber) = High disturbance i.e. more than half of all counts; 2 = Average i.e. half of all counts; 1 = Low i.e. less than half of all counts. Total levels of disturbance have been calculated for each count sector and each category of disturbance (Very high - red > 20; High - amber = 10-19)

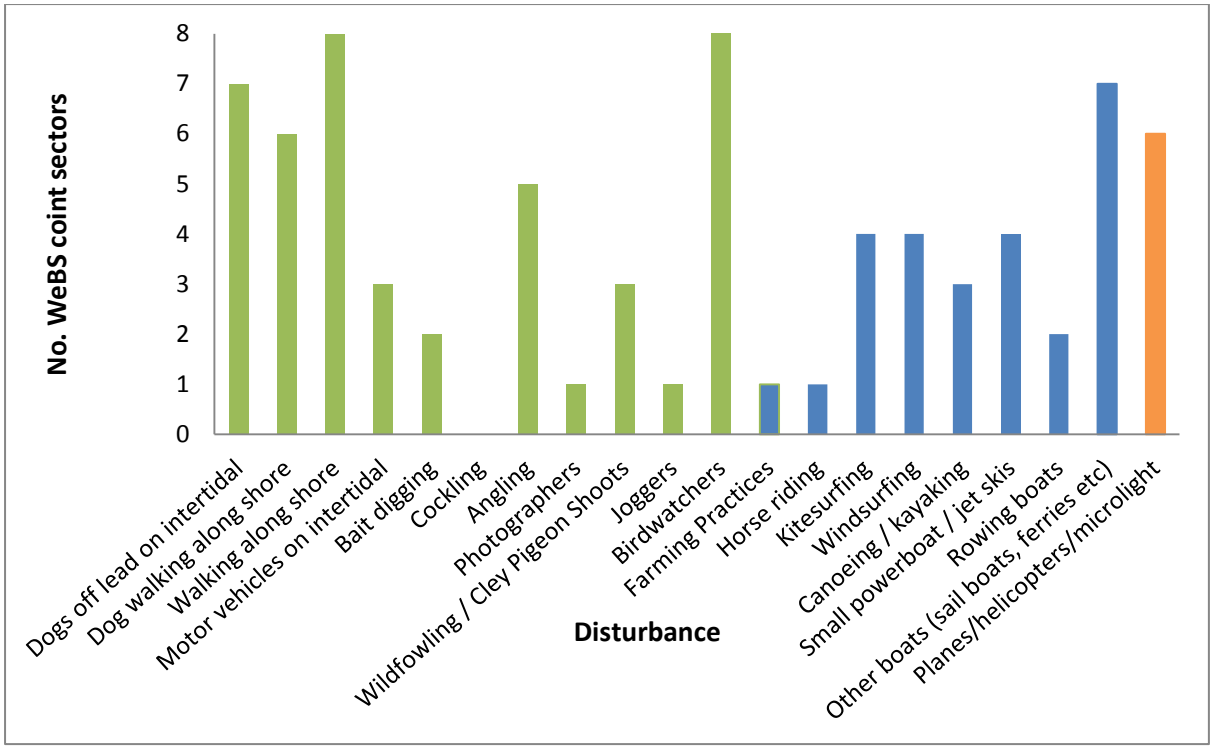

Figure 3.3 Categories of disturbance recorded on WeBS counts within and in the surrounding areas of the Liverpool City Region SPAs. Land-based disturbance types are shown in green, water-based disturbance in blue and air-based disturbance types in orange.

3.4 Count Sectors in detail

The following accounts provide details of important roosts, habitat type and pressures reported to exist in each sector. Only sectors for which questionnaires were received are listed below.

3.4.1 Ribble and Alt Estuaries SPA WeBS Sectors

Formby (46418)

Species with (number of) roosts containing Internationally important numbers	Knot (1), Sanderling (1) and Bar-tailed Godwit (1)
Species with (number of) roosts containing Nationally important numbers	Cormorant (1), Grey Plover (1) and Dunlin (1)
Habitat Type	Sandy shore at all roosts

Other roosts were identified from WeBS data, site meetings and the results of questionnaires. Figure A.3.1 in Appendix 3 shows the locations of all roost sites in this sector.

Information concerning recent changes and disturbance issues in the Formby sector has been collated from site meetings and the results of questionnaires. A summation of these factors is provided below:

- Human disturbance was noted by WeBS counters to come from an increase in recreational activities such as dog walking and the tourism generated from a statue of an iron man on the beach. However, WeBS counters noted that disturbance does not seem to impact birds heavily in this sector as there are other undisturbed refuge areas nearby.

- Other categories of disturbance described by WeBS counters were bait digging, kitesurfing, planes/helicopters/microlights, and birdwatchers.

- WeBS counters suggested that there are continuous natural changes to mudflat structure, which may affect water-bird foraging areas; however, given that there are plenty of other foraging areas nearby, the counters noted that it is 'unlikely' that water-bird populations are affected by this.

- WeBS counters noted a loss of a roosting area during high tides, specifically at Cabin Hill NNR and on the adjacent agricultural fields. In the 1980's and 1990's, the roost contained Turnstone, Redshank, Knot, and Bar-tailed godwit. This area also formerly held breeding Shelduck. Research suggests that only Curlew now use this area.

Hightown (46419)

Species with (number of) roosts containing Internationally important numbers	Knot (1) and Sanderling (1).
Species with (number of) roosts containing Nationally important numbers	Dunlin (1) and Curlew (1)
Habitat Type	Sandy Shore for Knot, Curlew and Sanderling roosts; shingle bank for Dunlin Roost

Other roosts were identified from WeBS data, site meetings and the results of questionnaires. Figure A.3.1 in Appendix 3 shows the locations of all roost sites in this sector.

Information concerning recent changes and disturbance issues in the Hightown sector has been collated from site meetings and the results of questionnaires. A summation of these factors is provided below:

- WeBS counters noted that the sector's water-bird roosts frequently suffer from disturbance from dog walkers, walkers and cyclists. It was observed that the improved footpath between Hall Road and Hightown (improvements made in the year 2012) has increased the frequency of disturbance and a second footpath, overlooking the beach from Hall Road to Hightown, has also generated a high level of disturbance (since around 2007). Disturbance has also increased from walkers visiting the iron men statues. Disturbance to roosts from dog walkers and walkers was noted to occur during every Hightown WeBS count and is thought to be a cause of bird decline in the area. WeBS counters suspect birds have moved to another roost site. In addition, ducks apparently keep away from the shallow water in order to avoid dogs.

- WeBS counters noted some disturbance from motor vehicles. Within the Altcar Rifle Range on the Western Beach side, roosts are apparently disturbed by the Range Officer's land rover movements. This disturbance has become more frequent since around the year 2000. Disturbance caused by motor vehicles is reported to occur on less than half of all WeBS counts of the sector and, reportedly, does not seem to have a long-term effect on roosting numbers, as birds quickly return to the roost after.

- WeBS counters also noted disturbance from boat operations associated with the nearest boat yard on the River Alt. Ducks and geese reportedly avoid the bay when boats are present.

- In order to bolster sea defence, since 2010/11 there has been a major transfer of sand from Waterloo to Hightown. Vehicles associated with this operation were noted to cause disturbance to water-birds by WeBS counters. The birds apparently stop using the beach for roosting and stop using the bay for feeding when the vehicles are present.

- WeBS counters noted a decrease in roosting space when the beach south of the mouth of the river Alt is completely submerged at high tide.

- Other categories of disturbance described briefly by WeBS counters were: angling, dogs off the lead on intertidal areas, and micro-lights.

Crosby Marine Park (46424)

Species with (number of) roosts containing Internationally important numbers	None Stated
Species with (number of) roosts containing Nationally important numbers	None Stated
Habitat Type	Coastal Lagoon

Information concerning recent changes and disturbance issues in the Crosby Marine Park sector has been collated from site meetings and the results of questionnaires. A summation of these factors is provided below:

- WeBS counters noted that the regenerated water sports centre has caused a surge in visitor numbers and boat traffic on the eastern shore of the lake. WeBS counters noted that birds are 'seldom seen' on the big marina.

- A new small nature reserve has been created. WeBS counters have noted single Redshank to 'occasionally' visit.

- WeBS counters noted that mussel beds have been put in place to improve water quality.

- WeBS counters suggested that the creation of a new children's play area has resulted in increased disturbance for water-birds.

- WeBS counters noted that an increased volume of visitors to the iron men statues in the sector causes high tide water-bird roosts to be continuously flushed.

- Other categories of disturbance described by WeBS counters were dogs of the lead on intertidal, dog walking along the shore, motor vehicles on intertidal, bait digging, cockling, angling, windsurfing, canoeing/kayaking, small powerboats/jet skis, other boats (sail boats, ferries, etc) and joggers.

Marshside Beach (46431)

Species with (number of) roosts containing Internationally important numbers	Knot (1), Dunlin (1) and Bar-tailed Godwit (1)
Species with (number of) roosts containing Nationally important numbers	Grey Plover (1)
Habitat Type	Extensive mudflats / sand at all roosts

Other roosts were identified from WeBS data, site meetings and the results of questionnaires. Figure A.3.2 in Appendix 3 shows the locations of all roost sites in this sector.

Information concerning recent changes and disturbance issues in the Marshside Beach sector has been collated from site meetings and the results of questionnaires. A summation of these factors is provided below:

- WeBS counters described expansion of the saltmarsh since the 1970's, which now almost completely covers the sandy / mudflat areas. There has been a decline in wader roosts within these areas.

Marshside Sand Company (46432)

Species with (number of) roosts containing Internationally important numbers	None Stated
Species with (number of) roosts containing Nationally important numbers	None Stated
Habitat Type	NA

Other roosts were identified from WeBS data, site meetings and the results of questionnaires. Figure A.3.2 in Appendix 3 shows the locations of all roost sites in this sector.

Information concerning recent changes and disturbance issues in the Marshside Sand Company sector has been collated from site meetings and the results of questionnaires. A summation of these factors is provided below:

- Several questionnaires suggested that the closure of the sand extraction plant may have reduced water-bird disturbance in recent years.

- WeBS counters drew attention to declines in local Hen Harrier (*Circus cyaneus),* Marsh Harrier (*Circus aeruginosis)* and Short-eared Owl (*Aseo flammeus)* populations.

- WeBS counters noted that dog walkers can access the areas of marsh close to the roost sites.

- WeBS counters suggested that an observed increase in cockling in this sector may cause additional disturbance to water-birds.

Marshside 1 (46433)

Species with (number of) roosts containing Internationally important numbers	Black-tailed Godwit (1)
Species with (number of) roosts containing Nationally important numbers	Wigeon (1), Teal (1), Pintail (1)
Habitat Type	Wet grassland

Other roosts were identified from WeBS data, site meetings and the results of questionnaires. Figure A.3.2 in Appendix 3 shows the locations of all roost sites in this sector.

Information concerning recent changes and disturbance issues in the Marshside 1 sector has been collated from site meetings and the results of questionnaires. A summation of these factors is provided below:

- WeBS counters noted a general improvement since the RSPB took over the management of areas of the sector, in 1994. Their management of the area has led to a 'steady improvement' in water retention in the summer and a 'reduction' of human disturbance in all seasons. As such, the WeBS counters have noted a general increase in numbers of wintering, passage and breeding water-birds.

Marshside 2 (46434)

Species with (number of) roosts containing Internationally important numbers	Black-tailed Godwit (1)
Species with (number of) roosts containing Nationally important numbers	None Stated
Habitat Type	Wet grassland

Other roosts were identified from WeBS data, site meetings and the results of questionnaires. Figure A.3.2 in Appendix 3 shows the locations of all roost sites in this sector.

Information concerning recent changes and disturbance issues in the Marshside 2 sector has been collated from site meetings and the results of questionnaires. A summation of these factors is provided below:

- WeBS counters noted a general improvement since the RSPB took over the management of areas of the sector, in 1994. Their management of the area has led to a 'steady improvement' in water retention in the summer and a 'reduction' of human disturbance in all seasons. As such, the WeBS counter has noted a general increase in numbers of wintering, passage and breeding water-birds.

Lytham Beach (57455)

Species with (number of) roosts containing Internationally important numbers	None Stated
Species with (number of) roosts containing Nationally important numbers	Grey Plover (1), Sanderling (2) and Bar-tailed Godwit (2)
Habitat Type	Saltmarsh at all roosts. Sanderling also roost in shingle bank.

Other roosts were identified from WeBS data, site meetings and the results of questionnaires. Figure A.3.5 in Appendix 3 shows the locations of all roost sites in this sector.

Information concerning recent changes and disturbance issues in the Lytham Beach sector has been collated from site meetings and the results of questionnaires. A summation of these factors is provided below:

- WeBS counters noted a rapid spread of *Spartina*, affecting the dunes west of Fairhaven Lake. The spread has been consistent over the last 40 years, but WeBS counters note that it has become 'very noticeable' recently as it spreads east and south towards the shore.

- WeBS counters noted a continued presence of dog walkers. Disturbance was noted to be particularly high at the main high tide roost site at the St Anne's end of Granny's Bay, where dogs off the lead frequently prevent waders from settling. This area is the largest expanse of saltmarsh/mudflat/sand in the sector. It was also noted that horse-riding and motor vehicles have impacted 'occasionally' within this area. The Lytham end of Granny's Bay also suffers from less frequent dog walking disturbances, so here dog-walking is thought to be 'more tolerable'.

- Other categories of disturbance described by WeBS counters were bait digging, small powerboats/jet skis and birdwatchers.

Crossens Outmarsh (57457)

Species with (number of) roosts containing Internationally important numbers	None Stated
Species with (number of) roosts containing Nationally important numbers	Grey Plover (1)
Habitat Type	Ungrazed saltmarsh at Grey Plover roost

Other roosts were identified from WeBS data, site meetings and the results of questionnaires. Figure A.3.2 in Appendix 3 shows the locations of all roost sites in this sector.

Information concerning recent changes and disturbance issues in the Crossens Outmarsh sector has been collated from site meetings and the results of questionnaires. A summation of these factors is provided below:

- WeBS counters described an increase in vegetation within ungrazed saltmarsh areas. Since this change, the grazed areas of the sector have reportedly become more important as a wader roost.

- Categories of disturbance described by WeBS counters were birdwatchers, planes/helicopters/microlights, and farmers tending to their animals. These disturbances were reported to occur on less than 50% of all WeBS counts.

Banks Marsh East (57451)

Species with (number of) roosts containing Internationally important numbers	None Stated
Species with (number of) roosts containing Nationally important numbers	None Stated
Habitat Type	NA

No roosts were reported in this sector.

Information concerning recent changes and disturbance issues in the Banks Marsh East sector has been collated from site meetings and the results of questionnaires. A summation of these factors is provided below:

- Bird watchers reportedly cause some disturbance to water-birds in the area.

- WeBS counters noted that a mixed gull colony of Lesser Black-backed Gulls (*Larus fuscus*) and Herring Gulls (*Larus argentatus*) has been increasing in size. Counters attributed this as a possible cause of Black-headed Gull (*Chroicocephalus ridibundus*) and Common Tern (*Sterna hirundo*) declines noted to occur in the area.

- WeBS counters linked an increase in cattle grazing to declines in Redshank.

Banks Marsh West (57458)

Species with (number of) roosts containing Internationally important numbers	Knot (1) and Dunlin (1)
Species with (number of) roosts containing Nationally important numbers	None Stated
Habitat Type	Saltmarsh at both roosts

Other roosts were identified from WeBS data, site meetings and the results of questionnaires. Figure A.3.3 in Appendix 3 shows the locations of all roost sites in this sector.

Information concerning recent changes and disturbance issues in the Banks Marsh West sector has been collated from site meetings and the results of questionnaires. A summation of these factors is provided below:

- Categories of disturbance described briefly by WeBS counters were: walking along the shore, other boats (sail boats, ferries etc), birdwatchers, and planes/helicopters/micro-lights etc.

- WeBS counters noted an increase in *Spartina.*

- WeBS counters noted an increase in *Larus* gull spp, with a possible impact on Black-headed Gull populations.

- WeBS counters noted that the channel into Preston Dock is no longer dredged. This has resulted in an increase in silt deposition on the marsh and an increase in vegetation. This is grazed by cattle in the summer, which reportedly, has led to an increase in Wigeon and goose numbers in the area.

Banks Marsh Central (57459)

Species with (number of) roosts containing Internationally important numbers	Wigeon (1), Dunlin (1)
Species with (number of) roosts containing Nationally important numbers	Oystercatcher (1)
Habitat Type	Saltmarsh at all roosts

Other roosts were identified from WeBS data, site meetings and the results of questionnaires. Figure A.3.3 in Appendix 3 shows the locations of all roost sites in this sector.

Information concerning recent changes and disturbance issues in the Banks Marsh Central sector has been collated from site meetings and the results of questionnaires. A summation of these factors is provided below:

- Categories of disturbance described briefly by WeBS counters were: kitesurfing, windsurfing, small powerboats/jet skis and other boats (sail boats, ferries etc).

- WeBS counters noted an increase in Wigeon after a no-wildfowling zone was extended in the 1980's.

- A decline (and almost total elimination in some areas) of *Spartina* grass coverage. These areas are now grazed by Wigeon and Pink-footed goose.

Hesketh Outmarsh East (57462)

Species with (number of) roosts containing Internationally important numbers	None Stated
Species with (number of) roosts containing Nationally important numbers	Wigeon (1)
Habitat Type	Saltmarsh

Other roosts were identified from WeBS data, site meetings and the results of questionnaires. Figure A.3.4 in Appendix 3 shows the locations of all roost sites in this sector.

Information concerning recent changes and disturbance issues in the Hesketh Outmarsh East sector has been collated from site meetings and the results of questionnaires. A summation of these factors is provided below:

- Categories of disturbance described briefly by WeBS counters were: walking along shore, angling, wildfowling / clay pigeon shoots, birdwatchers, canoeing / kayaking, small powerboat / jet skis, other boats (sail boats, ferries, etc) and planes/helicopters/micro-lights.

- WeBS counters noted saltmarsh restoration within the sector, which began in 2006, may have increased feeding and breeding opportunities for water-birds.

- WeBS counters that the re-building of the sea wall over two years caused some minimal disturbance to water-birds.

3.4.2 Mersey Narrows and North Wirral Foreshore SPA WeBS Sectors

Red Rocks (46473)

Species with (number of) roosts containing Internationally important numbers	Non Stated
Species with (number of) roosts containing Nationally important numbers	Non Stated
Habitat Type	NA

Other roosts were identified from WeBS data, site meetings and the results of questionnaires. Figure A.3.6 in Appendix 3 shows the locations of all roost sites in this sector.

Information concerning recent changes and disturbance issues in the Red Rocks sector has been collated from site meetings and the results of questionnaires. A summation of these factors is provided below:

- Categories of disturbance described by WeBS counters were dogs off lead on intertidal, dog walking along shore, walking along shore, angling, kitesurfing, windsurfing, other boats (sail boats, ferries, etc) birdwatchers.

- WeBS counters noted an accretion of saltmarsh on beach areas. Control measures were implemented in the 1990's by the local council.

- WeBS counters noted an increase in recreational activities in general.

Hoylake (46475)

Species with (number of) roosts containing Internationally important numbers	Knot (1
Species with (number of) roosts containing Nationally important numbers	Oystercatcher (1), Grey Plover (1), Ringed Plover (1), Sanderling (1) and Dunlin (1)
Habitat Type	Groynes or intertidal mudflats at all roosts

Other roosts were identified from WeBS data, site meetings and the results of questionnaires. Figure A.3.6 in Appendix 3 shows the locations of all roost sites in this sector.

Information concerning recent changes and disturbance issues in the Hoylake sector has been collated from site meetings and the results of questionnaires. A summation of these factors is provided below:

- Categories of disturbance described by WeBS counters were dogs off lead on intertidal, dog walking along shore, walking along shore, kitesurfing, windsurfing, other boats (sail boats, ferries, etc), birdwatchers and photographers.

- WeBS counters noted an accretion of saltmarsh on beach areas. Control measures were implemented in the 1990's by the local council.

- WeBS counters noted an increase in recreational activities in general.

- A new lifeboat station and slipway was completed in 2008. There has been a build-up of mud immediately west of its position. This has reportedly changed the nature of the high tide feeding areas, including a reduction in feeding numbers of Bar-tailed Godwit and Redshank.

Leasowe Bay and Islands (46476)

Species with (number of) roosts containing Internationally important numbers	Non Stated
Species with (number of) roosts containing Nationally important numbers	Non Stated
Habitat Type	NA

Other roosts were identified from WeBS data, site meetings and the results of questionnaires. Figure A.3.7 in Appendix 3 shows the locations of all roost sites in this sector.

Information concerning recent changes and disturbance issues in the Leasowe Bay and Islands sector has been collated from site meetings and the results of questionnaires. A summation of these factors is provided below:

- WeBS counters noted disturbance from fishermen in this area.

3.4.3 Mersey Estuary SPA WeBS Sectors

Frodsham Sludge Lagoons (45351) and surrounding areas

Species with (number of) roosts containing Internationally important numbers	None Stated
Species with (number of) roosts containing Nationally important numbers	None Stated
Habitat Type	NA

Note that this sector is near to, but outside the Mersey Estuary SPA boundary.

Other roosts were identified from WeBS data, site meetings and the results of questionnaires. Figure A.3.9 in Appendix 3 shows the locations of all roost sites in this sector.

Information concerning recent changes and disturbance issues in the Frodsham Sludge Lagoons sector has been collated from site meetings and the results of questionnaires. A summation of these factors is provided below:

- Categories of disturbance described briefly by WeBS counters were: bird watchers.

- Shooting clubs were reported by WeBS counters to cause disturbance to water-birds. Shooting has increased with a regime of pheasant rearing. Clubs usually shoot near to tank no. 3 and tank no. 5, and within the area to the east of these.

- There is a model aircraft flying club situated on Lordship Marsh, south of tank no. 6. The models regularly fly over high tide roosts, causing disturbance.

- WeBS counters have noted a change in the locations used by waders for feeding and roosting. After the creation of a new sludge deposit tank (no. 6), the old tank (no. 4) and ICI tanks have since become overgrown with *Phragmites* reed beds and alder (*Alnus)* / willow scub (*Salix*) scrub. Waders now use the areas in close proximity to tank no. 6, reportedly due to the better feeding conditions.

- WeBS counters noted that water levels have been kept high on the Weaver Bend and the Weaver Estuary. Since 1990 roosts have moved from this area. Very occasionally the water level drops in this area, creating good feeding conditions for waders.

New Ferry (45418)

Species with (number of) roosts containing Internationally important numbers	None Stated
Species with (number of) roosts containing Nationally important numbers	None Stated
Habitat Type	NA

Other roosts were identified from WeBS data, site meetings and the results of questionnaires. Figure A.3.11 in Appendix 3 shows the locations of all roost sites in this sector.

Information concerning recent changes and disturbance issues in the New Ferry sector has been collated from site meetings and the results of questionnaires. A summation of these factors is provided below:

- A dredger moored offshore has become a roost site for Redshank.

Ince Bank (45420)

Species with (number of) roosts containing Internationally important numbers	Dunlin (1)
Species with (number of) roosts containing Nationally important numbers	Shelduck (1), Cormorant (1), Teal (1)
Habitat Type	Grazed saltmarsh at all roost locations

Other roosts were identified from WeBS data, site meetings and the results of questionnaires. Figure A.3.9 in Appendix 3 shows the locations of all roost sites in this sector.

Information concerning recent changes and disturbance issues in the Ince Bank sector has been collated from site meetings and the results of questionnaires. A summation of these factors is provided below:

- WeBS counters noted a rise in Canada Goose numbers coinciding with a decrease in Wigeon numbers in the area.

- WeBS counters noted a decrease in Sea Splurrey (*Spergularia spp*.) coinciding with a decrease in pintail numbers.

- WeBS counters noted that the saltmarsh has started to erode and sand is moving across to Dungeon Banks.

Hale (46407)

Species with (number of) roosts containing Internationally important numbers	None Stated
Species with (number of) roosts containing Nationally important numbers	Ringed Plover (1)
Habitat Type	None Stated

Other roosts were identified from WeBS data, site meetings and the results of questionnaires. Figure A.3.9 in Appendix 3 shows the locations of all roost sites in this sector.

Information concerning recent changes and disturbance issues in the Banks Marsh West sector has been collated from site meetings and the results of questionnaires. A summary of these factors is provided below:

- WeBS counters noted that since cattle were introduced to graze the west side of the marsh, wader roosts have moved to a less vegetated area on the east side. Large numbers of Canada geese help to keep the east side's vegetation under control; however, Wigeon no longer feed in this area amongst the geese.

- WeBS counters noted an increase in presence from local shooting syndicates using an area between Hale Head and Decoy since 2011. This apparently disturbs flight lines between Decoy and Carr Lane Pools. Duck numbers using Decoy have declined since 2000.

4. DISCUSSION

Recent WeBS analysis has shown that several water-bird species are in decline within the boundaries of the Liverpool City Region SPAs. At site level, of particular concern are Bewick's Swan and Oystercatcher in the Ribble and Alt Estuaries SPA; Shelduck, Wigeon, Teal, Pintail, Golden Plover, Lapwing and Redshank in the Mersey estuary SPA; and Bar-tailed Godwit in the North Wirral Foreshore SSSI. For each of these species, comparison of site trends with broad scale trends suggests that the declines may be driven by site-specific pressures (Cook *et al.* 2013).

In order to underpin these declines, the results of this study should be compared with recent sector level analysis of the Liverpool City Region SPAs (Ross-Smith *et al.* 2013). Site specific pressures can then be addressed through appropriate management.

Through this study, several pressures have been identified with a range of potential impacts on water-bird usage within and outside the SPA network. One of the most visible pressures to WeBS counters comes from the perceived disturbance generated from human activity, with high levels of recreational activity, occurring particularly in the sectors immediately north and west of Liverpool city. Recreational disturbance has previously been considered to be a possible contributory factor to water-bird declines within the area (Armitage *et al.* 2004), and within the region's most heavily disturbed sectors, several water-bird species have shown recent 25 year population declines (Ross-Smith *et al.* 2013). However, whether recreational disturbance has a direct effect on populations of water-birds in and around the Liverpool City Region SPAs remains unclear, as avoidance of recreational disturbance does not always reflect population level consequences (Gill *et al.* 2001). Further research into the specific effects of this type of disturbance on water-birds in the region is required.

Several questionnaires reported the continued regional spread of saltmarsh vegetation including the cord-grass *Spartina*, indicating that grazed areas are becoming increasingly important as wader roosts. The rapid colonisation of *Spartina* over extensive flats in sites with large wintering populations of waders and wildfowl is a concern because of the birds' loss of habitat for feeding and roosting (Davidson *et al.* 1991). For example, Goss-Custart & Moler (1998) previously linked a national decline in Dunlin populations to the spread of *Spartina anglica* over mudflat feeding areas. *Spartina* spread was reported in Marshside Beach, Lytham Beach, Crossens Outmarsh, Banks Marsh Central, Redrocks and Hoylake, and an effect on water-bird distribution was reported in Marshside Beach and Crossens Outmarsh. Some observed declines have occurred in Hoylake, Redrocks and Banks Marsh Central, and various management regimes have been implemented to control the spread (e.g. Hanik 2010).

WeBS counters also noted on-going changes to intertidal mudflats caused by sediment accretion and erosion. In the Ribble and Alt Estuaries SPA, the effects of human activities e.g. training walls, land claim & dredging, has increased accretion of sediments within the higher parts of the intertidal zone (saltmarsh and sandbanks) and also led to the infilling of major channels (Van der Wal & Pye 2002). Since maintenance dredging of the Ribble Channel for shipping ceased in 1980, the estuary has begun to revert to its natural state resulting in dramatic changes in the course of channels in the outer estuary (Ribble Estuary Strategy Steering Group 1997). Moreover the cessation of dredging has also led to a build-up of mud slurry on the south side of the channel near Crosby and subsequent saltmarsh encroachment.

4.1 Knowledge Gaps and Further Recommendations

Within the current study an insufficient level of detail on the movements of water-birds between feeding areas and roosts were derived from the questionnaires received. Site meetings were setup to explain how to fill out the questionnaires; however, as time elapsed between the meetings and the date of questionnaire completion, some of the key objectives of the questionnaire may have been forgotten by WeBS counters. In addition, some WeBS counters may have found it difficult to quantify their flyway observations of a map. Future research could address these problems to gain a better understanding of the relationship between roost sites and feeding areas within the study area.

Several questionnaires were not returned, leaving gaps in the information collected for some important areas of the Liverpool City SPAs, including Freshfield, Ainsdale Beach South and Southport Beach (Figures 3.1.1 – 3.1.3). Future research should prioritise these sectors and others for which data were not received. Similarly, only one questionnaire was received for a sector outside the Liverpool City Region SPAs. A stronger emphasis on non-SPA sectors may be required in order to underpin the water-bird roosting and feeding habits in the study area.

Other gaps in the current knowledge of water-bird use in the Liverpool City Region SPAs are the result of uneven coverage of WeBS sectors; some sectors are currently not counted and for those that are, some groups such as gulls may not be recorded. Sectors currently not counted by WeBS that are worthy of particular attention in terms of recruitment are Freckleton Marsh, New Ferry, Oglet and Garston Shore.

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APPENDIX 1a EXAMPLE OF THE QUESTIONNAIRE SENT TO WeBS COUNTERS

British Trust for Ornithology
The Nunnery
Thetford
Norfolk
IP24 2PU

QUESTIONNAIRE

Changes within Mersey Estuary Special Protection Area (SPA)

Dear Observer

The British Trust for Ornithology (BTO) and the Wildfowl and Wetlands Trust (WWT) are co-ordinating a study into the wintering bird numbers and distributions on the Mersey Estuary SPA on behalf of the Environment Agency (EA), with the support of the Countryside Council for Wales (CCW), English Nature (EN) and the Joint Nature Conservation Committee (JNCC). The aim of this study is to try and determine why a number of the species that have been designated as being important on this SPA are declining.

The enclosed questionnaire is intended to collect information, which will be of high conservation importance, and is important in informing future management of the SPA. We realise the time constraints that you are under, but anticipate that this form should take no more than half an hour to complete in most instances. It is not expected that everyone will be able to fill all of the space, or be able to answer all the questions on the questionnaire. We greatly appreciate your response as you know the site well and your advice is very valuable to us.

As part of their programme of work, EA is obliged to review whether any of the consents that it dispenses could be having an adverse impact on SPAs. To meet these requirements, recent work undertaken by the BTO on the trends in wintering bird numbers (using Wetland Bird Survey data) has determined that 3 out of the 10 designated species evaluated on the Mersey Estuary SPA appear to show signs of decline at the site. These were identified from examining changes in each of the designated species site populations over 5-year, 10-year and 25-year time periods. Population declines of between 25% and 50% are flagged as "Medium Alerts" and declines of greater than 50% as "High Alerts". All species evaluated for which the Mersey Estuary is important and those species for which "High Alerts" and "Medium Alerts" have been triggered are listed below.

Evaluated Species: Great Crested Grebe, Shelduck, Wigeon, Teal, Pintail, Grey Plover, Dunlin, Black-tailed Godwit, Curlew, Redshank

*High Alert**: Great Crested Grebe[5,10], Pintail[5,10,25], Grey plover[5]
*Medium Alert**: Grey Plover[10]

* Superscript values by species' names indicate the time period for which the Alerts have been triggered (5, 10 or 25 years).

Attempts are being made to explain these apparent declines. One method being used to assist in this process is to gather data from professionals and local experts, who in many cases have built up an intimate knowledge of the site and its wintering bird populations over many years. The aim of this questionnaire is to gather information on any changes that have occurred at the Mersey Estuary SPA over the last 30 years which may have impacted on these wintering bird populations either directly (*e.g.* pollution incidents or very cold winters), or indirectly (*e.g.* changes in sediments leading to changes in habitat quality).

Your local knowledge of this area is an essential element of this work. We are particularly interested in any changes at the site that you think may have impacted upon bird numbers and bird distribution. The information you provide will be used to inform the EA Review of Consents process and in addition will help provide background information that can be fed into the SPA management process.

With respect to changes within the SPA, please give as much detail regarding location and date as possible. The form is set out in such a way as to prompt your thoughts.

Please do not feel restricted by the form as to the number of potential impacts you may be aware of or any additional comments you wish to make. An extra sheet (section 6) has been provided for this purpose.

Please return the questionnaire in the Freepost Self Addressed Envelope (no need to include a stamp) to **Neil Calbrade** by **XXXX XXth 2013**. If you have any further queries please contact me by phone on 01842 750050 or e-mail Neil.Calbrade@bto.org.

Thank you in advance for your co-operation.

Yours faithfully

Neil Calbrade

Questionnaire (Page 1 of 6):

Factors potentially affecting the Mersey Estuary SPA waterbird populations

Please return by Oct 17th 2003 to **Michael Armitage**, British Trust for Ornithology, The Nunnery, Thetford, IP24 2PU (Tel: 01842 750050) (Michael.Armitage@bto.org)

THE COMPLETION OF SECTION 1 IS OPTIONAL

1 Your details:

Name (optional): .....

Address (optional): .....

.....

.....

.....

Daytime telephone number (optional): .....

e-mail (optional): .....

2 Based on your knowledge and experience of this SPA, which of the following events or changes have occurred at the site over the last 30 years?

Please tick "Yes", "No", or "Don't know" for each issue listed below. If there has been some event or change at the site that is not listed, please enter it in the "Other (please specify):" box.

You will be able to give details of any events or changes that have occurred in the next sections of the questionnaire.

(in no particular order of importance)	Yes	No	Don't know
Habitat loss or change	❒	❒	❒
Changes in saltmarsh area and quality	❒	❒	❒
Changes in intensity of disturbance due to human activity	❒	❒	❒
Changes in raptor populations	❒	❒	❒
Changes in surrounding land use (*e.g.* housing, agricultural practices)	❒	❒	❒
Flood defence developments	❒	❒	❒
Changes in fishing activities	❒	❒	❒
Changes in vegetation type	❒	❒	❒
Changes in invertebrate populations or communities	❒	❒	❒
Changes in water quality	❒	❒	❒
New discharges/changes in discharge regimes	❒	❒	❒
Pollution incidents	❒	❒	❒
Changes in water abstraction regime	❒	❒	❒
Changes in landfill/waste operations	❒	❒	❒
Changes in physical regime (*e.g.* water level, surface flooding)	❒	❒	❒
Severe weather events (*e.g.* notably harsh winters)	❒	❒	❒
A suitable 'new' site for waterbirds has been created nearby	❒	❒	❒
Other (please specify):	❒	❒	❒
Other (please specify):	❒	❒	❒

Questionnaire (Page 2 of 6):

Factors potentially affecting the Mersey Estuary SPA waterbird populations

3 Which area or WeBS sectors do you count/visit/know well?

Please mark and number them on one of the attached maps

The first lines in the table below have been filled in as an example. Please list each sector/area number in the **Area** column. In the **Years** column indicate how long you have known it in years. In the **Knowledge of area** column, please tick "Good", "Fair" or "Some" to indicate how well you know it, as follows:

Good good knowledge of sector/area, being regular counter/visitor for at least 5 years;

Fair fair knowledge of sector/area through casual observation (*e.g.* irregular visitor, say 1-2 visits per winter), anecdotal evidence or counted the sector in the past (*e.g.* more than 5 years ago)

Some some knowledge of sector/area (*e.g.* anecdotal evidence only)

Sector/ Area	**Years** (Please indicate range of years)	**Knowledge of area**		
		Good	Fair	Some
12	1993-1995, 1998-2003	☑	❒	❒
15	1998-2003	❒	☑	❒
		❒	❒	❒
		❒	❒	❒
		❒	❒	❒
		❒	❒	❒
		❒	❒	❒
		❒	❒	❒
		❒	❒	❒
		❒	❒	❒
		❒	❒	❒
		❒	❒	❒
		❒	❒	❒
		❒	❒	❒
		❒	❒	❒
		❒	❒	❒
		❒	❒	❒
		❒	❒	❒
		❒	❒	❒
		❒	❒	❒
		❒	❒	❒

Questionnaire (Page 3 of 6):

Factors potentially affecting the Mersey Estuary SPA waterbird populations

4.1 Over the last 30 years what management regimes/natural events have impacted upon the site (please continue on a separate sheet if necessary)?

e.g. The completed public footpath has led to increased human recreational disturbance in the SPA

a. .....

.....

b. .....

.....

c. .....

.....

d. .....

.....

e. .....

.....

4.2 When and where did these management regimes/natural events occur? Please mark the location and extent of the event/impact on the other map, giving the event/impact the letter used for it above *e.g. "*a", "b", etc. (Please continue on a separate sheet if necessary)

e.g. The public footpath completed in 1994 runs from "village A" to "town B" on the north side of the SPA

a. .....

.....

b. .....

.....

c. .....

.....

d. .....

.....

e. .....

.....

Questionnaire (Page 4 of 6):

Factors potentially affecting the Mersey Estuary SPA waterbird populations

4.3 What effect did these management regimes/natural events have upon different elements of the site, such as sediment, water quality, vegetation, etc.?

e.g. The public footpath has led to increased visitors – no other obvious impact

a. .....

.....

b. .....

.....

c. .....

.....

d. .....

.....

e. .....

.....

4.4 In your opinion, how did these affect bird populations, if at all?

e.g. Waterbirds, especially teal and mallard, stopped using the saltmarsh near the path

a. .....

.....

b. .....

.....

c. .....

.....

d. .....

.....

e. .....

.....

Questionnaire (Page 5 of 6):

Factors potentially affecting the Mersey Estuary SPA waterbird populations

5 Please list any sources of information that you are aware of:
(*e.g.* scientific papers, articles in county bird reports *etc.*)

.....

.....

.....

.....

.....

.....

6 Continuation sheet and additional comments

Questionnaire (Page 6 of 6):

Factors potentially affecting the Mersey Estuary SPA waterbird populations

6 Continuation sheet and additional comments

APPENDIX 1b EXAMPLE OF THE QUESTIONNARE SENT TO WeBS COUNTERS

Section Name and Code: Southport Beach (46402)

On the map provided, please **outline and number** the MAIN roost(s) for each species in your count sector. If a roost site is used by several species, please give each species its own roost number (see example).

For **each numbered roost**, in the table below please indicate the species and count:

Roost number	Species	Average monthly count	Extra comments
1	*Oystercatcher*	*750*	*Double that number on v.high tide*
2	*Bar-tailed Godwit*	*25*	
3	*Bar-tailed Godwit*	*400*	*Roost site not used in northerly winds*
4	*Wigeon*	*100*	
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

Habitat

For **each numbered roost**, please comp[illegible]e the q[illegible]estions in the tables below regarding the habitat type of each roost by placing a tick [illegible]ropriate space.

Roost No.	Saltmarsh	Shingle Bank	R[illegible]ky Pro[illegible]to[illegible]	Jetty	Seawall – unfenced	Fenced-off seawall	Sheep Grazed	Cattle Grazed	Ungrazed
1	✔								
2	✔								
3	✔								
4				✔					
5									
6									
7									

8									
9									
10									

On the map, and if applicable, please annotate **places that allow the public to access the roost area** e.g. car park, footbridge over railway line, footpath, boat slipway etc

If you have **any other information/observations** about the roost please write it on the back of this sheet (or add notes to the map if that is more applicable) e.g. any planned developments.

Disturbance

On your count section, please **Tick the relevant column if it occurs all year, otherwise put A (for autumn Jul -Sep), W (for winter Oct - Feb), and/or S (for spring Mar- Jun) to indicate the season(s) to which it applies:**

Type of disturbance	Every Count	More than half of counts	About half of counts	Less than half of counts	Never
Dogs off lead on intertidal		✔			
Dog walking along shore		✔			
Walking along shore	✔				
Motor vehicles on intertidal			✔		
Bait digging					✔
Cockling					✔
Angling					✔
Kitesurfing					✔
Windsurfing					✔
Canoeing/kayaking					✔
Small powerboats /jet skis				S/A	
Rowing boats					✔
Other boats (sail boats, ferries					✔
Birdwatchers				✔	
Planes/helicopters/microlites				✔	
Others (please describe):					

Part 2

APPENDIX 2 ROOST LOCATIONS BY SPECIES AT REGIONAL LEVEL

Each species map shows the distribution of roosts within and close to the boundaries of the three SPAs and whether these are Nationally Important i.e. they hold 1% or more of the British population, or Internationally Important i.e. they hold 1% or more of the West European population in the case of wildfowl, or 1% or more of the East Atlantic Flyway population in the case of waders. Maps have only been produced for waterbird species for which data could be obtained from WeBS counts, site meetings and the results of questionnaires.

- Red circles denote roosts of international importance
- Orange circles denote roosts of national importance
- Green circles denote all other roosts

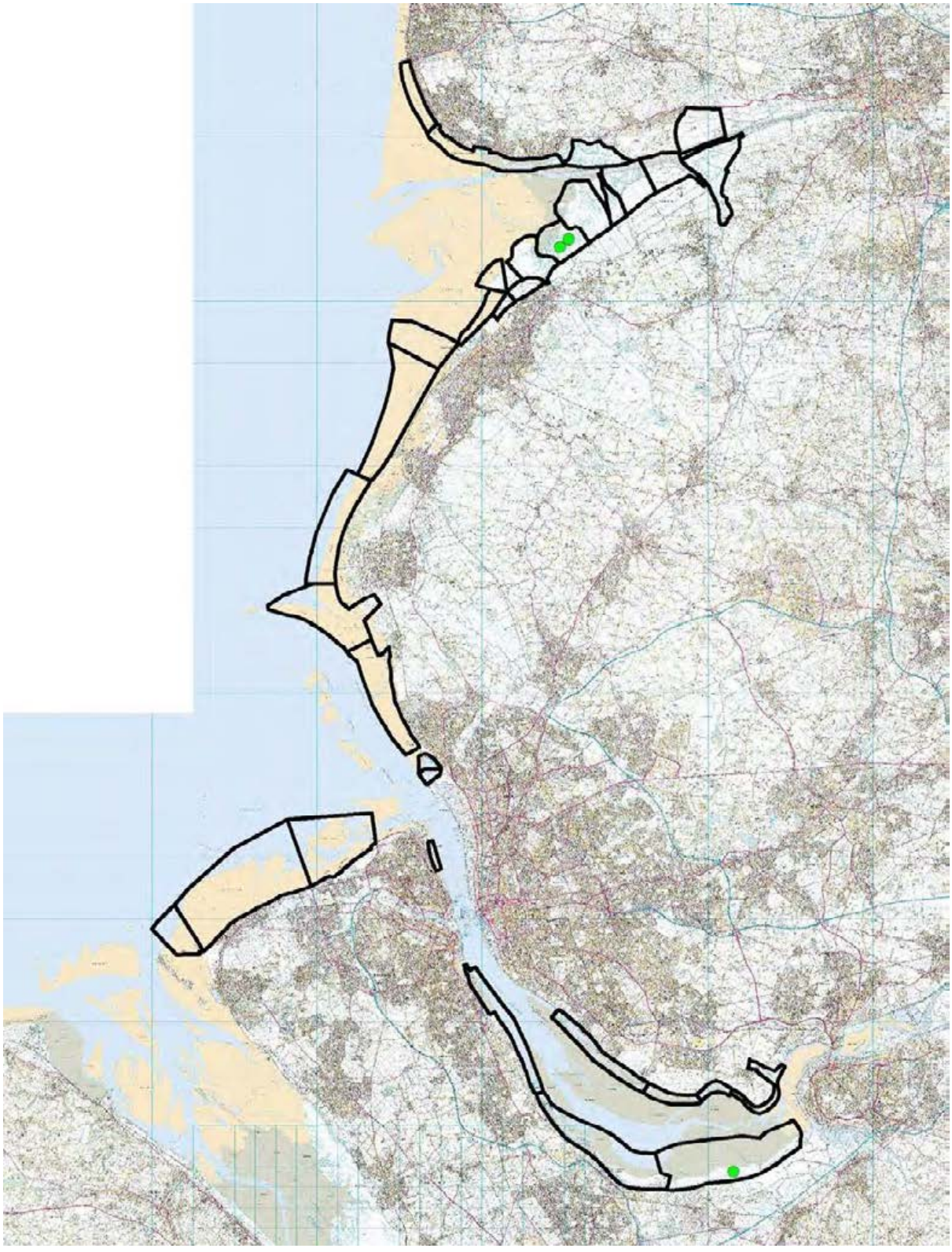

Figure A.2.1 Whooper Swan roosts within and close to the boundaries of the Liverpool City Region SPAs

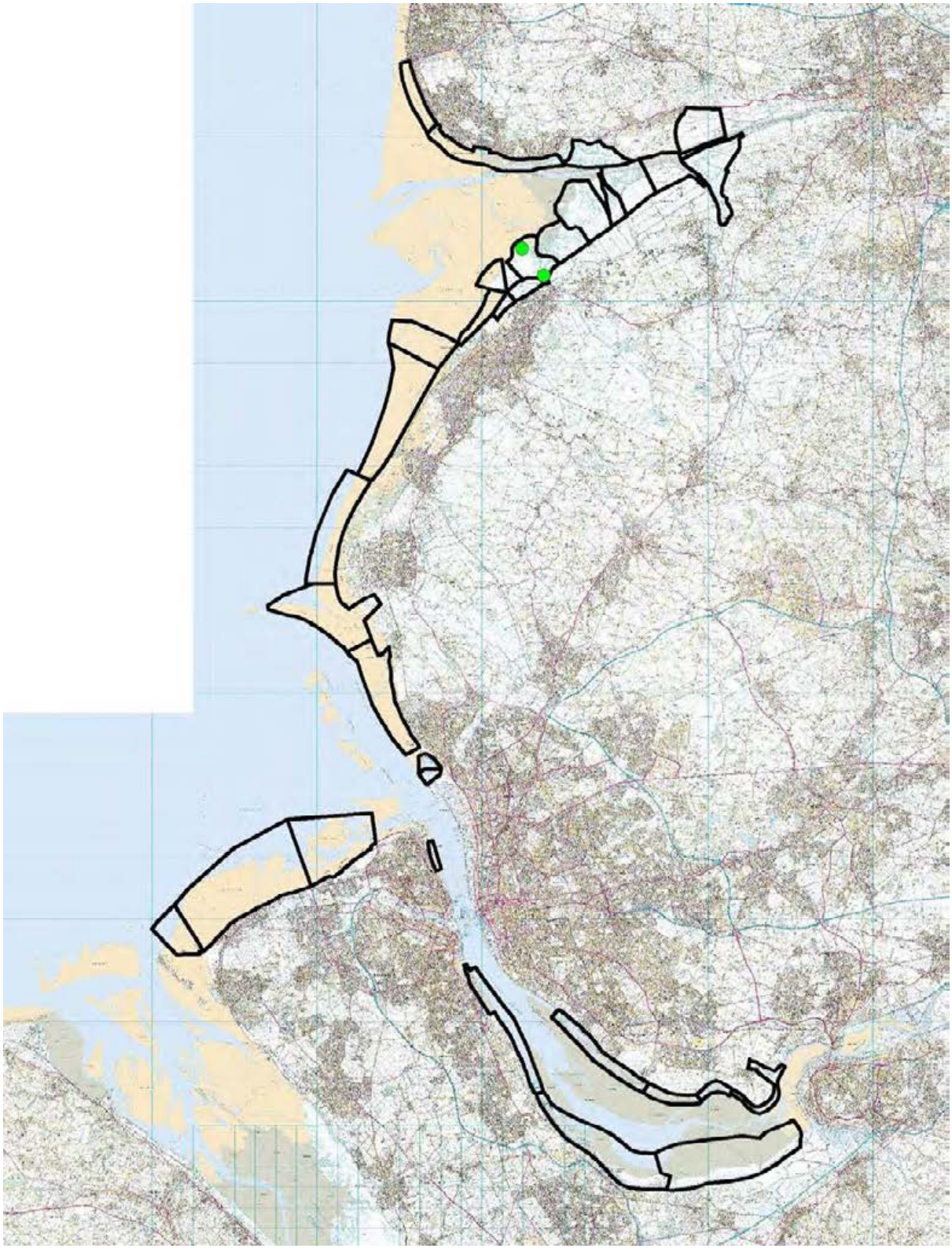

Figure A.2.2 Pink-footed Goose roosts within and close to the boundaries of the Liverpool City Region SPAs

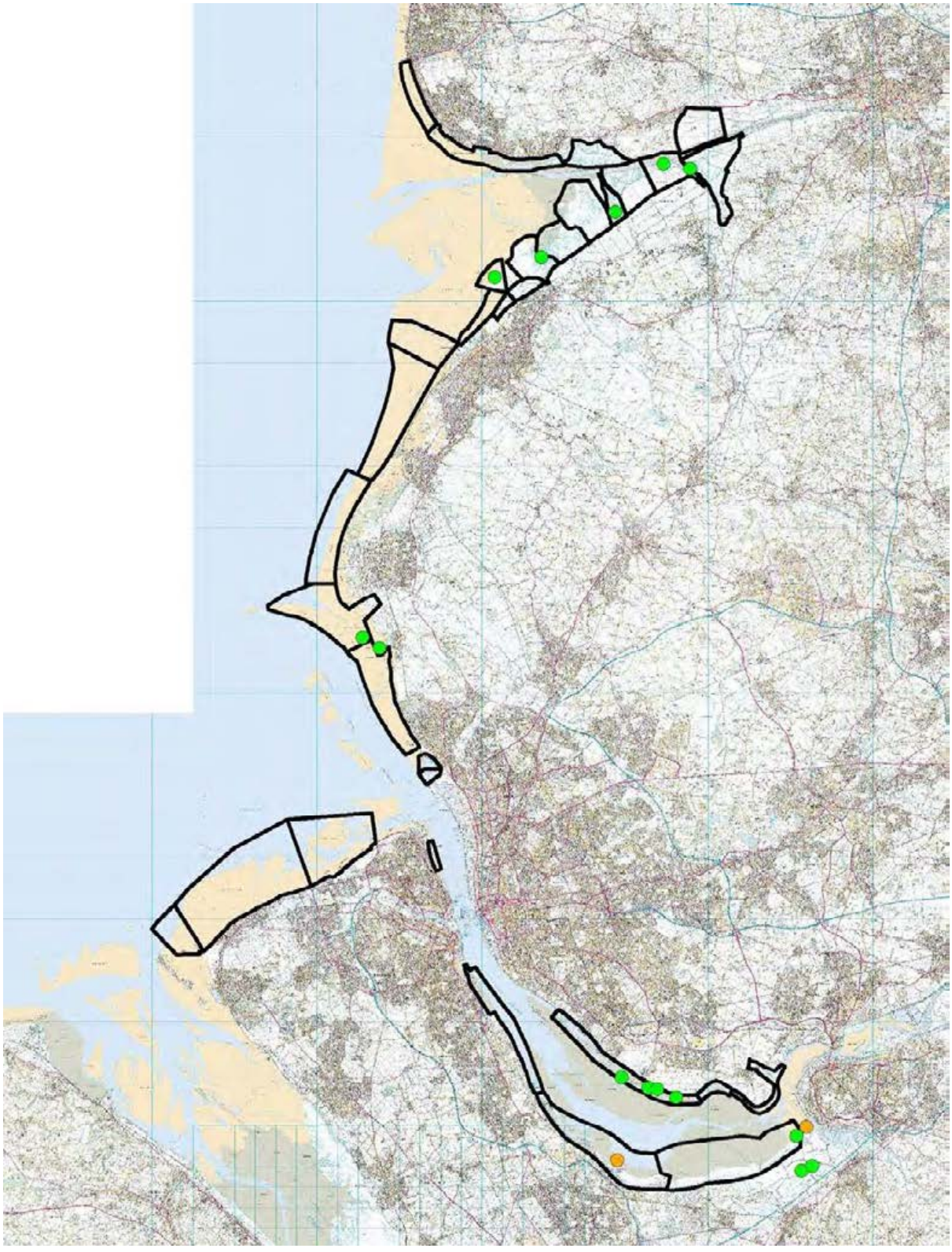

Figure A.2.3 Shelduck Roosts within and close to the boundaries of the Liverpool City Region SPAs

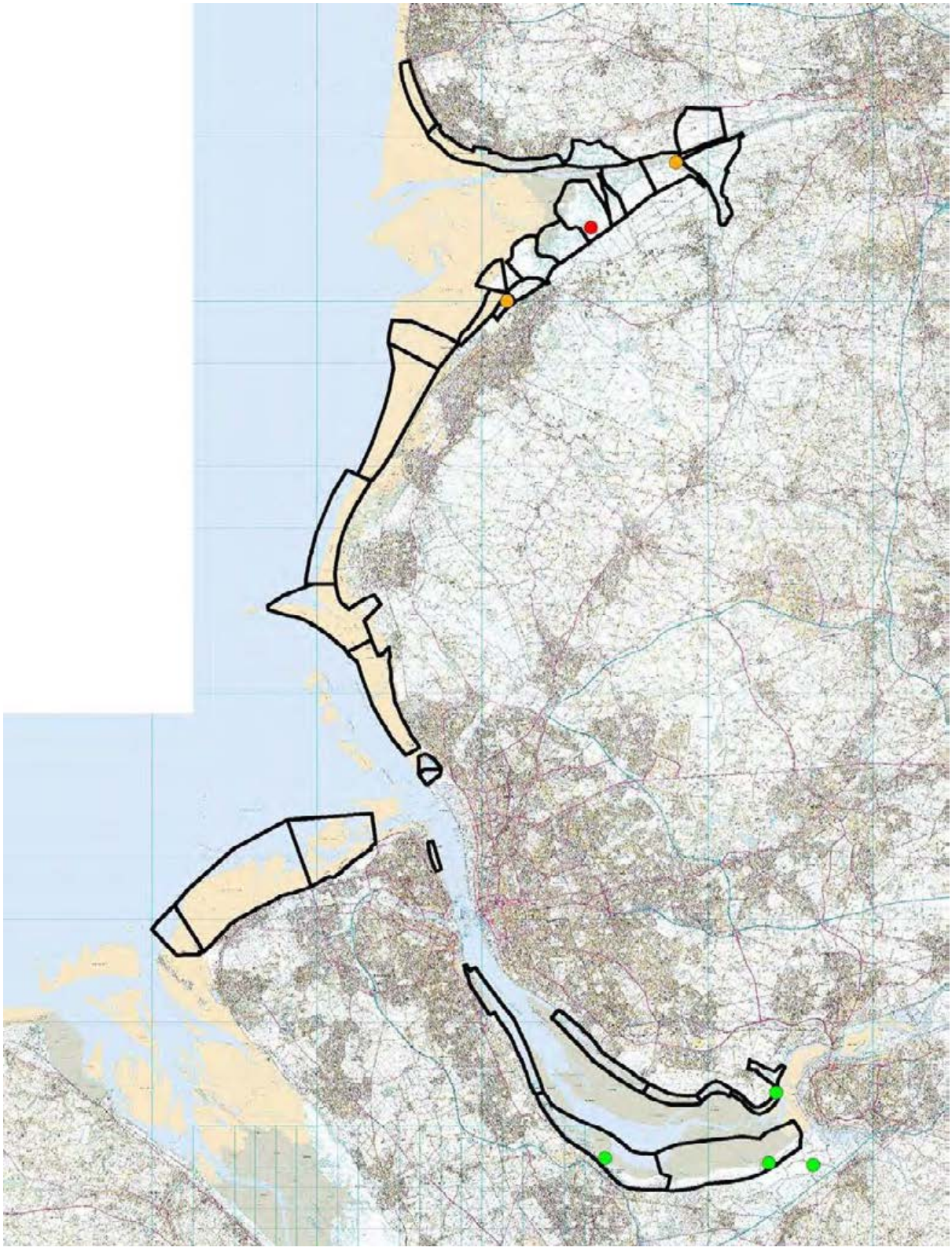

Figure A.2.4 **Wigeon Roosts within and close to the boundaries of the Liverpool City Region SPAs**

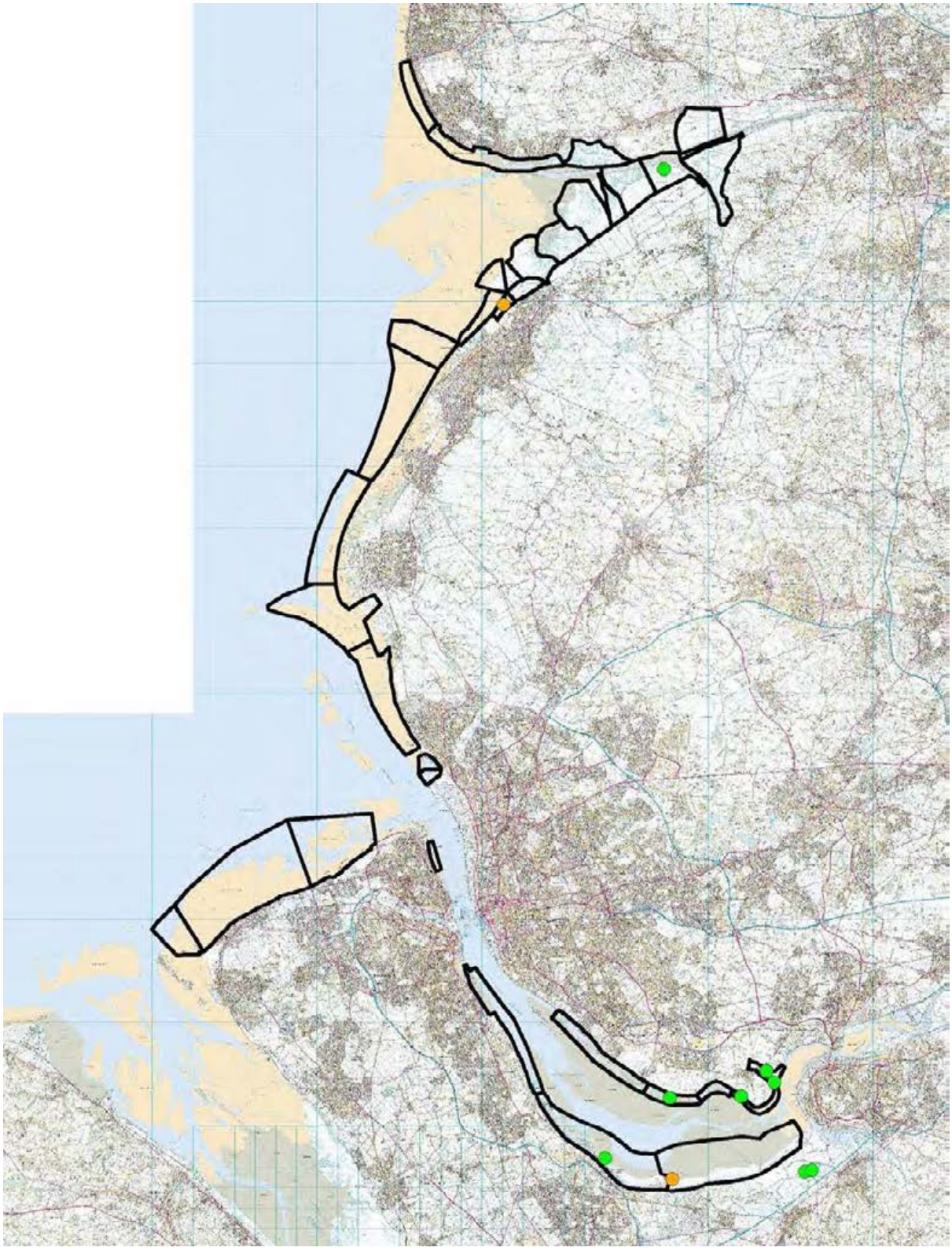

Figure A.2.5 Teal Roosts within and close to the boundaries of the Liverpool City Region SPAs

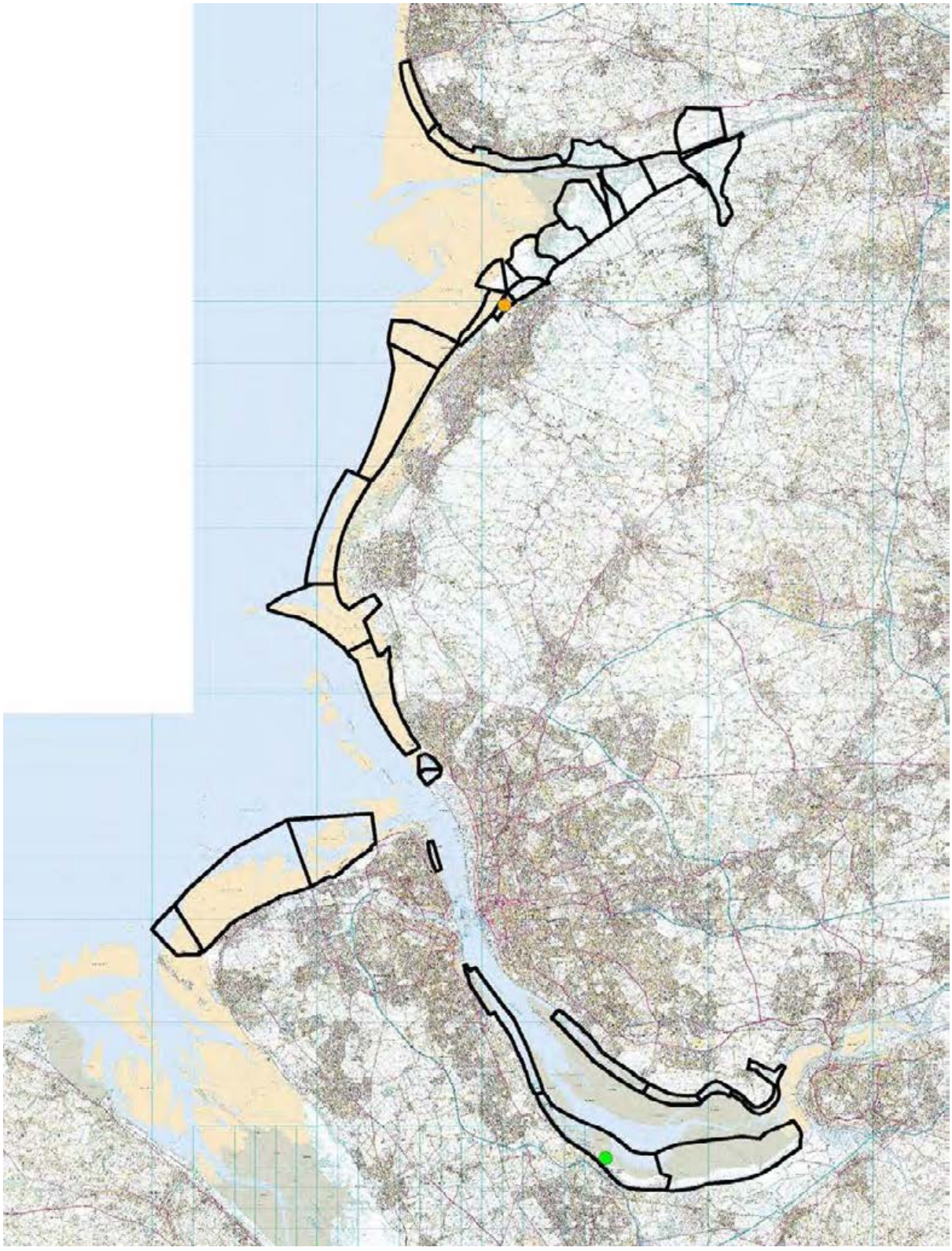

Figure A.2.6 Pintail Roosts within and close to the boundaries of the Liverpool City Region SPAs

