Natural England Commissioned Report NECR082

What do we know about the birds and habitats of the North Kent Marshes?

Baseline data collation and analysis

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Foreword

Natural England commission a range of reports from external contractors to provide evidence and advice to assist us in delivering our duties. The views in this report are those of the authors and do not necessarily represent those of Natural England.

Background

This research was commissioned by Natural England in 2009 to collate the available baseline evidence on birds and habitats of the international wildlife sites around the Swale, Medway and Thames estuaries. Information on factors affecting the sites was also collated and any conclusions that could be drawn from the existing data were made.

The report recommends further research to determine the reasons behind the declines in certain bird species in order to better understand the various causal factors.

Natural England will use the report to inform partner organisations on further research needs to understand the impacts of growth on these important sites and to work with our partners to help protect the wildlife of this important area.

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Further information
This report can be downloaded from the Natural England website: **www.naturalengland.org.uk**. For information on Natural England publications contact the Natural England Enquiry Service on 0845 600 3078 or e-mail **enquiries@naturalengland.org.uk**.

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Summary

This report focuses on three European Protected Sites in Kent, namely the Thames Estuary and Marshes; the Medway Estuary and Marshes and The Swale. The three sites are designated as Special Protection Areas (SPAs) and also as Ramsar Sites and form a contiguous swathe of coastal habitats along the north Kent shore. The designations reflect the importance of the area for wintering waterfowl, breeding waterfowl, breeding and wintering raptors and also encompass a range of rare plant and invertebrate species.

The three sites are under pressure from a suite of potential impacts. Lying so close to London, connected to the city by the high speed rail link, and also lying close to major ports, north Kent is of considerable strategic economic importance. Much of the area lies within the Thames Gateway Growth Area, a Government priority for regeneration and economic development. A real and current issue for nature conservation in the UK is how to ensure the integrity of key sites in the context of development and other pressures. There is now a strong body of evidence showing how increasing levels of development, even when well outside the boundary of protected sites, can have negative impacts on the sites. The SPA and Ramsar designations bring particular and strict legal requirements relating to plans and projects which are not for nature conservation management.

In this report we collate existing baseline information relating to the three European Sites, summarising the designated interest features, their status and trends, habitat issues and potential threats. The aim of the work is to provide these data in a way that is easy to access and available to others. It also provides an assessment of where there are gaps in our knowledge about the European sites. It will be used in a variety of ways, including:

- Providing clear further steps for additional research to further understand the issues and ensure compliance with national and European legislation
- Guiding Natural England's input into the LDF process and advice to local authorities
- Helping land managers and conservation practitioners to manage the SPAs.

The report highlights that there have been marked declines for some wintering bird species in North Kent, especially on the Medway, where 14 bird species have undergone recent declines of 25% or more. The reasons for these have not been clarified and further work will be necessary to determine the cause of the declines.

The report has identified a lack of information on the Ramsar interest features, particularly for some of the invertebrates.

Key issues and potential threats to the European sites include:

- Predicted changes in the extent of key habitats as a result of coastal squeeze will mean a loss of mudflat habitat, particularly on the Medway, over the next 100 years.
- Recreational use of the area appears to be increasing and includes a wide range of shore based, water based and air-borne activities. Anecdotal reports indicate that micro-lights, helicopters and small aeroplanes; pleasure boats; birdwatchers; bait diggers; cyclists, dog-walkers and fishermen all cause disturbance to wintering waterfowl.
- North Kent will be one of the first areas in the country to see enhanced coastal access through the Marine and Coastal Access Act. There is relatively little data on shore-based recreation or visitor access patterns.
- Existing levels of housing are high, with the Medway having the most amount of current housing directly adjacent to the SPA boundary.

- Future changes to the general area will include high levels of new development, resulting in new housing, employment sites and new infrastructure. It is currently not possible to determine the potential in-combination impacts of these changes.

There is a clear need for further research to understand the declines in the bird numbers and to understand the various issues in more detail. We set therefore also set out a costed plan for research and monitoring that will address the issues identified within the main text of the report.

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1 Introduction

Overview

1.1 This report focuses on an area of North Kent adjoining the Thames Estuary, where there are particular pressures on three international wildlife sites (see also Map 1):

- The Thames Estuary and Marshes
- Medway Estuary and Marshes
- The Swale

1.2 The report sets out a baseline assessment of the three sites. It aims to collate all existing information on the three European and international wildlife sites, and examine in detail the relevant interest features for the three sites, their current sensitivities and likely impacts that may affect those interest features. The purpose of the report is to provide all relevant and current information within one document, which can then be used in any assessment of impacts and pressures upon the three sites, and enable a better understanding of how various impacts might affect the sites either individually or collectively.

1.3 A real and current issue for nature conservation in the UK is how to ensure the integrity of key sites in the context of development and other pressures. There is now a strong body of evidence showing how increasing levels of development, even when well outside the boundary of protected sites, can have negative impacts on the sites. The issues are particularly acute in southern England, where work on heathlands (Clarke, Liley and Sharp 2008, Liley and Clarke 2003, Mallord 2005, Sharp et al. 2008, Underhill-Day 2005) and coastal sites (Liley, Sharp and Clarke 2008, Liley and Sutherland 2007, Randall 2004, Saunders et al. 2000, Stillman et al. 2009) provides compelling indications of the links between housing, development and nature conservation impacts.

1.4 The nature conservation impacts of development are varied, for example development can result in increased fragmentation, changes in levels of access (and therefore potentially disturbance and other impacts from access) on adjacent sites, reduced water availability, eutrophication from run-off and discharge. Such impacts need to be considered in context with climate change, and for coastal sites, sea-level rise and legislation to enhance access to the countryside through improved coastal access.

1.5 The report provides a summary of the conservation interest of these sites and an overview of the current status of the sites, potential threats and further work needed to understand the issues.

The area of study

1.6 The area of study is the northern part of the county of Kent, which encompasses a suite of three Special Protection Areas (SPAs), also listed as international wetlands under the Ramsar Convention, that form a swathe of wetland, marsh and intertidal habitat along the Thames and Medway Estuaries. The North Kent and Medway area forms part of the renowned ‘Thames Gateway’, a focal point for economic regeneration and growth for the south east region. It is therefore critical that information on the natural environment in North Kent, and factors that may impact upon and degrade such assets, is brought together, collectively understood and appropriately used by all involved with the sustainable development of the area. In order to appreciate the importance of a co-ordinated and robust approach to tackling the range of impacts upon the three sites, it is essential to understand the high level of development pressure arising from the regional, national and international economic importance of the Thames Gateway.

Economic and social value of the area

1.7 The Thames Gateway is a key priority of Central Government, and the sustainable development and regeneration of the Gateway is co-ordinated by a ministerial-led partnership. This oversees the three partnerships taking regeneration forward in the three sub areas of the Gateway, Kent, London and South Essex. The Thames Gateway Strategic Framework guides the delivery of the Government's Sustainable Communities Plan. The South East Plan set a housing target for the Kent Thames Gateway of 53,140 net additional dwellings by 2026[1].

1.8 The Thames Gateway Kent Partnership is one of the three public and private sector partnerships, and is driving forward the Strategic Framework in Kent. The Department for Communities and Local Government is funding £230 million of projects in the North Kent area[2]. Government investment priorities in the area, in line with the strategic framework for the whole gateway, span a range of projects including brownfield remediation, land assembly, new transport infrastructure, environmental and cultural enhancements, town centre regeneration and better education and skills facilities for local communities.

1.9 Kent is a currently a place of change. With the strong driving force of the Gateway partnerships, spatial planning has a strong economic focus and County and District level spatial planning documents set out aspirations for economic regeneration across the county. Kent County Council recently commissioned the renowned architect Terry Farrell to prepare '21st century Kent – a blueprint for the county's future'[3] in order to set out challenging aspirations for the future of sustainable development in the county. This document describes Kent as the UK's 'front door.' Its close proximity to London, it's key role in trade with mainland Europe (through the ports of Dover, Medway and Sheerness), all push the county forward as a key part of the UK economy.

1.10 The area is of increasing interest to international investors and developers. According to the 21st Century Kent document, Kent has the UK's largest quantity of high quality affordable development land, stating that Kent has unrivalled opportunities for high value business and housing growth. The key aspirations within the document for the transformation of Kent and its coast, reflecting and complementing the objectives of the South East Plan, include:

- Accommodating major new communities, linked to the capital.
- The amalgamation of towns in Medway to create a new city, which will be the hub of clean power generation, and will have strengthened links to Europe.
- Ashford's population doubling in size, with the town undergoing significant expansion and regeneration. Transport connections to the European mainland will be significantly improved.
- The £400m port expansion at Dover will attract 2,500 new jobs.
- The Kent coast will be an international destination for water sports, cultural activities and festivals.
- The North Kent coast is a haven for recreational activities, (both water and land based) and a large number of businesses are reliant upon this visitor trade. The aim is to increase and promote these activities. The area also has significant cultural links to music, art and literature and is therefore regularly host to a number of festivals and cultural events.
- With significant government funding, the coast will be renowned for its green energy generation, with wind and tidal power, along with energy crops, contributing to the economy of the area. The

[1] Policy KTG4

[2] The Thames Gateway Kent Partnership website, 2009 **www.tgkp.com**

[3] **https://shareweb.kent.gov.uk/Documents/council-and-democracy/policies-procedures-and-plans/plans/21st-century-Kent5.pdf**

government is promoting the gateway as its primary ‘eco-region’; where green energy is at the forefront of all large scale economic development projects.

- Manston airport will form part of the national airport network, further high speed rail links and improvements to the A21 corridor will vastly improve connectivity locally, nationally and across to Europe.
- Increased capacity of public transport.

The natural environment

1.11 The natural environment of the North Kent coast is also an area of change. The dynamic coast can bring almost daily changes, as the sea shifts sediments around the gateway, exacerbated by shipping and periodic dredging, thus resulting in a rapidly changing landscape of the seabed and intertidal areas. The Thames Estuary as a whole is affected by two tidal influences; the North Sea entering the estuary from the north, and the English Channel entering the estuary from the south. The area is important for fish stocks and offers vital spawning grounds for a number of species.

1.12 The natural environment outside the SPA boundaries is rich in biodiversity and high quality landscapes, with a range of national and local designations, together with RSPB reserves and local nature reserves (see Map 2). A key element of the North Kent coast as a tourist destination is its rich natural heritage set against the landscapes and seascapes of the area. The chain of three SPAs running along the North Kent coast provides an outstanding array of waders and waterfowl, either visiting the site briefly whilst on passage, settling overwinter, or taking advantage of the rich invertebrate food supplies of the intertidal habitats and staying to breed over the summer.

1.13 The three European sites are the Thames Estuary and Marshes SPA, Medway Estuary and Marshes SPA and The Swale SPA. All three sites are also listed as Ramsar sites, as wetlands of international importance supporting a wide range of species and habitats associated with wetlands. Further information on the Ramsar site listings and relevant features of interest for each site are provided in the following section. Directly abutting the seaward boundary of the three sites is the marine protected area, Outer Thames Estuary SPA, designated for its wintering population of red-throated diver, which are generally found in waters up to approximately 20 metres deep, feeding on small fish species.

1.14 It is the three coastal SPA and Ramsar listed sites that are the subject of this assessment, which collates and reviews all available bird data, habitat data and disturbance research, in order to provide a comprehensive baseline of evidence that will enable conformity of evidence used in the range of forthcoming assessments for the North Kent area, guiding coastal access, sustainable land use planning and practical land management.

SPA classifications and relevant interest features

1.15 The three sites run along the North Kent coast from the inner estuary in the west to the eastern mouth opening out to the North Sea. From west to east, they are the Thames Estuary and Marshes, the Medway Estuary and Marshes and the Swale.

1.16 The Thames Estuary and Marshes SPA extends for about 15 km along the south side of the estuary and also include intertidal areas on the north side of the estuary. To the south of the river, much of the area is brackish grazing marsh, although some of this has been converted to arable use. At Cliffe, there are flooded clay and chalk pits, some of which have been in-filled with dredgings. Outside the sea wall, there is a small extent of salt marsh and broad intertidal mud-flats.

1.17 The Medway Estuary feeds into, and lies on, the south side of the outer Thames Estuary and forms a single tidal system with the Swale, joining the Thames Estuary between the Isle of Grain and

Sheerness. It has a complex arrangement of tidal channels, which drain around large islands of salt marsh and peninsulas of grazing marsh. The mud-flats are rich in invertebrates and also support beds of green algae and some eelgrass *Zostera*. Small shell beaches occur, particularly in the outer parts of the estuary. Grazing marshes are present inside the sea walls around the estuary.

1.18 The Swale is an estuarine area that separates the Isle of Sheppey from the Kent mainland. To the west it adjoins the Medway Estuary. It is a complex of brackish and freshwater floodplain grazing marsh with ditches, and intertidal salt marshes and mud-flats. The intertidal flats are extensive, especially on the east of the site, and support dense invertebrate fauna and beds of algae and eelgrass. Locally there are large mussel Mytilus beds formed on harder areas of substrate. The SPA contains the largest extent of grazing marsh in Kent (although much reduced from its former extent). There is much diversity both in the salinity of the dykes (which range from fresh to strongly brackish) and in the topography of the fields.

1.19 All three sites qualify for classification as SPAs under the European Birds Directive. This European Directive sets out the requirements for Member States to classify sites that are important for rare and vulnerable birds listed at Annex 1 of the Directive, and also sites that regularly support migratory birds.

1.20 As the Birds Directive does not provide detailed criteria for the selection of SPAs, the Joint Nature Conservation Committee (JNCC) has published guidelines for the appropriate selection of sites. In accordance with the requirements of the Directive to select the most suitable territories, the JNCC has set particular thresholds for the consideration of suitable sites.

1.21 Article 4.1 of the Birds Directive requires Annex 1 bird species to be the subject of special conservation measures concerning their habitat in order to ensure their survival and reproduction in their area of distribution, and their most suitable territories are therefore classified as SPAs. The JNCC has determined that any area used regularly by 1% or more of the Great Britain population of a bird species listed on Annex 1 of the Directive should be considered in the process of selecting the most suitable territories. For classified SPAs, any such species from the site's qualifying interest, in accordance with Article 4.1 of the Directive.

1.22 Article 4.2 of the Birds Directive requires member states to take similar measures for regularly occurring migratory species not listed in Annex 1, with regard to their breeding, moulting, wintering sites and also their staging posts along migratory routes. The JNCC has determined that any area used regularly in any season by 1% or more of the bio-geographical population of a regularly occurring migratory species not listed on Annex 1 of the Directive should be considered in the process of selecting the most suitable territories. For classified SPAs, any such species also form the site's qualifying species, in accordance with Article 4.2 of the Directive.

1.23 In considering the wording of Article 4.2 of the Directive, the JNCC has also determined that any area used regularly in any season by a mixed species assemblage of at least 20,000 waterfowl or seabirds should also be considered in the process of selecting the most suitable territories. Thus for classified SPAs any such collective groups of migratory species form the site's qualifying assemblage, in accordance with Article 4.2 of the Directive.

1.24 For the purposes of this report it is therefore important to clarify that the qualifying features of the three SPAs will be one of the following:

- Specific qualifying species listed on Annex 1 (during the breeding season or over winter) under article 4.1.
- Specific qualifying migratory species not listed on Annex 1 (during the breeding season, overwinter or on passage) under article 4.2.

- Migratory species that form part of the qualifying assemblage of waterfowl or seabirds under article 4.2.

1.25 In Table 1 we set out the species that are qualifying features under one of the above categories. The table includes all species listed on the standard Natura 2000 form for each site and all species listed in the SPA review for each site. Additional background information relating to the importance of each species is provided in Appendix 1, which summarises the information on the standard Natura 2000 form for each SPA and has been downloaded from the JNCC website.

1.26 Besides the species listed in Table 1, there is one species (spotted redshank) which is listed in the original SPA citation for the Medway, but is not included on the Standard Natura 2000 form[4] or the SPA Review.

[4] **http://www.jncc.gov.uk/pdf/SPA/UK9012031.pdf**

Table 1 Summary of SPA interest features on the three sites

Species	Thames Estuary & Marshes SPA			Medway Estuary & Marshes SPA					The Swale SPA				
	Overwinter	On passage	Wintering Waterfowl Assemblage	Breeding	On passage	Overwinter	Wintering Waterfowl Assemblage	Breeding Assemblage	Breeding	On passage	Overwinter	Wintering Waterfowl Assemblage	Breeding Assemblage
White-fronted Goose			✓									✓	
Bewick's Swan						✓	✓						
Dark-bellied Brent Goose						✓	✓			✓		✓	
Shoveler			✓			✓	✓			✓		✓	
Mallard							✓	✓					✓
Pintail			✓			✓	✓			✓		✓	
Gadwall			✓									✓	✓
Shelduck			✓			✓	✓					✓	✓
Wigeon						✓	✓					✓	
Teal						✓	✓					✓	✓
Pochard							✓	✓					
Red-throated Diver							✓	✓					
Great-crested Grebe							✓						
Little Grebe			✓				✓					✓	
Cormorant							✓					✓	
Marsh Harrier									✓				

Table continued...

Species	Thames Estuary & Marshes SPA			Medway Estuary & Marshes SPA					The Swale SPA				
	Overwinter	On passage	Wintering Waterfowl Assemblage	Breeding	On passage	Overwinter	Wintering Waterfowl Assemblage	Breeding Assemblage	Breeding	On passage	Overwinter	Wintering Waterfowl Assemblage	Breeding Assemblage
Hen Harrier	✓							✓		✓			
Merlin								✓					
Mediterranean Gull									✓				
Little Tern				✓									
Common Tern				✓									
Turnstone						✓	✓						
Oystercatcher						✓	✓					✓	✓
Avocet	✓		✓	✓		✓	✓		✓	✓		✓	
Ringed Plover	✓	✓	✓		✓	✓	✓				✓		✓
Grey Plover	✓		✓			✓	✓			✓		✓	✓
Golden Plover										✓		✓	
Lapwing			✓				✓	✓				✓	✓
Dunlin	✓		✓			✓	✓			✓		✓	
Knot	✓		✓			✓	✓			✓		✓	
Black-tailed Godwit	✓		✓			✓	✓			✓		✓	
Bar-tailed Godwit										✓		✓	
Curlew						✓	✓					✓	✓
Whimbrel			✓		✓		✓						

Table continued...

Species	Thames Estuary & Marshes SPA			Medway Estuary & Marshes SPA					The Swale SPA				
	Overwinter	**On passage**	**Wintering Waterfowl Assemblage**	**Breeding**	**On passage**	**Overwinter**	**Wintering Waterfowl Assemblage**	**Breeding Assemblage**	**Breeding**	**On passage**	**Overwinter**	**Wintering Waterfowl Assemblage**	**Breeding Assemblage**
Redshank	✓		✓		✓	✓				✓		✓	✓
Greenshank					✓	✓							
Kingfisher								✓					
Short-eared Owl								✓					
Reed Warbler													✓
Reed Bunting													✓
Coot													✓
Moorhen													✓

Ticks in bold indicate species listed on the Standard Natura 2000 form whereas those not in bold are those solely included in the SPA review (published in 2001). Those in bold and underlined are listed on the Standard Natura 2000 form, but not the SPA review.

Ramsar interest features

1.27 The three Ramsar sites of the southern fringes of the Thames Estuary in Kent, including the Medway estuary and the Swale, comprise 17,000ha of continuous maritime habitats extending from Gravesend in the west to Whitstable in the east. The large extent of the principal maritime habitats, and the diversity of habitats represented, supports an impressive number of nationally scarce and local plants and invertebrates (Ramsar Criterion 2). The complex of habitats also regularly supports an internationally important assemblage of wading birds and waterfowl in winter (Ramsar Criterion 5); and many of these species individually occur in internationally and nationally significant numbers (Ramsar Criterion 6).

1.28 The site has extensive areas of inter-tidal mudflats with fine silty sediment, grading upwards into salt marshes, the whole complex being drained by a network of tidal channels. There are large areas of grazing marshes, some behind seawalls, some seasonally inundated, with a range of salinities represented from brackish to freshwater conditions. Ditches and saline lagoons provide further habitat variety, while locally over some of the mudflats there are patches of shingle, shell and shell sand. Also locally within the site are flooded clay and chalk pits.

1.29 The mudflats and salt marshes demonstrate a wide range of conditions from bare mud, through pioneer plant communities with eelgrass and glassworts *Salicornia* species, to high-level salt marshes with a full and characteristic suite of plants. The grazing marshes range from relatively species-poor mesotrophic swards, with scarce annuals present locally in bare or trampled ground, to brackish, inundated grassland with further scarce species. For some species or species groups, this is the most important locality in the country. The ditches and saline pools, and the areas of shelly sand support further typical maritime plants, some scarce; and the whole diverse complex is a rich locality for invertebrates, with at least 27 rare or nationally scarce species present, ranging from water beetles to flies and moths. Non-avian Ramsar interest features are summarised in Table 2 (plants) and Table 3 (invertebrates).

Table 2 Summary of the plant Ramsar interest features on the three sites

Common name	Latin name	Thames Estuary & Marshes	Medway Estuary & Marshes	The Swale
Bulbous Foxtail	*Alopecurus bulbosus*	✓		
Slender Hare's-ear	*Bupleurum tenuissimum*	✓	✓	✓
Divided Sedge	*Carex divisa*	✓		✓
Small Red Goosefoot	*Chenopodium chenopodioides*	✓	✓	✓
Sea Barley	*Hordeum marinum*	✓	✓	✓
Golden Samphire	*Inula crithmoides*	✓	✓	✓
Least Lettuce	*Lactuca saligna*	✓		✓
Curved Hard-grass	*Parapholis incurve*		✓	
Hog's Fennel	*Peucedanum officinale*			✓
Annual Beard-grass	*Polypogon monspeliensis*	✓	✓	✓
Borrer's Salt marsh Grass	*Puccinellia fasciculate*	✓	✓	✓

Table continued...

Common name	Latin name	Thames Estuary & Marshes	Medway Estuary & Marshes	The Swale
Stiff Salt marsh Grass	*Puccinellia rupestris*	✓	✓	✓
One-flowered Glasswort	*Salicornia pusilla*	✓	✓	✓
Perennial Glasswort	*Sarcocornia perennis*		✓	✓
Small Cord-grass	*Spartina maritime*	✓	✓	✓
Clustered Clover	*Trifolium glomeratum*	✓		
Sea Clover	*Trifolium squamosum*	✓	✓	✓
Narrow-leaved Eel-grass	*Zostera angustifolia*	✓		
Dwarf Eel-grass	*Zostera noltei*	✓		

Table 3 Summary of the invertebrate Ramsar interest features on the three sites

Name		Thames Estuary & Marshes	Medway Estuary & Marshes	The Swale
Anagnota collini	A fly		✓	
Anisodactylus poeciloides	A ground beetle	✓		
Atylotus latistriatus	A horsefly			✓
Aulacochthebius exaratus	A water beetle	✓		
Bagous cylindrus	A weevil	✓	✓	
Bagous longitarsis	A weevil	✓		
Baris scolopacea	A weevil		✓	✓
Baryphyma duffeyi	A spider	✓		
Berosus fulvus	A water beetle	✓		
Berosus spinosus	A water beetle		✓	
Campsicnemus magius	A fly	✓	✓	✓
Cantharis fusca	A soldier beetle		✓	
Cephalops perspicuous	A fly		✓	
Cercyon bifenestratus	A water beetle	✓		
Dicranomyia danica	A cranefly			✓
Elachiptera rufifrons	A true fly		✓	

Table continued...

Name		Thames Estuary & Marshes	Medway Estuary & Marshes	The Swale
Erioptera bivittata	A cranefly	✓	✓	
Haematopota bigoti	A horsefly	✓		
Henestaris halophilus	A groundbug	✓		
Hybomitra expollicata	A horsefly	✓		
Hydrochus elongatus	A water beetle	✓		
Hydrochus ignicollis	A water beetle	✓		✓
Hydrophilus piceus	A water beetle	✓		✓
Lejops vittata	A hoverfly	✓	✓	✓
Lestes dryas	A damselfly	✓		✓
Limnophila pictipennis	A cranefly	✓		
Limonia danica	A cranefly			✓
Malachius vulneratus	A beetle	✓	✓	✓
Malacosoma castrensis	Ground Lackey moth	✓	✓	✓
Micronecta minutissima	A true bug			✓
Myopites eximia	A true fly			✓
Ochthebius exaratus	A water beetle	✓		
Philanthus triangulum	A solitary wasp	✓		
Philonthus punctus	A rove beetle	✓	✓	✓
Poecilobothrus ducalis	A dancefly	✓	✓	✓
Polystichus connexus	A ground beetle			✓
Pteromicra leucopeza	A snail-killing fly	✓		
Stratiomys longicornis	A soldier fly	✓		
Telmatophilus brevicollis	A fungus beetle	✓		

Implications of the international designations

1.30 Sites of European and international importance are protected by a suite of legislation and an international convention. Following the Birds Directive in 1979, the Habitats Directive came into force across Europe in 1992. The Birds Directive focused upon the conservation of birds and the habitats upon which they rely, whereas the Habitats Directive increased the protection afforded to plants, habitats and animals other than birds, including through the creation of Special Areas of Conservation (SAC).

1.31 Most importantly for considering the protection of European sites, by virtue of Article 7 of the Habitats Directive, the procedures relating to the protection of SACs set out within Article 6 of the Habitats Directive equally applies to SPAs as well as SACs. The elements of Article 6 applicable to both SACs and SPAs are as follows:

- Article 6(2). Member States shall take appropriate steps to avoid, in the special areas of conservation, the deterioration of natural habitats and the habitats of species as well as disturbance of the species for which the areas have been designated, in so far as such disturbance could be significant in relation to the objectives of this Directive.
- Article 6(3). Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public.
- Article 6(4). If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, the Member State shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted.

1.32 The Conservation of Habitats and Species Regulations 2010[5], normally referred to as the 'Habitats Regulations,' transpose the requirements of the European Habitats Directive 1992 into UK law. Both the European and domestic legislation apply when considering the protection of European sites in the UK.

1.33 The Ramsar Convention is a global convention to protect wetlands of international importance. In complying with the Convention, the UK Government treats listed Ramsar sites as if they are European sites, as a matter of policy. Most Ramsar sites are also a SPA or SAC, but the Ramsar features and boundary lines may vary from those for which the site is classified as a SPA or designated as a SAC.

1.34 The purpose of this report is to bring together a baseline assessment of the three SPA and Ramsar sites, in order to provide a comprehensive data set that can be used to ensure that the requirements of Article 6 of the Habitats Directive are fully met when considering plans or projects that have the potential to affect the interest features of the three sites. It is important therefore at this point to establish the principle of determining what constitutes a potential effect upon a qualifying feature.

1.35 The bird assemblage interest feature encompasses a range of different species, each with different habitat requirements, different diets and different behaviours. The species will breed in different areas and the relative abundance of each species will change each year. Quantifying what constitutes an adverse effect on integrity is therefore not straight forward. The precautionary principle is embedded within the European and UK legislation, whereby it must be ascertained that interest features are not adversely affected by a particular impact, otherwise it is assumed that they are adversely affected by such an impact. In the absence of detailed research to determine at what point the ecological integrity of a bird assemblage may be adversely affected, it is the conclusion of the authors of this report that adverse effects relating to a single species that forms part of a qualifying assemblage must be taken to be adverse effects upon the qualifying assemblage as a whole, because any higher threshold is currently unknown and the precautionary principle must therefore apply.

[5] Statutory Instrument 2010 No. 490. The Conservation of Habitats and Species Regulations 2010 consolidates the Habitats Regulations 1994 and subsequent amendments, and also implements aspects of the Marine and Coastal Access Act 2009. The requirement for the assessment of plans, projects and land use plans has not substantively changed, but relevant duties are now found under different Regulation numbers.

Aims and objectives

1.36 The three sites of interest form an almost contiguous belt of protected land, in an area just to the east of London and subject to a range of pressures. Threats and issues for the three sites are broadly similar and include sea-level rise (potentially resulting in erosion, flooding and the possible need for coastal defence works); infrastructure development (including road, powerline, industrial, wharf, marina and recreational developments); dredging proposals (and impacts from dredging and canalisation); water shortages for wetland enhancements due in part to groundwater abstraction; agricultural intensification and expansion; disturbance by fisheries and dredging; waste disposal; changes in water quality resultant from improvements to waste water discharges; recreational disturbance; cord-grass and eelgrass invasion and reduced freshwater input.

1.37 The SPA and Ramsar designations bring particular and strict legal requirements relating to plans and projects which are not for nature conservation management. The designations reflect the importance of the sites for birds, plants and invertebrates and include wintering raptors, wintering waders, wintering waterfowl assemblage, breeding waders, gulls, terns and a raptor, nationally scarce plants, predominantly associated with salt marsh communities and a range of important invertebrate species

1.38 In the context of the threats and the international designations, this report sets out a baseline assessment of these three international sites. We collate and present the bird data, the status of the Ramsar interest features, disturbance data and habitat data. The work is not a literature review but rather a gap analysis including data gathering, data presentation and a specification and draft costing for any further work that might be required. The baseline data will be used in a variety of ways, these include:

- Guiding the implementation of enhanced coastal access.
- Natural England's input into the LDF process and advice to local authorities.
- Helping land managers and conservation practitioners to manage the SPAs.
- Providing clear further steps for additional research to further understand the issues and ensure compliance with national and European legislation.

2 Our approach

Literature sources

2.1 Relevant material was initially sourced through contact with the project officer and other Natural England staff. Additional material was sourced through contact with other relevant organisations (NGOs and local authority contacts). A check for additional relevant material was undertaken on-line using Google and Google Scholar. Terms included 'Thames Estuary Disturbance, Visitor , Access', 'North Kent Marshes Visitor ,Access, Bird Disturbance, Ecology', 'Medway Thames Swale SPA Visitor Access, Recreation', 'Visitor Pressure Thames Estuary', 'Invertebrate Prey, North Kent Marshes, Medway Thames Swale', 'Birds Thames', 'Bird Movements Thames'.

Species data

2.2 Bird data were obtained for the three SPAs directly from the BTO. Core count data was obtained for all sections in all months from 1988 – 2008. Additional data were sourced directly from relevant sources, including the RSPB. Invertebrate and plant records for the Ramsar interest features were sourced from the Kent Biological Records Centre.

Mapping

2.3 Information collated on the study area including site designations, interest features, access infrastructure, commercial infrastructure and housing is presented in a series of maps created in MapInfo v10. The data sources and methods used to collate this information are summarised in Table 4.

Table 4 Details of data sources and approaches to GIS mapping

Map number	Title	Data source / Approach
1	Overview of location of the three SPAs / Ramsar Sites	Boundary files for designations downloaded from Natural England website
2	National Nature Reserves, and RSPB and Kent Wildlife Trust Reserves	Natural England, RSPB, KWT
3-20, 22-27	WeBS data for wintering and breeding bird species	British Trust for Ornithology, Wetland Bird Survey
21	Indicative areas for breeding Marsh Harrier	John Day (RSPB)
28	Ramsar interest features within or near the Ramsar sites: Invertebrates	Kent Biological Records Centre
29	Ramsar interest features within or near the Ramsar sites: Plants	Kent Biological Records Centre
30	SSSI condition assessments indicating issues	Natural England website, discussions with site managers
31	Spatial distribution of housing	Postcode data held by Footprint Ecology (2010)
32	Formal and informal parking within or near the SPA and Ramsar sites	Formal car-parks located using OS Raster data, informal car parks (lay-bys, seafronts and entrances to tracks etc), beach huts and caravan parks were identified using 1:50,000, 1:10,000 OS raster data and aerial images. Car parks within 1km of the study area were included but others further away from the SPA boundaries were included if they were situated on a footpath leading into the study area.
33	Public Rights of Way within or near the SPA and Ramsar Sites	Provided by Kent County Council
34	Other access infrastructure: holiday parks and beach huts	Mapped using 1:10,000 and 1:50,000 base maps and aerial photographs. All caravan parks in the wider area (3.5km from the study area boundary) were included.
35	Recreational sailing infrastructure and levels of use	RYA UK Coastal Atlas
36	Shipping terminals, with levels of use, and boatyards	Peel Ports Medway, RYA UK Coastal Atlas
37	Industry	Mapped using 1:10,000 and 1:50,000 OS raster data and aerial photographs

Consulting WeBS counters and site staff

WeBS counter questionnaires

2.4 As a means of gathering some general information on issues to birds across the three sites we contacted the local WeBS counters (via the local WeBS coordinators) and following an initial email asking for help, individual WeBS counters were contacted with a short questionnaire. The questionnaire was designed to identify the issues WeBS counters perceived to be the major threats and how these have changed since they started counting for WeBS in the North Kent area. The questionnaire asked which activities the counters thought caused disturbance (i.e. flushing birds) in their sectors. Information about shore and water-based activities such as dog walking, kite surfing, industrial activity, bait digging, boating etc. was requested. WeBS counters were asked to score the types of access and disturbance in each sector (from 0, indicating that the activity does not take place, to 5, indicating that the activity is common) in order to gain more detail about the relative intensity of the different activities around the SPAs.

Interviews with site staff

2.5 Site and area managers and project officers in the North Kent Marshes area were interviewed over the phone. We collated their opinions on the threats and issues that they perceive to be important in the area of their work. We spoke to staff from Natural England, RSPB and Kent Wildlife Trust.

3 Bird species: Status, distribution and trends of SPA interest features

Introduction

3.1 In this section we provide summary accounts of the various SPA interest features, summarising their status and occurrence within the three SPAs. We structure the section as follows:

- Overview of WeBS data, WeBS alerts and other data sources
- Bird movements and links between the three SPAs
- Species accounts

We focus on the species within the relevant SPA designations (as listed in Table 1), and within the species accounts we refer directly to the SPA designation. There is much overlap between the SPA and Ramsar bird interest for each of the three sites.

Overview of WeBS data

3.2 WeBS data provide standard count data for each site, and allows direct comparisons between sites. WeBS data were provided directly by the BTO and we also refer to the summary WeBS reports (of which Calbrade *et al.* 2010 is the most recent).

3.3 WeBS core count data cover all years. Low tide WeBS data are also available with coverage for the Swale (in 1992-93 and 2001-2002); for the Medway (1996-7 and 2004-2006) and for the Thames (1993-1994, 1998-2000; 2002-2003). Few of the low tide counts provide good coverage and for most years the coverage is 'partial', i.e. not all areas were covered on all count dates.

3.4 Other useful sources on the birds of the area include the Kent Bird Reports, the Birds of Kent (Taylor, Davenport and Flegg 1984) and the Birds of the North Kent Marshes (Gillham and Homes 1950).

3.5 The annual WeBS reports provide accounts for each species and provide yearly maxima where the recent data shows the species is present in nationally or internationally important numbers on a given site. These data are summarised in Table 5.

Table 5 Species totals from recent WeBS Report (Calbrade et al. 2010)

Species	International Threshold	GB Threshold	Thames		Medway		Swale	
			Peak Count 04/05 - 08/09	Mean 04/05 - 08/09	Peak Count 04/05 - 08/09	Mean 04/05 - 08/09	Peak Count 04/05 - 08/09	Mean 04/05 - 08/09
White-fronted Goose	10,000	58					430	332
Dark-b. Brent Goose	2,000	981	22,047	12,771	1,834	1,436	2,310	2,051
Shelduck	3,000	782	2,318	2,064	2,360	2,155	2,207	1,936
Wigeon	15,000	4,060	9,293	5,374			16,651	12,244
Gadwall	600	171	471	438			(198)	127
Teal	5,000	1,920	5,433	4,911			(5,783)	4,981
Mallard	20,000	3,520					2,972	2,410
Pintail	600	279			812	761	731	642
Shoveler	400	148	524	428	(509)	269	331	274
Little Grebe	4,000	78	499	403			(191)	102
Great-c. Grebe	3,600	159						
Cormorant	1,200	230	654	538				
Mediterranean Gull	6,600		71	40	(18)	12		
Moorhen	20,000	7,500	383	374				
Coot	17,500	1,730						

Table continued...

Species	International Threshold	GB Threshold	Thames		Medway		Swale	
			Peak Count 04/05 - 08/09	Mean 04/05 - 08/09	Peak Count 04/05 - 08/09	Mean 04/05 - 08/09	Peak Count 04/05 - 08/09	Mean 04/05 - 08/09
Oystercatcher	10,200	3,200	33,659	26,350	(4,160)	2,937	5,225	4,279
Avocet	730	35	1,663	1,395	(1,027)	1027	1,290	686
Ringed Plover	730	330	1,998	1,186	332	332	(605)	(605)
Golden Plover	9,300	4,000	7,401	5,004			17,327	14,671
Grey Plover	2,500	530	13,028	5,673	(1,586)	1,302	1,631	1,631
Lapwing	20,000	206	18,662	16,863			23,479	16,129
Knot	4,800	2,500	83,716	42,871	4,304	3,461	5,002	3,927
Dunlin	13,300	5,600	40,838	37,251	(10,633)	9,126	9,181	7,366
Black-tailed Godwit	470	150	8,081	5,311	(1,120)	(1,120)	1,782	1,589
Bar-tailed Godwit	1,200	620	8,629	5,870			922	716
Whimbrel	6,800	6,800						
Curlew	8,500	1,500	6,993	4,549				
Greenshank	2,300	6	259	183	(35)	(35)	(55)	26
Redshank	2,800	1,200	5,081	4,313	1,068	1,237	1,715	1,527
Turnstone	1,500	500	1,090	844			(515)	(515)
Little Tern	490		154	84				
Common Tern	1,900		(553)	373				

For all species included in the SPA citations and for which site specific totals are listed in the report.

3.6 WeBS alerts provide the most robust and standardised means of highlighting which species have undergone major declines on particular protected sites and provide important context for this section of the report. WeBS alerts are based on trends, assessed over the short-, medium-, and long-term (5, 10 and up to 25 years respectively) and also since site designation. Declines exceeding 50% are “High Alerts”. If declines exceed 25% then a "Medium Alert” is issued. WeBS alerts for the winters to 2007/08 inclusive are currently available[6] and are summarised in Table 6 and Table 7. It can be seen (Table 6) that in particular the Medway Estuary and Marshes SPA has a large number of current alerts, with 12 species listed as high alert and an additional two species with medium alerts only – i.e. 14 species for which the site is designated have undergone recent declines of 25% or more. Table 8 (The percentage of SPAs for which WeBS alerts have been issued for short (S) medium (M) or long term (L), or since designation (D) declines) offers comparisons with the rest of England and the rest of the south-east region respectively. In the table we list the species for which there is an alert on the Swale, Medway Estuary and Marshes or Thames Estuary and Marshes (as listed in Table 6). The table then summarises the percentage of English SPAs (of which we included a total of 49) that have an alert for that species. Similarly for the south-east region (13 SPAs) we highlight the percentage of sites (including the Swale, Medway Estuary and Marshes and the Thames Estuary and Marshes) with alerts issued. It can be seen that for wigeon, teal, little grebe and curlew in particular there are relatively few sites in the south-east for which alerts have been issued.

Table 6 Summary of WeBS Alerts for the three SPAs

Species	High Alert			Medium Alert		
	Thames Estuary & Marshes SPA	Medway Estuary & Marshes SPA	The Swale SPA	Thames Estuary & Marshes SPA	Medway Estuary & Marshes SPA	The Swale SPA
European white-fronted goose	✓		✓			
D-b. Brent goose		✓			✓	
Shelduck		✓		✓		
Wigeon		✓			✓	✓
Gadwall				✓		✓
Teal					✓	
Pintail	✓	✓		✓		
Shoveler				✓		✓
Little grebe			✓			✓
Great-crested Grebe		✓				
Cormorant		✓	✓			✓
Oystercatcher		✓			✓	✓
Ringed plover		✓			✓	

Table continued...

[6] **http://www.bto.org/webs/alerts/alerts2010/Results/SPAmap.htm**

Species	High Alert			Medium Alert		
	Thames Estuary & Marshes SPA	Medway Estuary & Marshes SPA	The Swale SPA	Thames Estuary & Marshes SPA	Medway Estuary & Marshes SPA	The Swale SPA
Grey plover	✓	✓	✓	✓	✓	✓
Lapwing	✓			✓	✓	
Knot	✓			✓		
Dunlin		✓	✓		✓	✓
Curlew		✓			✓	
Redshank		✓			✓	✓

Table 7 WeBS alert data for the three SPAs: percentage changes for each species at each site

Site	Species	First Winter	Reference Winter	Short-term percentage change	Medium-term percentage change	Long-term percentage change	Percentage change since designation
Thames	European White-fronted Goose	81/82	06/07	-86	-92	-99	-86
	Shelduck	81/82	06/07	-9	-30	-41	-28
	Gadwall	81/82	06/07	-37	9	188	-9
	Pintail	81/82	06/07	-68	-61	-33	-47
	Shoveler	81/82	06/07	-48	-15	-48	-33
	Little Grebe	90/91	06/07	15	26	193	68
	Avocet	85/86	06/07	9	70	7200	92
	Ringed Plover	81/82	06/07	27	12	51	45
	Grey Plover	81/82	06/07	-49	-20	8	-50
	Lapwing	81/82	06/07	-46	-39	74	-52
	Knot	81/82	06/07	-77	-58	-37	-74
	Dunlin	81/82	06/07	-16	-1	-5	9
	Black-tailed Godwit	85/86	06/07	593	352	5100	700
	Redshank	81/82	06/07	-4	-18	-12	-12
Medway	Dark-bellied Brent Goose	81/82	06/07	-30	-52	21	-62
	Shelduck	81/82	06/07	-3	-58	-20	-61
	Wigeon	81/82	06/07	18	-59	95	-46
	Teal	81/82	06/07	-22	-44	93	-44

Table continued...