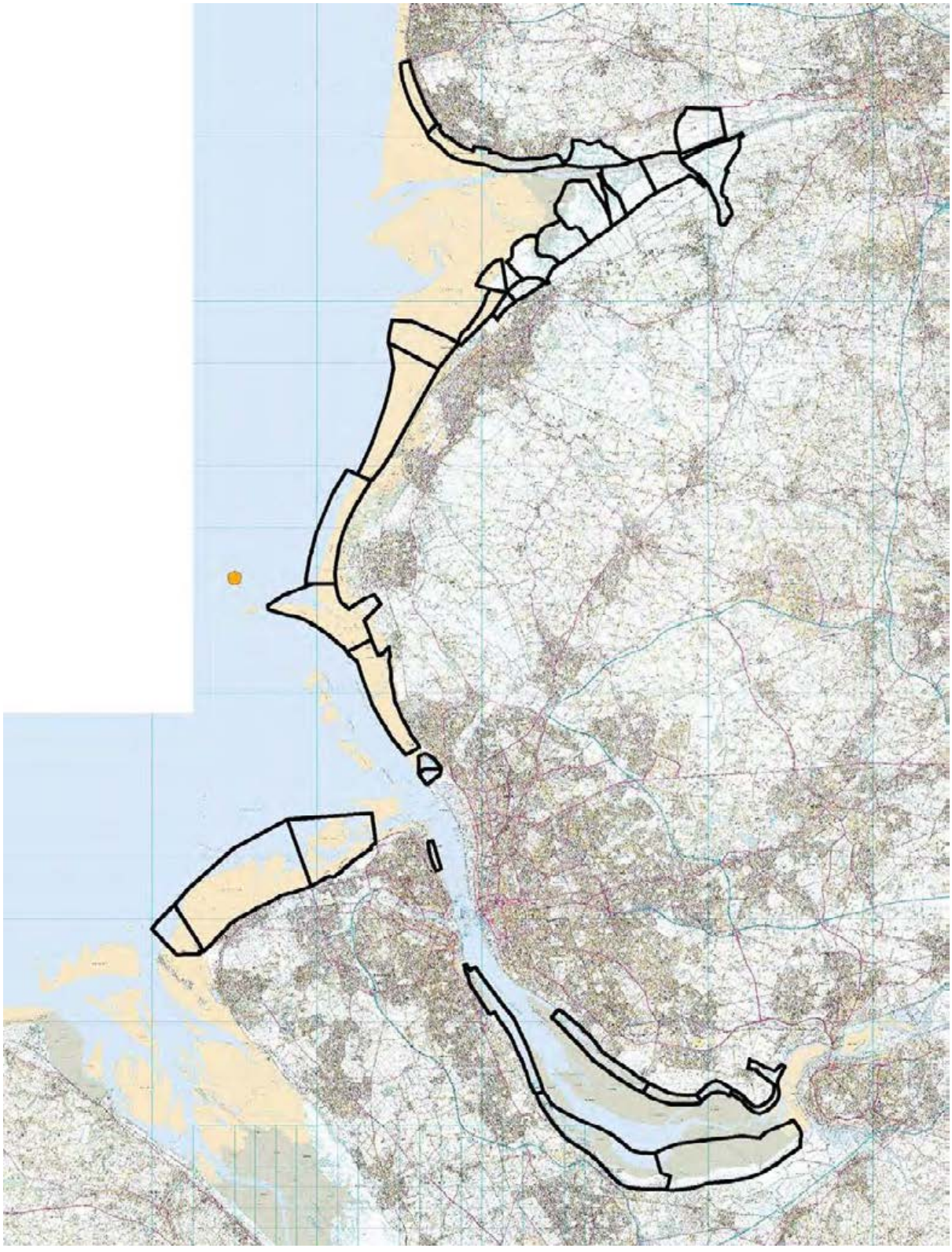

Figure A.2.7 Common Scoter roosts within and close to the boundaries of the Liverpool City Region SPAs

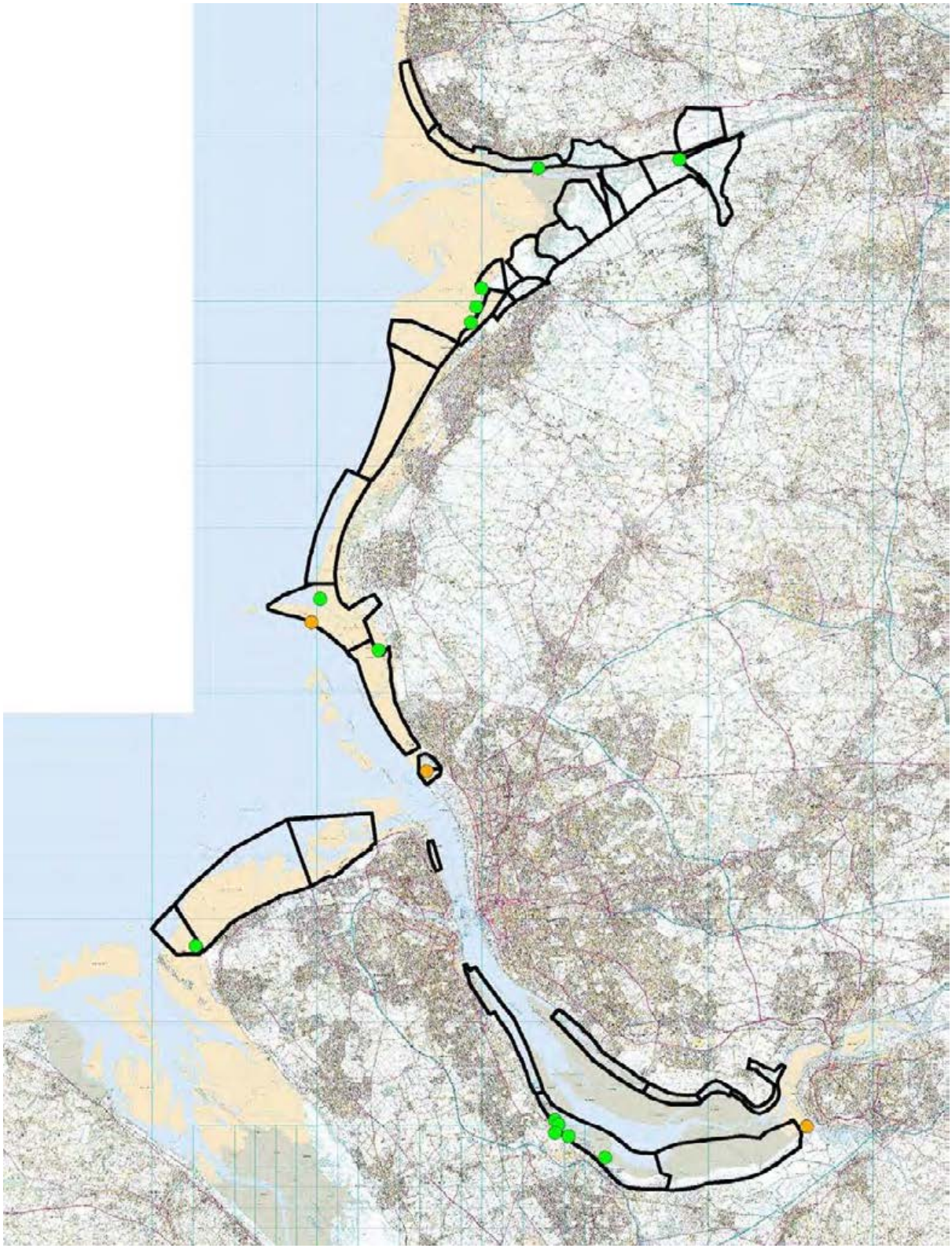

Figure A.2.8 Cormorant Roosts within and close to the boundaries of the Liverpool City Region SPAs

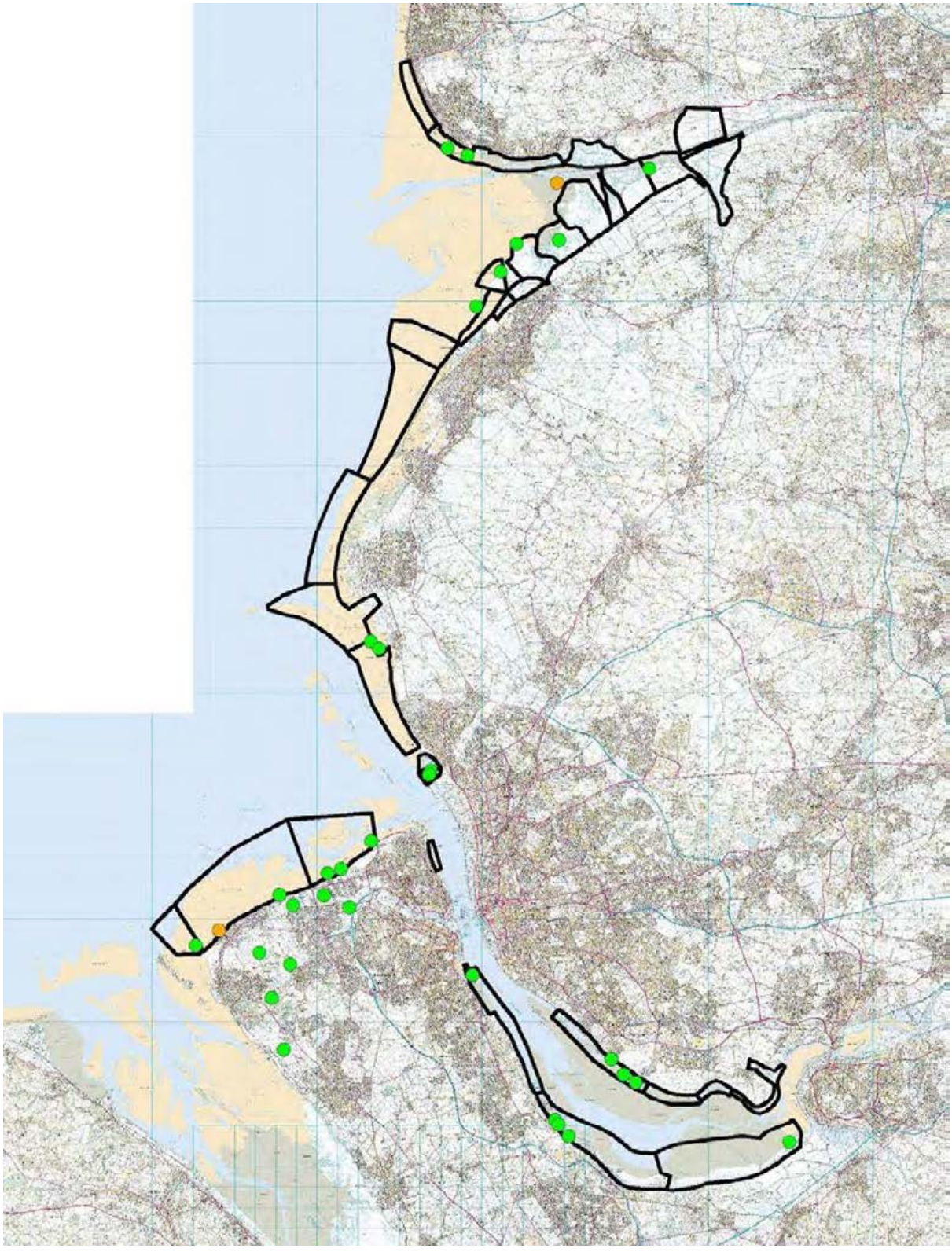

Figure A.2.9 Oystercatcher Roosts within and close to the boundaries of the Liverpool City Region SPAs

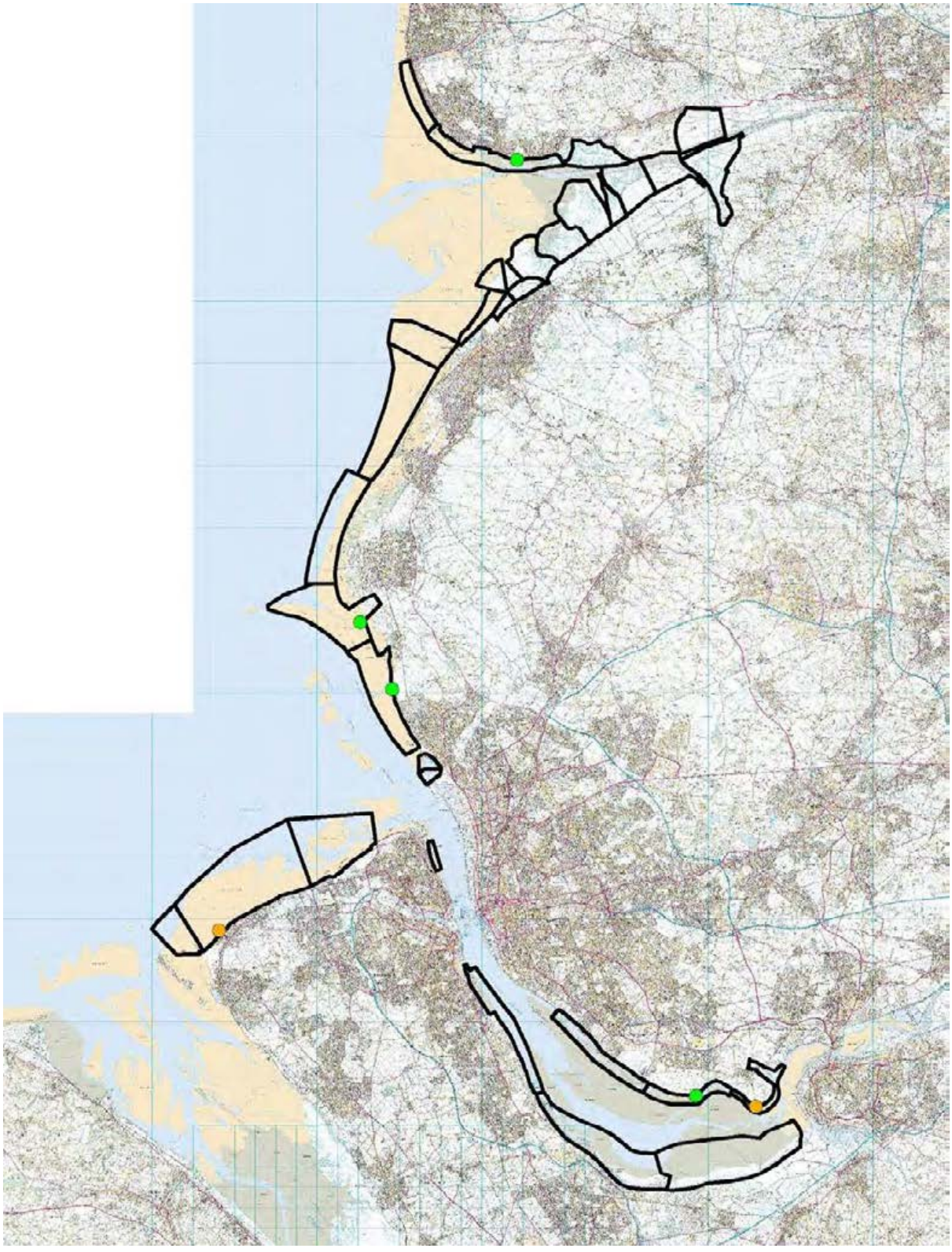

Figure A.2.10 Ringed Plover Roosts within and close to the boundaries of the Liverpool City Region SPAs

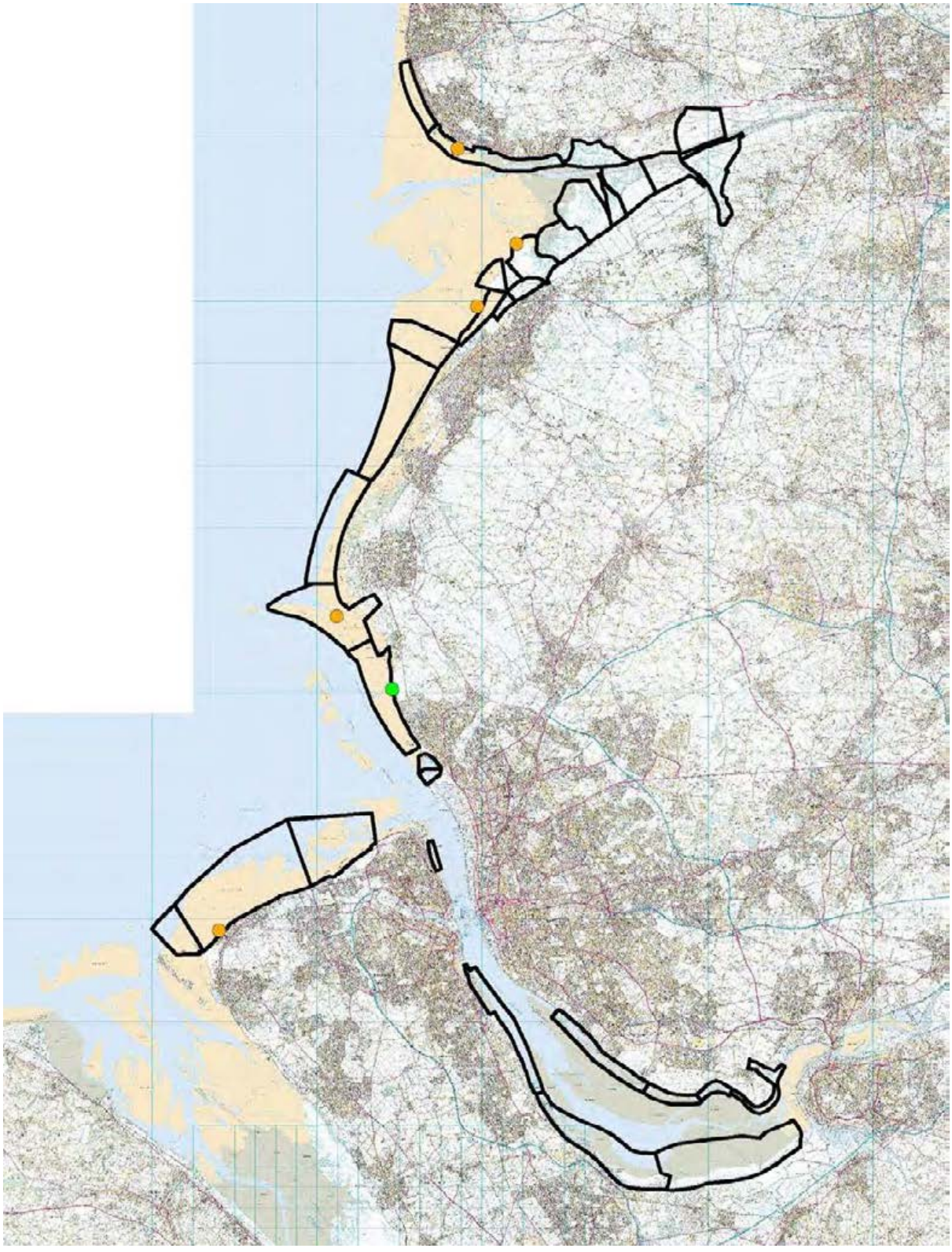

Figure A.2.11 Grey Plover Roosts within and close to the boundaries of the Liverpool City Region SPAs

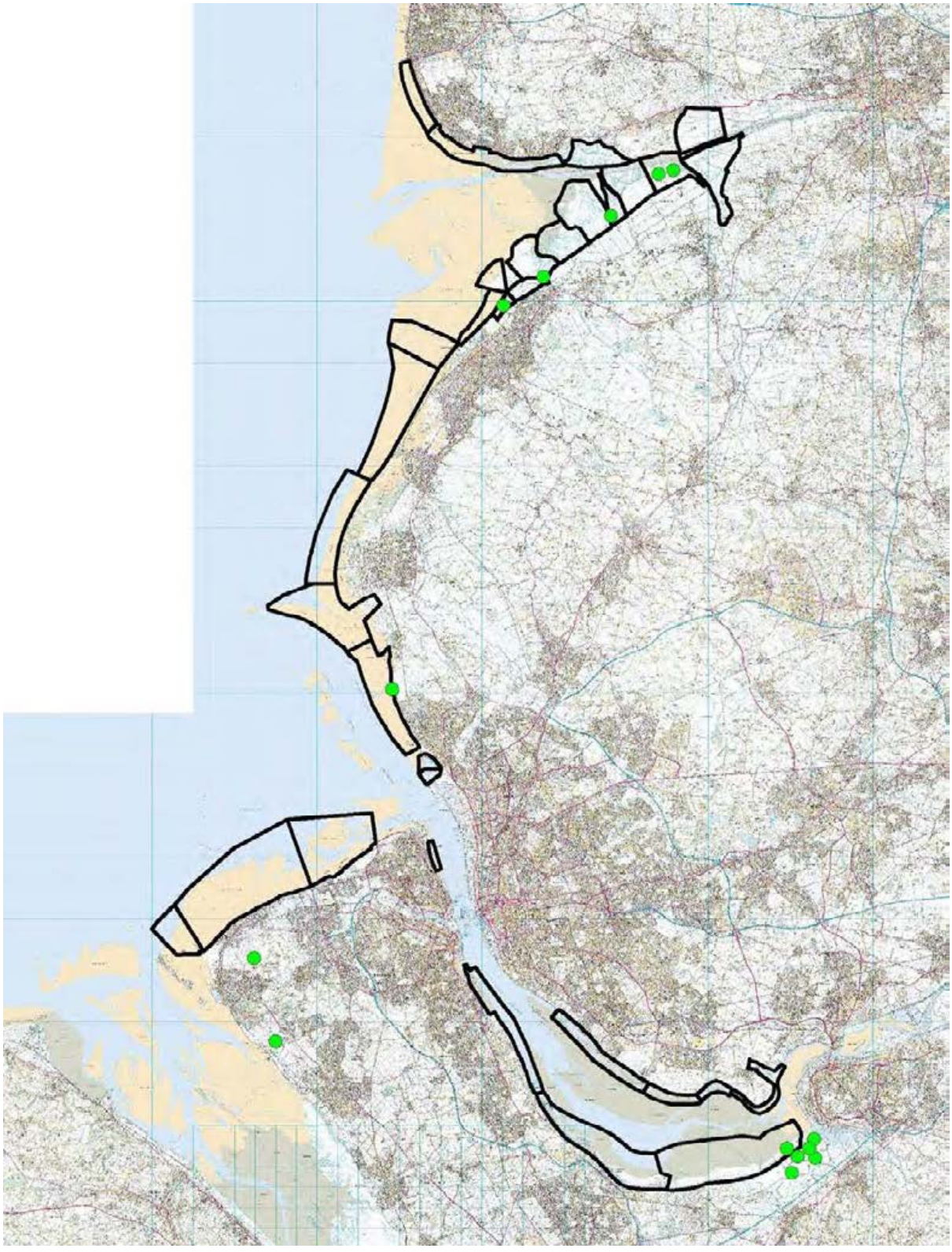

Figure A.2.12 Golden Plover Roosts within and close to the boundaries of the Liverpool City Region SPAs

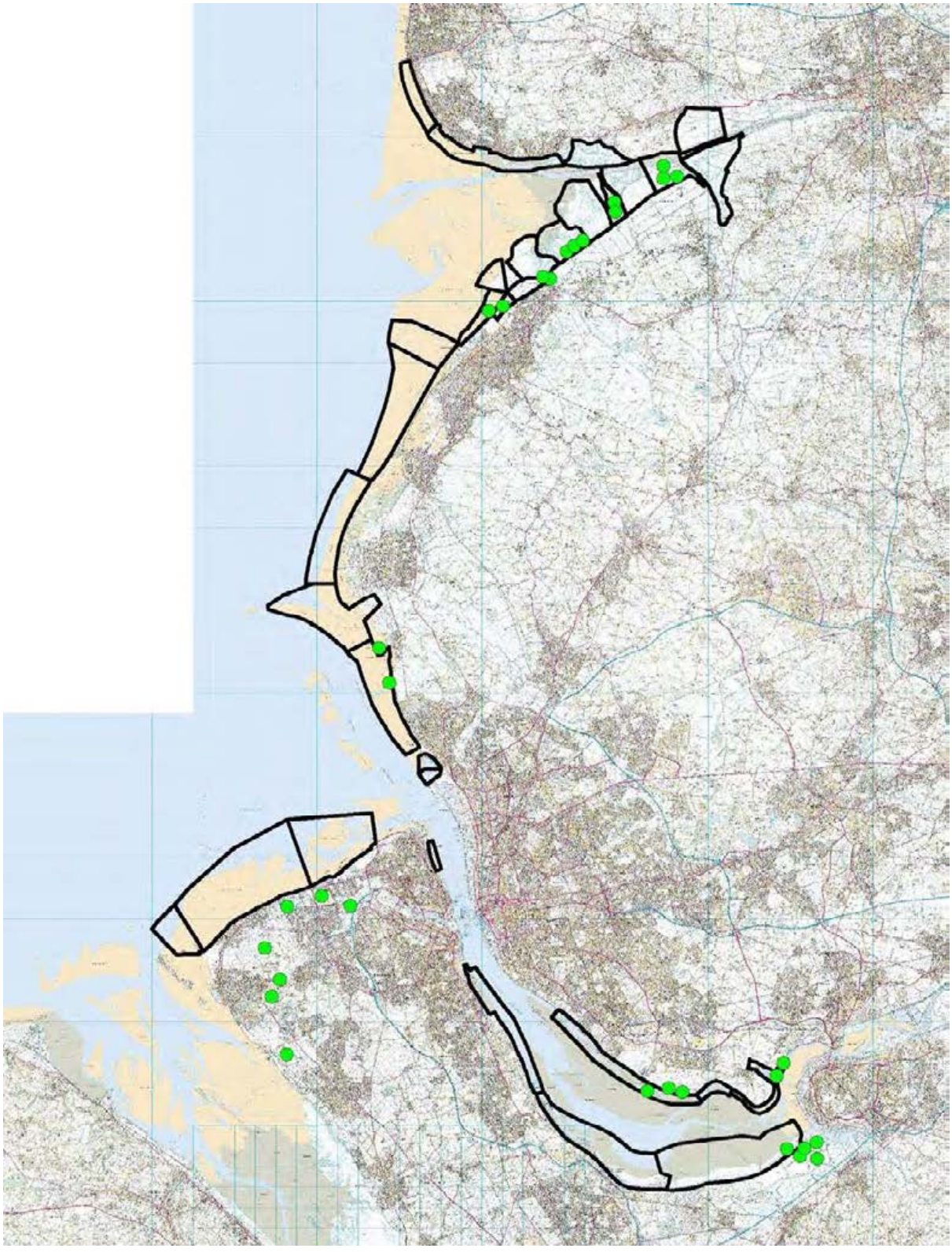

Figure A.2.13 Lapwing Roosts within and close to the boundaries of the Liverpool City Region SPAs

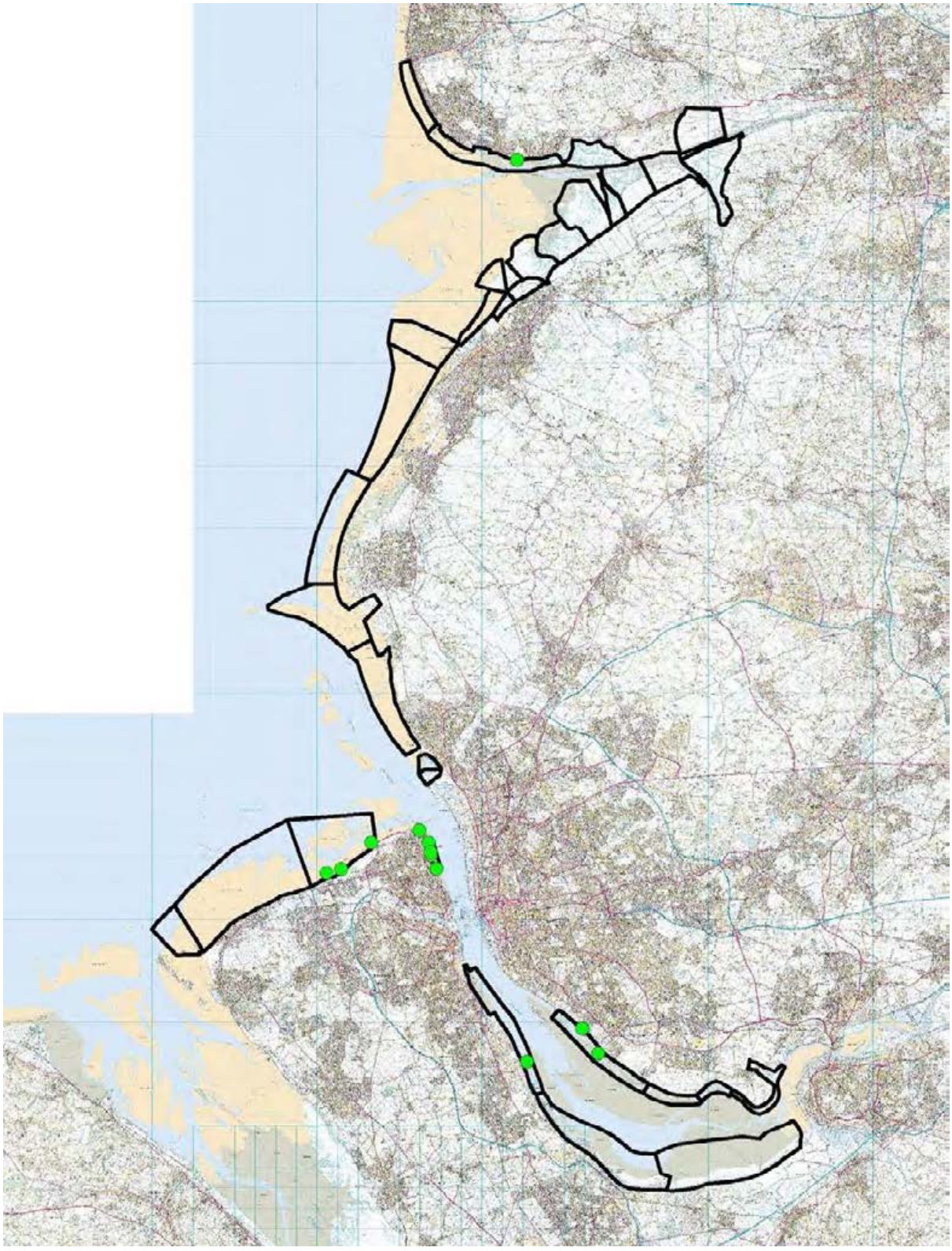

Figure A.2.14 Turnstone Roosts within and close to the boundaries of the Liverpool City Region SPAs

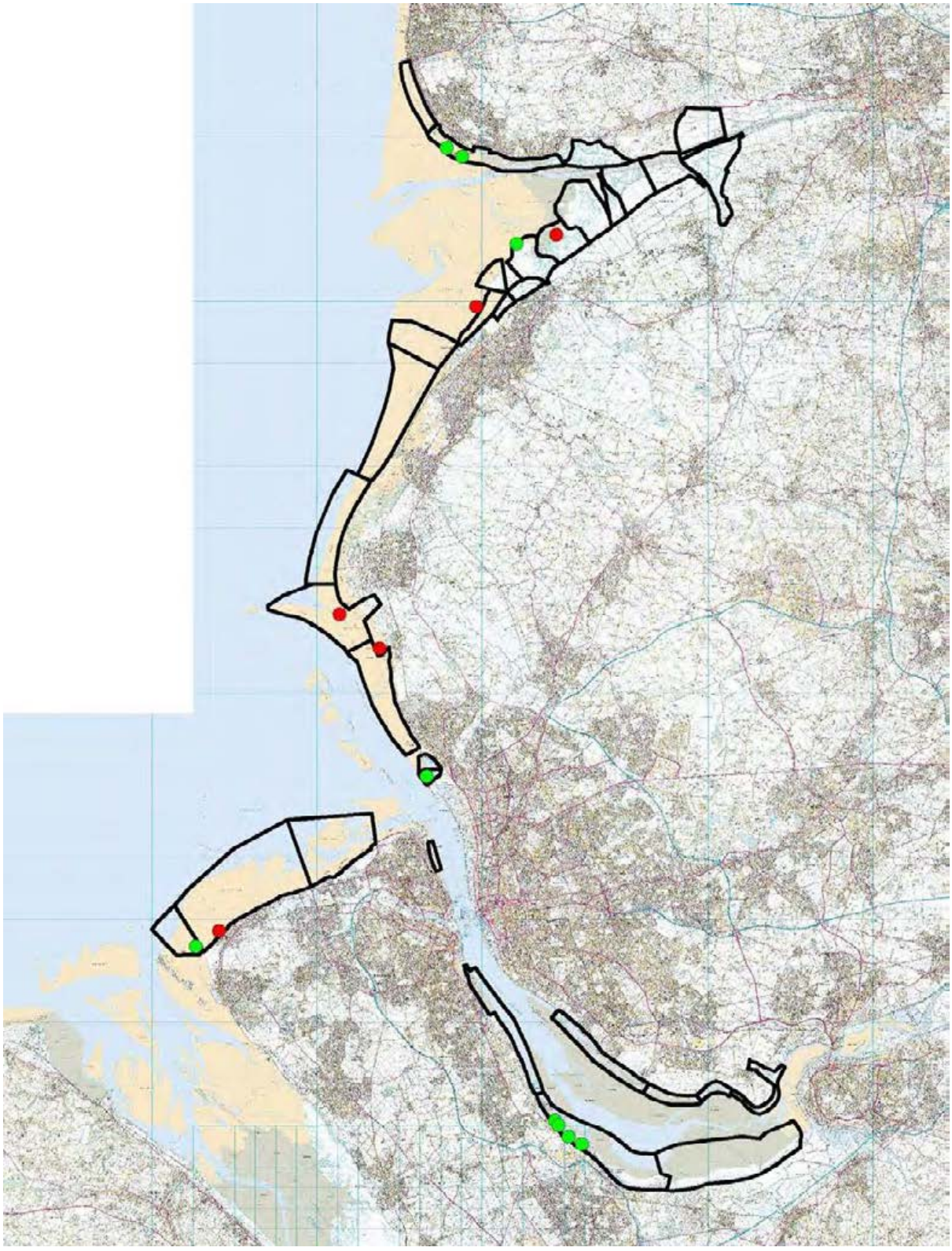

Figure A.2.15 Knot Roosts within and close to the boundaries of the Liverpool City Region SPAs

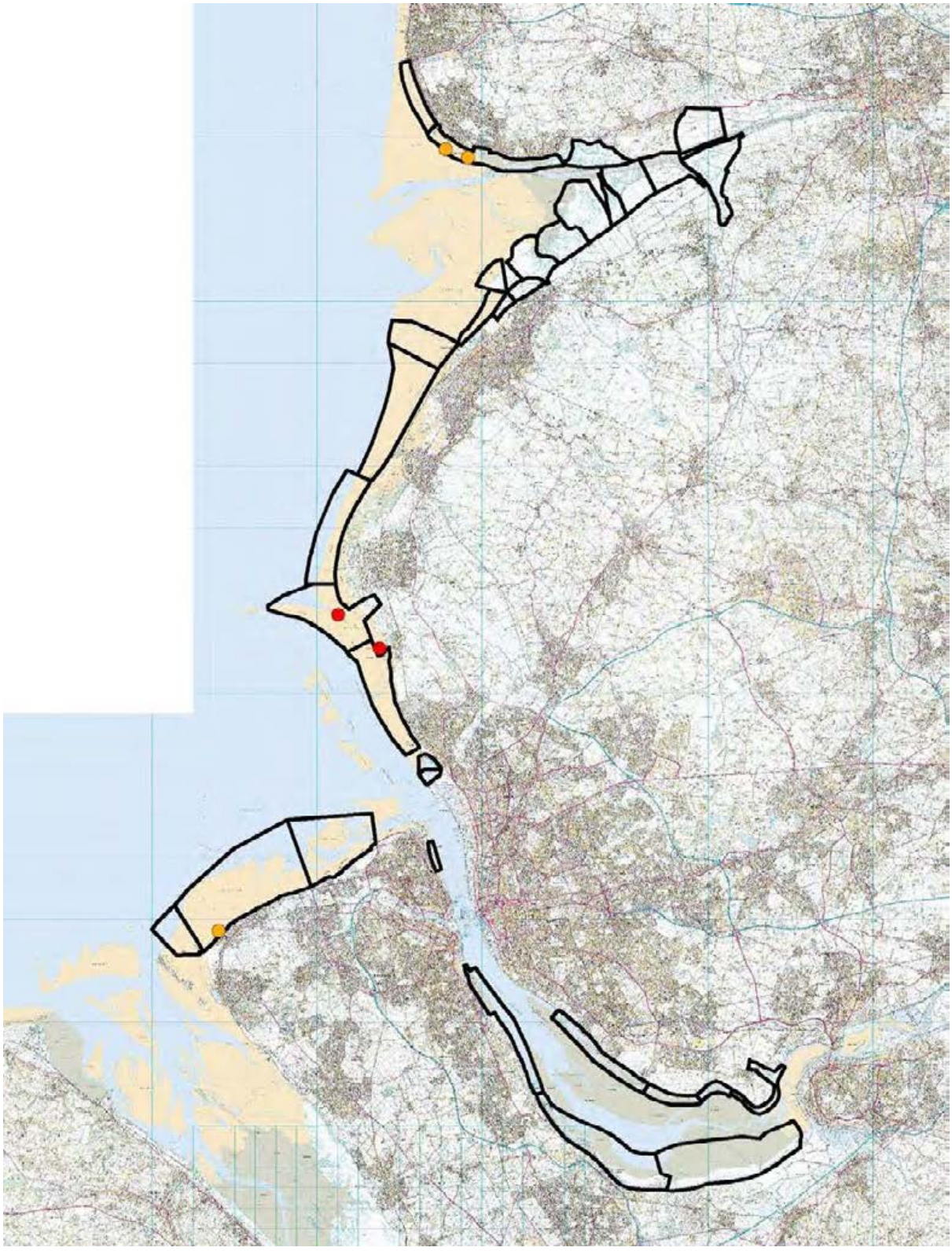

Figure A.2.16 Sanderling Roosts within and close to the boundaries of the Liverpool City Region SPAs

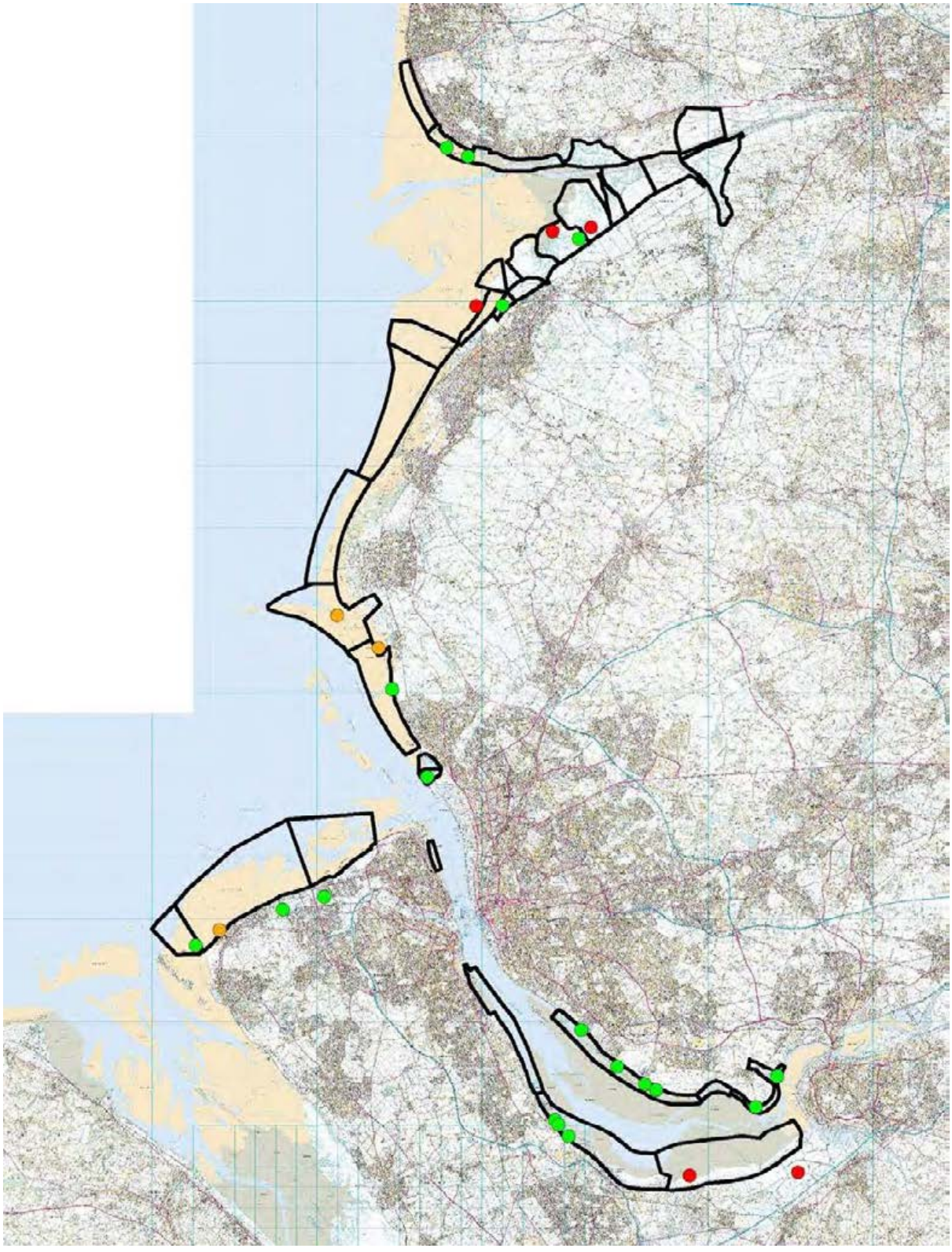

Figure A.2.17 Dunlin Roosts within and close to the boundaries of the Liverpool City Region SPAs

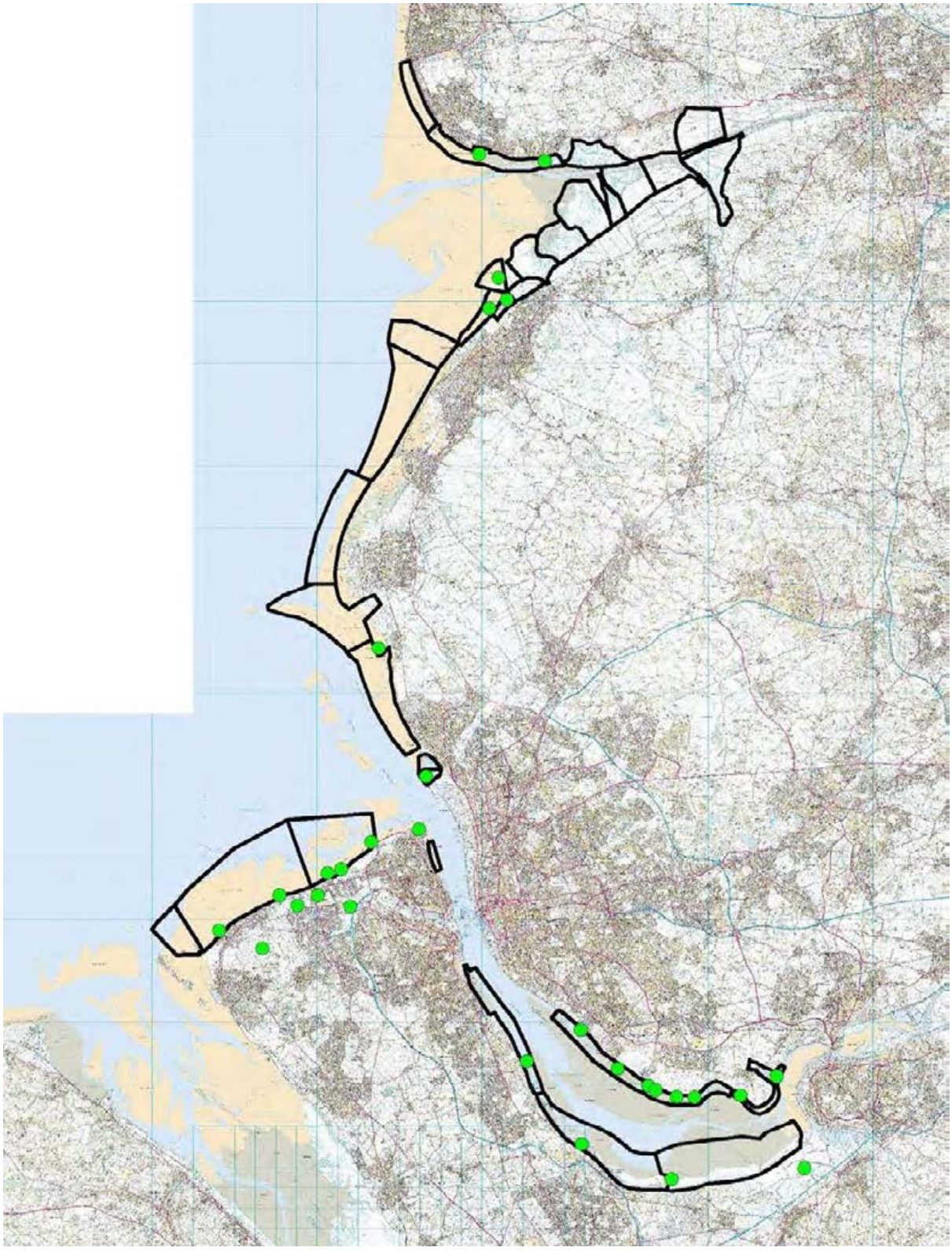

Figure A.2.18 Redshank Roosts within and close to the boundaries of the Liverpool City Region SPAs

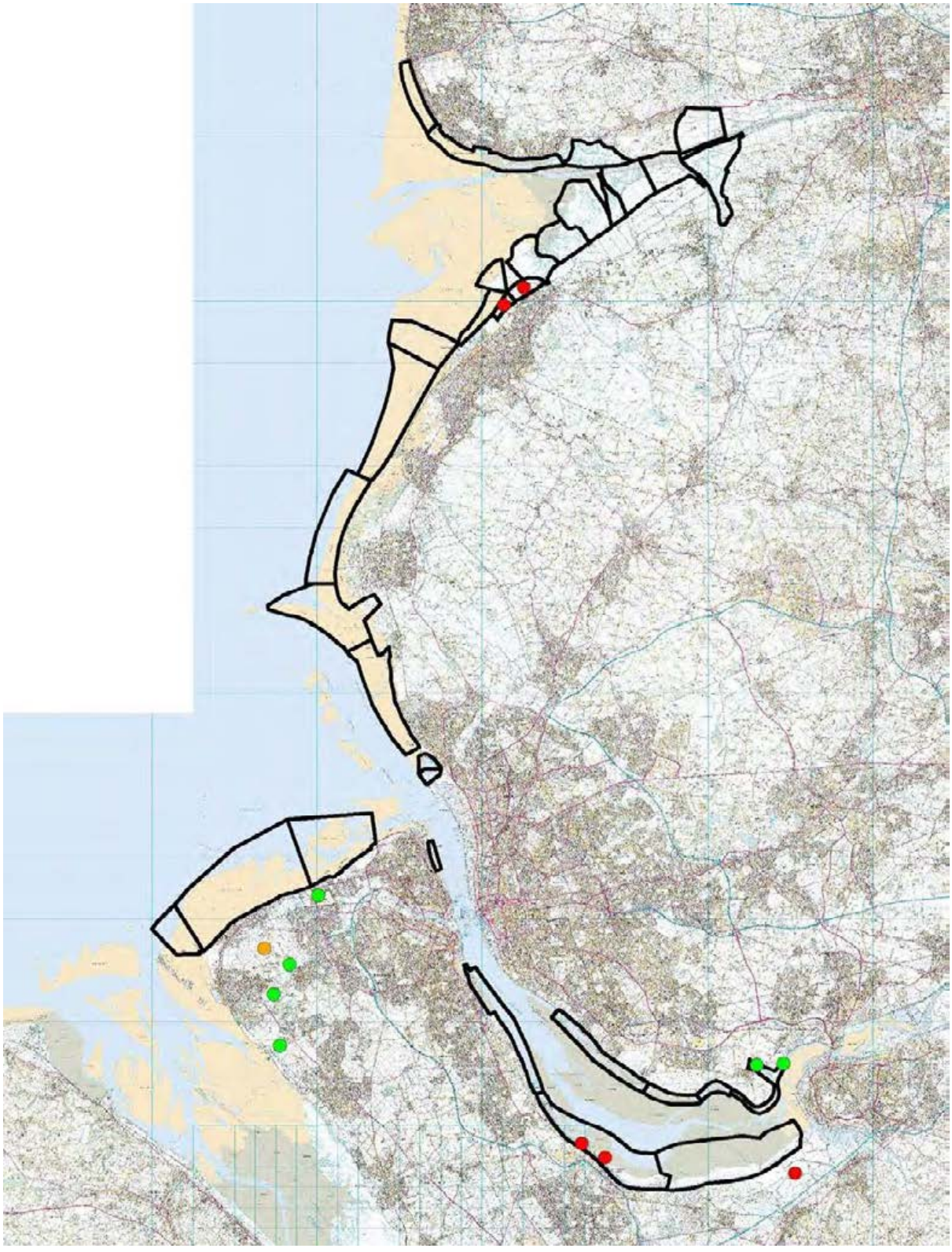

Figure A.2.19 Black-tailed Godwit Roosts within and close to the boundaries of the Liverpool City Region SPAs

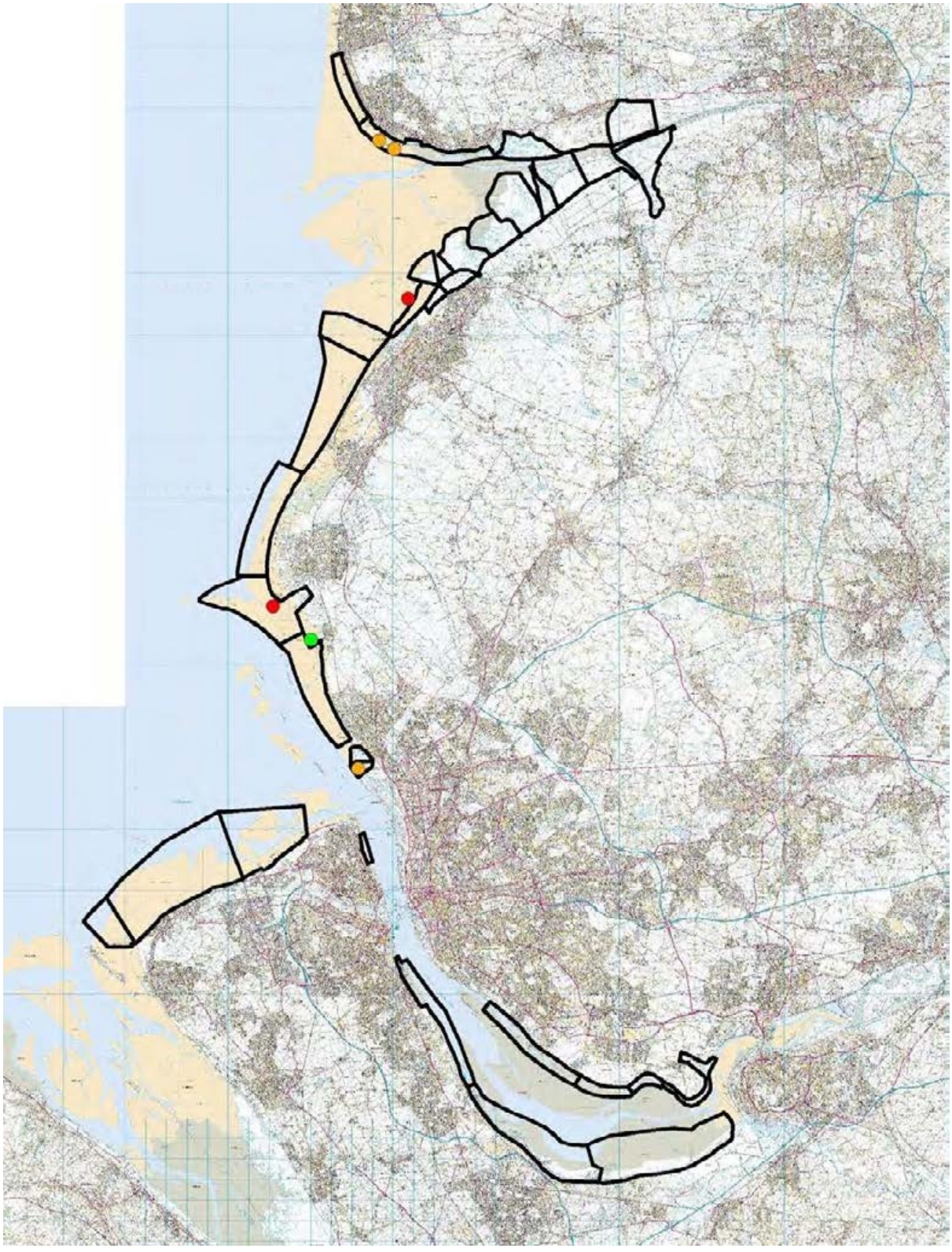

Figure A.2.20 Bar-tailed Godwit Roosts within and close to the boundaries of the Liverpool City Region SPAs

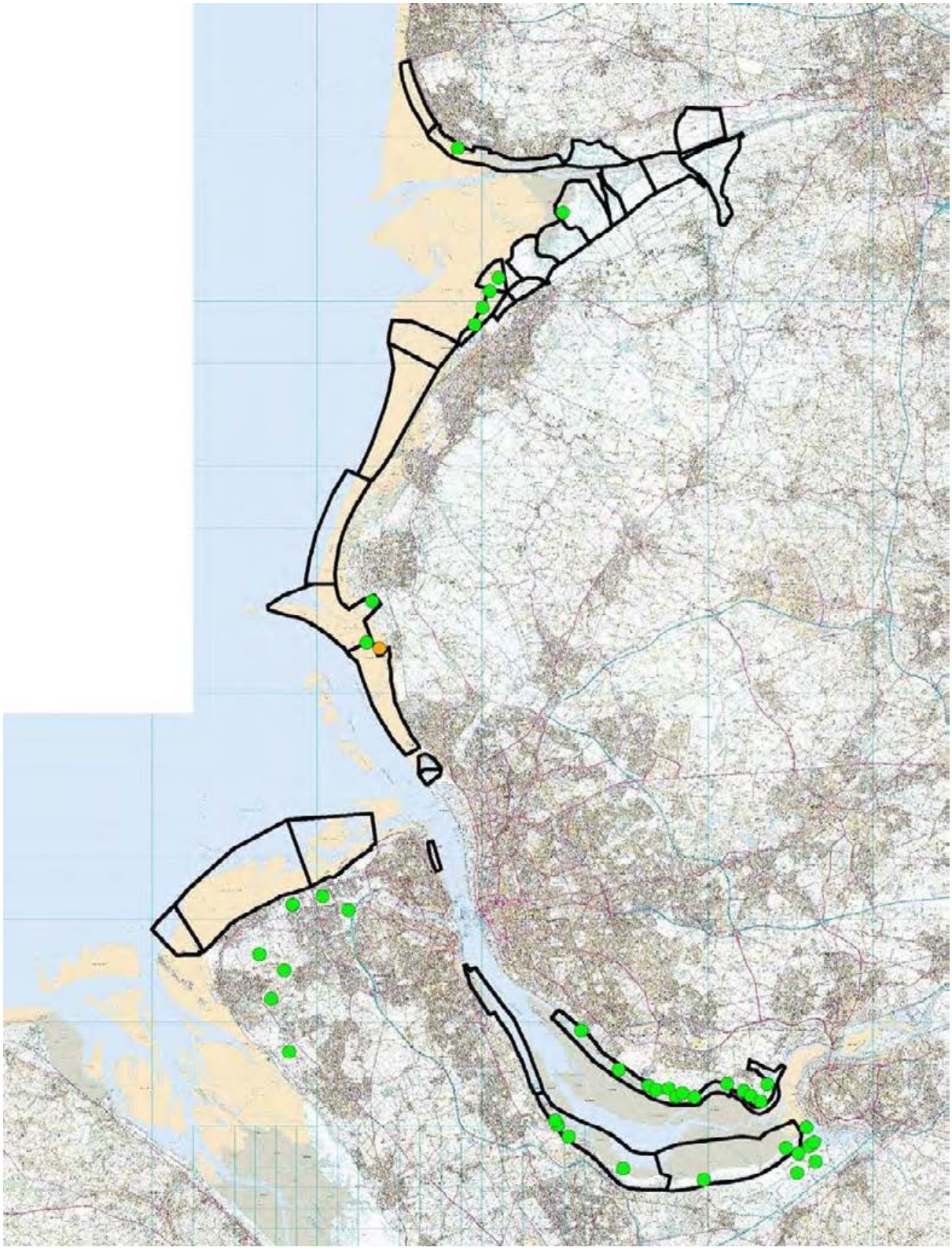

Figure A.2.21 Curlew Roosts within and close to the boundaries of the Liverpool City Region SPAs

APPENDIX 3 ROOST LOCATIONS AT SECTOR LEVEL

This appendix contains figures for waterbird species for which data was obtained through WeBS counts, site meetings and the results of questionnaires. Each map shows the areas taken up by each roost inside or near to the boundaries of the Liverpool City Region SPAs.