Site	Species	First Winter	Reference Winter	Short-term percentage change	Medium-term percentage change	Long-term percentage change	Percentage change since designation
	Pintail	81/82	06/07	58	-54	211	28
	Little Grebe	90/91	06/07	-2	6	6	-3
	Great Crested Grebe	85/86	06/07	45	-16	-66	-18
	Cormorant	88/89	06/07	-55	-60	-73	-52
	Oystercatcher	81/82	06/07	-35	-56	295	-43
	Avocet	86/87	06/07	38	156	15500	263
	Ringed Plover	81/82	06/07	-48	-75	-65	-79
	Grey Plover	81/82	06/07	-39	-62	60	-66
	Lapwing	81/82	06/07	40	-26	727	0
	Dunlin	81/82	06/07	25	-67	-43	-74
	Black-tailed Godwit	81/82	06/07	56	13	3133	56
	Curlew	81/82	06/07	-41	-48	53	-57
	Redshank	81/82	06/07	-27	-62	-36	-71
Swale	European White-fronted Goose	81/82	06/07	-23	-76	-81	-82
	Dark-bellied Brent Goose	81/82	06/07	20	-3	49	17
	Shelduck	81/82	06/07	0	-15	61	61
	Wigeon	81/82	06/07	-26	-34	46	32
	Gadwall	81/82	06/07	-47	3	25	3
	Teal	81/82	06/07	6	80	80	93

Table continued...

Site	Species	First Winter	Reference Winter	Short-term percentage change	Medium-term percentage change	Long-term percentage change	Percentage change since designation
	Pintail	81/82	06/07	-3	62	194	137
	Shoveler	81/82	06/07	-37	-39	-20	-26
	Little Grebe	90/91	06/07	-16	-57	-26	
	Cormorant	88/89	06/07	-32	-56	-79	
	Oystercatcher	81/82	06/07	-34	-1	26	15
	Avocet	87/88	06/07	54	255	5050	
	Golden Plover	81/82	06/07	60	230	1457	1717
	Grey Plover	81/82	06/07	-44	-54	-13	-10
	Lapwing	81/82	06/07	3	41	115	129
	Knot	81/82	06/07	33	-9	35	45
	Dunlin	81/82	06/07	-27	-51	-34	-34
	Black-tailed Godwit	81/82	06/07	30	88	1480	1217
	Bar-tailed Godwit	81/82	06/07	-24	-15	59	27
	Curlew	81/82	06/07	8	7	-9	-13
	Redshank	81/82	06/07	-33	-32	-13	-22

Table 8 The percentage of SPAs for which WeBS alerts have been issued for short (S) medium (M) or long term (L), or since designation (D) declines

Species	Number of SPAs assessed for species in England (inc SE)	% of English SPAs with a high or medium alert				Number of SPAs assessed for species in SE	% of SPAs within the SE region with a high or medium alert			
		S	M	L	D		S	M	L	D
European white-fronted goose	8	88	88	75	75	2	50	100	100	100
D-b. Brent goose	18	6	28	0	17	5	20	20	0	20
Shelduck	23	17	48	26	48	5	20	60	60	80
Wigeon	28	11	21	11	18	5	40	40	0	20
Gadwall	15	33	20	7	13	6	50	17	0	17
Teal	22	27	23	18	18	5	20	20	20	20
Pintail	21	19	38	24	29	6	17	33	17	17
Shoveler	22	32	18	9	14	8	50	25	13	38
Little grebe	8	0	13	13	0	5	0	20	20	0
Great-crested Grebe	11	27	36	27	45	2	0	0	50	0
Cormorant	21	24	24	29	24	4	50	50	75	50
Oystercatcher	14	43	14	21	57	3	67	33	0	33
Ringed plover	15	33	40	27	60	4	25	50	75	50
Grey plover	21	52	71	10	48	5	60	60	0	40
Lapwing	30	7	53	3	40	5	20	80	0	20
Knot	15	20	33	20	27	3	33	67	33	67
Dunlin	25	56	76	48	72	5	40	60	80	80
Curlew	16	19	25	6	38	4	25	25	0	25
Redshank	22	59	50	18	50	5	40	60	40	40

3.7 From the alerts it is clear that there have been marked declines on the Medway in particular. The declines on this site are addressed by Banks *et al.* (2005), who compare the declines on the Medway with trends for the Swale and Thames in order to determine whether the decline can be linked to increase in numbers on adjacent sites / count sectors. Banks *et al.* found declines within the period from 1993/94 to 2003/04 for 11 species: great-crested grebe, dark-bellied Brent goose, shelduck, pintail, oystercatcher, ringed plover, grey plover, dunlin, black-tailed godwit, curlew and redshank. 'High alerts' (declines >50%) were identified over the 11-year period from 1993/94 to 2003/04 for six of these. For two species, ringed plover and dunlin, there was evidence that the Medway was holding declining proportions of the regional and local populations, implying that rates of change were more rapid on the Medway than the comparative wider scale site complexes. Other declines appeared broadly consistent with regional and / or local trends. The greatest declines within the Medway had occurred in the sector that includes, Hoo, Nor, Bishop and Copperhouse Marshes.

3.8 Of the 11 species identified to be in decline by Core Count data, Banks *et al.* also found that eight species also showed declines in their Low Tide Count trends, indicating that the factors leading to declines have similarly affected both roosting and feeding usage of the site.

3.9 These declines are discussed in more detail in the relevant species accounts. Data for key species are also summarised graphically in Figure 1 and Figure 2b. In Figure 1 the total number of waterfowl present each month is summarised by site, showing that for all three sites the waterfowl numbers are highest over the period November – February, with a January peak for each site. Numbers of birds are highest on the Swale, where lapwing, dunlin and wigeon in particular account for a large proportion of the birds present. The Thames has the next highest totals of birds, with knot accounting for a particularly high proportion of the total count. In Figure 2a WeBS data are used to plot peak counts (per month per year) for a selection of species for each SPA.

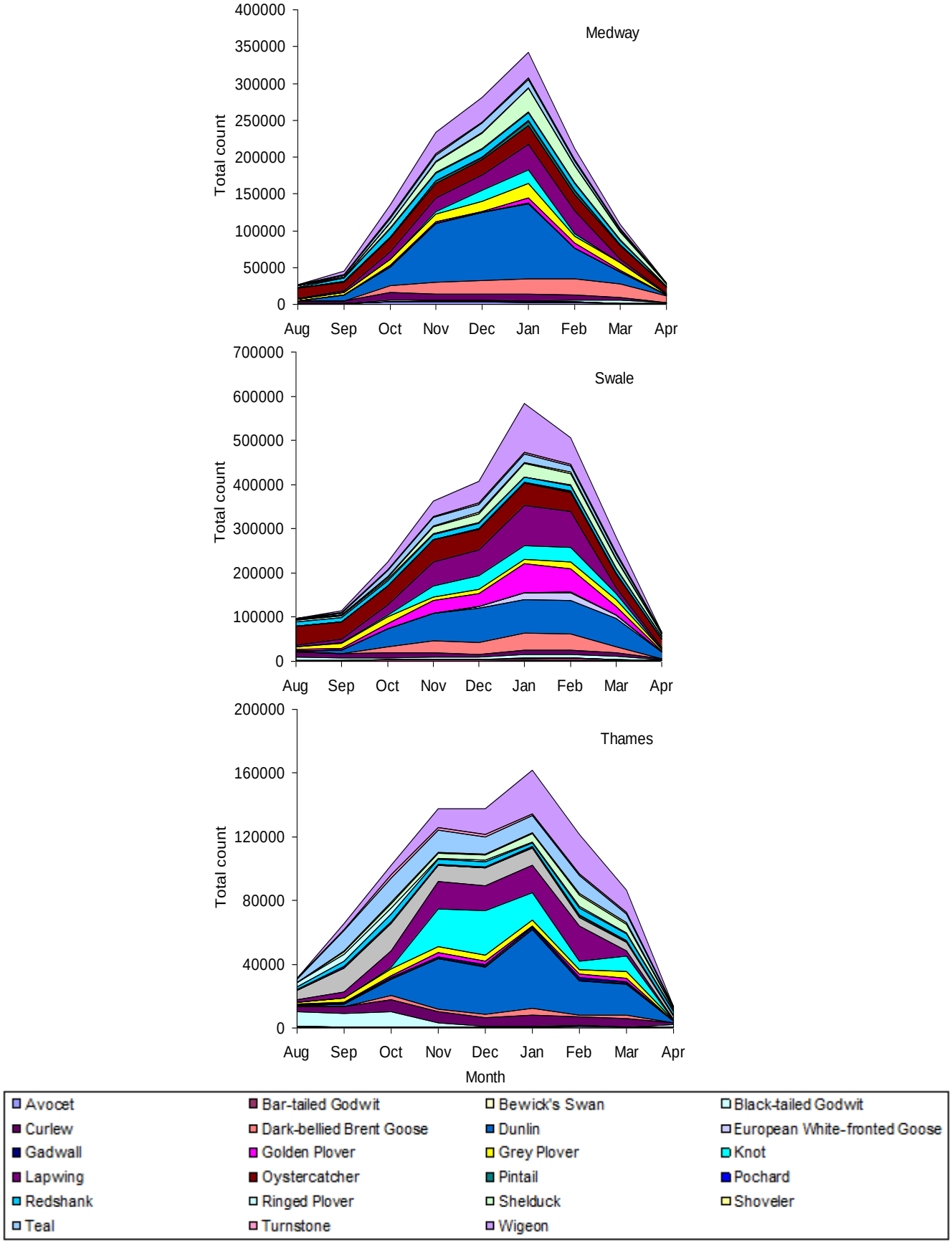

Figure 1 Monthly count data from the Wetland Bird Survey across all sectors totalled over 20 years (1988-2007) for 23 bird species within each SPA

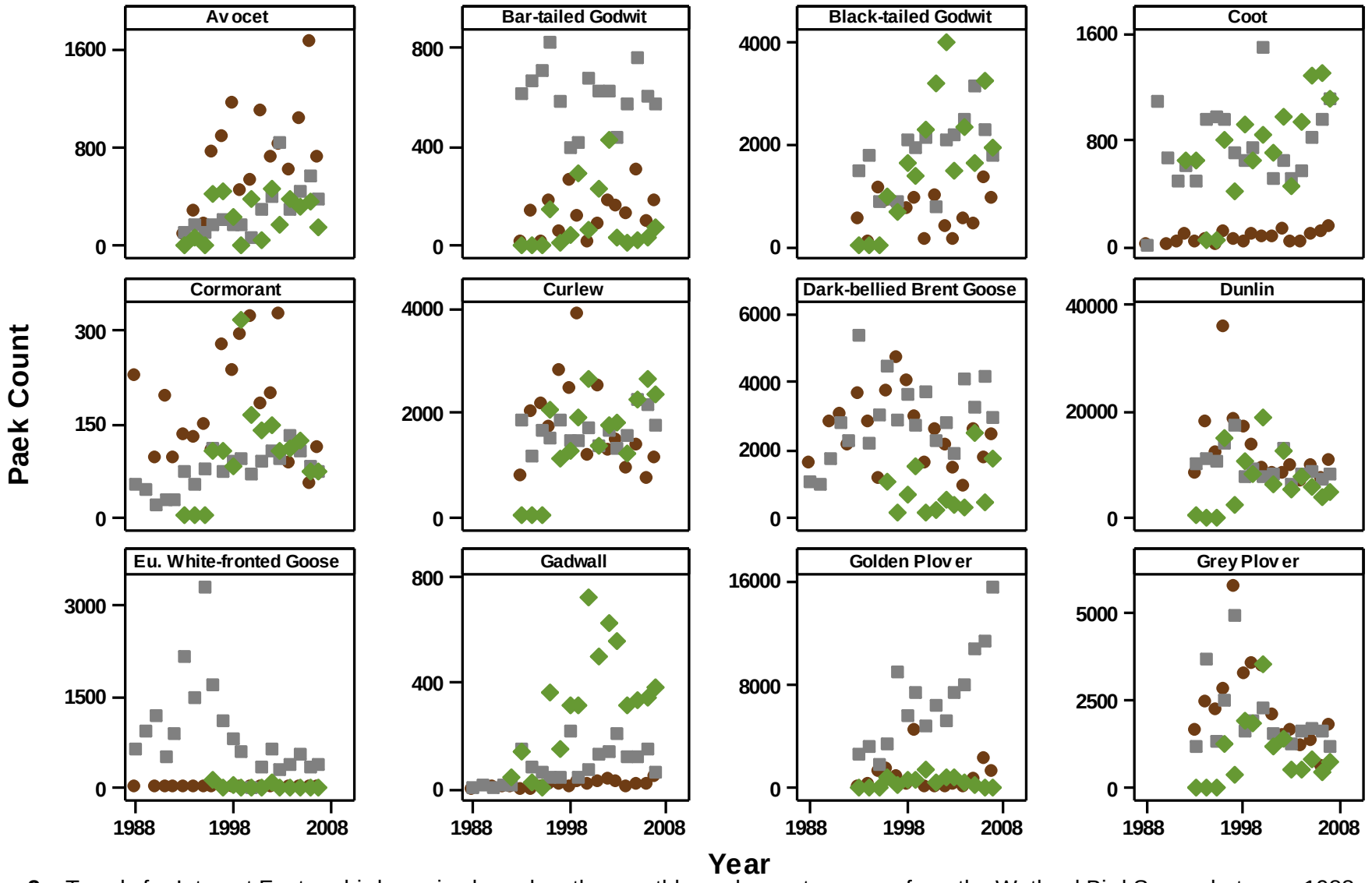

Figure 2a Trends for Interest Feature bird species based on the monthly peak count per year from the Wetland Bird Survey between 1988 and 2007 (Swale, grey; Medway, brown; Thames, green)

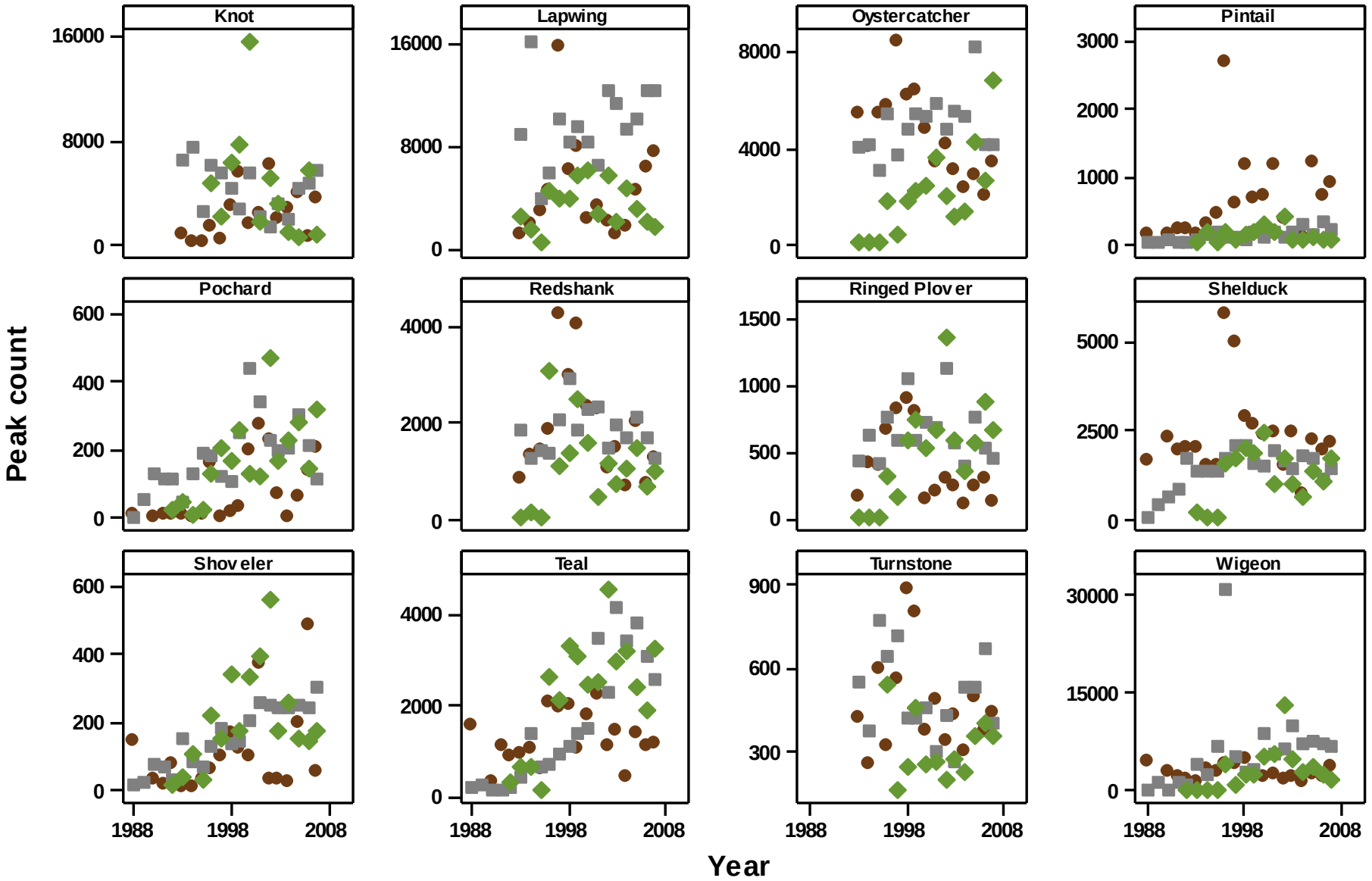

Figure 2b Trends for Interest Feature bird species based on the peak count (per month) per year from the Wetland Bird Survey between 1988 and 2007 (Swale, grey; Medway, brown; Thames, green)

Movements between SPAs

3.10 Detailed descriptions of individual species' movements can be found within the species accounts. The three SPAs that are the focus of this report lie directly adjacent to each other, and birds are likely to move freely between the three sites. The extent of movement and the links between the three SPAs will however vary between species. In general however, although waders and other waterfowl tend to fly long distances during migration, once on their wintering grounds they tend to move only short distances between roosts on an estuary (Rehfisch *et al.* 1996, Rehfisch, Insley and Swann 2003, Burton 2000). For example analysis of ringing data from the Wash, aimed at determining how far apart refuges should be placed to provide secure roost site for grey plover, dunlin and redshank, suggested distances ranging between 3 and 5.5km in order to cater for 75% of the respective populations (Rehfisch *et al.* 1996).

Individual species accounts: Wintering and passage birds

3.11 In the following species accounts we describe the current status of a selection of the SPA interest features (see Table 1 for full list), focusing on the wintering waterfowl and individually listed breeding species. There is much overlap with the Ramsar designations, but for simplicity we focus on the SPA designations.

3.12 Maps 3 – 27 show the peak counts for some of the species addressed within the species accounts, with the maps in sequence to match the text (following taxonomic order). The maps show the mean peak count for each WeBS count sector for the period 1988-2010. The dark red sections reflect the areas with the highest mean count for each species. The threshold values used to determine the colours are different for each map, and reflect the thresholds for national and international importance for each species.

White-fronted goose Anser albifrons albifrons

3.13 This species is included within the SPA Review as part of the wintering assemblage of over 20,000 waterfowl on the Thames Estuary and Marshes SPA and The Swale SPA.

3.14 The so-called European white-fronts, the Baltic-North Sea population breeding on the Taimyr Peninsula in European Arctic Russia and north-west Siberia, comprises about a million birds and has been rapidly increasing since the late 1960s (Hearn and Mitchell 2004). Since the late 1960s numbers in the UK have been falling, a trend mirrored on the Thames Estuary where a small population of between 100-150 birds had declined to a five year mean of below 50 by 2002/03. In contrast to the other major UK sites, numbers of geese on The Swale increased from 1960 and were then stable to the mid 1990s. This was then followed by a decline as the five year mean 1993/94-1997/98 of 1696 had dropped to 332 by 2004/05-2008/09, although the site still holds nationally important numbers and is the third most important site in the UK for this species. It is believed that the reason for the decline in the UK is due to the birds 'short-stopping', that is, stopping off in The Netherlands and other areas in North-West Europe rather than flying on to the UK to winter, and that this trend may have been driven by warmer winters and perhaps influenced by changes in agricultural practice and hunting pressures. Most birds on The Swale forage on the Sheppey marshes, favouring the Capel Fleet area to Harty and Leysdown marshes and the RSPB reserve at Elmley, and also occasionally feed on the south shore notably on Graveney marshes (Hearn and Mitchell 2004).

3.15 The declines on both the Thames and the Swale have triggered a high alert for this species on these sites, with the alert being for the medium term, long term and since designation on the Swale and for the short term, medium term, long term and since designation on the Thames Estuary and Marshes . These two sites are the only two in the south-east that are included in the WeBS alert analysis for this species. Nationally across England there are alerts for European White-fronted Geese on 88% of sites (8 sites assessed including the south-east). White-fronted

geese are still a legitimate quarry species in England and Wales. The birds feed mostly on estuarine and coastal grasslands with increasing numbers wintering on intensively managed rotational grasslands (Wernham *et al.* 2002). Their feeding grounds could be affected by changes in agriculture, and the effects of pollution both within and around the SPA.