- Red areas denote wader roosts
- Orange areas denote wildfowl roosts
- Brown areas denote cormorant roosts

Ribble & Alt Estuaries SPA

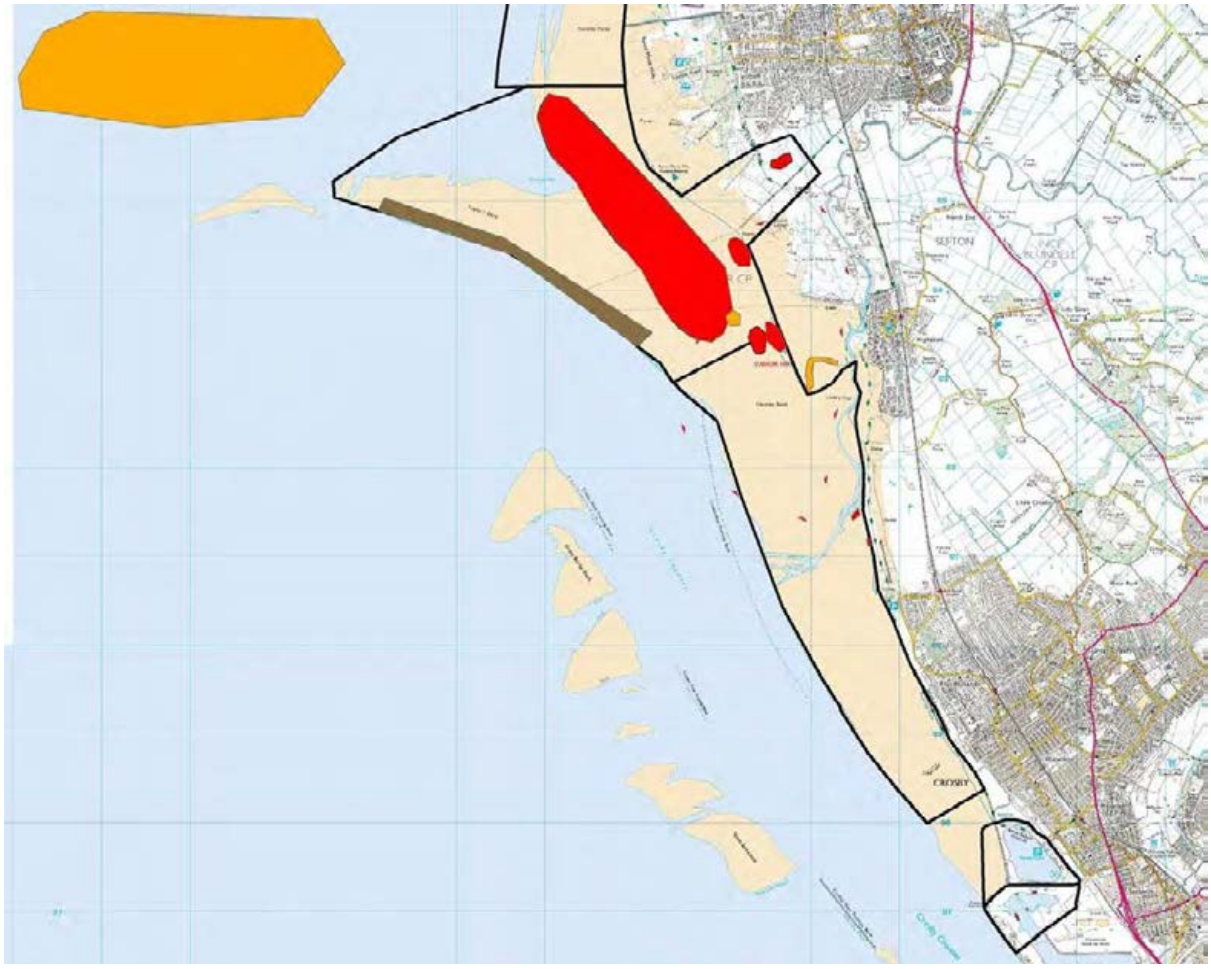

Figure A.3.1 Roost Locations: Seaforth to Formby

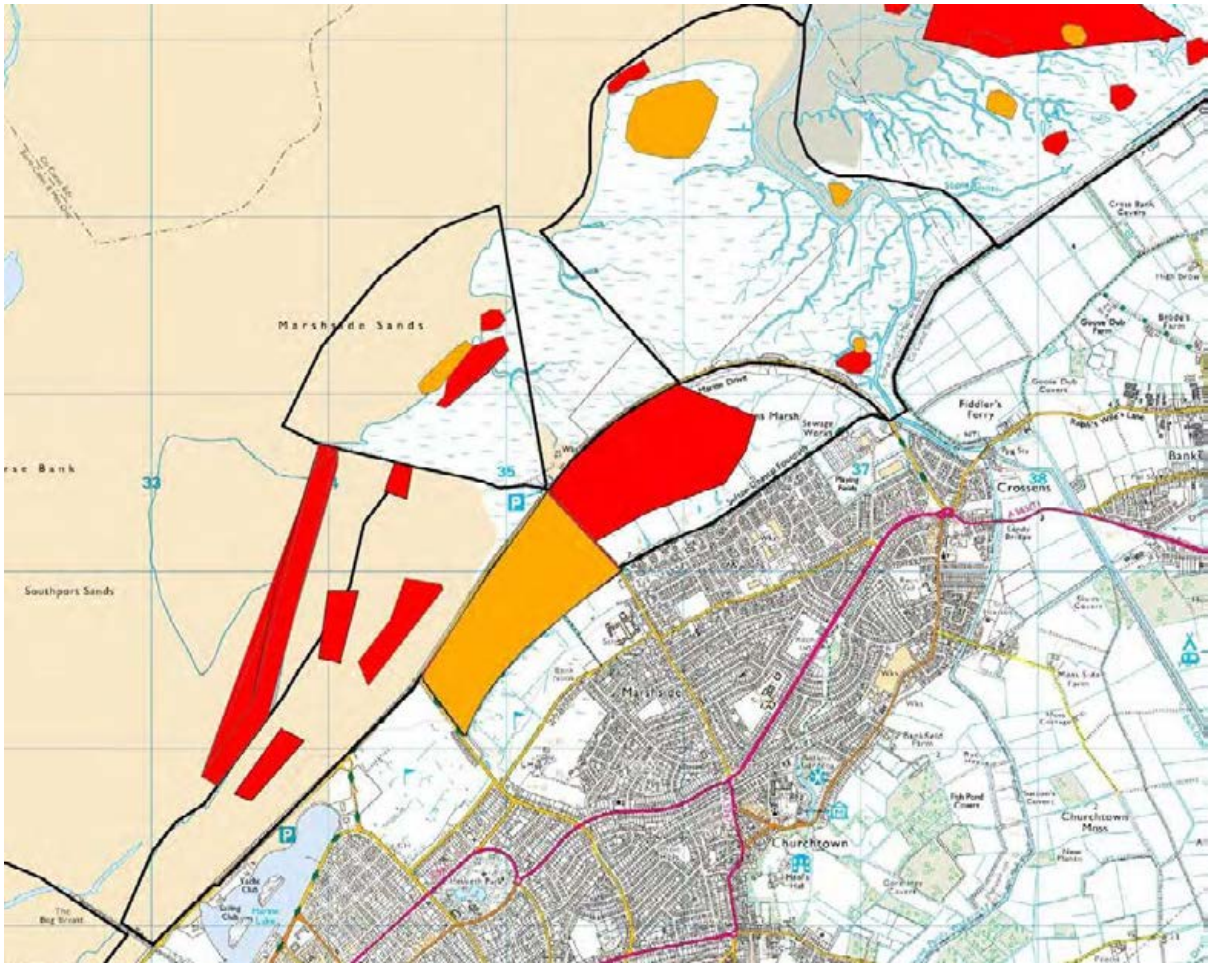

Figure A.3.2 Roost Locations: Marshside Beach to Banks Marsh West

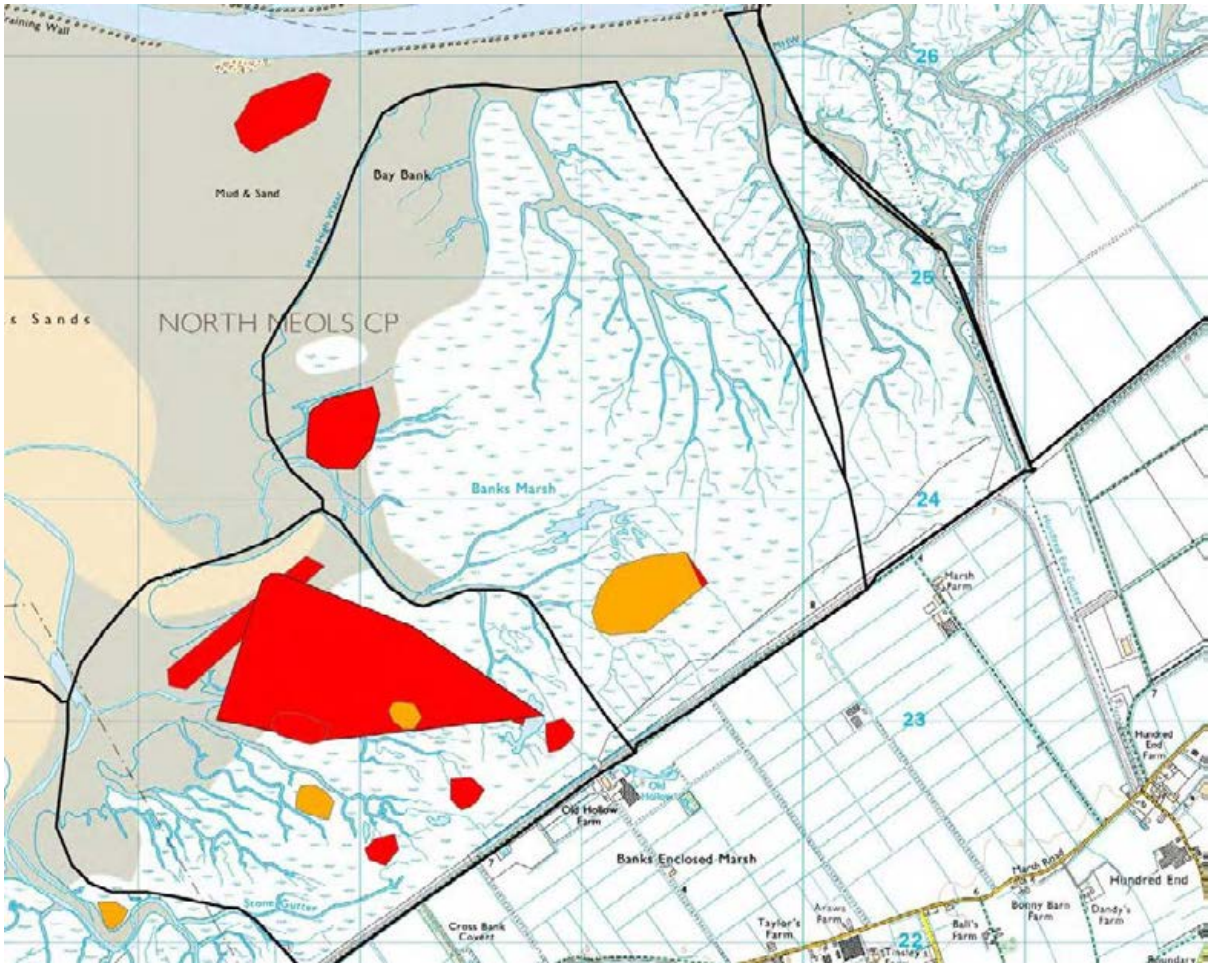

Figure A.3.3 Roost Locations: Crossens Out-Marsh to Banks Marsh Central

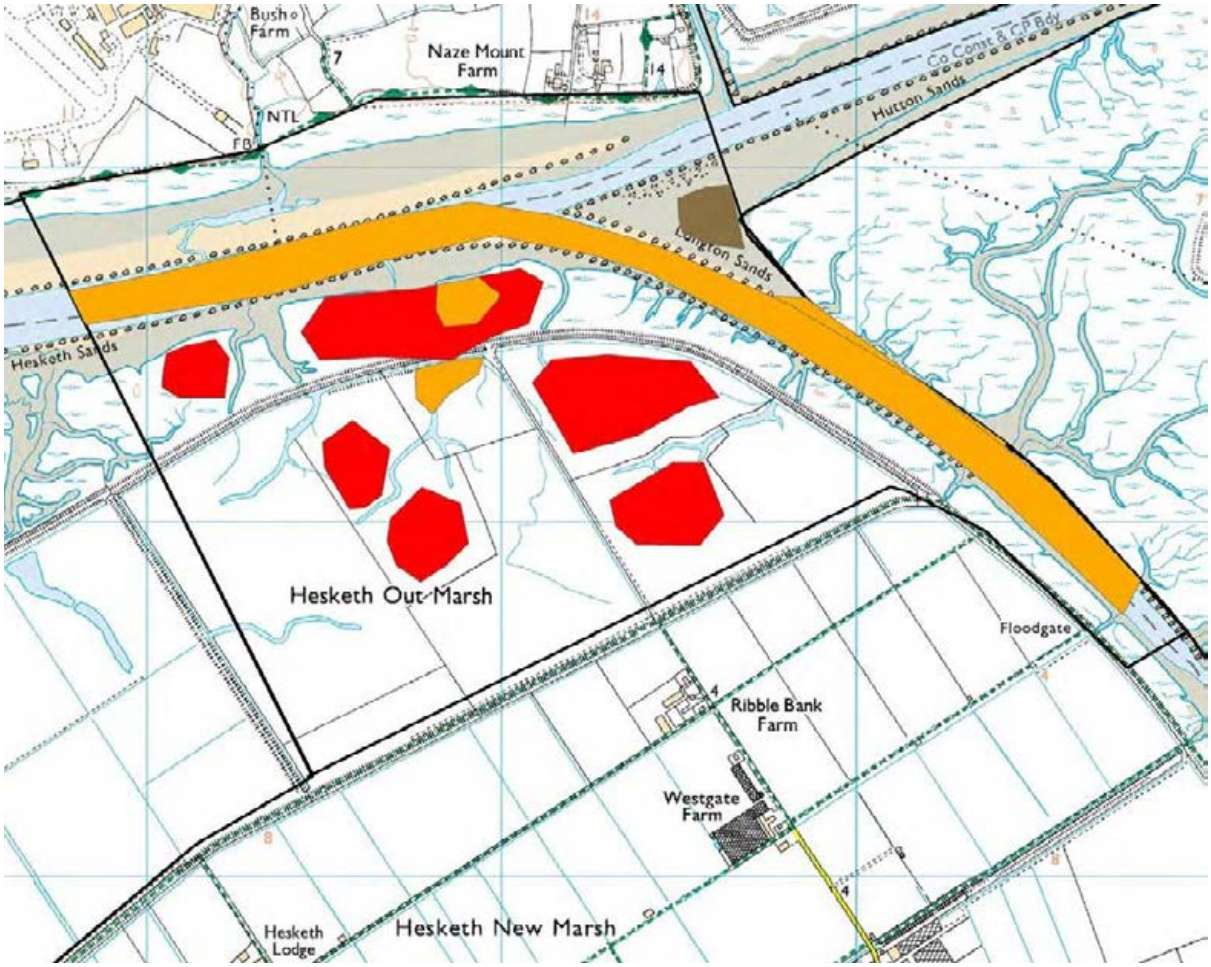

Figure A.3.4 Roost Locations: Hesketh Outmarsh East

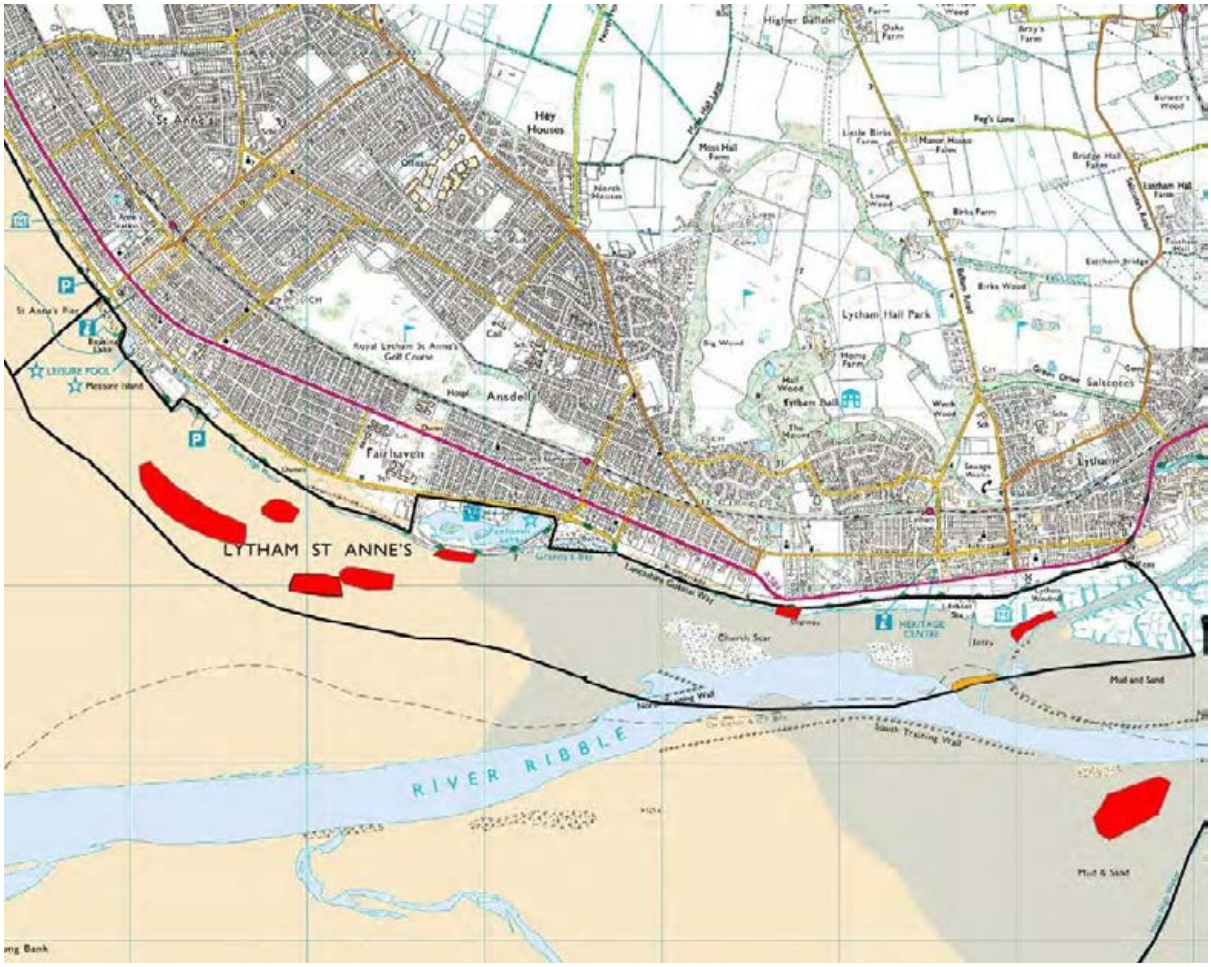

Figure A.3.5 Roost Locations: Lytham Beach

Mersey Narrows & North Wirral Foreshore SPA

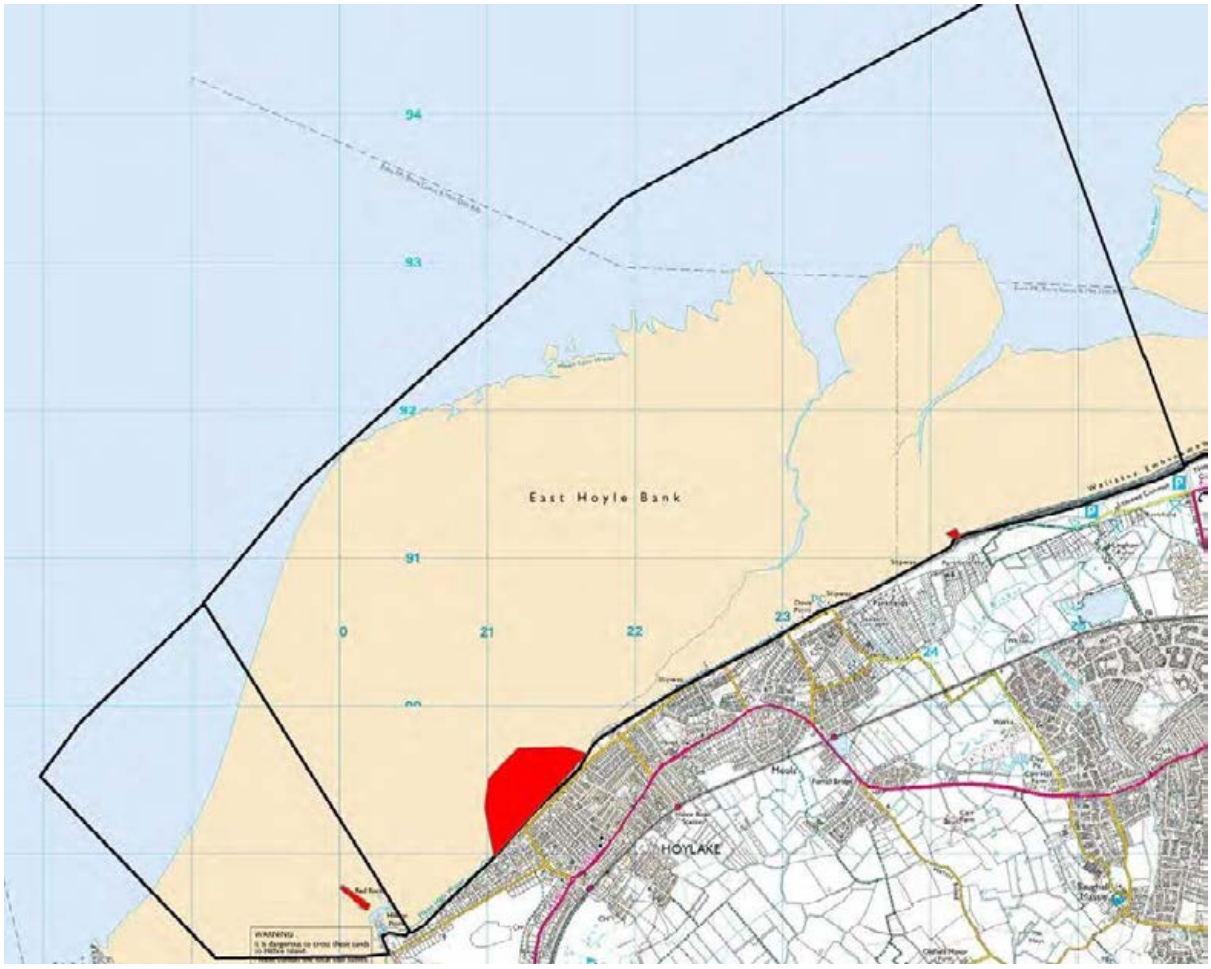

Figure A.3.6 Roost Locations: Red Rocks to Hoylake

Figure A.3.7 Roost Locations: Leasowe Bay and Islands

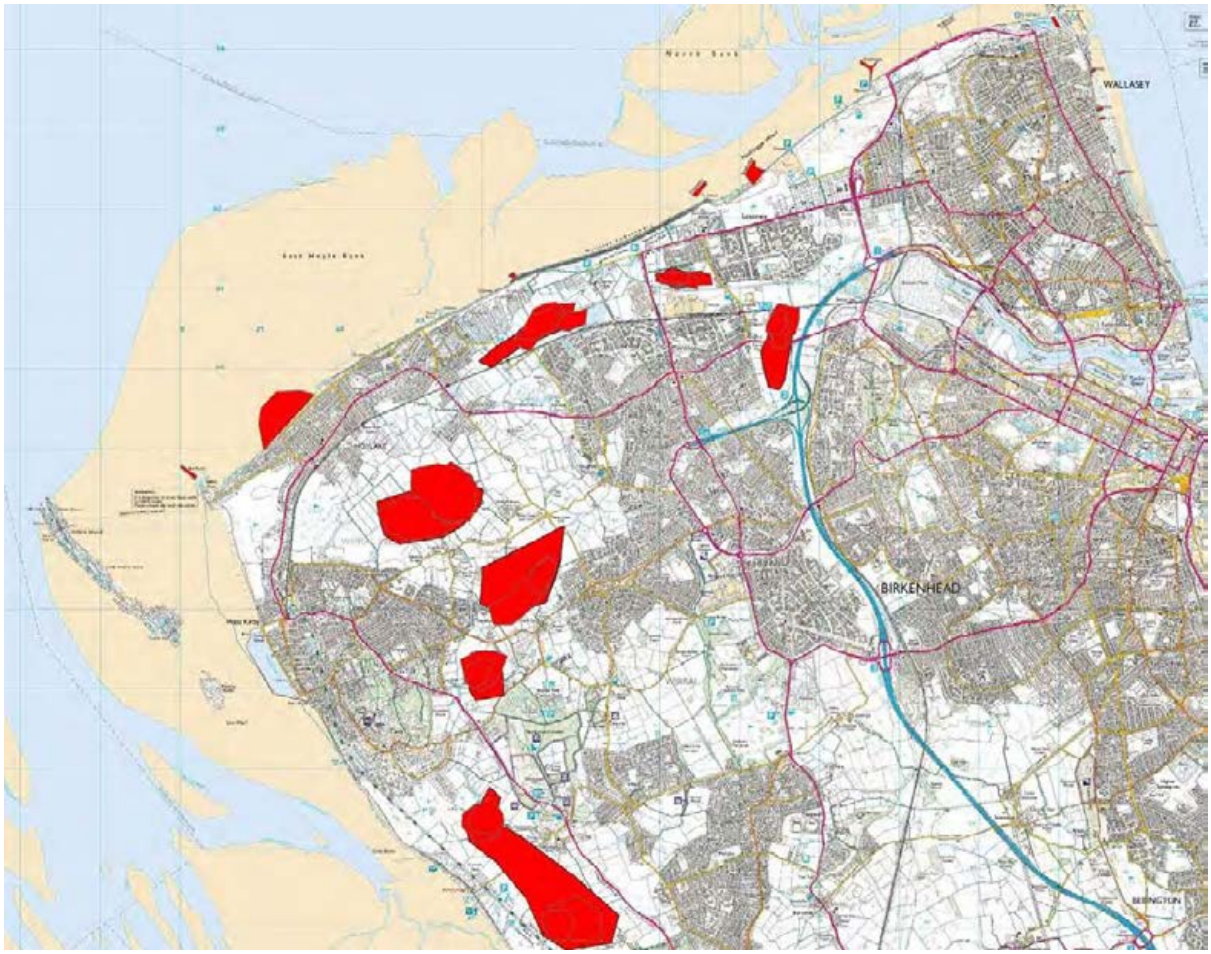

Figure A.3.8 **Roost Locations: Thurstaston Fields, Caldy Fields, Frankby Fields, Gilroy Pond and Hoylake Langfields, Meols and Leasowe Lighthouse Fields, Leasowe Fields, and Bidston and Fender Fields (outside SPA boundaries)**

Mersey Estuary SPA

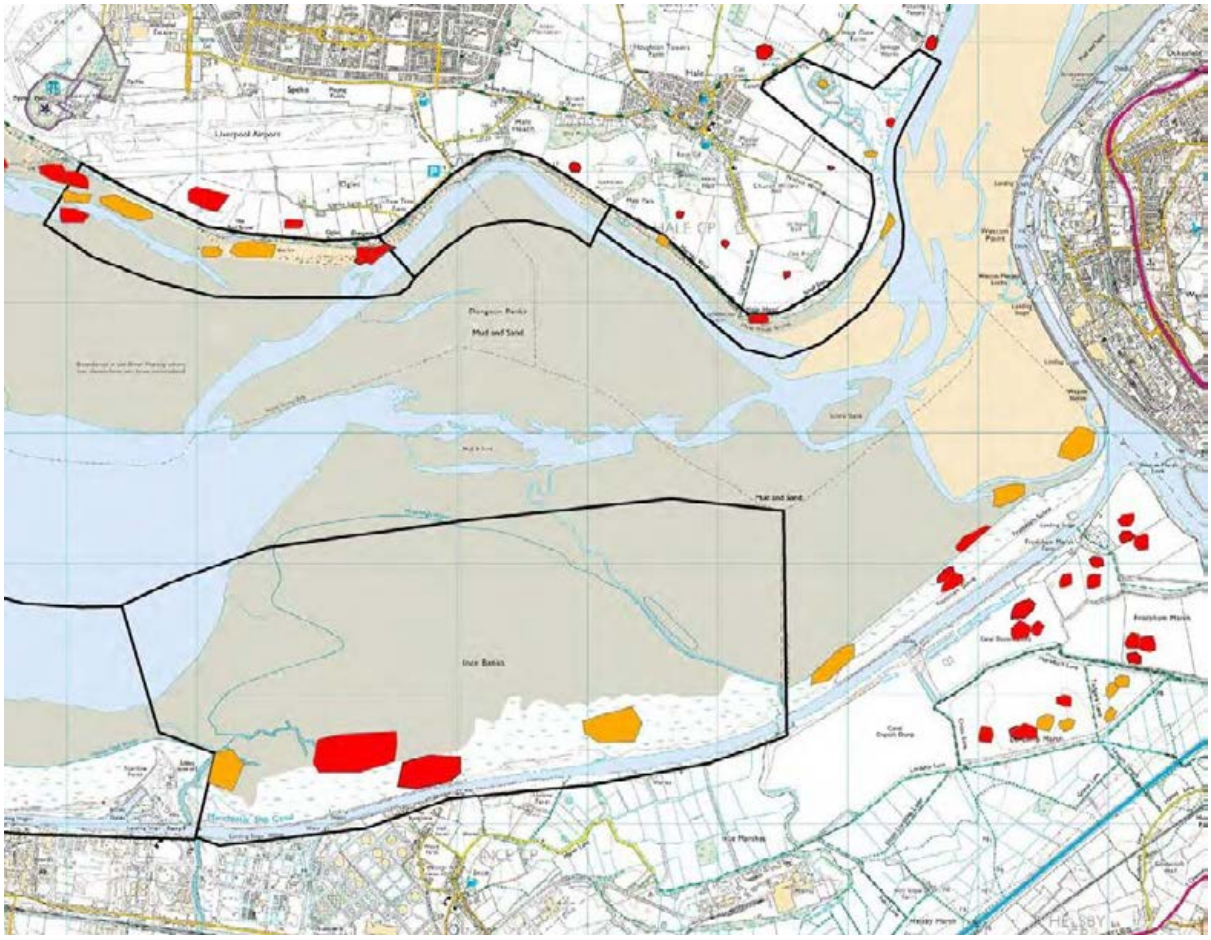

Figure A.3.9 Roost Locations: Garston Shore to Hale, including Ince Bank and Frodsham Sludge Lagoons (outside SPA boundaries)

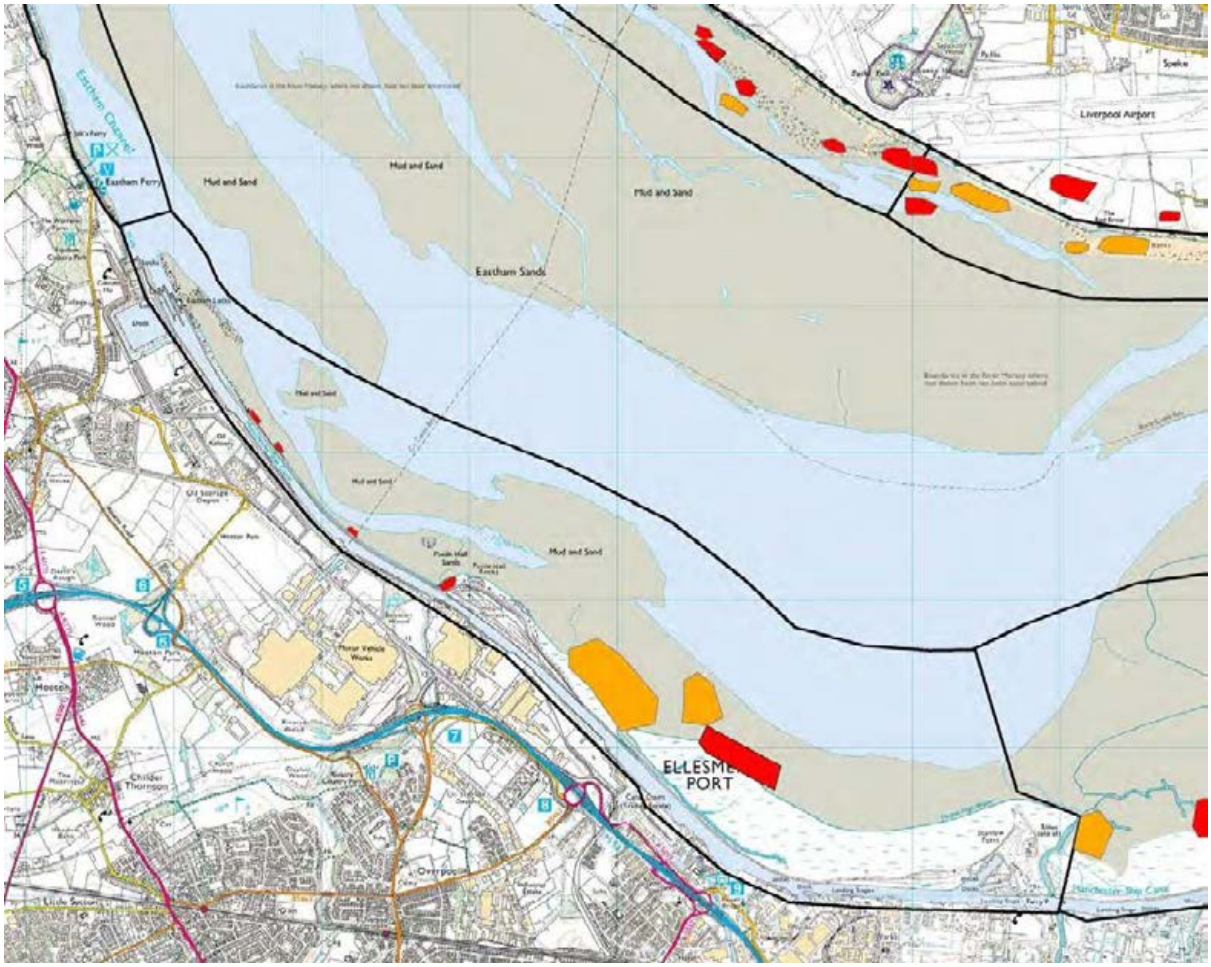

Figure A.3.10 Roost Locations: Manisty Bay

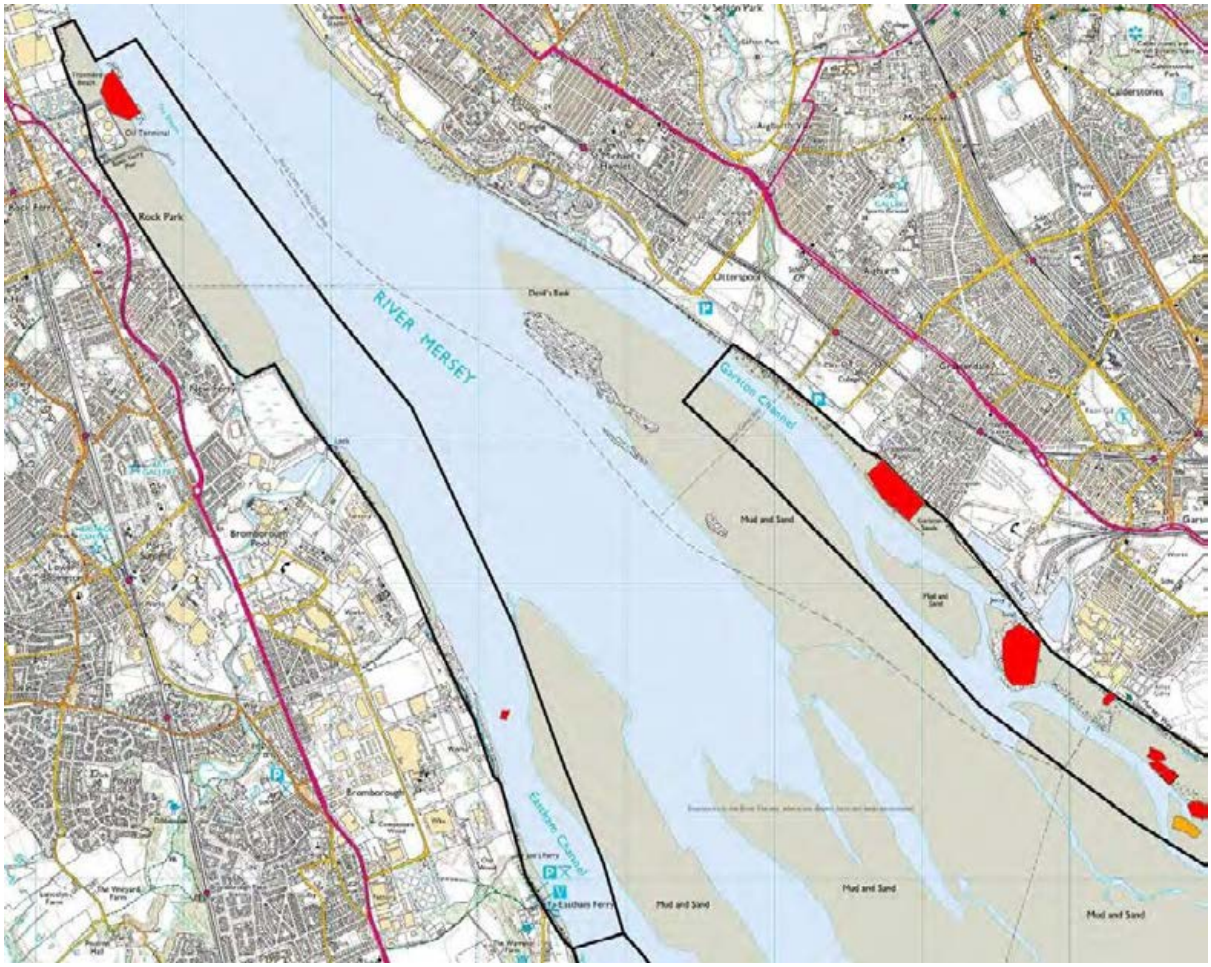

Figure A.3.11 Roost Locations: New Ferry

APPENDIX 4 LOW TIDE FEEDING DISTRIBUTIONS AND ROOST LOCATIONS

Each figure combines the roost locations shown in Appendix 1 with low tide feeding distributions for species for which low tide count data was available. Low Tide data for each estuary is as follows: Ribble – 2012/13, Alt – 2008/09, Mersey – 2012/13 and North Wirral Foreshore (as part of the Dee) – 2008/09.

- A red dot indicates the number of individuals at a low tide feeding area.
- A blue dot indicates the location of roosts.

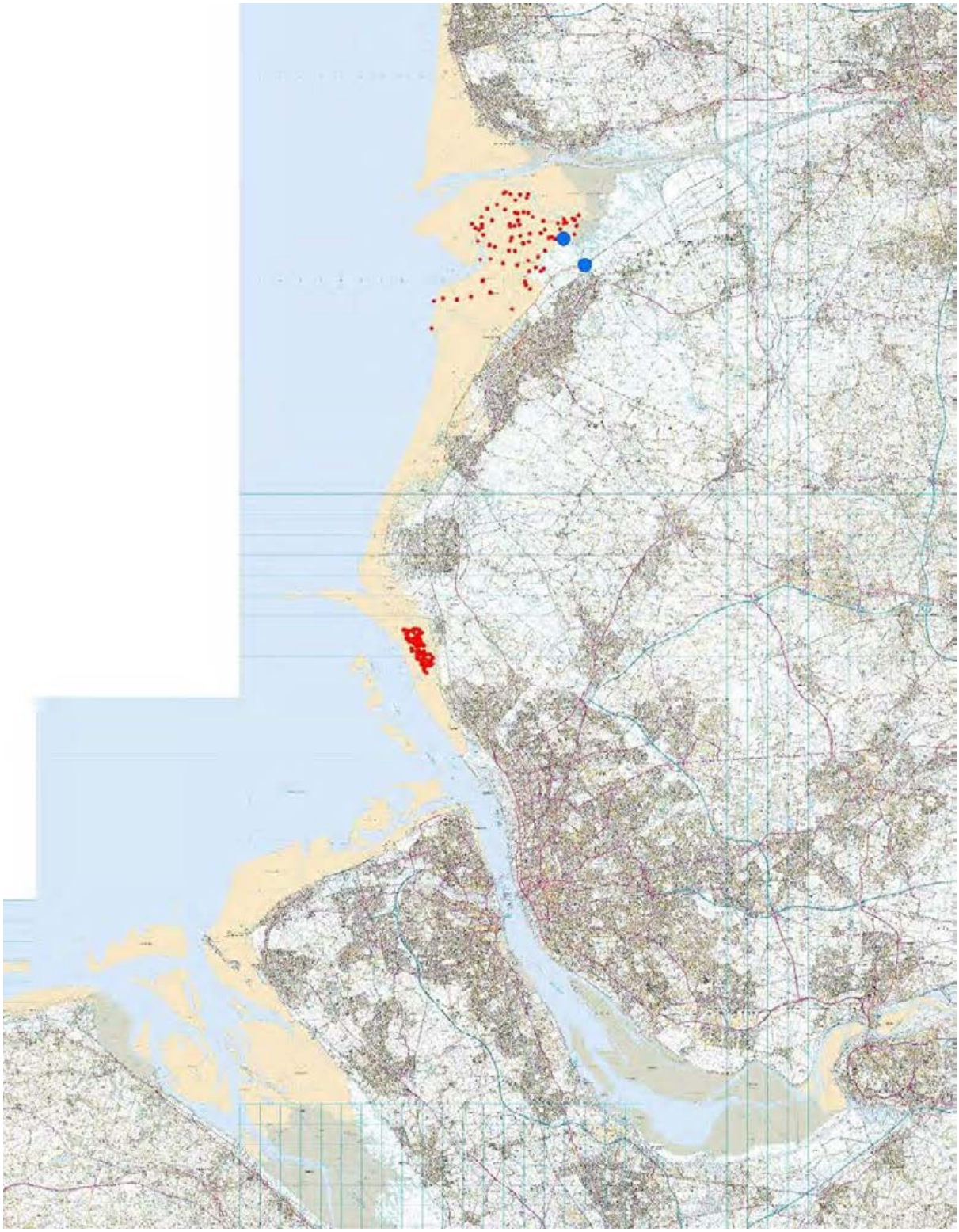

Figure A.4.1 **Pink-footed Goose low tide feeding distribution (red dot = 5 birds) and roost locations (blue dots) in the Liverpool City Region.**

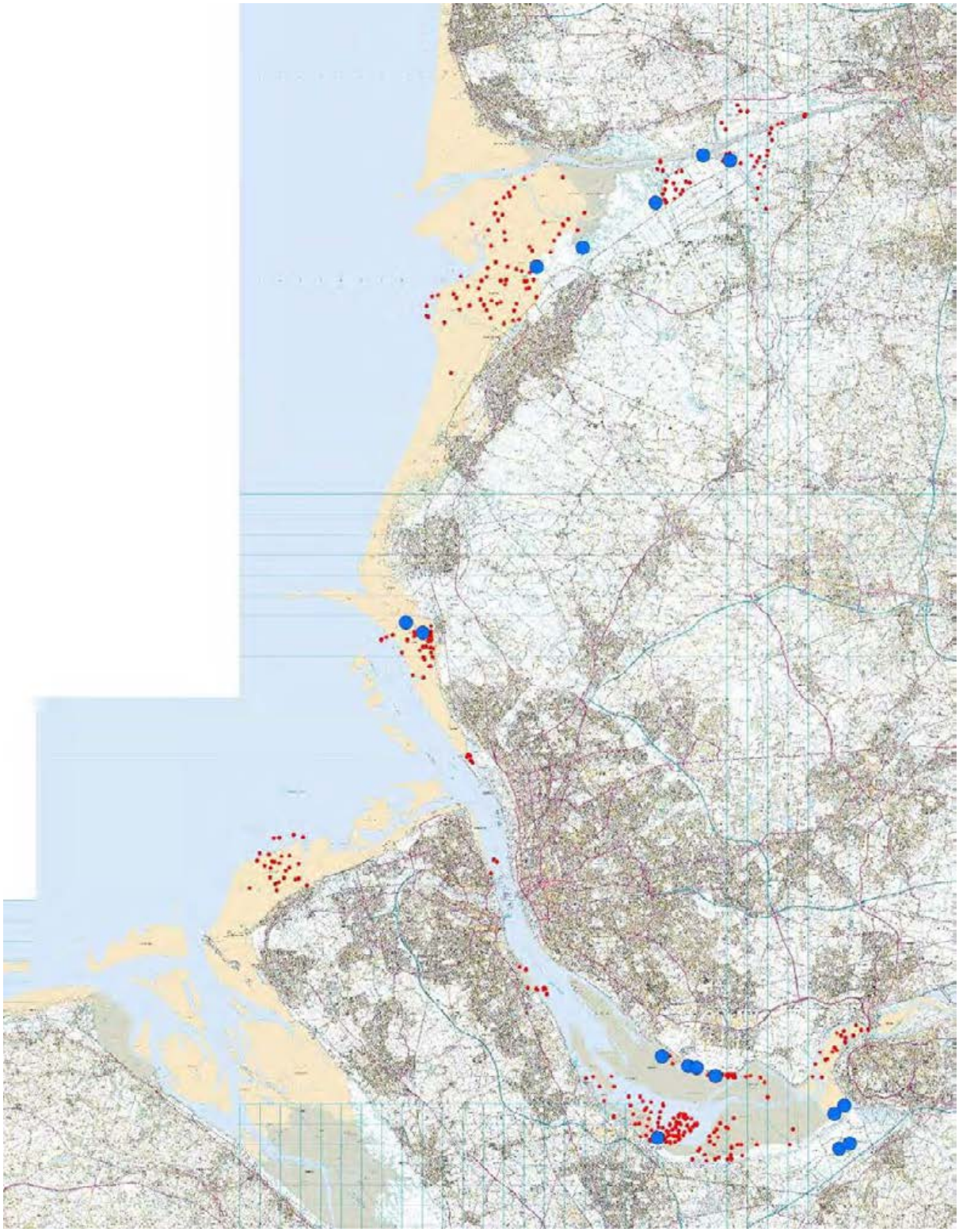

Figure A.4.2 **Shelduck low tide feeding distribution (red dot = 5 birds) and roost locations (blue dots) in the Liverpool City Region.**

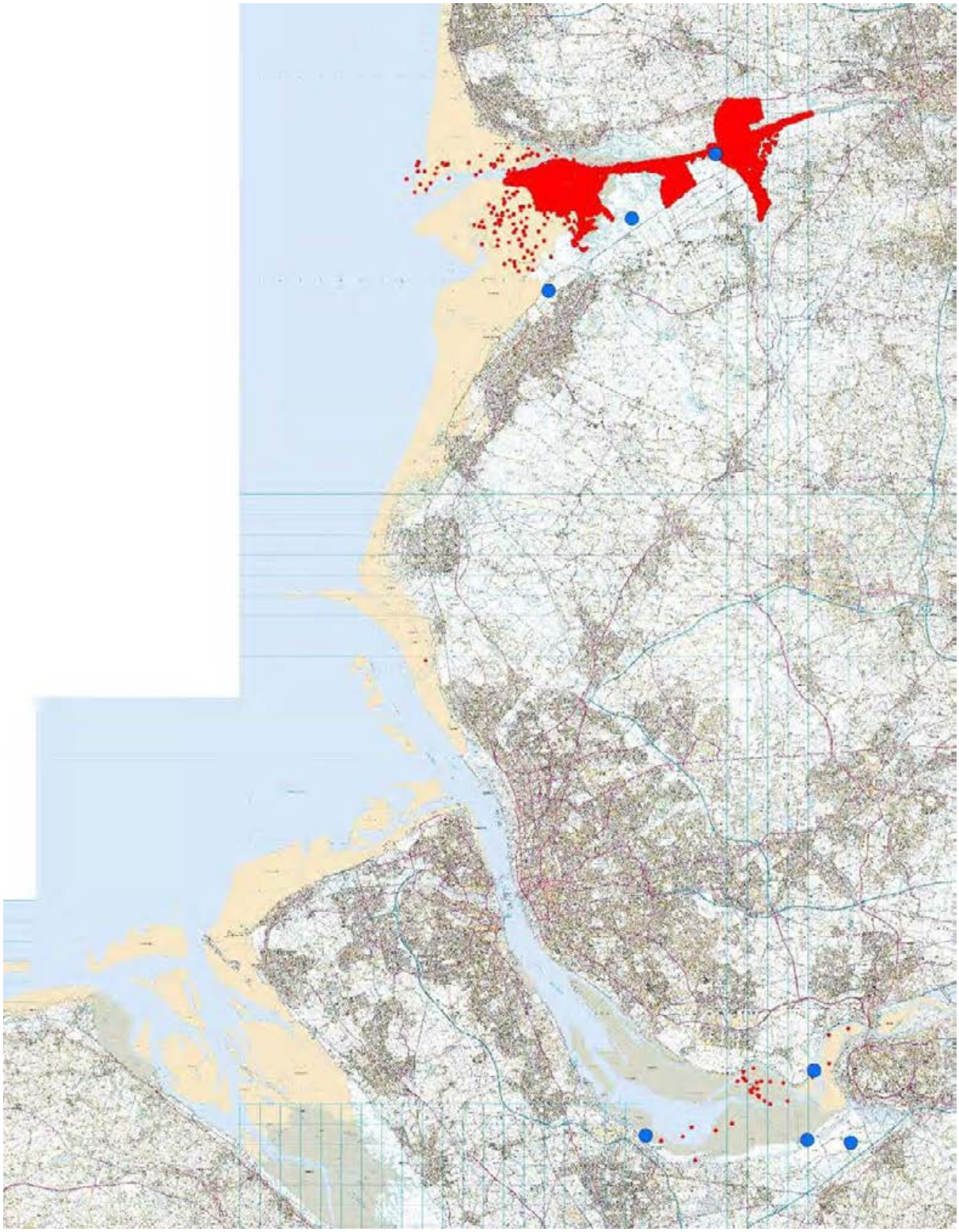

Figure A.4.3 **Wigeon low tide feeding distribution (red dot = 1 bird) and roost locations (blue dots) in the Liverpool City Region.**

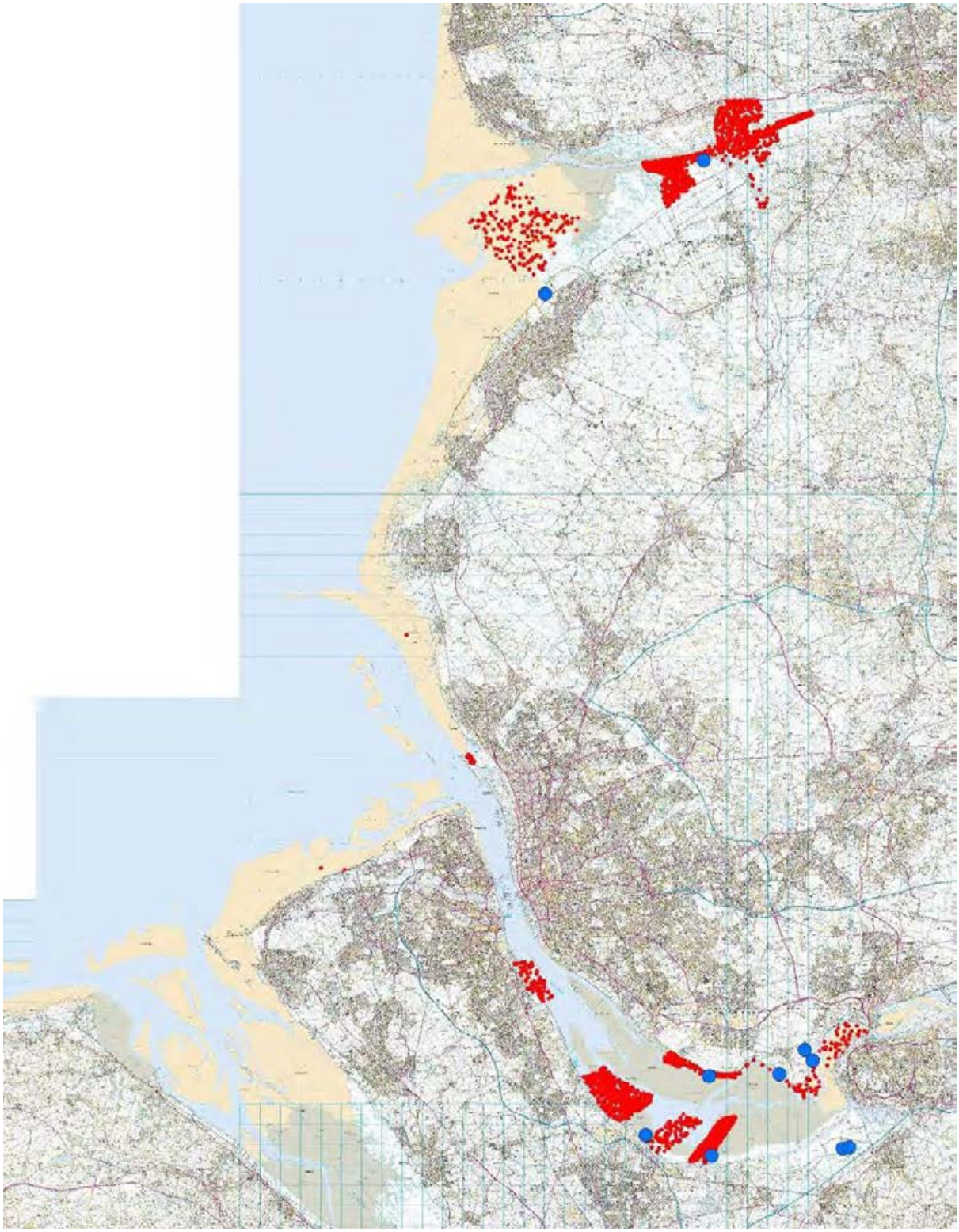

Figure A.4.4 **Teal low tide feeding distribution (red dot = 1 bird) and roost locations (blue dots) in the Liverpool City Region.**

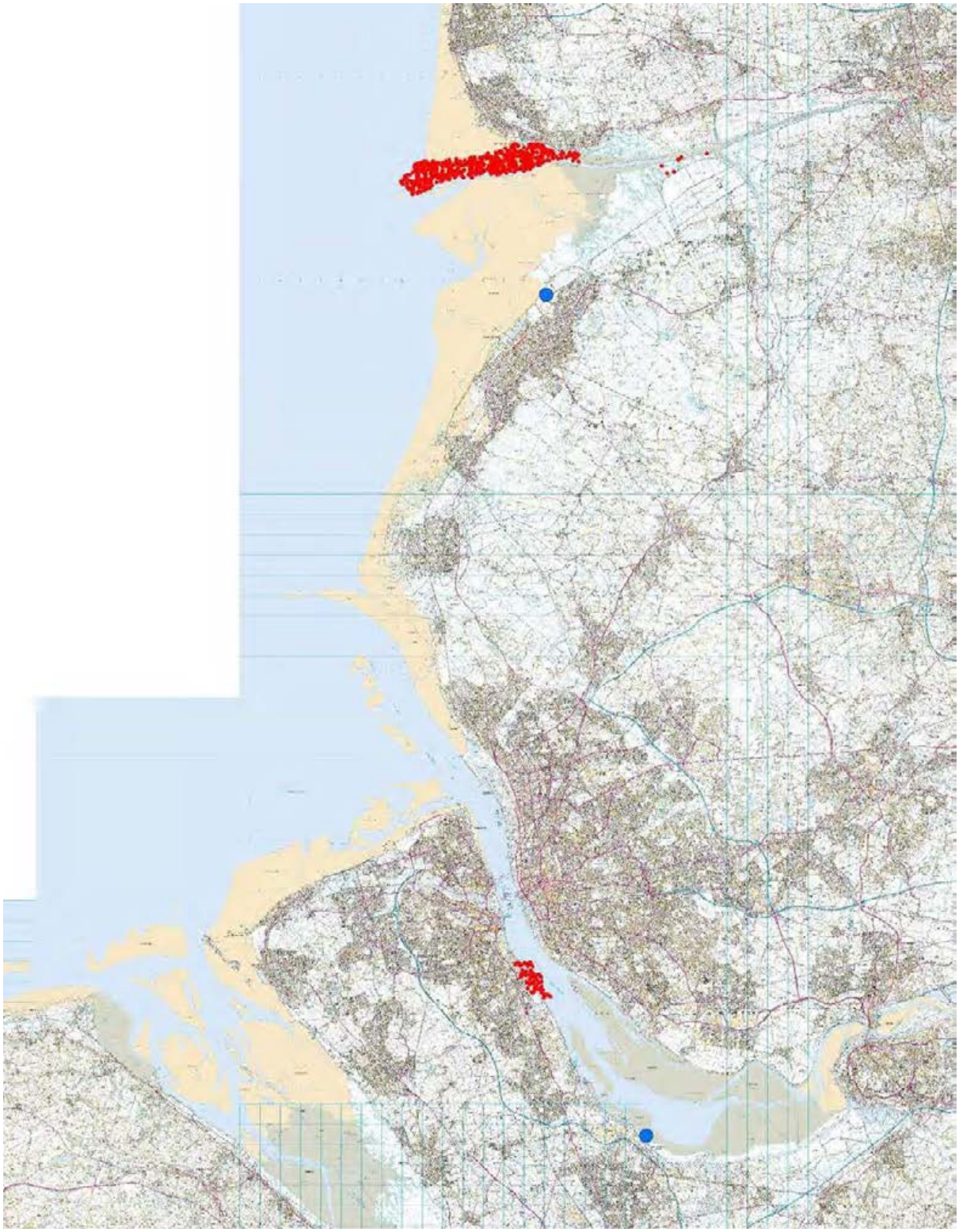

Figure A.4.5 **Pintail low tide feeding distribution (red dot = 1 bird) and roost locations (blue dots) in the Liverpool City Region.**

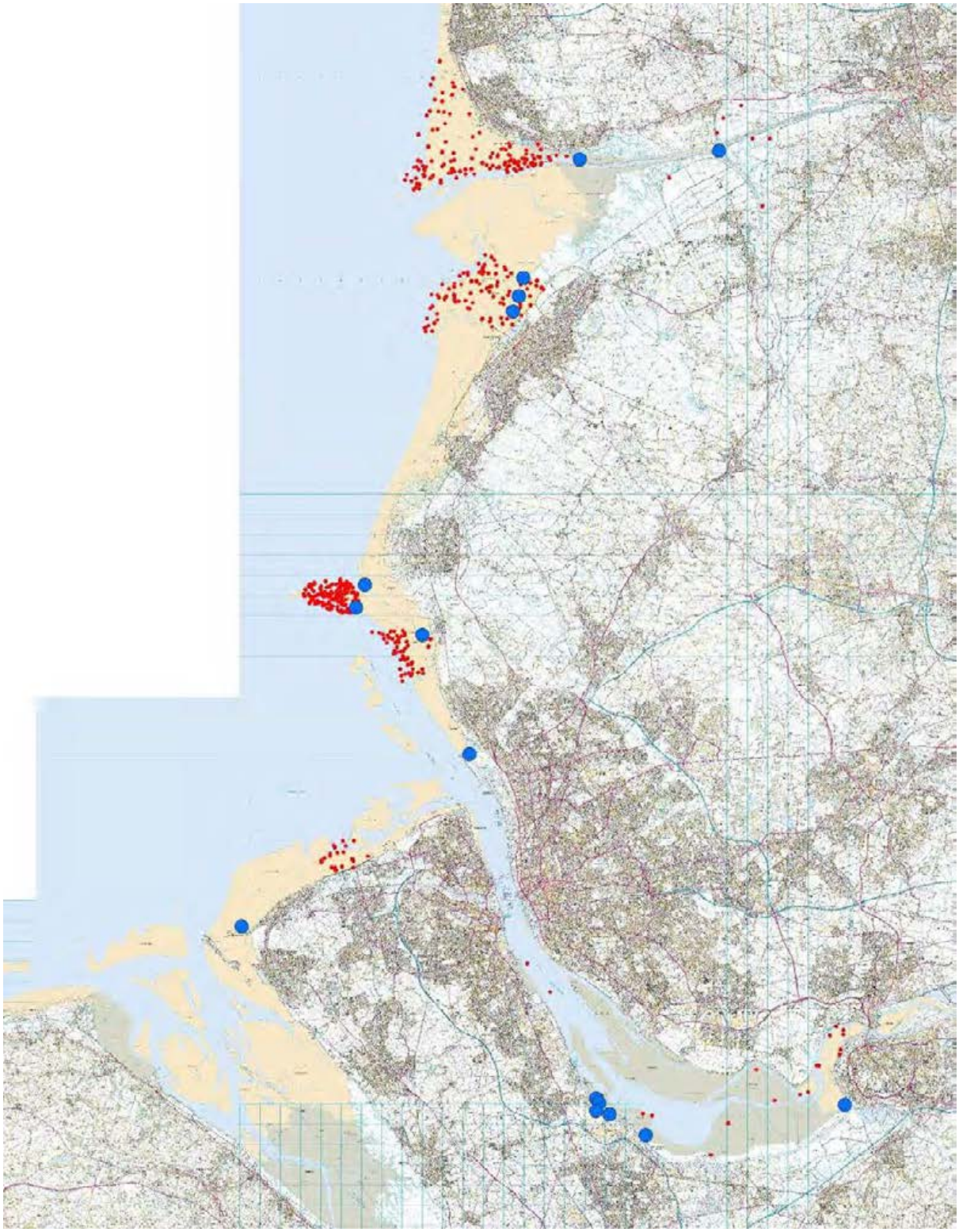

Figure A.4.6 **Cormorant low tide feeding distribution (1 red dot = 1 birds) and roost locations (blue dots) in the Liverpool City Region.**

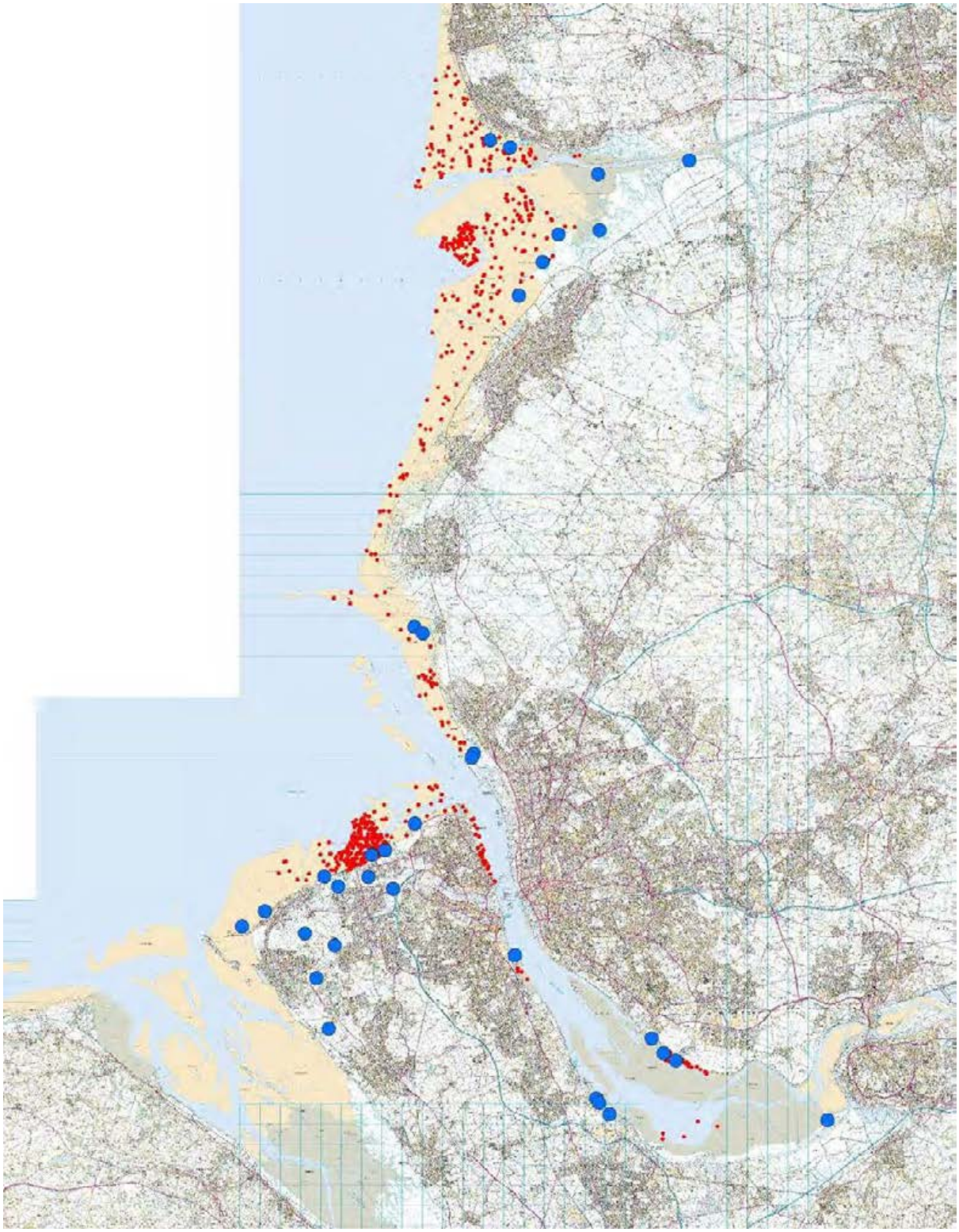

Figure A.4.7 Oystercatcher low tide feeding distribution (red dot = 10 birds) and roost locations (blue dots) in the Liverpool City Region.