Dark-bellied Brent goose Branta bernicla bernicla

3.16 This species is an interest feature for the Medway Estuary and Marshes SPA, where it is listed as holding 3205 individuals representing at least 1.1% of the wintering Western Siberia/Western Europe population (5 year peak mean 1991/92-1995/6), and on The Swale SPA where it is listed as supporting 0.7% of the Western Siberia/Western Europe population (mean peak 1991/92-1995/96). The dark-bellied Brent goose has not been included in the description of the Thames Estuary and Marshes SPA, although the estuary as a whole (which includes substantial areas on the north shore which are outside the SPA) is the second most important site in the UK for dark-bellied Brents and has had internationally important numbers throughout the last fifteen years with a peak of 22,000 in 2007/08, the highest number recorded for any single site in that year. Numbers here tend to peak in October/November with most birds on Maplin Sands, outside the SPA.

3.17 Dark-bellied Brent numbers in Great Britain represent nearly 50% of the estimated flyway population (Kershaw and Cranswick 2003). Numbers of dark-bellied Brent increased rapidly across Europe between the 1950s and 1990s following the recovery of eelgrass from a widespread wasting disease, and a decline in hunting pressure. Nationally numbers increased rapidly from the early 1960s until the early 1990s. In the UK the species was given protection from 1954 and numbers increased until the late 1980s and then declined until 2004, since when there has been a partial recovery. The population on both the Medway and The Swale seems to have followed a similar pattern with declines from the early 1990s through to 2003/04 followed by a slight recovery, although on the Medway these figures should be treated with caution as several of the counts since 1997/98 have been incomplete. The decline on the Medway has triggered a high alert (in the medium term and since designation) and a medium alert (short term) for this species. Of the five sites in the south-east assessed for this species as part of the WeBS alerts analysis, the Medway is the only site with an alert. Nationally there no other sites with a high alert for this species.

3.18 Low tide counts on the Medway show that the birds occurred widely across the estuary but with concentrations on the south shore and in the north at Colemouth Creeks, and on the Swale the grazing marshes bordering both shores are much used for feeding (Ward 2004).

3.19 In winter, Brent geese feed largely on eelgrass and *Enteromorpha* (green algae) species but as numbers have increased they have begun to make more extensive use of improved grassland and winter cereals for foraging inland. On the Thames a sharp drop in numbers occurs by December as stocks of eelgrass are depleted, some birds dispersing to the English south coast, France and to other sites along the east coast (Ward 2004). Numbers during the remainder of the winter are quite variable, with a second peak occurring in late winter in some years.

3.20 The use of agricultural land has led to conflicts with farmers and landowners in some areas of the UK due to damage from late autumn onwards to winter cereals and oil seed rape, and in England about 1000-3000 dark-bellied Brent geese are shot under licence each year (Ward 2004). Where these conflicts arise, the provision of alternative feeding areas combined with scaring techniques have proved to be successful and cost effective (McKay *et al.* 2001).

Shelduck Tadorna tadorna

3.21 This species is included as part of the Article 4.2 wintering assemblage of over 20,000 waterfowl on the Thames Estuary and Marshes SPA, The Swale SPA and the Medway Estuary and Marshes SPA, where it is listed as holding 1.5% of the N-W European population (5 year peak mean 1991/92-1995/6).

3.22 Back in the early 1960s, peak counts of shelduck include 10,000 on the Thames in February of 1960 and 1963, 3,400 in the Medway in February 1972 and 2500 in the Swale in December 1963 (Taylor *et al.* 1984).

3.23 Shelduck numbers increased nationally between 1965/66 until the mid-nineties when a slow decline began which appears to have stabilised during the last few years. In the south-east SPA estuaries there has however been a sustained decline in numbers. The winter population on the North Kent Marshes is thought to have declined by 2000 in the late 1960s (Taylor *et al.* 1984). The five year mean for the Thames and Medway estuaries and The Swale taken together was 10,063 during 1993/94-1997/98 and declined to 5,768 during 2003/04-2007/08. The figures are not precise because there are a number of incomplete counts during the later period, but the general trend is clear. There are alerts triggered for this species on the Medway Estuary and Marshes SPA (high alert for the medium term and since designation) and for the Thames Estuary and Marshes SPA (medium alert for the long term, medium term and since designation). Detailed comparisons between sites (Banks *et al.* 2005) confirm that the declines on the Medway and Thames have not been simultaneous with any increase in numbers on the Swale, where they suggest numbers have actually been largely stable on this site (with Elmley Marshes being the key location used by the species). There is therefore no indication of a local redistribution that may account for the declines. There are five sites in the south-east included in the WeBS alerts analysis and alerts have been issued for up to 80% (i.e. 4) sites (see Table 8). Nationally there are relatively few sites with alerts for this species. Comparison of the trends countrywide, regionally and for the Medway would indicate that the recent declines on the Medway are similar to those in the rest of the region, but they do not match the countrywide trend, which has been relatively stable in recent years.

3.24 Shelduck are fully protected from hunting in the UK, but about half of all ringing recoveries where cause of death is known are of shot birds. Shelduck are also vulnerable to pollution incidents, particularly oil spills in their coastal habitats. Severe winter weather can cause high mortality, for example in the winter 1962/63, 400 shelduck were found dead around the Kent coast. Such extreme weather, when the intertidal is frozen, results in birds failing to access the preferred food (layer spire shell *Hydrobia ulvae*).

Shoveler Anas Clypeata

3.25 This species is an interest feature on all three SPAs. It is part of the waterfowl assemblage on the Thames Estuary and Marshes SPA and on the other two sites is both part of the assemblage and also listed as an overwintering species in its own right. On the Medway Estuary and Marshes SPA the site is listed as holding 0.8% of the N-W and Central European population (5 year peak mean 1991/92-1995/96) and The Swale SPA, where is listed as holding 471 individuals representing at least 1.2% of the N-W/Central European population (5yr peak mean 1991/2-1995/6. WeBS data for the three areas are summarised in Tables 5, 6 and 7.

3.26 Nationally there has been a steady increase in numbers over the last 15 years, and this was mirrored on the Thames from 93/94 until 02/03 when there was a peak count of 697, and on the Swale to 01/02 with a peak of 587. There have been declines at both sites since then with maximum peak count of 524 in 06/07 and 331 in 07/08 respectively. Counts on the Medway have been incomplete over most of the period but a count of 509 in 06/07 highlights that large numbers of shoveler can also occur on this SPA. The Thames Estuary is internationally important and the Medway and Swale of national importance for this species, based on the recent counts.

3.27 It has been suggested (Holt *et al.* 2009) that the increase in numbers nationally may be due to more birds staying in the UK for the winter instead of travelling further south to France and Spain, and similarly, it may be that the reduction in numbers over the last five years regionally is due to birds staying further north in the UK or in N-W Europe. The declines on the Thames Estuary and Marshes SPA and the Swale have been sufficient to trigger a medium alert for this species (short

term, long term and since designation for the Thames Estuary and Marshes and short term, medium term and since designation on the Swale). The species was not evaluated on the Medway. Half of all eight sites in the south-east evaluated for this species in the WeBS alerts analyses have short-term alerts.

3.28 Shoveler generally favour shallow water with abundant zooplankton, and these are among the first to freeze in hard winter weather, causing large scale cold weather movements in this species. Almost all shoveler ringing recoveries are from hunters, (and this species can be legally taken outside the close season in the UK), suggesting that bird numbers and distribution may be influenced by hunting patterns (Wernham *et al.* 2002).

Northern Pintail Anas acuta

3.29 This species is an interest feature on all three SPAs. It is part of the waterfowl assemblage on the Thames Estuary and Marshes SPA and on the other two sites is both part of the assemblage and also listed as an overwintering species in its own right. For the Medway Estuary and Marshes SPA the is listed as holding 1.2% of the N-W European population (5 year peak mean 1991/92-1995/6) and the Swale SPA is listed as holding 966 individuals representing at least 1.6% of the N-W European population (5yr peak mean 1991/2-1995/6).

3.30 Peak counts in previous years have included 1,400 on the Thames in February 1963, 1,250 in the Medway in January 1972 and 200 in the Swale in January 1964.

3.31 Counted national pintail numbers rose rapidly between 1965 and 1975; then rose more slowly to a peak in 2005/06 with a fall of 30% since then (Holt *et al.* 2009). Within the Thames/Medway/Swale complex numbers exceeded 2,000 between 1993/94 and 1996/97 and then dropped by 40% and have remained between about 1,000 and 1,800 since apart from 2001/02 when 2339 were recorded. However these figures need to be treated as minima as there were incomplete counts in most years from 1997/98. Both the Medway and Swale are currently internationally important for pintail but the Thames Estuary ceased to be of national importance based on the five year mean in 2005/06. Prior to that time the highest count on the Thames Estuary had been 593 in 1994/95 after which there was a rapid decline to 50 in 1997/98. The counts then fluctuated between a minimum and maximum of 100-200, except for a count of 355 in 2002/03. The highest count on the Medway was 2,047 in 1996/97 and on The Swale 1,349 in 1993/94, with the highest joint counts in 1995/96 and 1996/97 of 2,243 and 2,324 respectively followed by a halving to 1029 in 1997/98. An examination of the figures for the Medway found declines from 1993/94 to 2003/04 were potentially sufficient to give real cause for concern (Banks *et al.* 2005). There are WeBS alerts triggered for this species on the Thames Estuary and Marshes SPA (high alert, short and medium term) and the Medway Estuary and Marshes SPA (High alert, medium term). Regionally, Pintail numbers in the south-east have shown a general increase since the late 1970s, a pattern which is not apparent on the Thames or the Medway, where numbers appear to rise and fall erratically without any general trend apparent.

3.32 Wintering pintail are extremely mobile and tend to concentrate in few sites, so there is likely to be considerable interchange between the SPAs described here, probably dependent on weather conditions (Prater 1981).

3.33 Pintail are predominantly estuarine birds in Europe and the UK in winter (Welch *et al.* 1996), but in recent years, numbers have stabilised on many coastal sites but have increased on reservoirs and riverine sites suggesting some spread into less traditional areas, with birds also feeding with other wildfowl on stubbles and waste root vegetables (Thomas 1981).

3.34 The Birds of Kent (Taylor *et al.* 1984) states that in the Medway the layer spire shell (favoured food) is more abundant thananywhere else in Kent.

3.35 As with several other duck species the main cause of mortality based on ringing returns is hunting (Wernham *et al.* 2002). Pintail can be legally shot in the UK outside the close season. Pintail have been given an ‘Unfavourable Conservation’ status in Europe with declines due to

loss of wetland and excessive hunting locally. Other causes of decline have been ascribed to drainage and farming intensification (Cabot 2009). The Birds of Kent (Taylor *et al.* 1984) attributes declines in the late 1970s on the Thames to birds tending to winter further up-river as a result of pollution control.

Gadwall Anas strepera

3.36 This species part of the wintering assemblage of over 20,000 waterfowl on the Thames Estuary and Marshes SPA and The Swale SPA. It is also included within the breeding assemblage on the original citation for the Swale SPA.

3.37 Numbers of wintering Gadwall nationally have increased over the last 40 years with the population index rising from less than 1 in 1965/66 to about 100 in 2008/09. As numbers have increased, the national threshold has also increased, from 80 in 2000/01 to 171 from 2001/02, and as a result, The Swale was dropped off the list of nationally important sites in that year. More recently, the peak count in the 08/09 winter on the Swale was 198. This was an incomplete count but was above the national threshold (171 in that year).

3.38 On the Thames Estuary, gadwall numbers have increased during the last 15 years with numbers fluctuating annually around 400-500 from 1998/99 except in 2002/03 when a peak of 815 were recorded. In the 08/09 winter the Thames ranked seventh in the country for this species, but numbers in the period 04/05-08/09 have consistently been well below the current international threshold of 600.

3.39 There are medium alerts (short term) for this species on the Thames Estuary and Marshes SPA and the Swale SPA. Regionally there are short-term alerts for one other site in the south-east, meaning of the six south-east sites evaluated for this species, alerts have been issued for half of them. Nationally there are five (out of fifteen evaluated for this species) sites outside the south-east with short-term alerts for this species.

3.40 Gadwall were released in Kent at Sevenoaks between 1964 and 1972 (Fox 1988), and these and other released birds may have formed the core of early wintering flocks, although between a third and a half of our wintering birds now come from Eastern Europe (Cabot 2009). Generally the largest concentrations of gadwall occur on reservoirs, gravel pits and inland floodwaters (JNCC). Gadwall are vegetarians, feeding largely on aquatic plants in winter which suggests that some of the birds recorded for the Thames Estuary may be associated with adjoining freshwater water bodies rather than estuarine habitat, at least for feeding.

Teal Anas crecca

3.41 This species is an interest feature on The Swale SPA and the Medway Estuary and Marshes SPA. The species has occurred in internationally important numbers in the Thames Estuary but mostly outside the SPA.

3.42 Nationally, teal numbers rose steadily between 1965/66 until 2005/06 when they fell back. Teal numbers can fluctuate more than that of most other dabbling ducks as the species is sensitive to cold weather and water levels and could have been short stopping as a result of milder winters. A study by Ogilvie (in Wernham *et al.* 2002) concluded that these small ducks show a remarkable capacity for responding to prevailing conditions of cold, drought and availability of water with almost continual movement between sites, or, alternatively to stay put for months on end where conditions are stable and favourable. It would be expected that teal in the Thames/Medway/Swale area would move easily between sites to reflect such changes, or other pressures such as disturbance or hunting. Most teal in the UK in winter are believed to come from Iceland, Scandinavia and the near continent (Holt *et al.* 2009).

3.43 Recent counts on the Swale have shown no clear pattern, with the most recent 5 year mean (for the period 04/05-08/09) of 4,981 falling just below the current threshold (5000 birds) for international importance. During the 08/09 winter the peak count on the Swale was 5,485. On the Thames numbers are declining: the 5 year mean is 4,911. During both the 04/05 winter and the 05/06 winter peak counts exceeded 5,000, but since the 05/06 winter peak counts have not exceeded 4,000 and the most recent totals for 08/09 were a peak of 3,496 (note this was an incomplete count).

3.44 Numbers of teal on the Medway Estuary and Marshes SPA have not exceeded the level for national importance in recent years. Banks *et al.* (2005) found little change or evidence of perhaps a slight decline for this species on the Medway over the periods they considered. The most recent WeBS alerts do however list teal for the Medway Estuary and Marshes SPA, indicating a medium alert (for the medium term and since designation). The Medway is the only site in the south-east (5 evaluated) with an alert for this species (Table 8).

Wigeon Anas penelope

3.45 This species is included as part of the wintering assemblage of over 20,000 waterfowl on The Swale SPA and the Medway Estuary and Marshes SPA, for the latter site the species is also listed on the standard Natura 2000 form as an overwintering species with the site listed as holding 1.6% of the Western Siberia/N-W/N-E European population (5 year peak mean 1991/92-1995/6). The species also occurs in nationally important numbers of the Thames Estuary but mostly outside the SPA.

3.46 Nationally, wigeon numbers rose between 1965/66 until 2005/6 by some 40% but since the 05/06 winter numbers have dropped slightly. On the Swale numbers have in recent years have fluctuated between 7,041 (in the 2006/07 winter) and a remarkable high of 40,000 birds in 1996/97. Over the period 04/05 – 08/09 numbers on the Swale have reached a maximum of 16,651 (in 05/06), with a five year mean peak of 12,244, well below the current international threshold. On the Thames numbers have fluctuated between 3,218 and 9,293 over the same period, with a five year mean peak of 5,374. Following a revision of the international and national thresholds for wigeon in 2001/02 (from 12,500 to 15,000 and from 2,800 to 4,060 respectively), the Medway no longer supports numbers of national importance for this species. There are alerts triggered for this species on the Medway (high alerts in the medium term and a medium alert since designation) and the Swale (medium alerts for the short-term and medium term). The Medway and the Swale are the only two sites in the south-east with medium-term alerts for this species. Nationally around a fifth (21%) of the 23 sites evaluated have medium term alerts (Table 8). The trends on the Swale and the Medway differ. In the early 1970s numbers were high and dropped markedly to a low in the early 80s, recovering again during the 1990s before a marked drop in the early 2000s, around which numbers have remained relatively stable. On the Swale, numbers have risen steadily over the period from the early 1970s until the late 1990s, since when numbers have declined. The Swale trend in many ways is similar to the pattern shown by the regional trend, while the trend on the Medway would appear to be markedly different, potentially indicating site specific issues at this site.

3.47 Numbers of wigeon fluctuate considerably from year to year probably reflecting cold weather both in the UK and in N-W Europe. Overall there seems to have been no consistent trend. Wigeon wintering in the UK come largely from breeding populations in Scandinavia, Northern Europe and eastern Russia. Wigeon are specialist graziers, leaving the safety of the water to graze adjacent grassland. They will repeatedly return to the same feeding areas of short grassland, and will concentrate their grazing on high quality fertilised grassland where this is available (Mayhew and Houston 1999). They prefer to remain close to water where it is safer from predators and males spend more time looking around and less time feeding the further they get from water on the breeding grounds (Jacobsen and Ugelvik 1994), and it seems likely that they display the same behaviour in winter. Thus their distribution is tied to the proximity of favourable grazing conditions close to water. The Swale has substantial areas of grazing marsh both to the north and south which may explain why this is such a favoured area for this species.

3.48 Wigeon can be legally hunted throughout their range and so like other wildfowl quarry species, most ringing recoveries are from shot birds (Wernham *et al.* 2002). Their preference for feeding on grassland close to water bodies makes them vulnerable locally to agricultural improvement, and drainage.

Hen Harrier Circus Cyaneus

3.49 The hen harrier is a qualifying species under Article 4.1 on the Thames Estuary and Marshes SPA with a population of 7 individuals representing at least 0.7% of the wintering population in Great Britain (five year mean 1993/94-1997/98) and on the Swale with 23 individuals representing at least 3.1% of the wintering count for Great Britain in 1996/98. More recent counts suggest fewer birds wintering, for example the Kent Bird Reports for 2005 and 2006 give peak counts at the roost on Sheppey of 12 and 18 respectively.

3.50 Estimates vary as to the total population of wintering hen harriers and numbers can vary greatly depending on weather. During the hard weather in early winter 1978/79, it was estimated that there were 753 hen harriers in England (Davenport 1982), but in a more normal year it has been estimated that there are about 300 wintering Hen harriers in England and 50 in Wales (Lack 1986), but a later estimate for England increased this to 400 (Clarke and Watson 1990). Clarke & Watson also listed the main observed threats to regular roost sites as disturbance, from (in descending order of importance) shooting, walkers, fire, birdwatchers and motorcycles with less significant disturbances from model aircraft, gamekeeping, reed cutting, flooding and falconry; and from land use changes following grazing/drainage, agriculture, development, afforestation and peat cutting. Ringing recoveries suggest that a proportion of the males wintering in the south-east are Scottish birds, but that females are mostly from northern France and the Low Countries.

3.51 Just under a quarter of hen harrier ring recoveries are of birds which have been shot, poisoned or trapped (Wernham *et al.* 2002). It is suggested that although the retention of grazing marshes and rank grasslands would benefit the species in the wintering areas of southern and eastern England, the greatest contribution to the conservation of the species in all seasons would be a more tolerant attitude on the part of landowners, hunters and gamekeepers (Etheridge, Summers and Green 1997, Stott 1998).

Great-crested Grebe Podiceps cristatus

3.52 This species is included as part of the wintering assemblage of over 20,000 waterfowl on the Medway Estuary and Marshes SPA. The species is not an interest feature for the Swale SPA but numbers at this site are occasionally high and have exceeded the threshold for national significance; for example the peak count over the winter 08/09 was an incomplete count of 191 birds, well above the threshold of 159 that indicates national significance. The species has not reached nationally important numbers on the Thames Estuary during the last fifteen years.

3.53 On the Medway, numbers have not reached qualifying levels since 1996/97 and the highest count was in 1995/96 with 161 individuals. Banks *et al.* (2005) state that a shallow decline in numbers of Great-crested Grebes took place on the Medway over the period prior to their analysis (up to the 2003/04 winter) with medium alters triggered then for both the previous 5 years and previous 10 years. Currently the species is flagged for a high alert (long term) on the Medway Estuary and Marshes SPA. The Medway is the only site in the south-east (2 sites evaluated for the species) with any WeBS alert for the species, but nationally (11 sites evaluated) there are more sites flagged for this species, 3 other sites have alerts in the long term (Table 8).

3.54 Most important wintering sites for great-crested grebes in the UK are either large tidal basins (for example, Morecambe Bay) or freshwater lakes such as Lough Neagh/Beg or reservoirs (for example, Grafham Water). There are few Estuaries (Forth and Solway) holding high numbers of

this species and where they are present there seems to be free movement between estuarine sites and the open sea depending presumably on the state of the tide and available prey species.

3.55 In hard weather birds move from inland sites to the coast where they are more at risk from pollution from coastal shipping (Wernham *et al.* 2002).