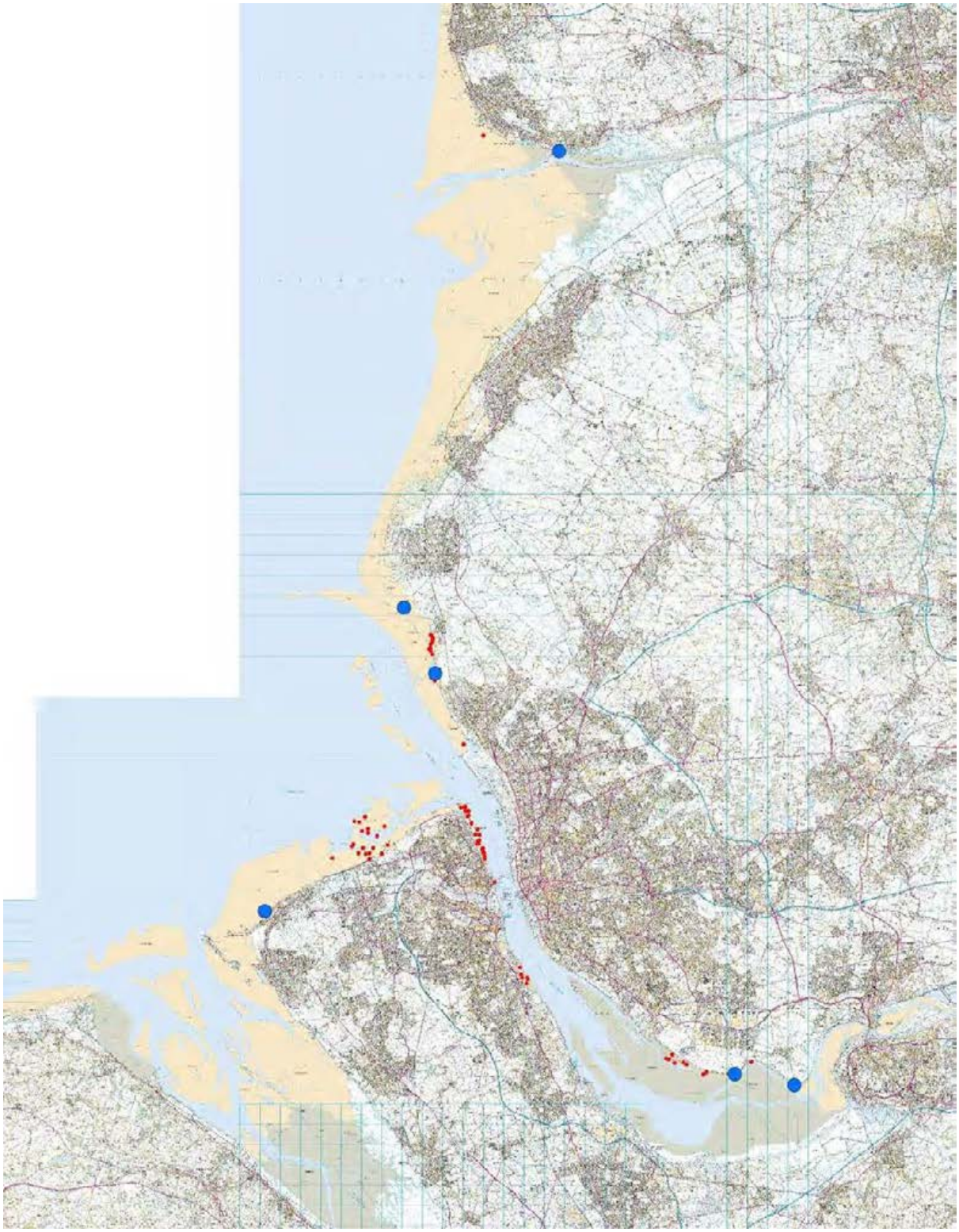

Figure A.4.8 **Ringed Plover low tide feeding distribution (red dot = 1 bird) and roost locations (blue dots) in the Liverpool City Region.**

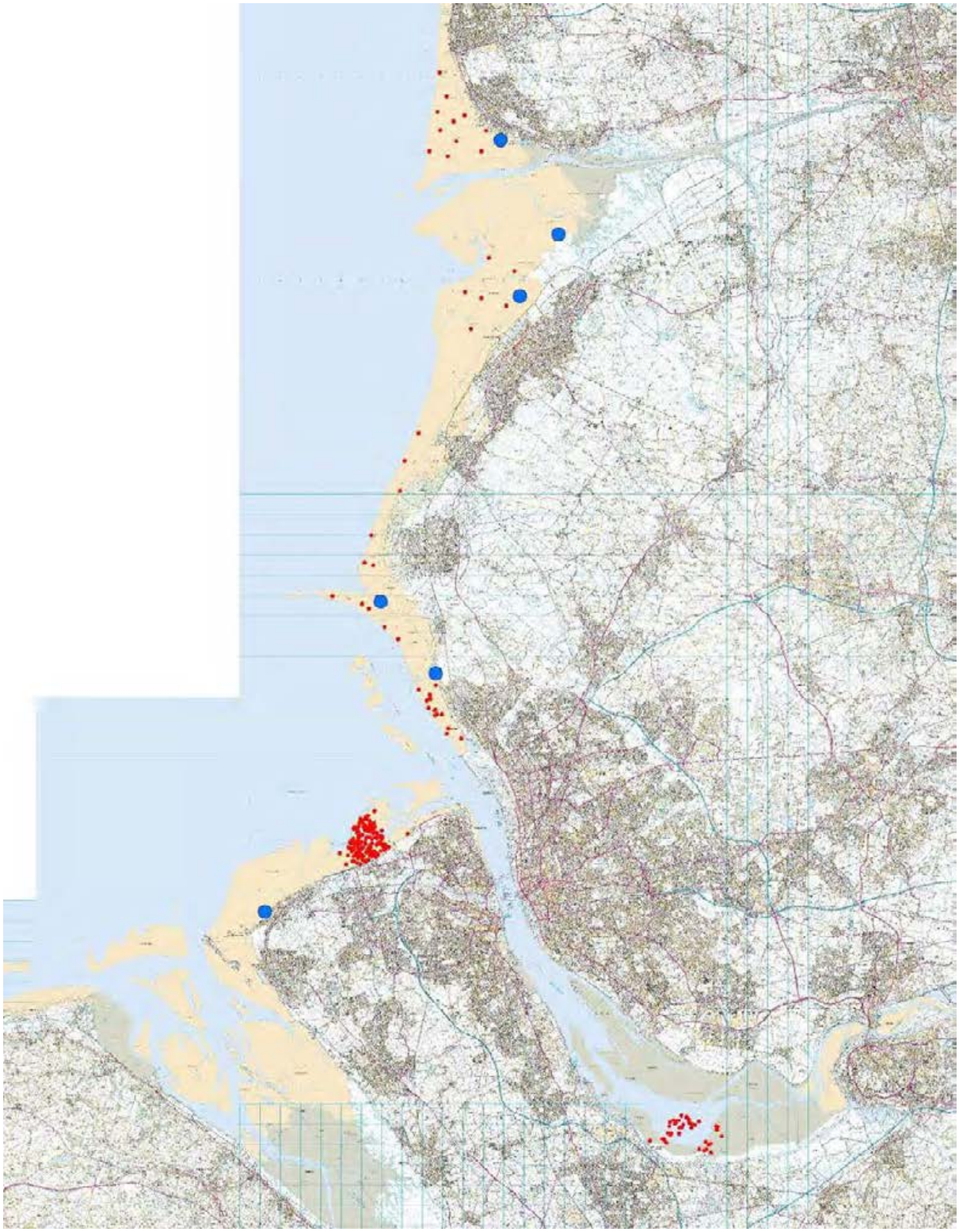

Figure A.4.9 **Grey Plover low tide feeding distribution (red dot = 5 birds) and roost locations (blue dots) in the Liverpool City Region.**

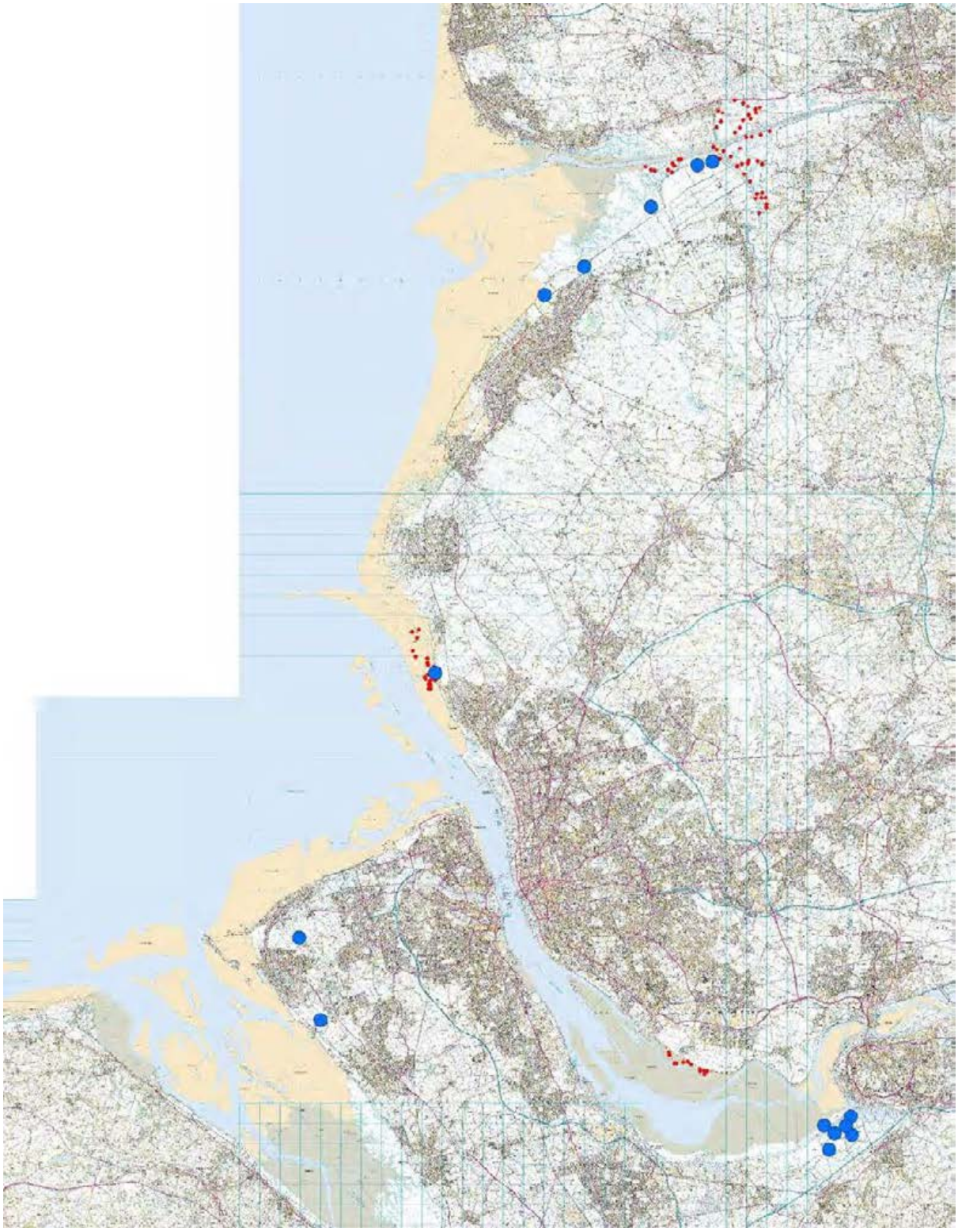

Figure A.4.10 Golden Plover low tide feeding distribution (red dot = 5 birds) and roost locations (blue dots) in the Liverpool City Region.

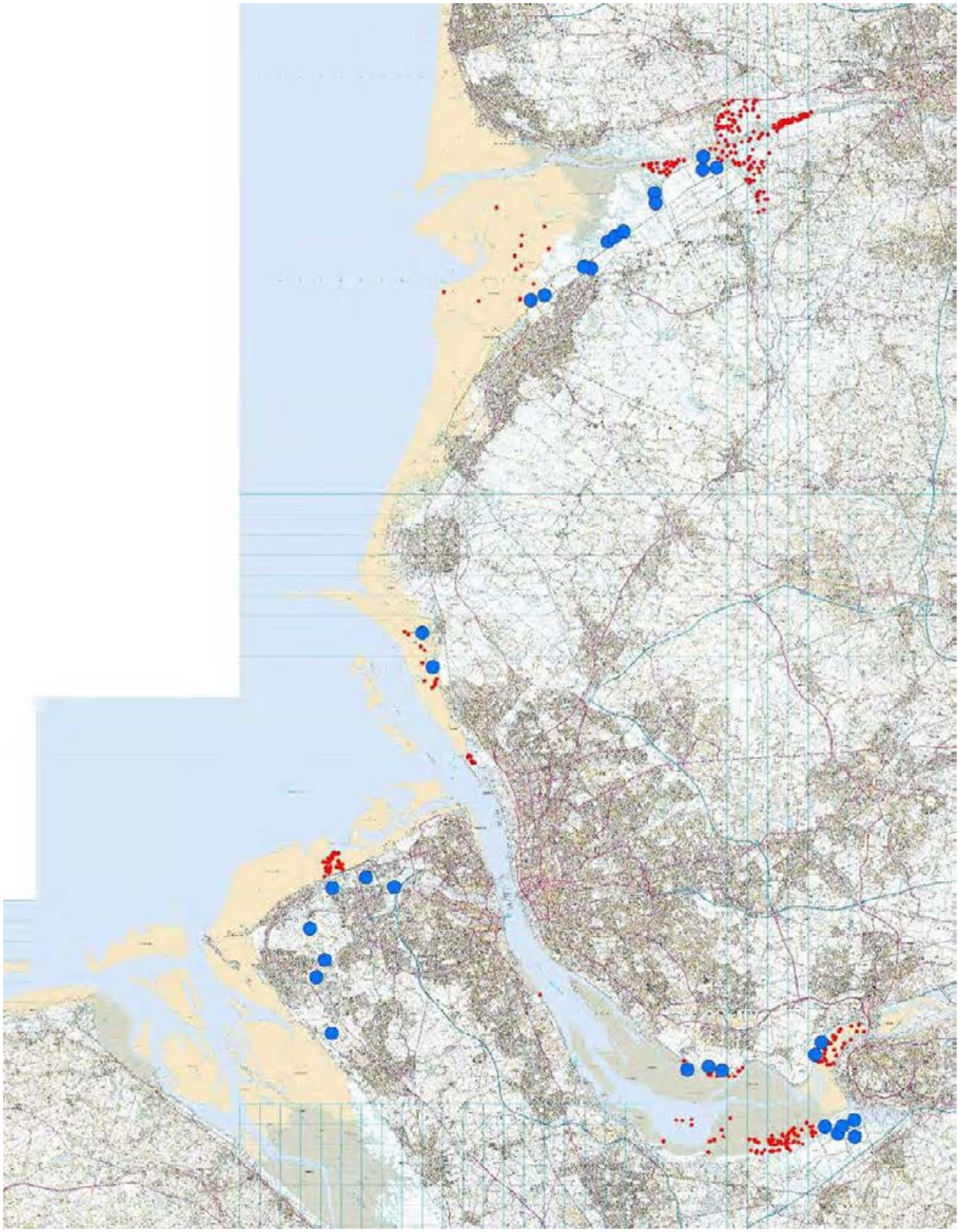

Figure A.4.11 Lapwing low tide feeding distribution (red dot = 10 birds) and roost locations (blue dots) in the Liverpool City Region.

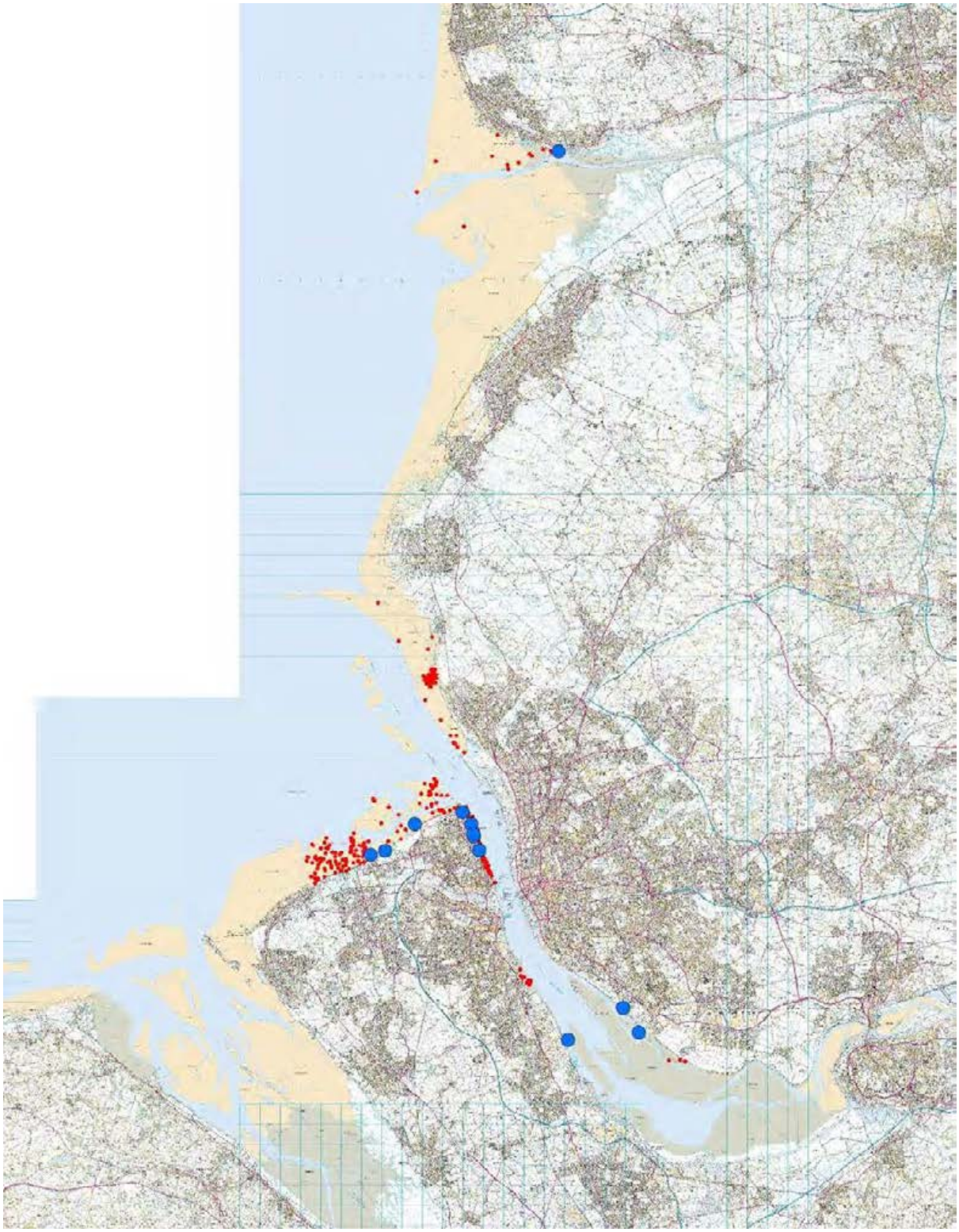

Figure A.4.12 Turnstone low tide feeding distribution (red dot = 1 bird) and roost locations (blue dots) in the Liverpool City Region.

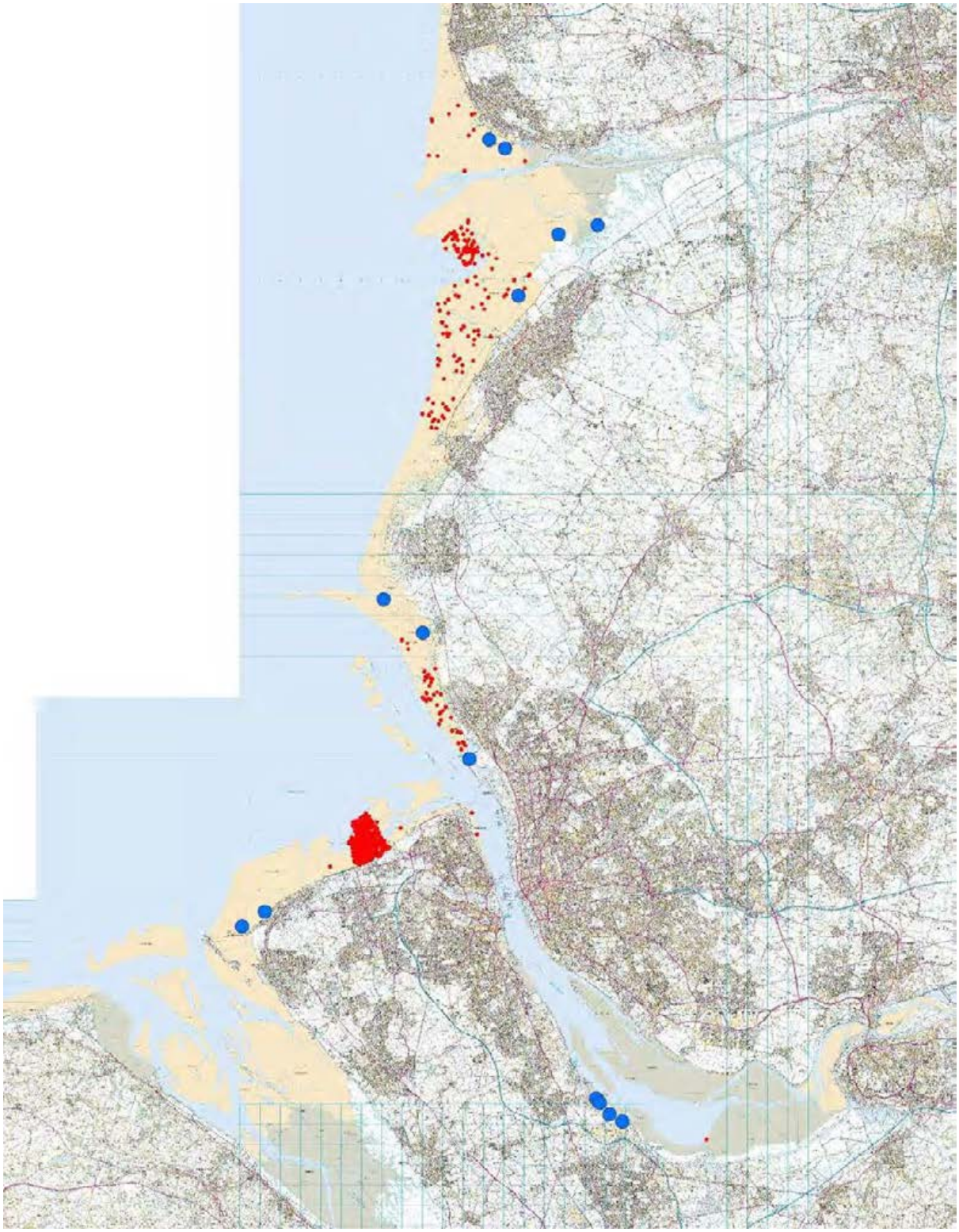

Figure A.4.13 Knot low tide feeding distribution (red dot = 5 birds) and roost locations (blue dots) in the Liverpool City Region.

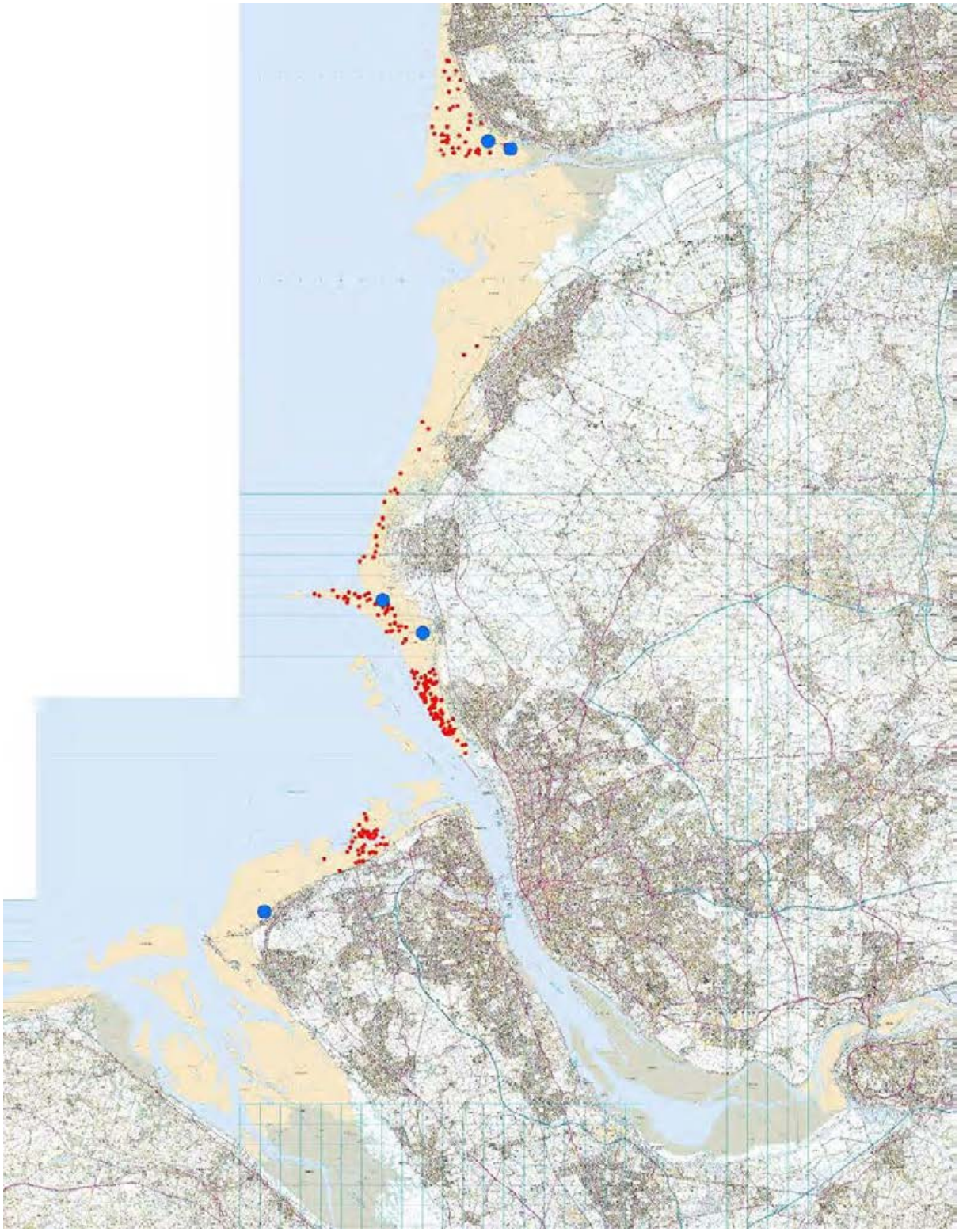

Figure A.4.14 Sanderling low tide feeding distribution (red dot = 5 birds) and roost locations (blue dots) in the Liverpool City Region.

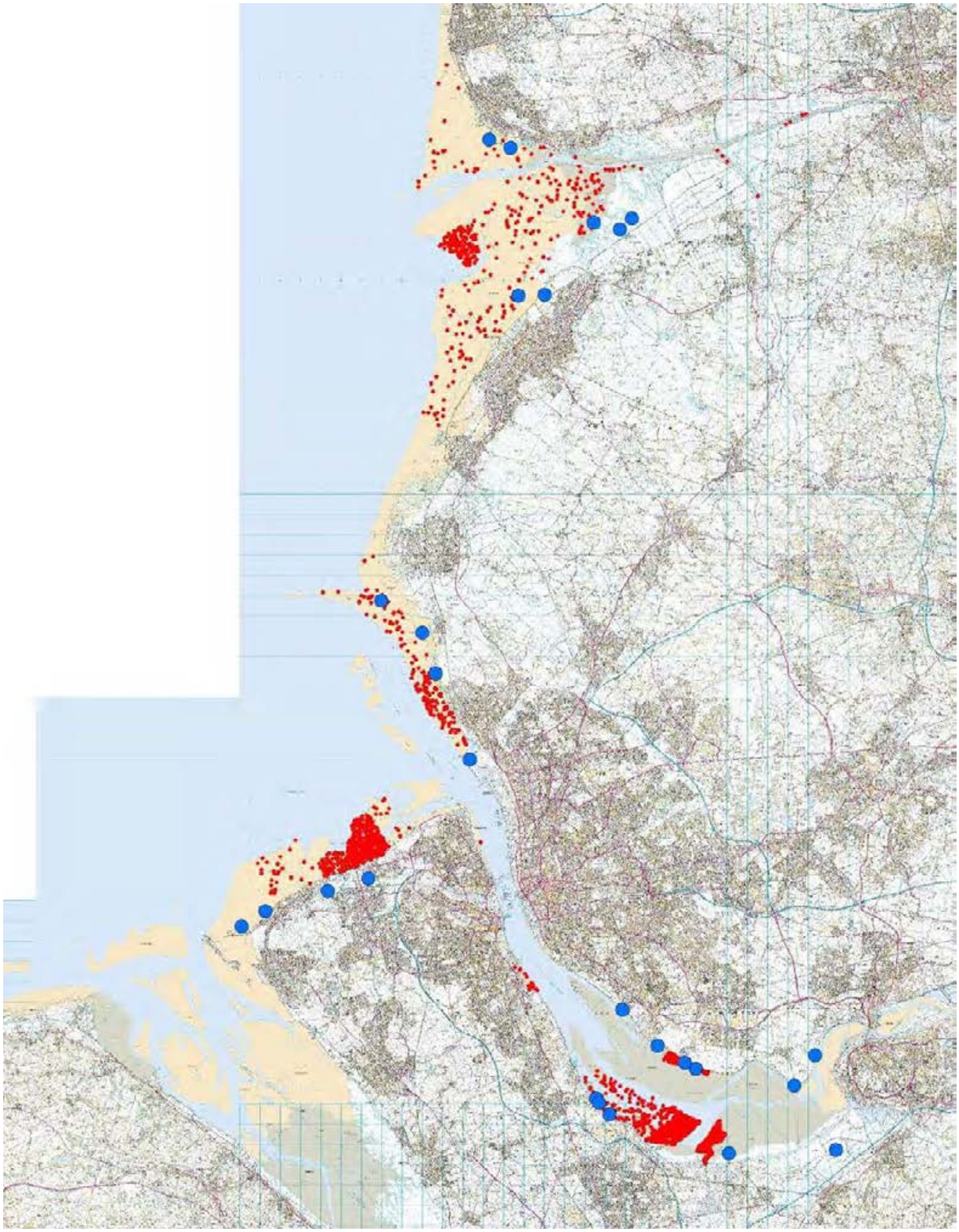

Figure A.4.15 Dunlin low tide feeding distribution (red dot = 10 birds) and roost locations (blue dots) in the Liverpool City Region.

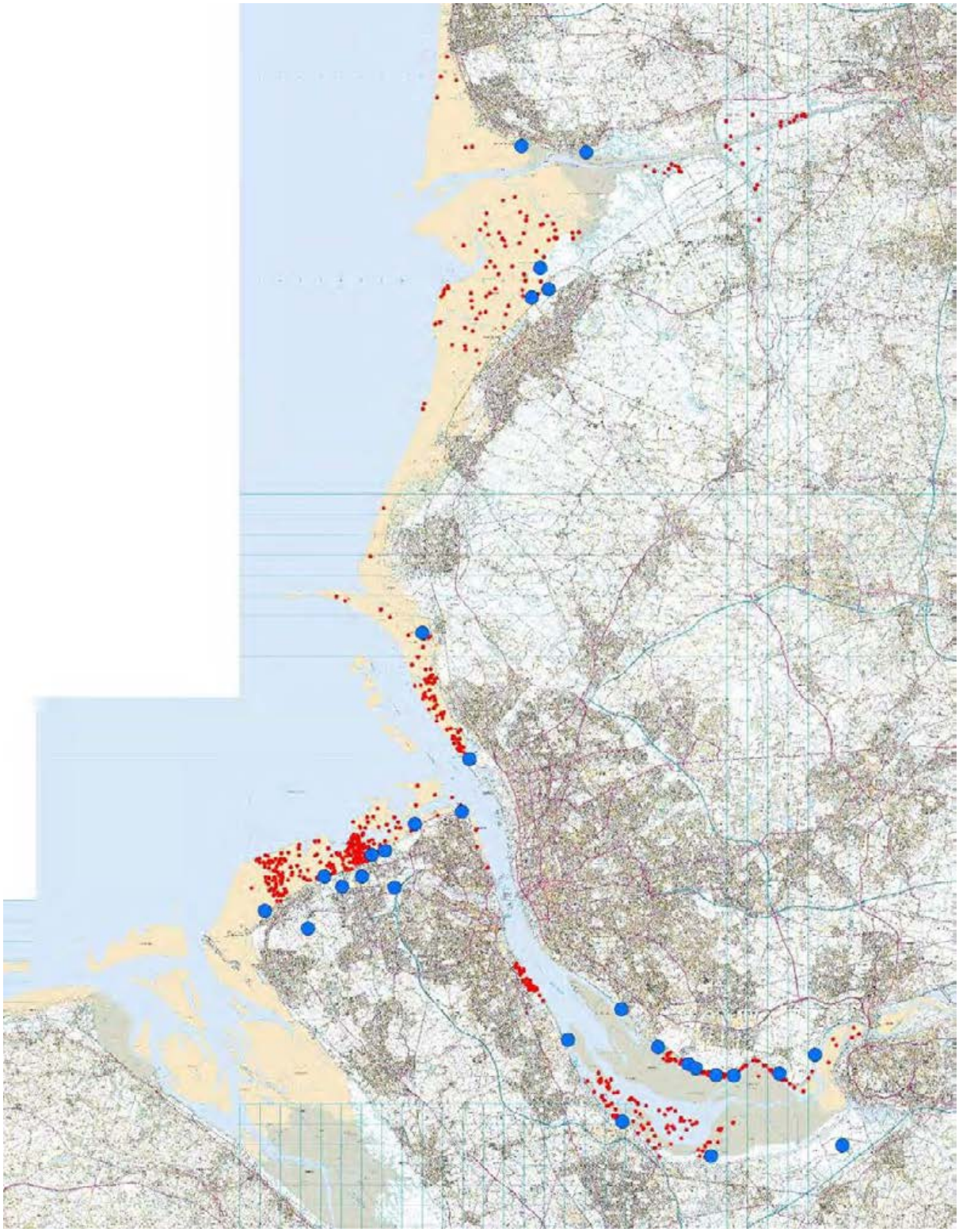

Figure A.4.16 Redshank low tide feeding distribution (red dot = 5 birds) and roost locations (blue dots) in the Liverpool City Region.

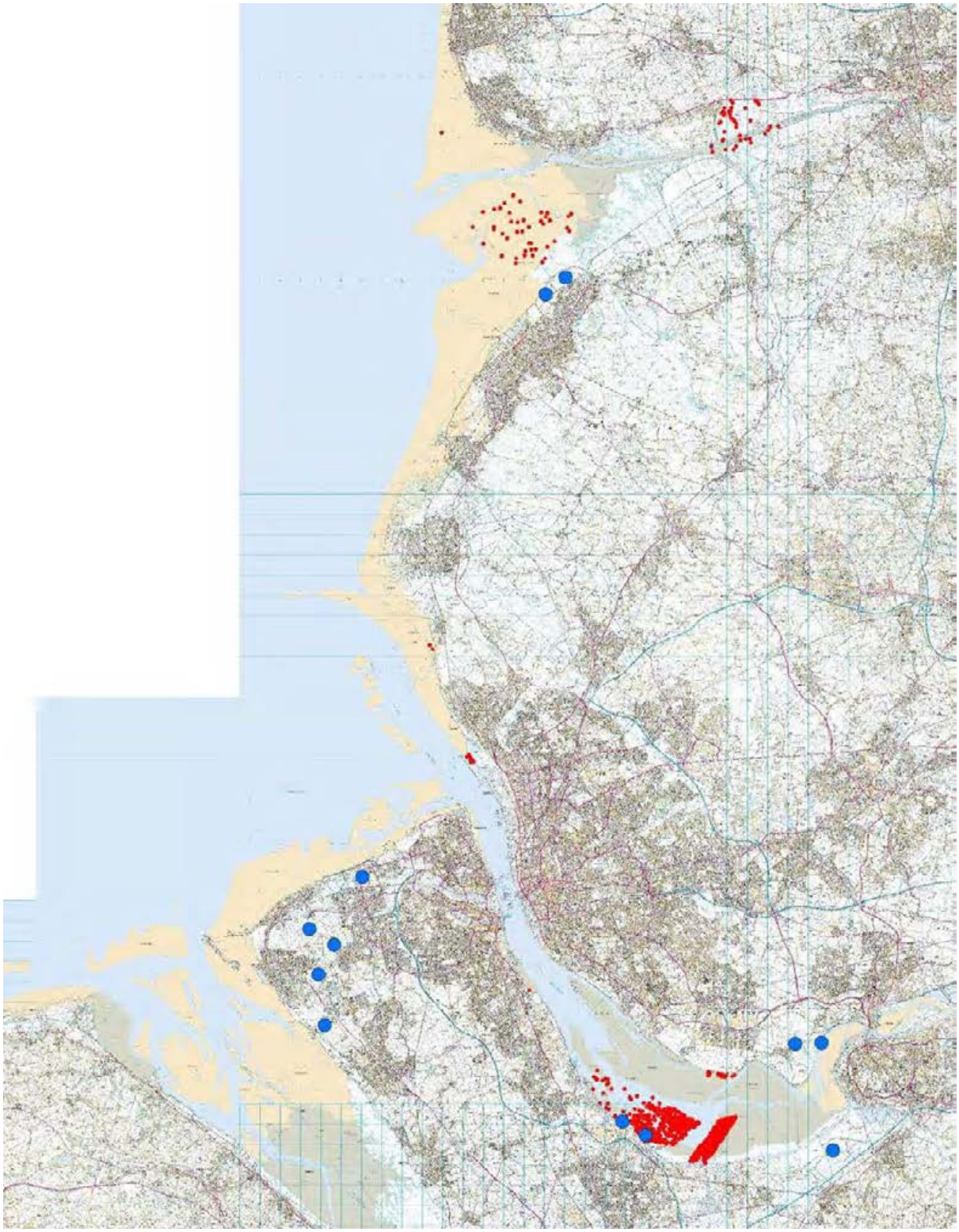

Figure A.4.17 Black-tailed Godwit low tide feeding distribution (red dot = 1 bird) and roost locations (blue dots) in the Liverpool City Region.

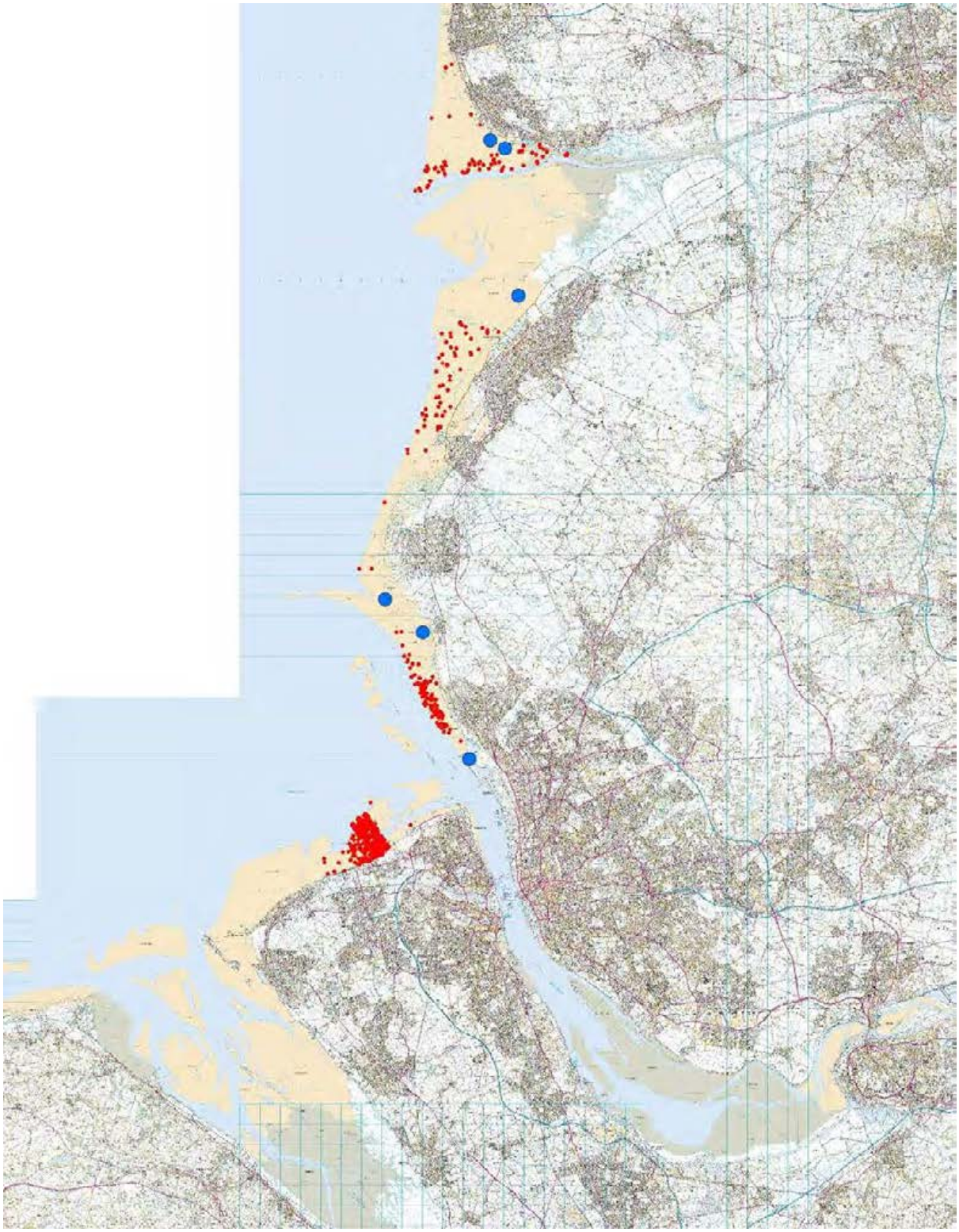

Figure A.4.18 Bar-tailed Godwit low tide feeding distribution (red dot = 10 birds) and roost locations (blue dots) in the Liverpool City Region.

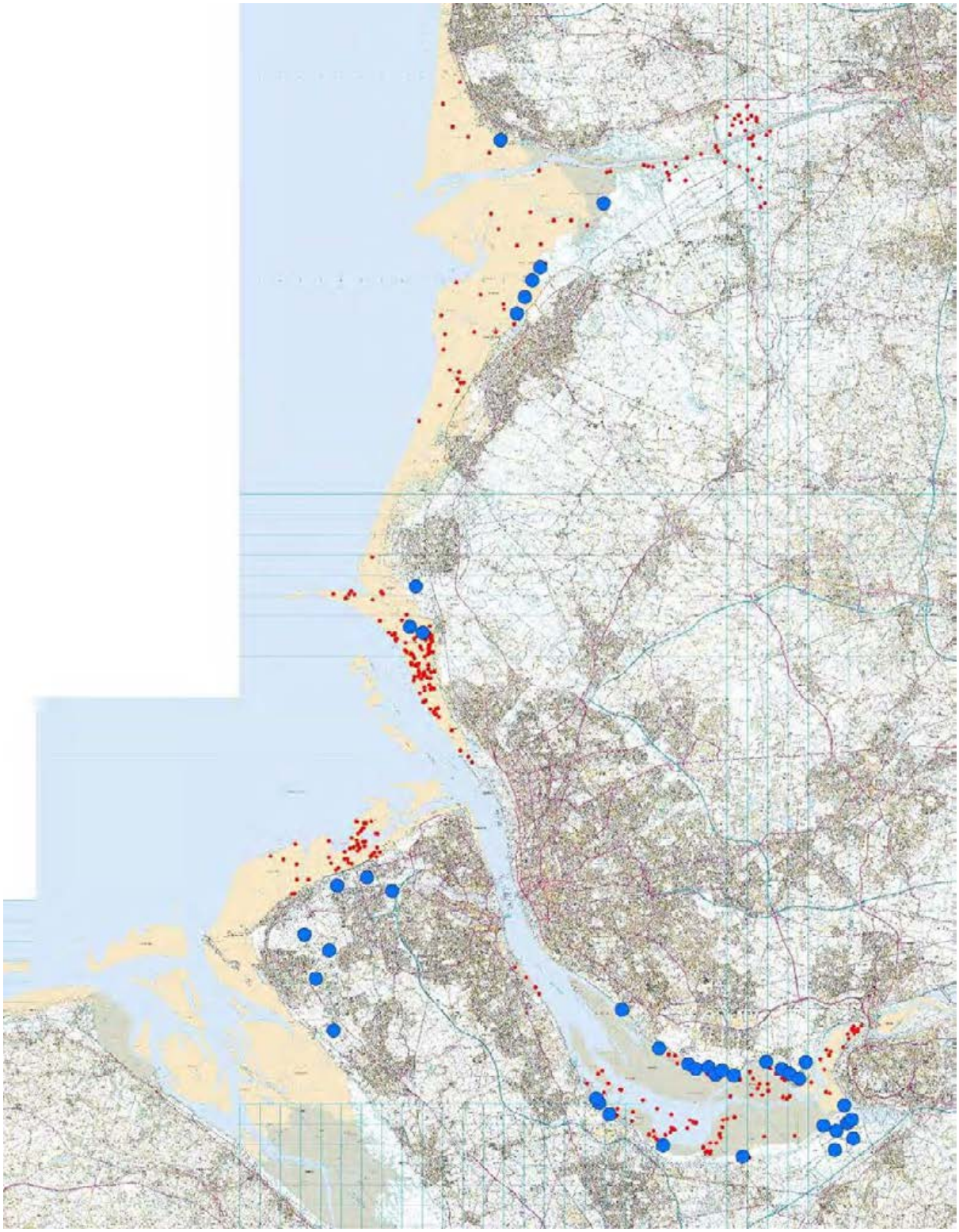

Figure A.4.19 Curlew low tide feeding distribution (red dot = 5 birds) and roost locations (blue dots) in the Liverpool City Region.

APPENDIX 5 MAPS OF FIVE YEAR MEAN DENSITIES

Each figure shows the mapped 5-year mean densities for selected species across the WeBS sectors in the Liverpool City Region SPAs. Here, peak winter density means are calculated across the following years:

- 1997/98 – 2001/02
- 2002/03 – 2006/07
- 2007/08 – 2011/12

Note, only species with available count data could be mapped.

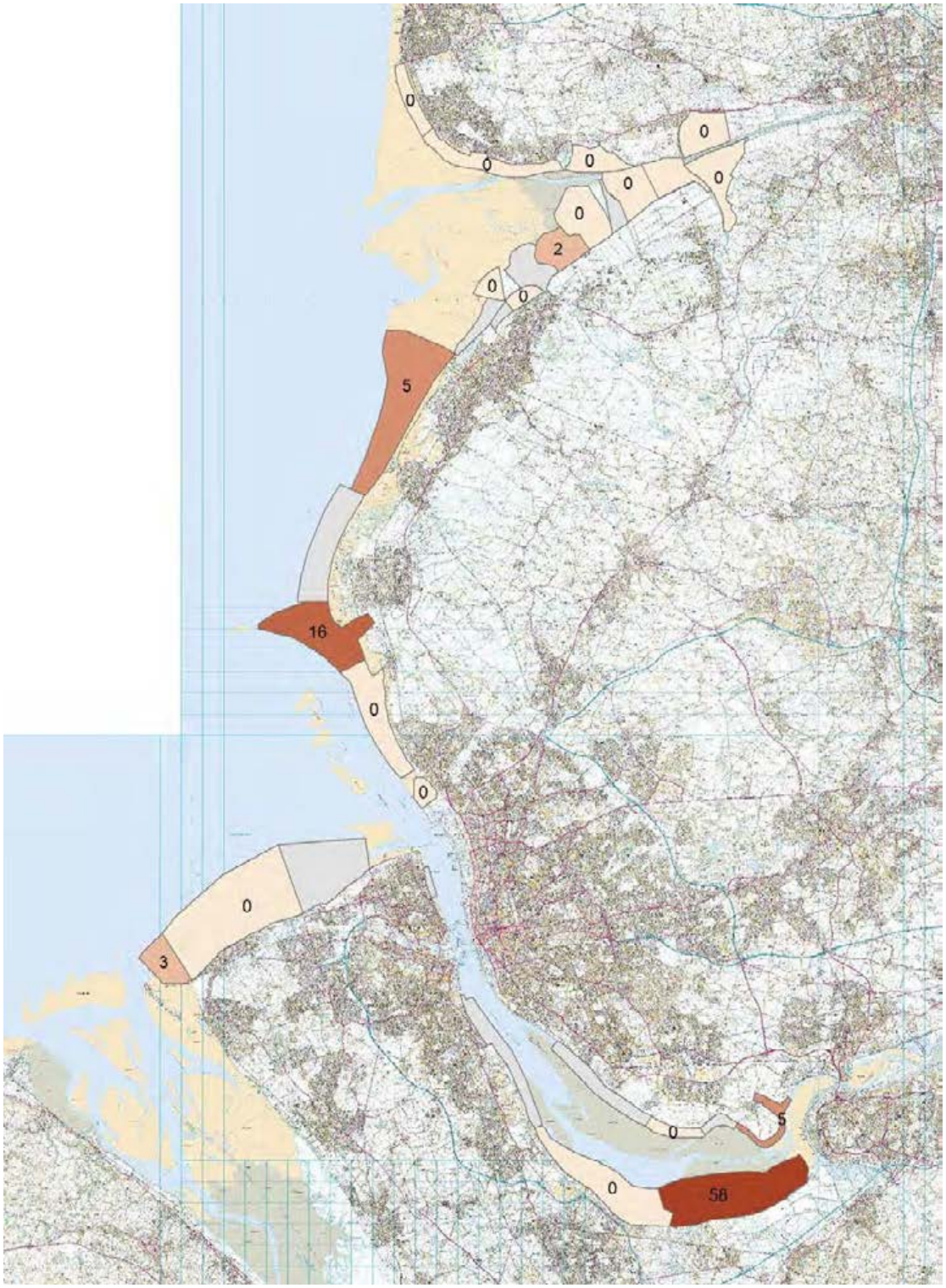

Figure A.5.1 **5-year mean densities of Great Crested Grebe (1997/98 – 2001/02) in the Liverpool City Region**

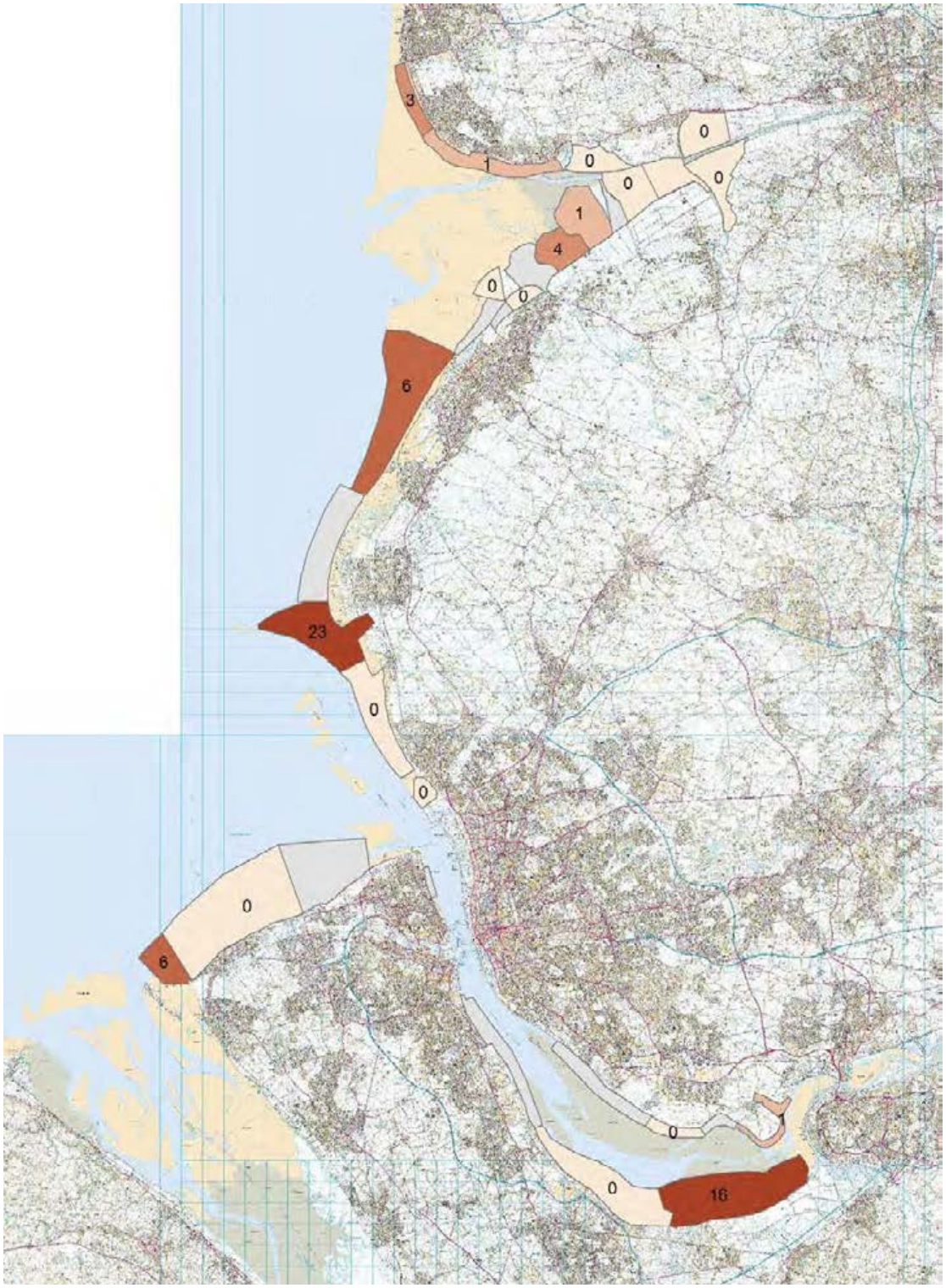

Figure A.5.2 **5-year mean densities of Great Crested Grebe (2002/03 – 2006/07) in the Liverpool City Region**

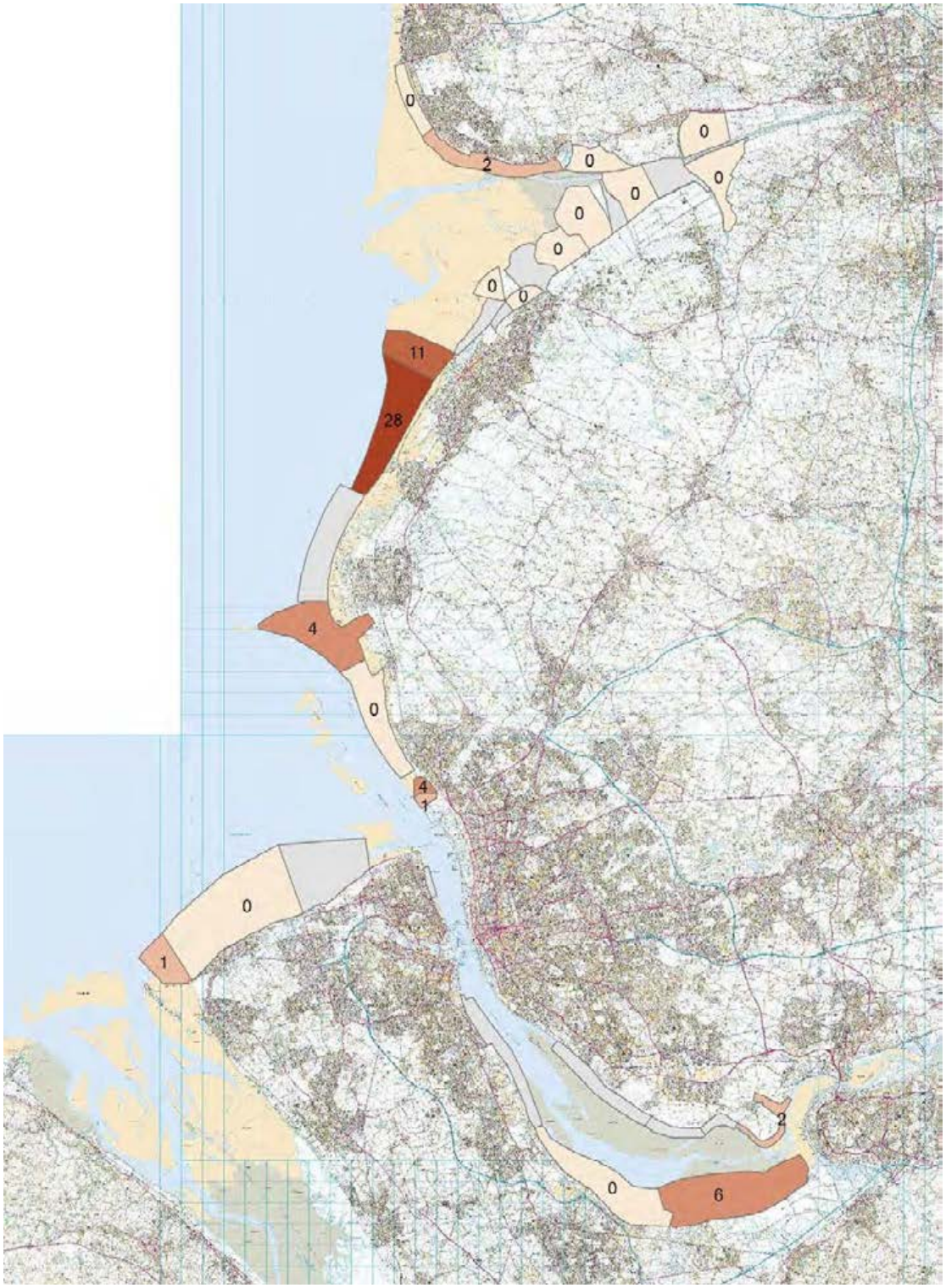

Figure A.5.3 **5-year mean densities of Great Crested Grebe (2007/08 – 2011/12) in the Liverpool City Region**

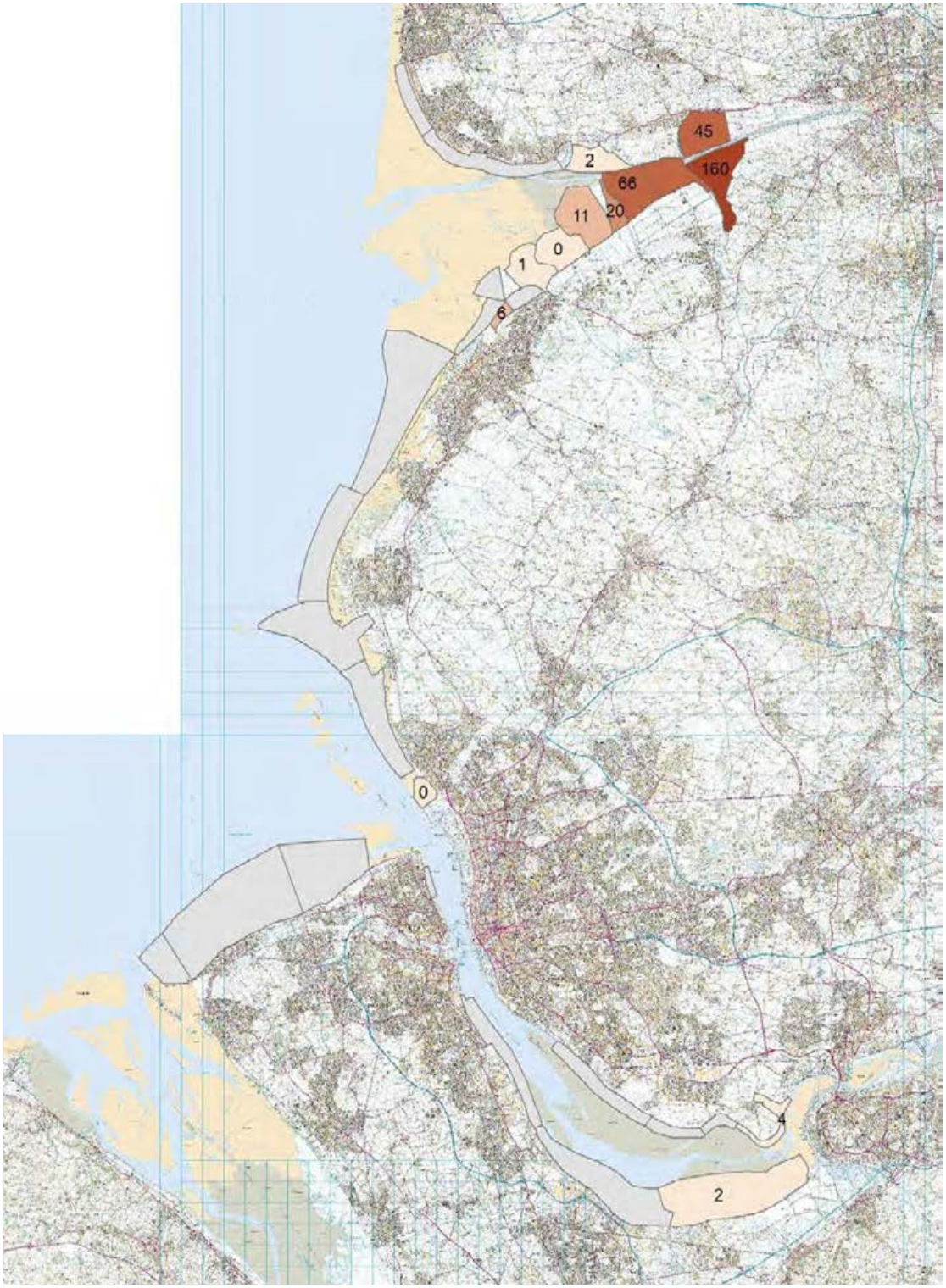

Figure A.5.4 **5-year mean densities of Bewick's Swan (1997/98 – 2001/02) in the Liverpool City Region**

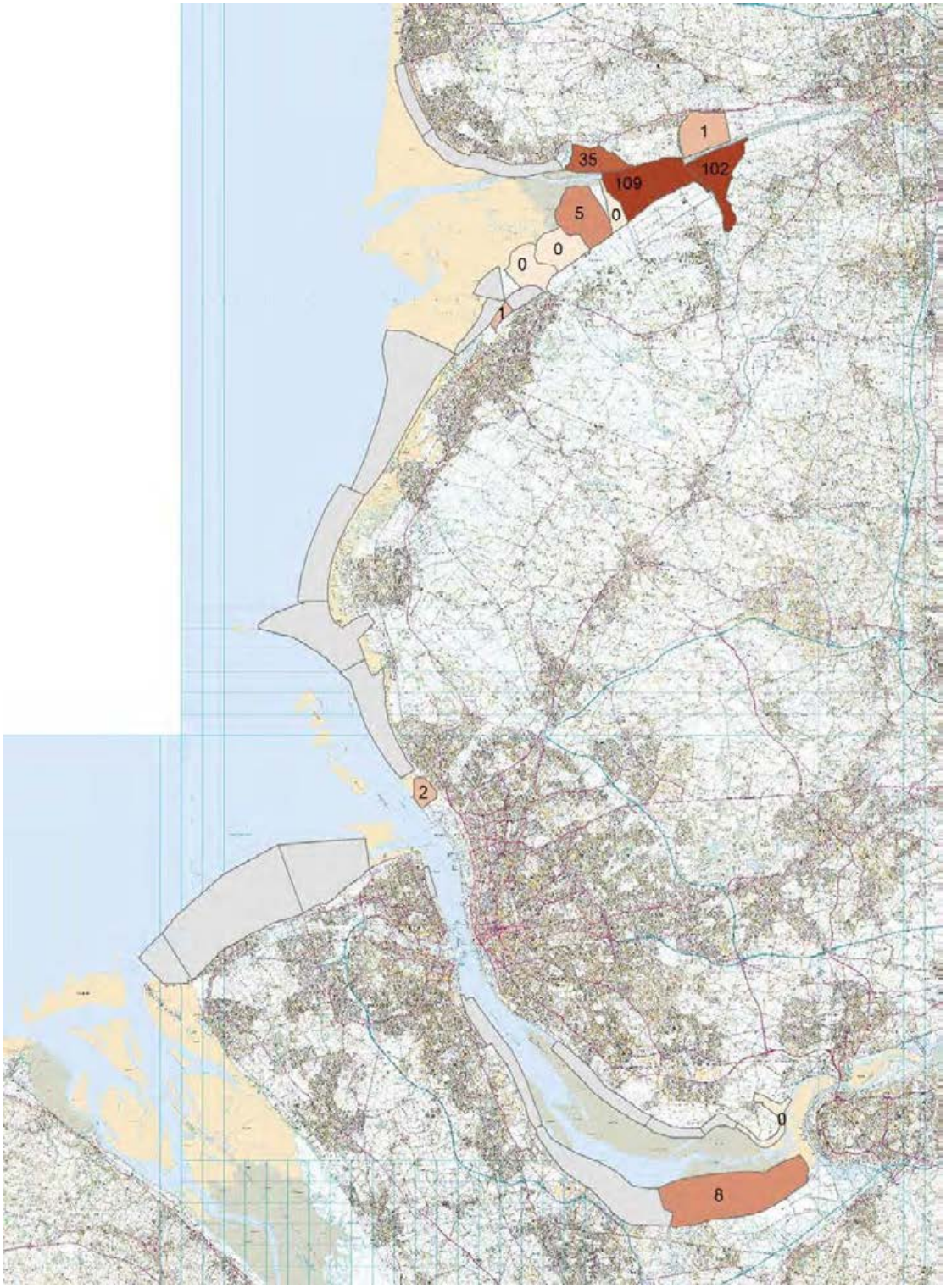

Figure A.5.5 **5-year mean densities of Bewick's Swan (2002/03 – 2006/07) in the Liverpool City Region**