Little grebe Tachybaptus ruficollis

3.56 This species is included as part of the Article 4.2 wintering assemblage of over 20,000 waterfowl on the Thames Estuary and Marshes SPA, The Swale SPA and the Medway Estuary and Marshes SPA.

3.57 There are no sites of international importance for little grebe in the UK, but the Thames Estuary has consistently been a top site of national importance during the last 15 years, with a population which has fluctuated between about 150 and 500 birds. The Swale was listed as having a nationally important population until the threshold was raised from 30 to 78 in 2003/04, and there are currently alerts for this species on the Swale SPA, with declines triggering a high alert in the medium term and a medium alert in the long term. On the Medway numbers declined from 51 in 1993/4 to 18 in 1997/98. The Swale is the only site in the south-east with an alert for this species (five sites evaluated – see Table 8) and also the only site in England with an alert for this species (eight sites assed in total).

3.58 Nationally, little grebe numbers have been increasing although the UK is of limited importance for this species in European terms. Little grebes can be difficult to count on open water depending on weather conditions, can be found on all types of water from open estuaries and large freshwater bodies to borrow dykes and ditches, and are adept at concealment. Therefore they are difficult to count and possibly are able to tolerate high levels of human disturbance.

3.59 The pattern of ringing recoveries suggests that this species is susceptible to hard winter weather (Wernham *et al.* 2002). Their use of small water bodies and ditches could be affected by agricultural improvement and drainage.

Cormorant Phalacrocorax carbo

3.60 This species is included as part of the Article 4.2 wintering assemblage of over 20,000 waterfowl on the Medway Estuary and Marshes SPA and The Swale SPA. There are currently alerts for this species on the Swale SPA (high alert, medium and long term; medium alert, short term) and the Medway Estuary and Marshes SPA (high alert in the long term, medium term, short term and since designation). There are four sites evaluated for this species in the south-east and all but one have alerts. Across England 21 sites were evaluated and around a quarter have alerts for this species (see Table 8).

3.61 Numbers are of national importance in the Thames Estuary but most of these birds are outside the SPA. On both the Medway and The Swale, numbers ceased to meet national thresholds when the national threshold was raised in 2000/01 from 130 to 230. The only year since when the peak count exceeded the new threshold was in 2003/04 when 305 individuals were recorded on the Medway.

3.62 Cormorants are difficult to count as they move freely within and between estuarine areas and the sea depending on the tides and availability of prey. Cormorants are, however believed to be generally faithful to their wintering sites.

3.63 Nearly 60% of ringed cormorant recoveries have been killed deliberately, reflecting the increasing belief of fishermen and fisheries managers that the birds pose a threat to their livelihood. Some of these birds will have been killed under licence. Nearly 25% of recoveries are of birds killed accidentally, mostly by drowning in fishing nets (Wernham *et al.* 2002).

Oystercatcher Haematopus ostralegus

3.64 Oystercatcher is included as part of the wintering assemblage on the Medway Estuary and Marshes SPA and The Swale SPA. It is also listed as a wintering interest feature in its own right on the Medway Estuary and Marshes SPA and it is part of the breeding assemblage for the Swale SPA.

3.65 The oystercatchers that occur in Britain belong to the nominate race, *ostralegus,* which breeds in Iceland, the coast of Europe and east to the Pechora river in Russia. Birds wintering on the east coast of Britain are mostly birds that breed in the low countries or Norway (Wernham *et al.* 2002).

3.66 On the Medway declines have triggered a high alert (medium term) and a medium alert (short term and since designation). The five year peak mean for the site (04/05-08/09 winter) is 2,937, but the 08/09 winter appears to have held particularly high numbers, with an incomplete count of 4,160 recorded. This is the highest count in recent years. On the Swale, over the period from the winter 2004/05 until 2008/9 numbers have consistently been above the national threshold (3,200), with peak counts ranging from 5,858 to 3,293 (the latter in 08/09). There is a medium alert for this species in the short term for the Swale SPA. For the Thames Estuary and Marshes SPA there is evidence of a recent increase in numbers (see Figure 2b). For the whole of the Thames the mean peak count for the period 04/05 – 08/09 is 26,350 (Calbrade *et al.* 2010), well above the international threshold for the species. The peak number on the Thames in the 08/09 winter was several thousand greater than that noted on the site in recent years; the count of 33,959 was the highest ever total there.

3.67 Within the south-east three different WeBS sites were evaluated for oystercatcher, and the Swale and the Medway are the only two sites with WeBS alerts issued. Nationally 14 sites have been evaluated and 43% (six sites) have short term alerts and 57% (eight sites) have alerts since designation. This would suggest fairly widespread declines in this species. Comparing the trends for the Swale, the Medway, the south-east region and the country reveals a pattern of a steady increase in numbers on the Medway since the early 1970s, followed by a decline since the mid to late 1990s. Numbers on the Swale have tended to fluctuate more markedly, particularly between the early 1970s and late 1990s, but since the late 1990s numbers have, like the Medway declined steadily. The trend for the region shows a similar decline over the last decade, but is less steep. Nationally there has been comparatively little change.

3.68 In general oystercatchers tend to show high site-fidelity to wintering sites, with 60% of 672 between-winter recoveries documented in the migration atlas (Wernham *et al.* 2002) occurring within 20km of the ringing site. This makes them more vulnerable to localised disturbance than more wide ranging species.

Avocet Recurvirostra avosetta

3.69 Avocet are a qualifying feature as an overwintering species and are also listed as part of the Article 4.2 wintering assemblage of over 20,000 waterfowl for all three SPAs. They also qualify as an interest feature as a breeding species on the Medway Estuary and Marshes SPA and the Swale SPA.

3.70 The numbers of birds wintering has increased markedly in recent years, following a national trend that shows a dramatic increase from the mid-1980s. The Birds of Kent (Taylor *et al.* 1984) describes the species as a regular spring migrant, irregular in other months, and the only wintering records cited are from The Swale where it states that two-four birds wintered regularly between 1955/56 and 1962/63. The comparison with 2006 (Table 9) is marked, with all three SPAs hosting wintering numbers in treble figures and the Thames and the Medway holding numbers approaching 1000 birds. Even more recently numbers have increased still further with peak counts exceeding 1000 on the Essex side (Chris Gibson, *pers. comm.*) and for all three SPAs peak counts in the period 04/05-08/09 have surpassed 1000.

Table 9 Peak monthly counts of Avocet (from the Kent Bird Report 2006)

	J	F	M	A	M	J	J	A	S	O	N	D
Thames	223	250	33	500	80	105	553	555	805	585	475	460
Medway	900	420	489	111	162	300	26	140	190	420	462	811
Swale	273	85	320	99	84	222	100	35	85	67	67	76

3.71 More recent counts on the Thames have indicated a dip in the number of wintering birds, with counts there during the 2008/09 winter being the lowest there since 2003/04.

3.72 Local observations imply that there is movement between the Medway SPA and Swale SPA with birds that are feeding in the Swale estuary moving to roost on the south side of the Medway estuary (Yates, unpublished).

Ringed Plover Charadrius hiaticula

3.73 Ringed Plover are cited as an interest feature for all three SPAs, as part of the wintering waterfowl assemblage and as an overwintering species. In addition they are listed as interest features on passage for the Medway Estuary and Marshes SPA and are cited as an interest feature as a breeding species on the Swale SPA.

3.74 The Birds of Kent (Taylor *et al.* 1984) states that the species is most numerous on autumn passage during August-September, with flocks of up to 400 on the Thames and 600 on the Medway and Swale. Taylor states that the major roost sites for the passage birds appear to have changed over time. On the Thames the major roost was at Yantlet in the late 1950s, but moved to Cliffe Pools in the 1960s. Apparently areas of dredging provided major roosts at Chetney in the 1960s and early 1970s and at Kingsnorth since 1970, where 1000 birds were counted in September 1970. On the Swale the usual roosts are on the beach at Shellness or the saltings at Harty.

3.75 Ringed plovers on passage in the UK are potentially from a wide range of breeding populations, including birds from Canada, Greenland, Iceland and Fennoscandia. Ringing recoveries of birds ringed on the east coast of the UK in the spring are typically birds from Fennoscandia (Wernham *et al.* 2002). Birds overwintering in the UK tend to be birds from similar latitudes, breeding around the North Sea or in the UK.

3.76 On the Medway, declines have resulted in the triggering of high alerts (long term, medium term and since designation) and medium alerts (short term). The most severe declines of ringed plover on the Medway occurred on sector number 22967 (Hoo, Nor, Bishop and Copperhouse Marshes), with numbers crashing from a peak in 1994/95 (Banks *et al.* 2005). Banks *et al.* also found that counts on the north shore of the Thames showed a possible influx of Ringed Plover at around the time the large declines were recorded on the Medway and suggest that there was local dispersal away from the Medway after 1994/95. Four sites have been evaluated within the south-east as part of the WeBS alerts work, and at least three of these sites have alerts (Table 8), indicating that declines on the Medway are perhaps not unique. Nationally fifteen sites have been evaluated and there are alerts for up to 60% of sites.

Golden Plover Pluvialis apricaria

3.77 Golden Plover (and Lapwing) tend to roost on intertidal habitat and feed on nearby arable or short grassland, contrary to most other waders. Kent is a key area for this species in winter within the UK, with the county holding around 10% of the English wintering population (Taylor *et al.* 1984). The Swale seems to be a particular stronghold within Kent, and the species is a qualifying interest feature both under Article 4.1 as an overwintering species and part of the Article 4.2 wintering assemblage of over 20,000 waterfowl on this SPA. The Swale held the third highest

counts from all WeBs sites in the 07/08 winter, with the maxima of 17,327 representing over 4% of the English population (Holt *et al.* 2009, Gillings and Fuller 2009).

3.78 Numbers on the Swale have fluctuated markedly in recent years, for example over the five year period 04/05-08/09 the peak count was the 17,327 recorded over the 07/08 winter, yet in two winters the peak counts were below 10,000, with the lowest (an incomplete count during the 04/05 winter) being 6,560. There are currently no alerts for this species on the Swale SPA.

3.79 The Migration Atlas (Wernham *et al.* 2002) states that flocks of wintering golden plover tend to use traditional wintering areas each year. Within these broad areas there may be marked fluctuations between years in the precise locations utilised by both feeding and roosting birds.

Grey Plover Pluvialis squatarola

3.80 The winter population of this species becomes established during November and numbers fall in February and March, as birds depart. The species is present on all three estuaries and for all three SPAs and is an interest feature over the winter and is part of the Article 4.2 wintering assemblage. There are currently high and medium alerts for this species on all three SPAs. On the Thames Estuary and Marshes the high alert is for the period since designation and the medium alert is for the short term. On the Medway Estuary and Marshes SPA the high alert is for the medium term and for the period since designation while the medium alert is for the short term. On the Swale SPA the high alert is for the medium term and the medium alert is for the short term. Five SPA sites have been evaluated for grey plover in the south-east, and the three SPAs that feature in this report are the only ones with alerts issued. Nationally there are many sites with alerts for this species, mostly for the short or medium term period (21 SPAs in England evaluated).

3.81 Nationally this species has shown a decline since the mid-1990s, which slowed in the mid-2000s and in the 2006/7 winter there was an upturn in numbers. The Wash and Dengie Flats are particularly important for this species, and an estimated half of all grey plovers wintering in the UK now occur at these two sites (Calbrade *et al.* 2010).

3.82 The Thames is one of seven areas in the UK currently supporting numbers above the threshold for international importance (2,500). Peak counts over the five year period 04/05-08/09 on the Thames have averaged 5,673 and included a peak of 13,028 in the winter of 05/06. The Swale and Medway both support numbers above the national threshold (530) with the mean peak counts over the five year period (04/05-08/09) for these two sites being 1,631 and 1302 respectively).

3.83 Three sectors of the Medway Estuary support the majority of the Grey Plover found on the SPA, each holding several hundred birds (see Map 9). All three have undergone gradual but substantial declines, with some fluctuation (Banks *et al.* 2005). Banks *et al.* did find one possible indication of localised movements, as at Shellness and Harty Marshes the species had undergone a sustained increase from 1993/94 to 1996/97, during which time there was a decline on the Medway. Such localised movements are however likely to be of small significance in the context of the general decline across all three local estuaries.

3.84 Various studies have shown that in winter, individual grey plover tend to use the same feeding area from tide to tide and from year to year (for example, Dugan 1982). Movements of birds ringed in the UK within the winter and recovered in the same or subsequent winter show few movements of more than 20km, and most only a short distance (median of 2.5km for within-winter recoveries) (Wernham *et al.* 2002). Calbrade *et al* (2010) highlight that the recent declines on the Thames and on the Stour have coincided with increases at the Wash and Dengie Flats, and they raise the possibility of a redistribution between sites or exchange between these locations.

Lapwing Vanellus vanellus

3.85 Lapwing are part of the wintering waterfowl assemblage for all three SPAs and are also part of the breeding assemblage on the Swale SPA and the Medway Estuary and Marshes SPA.

3.86 The Lapwing population wintering in the UK is comprised of that part of the breeding population that does not move south to continental Europe, supplemented by birds from Scandinavia, eastern Europe and Russia. The counted British maximum of Lapwing from WeBS in 08/09 was 287,223 in December. The national index has shown a fluctuating downward trend since the mid-1990s. WeBS data for this species can be difficult to interpret as the species spends a considerable proportion of time on agricultural land not covered by WeBS, and therefore counts can fluctuate markedly depending on where the birds have been feeding.

3.87 The Thames and the Swale have both supported wintering numbers of national significance in recent years (04/05-08/09 winter), with mean peaks of 16,863 and 16,129 respectively. Numbers on the Medway for the same period have been below the threshold for national significance (the threshold is 6,200 birds). There are currently alerts for this species on the Thames Estuary and Marshes SPA and the Medway Estuary and Marshes SPA. For the Thames there is a high alert for the period since designation and a medium alert for both the short and the medium term. On the Medway Estuary and Marshes SPA there is a medium alert for the medium term. Within the south-east five sites were evaluated for this species. The Thames Estuary and Marshes SPA was the only one with short term and since designation alerts, however two other sites besides the Medway Estuary and Marshes and the Thames Estuary and Marshes have alerts issued for the medium term. Nationally 30 sites have been evaluated and besides the Thames only one other site has a short term alert issued.

Knot Calidris canutus

3.88 Knots are wholly coastal in the winter, depending on extensive sand and mudflats in large estuaries where they tend to occur in dense flocks, often numbering thousands of birds. They are specialist feeders, preying almost entirely on molluscs. Large British estuaries are of major importance in the winter, as autumn moulting sites and as early spring staging sites, where knots rapidly accumulate fat stores before flying to Iceland or Norway, where they stage again before the final leg of their migration to the high Arctic where they breed (Wernham *et al.* 2002). Knot are a qualifying feature (as over wintering species and as part of the Waterfowl assemblage) for all three SPAs.

3.89 Within the Swale SPA, it is the mouth of the Swale that traditionally holding the largest flocks (Taylor *et al.* 1984). Until the late 1960's the average winter peak on the Swale was 9,500, with a maximum of 20,000 in December 1954. Across the three sites together the highest combined total was 29,000 birds, counted in the cold weather of early 1956, when 10,000 were present on the Thames, 5,000 on the Medway and 14,000 on the Swale (Taylor *et al.* 1984). Recent counts over the five year period 04/05-08/09 indicate mean peaks of 42,871 on the Thames, 3,927 on the Swale and 3,461 on the Medway. The Thames is therefore currently much more important for this species than the other two sites. Over the five years the maximum on the Thames was 83,716 (06/07); on the Swale 5,002 (07/08) and on the Medway 4,304 (08/09). The threshold for international importance is 4,500 and for national importance it is 2,800

3.90 There are alerts for this species on the Thames, with high alerts for the short term, medium term and since designation and a medium alert for the long term. Knot was not included in the WeBS alerts evaluation for the Medway Estuary and Marshes SPA. The Swale is the only site evaluated within the south-east (out of three) for which no alerts have been issued for this species. Nationally 15 sites have been evaluated for the species and alerts have been issued for up to five (Table 8).

3.91 Knot seem to show different patterns of site fidelity and ranging behaviour between the different sites they winter on. For example colour ringing and radio tracking has shown that in the

Wadden Sea (in the Netherlands / Germany / Denmark) knot readily change roost sites and easily cover areas of about 800 km^2 in the course of weeks, whereas at some other wintering sites (for example, Patagonia, Argentina, Mauritania) the daily foraging range is very small and birds are very faithful to roosts, for example utilising an intertidal area of just 2-16km^2 over several months (Leyrer *et al.* 2006). Little is published about knot movements in north Kent, for example the Greater Thames is under represented by ringing recoveries (Wernham *et al.* 2002). Birds from the Medway estuary and north side of the Swale estuary move to roosting sites in the south and east of the Swale estuary (Hori 1962). Hori also cites disturbance as an issue for this species on the Swale.

Dunlin Calidris alpina

3.92 Dunlin are a qualifying feature in their own right as an over wintering species on all three SPAs and they are part of the wintering waterfowl assemblage on the three sites. This species is experiencing a strong decline in the UK, a decline mirrored by increasing numbers in the Netherlands (see Calbrade *et al.* 2009). The suggestion is that, with milder winters, a greater proportion of birds are wintering in the Netherlands rather than move further west to the UK. In North Kent the wintering population of this species build up during the last quarter of the year and movements have been seen in the late autumn during cold NW winds, most frequently involving birds arriving in the mouth of the Swale at Shellness.

3.93 In the 1970s special counts were organised on the North Kent Marshes in order to accurately assess the wintering population of dunlin at the time. The results of these counts (1973 – 1977) are given in the Birds of Kent (Taylor *et al.* 1984), and show a peak on the Thames of 31,000 (1974/75 winter, 18,000 on the Medway (1976/77) and 10,000 on the Swale (1976/77), indicating a total annual winter population of around 40,000 birds.

3.94 The Thames held the second highest counts of any WeBS sites in the UK in recent years with counts over the period 2004/04- 08/09 averaging 37,251. The Swale and Medway have held numbers of national importance, with the mean for the same period being 7,351 and 9,126 respectively.

3.95 There are current alerts for Dunlin on both the Medway Estuary and Marshes SPA and the Swale SPA. On the Medway there is a high alert for the medium term and since designation and a medium alert for the long term. On the Swale the alerts are a high alert in the medium term and a medium alert for the short term, long term and since designation. Nationally the majority of sites have alerts for this species (for example, of the 25 sites evaluated, 76% have alerts issued for the medium term). Similarly within the region a high proportion of sites have alerts for this species.

3.96 Yates (unpublished) states that the Swale ringing group have ringed c.15,000 dunlin and hold data for over 370 recoveries for this species. Additional ringing data comes of interest comes from a series of canon net catches of roosting dunlin made in Essex at Canvey Island in 1998, on the north shore. The dunlin were dye-marked and subsequent sightings revealed that the birds were roaming over much of the estuary, with subsequent sightings in both the inner and outer Thames (P. Atkinson, *pers. Comm.*).

Black-tailed Godwit Limosa limosa

3.97 Black-tailed godwits are a designated interest feature for all three SPAs as part of the Waterfowl Assemblage and under article 4.1 as an overwintering species. Nationally the species has shown an upward trend since the early 1980s. Recent summaries of the WeBs data (Calbrade *et al.* 2010) show 34 sites supporting internationally important numbers, with the Thames, Swale and Medway all falling within the 'top' 20. Over the entire Thames, the mean peak count for the period 04/05 – 08/09 was 5,311. For the Swale the corresponding figure was 1,589 and for the Medway 1,120. The peak count for the 07/08 winter came from the Thames, where 8,081 were counted in September.

3.98 Within the Swale the species tends to favour the muddy creeks to the west (see Map 5 and also Rowlands 1993). On the Thames, the Northward Hill roost is used regularly until July or August after which the birds are assumed to use the Cliffe roost (Yates unpublished).

Bar-tailed Godwit Limosa lapponica

3.99 As with other species, such as dunlin, bar-tailed godwits have declined in recent years as a wintering species within the UK. Those wintering in Britain are of the nominate race *lapponica* whose breeding range extends from northeast Europe to western Siberia. The species is an interest feature of the Swale SPA only, where it qualifies under both article 4.1 (overwintering) and article 4.2 (waterfowl assemblage). Counts of this species on the Swale have been in the 1000s, for example 1,200 occurred in the Swale in February 1957 and December 1959 (Taylor *et al.* 1984). In recent years (2004/5– 2008/09) the site has supported nationally significant numbers with the five year mean being 716. There are no alerts triggered for the Swale for this species.

Whimbrel Numenius phaeopus

3.100 Whimbrel are an interest feature of the Medway SPA, occurring on passage. The species is also listed under article 4.2 as part of the waterfowl assemblage for the Medway SPA and the Thames Estuary and Marshes SPA. The Birds of Kent (Taylor *et al.* 1984) gives the peak spring passage for this species in the county as occurring during late April and the first half of May, with the earliest record in the Medway on 4th March 1961. The autumn migration develops during July and the highest numbers are recorded during the last week of July and the first three weeks of August. The species is often poorly represented by WeBs counts due to short migration window and limited coverage of counts between April and August.

Curlew Numenius arquata

3.101 Curlew are listed within the waterfowl assemblage for the Medway Estuary and Marshes SPA and the Swale SPA and also features as an interest feature in its own right as a wintering species for the Medway Estuary and Marshes SPA.

3.102 Nationally curlew numbers increased from the mid 1970s until the start of the 2000s, since when the trend has been one of a slow but steady decline, continuing in 2008/09 to a point where the index is now at a level similar to that when standardised monitoring commenced in 1974/75 (Holt *et al.* 2009).

3.103 According to the Birds of Kent, each of the three estuaries have regularly held over 1000 curlew between July-March, with most of the really high counts either in the autumn (July-September) and in mid-winter (January and February). Highest counts given in the period up to 1981 (when the first edition of the book was published) include 5,000 on Sheppey in February 1955 and March 1961 and on the Medway in August 1961, with 6,000 on the Thames in February 1966, when there were also 2,500 on the Swale. More recently, numbers on all three sites are much lower. Calbrade *et al.* (2010) do not list the Medway or the Swale as holding even nationally important numbers. The entire Thames for the period 2004/05 – 2008/09 held a mean of 4,549.

3.104 In common with a number of other wader species recorded on the Medway, Curlew numbers have shown a decline. This is sufficient to trigger a high alert (since designation) and a medium alert (in the short and medium terms) for the SPA. The Medway is the only site in the south-east (four sites evaluated) with alerts for this species, and nationally there is a relatively small proportion of sites with alerts for Curlew (see Table 8), potentially indicating site specific issues for this species on the Medway.

3.105 Extensive ringing of curlews has shown little interchange between the Swale and Thames populations (Taylor *et al.* 1984)

Redshank Tringa totanus

3.106 Redshank are a qualifying interest feature (under both article 4.1 and article 4.2) for all three SPAs. They are also part of the breeding assemblage on the Swale.

3.107 Redshank numbers tend to build up in July-August and the highest numbers for the year often occur in autumn, especially on the Medway were the autumn totals usually exceed the winter (Taylor *et al.* 1984). Extreme counts on the Medway have included 3,000 (September 1962) and 3,750 (October 1975). Numbers tend to drop in the early autumn and rise again over the winter. Cliffe Pools has historically held high numbers in mid winter (for example, 3,000 in February 1965).

3.108 Mean peak counts for the five year period (04/05-08/09) on the Thames, Swale and Medway have been 4,313, 1,527 and 1,237 respectively. The Medway is therefore only just above the current threshold for national significance (1,200). The Thames is the only one of the three SPA sites with numbers currently above the threshold for international significance (above 2,800).

3.109 There are alerts for this species for the Medway Estuary and Marshes SPA and the Swale SPA. On the Medway there are high alerts for the medium term and since designation, and medium alerts for both the short and the long term. On the Swale there are medium alerts for the short and medium term. Trends on the Swale appear to be similar to regional trends, but on the Medway Estuary and Marshes the trend indicates a marked increase (compared to the region as a whole) in the late 1980s, but since then a steady and very strong decline, triggering the high alerts. This would suggest site specific issues potentially on the Medway. Besides the Swale and the Medway three additional sites were evaluated for the species in the south-east and of these only one has any alerts (Table 8).

3.110 Colour ringing and radio-tracking at other estuaries in the UK shows wintering redshank to be relatively site faithful, with birds remaining within bays or adjacent sites both within and between winters and typically remaining within c.4km of the ringing location (Burton 2000).

Individual species accounts: Breeding birds

Marsh harrier Circus aeruginosus

3.111 Marsh harrier is listed under Article 4.1 as a breeding species in The Swale SPA with 24 pairs representing at least 15% of the breeding population of Great Britain in 1995.

3.112 Marsh harriers first bred in Kent in 1942 but thereafter there were only single breeding attempts during the 1940s and 1950s until 1983 and 1984 when birds bred on Sheppey. They then bred annually on the island in increasing numbers from 1989 with five nests in 1991, 14 in 1994 and 21-24 nests in 1997 (Rowlands 1999). The first nest record on the mainland since 1946 was in 1998 and in 2004 ten nesting attempts were recorded (Oliver pers. comm.). In 2005 there was a national survey of marsh harriers across the UK which located 352 nesting females across the UK. In Kent there were 41 successful nests, rearing 99 fledged young, a further seven possible nests and six failed nests giving 55 nests in all, or 16% of the national total of nests and 12% of the fledged young. Nest failure rates at 11% were over twice the national average of 5%. Most of the nests (35) were on Sheppey or the south Swale (7) in, or adjoining The Swale SPA with one on the south shore of the Medway and another on the south shore of the Thames Estuary.

3.113 Marsh harriers in the past have generally nested in large reedbeds, but in recent years have increasingly bred in smaller reedbeds in ditches and creeks as well as crops as the population has increased (Underhill-Day 1998)

3.114 Nest sites in small reed stands and crops are usually in remote areas, often surrounded by arable agriculture and far from human settlements. Marsh harriers are very vulnerable to disturbance,

particularly at the nest and in small reedbed sites. They are also susceptible to disturbance in agricultural crops, particularly from spraying operations early in the season and have in the recent past been persecuted by shooting and poisoning (Underhill-Day 1990).

Avocet Recurvirostra avosetta

3.115 Avocets are interest features for both the Swale and the Medway SPAs. Avocets were scare breeders in Kent by 1870 (Taylor *et al.* 1984) and the Birds of Kent documents only one breeding record, in 1958 at Yantlet.

3.116 The Kent Bird Report (Taylor *et al.* 1984) for 2006 reports that at least 284 pairs bred in the county, with 150 at Chetney, 10 at Northward Hill, 111 on Elmley RSPB Reserve, 3 on Oare Marshes and eight on the Swale NNR.

Mediterranean gull Larus melanocephalus

3.117 The Mediterranean gull is listed under Article 4.1 as a breeding species in The Swale SPA with twelve pairs representing at least 12% of the breeding population of Great Britain in 1995.

3.118 Mediterranean gulls are native to the Black Sea, where, following a massive increase in numbers, the species spread across Europe and has now been recorded breeding in most west European countries (Wernham *et al.* 2002). The species was first recorded breeding in the UK in 1968 and has since spread to a number of sites in East, South-east and Southern England and is also breeding in Ireland. Of a total population of some some 225 pairs in 2005 (the last year for which published figures are available) over 90% were in the South-east and South of England (Mavor *et al.* 2008). In Kent, the last available figures showed 21 pairs at three sites in 2002

3.119 The main threats to Mediterranean gulls come from high tides as the birds nest on high salt marsh or low islands. There have also been threats from egg collectors, particularly where the birds are nesting among black-headed gulls *Larus ridibundus* and the eggs of the latter are being collected (legally or illegally) for human consumption (Wood, Hudson and Doncaster 2009).

Little Tern Sterna albifrons

3.120 Little tern is listed under Article 4.1 as a breeding species in The Medway Estuary and Marshes SPA with 1.2% of the GB breeding population (5 year mean 1991-95).

3.121 The latest national breeding seabird survey took place in 1998-2000, and this estimated the national population of breeding little terns at 2153 pairs with 72% of these in England, 15% in Scotland, 4% in Wales and 10% in Northern Ireland (Mitchell *et al.* 2004). The national index for little tern shows a long term decline from 1987 to a low in 2005 with a rapid recovery to 1999 levels by 2008. In Kent the national surveys recorded 55 breeding little terns in 1969/70, 135 in 1985/88 and 38 during 1998/2000. This represents a decline of 31% since 1969/70 with the population during the last national survey being 2% of the GB population. In 2001 number dropped further to 23 pairs, no breeding pairs in 2002, with very small numbers since.

3.122 The latest Kent Bird Report (2006) states that none bred on the Medway (for the first time in many years) and that on the Swale birds were present (single figures in June), but no breeding confirmed. In 2005 there were 14 nests in the Medway and 5 nests on the Swale (at Castle Coote).

3.123 Little Terns in the UK tend to occur in small colonies and most colonies are fenced, protected and monitored each year. Measures employed at colonies include reducing disturbance by people and dogs through wardening, public education and fencing, moving nests to safer locations, raising individual nests or even whole nesting areas above the level of high spring tides. These measures can result in large, dense colonies in fixed locations, which in turn act as a focus for predators. In Portugal low breeding success of little terns has shown to be associated with

human activities (Calado 1996) and wardening has been shown to be effective (Medeirosa et al. 2007).

4 Invertebrate and plant species: Status of Ramsar interest features

Invertebrates

4.1 The Ramsar Interest Feature invertebrate species are described in Table 10 and locations of records are shown on Map 28. Of the 39 scarce or rare invertebrates listed in Table 10 that appear in the Ramsar citations for one or more of the Thames Gateway Ramsar sites, the great majority are closely associated with coastal habitats. Salt marshes and grazing marshes with brackish ditches or saline pools are the habitats that support most of these restricted species. In some instances however, whilst coastal locations account for the predominant occurrences, the species is found inland if suitable habitat survives. Reedbed and fen species such as the fly *Cephalops perspicuus* and the cranefly *Erioptera bivittata* are such examples; and of course it happens that coastal locations support some of the best surviving reedbed habitat.

4.2 Similarly some of the rare species that depend on pools happen to find suitable habitat in coastal locations, such as the water beetle *Cercyon bifenestratus*, the bug *Micronecta minutissima* and the snail-killing fly *Pteromicra leucopeza*.

4.3 For many of the scarce species, the south eastern coasts are especially important, and examples include the aquatic weevils *Bagous longitarsis* and *B. tubulus*, the spider *Baryphyma duffeyi*, the rove beetle *Philonthus punctus*, the horsefly *Hybomitra expollicata* and the ground lackey moth *Malacosoma castrensis.* For some of the rarest species, the coastal habitats of the Thames estuary are the only known locations in UK such as the beetle *Malachius vulneratus*, and the ground bug *Henestaris halophilus*.

4.4 As with plants, the Red Data listing reflects threat usually due to recent decline, rather than simply rareness based on number of 10km squares in which the species is recorded. There is some variability in the date for this Red Data assessment however, with the status of some species modified recently while others may have remained unchanged since their initial assessment in 1991. Perhaps the clearest example of an anomaly resulting from this difference in assessment date is that of the bee wolf *Philanthus triangulum*. This is given RD status of "vulnerable" but this wasp, unlike almost all of the other species listed in the table, has actually increased in distribution over the past few years, perhaps largely due to climate change.

4.5 It is clear that notwithstanding substantial former loss of habitat to agriculture and development, the surviving coastal habitats of the Thames Gateway in North Kent support an outstanding assemblage of rare and scarce species of plants and invertebrates.

Table 10 Actual data Ramsar invertebrates: Number of records, from Kent Biological Records Centre plus occupancy figures for England, Red Data List status and other listings

Name		Thames Estuary & Marshes	Medway Estuary & Marshes	The Swale	No. 10km square records in England	Red data listing	Other
Cercagnota (Anagnota) collini	A fly				10	Vulnerable	
Anisodactylus poeciloides	A ground beetle			1	24	NR	BAP
Atylotus latistriatus	A horsefly		1	1	17	NR	
Aulacochthebius exaratus=Octhebius exaratus	A water beetle				30	NR	
Bagous tubulus (cylindrus)	A weevil	2			11	Vulnerable	
Bagous longitarsis	A weevil				3	Endangered	
Cosmobaris(Baris) scolopacea	A weevil		2	2	11	NR	
Baryphyma duffeyi	A spider	1			14	NR	BAP
Berosus fulvus	A water beetle					NR	
Berosus spinosus	A water beetle				25		
Campsicnemus magius	A fly	3		4	15	Nr threatened	BAP
Cantharis fusca	A soldier beetle				69	NR	
Cephalops perspicuous	A fly		1		11	Nr threatened	
Cercyon bifenestratus	A water beetle	1			22	Notable A	
Dicranomyia danica=Limonia danica	A cranefly	1	2	2		NR	
Elachiptera rufifrons	A true fly		1	4	2	NR	
Erioptera bivittata	A cranefly	4	3	5	22	Vulnerable	
Haematopota bigoti	A horsefly	2			27	NR	

Table continued...

Name		Thames Estuary & Marshes	Medway Estuary & Marshes	The Swale	No. 10km square records in England	Red data listing	Other
Henestaris halophilus	A groundbug			1	6	Vulnerable	
Hybomitra expollicata	A horsefly		4	2	13	Vulnerable	
Hydrochus elongatus	A water beetle				81	NR	
Hydrochus ignicollis	A water beetle				25	NR	
Hydrophilus piceus	A water beetle	8	3	1	67	NR	
Lejops vittata	A hoverfly	3	1	3	31	Vulnerable	
Lestes dryas	Scarce Emerald damselfly	34		6	83	Nr threatened	
Limnophila pictipennis	A cranefly			4	22	Vulnerable	
Limonia danica	A cranefly				26	NR	
Malachius vulneratus	A beetle		2	3	10	NR	
Malacosoma castrensis	Ground Lackey moth	3	9	7	50	NR	
Micronecta minutissima	A true bug				22	NR	
Myopites eximia	A true fly		2		9	NR	
Ochthebius exaratus	A water beetle	2	4	1			
Philanthus triangulum	A solitary wasp	3	4	3	>100	Vulnerable	
Philonthus punctus	A rove beetle	1		1	14	NR	
Poecilobothrus ducalis	A dancefly		1	1	8	Nr threatened	
Polystichus connexus	A ground beetle			1	21	Vulnerable	
Pteromicra leucopeza	A snail-killing fly				10	Vulnerable	
Stratiomys longicornis	A soldier fly	4	1	3	32	Vulnerable	
Telmatophilus brevicollis	A fungus beetle				29	NR	

Plants

4.6 The Ramsar Interest Feature plant species are described in Table 11 and locations of records are shown on Map 29. Nineteen of the 25 plants listed in Table 11 that appear in the citations for one or more of the three Ramsar sites, are strongly coastal in their habitat preference. Of those that occur in other habitats, three (oak-leaved goosefoot *Chenopodium glaucum*, brackish water-crowfoot *Ranunculus baudotii* and Clustered clover *Trifolium glomeratum*) are frequently coastal though not exclusively so. Golden dock *Rumex maritimus* and soft hornwort *Ceratophyullum submersum* can tolerate slightly saline or brackish conditions, whilst occurring more widely in other wet habitats; while water soldier *Statiotes aloides* is widely introduced to waters away from its few native pond and canal sites in eastern England.

4.7 For the strongly coastal species, the habitats include grazing marshes, together with their brackish ditches; upper salt marsh; sandy shingle; tidal mudflats or sandy mud; sea walls and disturbed soils near the sea. Some of these plants have a wide distribution in UK in suitable coastal locations, (for example, golden samphire *Inula crithmoides,* curved hard-grass *Parapholis incurva,* dwarf eelgrass *Zostera noltei*), while some are more limited in their occurrence, often with a strong focus on south and east England (for example, sea barley *Hordeum marinum,* Borrer's salt marsh grass *Puccinellia fasiculata,* perennial glasswort *Sarcocornia perennis*). Several species are virtually restricted to a very few sites in the Thames estuary or adjoining east coast marshes – small red goosefoot *Chenopodium chenopodiodes,* least lettuce *Lactuca saligna,* hog's fennel *Peucedanum officinale.*

4.8 Those plants with a Red Data listing, though not necessarily the rarest as defined by numbers of 10km squares, are given this status due to recent marked declines in their frequency. In many cases this is thought to be the result of habitat losses, such as the reclamation of grazing marshes or the replacement of old clay sea banks with more engineered structures. One of the species – least lettuce – has also been added to Schedule 8 of the Wildlife & Countryside Act, the list of specially protected plants in UK.

Table 11 Actual data Ramsar plants: Number of records, from Kent Biological Records Centre

Common name	Latin name	Thames Estuary & Marshes	Medway Estuary & Marshes	The Swale	No. of 10km square records in England	Red data listing	Other
Bulbous foxtail	*Alopecurus bulbosus*	7		8	58		
Slender hare's-ear	*Bupleurum tenuissimum*	6	7	9	69	Vulnerable	
Divided sedge	*Carex divisa*	56	43	89	94	Vulnerable	
Small red goosefoot	*Chenopodium chenopodioides*	10	3	4	17		
Sea barley	*Hordeum marinum*	7	13	4	63	Vulnerable	BAP
Golden samphire	*Inula crithmoides*	4	10	5	100		
Least lettuce	*Lactuca saligna*	6		2	3	Endangered	Sched 8;BAP
Curved hard-grass	*Parapholis incurva*	1	9	4	84		
Hog's fennel	*Peucedanum officinale*			17	7		
Annual Beard-grass	*Polypogon monspeliensis*	32	21	5	30		
Borrer's salt marsh grass	*Puccinellia fasciculata*	9	3	2	61	Vulnerable	
Stiff salt marsh grass	*Puccinellia rupestris*	10	3	2	73		
One-flowered glasswort	*Salicornia pusilla*	1	1	3	48		

Table continued...

Common name	Latin name	Thames Estuary & Marshes	Medway Estuary & Marshes	The Swale	No. of 10km square records in England	Red data listing	Other
Perennial glasswort	*Sarcocornia perennis*		11	3	58		
Small cord-grass	*Spartina maritima*	1	2	3	28	Endangered	
Clustered clover	*Trifolium glomeratum*	2			93		
Sea clover	*Trifolium squamosum*	2	4	9	63		
Narrow-leaved eelgrass	*Zostera angustifolia*			4	50	Nr threatened	
Dwarf eelgrass	*Zostera noltei*	1	1	3	68	Vulnerable	
Additional species listed on Ramsar							
Oak-leaved goosefoot	*Chenopodium glaucum*				33[7]	Vulnerable	
Soft hornwort	*Ceratophyllum submersum*				119		
Sea kale	*Crambe maritima*				185		
Brackish water-crowfoot	*Ranunculus baudotii*				202		
Golden dock	*Rumex maritimus*				224		
Water soldier	*Sratiotes aloides*				166(15)[8]	Nr threatened	

[7] Non native “Archaeophyte” - first recorded in UK 1713

[8] Genuinely native only in E Anglia – all other records introductions

5 Habitat quality

Overview of key habitats and information on extent within the 3 SPAs

5.1 The three SPAs comprise a complex of brackish, floodplain grazing marsh, ditches, saline lagoons and intertidal salt marsh and mudflat. The intertidal flats are mostly fine, silty sediment, though they are sandy in parts. The salt marsh grades from pioneer communities containing eelgrass to salt marsh dominated by, for example, sea purslane *Atriplex portulacoides*. In the Swale SPA the salt marsh is species rich, for example containing all southern species of salt marsh grass *Puccinellia* and most glasswort *Salicornia* species.

5.2 The grazing marsh grassland is mesotrophic and generally species poor, although containing scattered rarities, mostly annuals characteristic of bare ground. Where the grassland is seasonally inundated and the marshes are brackish, the plant communities are intermediate between those of mesotrophic grassland and those of salt marsh. The grazing marsh ditches contain a range of flora of brackish and fresh water. Drainage channels are periodically cleared and hence support of mosaic of successional stages - the dominant emergent plants are common reed *Phragmites communis* and sea club-rush *Bolboschoenus maritimus.*

5.3 In the Thames Estuary and Marshes SPA in particular, saline lagoons are present which have a diverse molluscan and crustacean fauna. Dominant plants in the lagoons include sea lettuce *Ulva* and green hair algae *Chaetomorpha*. There are also flooded clay and chalk pits some of which have been infilled with dredgings.

Extent and predicted changes

5.4 Extent figures vary slightly according to whether the SPA or Ramsar habitat categories are considered. Figures given here are for the SPA (drawn from the 2001 Standard Natura 2000 data forms) and are supplemented with figures taken from Natural England's biodiversity habitat maps[9] and other sources where available. Information on habitat change is taken largely from the North Kent Coastal Habitat Management Plan (English Nature, 2002).

Thames Estuary and Marshes SPA

5.5 There are 57 ha of intertidal mudflats mapped in the Thames Estuary and Marshes SPA. Both erosion and accretion are currently taking place in different areas (IECS 1994, English Nature 2002). There is currently some accretion below mean Low Water at Blyth sands on the southern side of the estuary (corresponding erosion on the north bank of the Thames suggests that the channel is moving slightly northwards). Yantlet flats has experienced significant accretion along the lower edge of the intertidal since 1940 while the eastern edge of the Grain spit has been eroding. Mucking Flats on the northern side of the Thames (approximately 300ha in size) is reducing in area by about 0.1ha/yr, but has been accreting vertically at approximately 1cm/yr over the past 30 years. The loss of salt marsh habitat (see below) is anticipated to lead to an equivalent gain in mudflat habitat (English Nature, 2002). However, due to the small areas involved, this is expected to be relatively insignificant within the context of the entire intertidal area of the Thames Estuary system. Furthermore, if sediment supply cannot meet demand due to sea level rise, there may be some loss of mudflat habitats due to erosion.