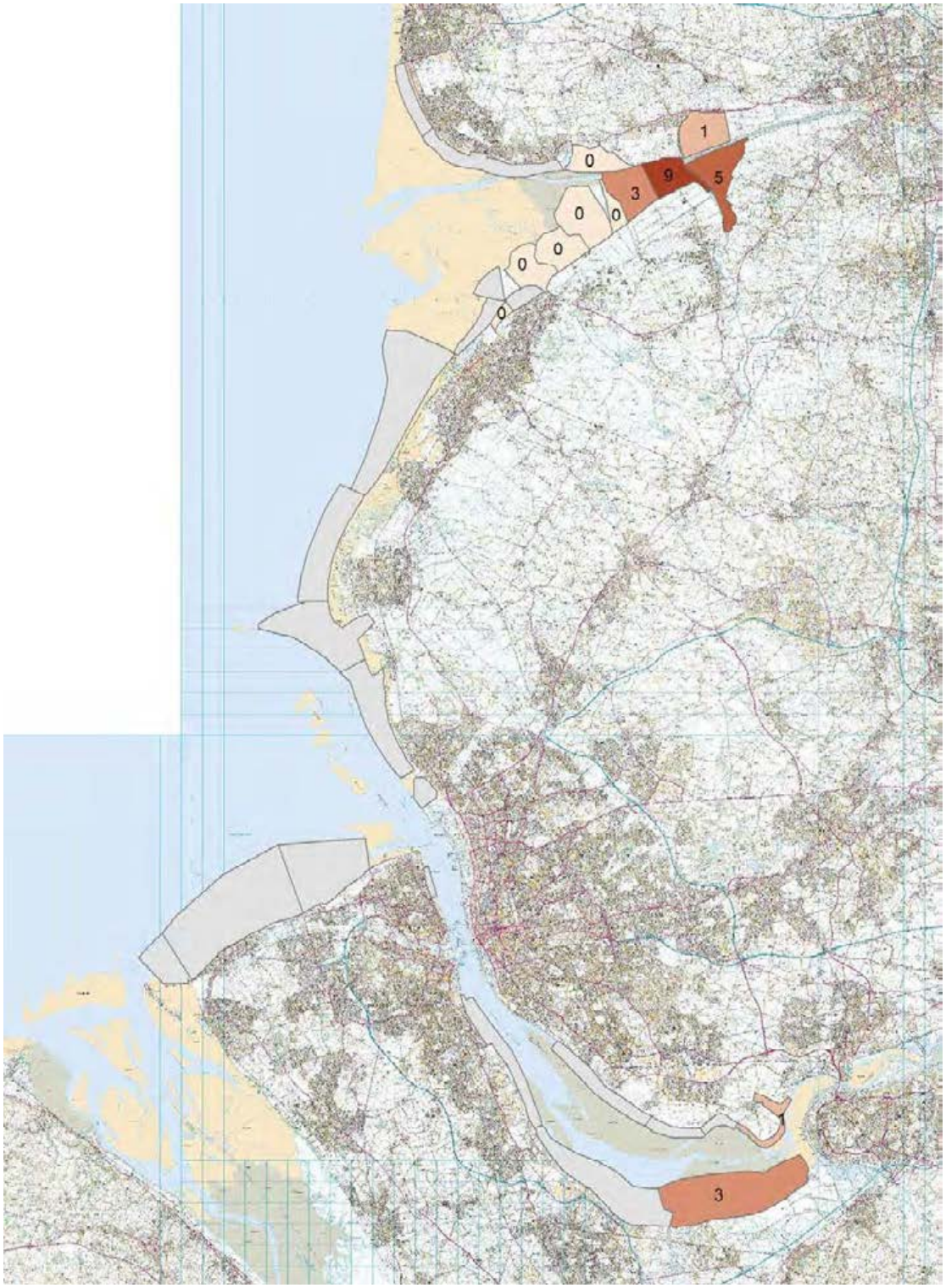

Figure A.5.6 **5-year mean densities of Bewick's Swan (2007/08 – 2011/12) in the Liverpool City Region**

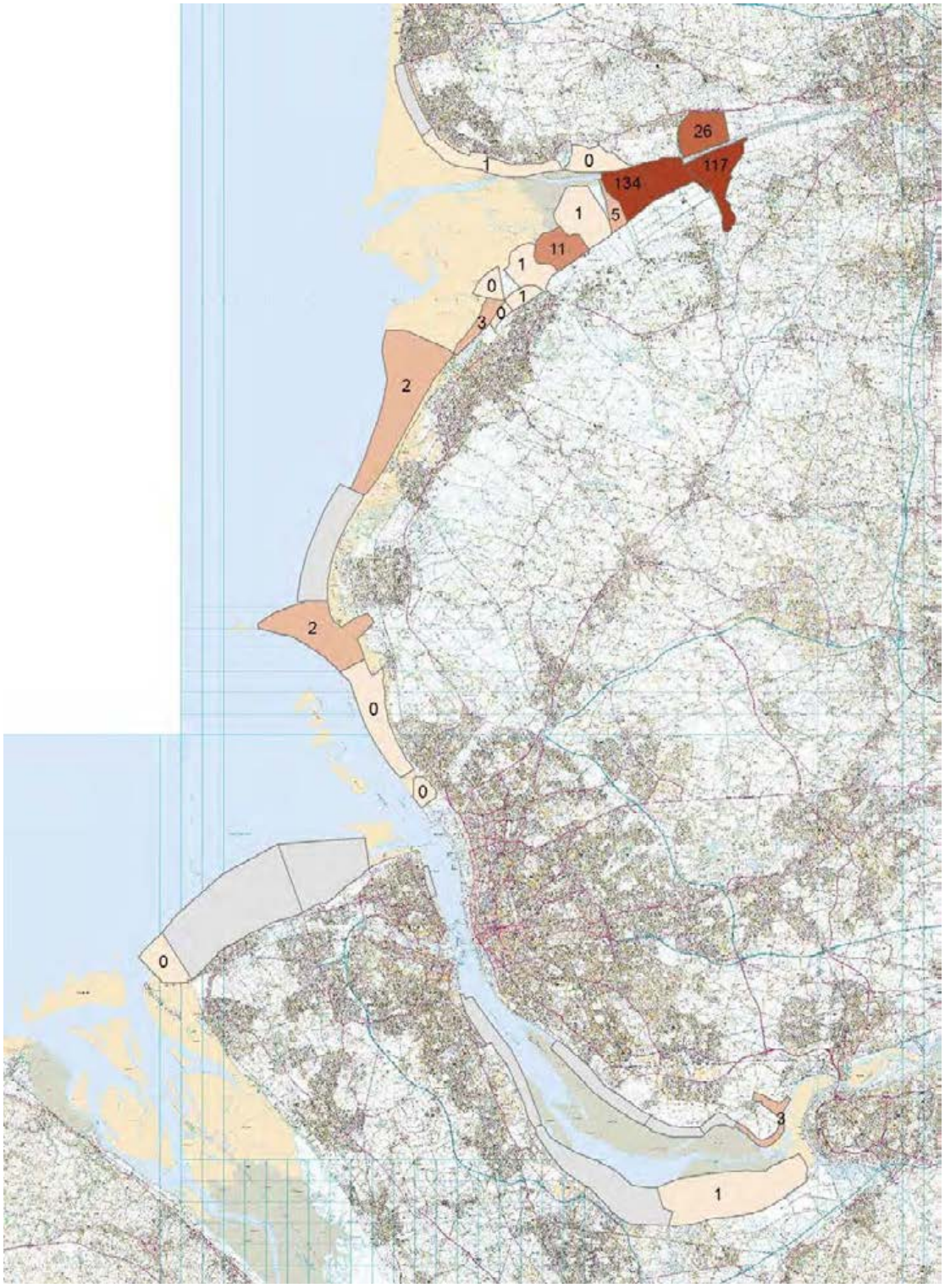

Figure A.5.7 **5-year mean densities of Whooper Swan (1997/98 – 2001/02) in the Liverpool City Region**

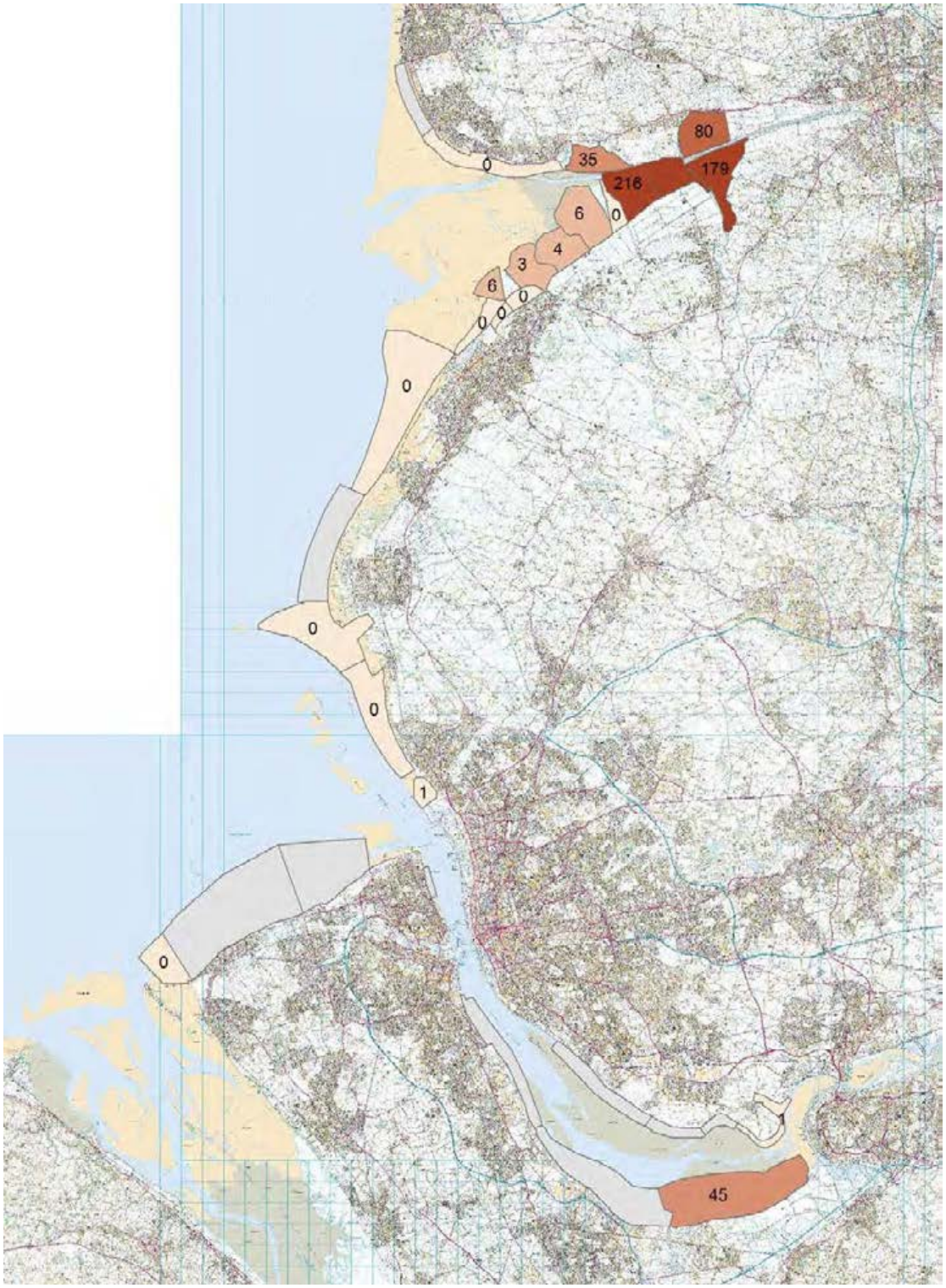

Figure A.5.8 **5-year mean densities of Whooper Swan (2002/03 – 2006/07) in the Liverpool City Region**

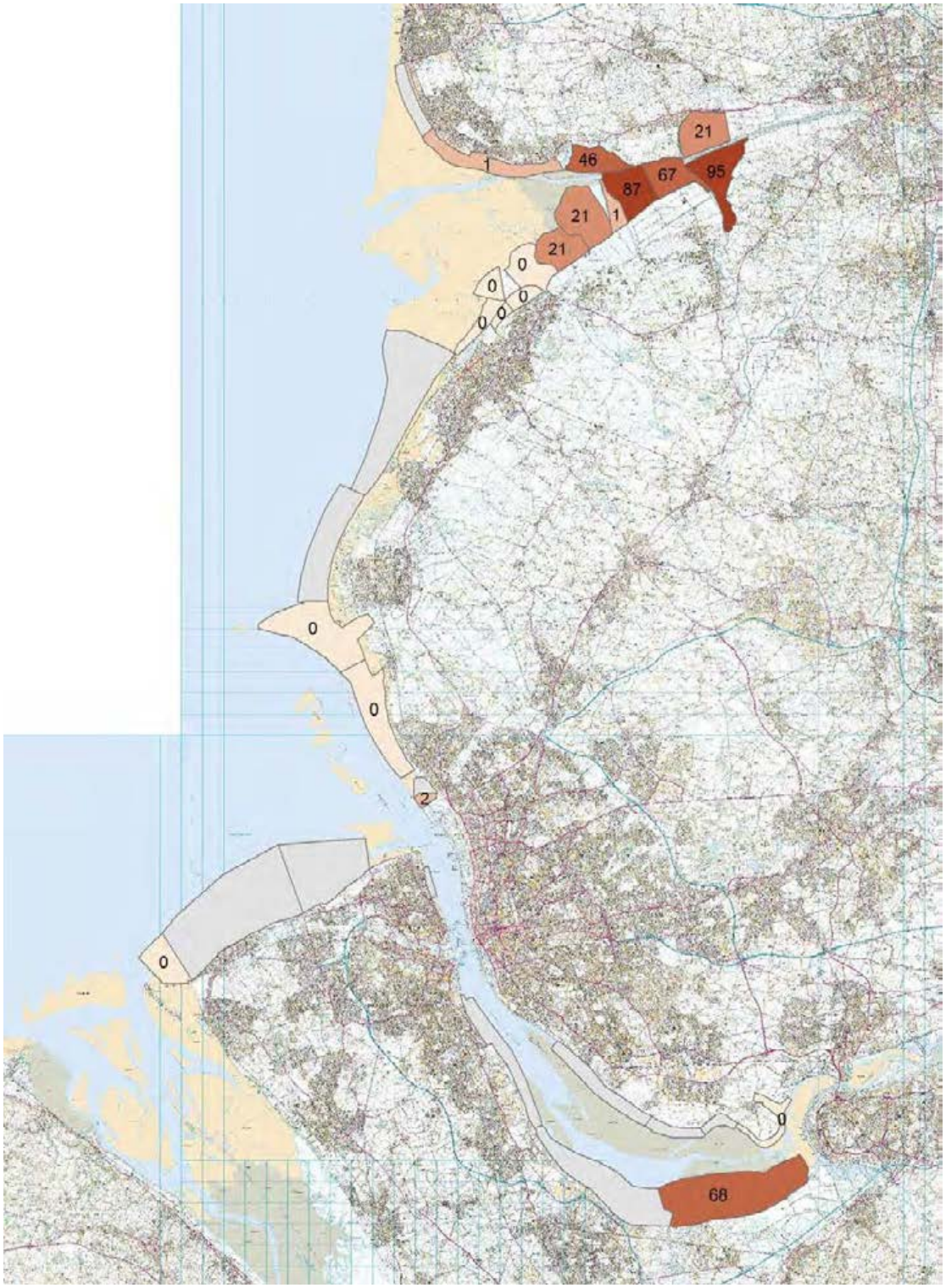

Figure A.5.9 **5-year mean densities of Whooper Swan (2007/08 – 2011/12) in the Liverpool City Region**

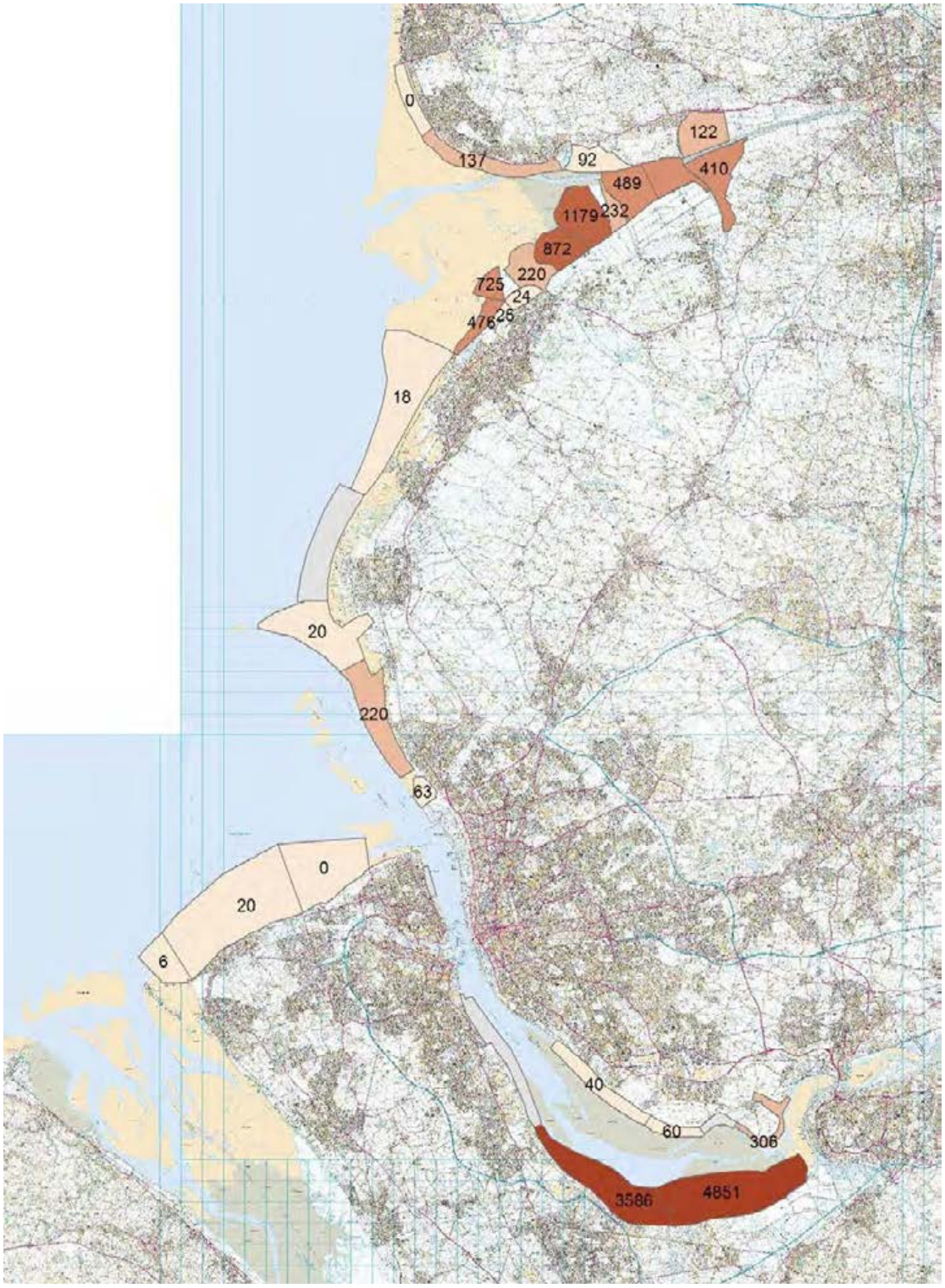

Figure A.5.10 5-year mean densities of Shelduck (1997/98 – 2001/02) in the Liverpool City Region

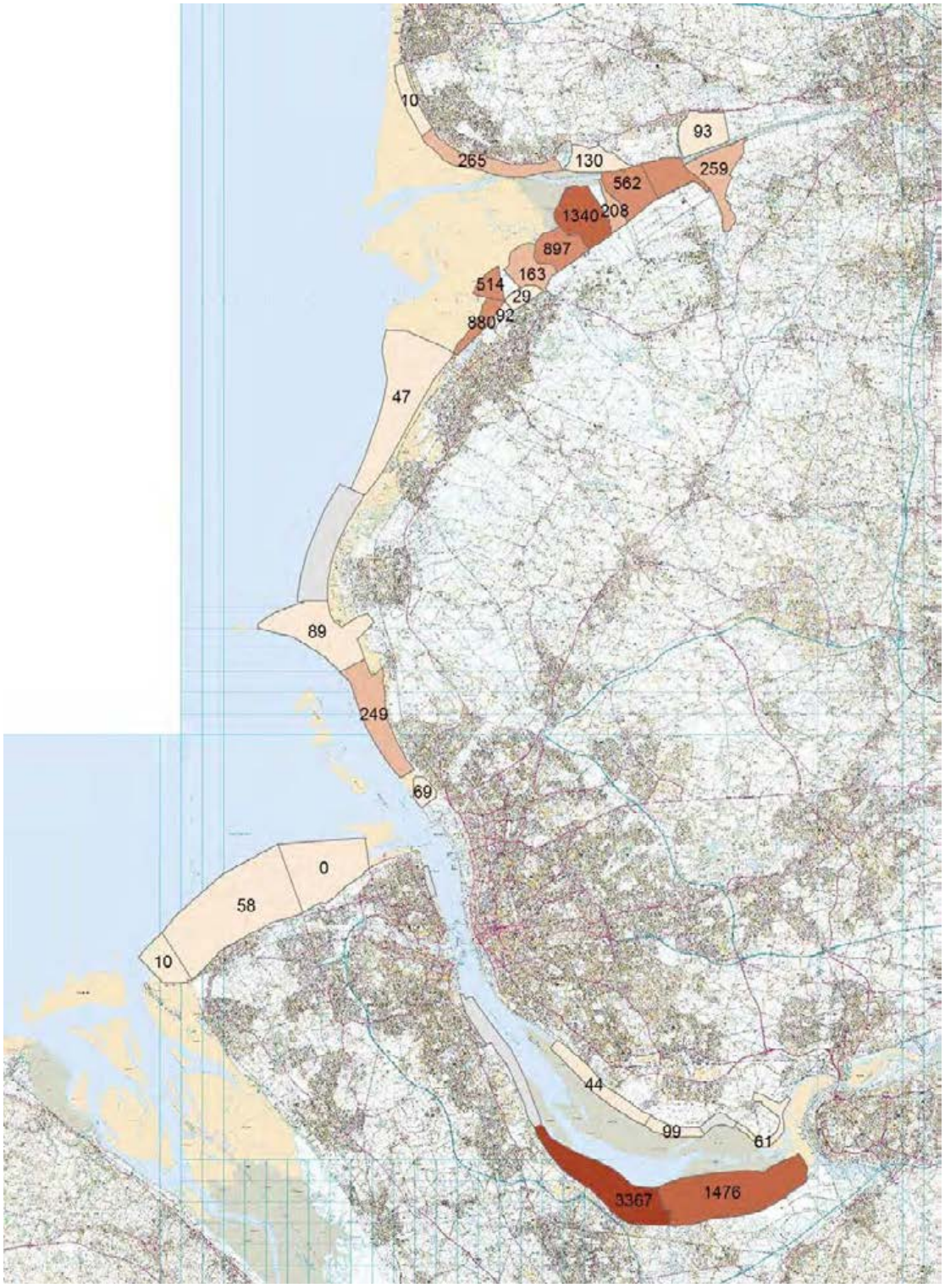

Figure A.5.11 5-year mean densities of Shelduck (2002/03 – 2006/07) in the Liverpool City Region

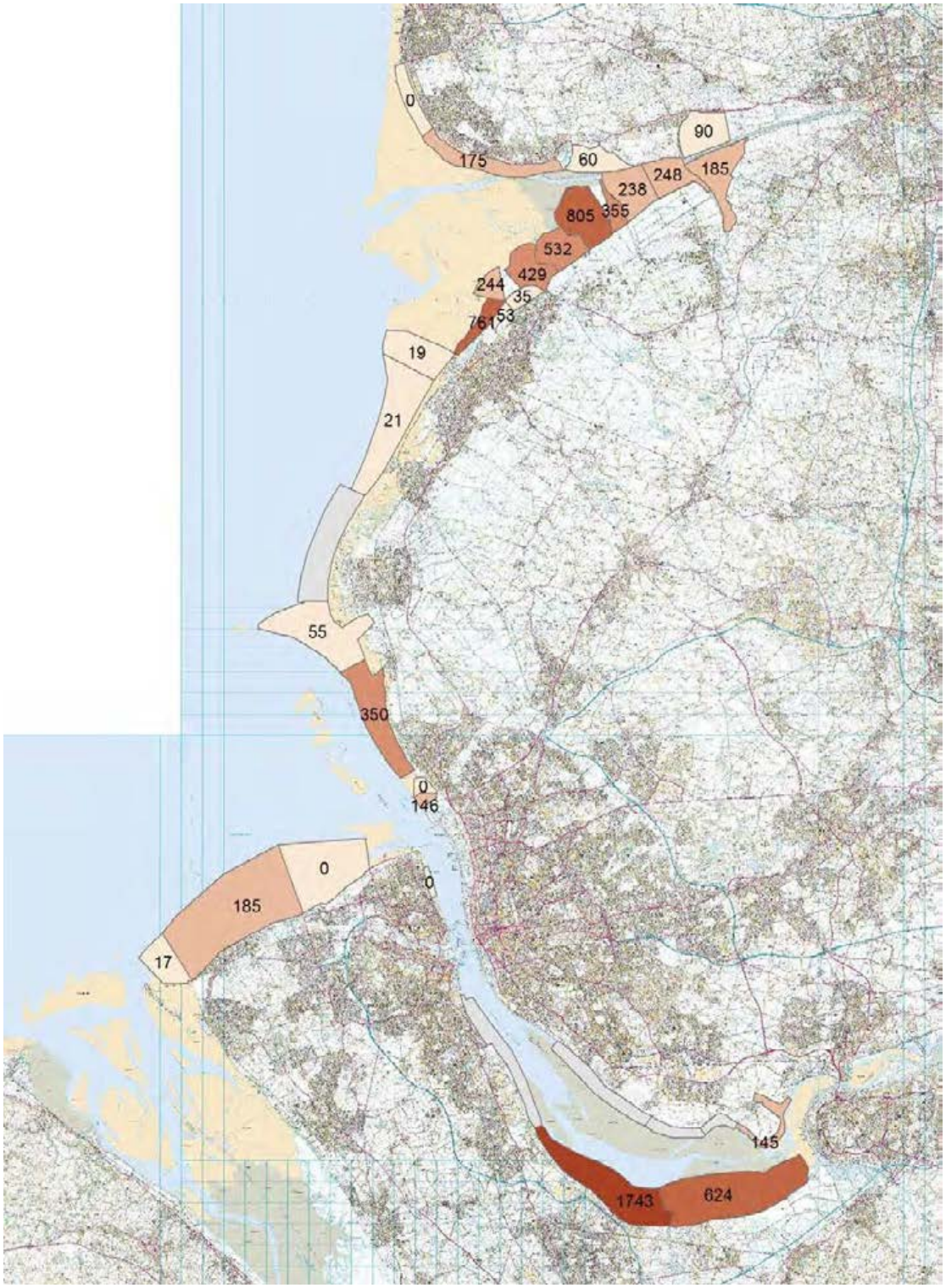

Figure A.5.12 5-year mean densities of Shelduck (2007/08 – 2011/12) in the Liverpool City Region

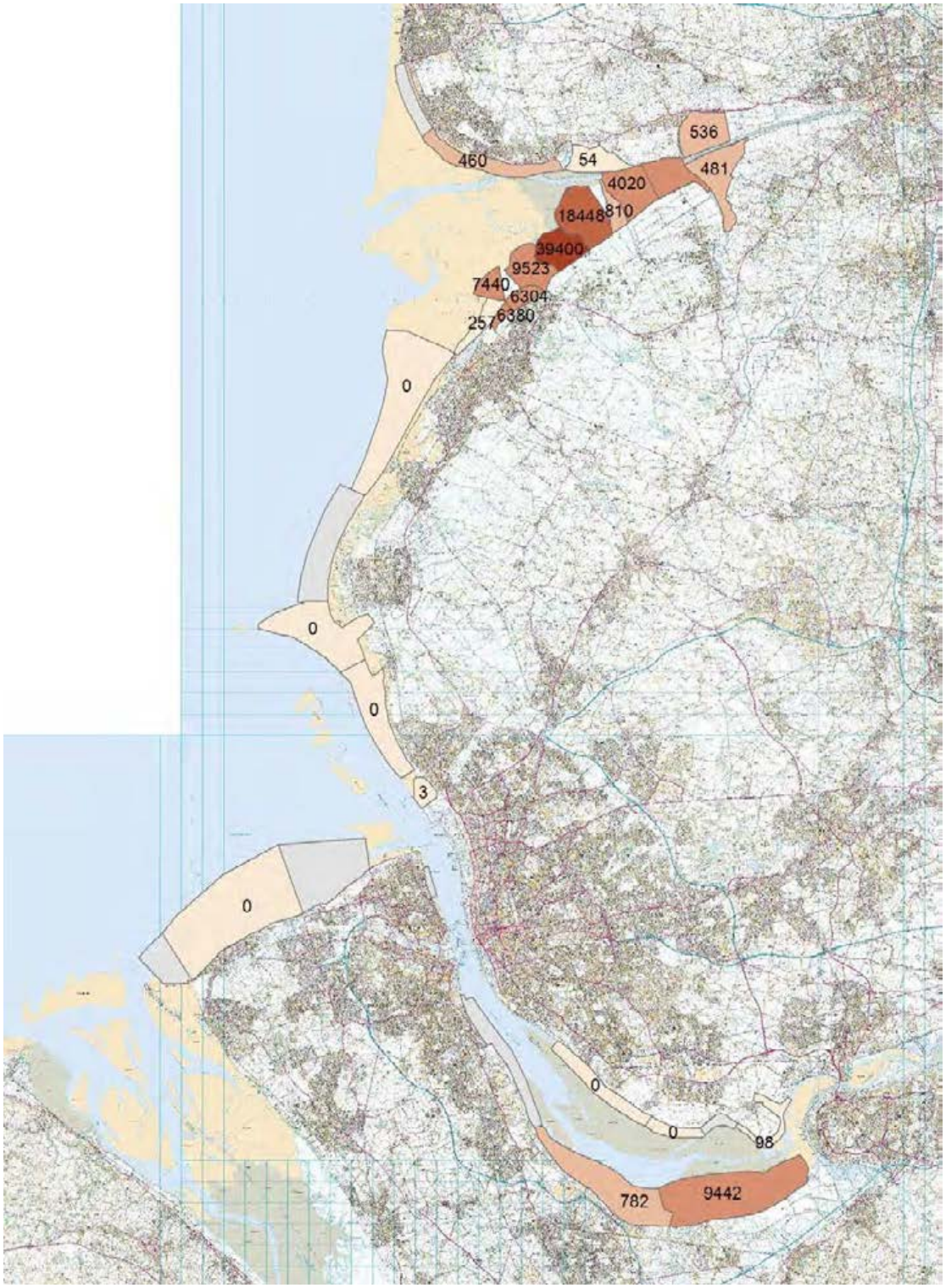

Figure A.5.13 5-year mean densities of Wigeon (1997/98 – 2001/02) in the Liverpool City Region

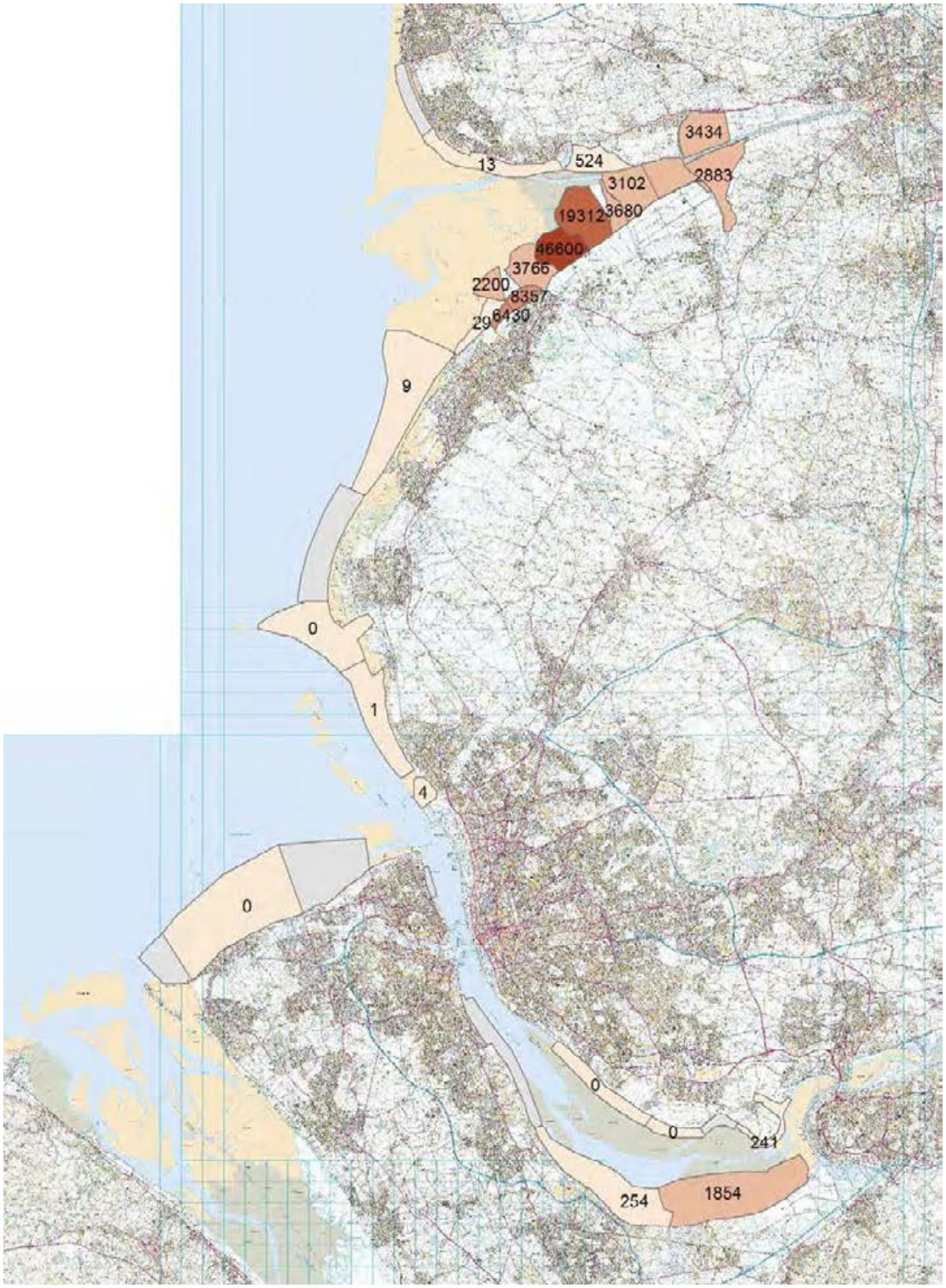

Figure A.5.14 5-year mean densities of Wigeon (2002/03 – 2006/07) in the Liverpool City Region

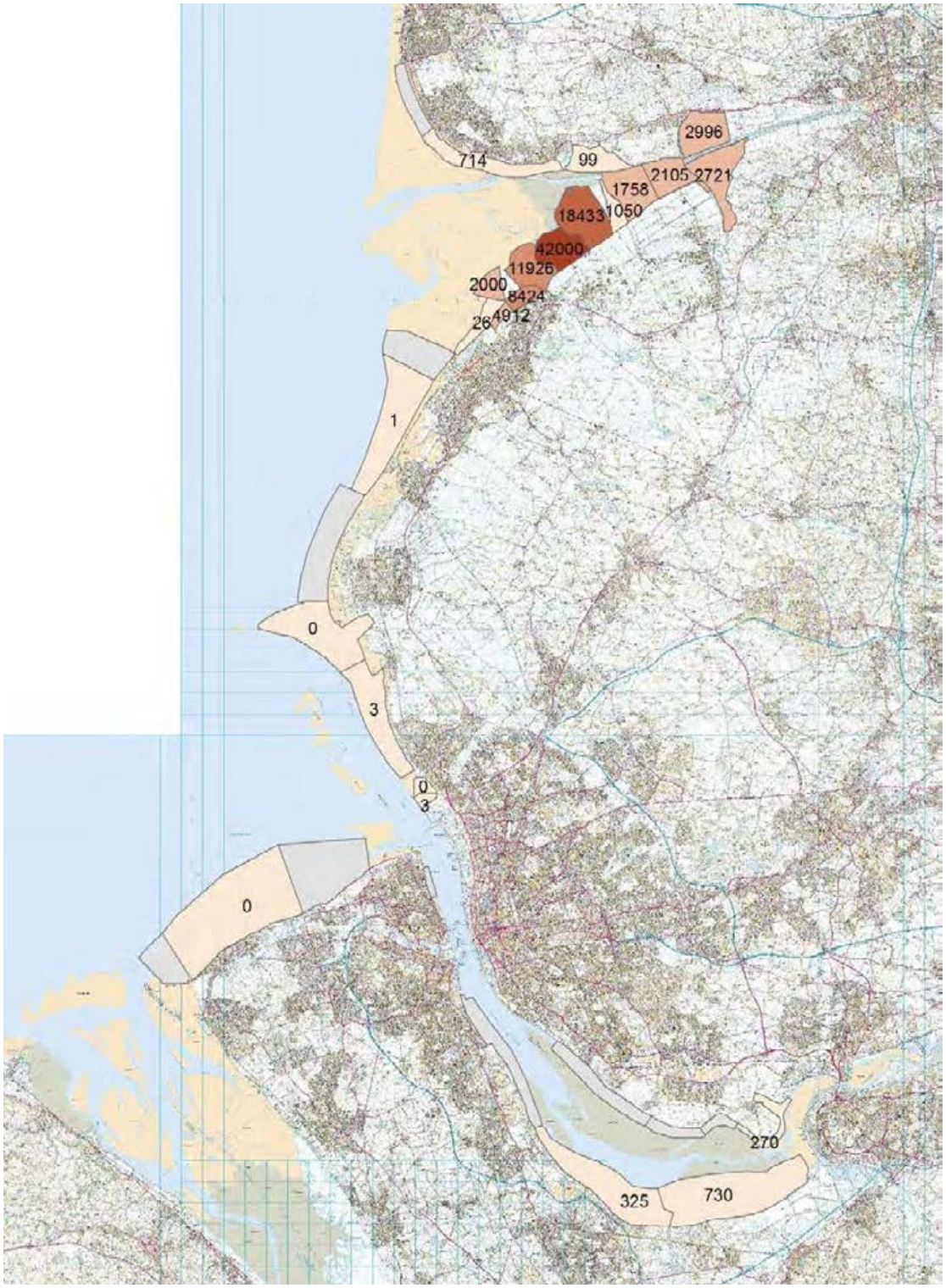

Figure A.5.15 5-year mean densities of Wigeon (2007/08 – 2011/12) in the Liverpool City Region

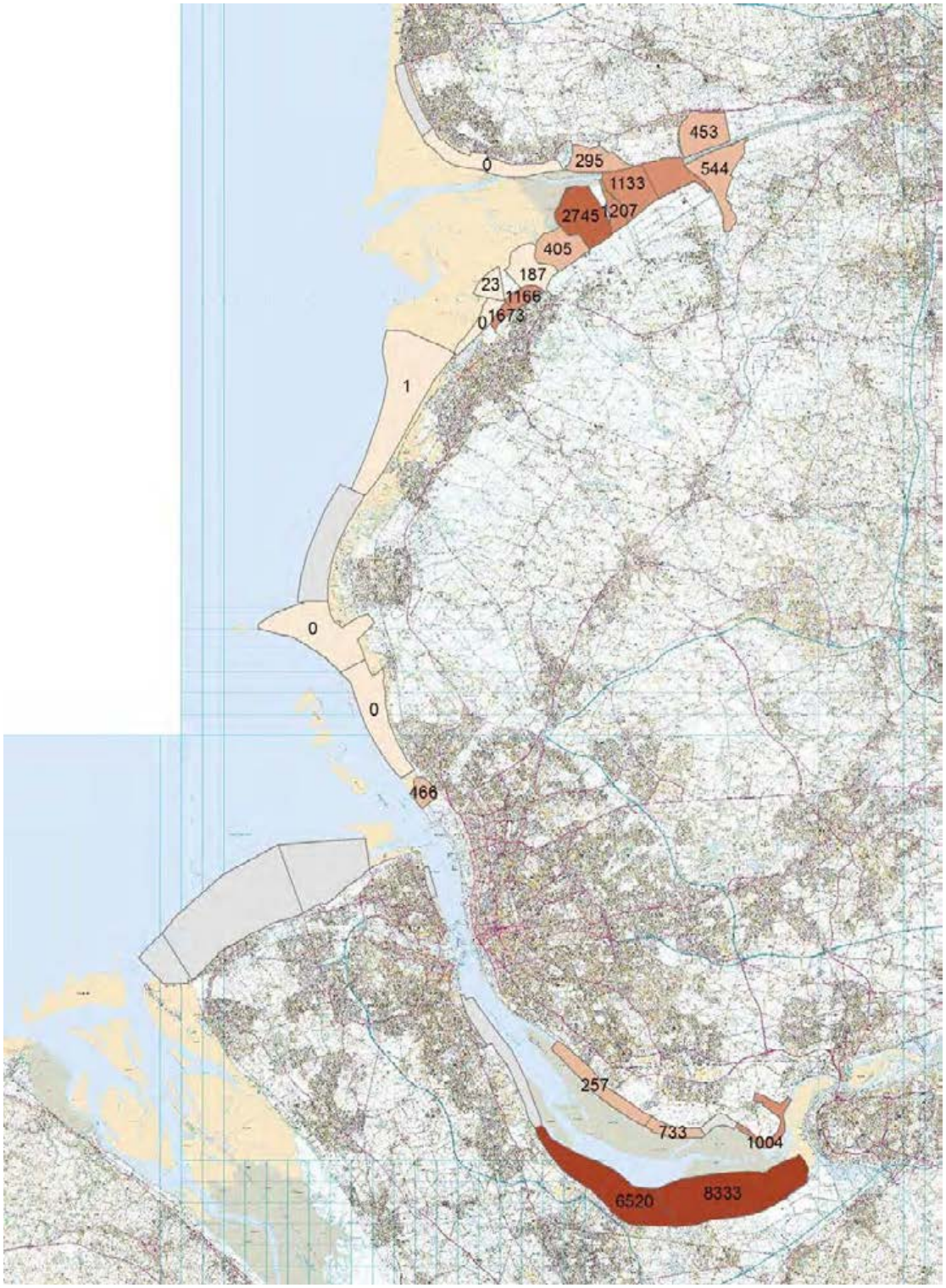

Figure A.5.16 5-year mean densities of Teal (1997/98 – 2001/02) in the Liverpool City Region

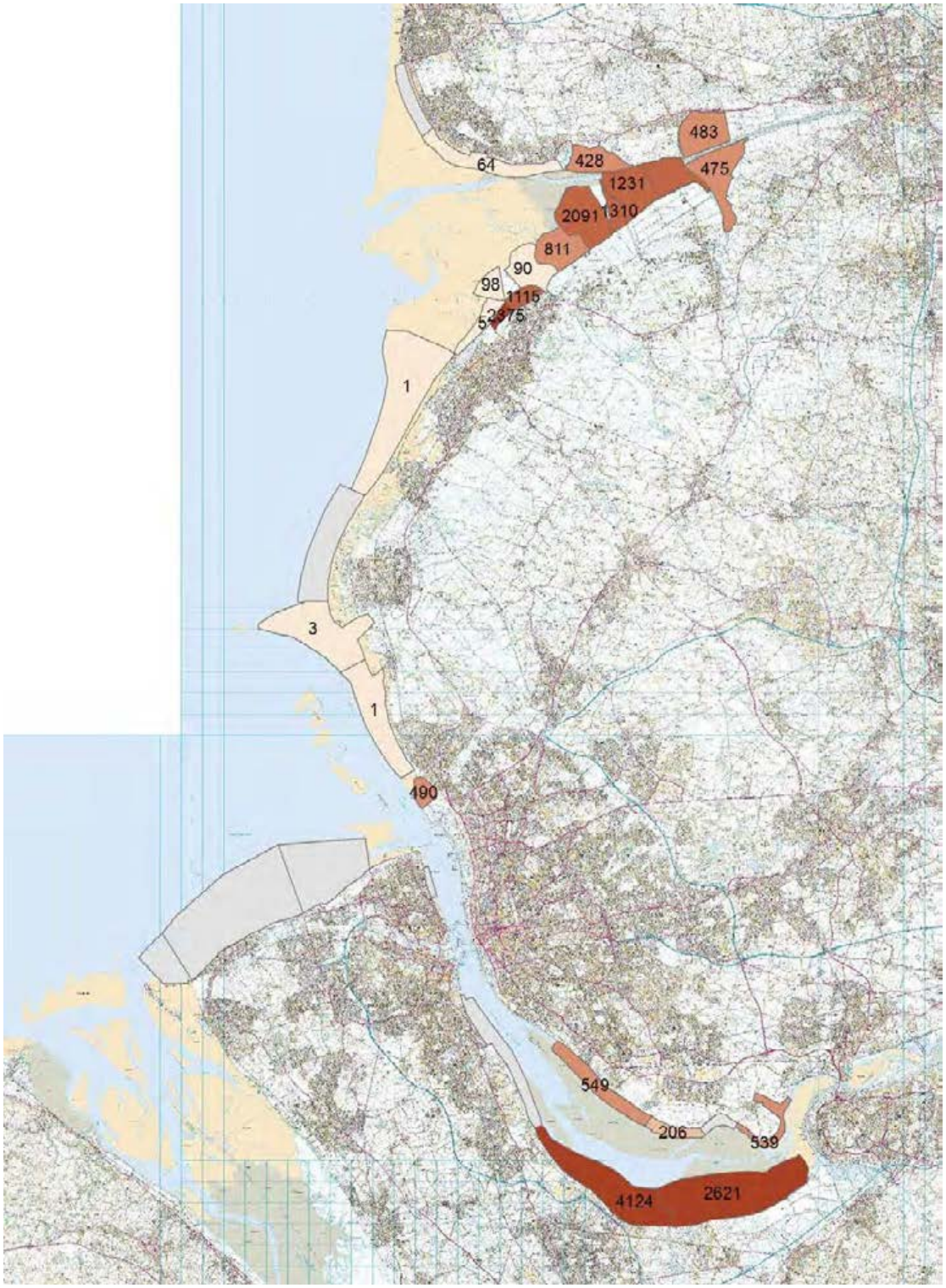

Figure A.5.17 5-year mean densities of Teal (2002/03 – 2006/07) in the Liverpool City Region

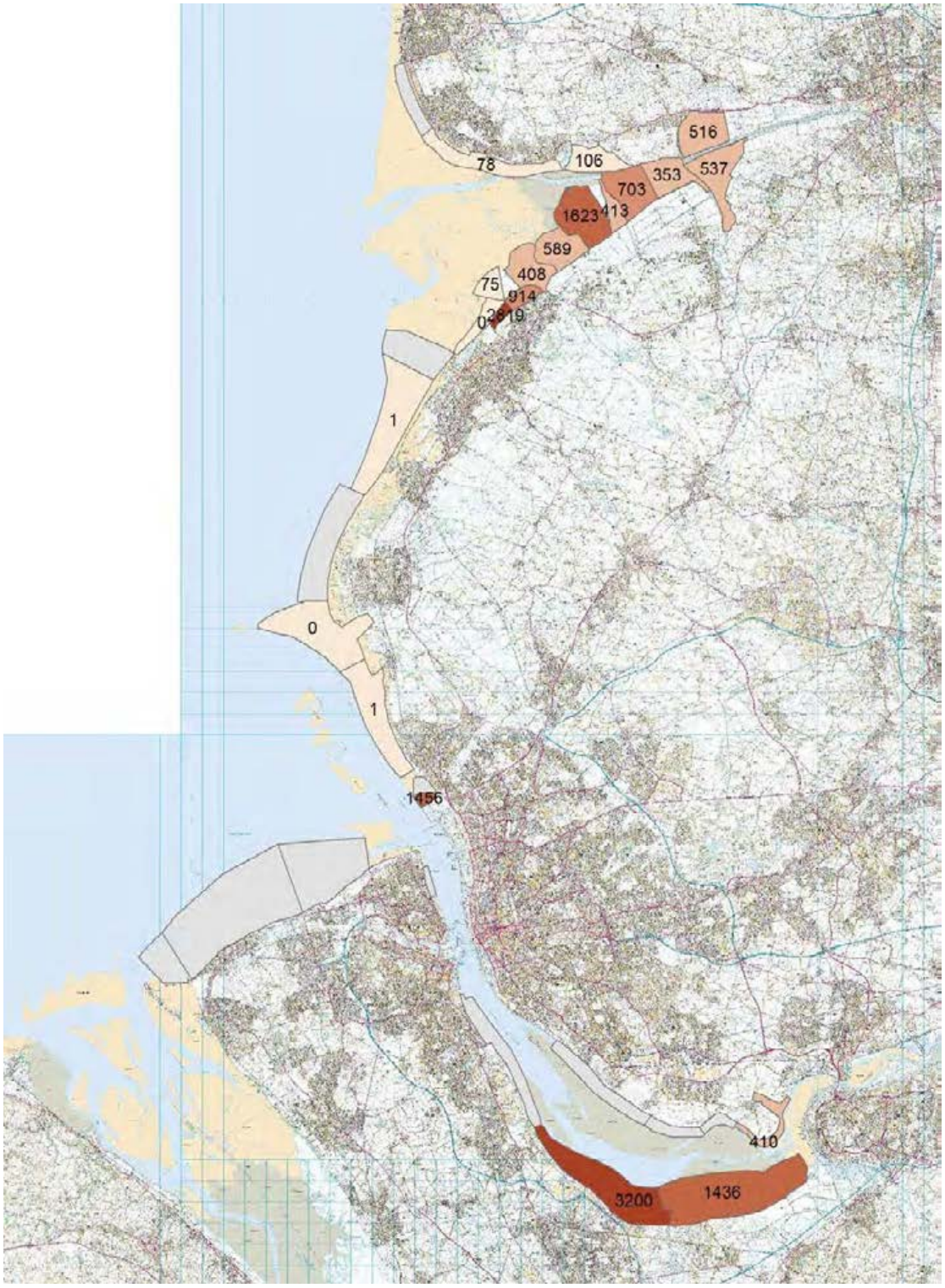

Figure A.5.18 5-year mean densities of Teal (2007/08 – 2011/12) in the Liverpool City Region

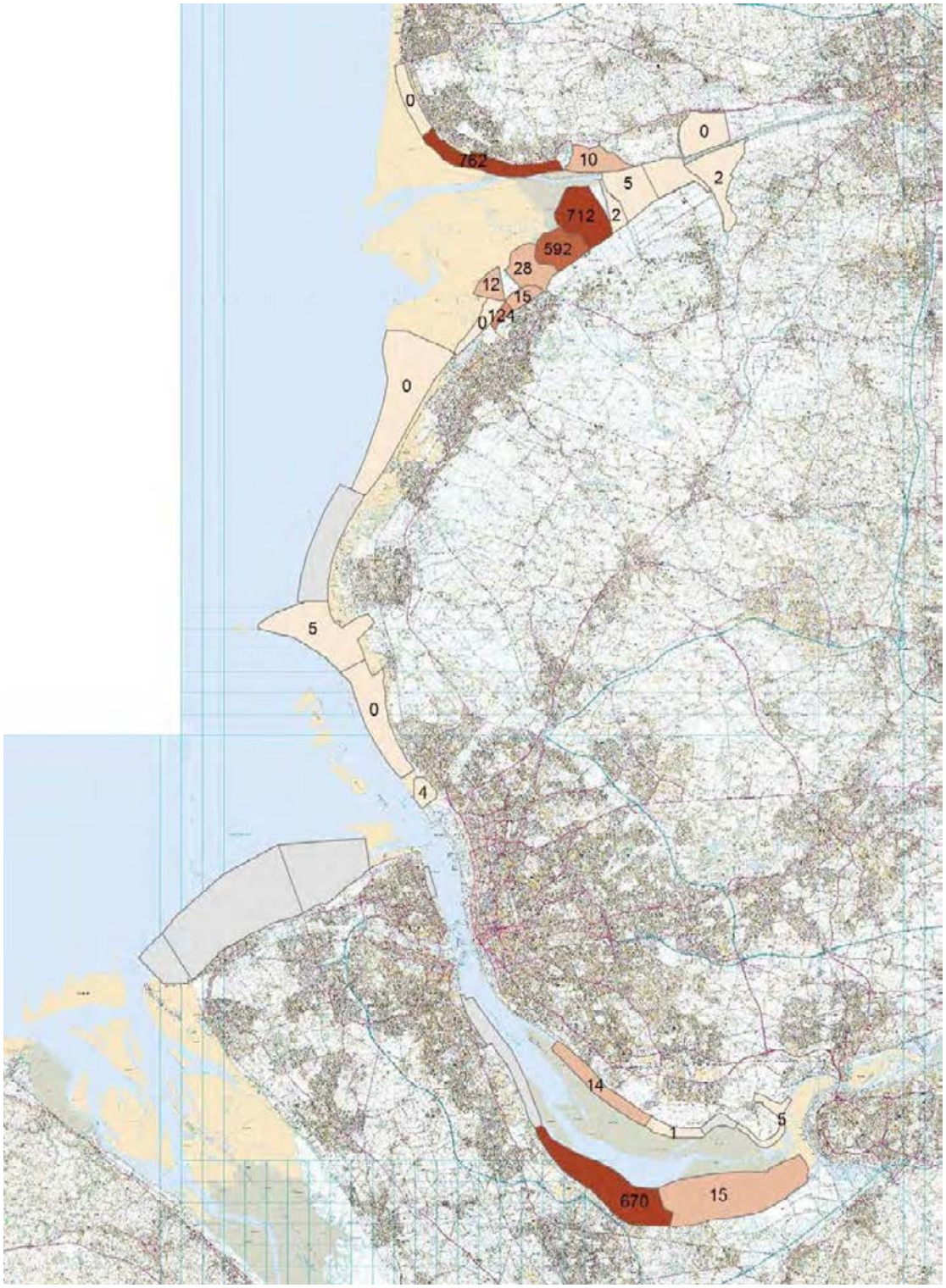

Figure A.5.19 5-year mean densities of Pintail (1997/98 – 2001/02) in the Liverpool City Region

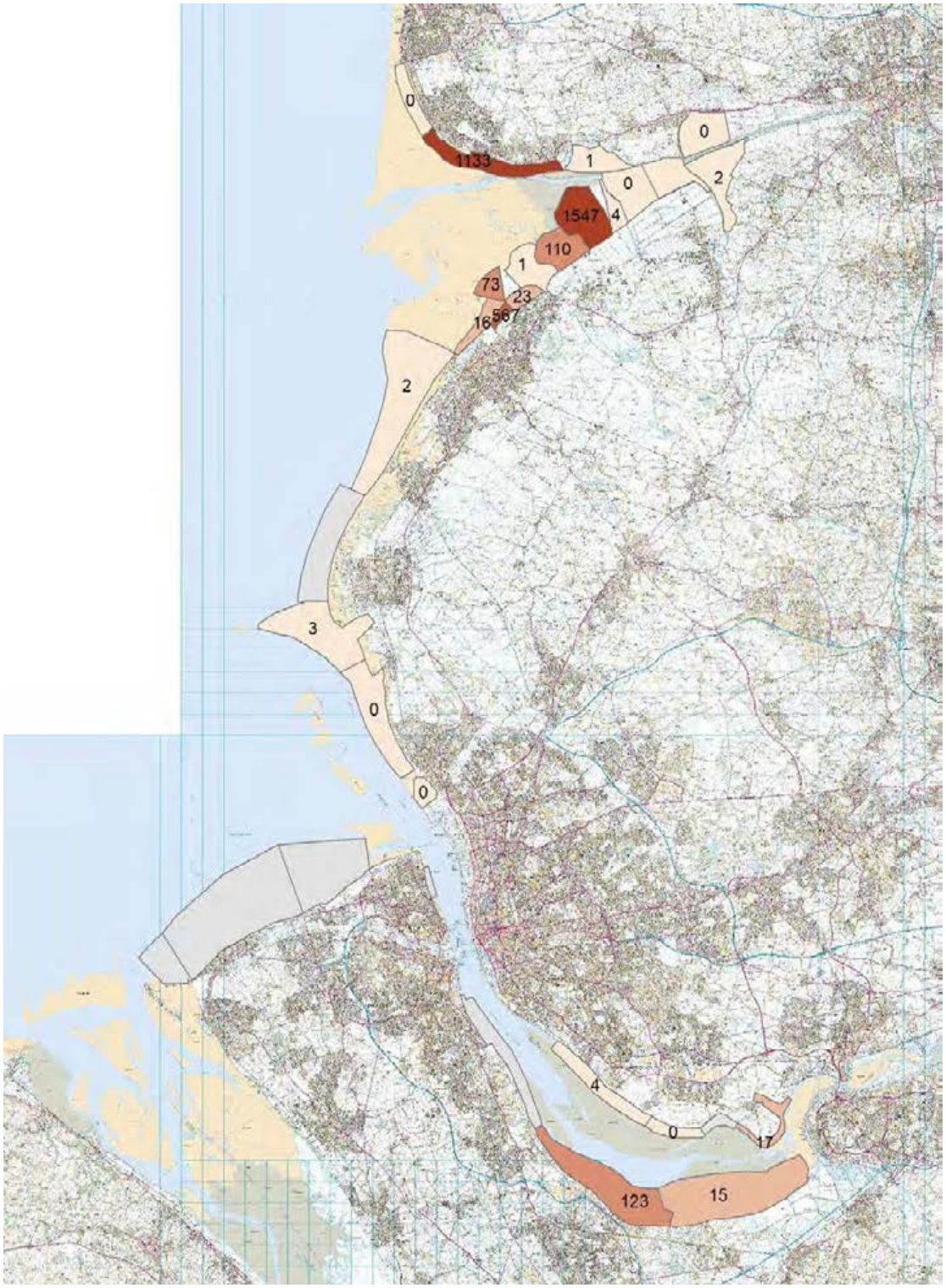

Figure A.5.20 5-year mean densities of Pintail (2002/03 – 2006/07) in the Liverpool City Region

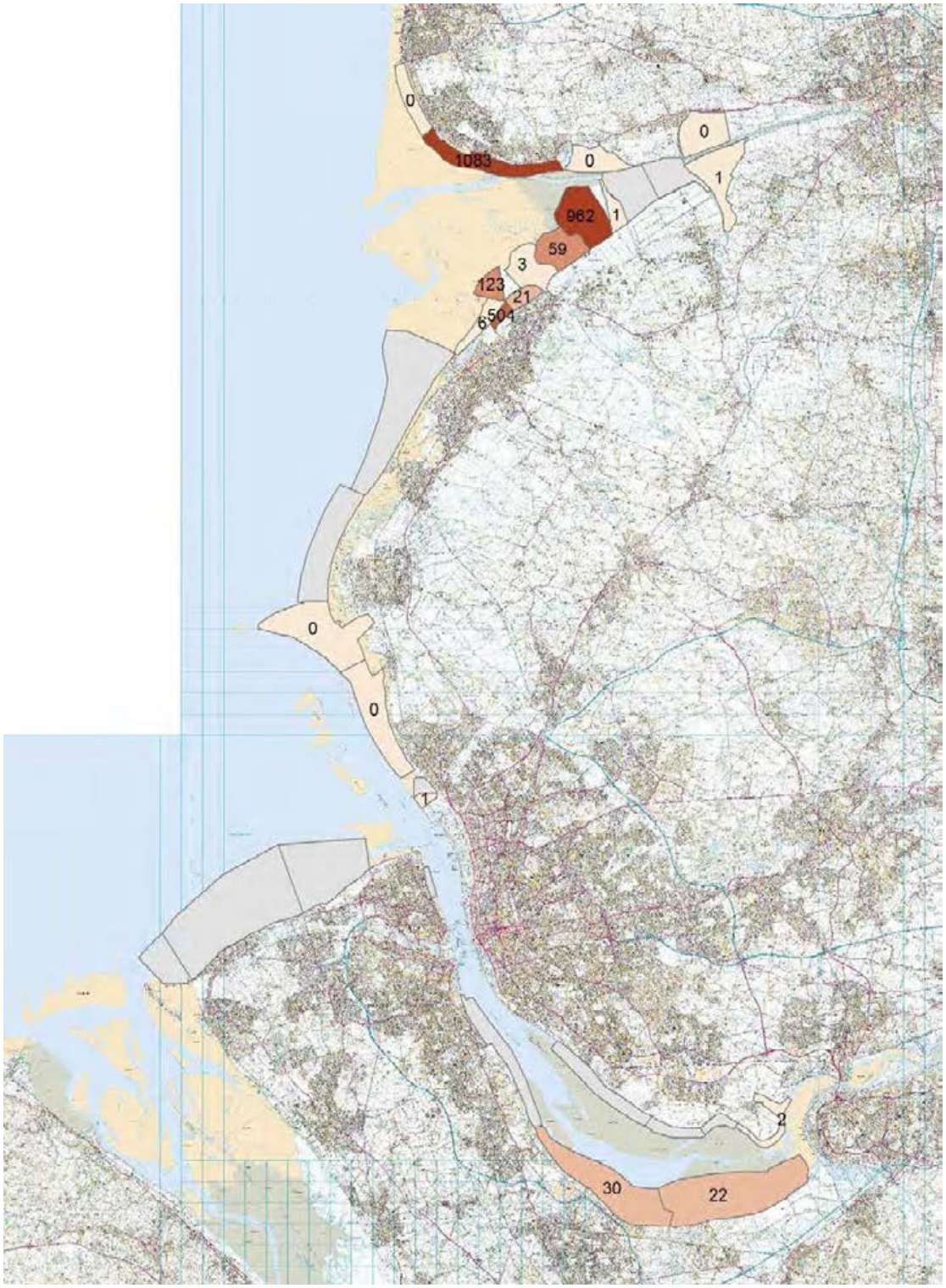

Figure A.5.21 5-year mean densities of Pintail (2007/08 – 2011/12) in the Liverpool City Region