[9] **http://www.gis.naturalengland.org.uk/pubs/gis/GIS_register.asp**

Table 12 Habitat areas estimated from percentage area figures provided on the standard Natura 2000 data form for each SPA

Habitat (Spa Categories)	Area (ha)		
	Thames Estuary & Marshes	**Medway Estuary & Marshes**	**The Swale**
Tidal rivers, Estuaries, Mud flats, Sand flats, Lagoons	2773 (75%)	3139 (67%)	2541 (39%)
Salt marshes	73 (1.5%)	703 (15%)	326 (5%)
Islets	44 (0.9%)		65 (1%)
Inland water bodies	271 (5.6%)	47 (1%)	130 (2%)
Marshes, Water fringed vegetation	179.04 (3.7%)	47 (1%)	
Dry grassland	91.94 (1.9%)	47 (1%)	
Humid grassland, Mesophile grassland	1408.13 (27.1%)	703 (15%)	
Other arable			3062 (47%)
Other, inc. towns, road, industrial			391 (6%)

5.6 Information from the late 1990s indicates that there is approximately 78ha of salt marsh within the Thames Estuary and Marshes SPA (Environment Agency 1999, Kent County Council 1997). The standard Natura 2000 data form[10] for the SPA lists 1.2 % (73ha) of the total site area as salt marsh. Small patches occur on the northern end of Mucking Flats (10ha) and within Mucking Creek (6ha). Relatively high rates of accretion (1cm/yr) are recorded for Mucking Flats and it is possible that if this continues salt marsh growth here may be able to keep pace with sea level rise (English Nature, 2002). Larger areas of salt marsh occur on the southern bank of the Thames. Analysis of aerial photographs indicates that over the last 40 years there has been an average net change of –0.36 ha/yr of salt marsh (Centre for Coastal Management (CCM) 2002). Erosion has predominantly occurred at the salt marsh–mudflat boundary, while accretion has occurred at the higher salt marsh levels closer to the landward margins. The presence of flood defences restricts the potential for long term landward migration of salt marsh. If the historical trend of salt marsh loss continues, then all of the salt marsh within this area could be lost by 2100 (English Nature, 2002).

5.7 Natural England's biodiversity habitat maps show 1,468ha grazing marsh and 155ha of saline lagoons within this SPA. The standard Natura 2000 data form for the SPA lists 27.1% (1408ha) of the total site under the corresponding category of humid and mesophile grassland.

Medway Estuary and Marshes SPA

5.8 There are 2,851ha of mudflat mapped in the Medway Estuary and Marshes SPA. Historical evidence indicates that the extent of the intertidal mudflats has increased over the last 200 years, probably attributable to salt marsh erosion (see IECS in English Nature 2002). However Kirby (1990) identified a trend in vertical mudflat erosion of 2m over the last 200 years (1cm yr-1). Predicted increases in the area of salt marsh (see para. 5.26) are likely to result in a concomitant decrease in the area of mudflats.

[10] **http://www.jncc.gov.uk/pdf/SPA/UK9012021.pdf**

5.9 The highly fragmented salt marshes of the Medway cover 15% of the total area (703ha) according to the standard Natura 2000 data form for the SPA[11], while English Nature (2002) quote a figure of 813ha in 2000. The late 17th Century map of the Medway shows that the estuary at this time possessed extensive salt marshes, probably covering 2500 to 3000ha. By the mid-20th Century, these salt marshes had almost entirely vanished. However, the overall trend since 1972 has been one of net accretion, although there has been continuing erosion of specific areas at the salt marsh – mudflat boundary as indicated by Burd (1992) and through the enlargement of internal creek channel (Kirby, 1990). The majority of salt marsh accretion has occurred in the Stoke Saltings area, landward of the original salt marsh – mudflat boundary and can be attributed to the growth of the invasive species cordgrass *Spartina* spp.

5.10 Predictions of the future development of salt marsh (English Nature 2002) suggest that 3000ha of salt marsh could be formed by 2100. The impact of any increase in the rate of sea level rise on these predictions is anticipated to be minor (for example, a reduction in overall extent of salt marsh by up to 200ha), as the expansion of salt marsh would appear to be linked to the recovery of the system following mud-digging rather than a response to sea level rise.

5.11 The Medway Estuary and Marshes SPA supports 626ha of grazing marsh according to the biodiversity habitat map. The standard Natural 2000 data form lists 15% of its area (703ha) under humid and mesophile grassland. Grazing marsh losses have been substantial between the 1930s and the 1980s. The SPA also supports a small area of saline lagoons (6.5ha).

The Swale

5.12 There is some discrepancy in the figures for the area of mudflat present in The Swale SPA. The biodiversity habitat map shows some 1,216ha, the standard Natura 2000 data form[12] lists 39% (2,541ha) of the SPA under mudflats and tidal estuary, while English Nature (2002) describes 2,042ha of intertidal mudflat. A loss of 170ha is predicted by 2100 (English Nature, 2002).

5.13 Analysis of aerial photographs (CCM 2002 in English Nature 2002) indicates that there are at least 282ha of salt marsh in the Swale, mainly in the wider eastern Swale, although small pockets exist at the western end of the channel. The standard Natura 2000 data form lists 5% (326) of the SPA as salt marsh. Comparison of historical aerial photographs of salt marsh habitat indicates that the overall trend in the Swale since 1961 has been one of net accretion (+1.50 ha per year) although there has been erosion in some areas, and both accretion and erosion have been greater since the 1980s (CCM, 2002). If this linear trend is extrapolated, the area of salt marsh in 2100 is predicted to be 425ha. Predictive modelling indicates that the rate of expansion will fall depending on the rate of sea level rise.

5.14 2,750ha of grazing marsh are shown on the biodiversity habitat map of grazing marsh, although this does not appear to be recorded on the standard Natura 2000 data form for the site. Kent County Council (1997) in English Nature (2002) states that there are about 3,000ha of grazing marsh in the Medway Estuary and Swale. Assuming at least 626ha to be in the Medway Estuary and Marshes SPA (see above), at least 2,374ha of grazing marsh are presumably present in The Swale SPA. The Information Sheet for Ramsar Wetlands[13] for the site describes 47.7% (3,107.5ha) of the site as being seasonally flooded agricultural land. Grazing marsh previously covered extensive areas backing the north and south bank of the Swale (Williams *et al* 1983). There are also 46ha of saline lagoon mapped for The Swale SPA.

[11] **http://www.jncc.gov.uk/pdf/SPA/UK9012031.pdf**

[12] **http://www.jncc.gov.uk/pdf/SPA/UK9012011.pdf**

[13] **http://www.jncc.gov.uk/pdf/RIS/UK11071.pdf**

Table 13 Summary of the predicted changes within the Thames Estuary and Marshes, Medway Estuary and Marshes and Swale SPAs for mudflat, salt marsh and grazing marsh by 2100 (after English Nature, 2002)

Habitat	Thames Estuary & Marshes	Medway Estuary & Marshes	The Swale
Mudflat	Overall, small-scale change anticipated with slight gain due to salt marsh loss, but with some loss due to landward migration of MLW under sea level rise.	Mudflat loss of 2900ha (under sea level rise of 6mm/yr).	Mudflat loss of up to 170ha (under sea level rise of 6mm/yr).
Salt Marsh	Total salt marsh loss (31ha) from the southern Thames. Small areas of salt marsh at Mucking (10ha) may be retained.	Salt marsh gain of approximately 3000ha (under sea level rise of 6mm/yr).	Salt marsh gain of up to 170ha (under sea level rise of 6mm/yr).
Grazing Marsh	Further isolation of low-lying land from saline intrusion, potential small-scale loss of area and quality.	Further isolation of low-lying land from saline intrusion, potential small-scale loss of area and quality.	Further isolation of low-lying land from saline intrusion, potential small-scale loss of area and quality.

Current quality issues

Water

5.15 The Environment Agency is responsible for monitoring water quality via a network of continuous automatic water quality monitoring stations. Dissolved oxygen, temperature and salinity are recorded and at times of low dissolved oxygen, aeration vessels and hydrogen peroxide dosing is used to raise the levels. There have been improvements to water quality over the last decade which are reflected by fish stock improvements (see para 6.26).

5.16 Water quality in the study area is influenced significantly by treated effluent from five Sewage Treatment Works which discharge into the Thames plus others which discharge in to the Medway and Swale. The system was designed in the 1800s and is not capable of handling the volumes of sewage in periods of heavy rainfall. In the 1960s improvements in sewage treatment system resulted in increased fish species diversity and changes in community structure (Araujo, Williams and Bailey 2000). Further increases in treatment capacity and/or improved effluent quality at the sewage works will be carried out over the next nine years, to 2014 (Thames Estuary Partnership 2005).

5.17 Studies by the Environment Agency indicate that the waters in the Thames and Medway estuaries are hyper-nutrified for nitrogen and phosphorus. Symptoms of eutrophication include the growth of green algae which covers large areas of the intertidal mudflats in late summer. However, work undertaken by the Environment Agency has established that, at present, the intertidal mud and associated wintering birds are not being adversely affected by algal mats.

5.18 Sewage discharges and industrial cooling from power stations can increase the water temperature within the study area. The water temperature in the estuary is often found to exceed the threshold (21.5°C) suitable for salmonids, resulting in interference of up-river migration and forcing fish to seek colder waters elsewhere (Thames Estuary Partnership 2005). Increased temperature combined with nutrient enrichment in the Thames results in low dissolved oxygen levels which occasionally fail to meet Environment Agency standards.

5.19 Surges in organic matter in the estuary in wet weather are likely to harbour high concentrations of copper and other metals. Copper and tributyltin (TBT) frequently fail limits set under the EC Dangerous Substances Directive (67/548/EEC) and sporadic failures have been reported for triphenyltin (TPT) and zinc.

5.20 There are no limits on suspended solids levels in the Thames but high levels are seen during spring tides and these can result in increased levels of pollutants released into the water column. Dredging activities can also disturb sediments resulting in the release of pollutants.

Terrestrial habitats

5.21 There is evidence of coastal squeeze and erosion of intertidal habitat within the site as described above. In some areas this appears to be due to natural processes (for example, Medway Estuary) although port dredging and the effects of sea defences and clay extraction may also have a role in intertidal habitat loss (research on mudflat recharge using dredging spoil is being investigated as a means of countering the erosion). The intertidal area is also vulnerable to disturbance from water borne recreation.

5.22 The terrestrial habitats depend on appropriate grazing and management of water quality and quantity. The availability of livestock may be affected by changes in agricultural markets. Evidence suggests that the water supply to grazing marsh has decreased. There has been great development pressure in recent years in the Thames Estuary and Marshes SPA, where implications of development include both direct land-take from the site and indirect disturbance and hydrological effects.

5.23 A number of non-native organisms have become established and may have ecological implications, including Chinese mitten crab *Eriocheir sinensis*, Japanese knotweed *Fallopia japonica*, Himalayan balsam *Impatiens glandulifera* and floating pennywort *Hydrocotyle ranunculoides*. It is also possible that the pacific oyster *Crassostrea gigas* may become established as it is moving westward from colonies in the Thanet area.

Ecological impacts of predicted changes in extent

5.24 The ecological consequences of predicted changes relate predominantly to the predicted shift from intertidal mudflat to salt marsh habitat principally within the Medway Estuary. This change is potentially of greatest significance with respect to a reduction in available feeding area for wintering waterfowl populations, notably mudflat specialists.

Mudflats

5.25 A loss of over 3,000ha of mudflat is predicted, predominately from the Medway Estuary. In terms of the designated interest features, the impacts of this loss are largely related to a reduction in available resource area for feeding wintering waterfowl. Given the size of the area involved, it seems likely that this could lead to a reduction in numbers, possibly below the qualifying thresholds. Displaced birds may be able to use mudflats elsewhere in the estuary – this will depend on whether the remaining mudflats are able to support an increase in feeding waterfowl. English Nature (2002) suggested that it was unlikely that a reduction in species will occur.

Salt marsh

5.26 A gain of some 3,000ha of salt marsh is predicted for the Medway Estuary. There could be potentially an increase (or at least no significant decrease) in the use of the Medway Estuary by salt marsh specialists or species which use both salt marsh and mudflat (for example, dark-bellied Brent geese, wigeon) (English Nature, 2002). Intertidal mudflats are generally more productive when they form part of a habitat complex with salt marsh - salt marsh vegetation provides nutrient input into areas of intertidal mud, which in turn provides an increased food resource for invertebrate fauna. It is therefore possible that the overall productivity of intertidal

mudflat areas could be increased if salt marsh growth is significantly increased. While probably not compensating for the extensive loss of mudflat area available to foraging waterfowl, this increase in productivity may reduce the potential decrease in population levels resulting from change in area (English Nature, 2002).

5.27 The development of new salt marsh within the Medway is principally a result of colonisation by cordgrass. This is a vigorous species which can, under favourable conditions, out-compete the majority of other pioneer salt marsh species, inhibiting the development of a diverse successional salt marsh community. In addition, a cycle of die-back of cordgrass and subsequent release of nutrients and sediment as been observed elsewhere - there can be a 20 year delay before mudflat invertebrate numbers recover (Sherwood *et al.* 2000). It is not currently possible to predict the ecological outcome of the observed colonisation and growth of *Spartina* within the Medway.

5.28 Salt marsh loss of 31ha is predicted from the Thames Estuary. Taken in isolation, this would be detrimental to the site interest features. However, the area is small in comparison to the area of mudflat available, and is unlikely to contribute feeding or breeding habitat for significant numbers of waterfowl (English Nature, 2002). While the site may be used for roosting, there are significant alternative areas (for example, grazing marsh adjacent to the estuary) in the Thames and Medway estuaries. Finally, the predicted large-scale increase in the area of salt marsh habitat within the Medway would more than compensate for the loss within the South Thames (it is likely that there is already significant exchange in waterfowl populations between the sites).

Grazing marsh

5.29 The need to reinforce defences could reduce saline influence and brackish conditions within some areas of grazing marsh (English Nature, 2002). This would affect in particular plant and invertebrate communities (designated Ramsar features) dependent on brackish conditions. More extensive structures could also reduce the suitability to waterfowl due to a reduction in field of view (English Nature, 2002).

Summary of SSSI condition

5.30 A condition assessment is an expert judgement of the condition of a site (that is, a site unit) at a moment in time, based upon available information on defined attributes (which may be biological, chemical or physical), for the notified features on the unit, at the date of assessment. Common Standards Monitoring (CSM) attributes are used to determine whether a site is in Favourable, Unfavourable Recovering, Unfavourable No Change, Unfavourable Declining, Destroyed or Part Destroyed condition.

5.31 Trend information for unfavourable assessments (Recovering, No Change and Declining) depends on information on the management of the site, on Natural England's knowledge of the management required for those features and on the previous condition assessments. Trend information for Favourable condition sites (maintained or recovered) is historically-based, and is determined using the previous condition assessments. Condition assessments of Unfavourable Declining or Unfavourable No Change include, with an assessment of condition, identification of the causes of unfavourable condition and remedies to address these.

5.32 Condition assessments are carried out following Common Standards Monitoring guidance and though relevant, condition assessment is not directly related to Favourable Conservation Status under the Habitats Directive or to assessments of impacts on integrity under the Habitats Regulations. Favourable Conservation Status does not explicitly apply to SPAs as it is a requirement of the Habitats Directive rather than the Habitats Regulations and is therefore not applicable to the North Kent Marshes SPAs.

5.33 Here we summarise SSSI condition assessment data from March 2010. Assessment data are summarised in Map 30.

The Swale

5.34 The SSSI covers an area of 6,568.45 ha, divided into 60 units with 97.83% in favourable condition (6,367.84 ha). Neutral Grassland units cover 48% of the SSSI and 38 of these units covering 2,451.11 ha are suitably managed and provide suitable habitat features for wintering bird species. 31 of these units covering 2,197.80 ha also provide a suitable range of habitat features for breeding birds including lapwing and possibly curlew. Sward structure was judged as good or very good for all units except four where the low-lying grassland is fairly uniform.

5.35 Three units covering 141.14 ha of grazing marsh around Whitstable Bay (2.17% of the site) is in unfavourable condition with no change due to undergrazing, poor ditch management and scrub encroachment with two units at Graveney Marshes under pressure from visitor access and fly-tipping (Map 30). Land parcels in this area are currently being taken into ownership by the council with a view to returning them to favourable condition. In all cases a greater extent of short grassland with open water needs to be made available for the wintering and breeding bird interest feature.

5.36 The remaining habitats in the SSSI consist of two units of standing open water and canals covering 91.26 ha, two units covering the northern and southern littoral sediment habitat in the estuary (3,261.65 ha, 50% of the SSSI) and one narrow unit of fen, marsh and swamp lowland – all four units are in favourable condition.

Thames Estuary and Marshes

5.37 The SSSI covers an area of 5,288.95 ha, divided into 58 units with 95.28% in favourable condition (5,039.23 ha). Four units comprising littoral sediment cover 46.2% of the SSSI. Two units covering 2,443.33 ha are in favourable condition and are used by high numbers of waterfowl including teal and shoveler, shelduck, dunlin, curlew, oyster catcher and lapwing. Two further units (94.52 ha) of scattered salt marsh situated between mudflats and the sea wall along the north coastline of the Hoo Peninsula are in unfavourable declining condition due coastal squeeze (Map 30).

5.38 Coastal lagoon habitat at Cliffe Pools covering 161.07 ha across three units is in favourable condition for breeding and over wintering birds with large numbers of geese, teal, shoveler, pochard and lapwing recorded. In the past unauthorised vehicle access, burning of cars and fly-tipping have posed threats to two units but are no longer an issue since the acquisition of the site by the RSPB in the last 10 years. An adjacent coastal lagoon is currently in unfavourable recovering condition and scrub clearance and grazing management is being undertaken at the site to improve the habitat for breeding and wintering birds (Map 30). Noise disturbance from a nearby industrial works may be an issue in this area from a conveyor belt moving materials from the works to Cliffe Fort.

5.39 The remaining 45% of the SSSI is grazing marsh with 96% of the area in favourable condition as breeding and over wintering habitat for species such as widgeon, shelduck, lapwing, avocet, and curlew. The grazing marsh is concentrated between Gravesend and Cliffe and also between Allhallows and Grain and also has associated common reed bed margins in places. There are two units (grazing marsh and boundary linear feature) which help screen more sensitive nesting areas as one unit deflects high visitor numbers and the other acts as a physical barrier to industrial works.

5.40 Westcourt Marshes on the outskirts of Gravesend is in unfavourable condition with no change due to damage by regular ploughing and the habitat is not meeting objectives for the breeding and wintering bird features. The adjoining SSSI also experiences disturbance through antisocial behaviour. There are ongoing discussions with a development company to bring this land back

into favourable condition. (This part of the SSSI is not SPA and the ploughed area lies outside of the Ramsar site). The unit at Ryestreet Common is in unfavourable condition due to drainage and grazing issues which are to be addressed through a future HLS agreement.

Mucking Flats

5.41 The Thames SPA includes Mucking Flats SSSI on the north shore of the Thames. The site includes 312.71 ha of littoral sediment in favourable condition for wintering and breeding birds. One unit covering 18.37 ha classified as coastal lagoon is currently in unfavourable condition with no change (Map 30). The grassland in this unit is rank with some tall ruderal species and weed control measures are required to return this area to suitable habitat as a high tide roost. In addition this unit has a footpath running along the western edge from Coalhouse Fort causing considerable disturbance from visitors.

Medway Estuary and Marshes

5.42 The SSSI covers an area of 4,748.83 ha, divided into 29 units with (in March 2010), 98.84% in favourable condition (4,693.79 ha). Over 80% of the SSSI is formed of two units of littoral sediment in favourable condition running from St Mary's Island to Sheerness on both sides of the estuary. Both units were previously listed as unfavourable due to the poor botanical quality and suspected impacts of algal mats, however, neither issue is considered to be affecting the condition of the site.

5.43 Neutral grassland covers 17.7% of the SSSI and is roughly split between the area to the north of Gillingham and the north west of the Kingsferry Bridge. Good numbers of wigeon have been recorded on the Medway grazing marshes and active ditch management is occurring across much of the site. Two units around Otterham Creek are in unfavourable condition with no change due to undergrazing on the grassland unit and inappropriate ditch management on both the grassland and fen units. Kent Wildfowling and Conservation Association own the fen unit and they are working with Natural England to bring the area back in to favourable condition. There is one coastal lagoon mudflat unit (22.56 ha) to the north of Queenborough which was destroyed due to planning development for a car park as part of Sheerness Docks.

5.44 The condition of the Medway Estuary and Marshes SSSI was reassessed in 2010 with particular regards to the main bird features. The condition was determined as unfavourable recovering. The bird features were assessed as unfavourable because there have been some bird declines of over 50% in the SSSI that are not in line with regional or national trends and appear to be related to local, site-specific factors. Recovering means that processes are in place to address the factors that are known to be reasons for declines.

Information on prey abundance

5.45 There are significant stocks of cockles, mussels, native flat oysters, pacific rock oysters, shrimps and razor fish within the Thames Estuary. Information on invertebrate prey abundance has been gathered with respect to the shellfishery only and is summarised in the State of the Thames Estuary Report (Thames Estuary Partnership 2005).