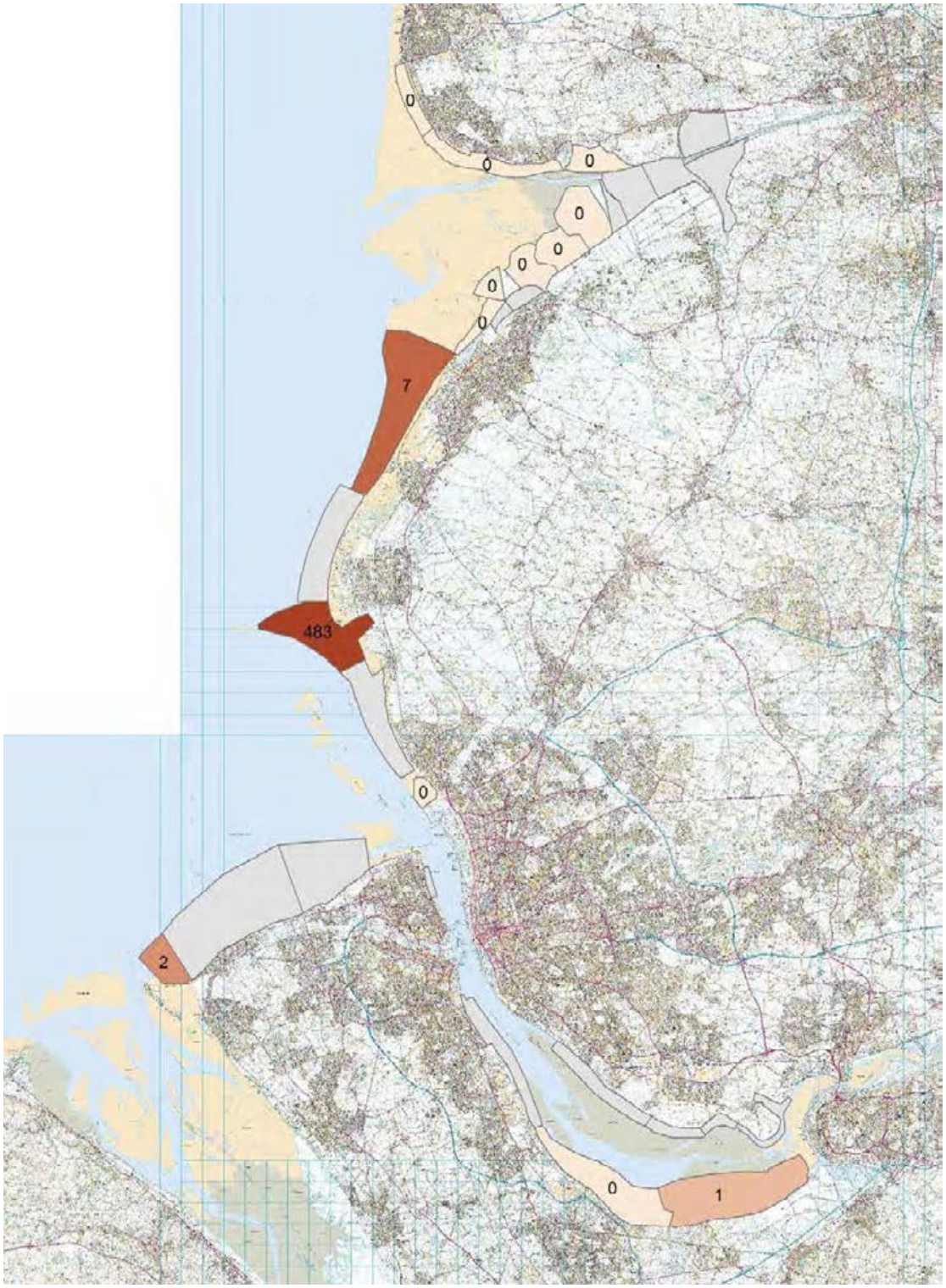

Figure A.5.22 5-year mean densities of Common Scoter (1997/98 – 2001/02) in the Liverpool City Region

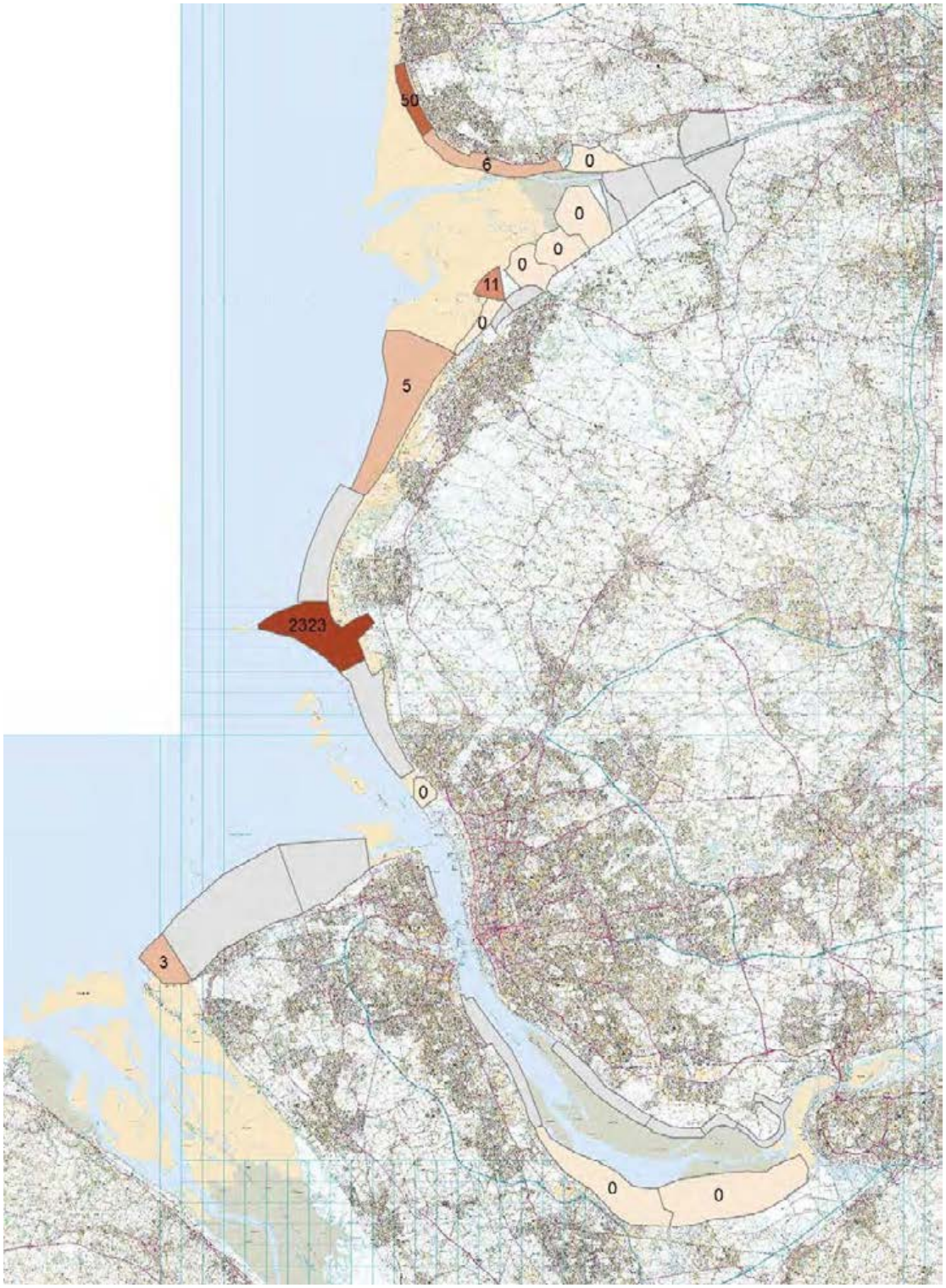

Figure A.5.23 5-year mean densities of Common Scoter (2002/03 – 2006/07) in the Liverpool City Region

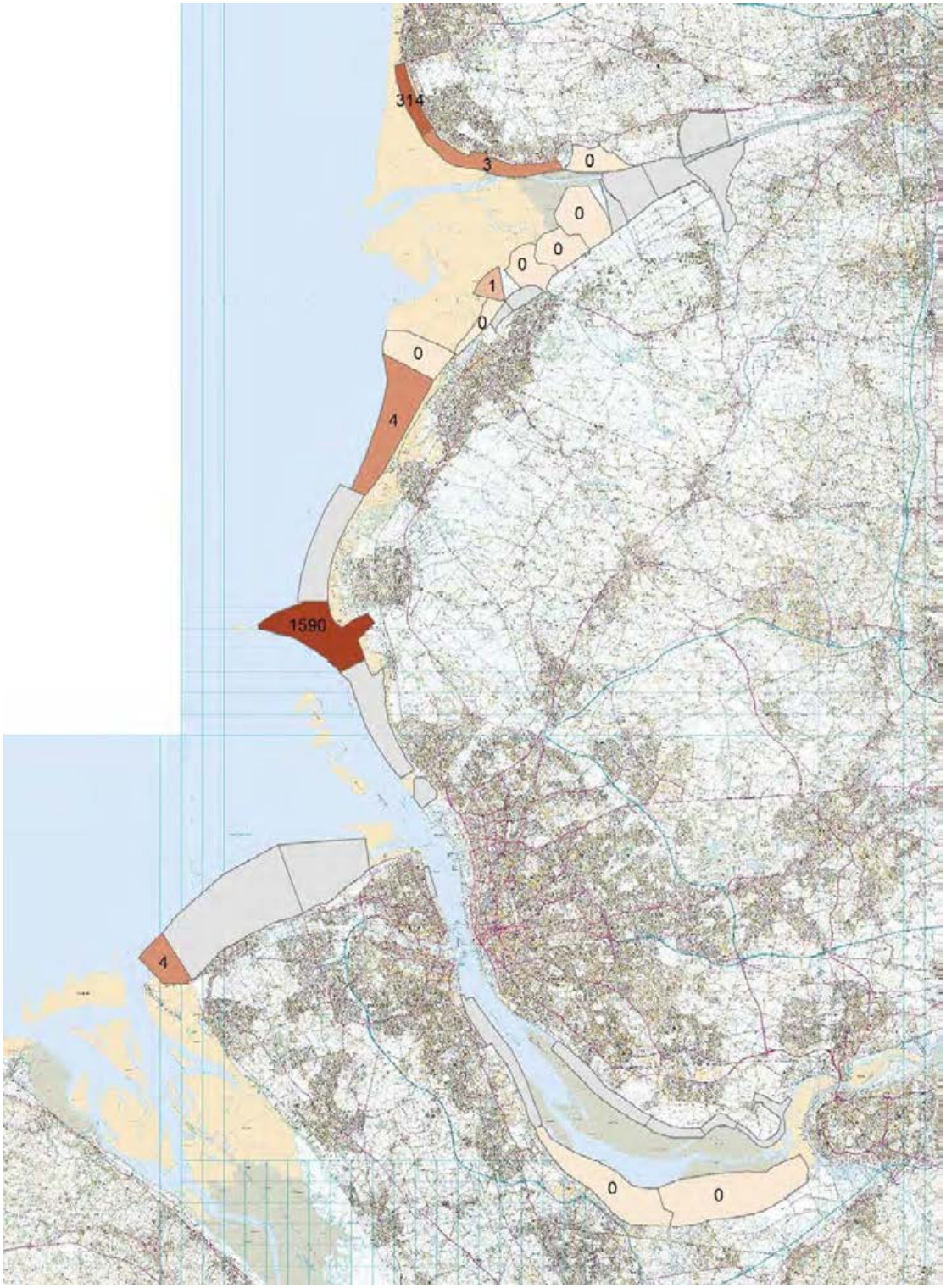

Figure A.5.24 5-year mean densities of Common Scoter (2007/08 – 2011/12) in the Liverpool City Region

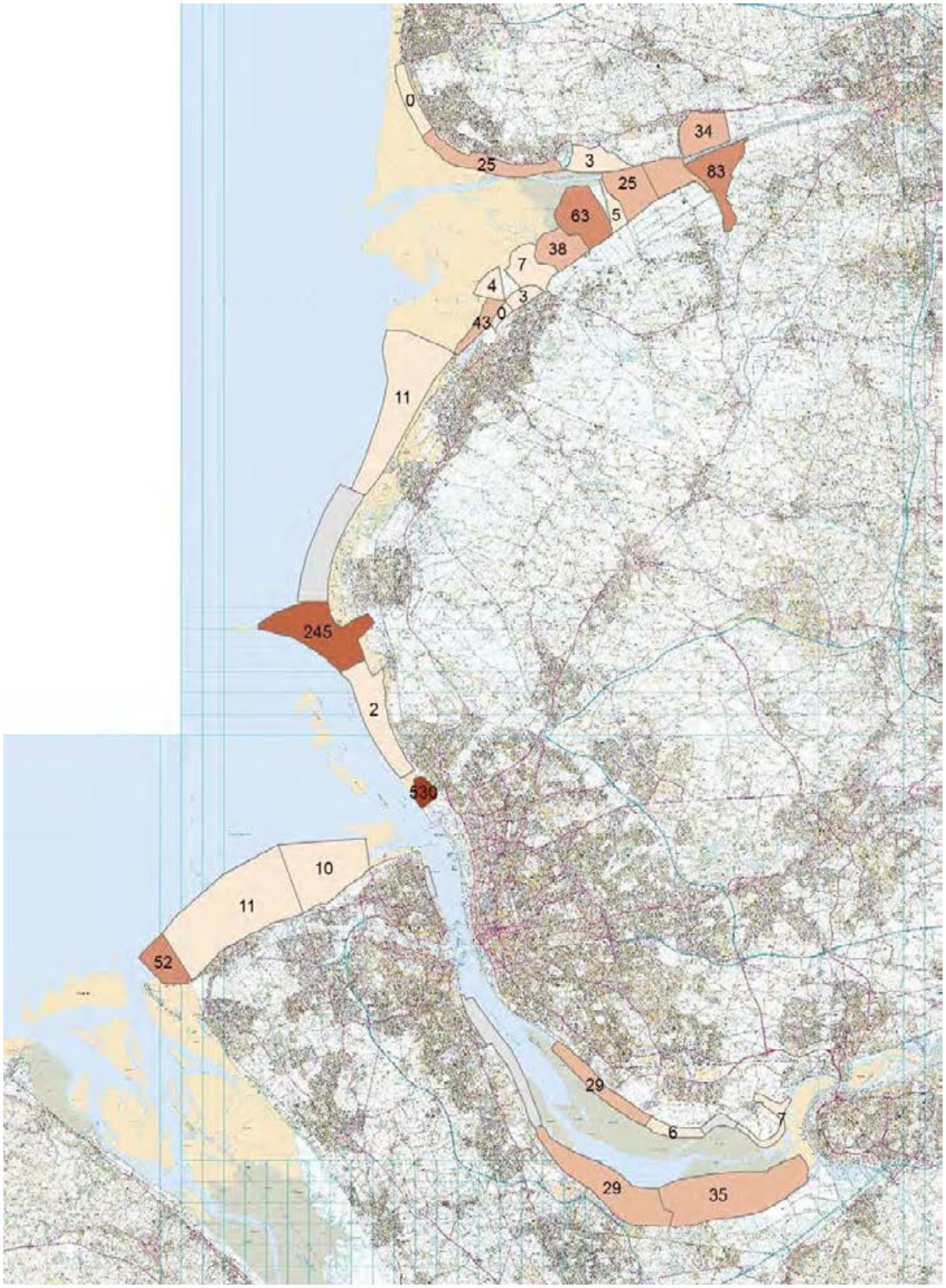

Figure A.5.25 5-year mean densities of Cormorant (1997/98 – 2001/02) in the Liverpool City Region

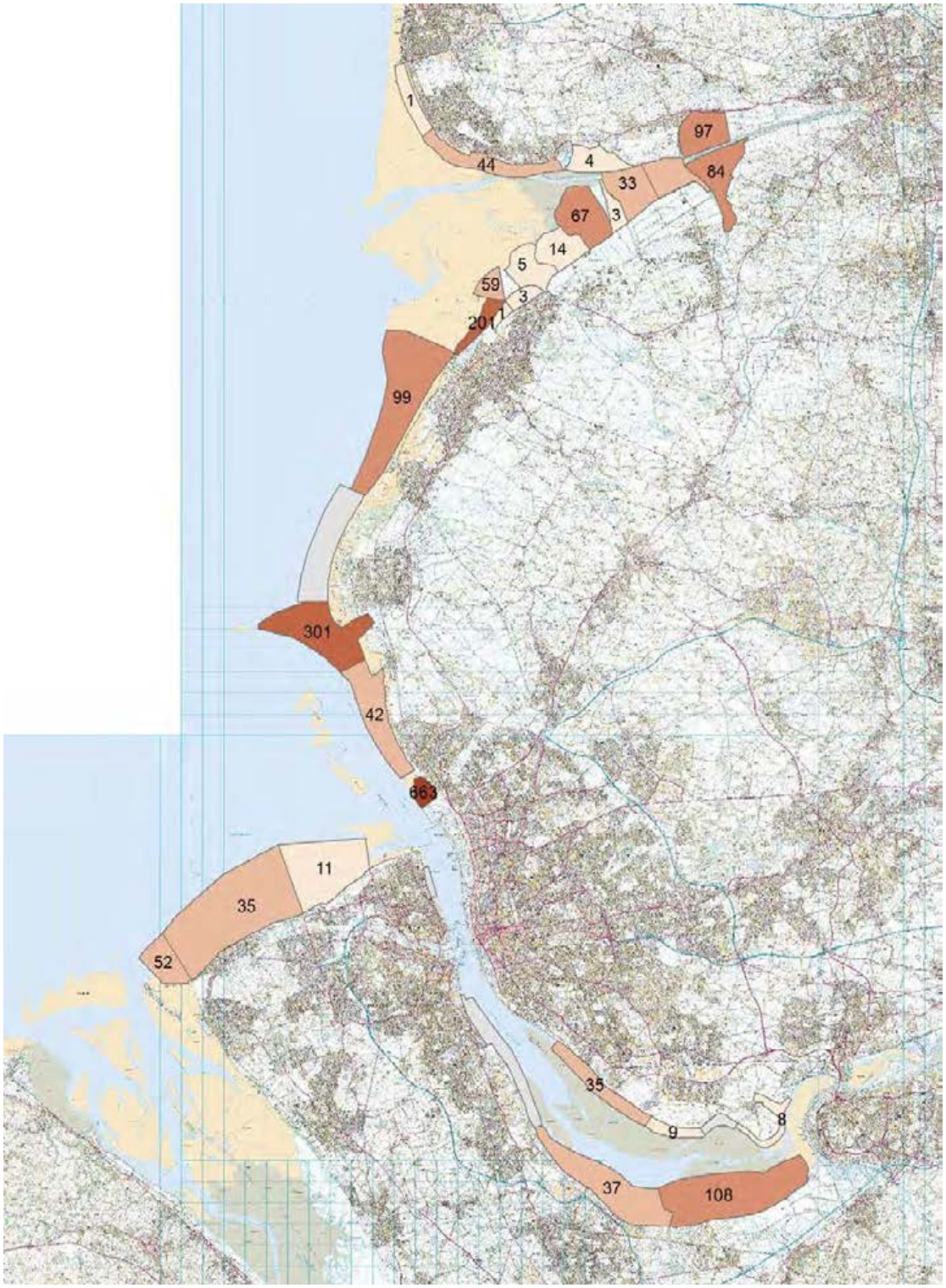

Figure A.5.26 5-year mean densities of Cormorant (2002/03 – 2006/07) in the Liverpool City Region

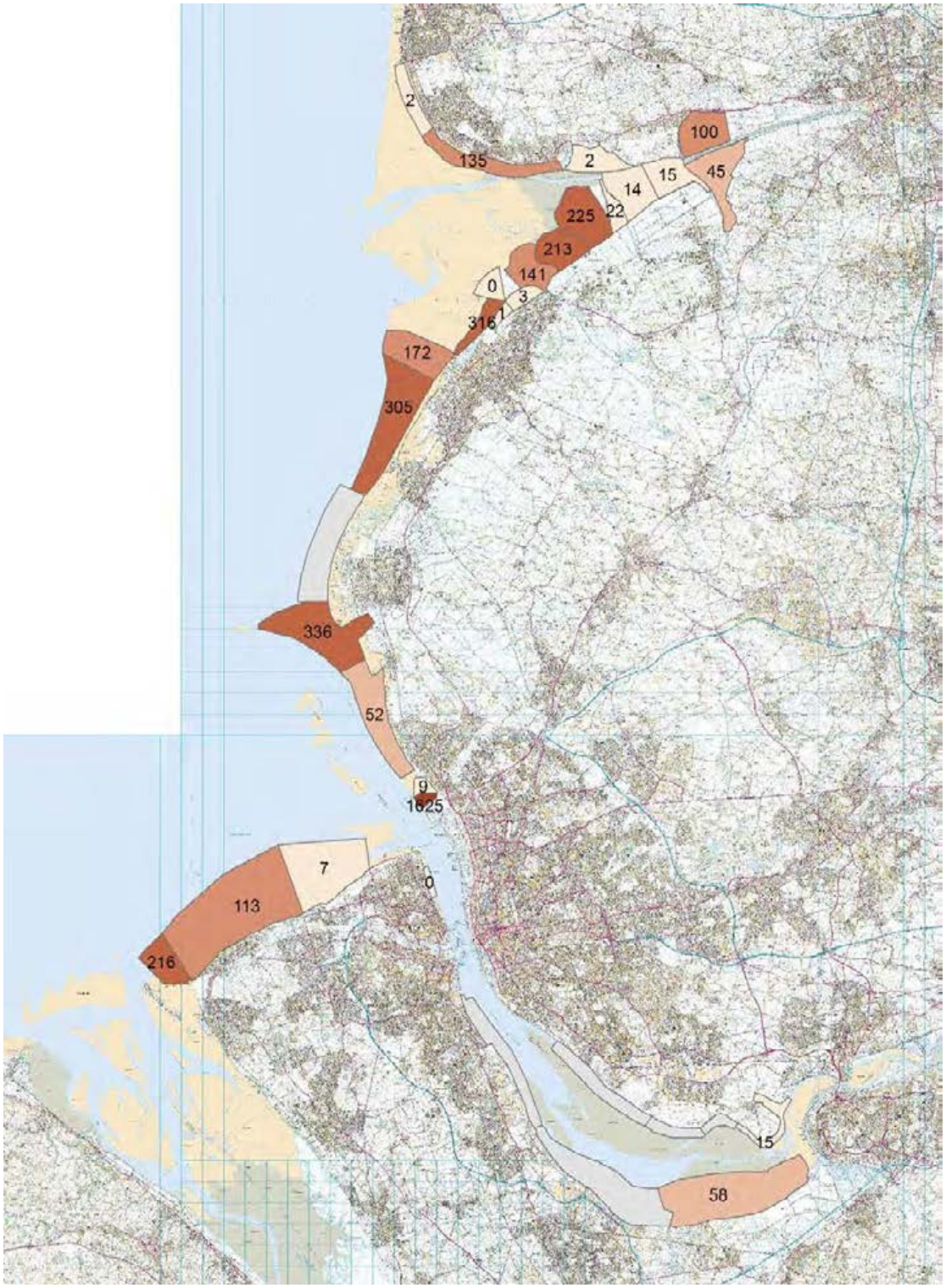

Figure A.5.27 5-year mean densities of Cormorant (2007/08 – 2011/12) in the Liverpool City Region

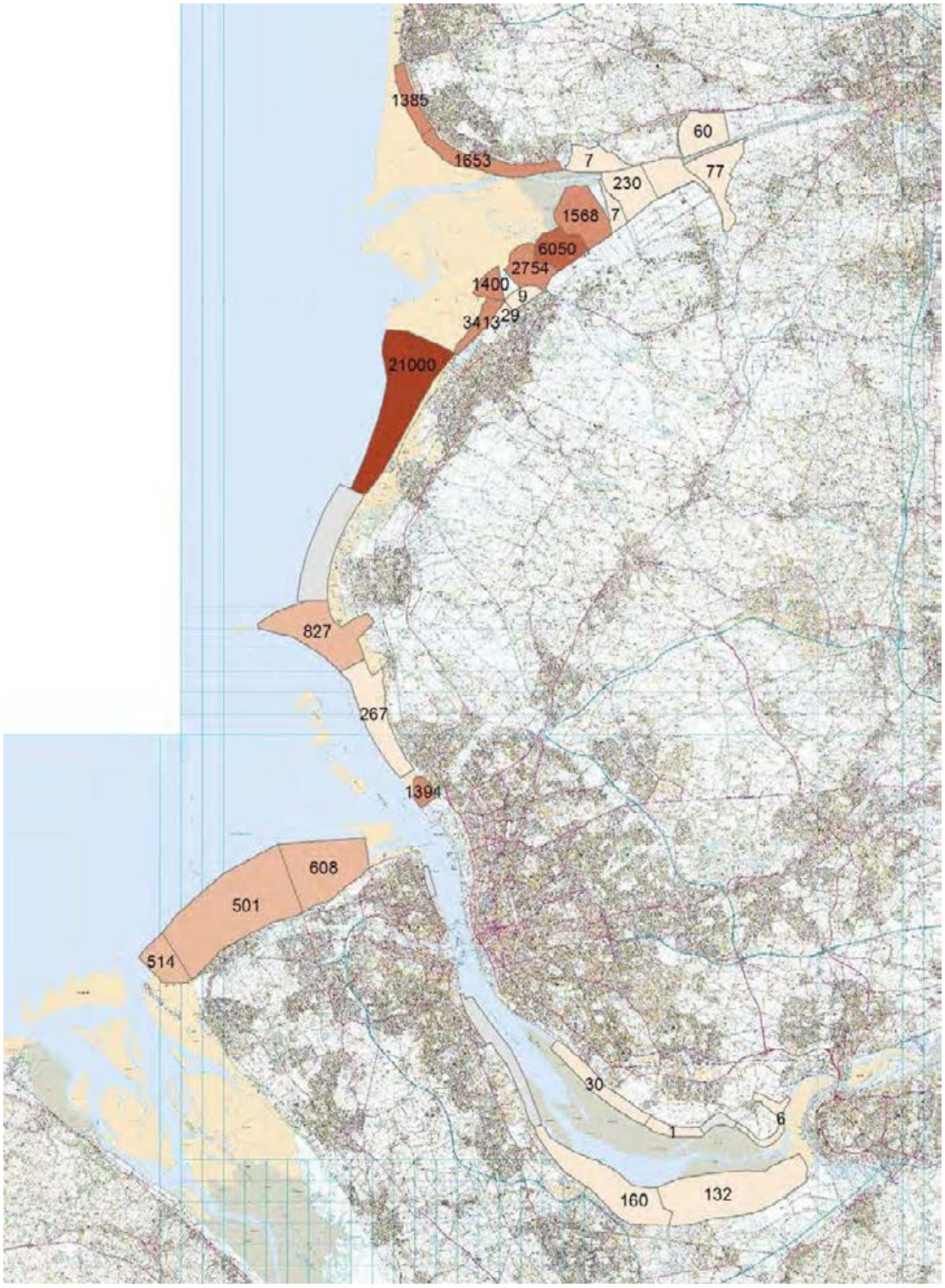

Figure A.5.28 5-year mean densities of Oystercatcher (1997/98 – 2001/02) in the Liverpool City Region

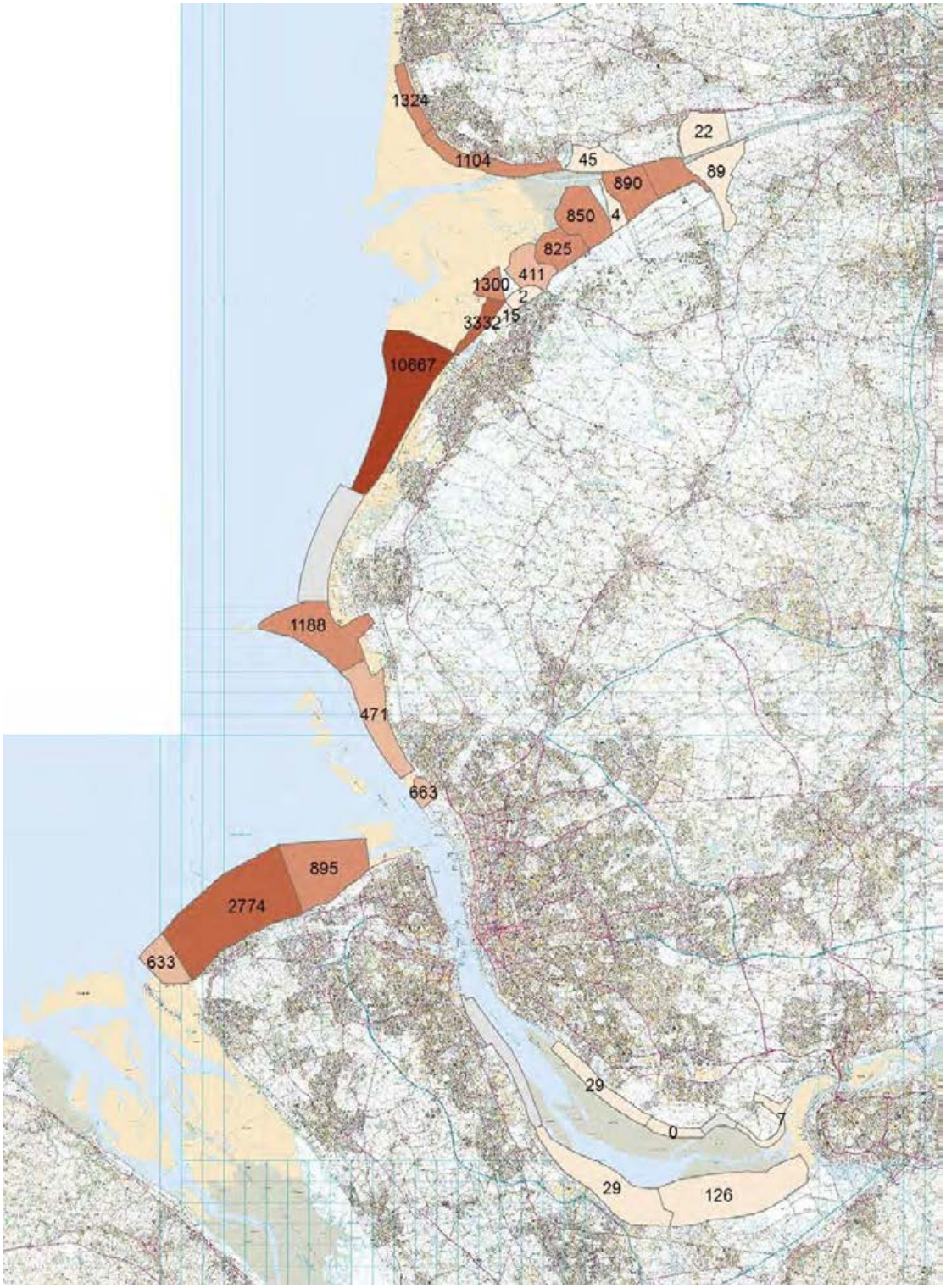

Figure A.5.29 5-year mean densities of Oystercatcher (2002/03 – 2006/07) in the Liverpool City Region

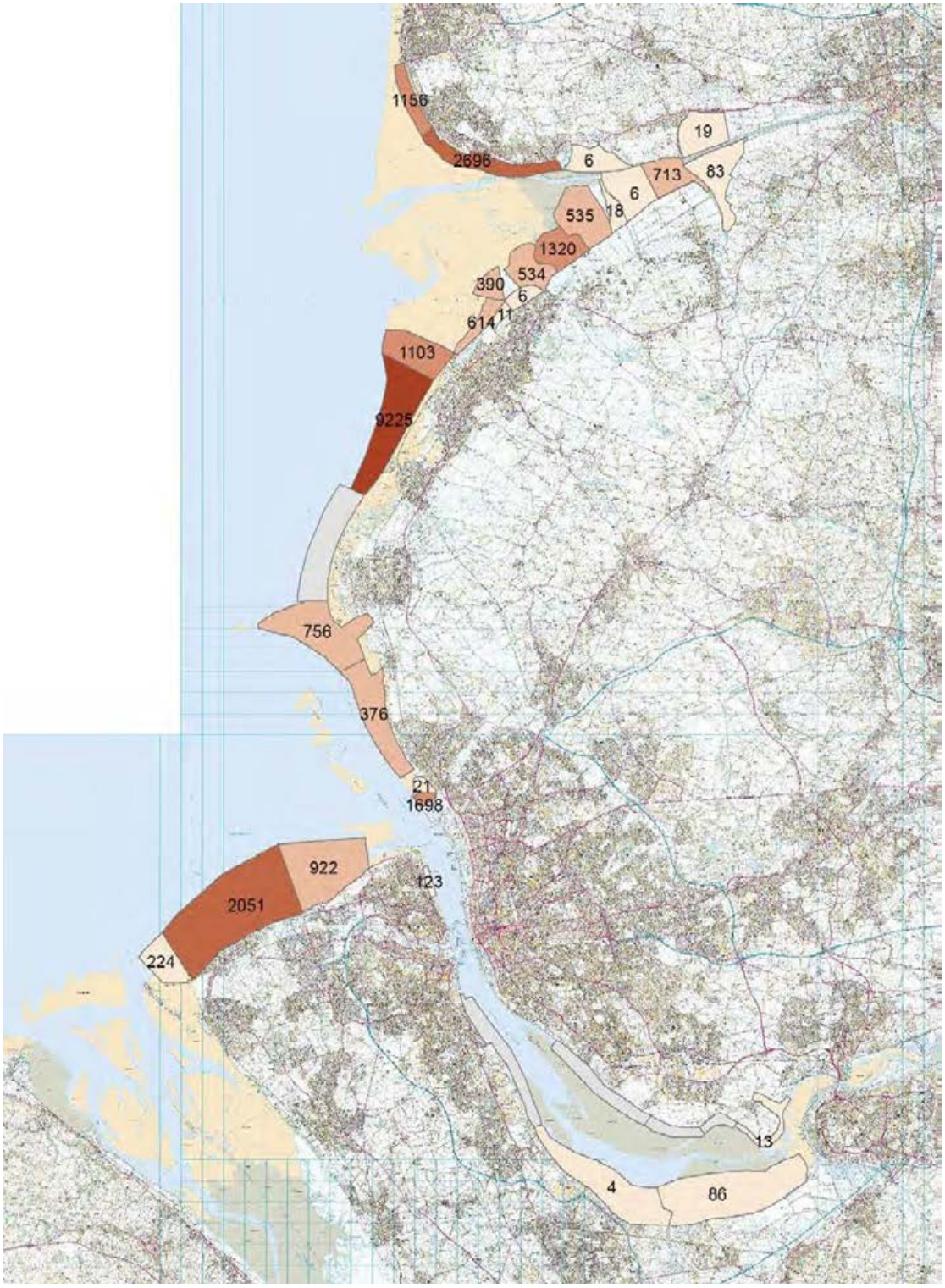

Figure A.5.30 5-year mean densities of Oystercatcher (2007/08 – 2011/12) in the Liverpool City Region

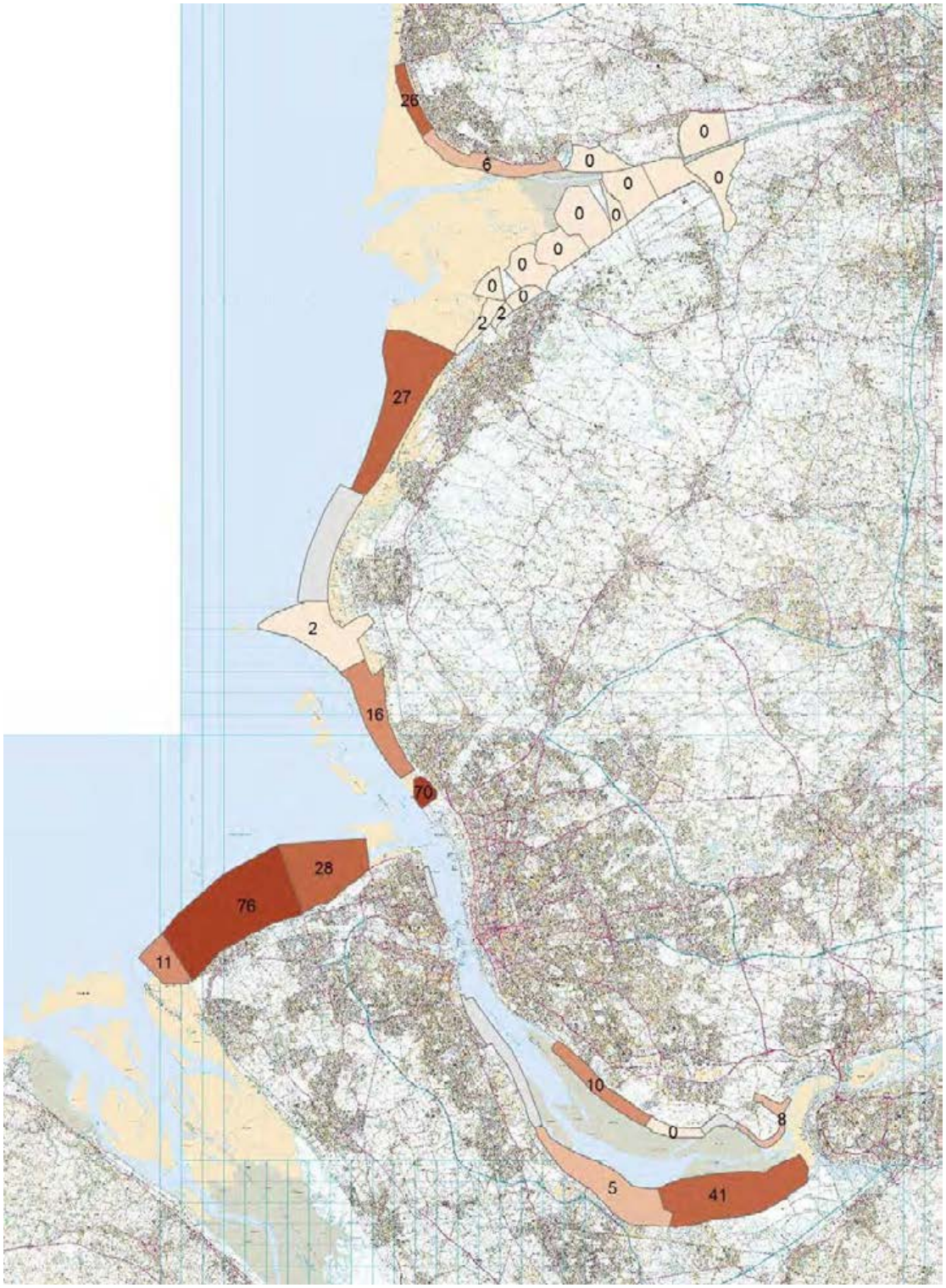

Figure A.5.31 5-year mean densities of Ringed Plover (1997/98 – 2001/02) in the Liverpool City Region

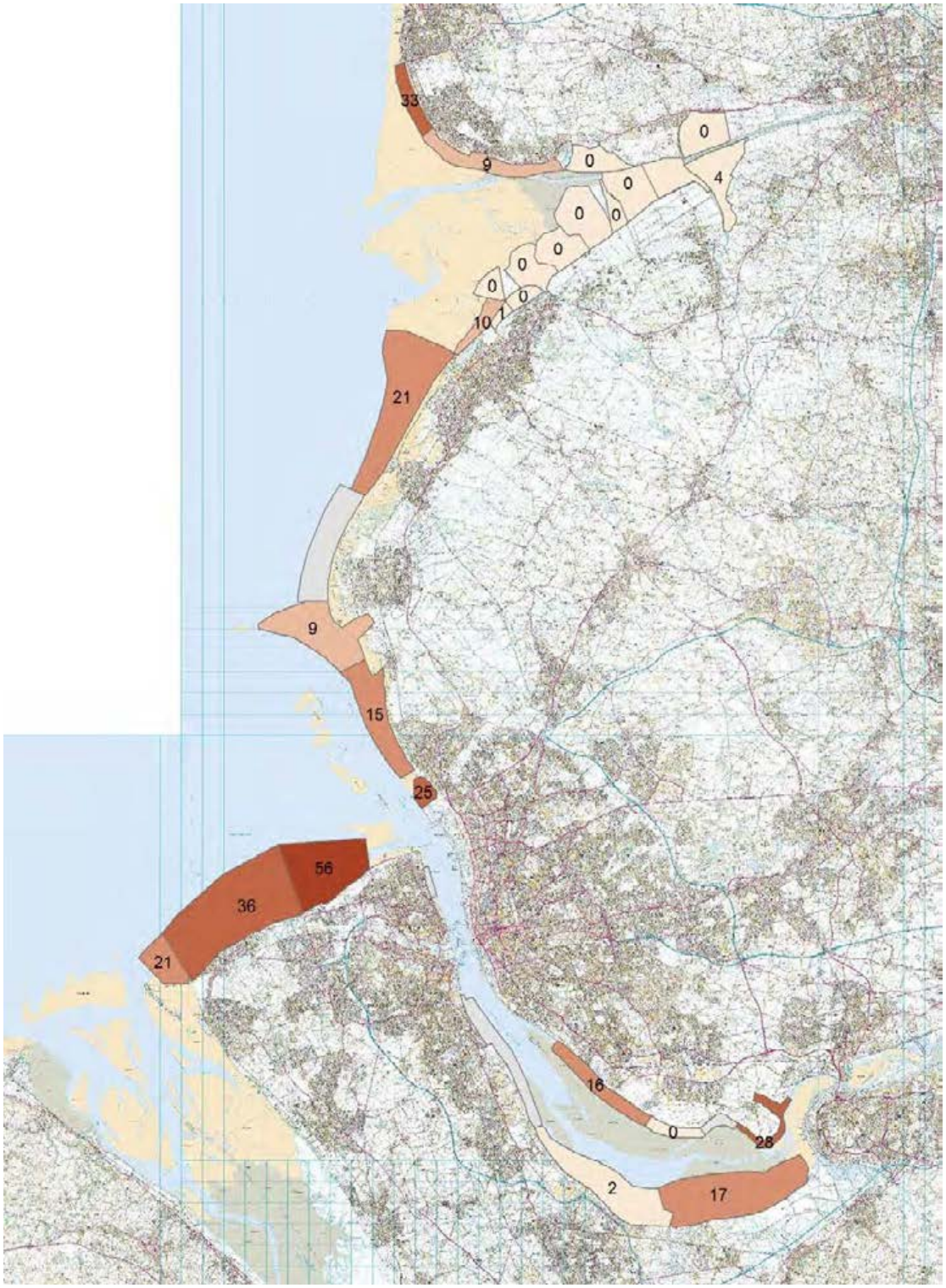

Figure A.5.32 5-year mean densities of Ringed Plover (2002/03 – 2006/07) in the Liverpool City Region

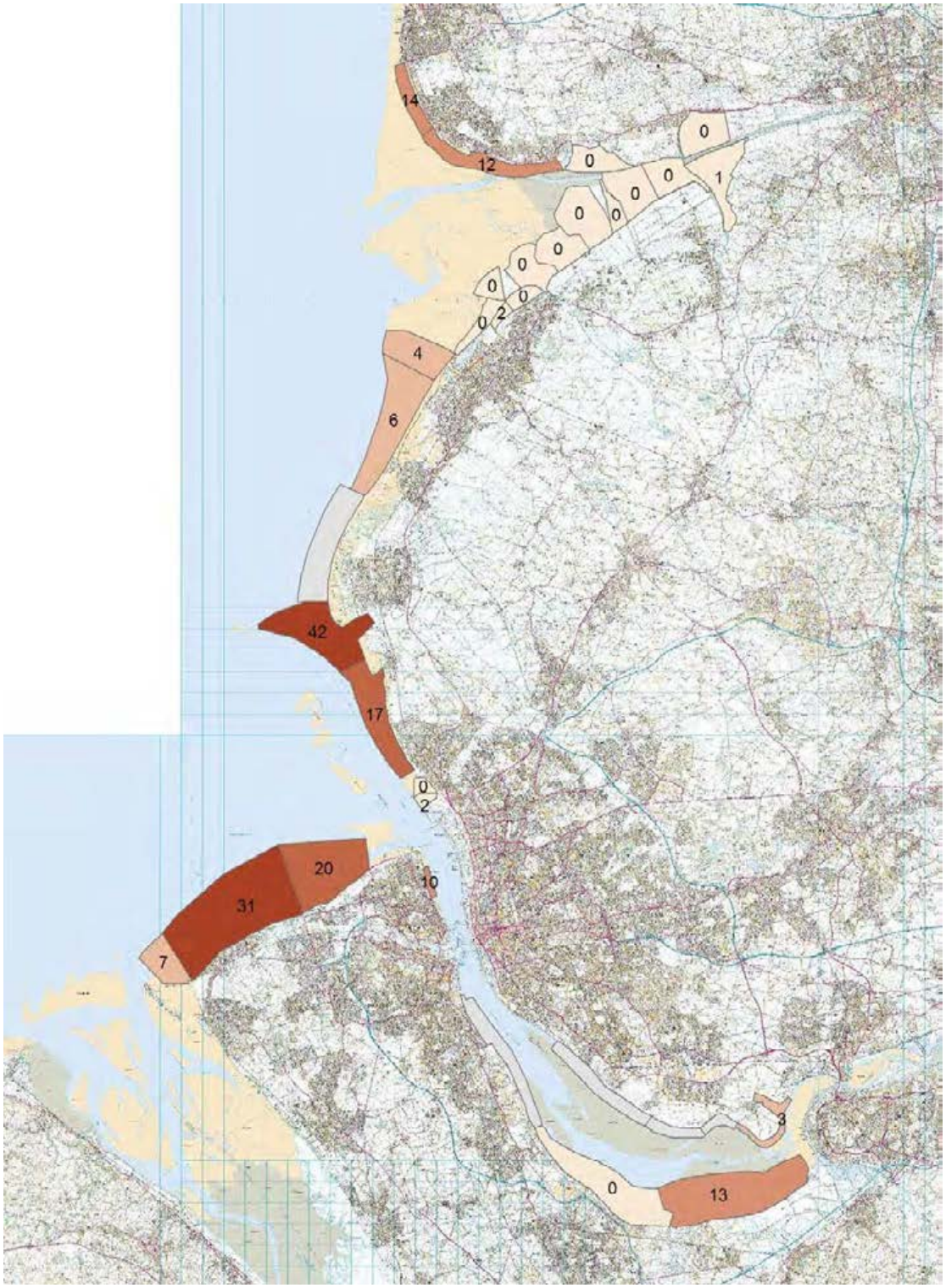

Figure A.5.33 5-year mean densities of Ringed Plover (2007/08 – 2011/12) in the Liverpool City Region

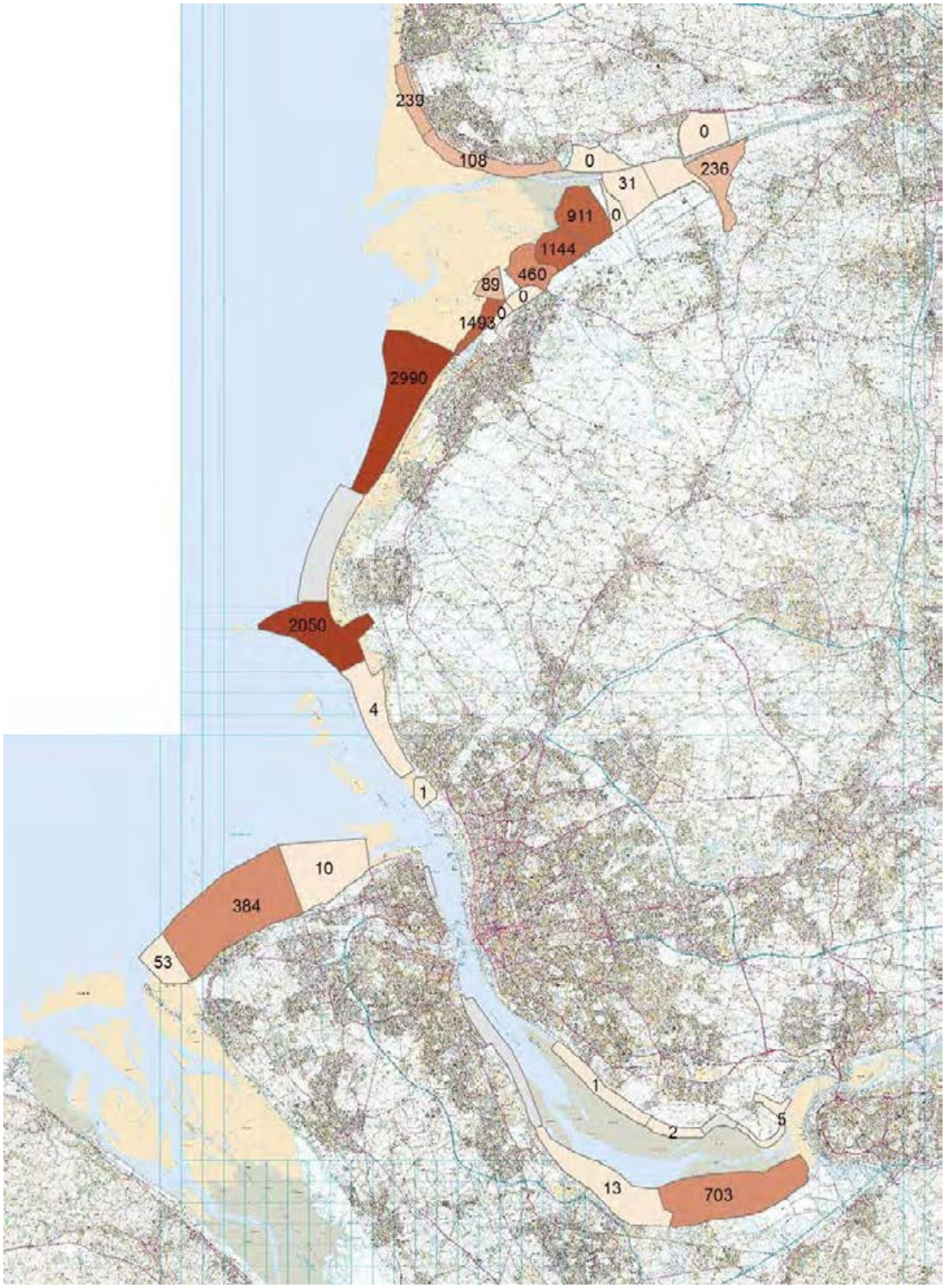

Figure A.5.34 5-year mean densities of Grey Plover (1997/98 – 2001/02) in the Liverpool City Region

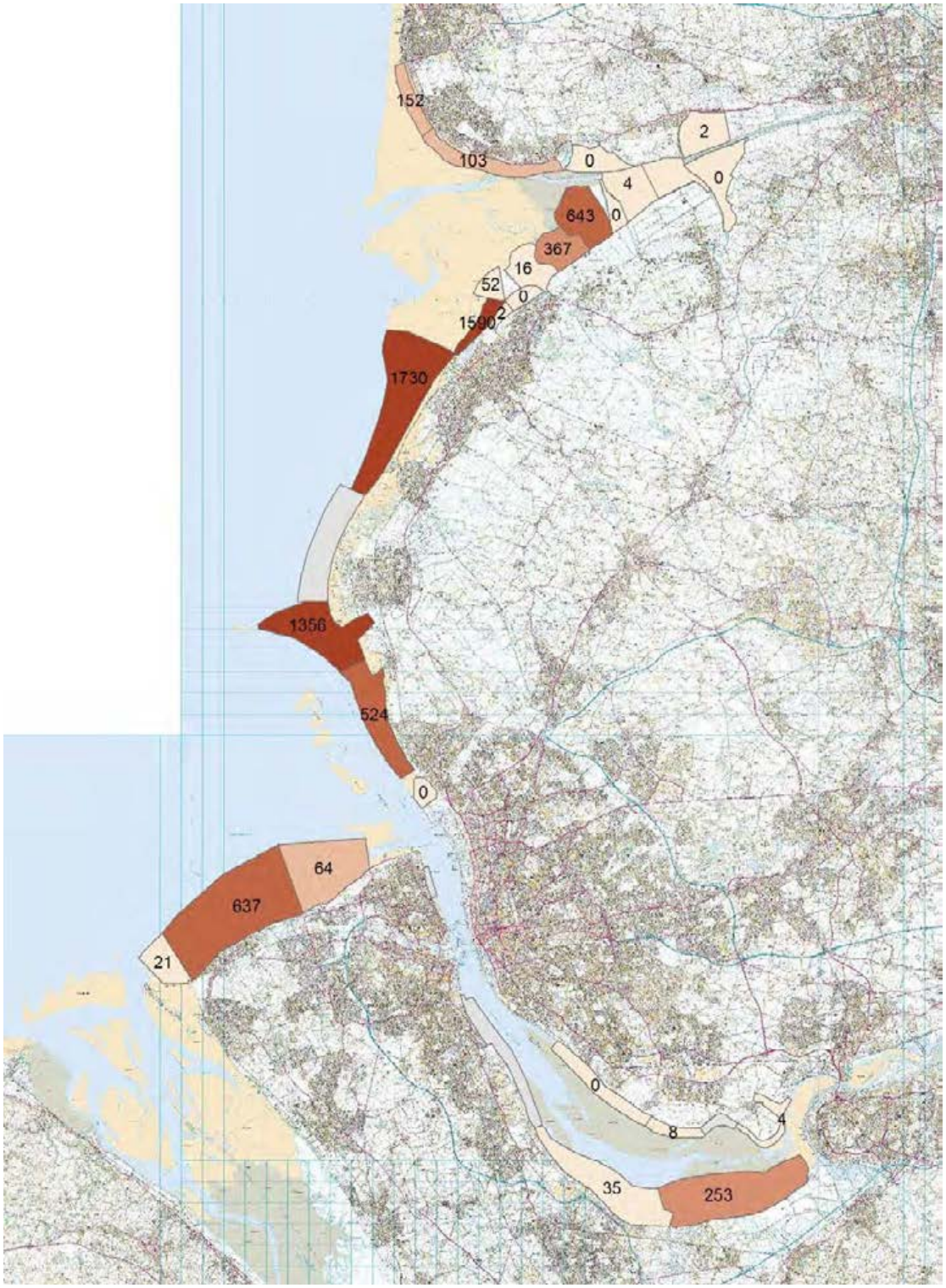

Figure A.5.35 5-year mean densities of Grey Plover (2002/03 – 2006/07) in the Liverpool City Region

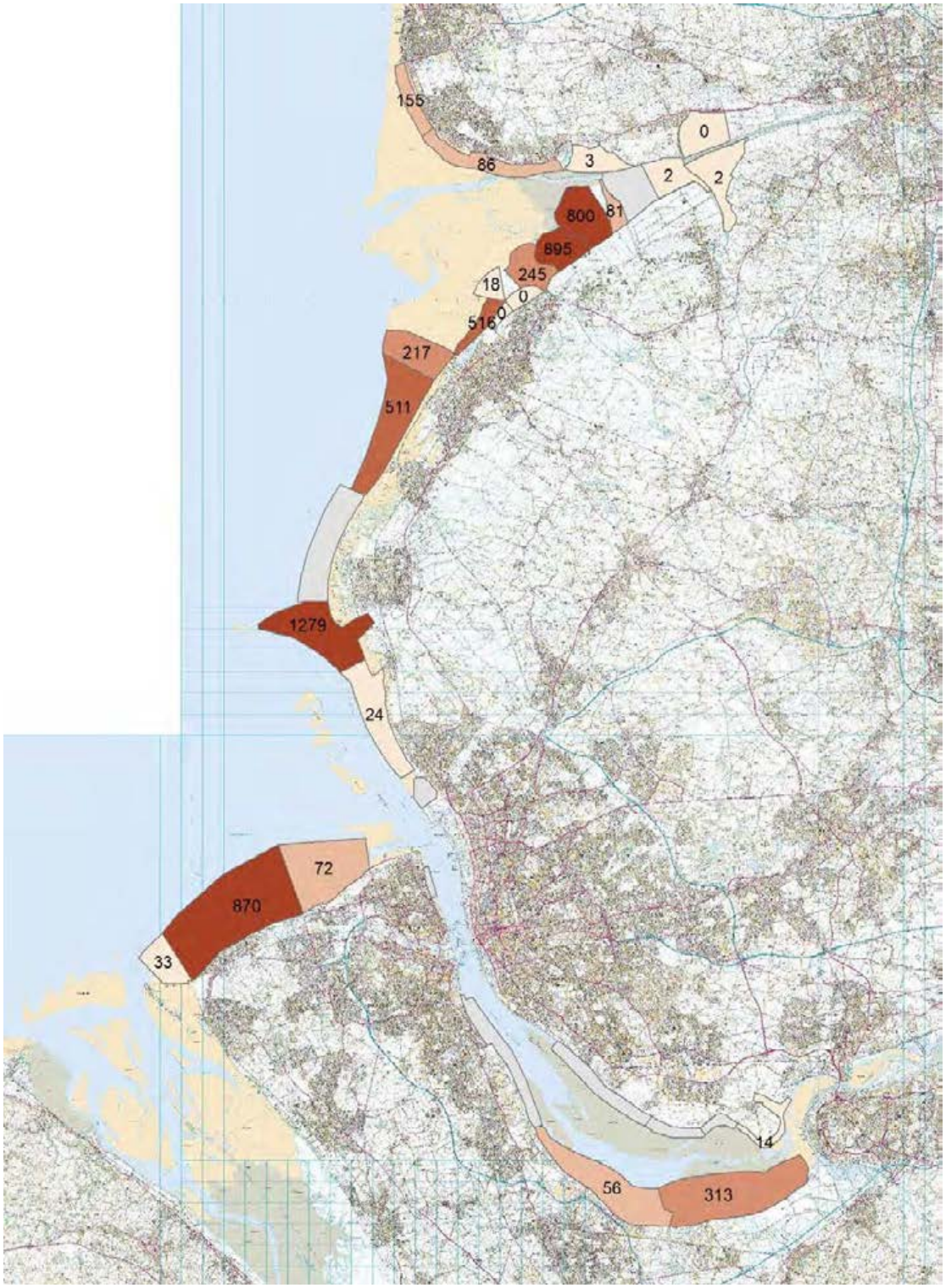

Figure A.5.36 5-year mean densities of Grey Plover (2007/08 – 2011/12) in the Liverpool City Region

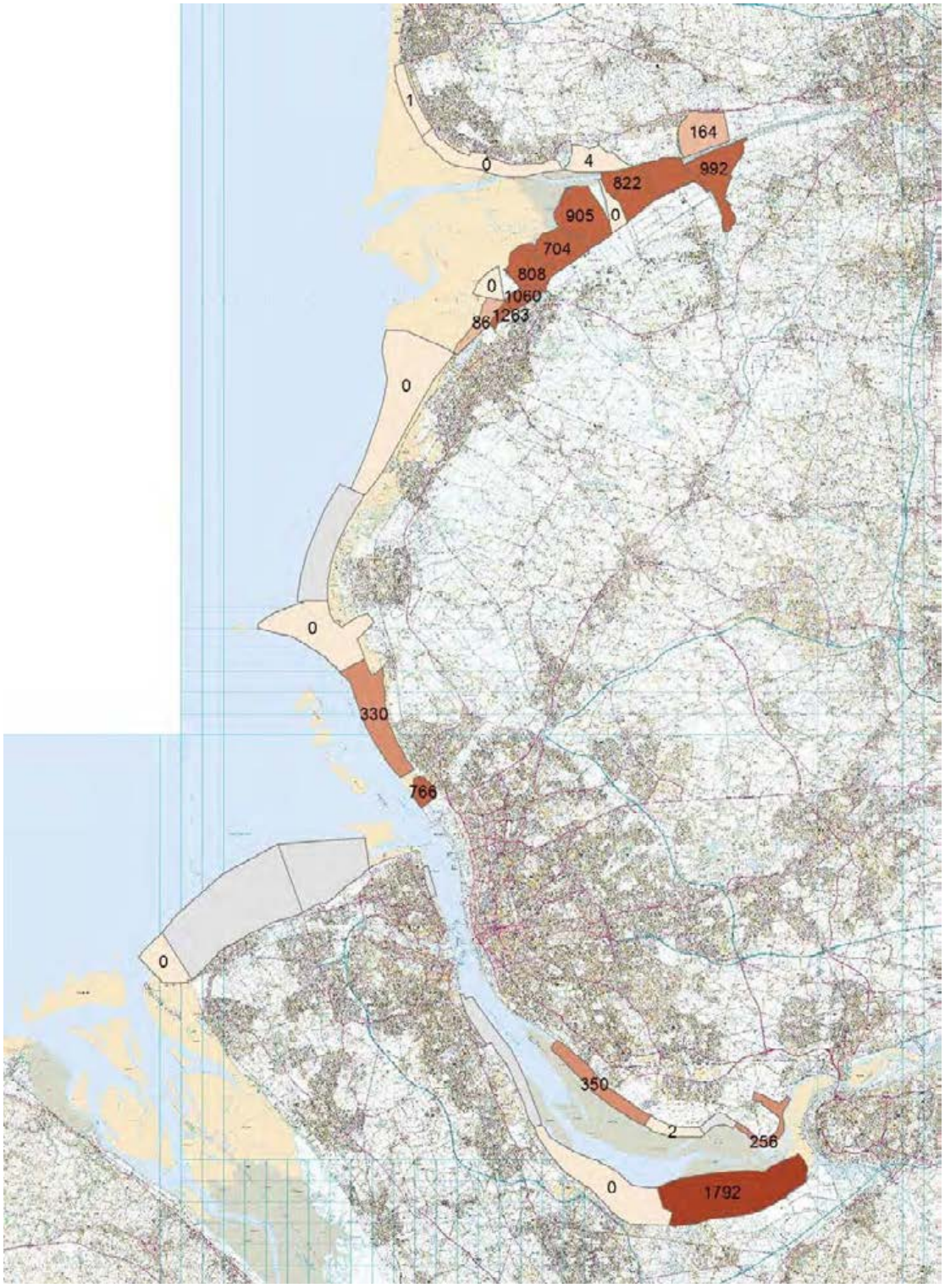

Figure A.5.37 5-year mean densities of Golden Plover (1997/98 – 2001/02) in the Liverpool City Region

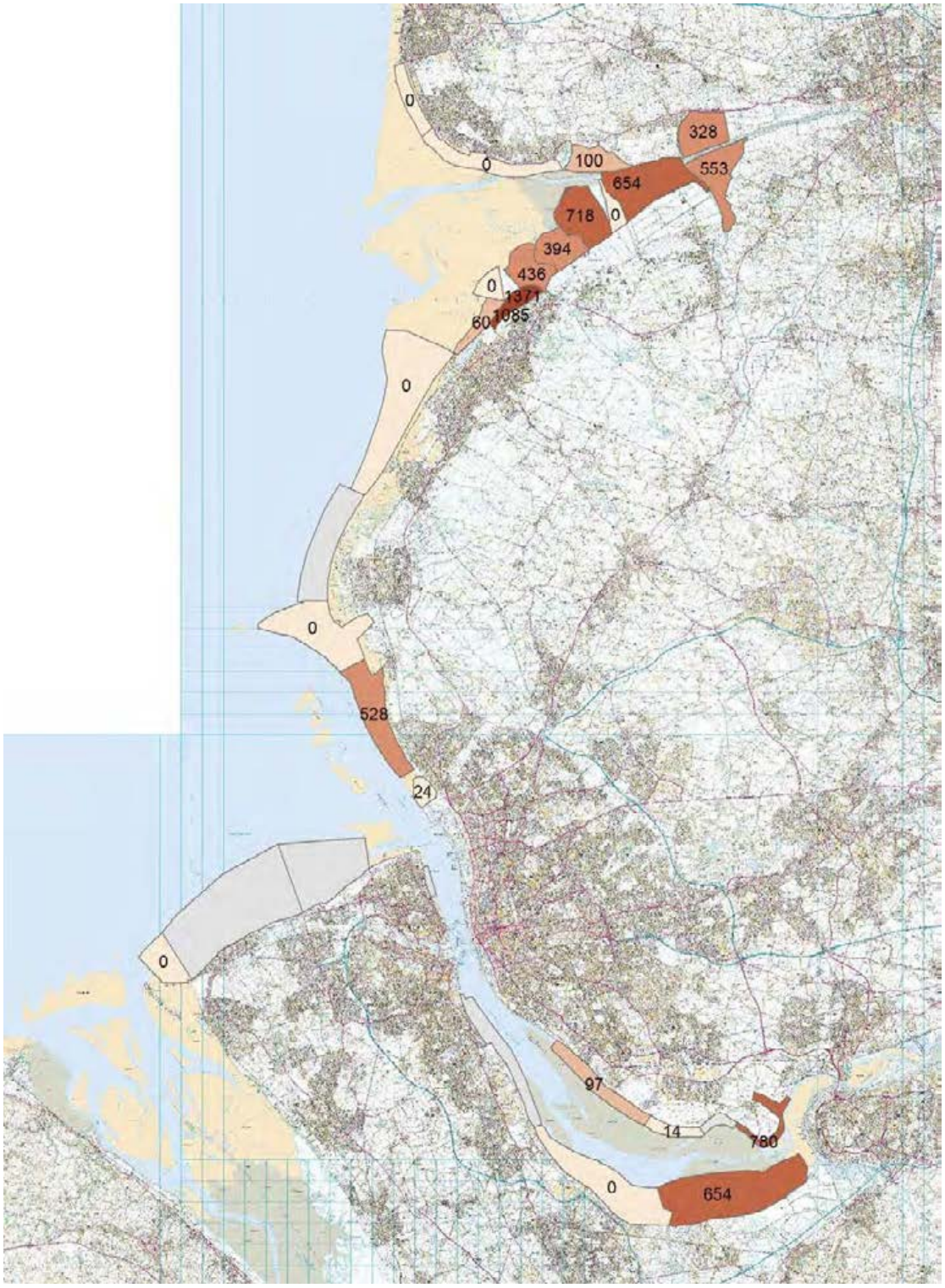

Figure A.5.38 5-year mean densities of Golden Plover (2002/03 – 2006/07) in the Liverpool City Region

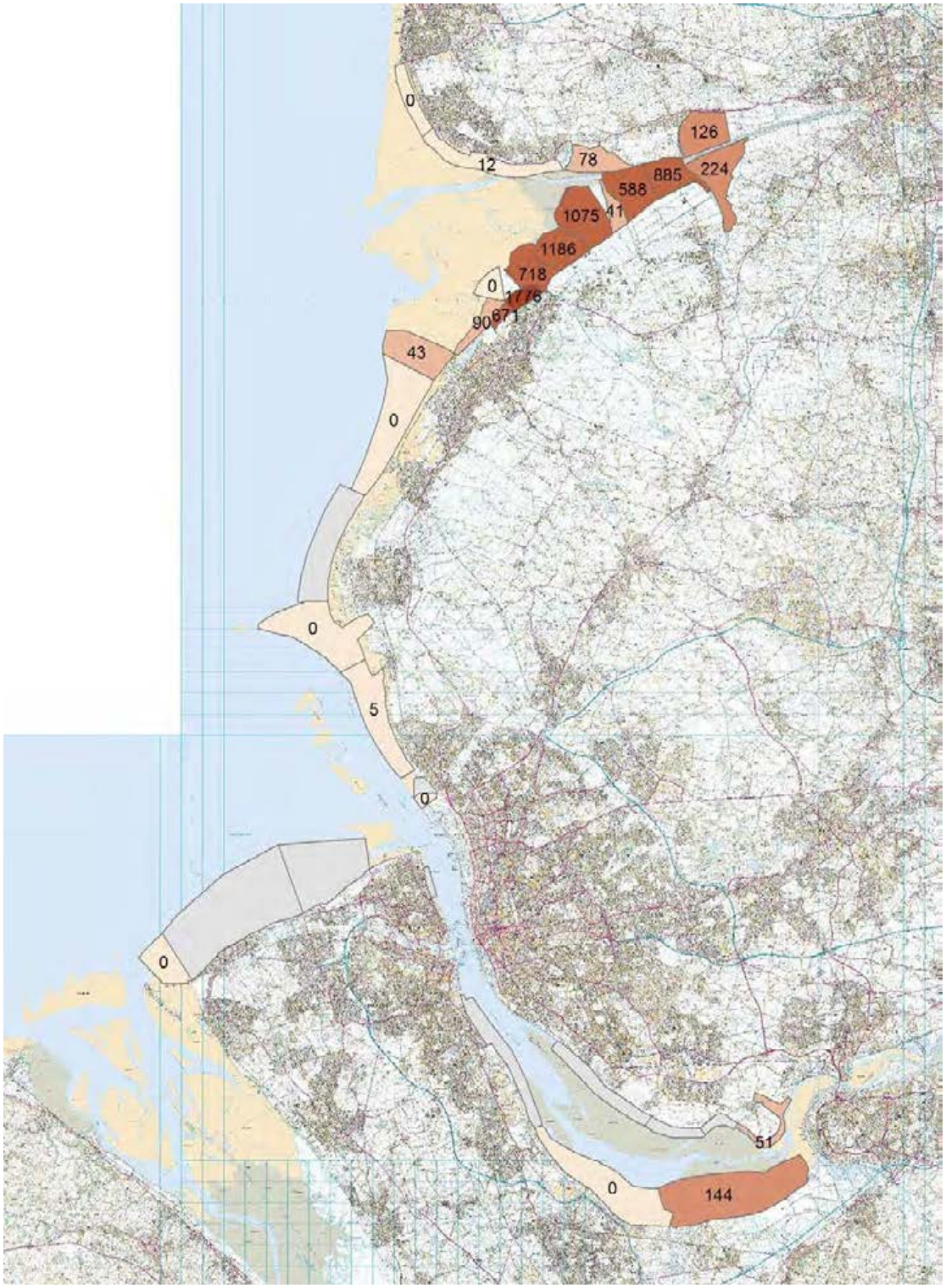

Figure A.5.39 5-year mean densities of Golden Plover (2007/08 – 2011/12) in the Liverpool City Region

Figure A.5.40 5-year mean densities of Lapwing (1997/98 – 2001/02) in the Liverpool City Region

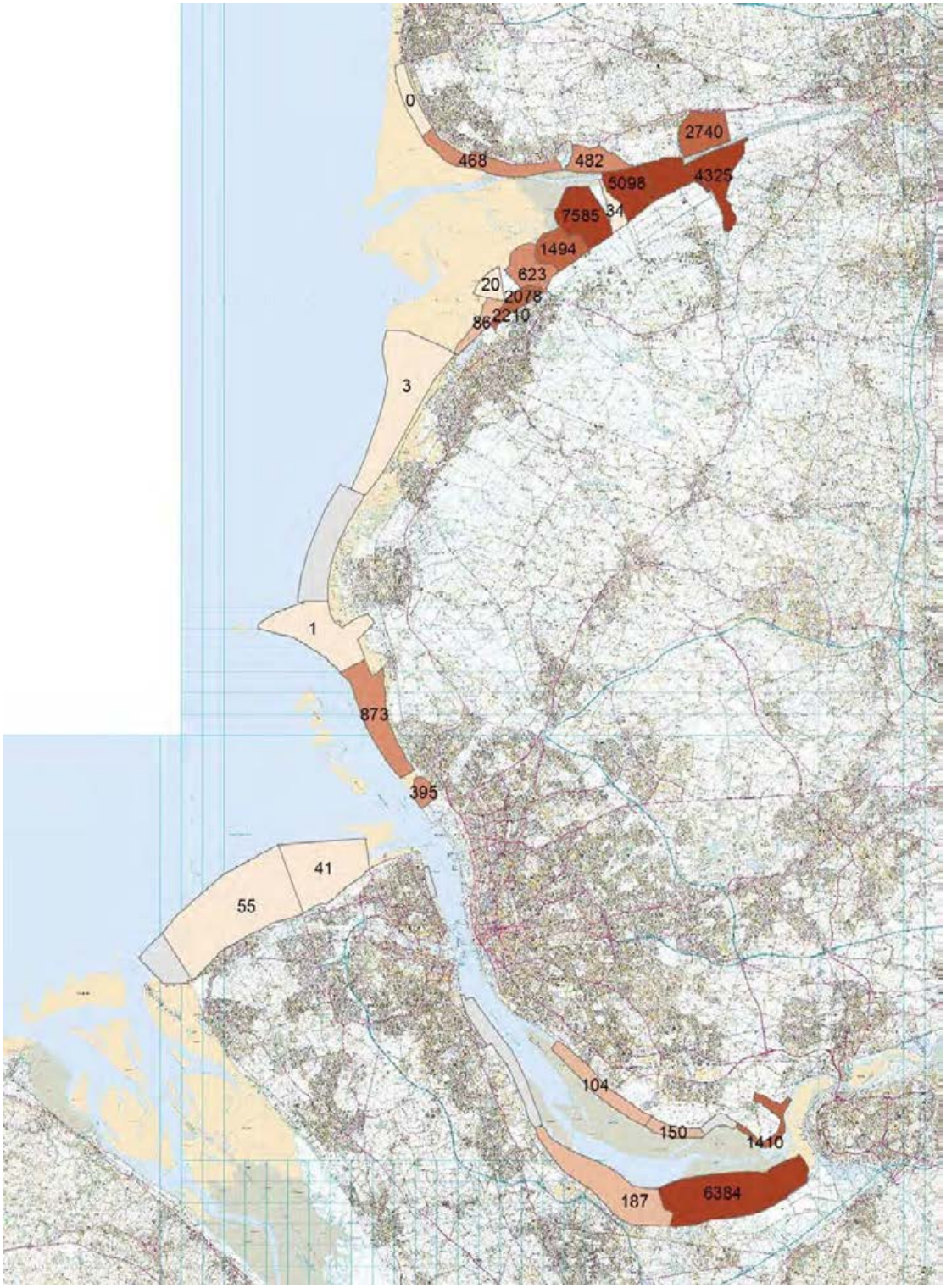

Figure A.5.41 5-year mean densities of Lapwing (2002/03 – 2006/07) in the Liverpool City Region

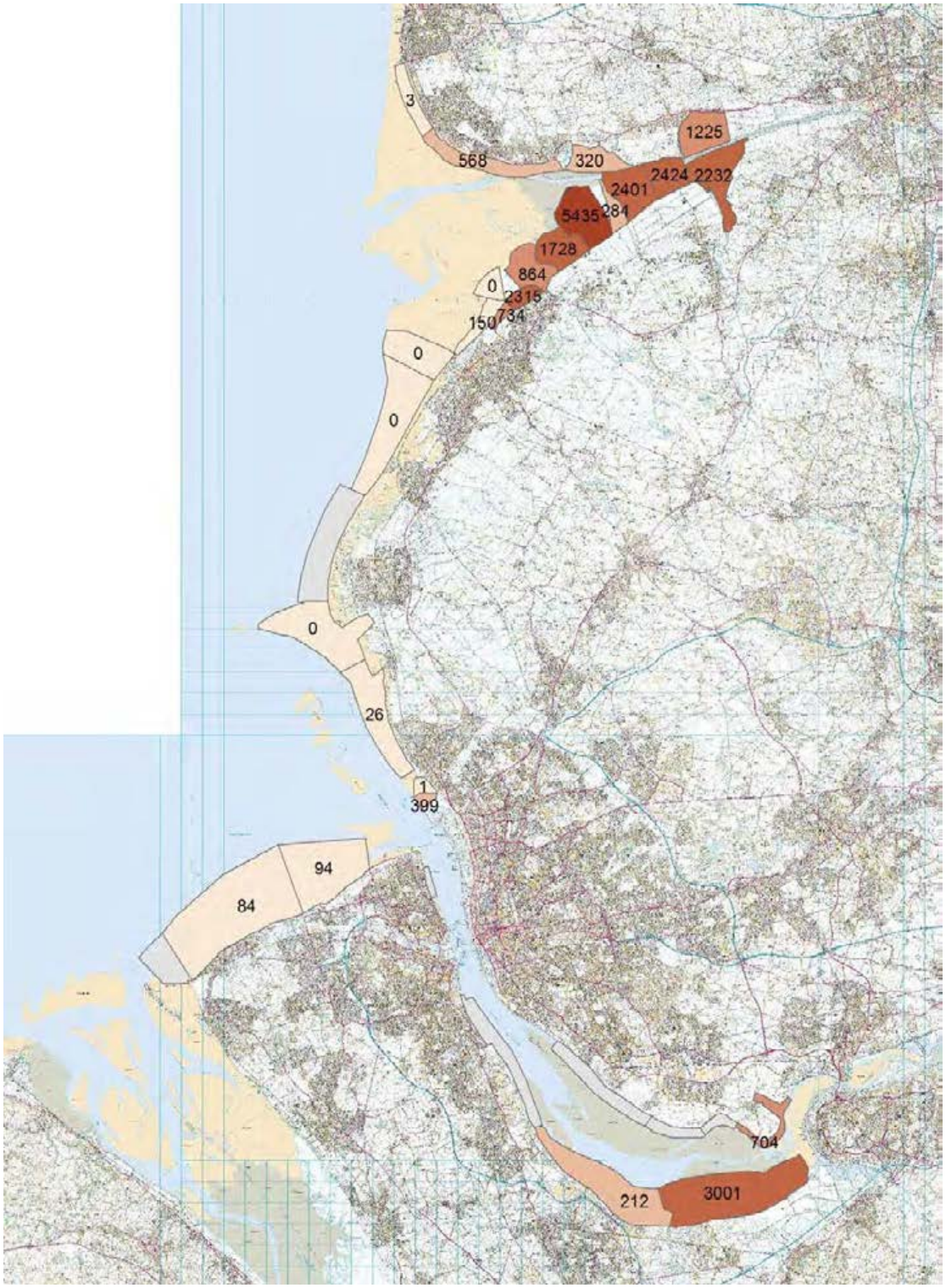

Figure A.5.42 5-year mean densities of Lapwing (2007/08 – 2011/12) in the Liverpool City Region

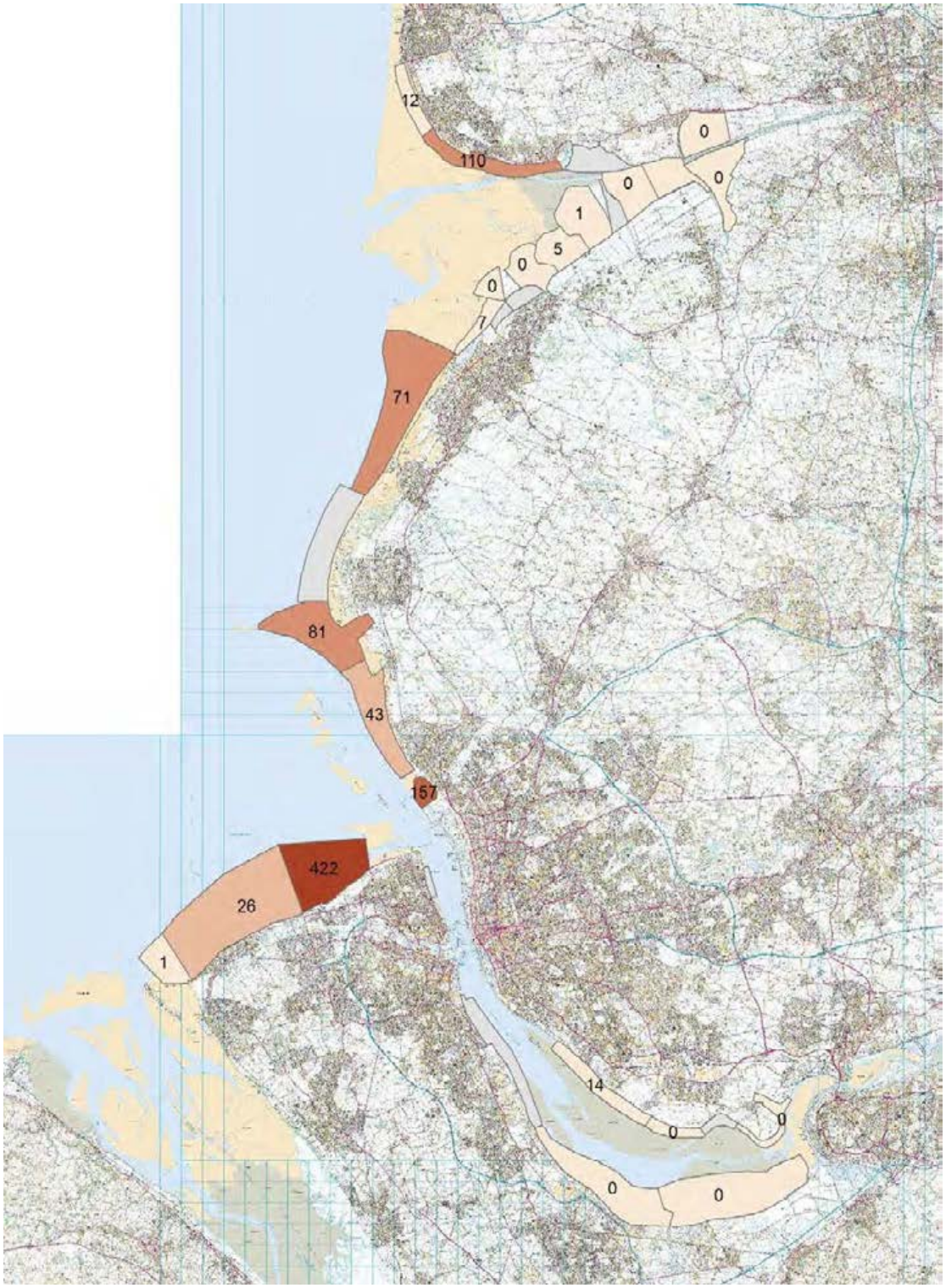

Figure A.5.43 5-year mean densities of Turnstone (1997/98 – 2001/02) in the Liverpool City Region

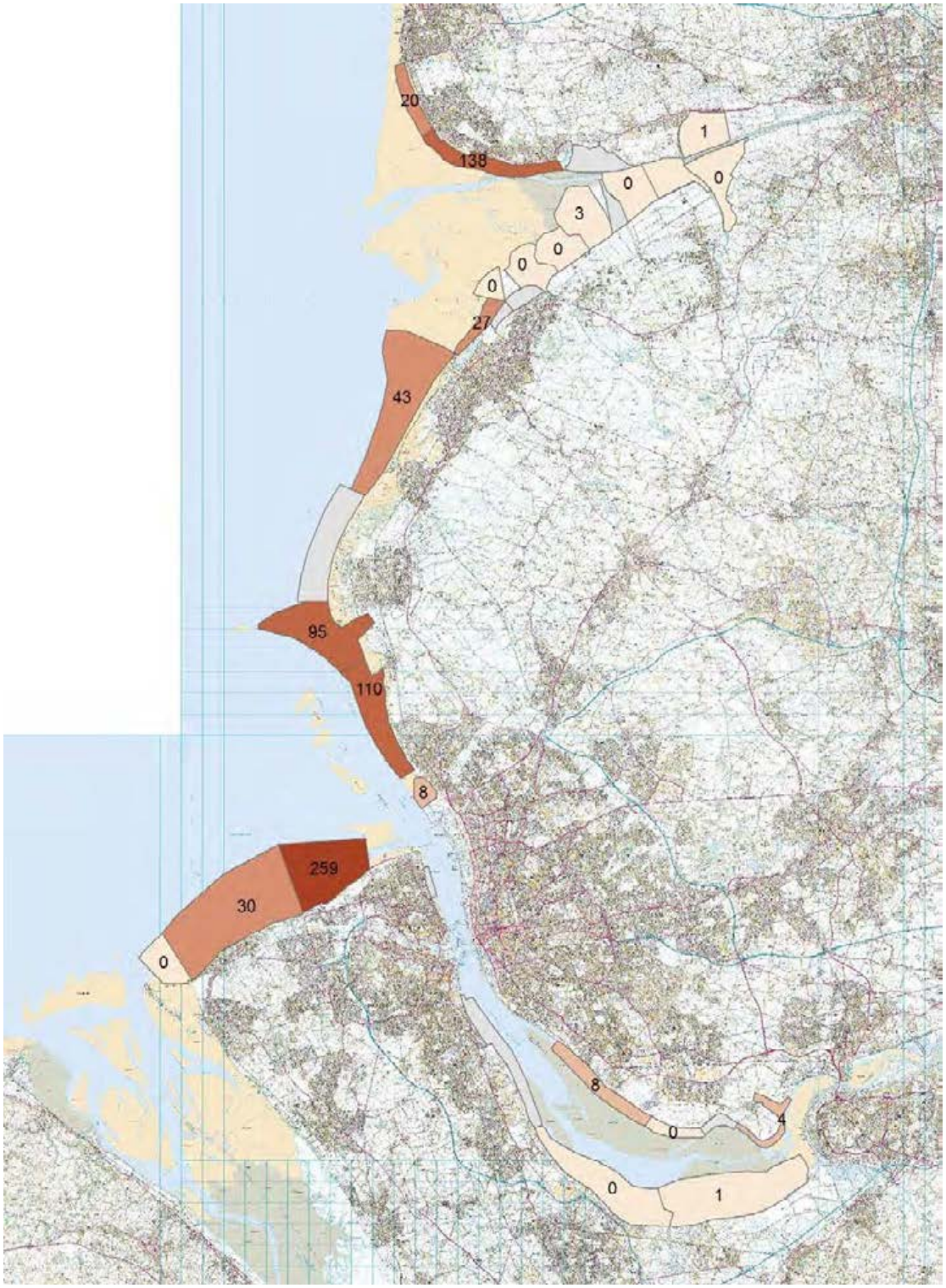

Figure A.5.44 5-year mean densities of Turnstone (2002/03 – 2006/07) in the Liverpool City Region

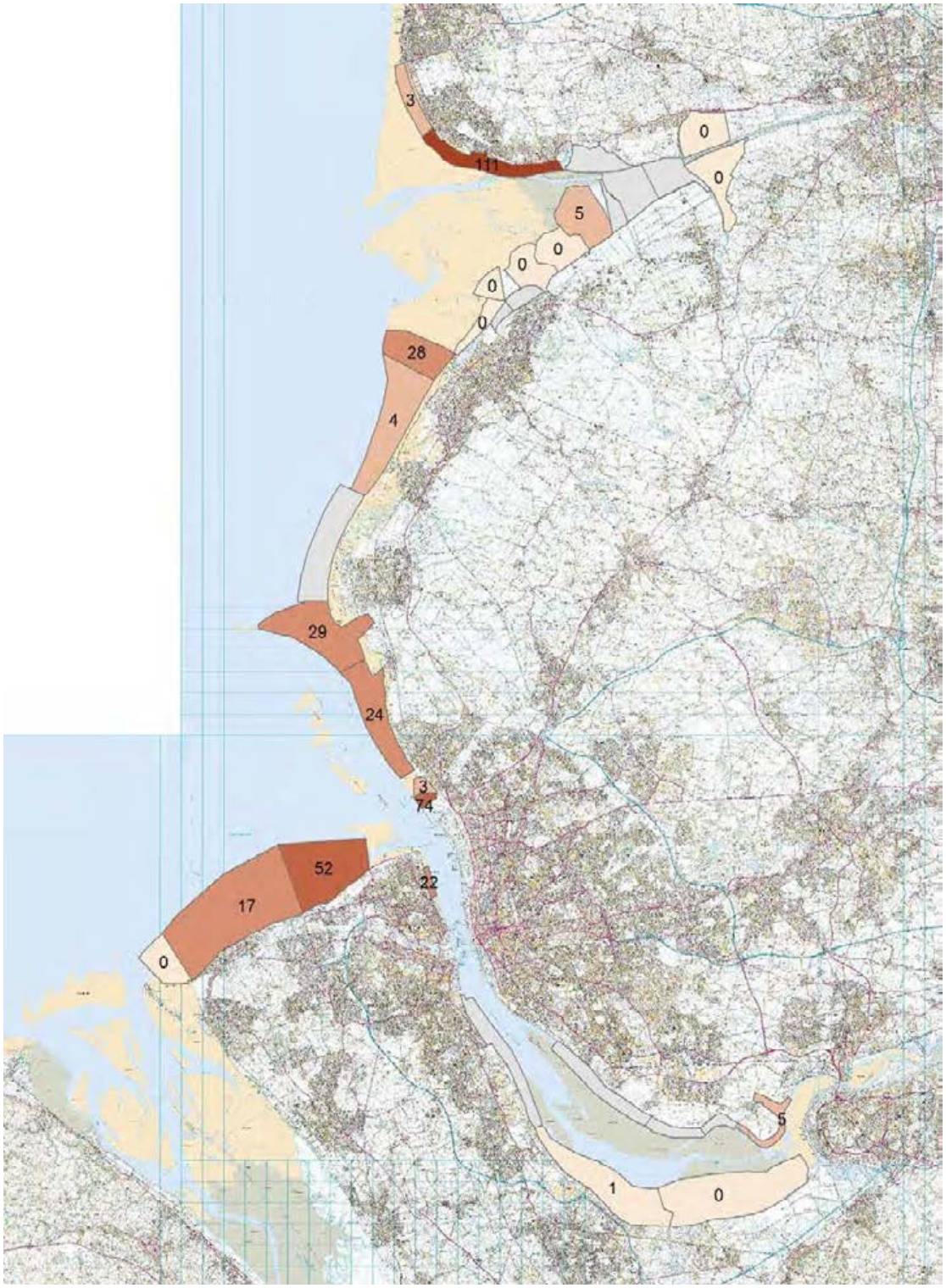

Figure A.5.45 5-year mean densities of Turnstone (2007/08 – 2011/12) in the Liverpool City Region

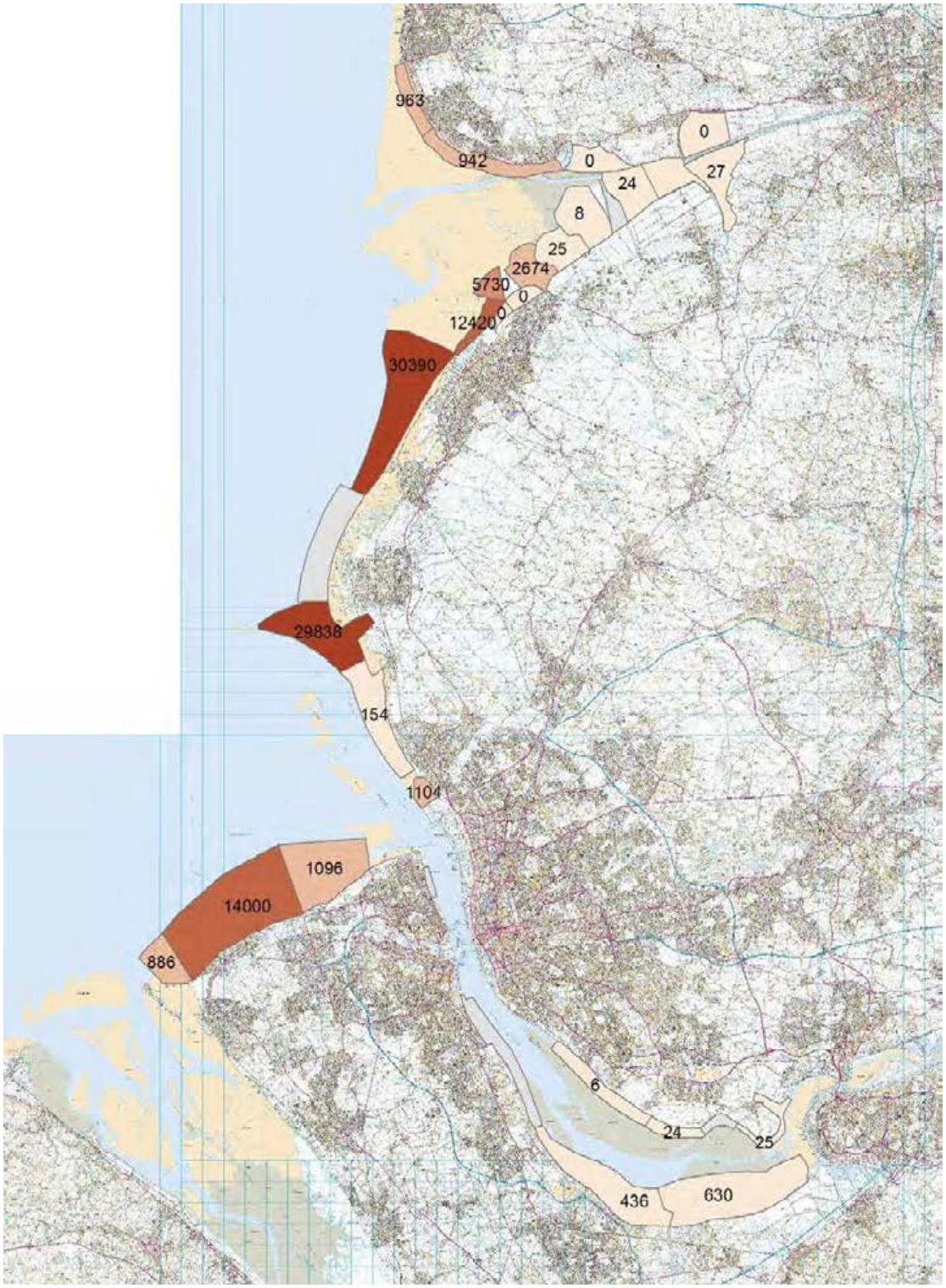

Figure A.5.46 5-year mean densities of Knot (1997/98 – 2001/02) in the Liverpool City Region

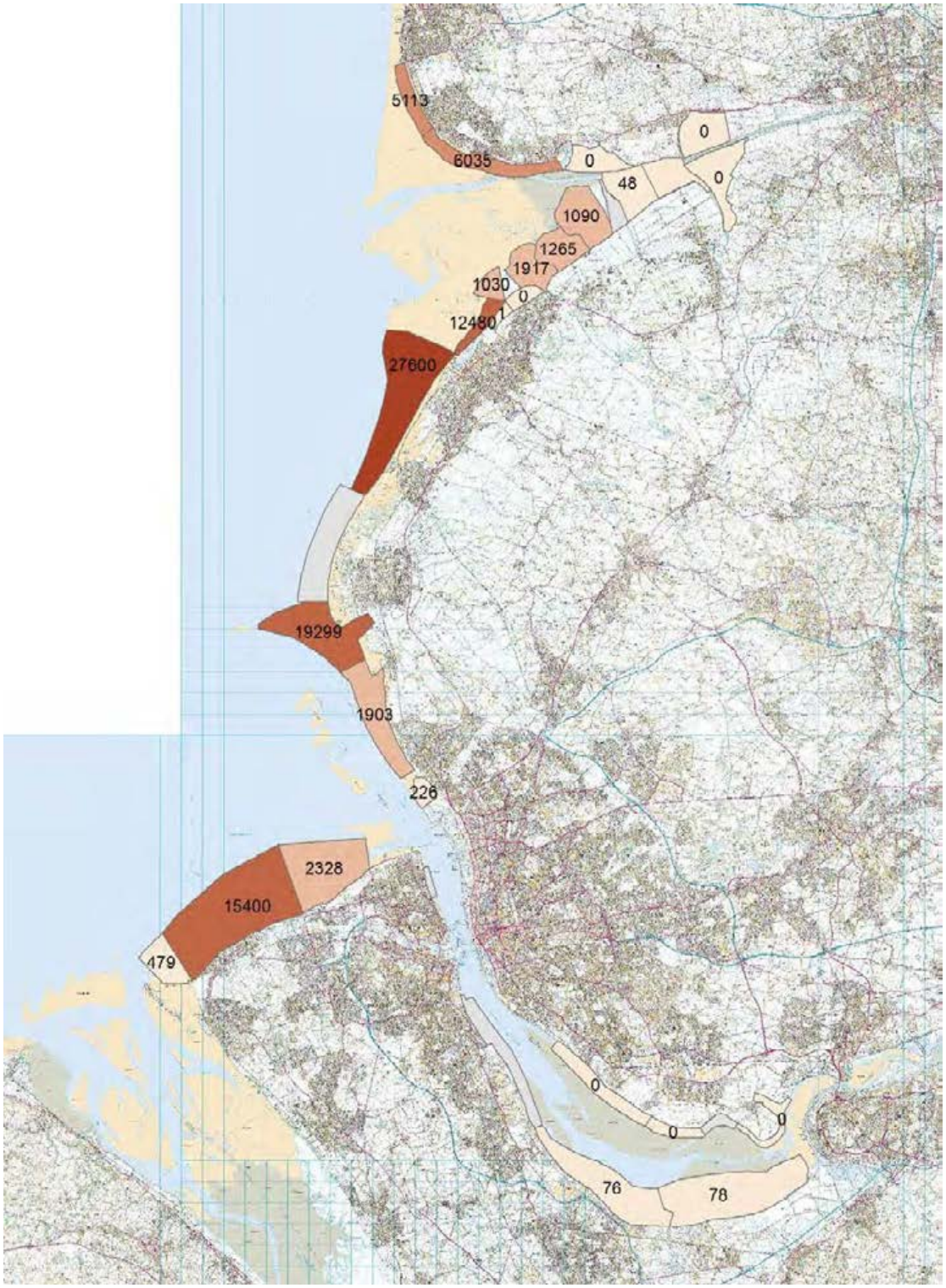

Figure A.5.47 5-year mean densities of Knot (2002/03 – 2006/07) in the Liverpool City Region

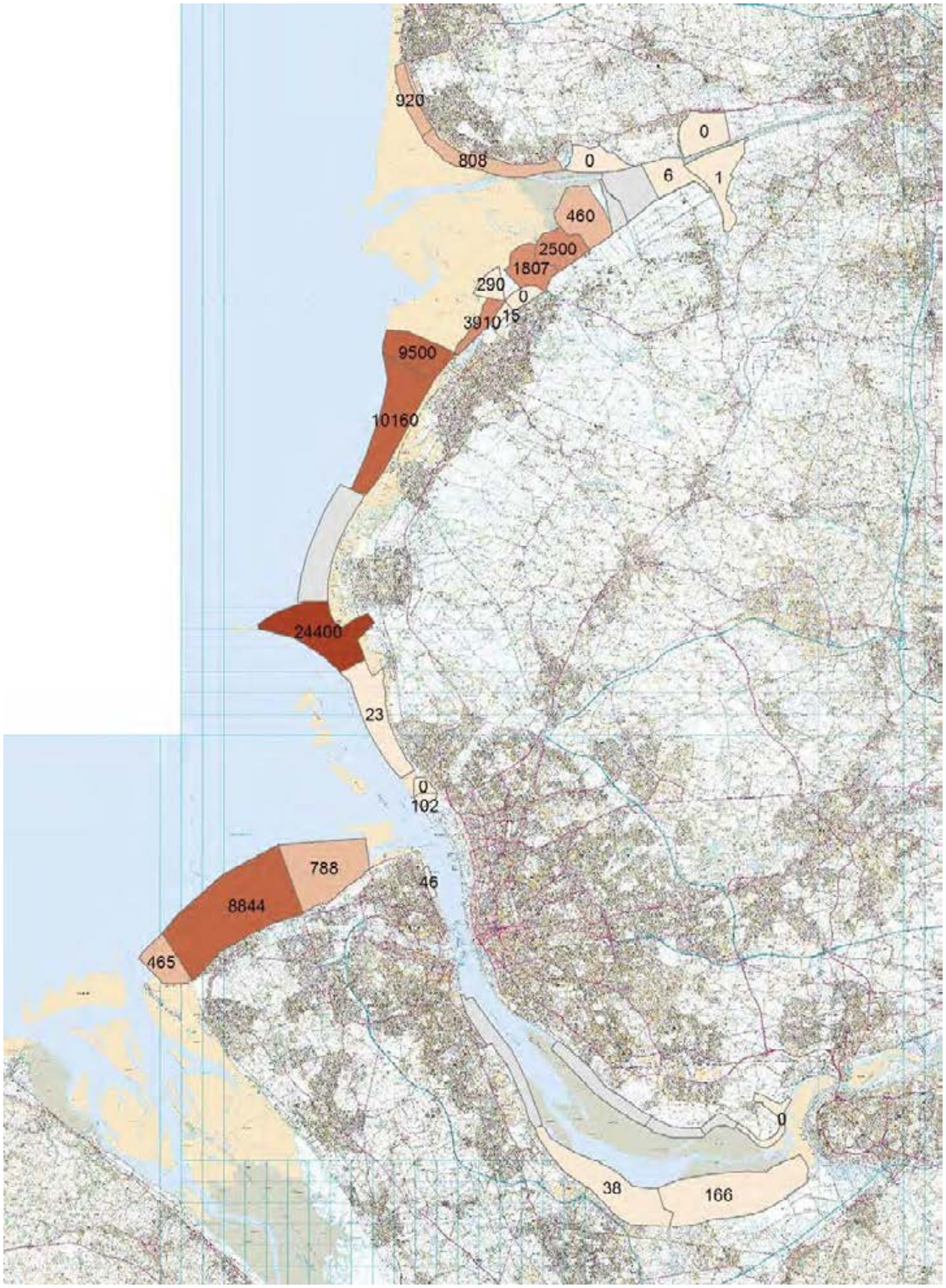

Figure A.5.48 5-year mean densities of Knot (2007/08 – 2011/12) in the Liverpool City Region

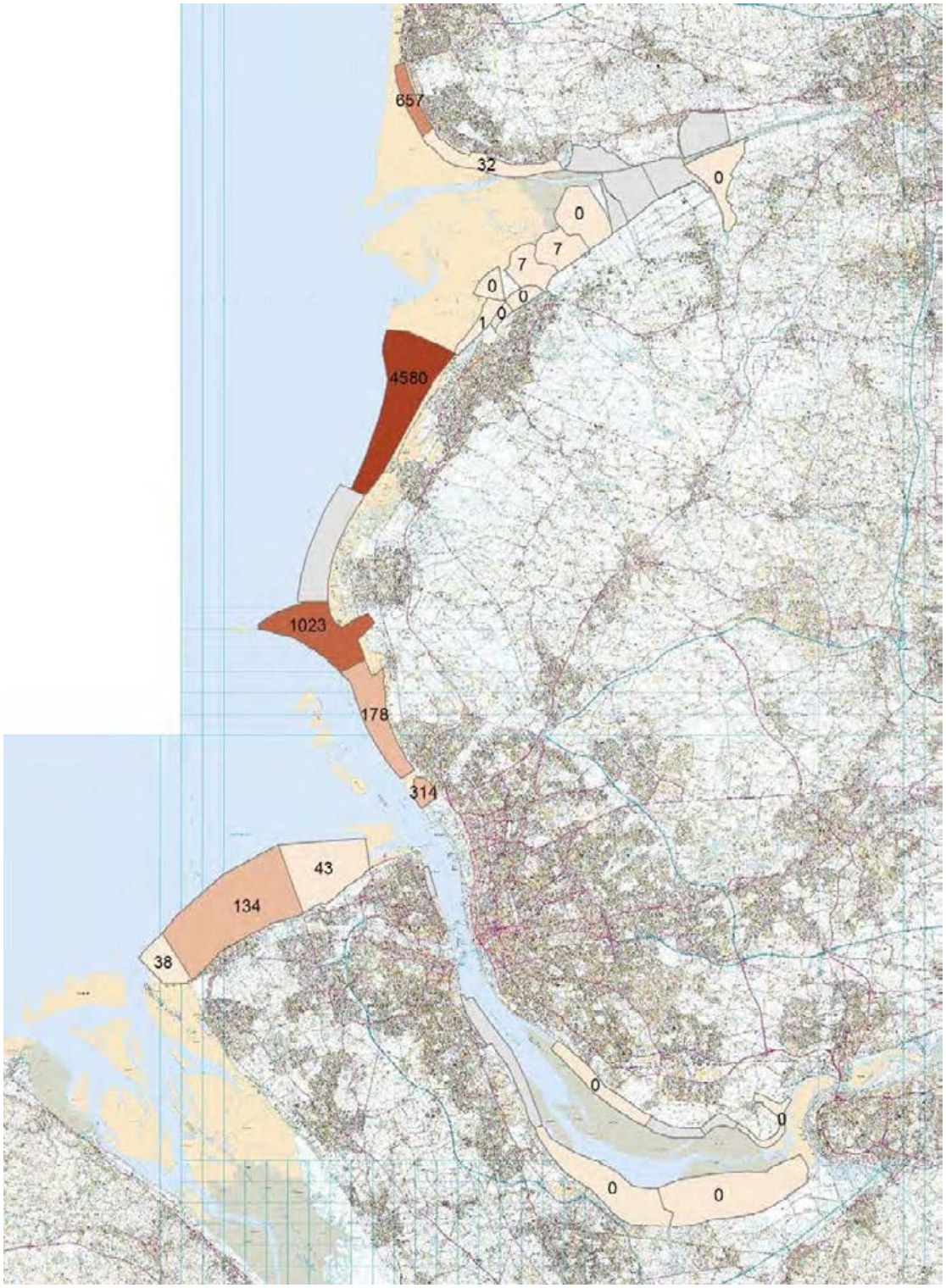

Figure A.5.49 5-year mean densities of Sanderling (1997/98 – 2001/02) in the Liverpool City Region

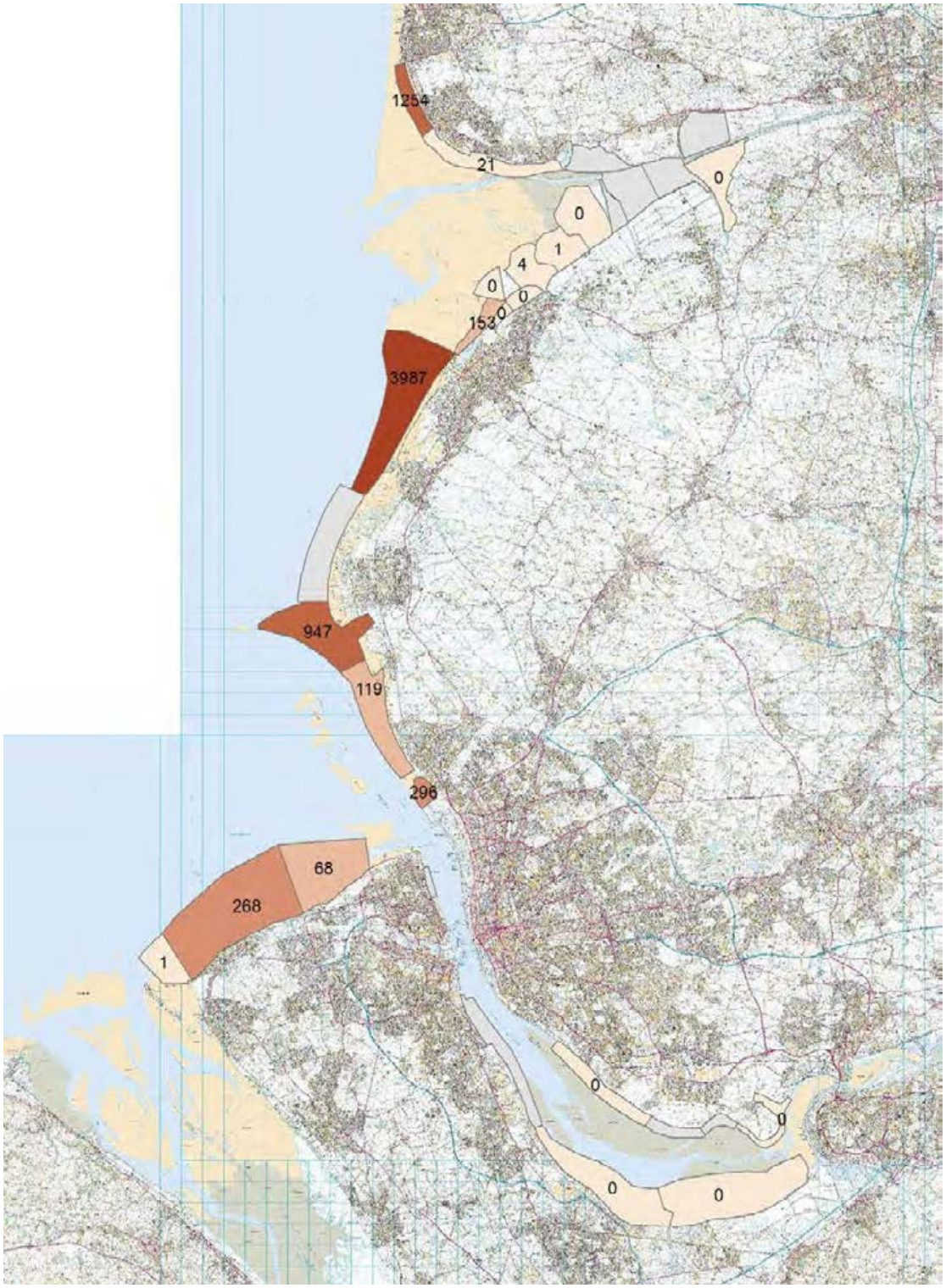

Figure A.5.50 5-year mean densities of Sanderling (2002/03 – 2006/07) in the Liverpool City Region

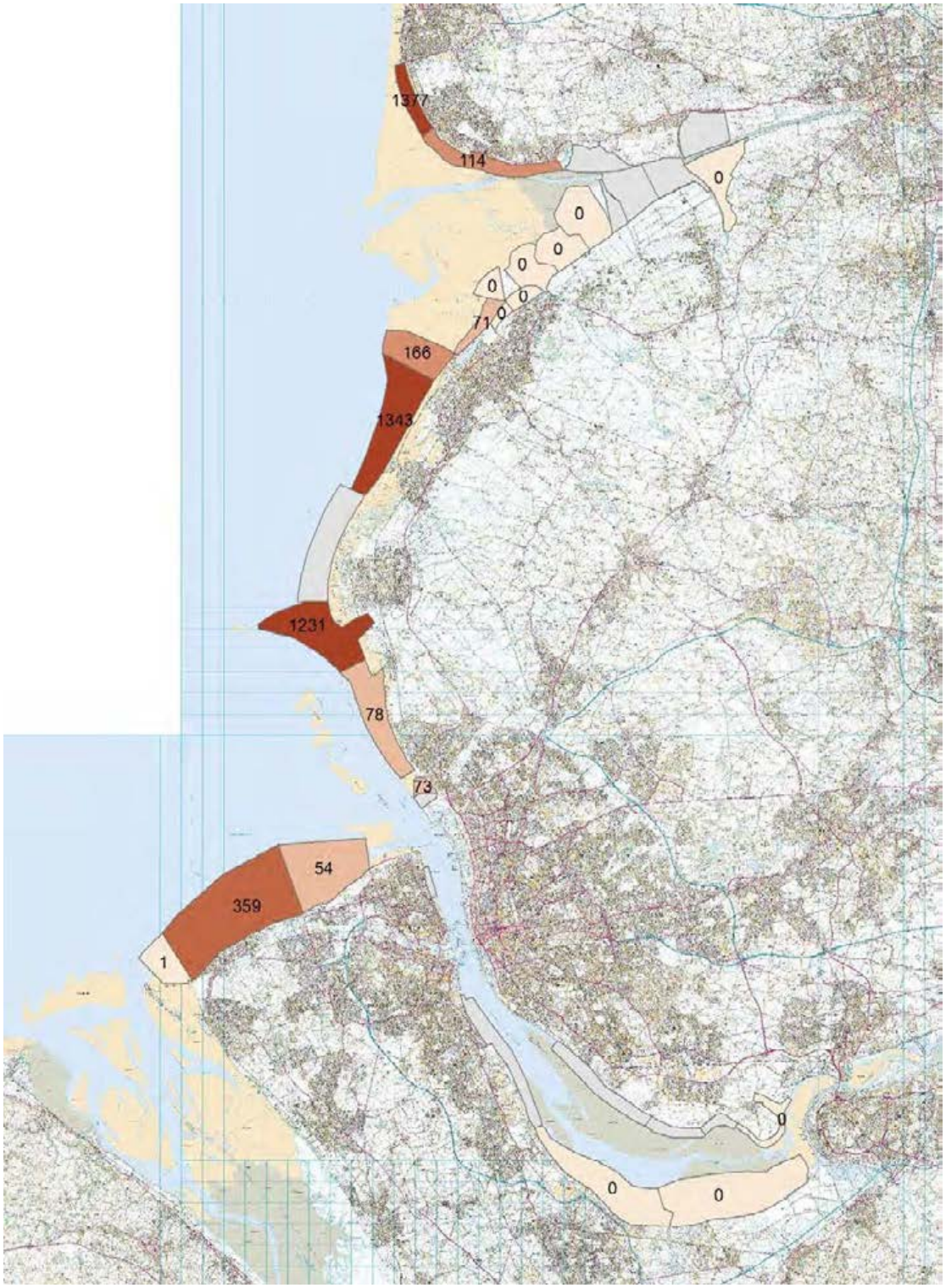

Figure A.5.51 5-year mean densities of Sanderling (2007/08 – 2011/12) in the Liverpool City Region

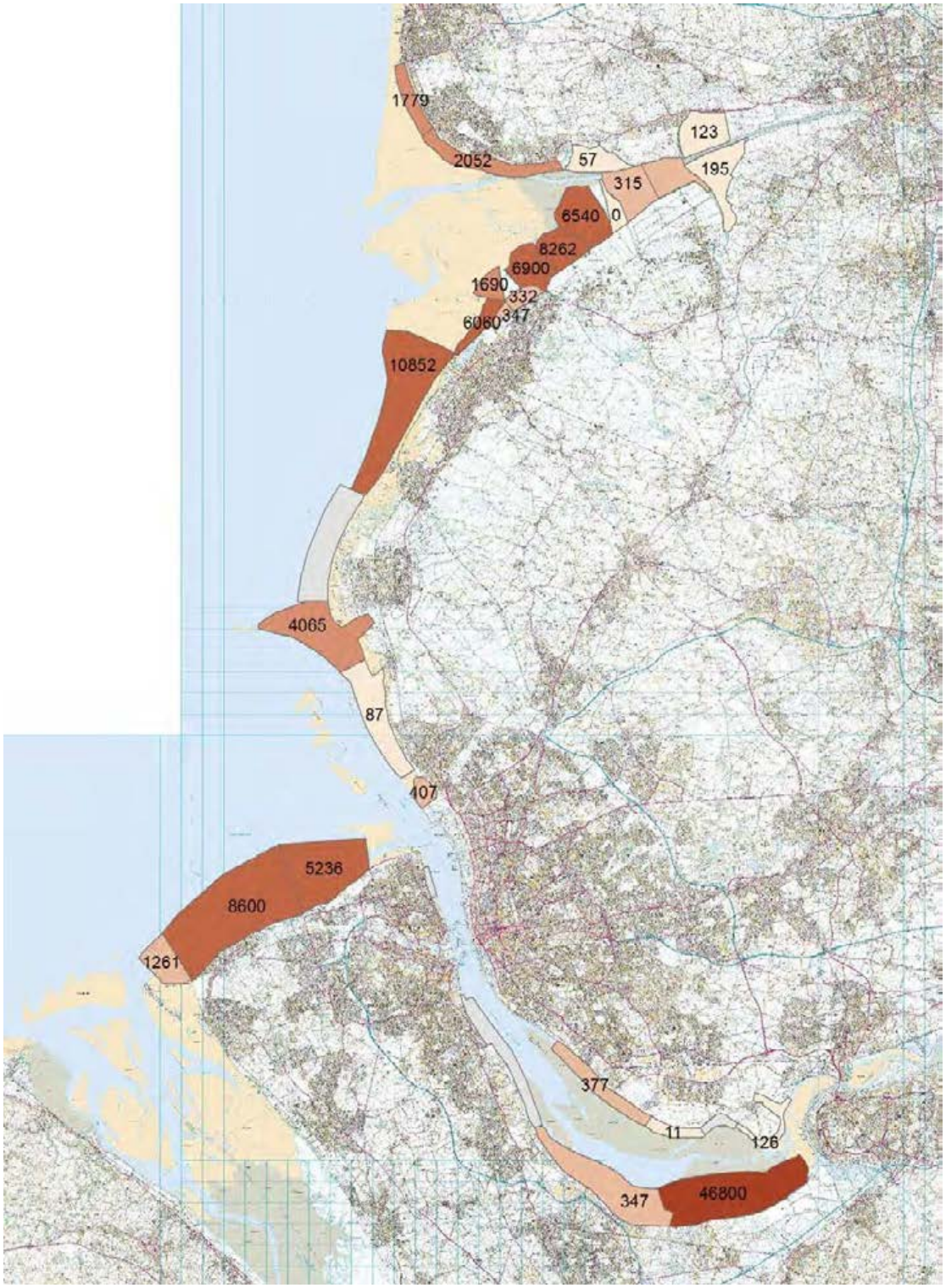

Figure A.5.52 5-year mean densities of Dunlin (1997/98 – 2001/02) in the Liverpool City Region

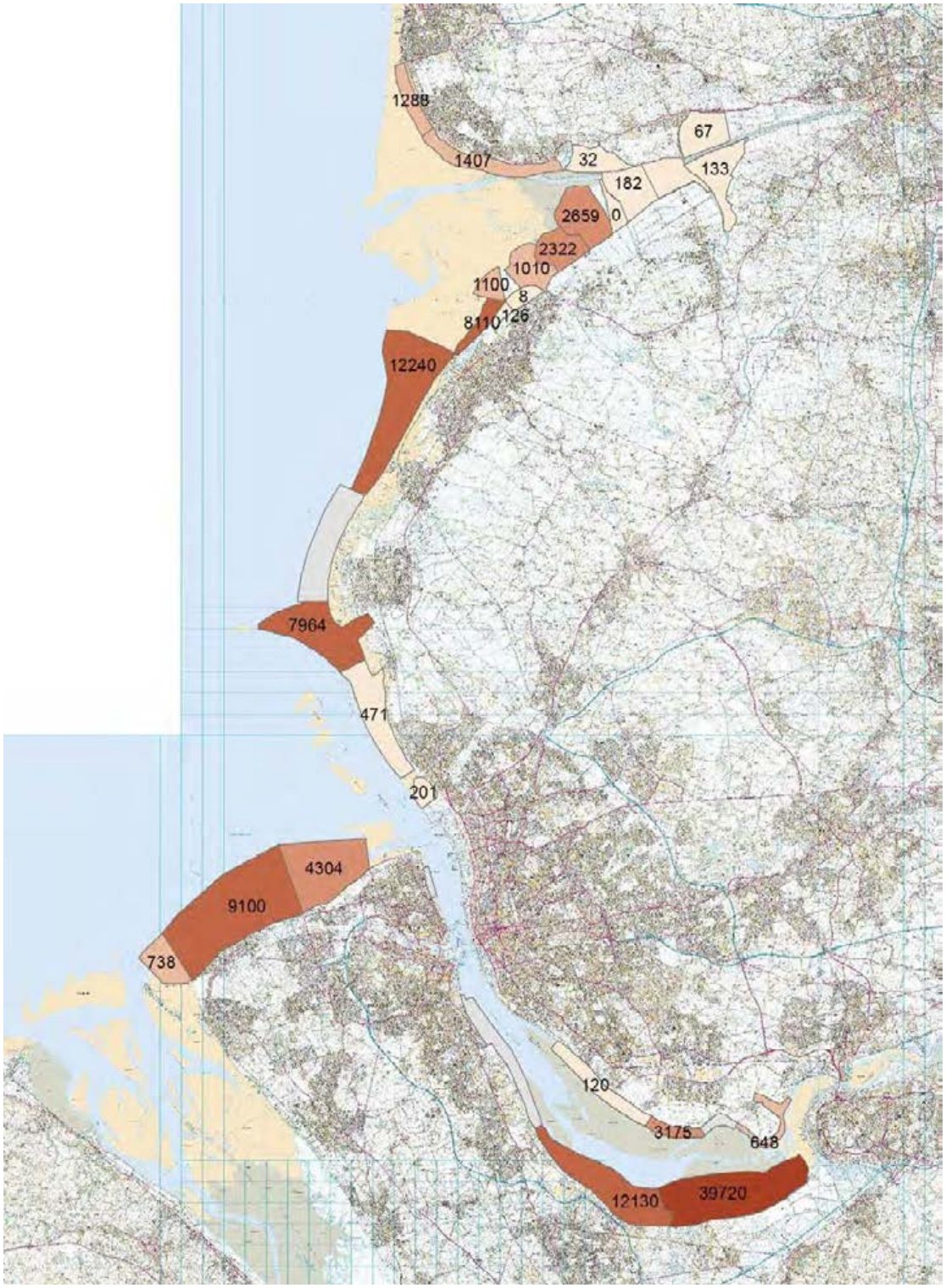

Figure A.5.53 5-year mean densities of Dunlin (2002/03 – 2006/07) in the Liverpool City Region

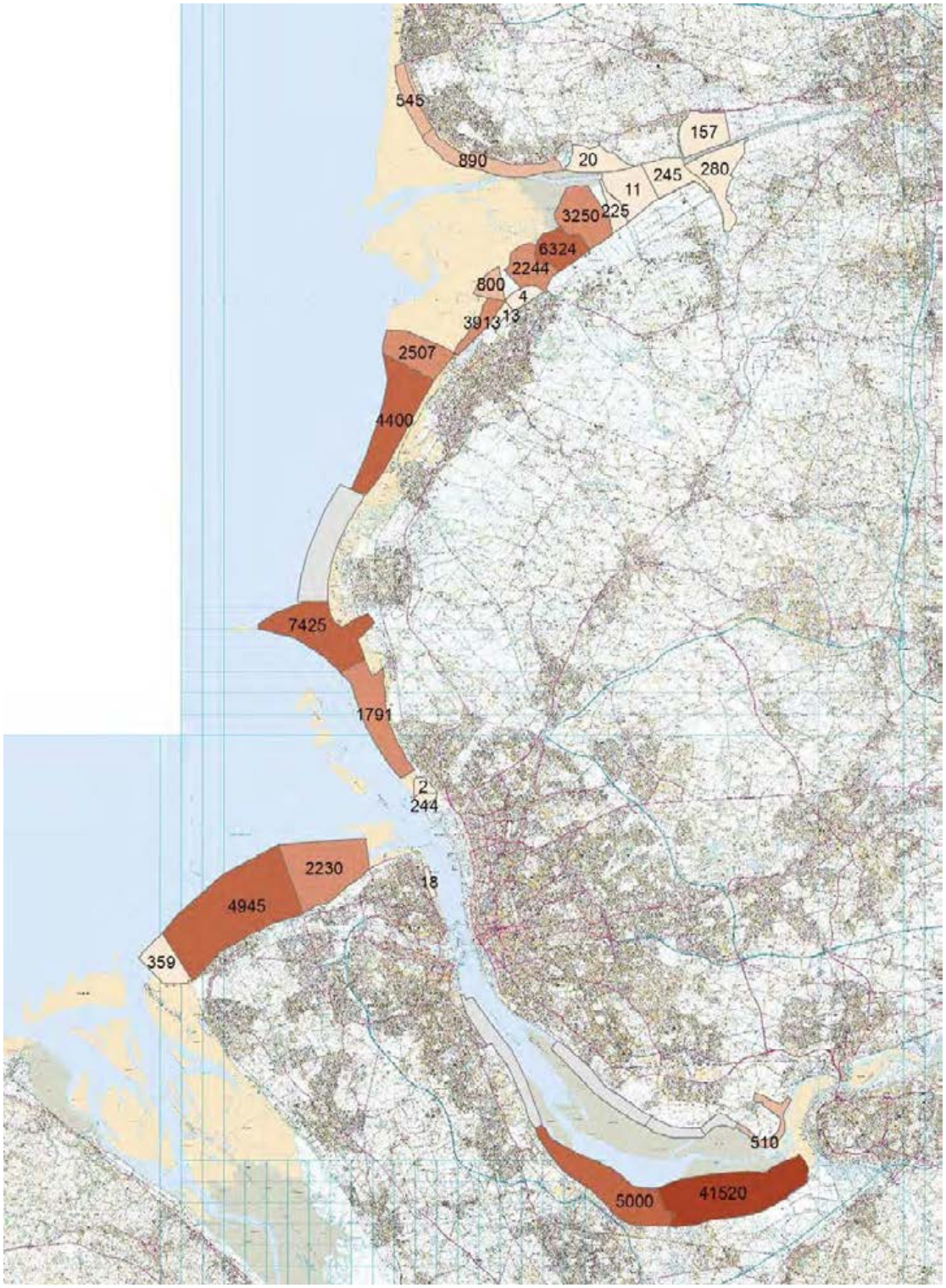

Figure A.5.54 5-year mean densities of Dunlin (2007/08 – 2011/12) in the Liverpool City Region

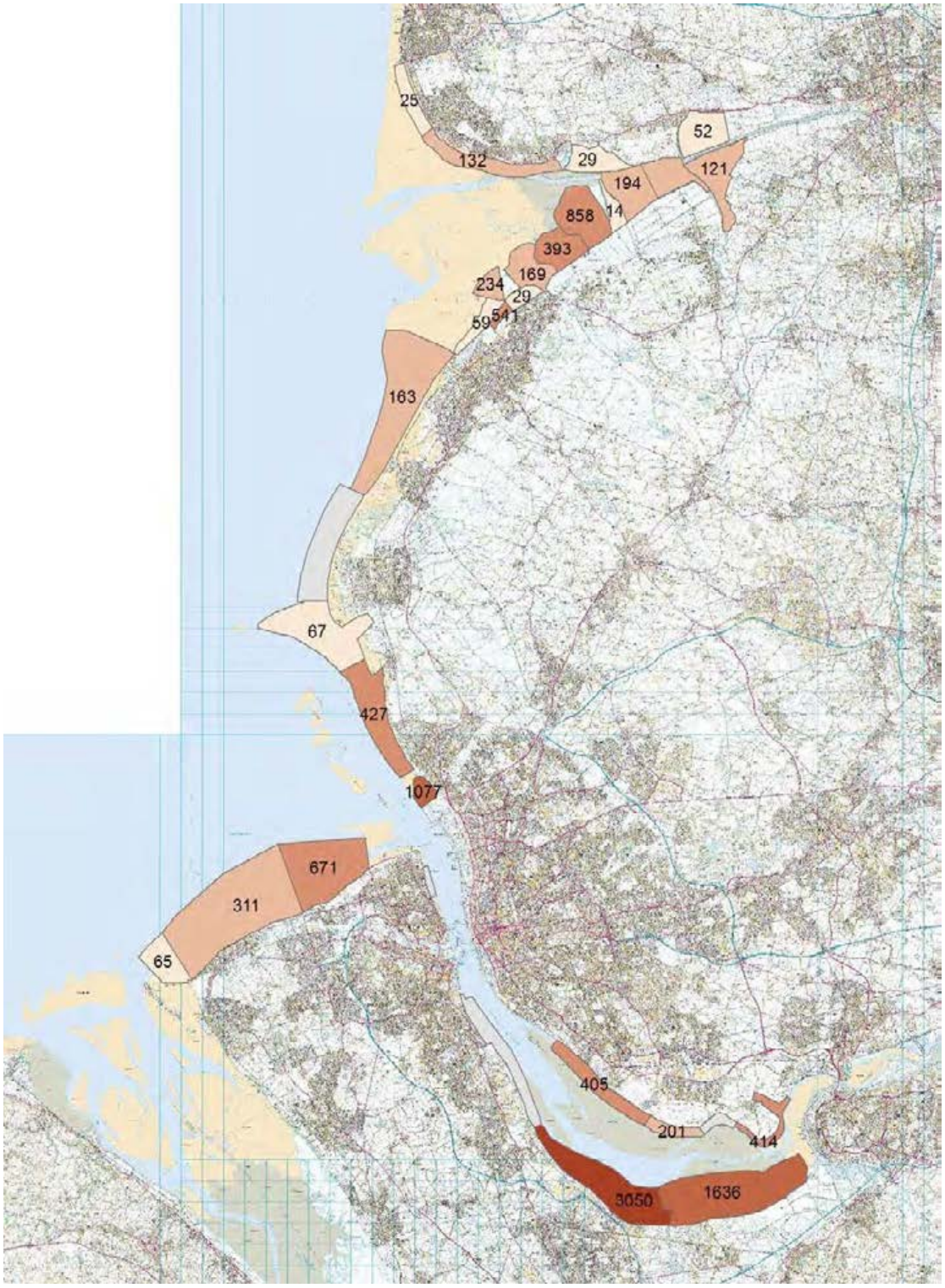

Figure A.5.55 5-year mean densities of Redshank (1997/98 – 2001/02) in the Liverpool City Region

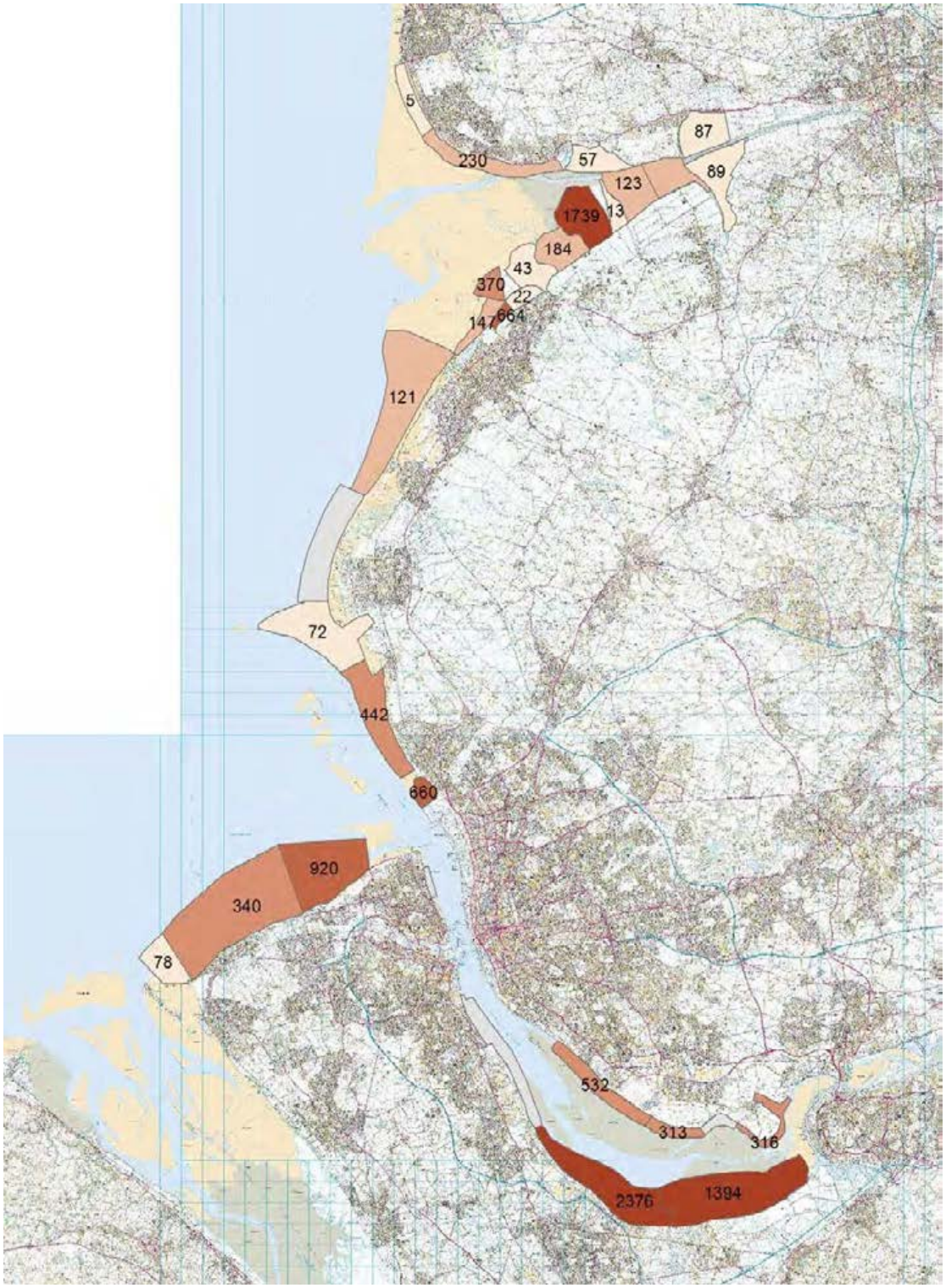

Figure A.5.56 5-year mean densities of Redshank (2002/03 – 2006/07) in the Liverpool City Region

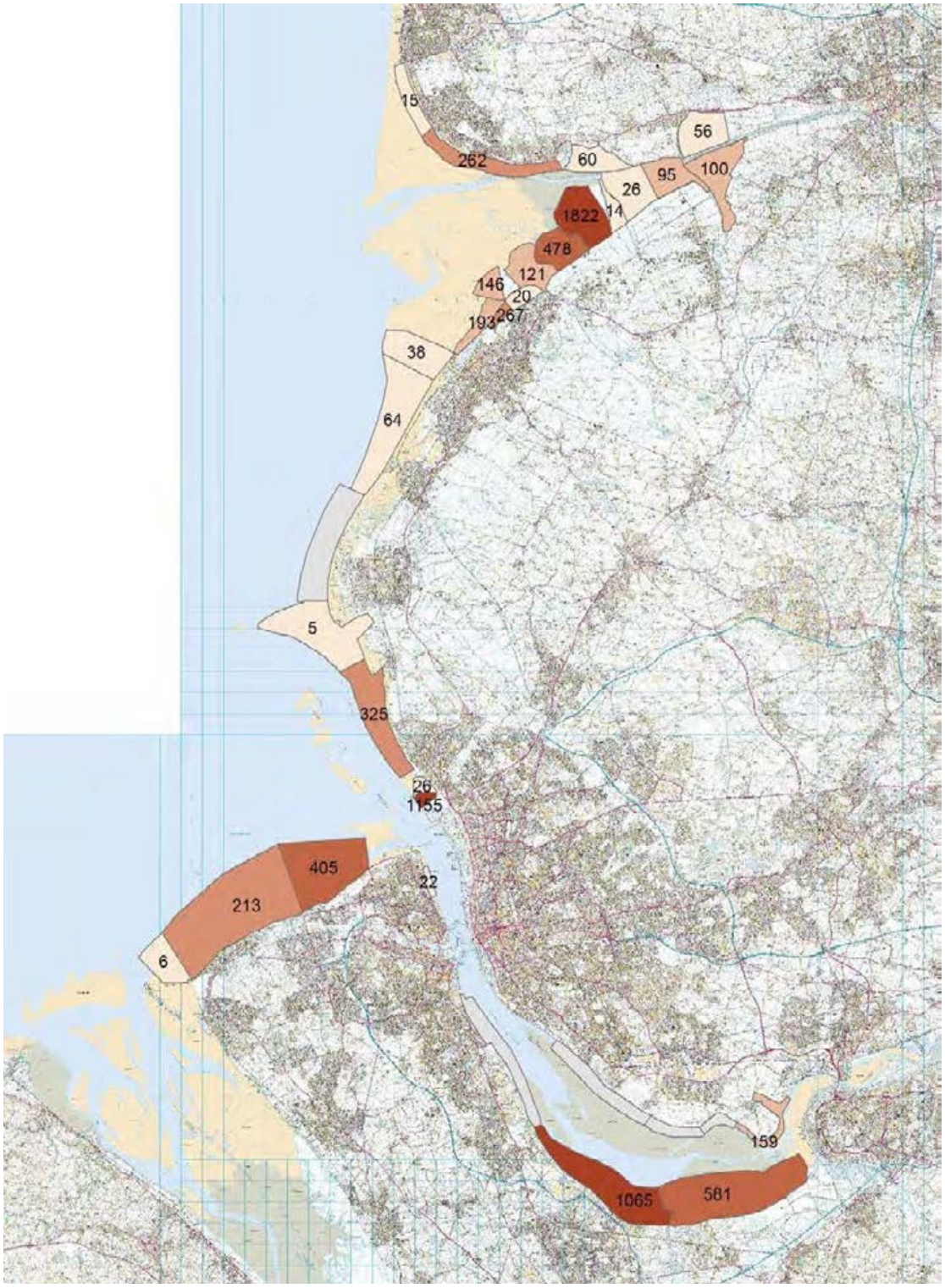

Figure A.5.57 5-year mean densities of Redshank (2007/08 – 2011/12) in the Liverpool City Region

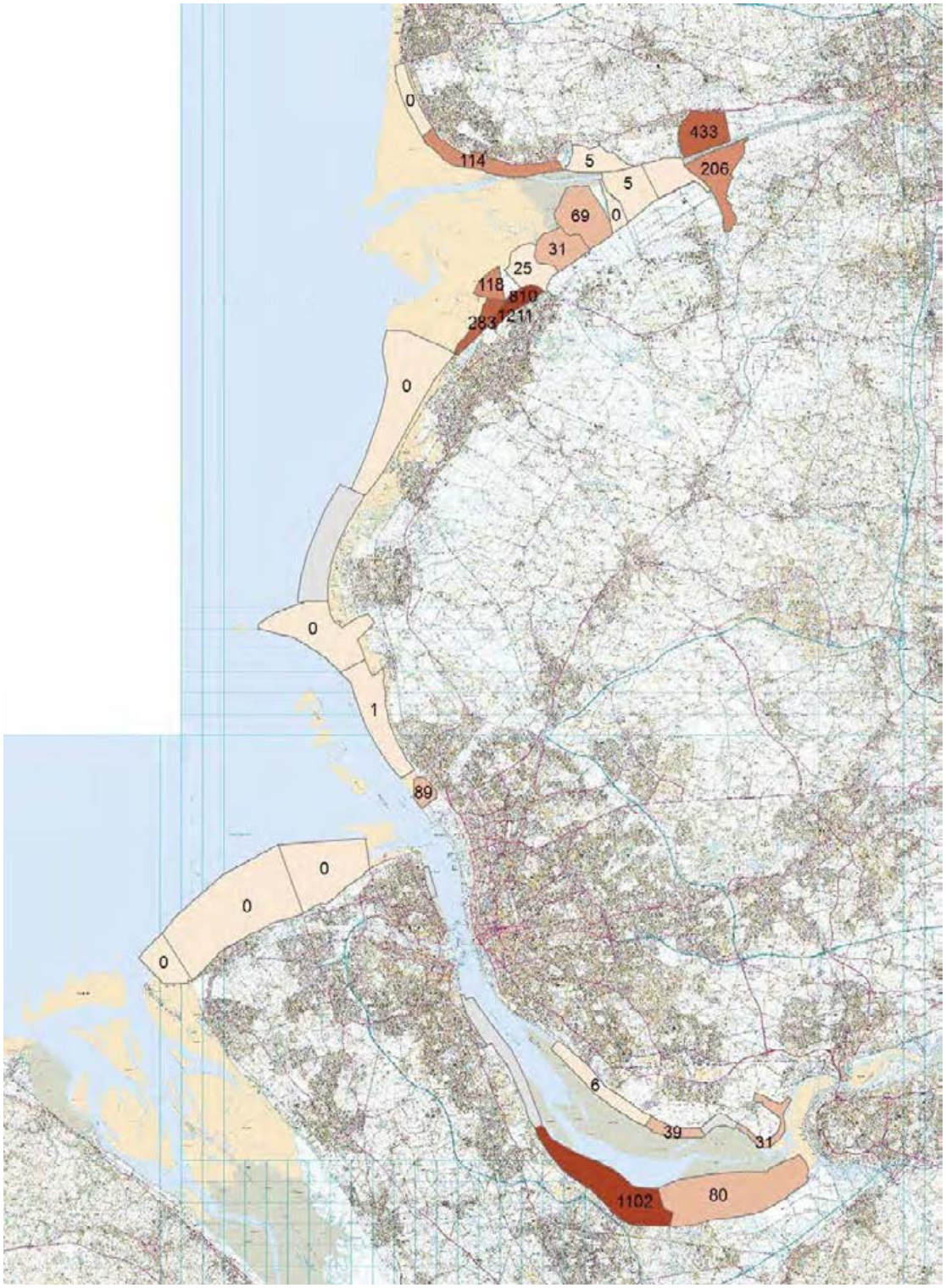

Figure A.5.58 5-year mean densities of Black-tailed Godwit (1997/98 – 2001/02) in the Liverpool City Region

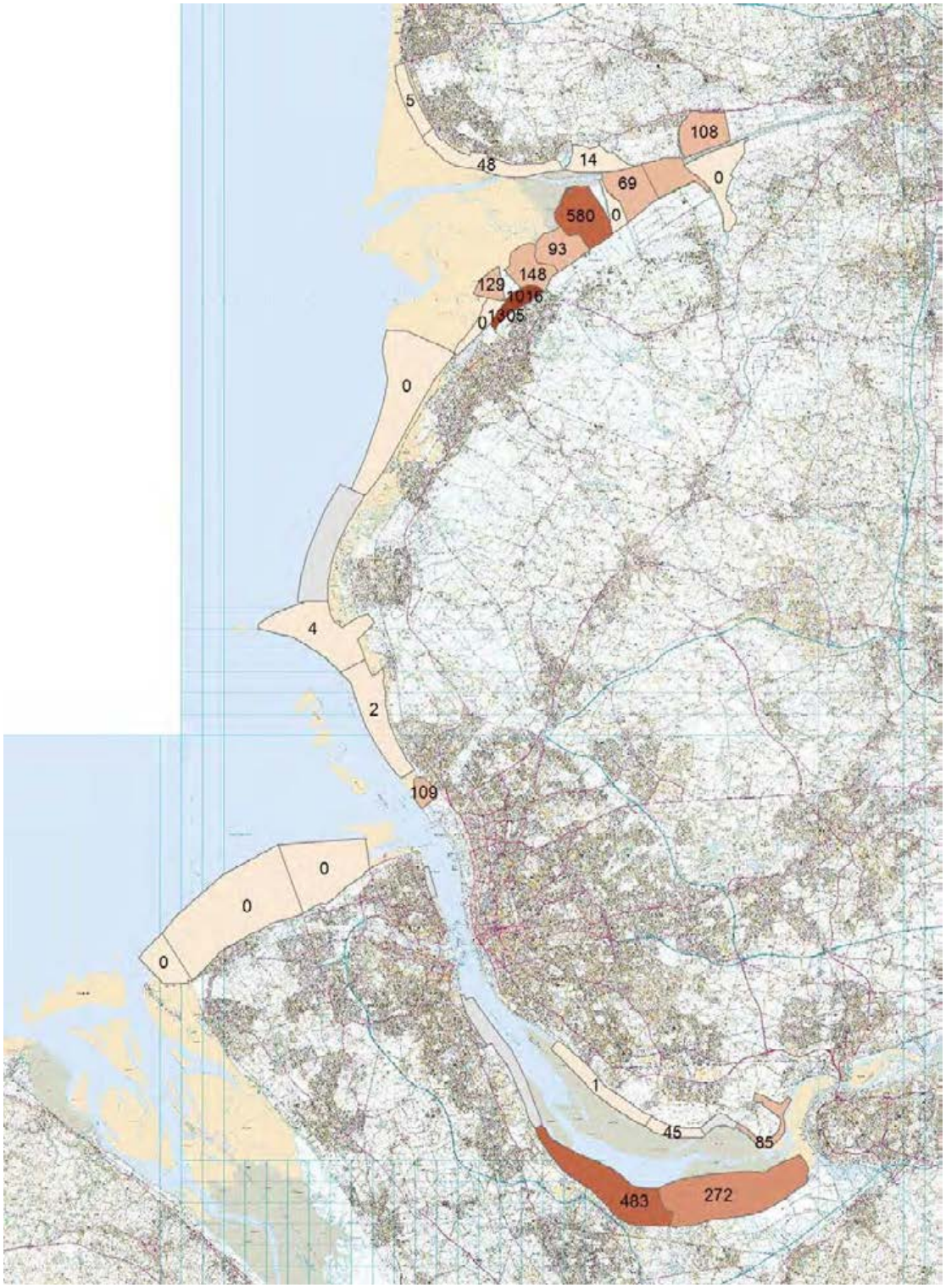

Figure A.5.59 5-year mean densities of Black-tailed Godwit (2002/03 – 2006/07) in the Liverpool City Region

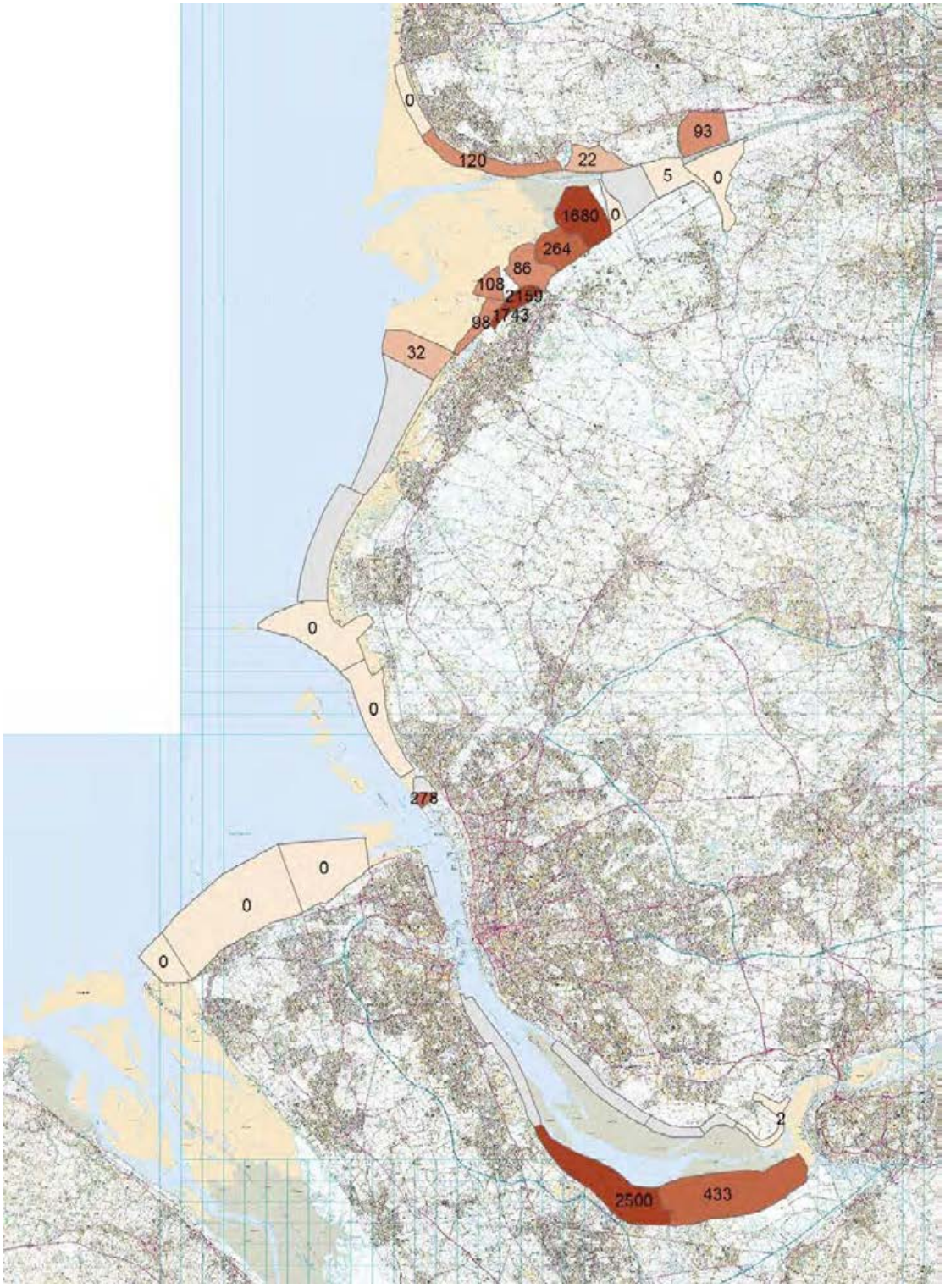

Figure A.5.60 5-year mean densities of Black-tailed Godwit (2007/08 – 2011/12) in the Liverpool City Region

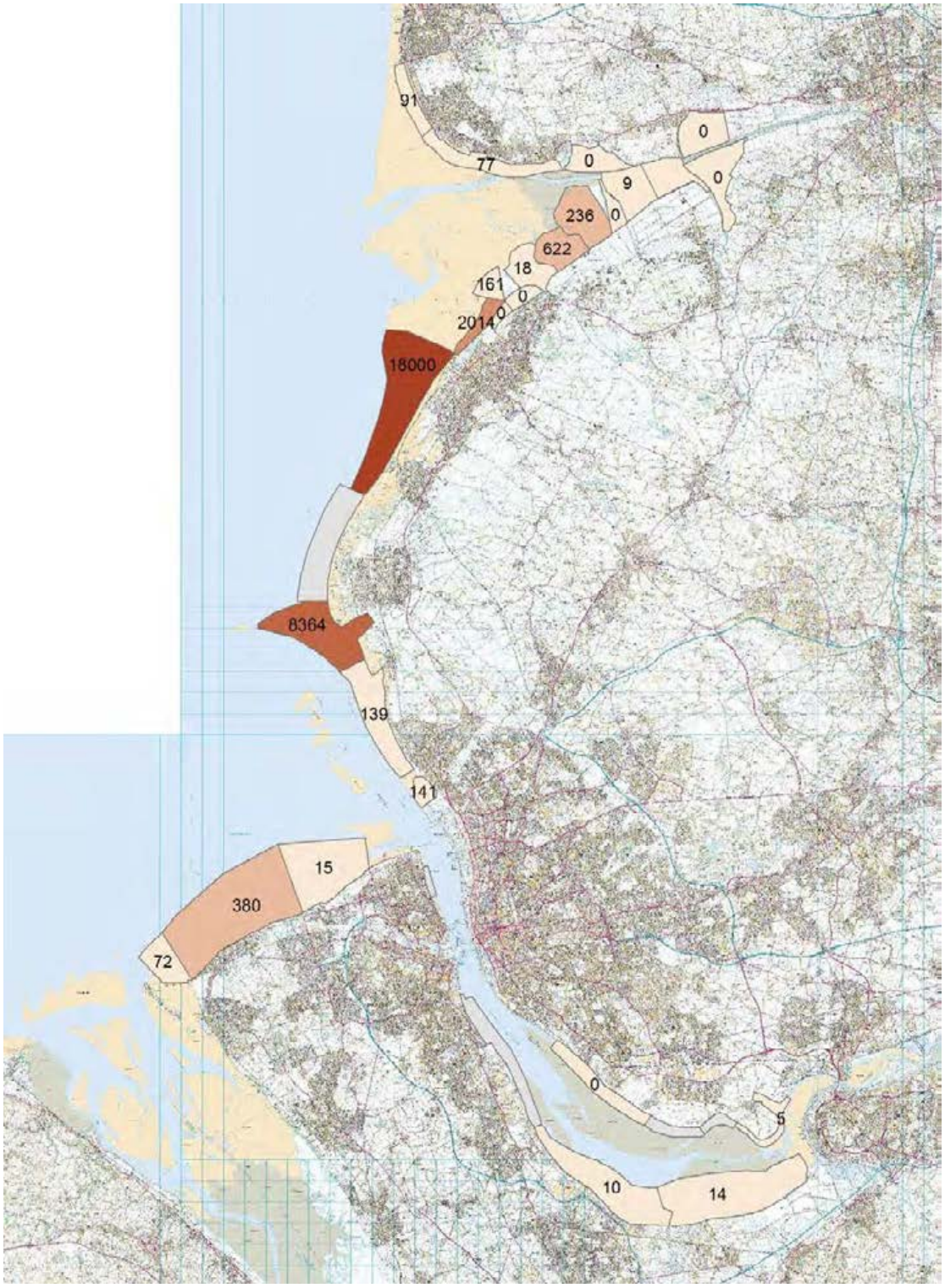

Figure A.5.61 5-year mean densities of Bar-tailed Godwit (1997/98 – 2001/02) in the Liverpool City Region

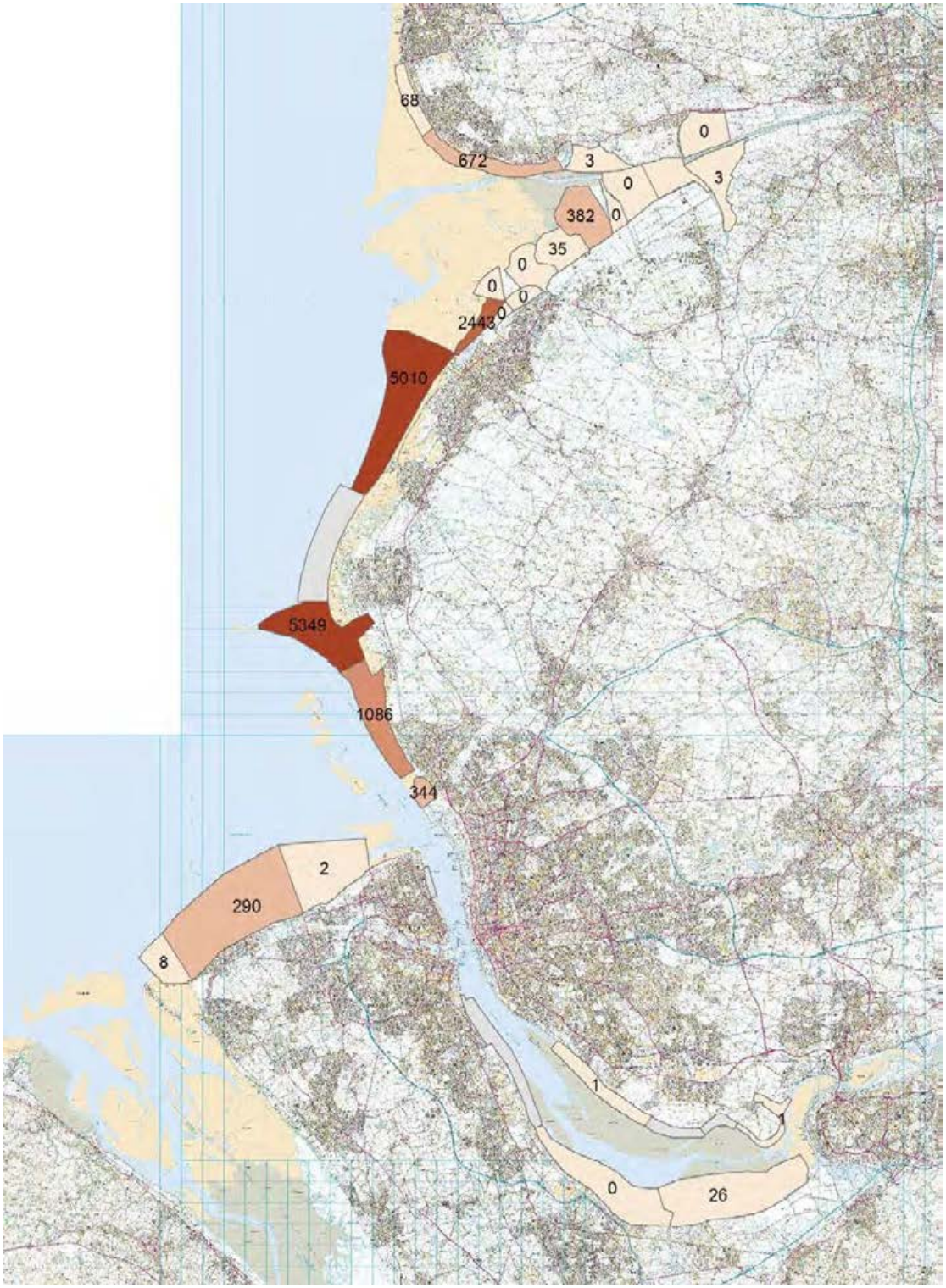

Figure A.5.62 5-year mean densities of Bar-tailed Godwit (2002/03 – 2006/07) in the Liverpool City Region

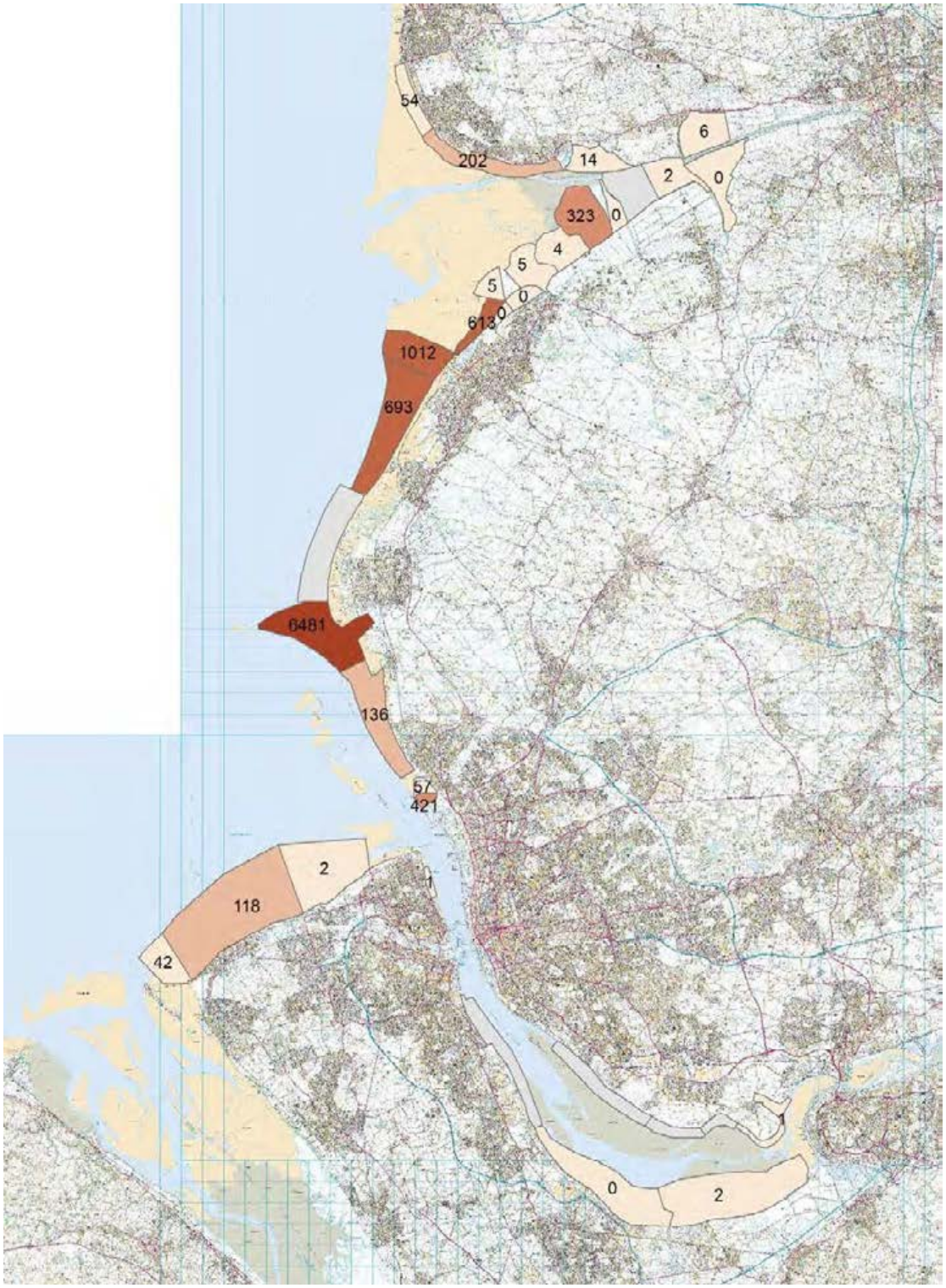

Figure A.5.63 5-year mean densities of Bar-tailed Godwit (2007/08 – 2011/12) in the Liverpool City Region

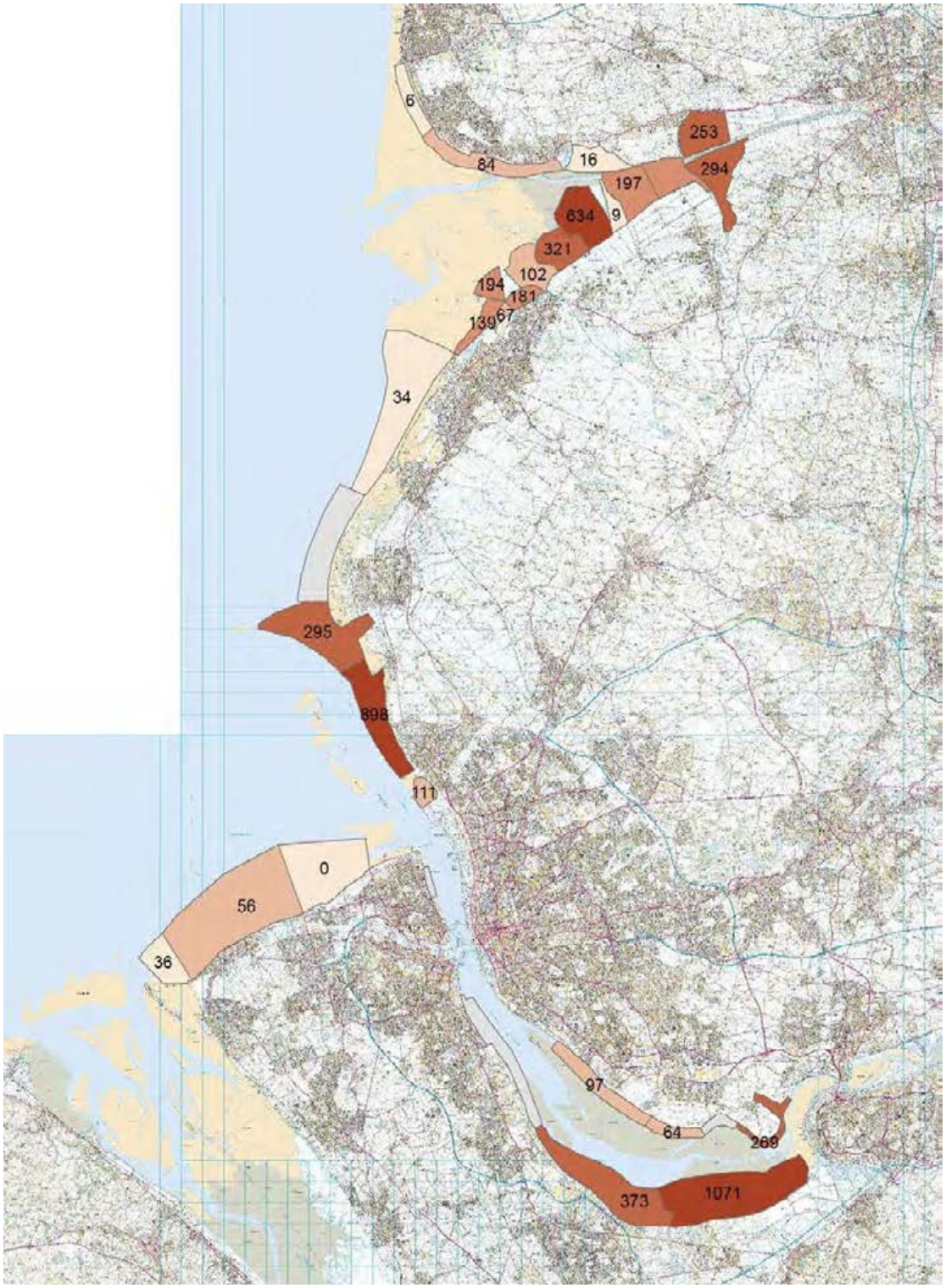

Figure A.5.64 5-year mean densities of Curlew (1997/98 – 2001/02) in the Liverpool City Region

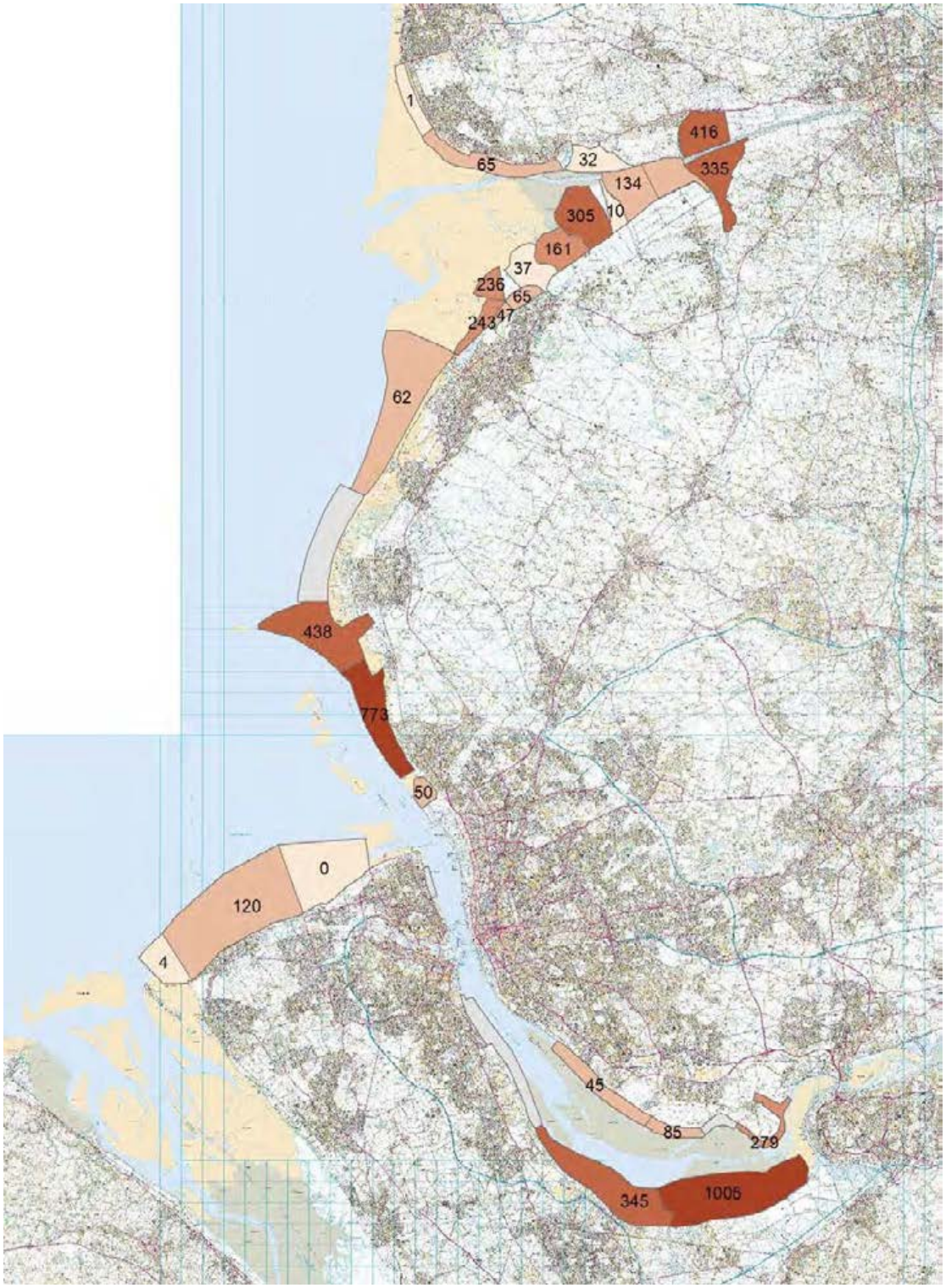

Figure A.5.65 5-year mean densities of Curlew (2002/03 – 2006/07) in the Liverpool City Region

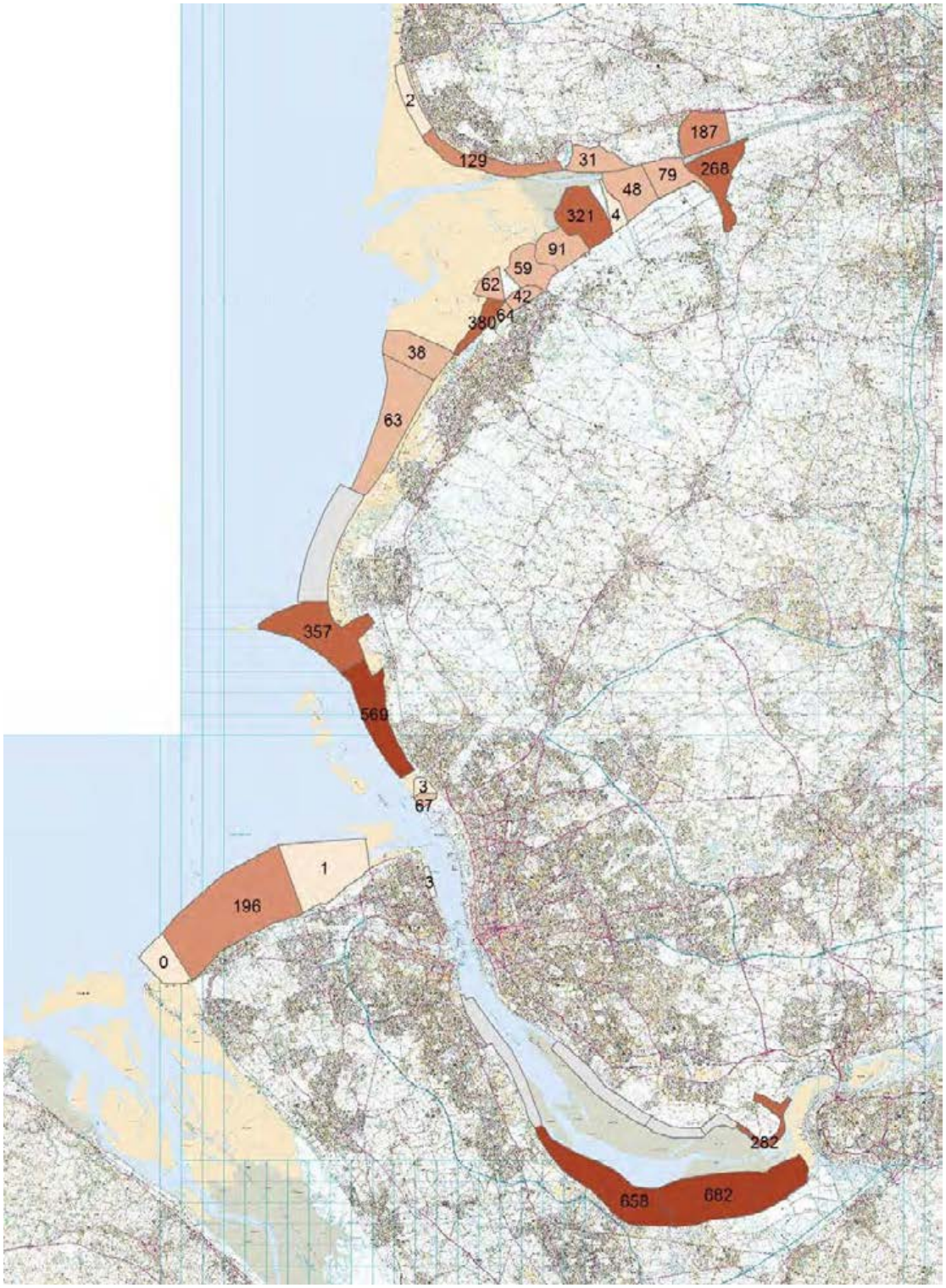

Figure A.5.66 5-year mean densities of Curlew (2007/08 – 2011/12) in the Liverpool City Region

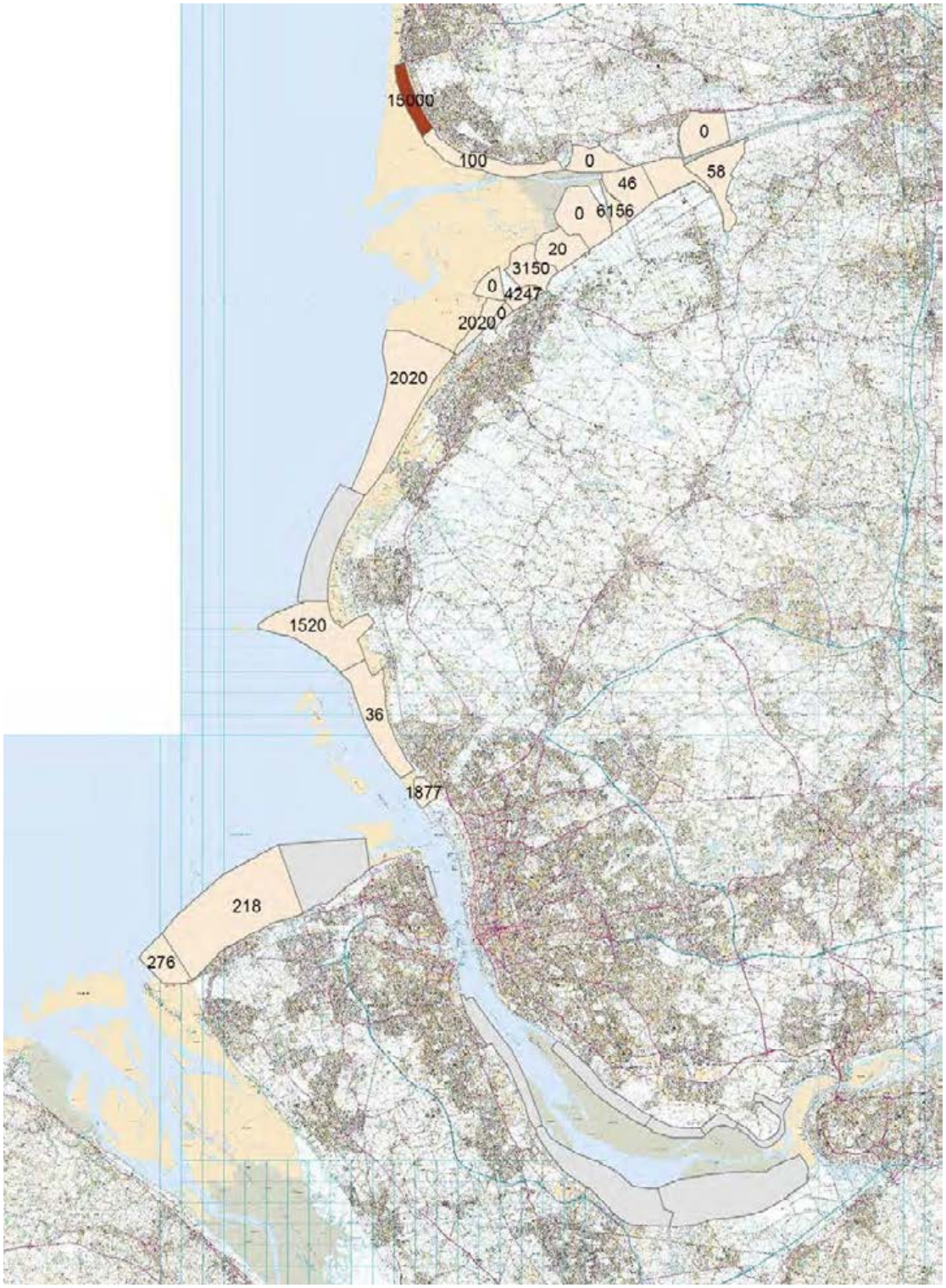

Figure A.5.67 5-year mean densities of Black-headed Gull (1997/98 – 2001/02) in the Liverpool City Region

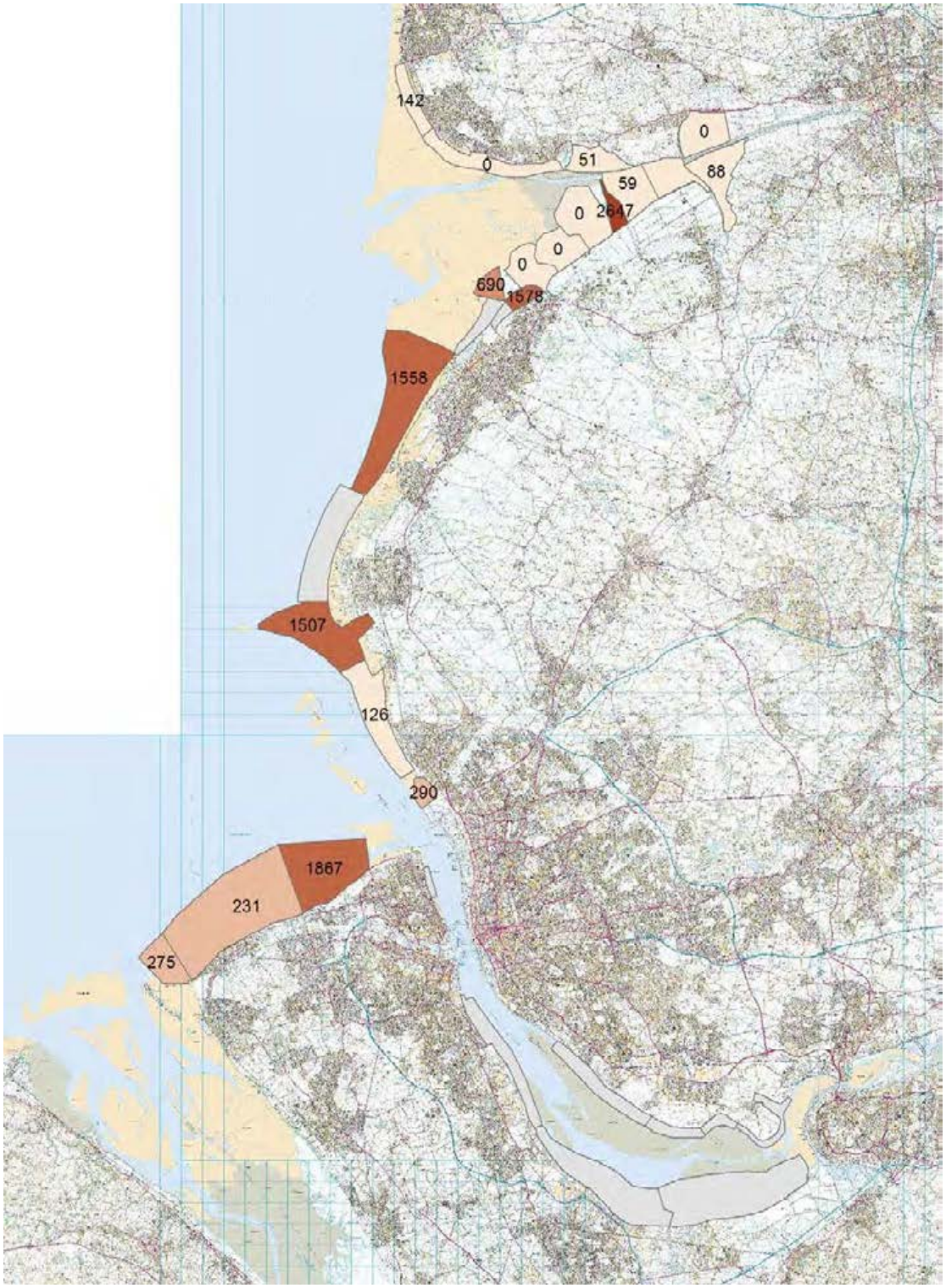

Figure A.5.68 5-year mean densities of Black-headed Gull (2002/03 – 2006/07) in the Liverpool City Region

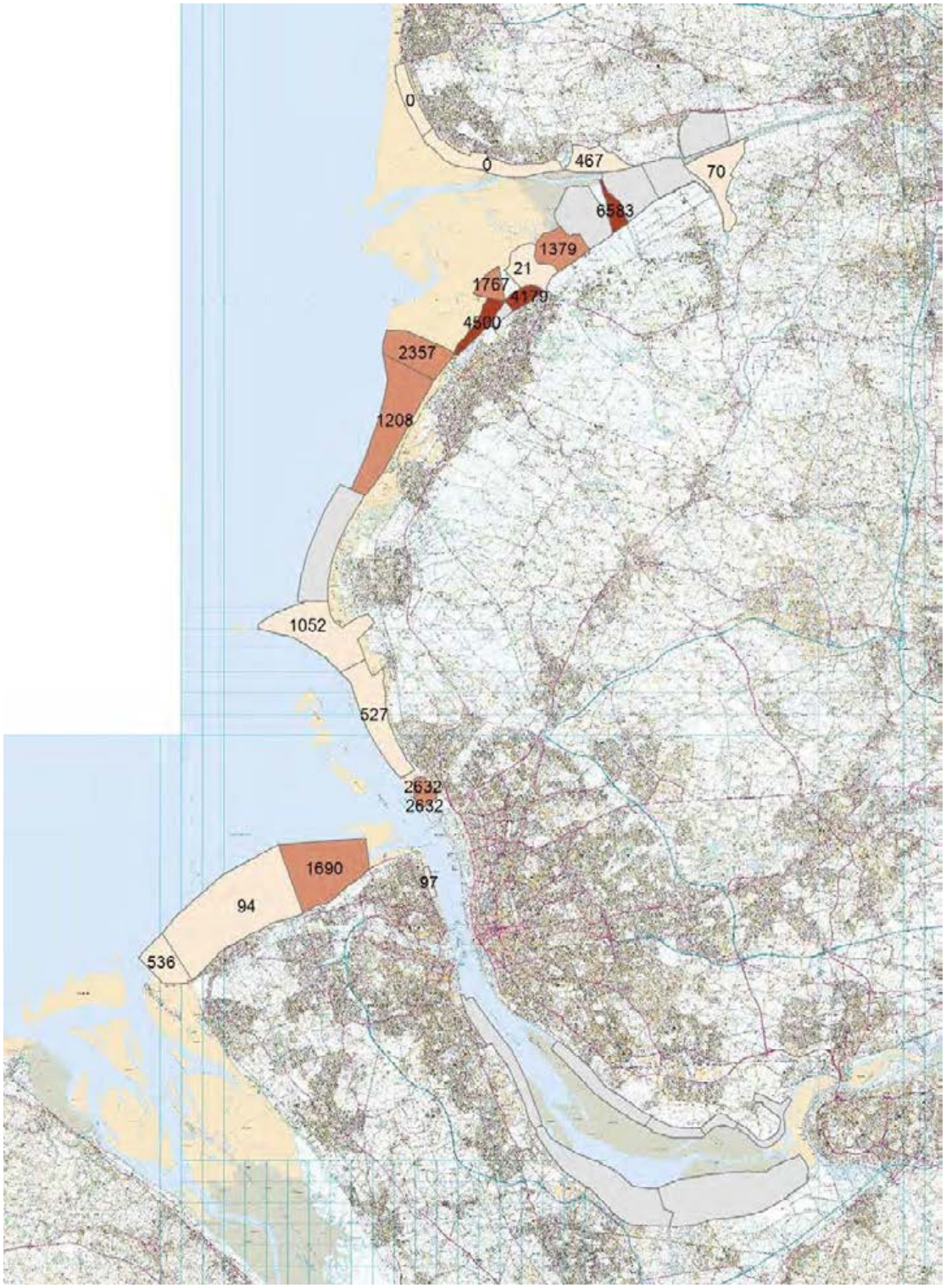

Figure A.5.69 5-year mean densities of Black-headed Gull (2007/08 – 2011/12) in the Liverpool City Region

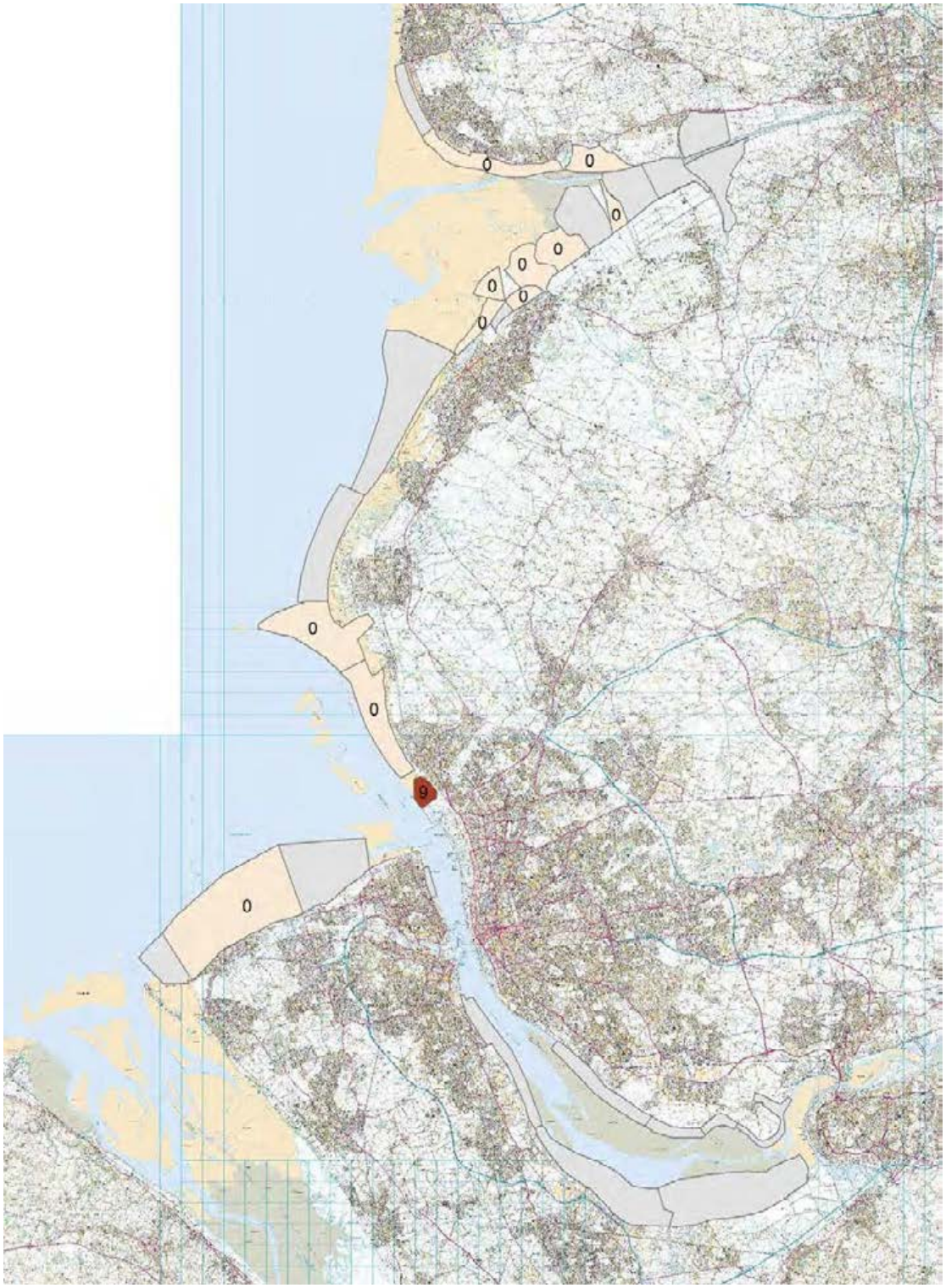

Figure A.5.70 5-year mean densities of Little Gull (1997/98 – 2001/02) in the Liverpool City Region

Figure A.5.71 5-year mean densities of Little Gull (2002/03 – 2006/07) in the Liverpool City Region

Figure A.5.72 5-year mean densities of Little Gull (2007/08 – 2011/12) in the Liverpool City Region