5.46 Virtually all management of shellfish stocks is undertaken by Kent and Essex Sea Fisheries Committee (K&ESFC). Data are available from annual surveys of the cockle beds conducted by the K&ESFC within the Thames Estuary since 1988. Sample stations are positioned within a grid and sampled using a 0.1m² quadrat. The results of the surveys are used to examine the distribution and density of cockles, and to produce estimated values of population size. In 2009 27 grab samples were taken across 3.6km2 in the Leysdown and Ham grounds with a stock assessment estimate of 85.6 million cockles with a mean weight of 0.2g (Bailey and Wiggins 2009).

5.47 The management of fin fish stocks is also overseen by K&ESFC. CEFAS and the Environment Agency undertake annual surveys of fish stocks in the estuary. The Zoological Society for London has also been running a long-term monthly fish survey at Tilbury Marshes since 2006. The ZSL survey will provide information on the effects of pollution incidents, the overall water quality of the Thames and natural fluctuations in important commercial and recreational fish populations.

6 Threats and issues

Current extent of housing and other development

6.1 The current level of residential development surrounding the three sites is considerable (see Map 31 which shows the distribution of residential postcodes and number of residential properties in relation to the three SPAs). Chatham, Sheerness, Sittingbourne, Gillingham, Whitstable and Gravesend all lie adjacent to the SPA boundary. There are in fact over 30,000 residential properties within 1km of the three SPAs (i.e. a single buffer plotted around all three SPAs), and nearly 90,000 within 2km .

6.2 The number of houses and businesses at different distance bands from each SPA are summarised in Figure 3. The proximity of the Thames SPA to the outskirts of London is clear, with a steady rise in the amount of development at successive distance bands and large amounts of housing and development between 15 and 20km from the SPA boundary. The cumulative amount of development within 20km of the Thames Estuary is by far the highest of the three sites (Table 14), but looking at the closer distance bands it is the Medway that has the highest amount of development directly adjacent to the SPA, with around 50% more houses within 5km as the Thames Estuary and Marshes SPA and the Swale SPA. Taking the national average occupancy rate of 2.36[14] people, the Medway has over a quarter of million people living within 5km.

Table 14 Cumulative totals for the amount of residential properties within different distance bands from each SPA

SPA	Distance from SPA boundary			
	5km	10km	15km	20km
Thames Estuary & Marshes	74,710	268,498	471,223	766,847
Medway Estuary & Marshes	112,509	194,739	399,938	562,528
The Swale	69,492	123,546	208,068	398,711

Data extracted from royal mail delivery point data in GIS.

[14] The national average from the 2001 census, see:
http://www.statistics.gov.uk/census2001/profiles/commentaries/housing.asp

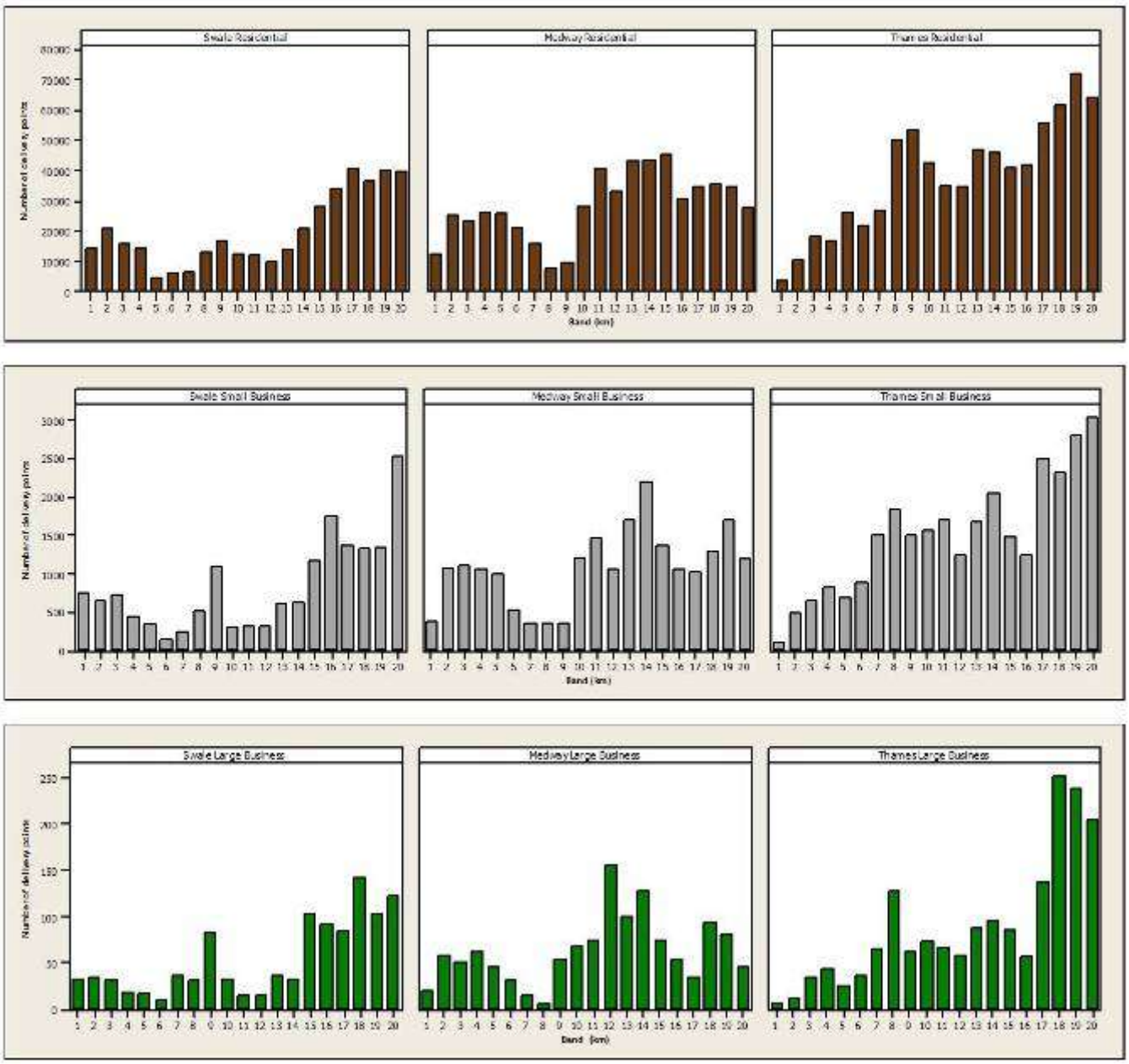

Figure 3 Number of Royal Mail delivery points within different distance bands (1km bands, up to 20km) from the SPA boundary, derived separately for each SPA

Future development

6.3 The Thames Gateway stretches 70km east from inner East London on both sides of the River Thames and the Thames Estuary, and encompasses the Isle of Sheppey. The area, which includes much brownfield land, has been designated as a growth area and a national priority for urban regeneration by the Government. The development is delivered through regional development agencies, special purpose development corporations and local partnerships. The Thames Gateway Delivery Plan includes proposals to create 225,000 jobs and build 160,000 houses by 2016. Key sites for development include the Medway Waterfront and Kent Thameside Waterfront. Future development is summarised in the State of the Thames Estuary Report (Thames Estuary Partnership 2005) with a summary map of key development sites.

Table 15 Summary of selected major development locations in North Kent, from the Thames Gateway Delivery Plan

Name	Description
Chatham Maritime – Medway Renaissance	Major mixed-use development and conservation of former Dockyard in Chatham. Includes a range of commercial, retail, leisure development, a marina, housing, community facilities.
Chatham Centre and Waterfront – Medway Renaissance	Mixed use redevelopment throughout the town centre, in what will become the centre of Medway City. The programme includes Waterfront, Brook and Station Gateway sites as well as redevelopment and retail expansion of the Pentagon Shopping Centre.
Dartford Town Centre – Kent Thameside Delivery Board	Redevelopment throughout the town centre, including the Northern Gateway and Lowfield Street areas including new housing and commercial development.
Ebbsfleet Valley – Kent Thameside Delivery Board	Major mixed-use redevelopment surrounding the new International Station at Ebbsfleet.
Gravesend Town Centre – Kent Thameside Delivery Board	Redevelopment throughout the town centre, including the Heritage Quarter, the waterfront and the Transport Quarter.
Kent Thameside Waterfront Development – Kent Thameside Delivery Board	Mixed-use development along the 9 mile stretch of waterfront of the Dartford and Gravesham boroughs including Northfleet Embankment, the Bridge, Ingress Park, Swanscombe Peninsula and the Gravesham Canal Basin.
Queenborough and Rushenden – Swale Forward	Community led mixed-use development on the Isle of Sheppey including new housing, green space, school, a new marina and leisure facilities, plus major new commercial space and employment growth.
Rochester – Medway Renaissance	New housing, hotels, commercial space, river walk, public realm, and health and community space along the waterfront at Rochester
Sittingbourne – Swale Forward	Mixed use redevelopment within the Sittingbourne area including developments of The Meads, Iwade, East Hall Farm, Kemsley Fields, Milton Creek, and retail expansion of the town centre.
Strood – Medway Renaissance	Mixed use redevelopment along Strood waterfront

6.4 Proposals for a large international airport on Cliffe Marshes were dropped from the Government's white paper on air transport in 2003. Other options for airport expansion have been suggested including the possibility of a floating airport off the Isle of Sheppey (Oakervee 2009).

Extent of public access and access infrastructure

Coastal access

6.5 In 1995 the Port of London Authority identified over 250 access points, primarily stairways and slipways around the Thames (excluding the Medway and Swale) and a recent survey has reviewed the condition, status and usage of these access points (Thames Estuary Partnership 2005). Map 33 shows the locations of Public Rights of Way in North Kent.

6.6 In 2001 The Thames Estuary Recreation Study was completed to provide a comprehensive overview of water and land-based recreation. The study details measures to enhance foreshore

access, but does not quantify the level of existing foreshore access or comment on the quality of such access. The study identified a wide range of projects to address:

- The development of a Thames walking and cycling route from City to Sea.
- Promotion of approved and accessible launching and landing sites, mooring and amenities.
- Co-ordination of information and promotional material for water and land based recreation opportunities and safe practice.

6.7 The City to Sea project is a rights of way initiative for the outer Thames Estuary. The project outlined a vision to highlight the opportunities created from connecting the Thames Barrier to the outer reaches on both sides of the Estuary. The route would effectively extend the Thames Path National Trail (launched in 1996) out to the Isle of Grain (Kent) and Shoeburyness (Essex). This project has most likely influenced the proposals for the North Kent Coast to be one of the first areas to have coastal access improved through the Marine and Coastal Access Act 2009. Natural England will be creating the path over the next ten years and the exact route will be negotiated with interested parties (Natural England 2009).

6.8 In 2005 the Environment Agency commissioned Capita Symonds Ltd to undertake a study as part of the Thames Estuary 2100 (TE2100) project to map recreational sensitivity in the Thames area. This exercise involved mapping all recreation clubs such as sailing and sports clubs and collecting questionnaire data to look at the type and intensity of activities. Whilst the main aim of this study was to assess the sensitivity of recreation to the impacts of different ways of managing flood risk, the study has meant that a large body of GIS data already exists on recreational infrastructure surrounding the Thames SPA / Ramsar.

6.9 The Marine and Coastal Access Act (2009) will result in enhanced access to England's coast. North Kent will be one of the initial areas where access will be improved[15].

Car parks

6.10 Car parks were identified and mapped within 1km of the study area (Map 32, Table 16) to inform this report. Fifty-six car parks were identified, providing 2,061 spaces. More than half of the car parking spaces in the study area are situated around the Swale. Thirty-seven percent of car parking spaces in the study area are informal, for example lay-bys etc. There is a particular focus of car parking facilities along the seafront from Whitstable to Faversham and also between Leysdown down to Shellness to the north. The majority of caravan parks and beach huts are also located in these areas with over 6,000 caravans and chalets on the north coast of the Isle of Sheppey (Map 34).

6.11 Between Faversham and Sittingbourne there are very few car parking locations with the largest provision at the Oare Marshes reserve where the Saxon Shore Way runs west with no access by car until Conyer, where there is limited parking. Car parking was not identified at Sittingbourne although this is a residential area adjacent to the Swale SPA with access via the Swale Heritage Trail and Saxon Shore Way. On the north shore of the Swale there are few parking locations apart from the Ferry Inn at Harty and possibly within the surrounding villages. Further west along the Isle of Sheppey there is a car park and access to the SPA, NNR and coast at the RSPB Elmley reserve.

6.12 Into the Medway SPA, more than 200 spaces are available within Queenborough town centre although there is limited access to the SPA except along the harbour front to Rushenden. However, the level of access to the foreshore will change under plans for improved coastal access in the area. There is a concentration of formal and informal parking from Otterham Creek to Gillingham with 80 spaces provided at the Riverside Country Park. Car park data from automated counter strips covering the period 2008/9 (April – December) and visitor centre data

[15] **http://www.naturalengland.org.uk/about_us/news/2009/121109c.aspx**

for 2009/10 (excluding March) are available for Riverside Country Park (Figure 4). In total 63,959 people were recorded at the visitor centre and 121,395 cars were counted in the car parks.

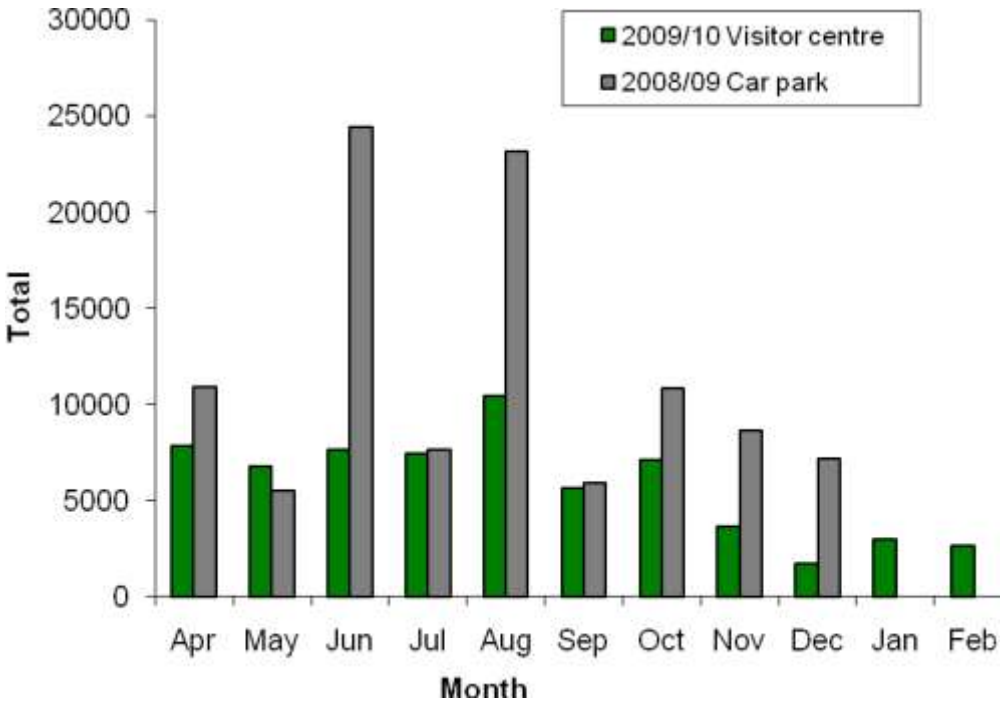

Figure 4 Monthly car park and visitor centre count data for Riverside Country Park (Medway Council)

6.13 On the north shore of the Medway there are two large car parks (c.80 spaces) at Lower Upnor and Hoo St Werburgh, each roughly a kilometre from the SPA boundary. Despite their distance from the SPA boundary, these car parks were included as they are linked to footpaths which lead on to the Saxon Shore Way around the Hoo flats and marshes (Table 16). From Kingsnorth to Grain there is limited informal parking (less than 15 spaces) to access the coast path around the Stoke Saltings.

6.14 There is a car park at Grain providing 70 spaces with access for visitors to the blue flag beach at the south eastern tip of the Thames SPA. Along the north shore of the Hoo peninsular there is limited access to the Thames SPA apart from Allhallows holiday park (140 spaces) and also minimal informal parking within the villages inland from the Thames heading to Gravesend. On the north shore of the Thames, car parking is provided at Coalhouse Fort which is a popular visitor attraction with access to a footpath to the north along the SPA boundary.

Table 16 Car parking capacity within approximately 1km of each SPA

Capacity	Swale		Medway		Thames	
	Car parks	Spaces	Car parks	Spaces	Car parks	Spaces
1-10	6	48	11	37	8	32
11-30	7	164	5	91	3	65
31-100	5	283	2	160	4	305
101-200	2	330	1	166	1	120
>200	1	260	0	0	0	0
Total	**21**	**1085**	**19**	**454**	**16**	**522**

Water-based access

6.15 Sailing and other water-based recreation is very popular in the wider Thames Estuary. In 2001 there were around 20 yacht clubs situated along the wider Thames Estuary (Thames Estuary Partnership 2005).

6.16 The Medway and Swale are particularly well used as they provide calm sheltered water and a variety of popular locations all within a day's sail. Most water-based access points such as jetties, slipways and marinas and their associated sailing clubs (Map 35) are located around the larger towns and there are concentrations in the Faversham, Oare, Conyer and Milton Creeks. There are a number of facilities including eight slipways, seven sailing clubs and three marinas on the north shore of the Medway between Lower Upnor and Hoo St Werburgh, plus two large marinas to the south at Gillingham. This area is popular for recreational sailing and a high number of boats sail around the islands within the Medway. Data on the extent of recreational sailing in the Medway area are unavailable and the direct impacts on wintering and breeding birds are unknown.

6.17 There are a number of additional slipways and jetties within the SPAs which are located away from settlements and sailing clubs etc. - the extent to which they are used is unknown.

6.18 Other recreational water sports undertaken in the area include jet skiing, kayaking/canoeing, wake-boarding, water-skiing, kite-surfing, motor cruising, dinghy sailing, windsurfing, tall ships, rowing, skiff rowing, dragon boat racing and power boating. The specific areas and intensity of water sports is unknown, although data may be available through the Thames Estuary Recreational Study[16].

6.19 As the popularity of water-based recreation grows, there is a need for improved management which must take into account the sensitivity of the SPAs. Proposed improvements include recreation zonings to avoid conflicts between user groups, congestion management and also provision of fuelling stations, fresh water and disposal points at marinas (Thames Estuary Partnership 2005).

Wildfowling

6.20 The Kent Wildfowling and Conservation Association is the largest in the UK, with shooting rights on over 60 miles of coastline, over 816ha of freehold land ownership from Gravesend to Herne Bay, plus additional areas of leased marsh and estuary. Furthermore KWCA is the largest landowner in the Medway with over 542ha. At least 29 shooting areas have been identified

[16] **http://www.thamesweb.com/page.php?page_id=73&topic_id=12**

across the three SPAs; Medway (14), Swale (8) and Thames (7). At least eight reserve areas exist at Cliffe, Cooling, Leysdown, Graveney, Little Murston Farm, Blacketts, Rosecourt Farm (Isle of Grain) and Harty Fields.

6.21 The KWCA shoots inland between September 1st and January 31st and below the high water mark between September 1st and February 20th. Wildfowling is also permitted on Sundays in Kent and there is a local voluntary restriction which means that Allhallows and Egypt Bay permit areas are not shot until 2nd October. Accurate information on the intensity and extent of wildfowling activities in the area is limited. Furthermore the resultant disturbance effects on wintering birds in the area are unknown.

Industry

6.22 The North Kent area has undergone extensive industrial development. Prominent industrial activities include ship building, cement-making, commercial marine and land-based aggregate extraction, papermaking, brickmaking and also engineering. The numerous ports around the wider Thames estuary have performed a significant role in defence and also in the growth of global trade by sea (see Shipping). The industrial areas are primarily associated with Faversham, Sittingbourne, Queenborough and Sheerness - although there is considerable activity covering 3km of the Swale SPA coastline south of Ridham docks (Map 37).

6.23 The extensive port infrastructure is directly linked to the growth of energy industry in the area with energy generation sites located at Kingsnorth (power station to close by 2015, replacement pending), Grain (oil-fired power station to close by 2015 and new gas-fired combined heat and power station to be completed 2010), Coryton (power station and oil refinery) and Tilbury (power station to be upgraded by 2014). There is a liquid natural gas storage site on the Isle of Grain and plans rumoured for further development and a jetty at Burntwick Island. Permission has also been granted for at least nine onshore wind turbines in the area; five on the Isle of Grain (plans on hold) and four at Lappel bank, Sheerness - with more applications expected in the future, for example, Capel Fleet.

Shipping

6.24 London is one of the top three busiest ports in the UK. In 2008 over 22,000 cargo vessel movements (arrivals plus departures) were recorded through the Thames estuary plus substantial intra-port movements. The main shipping activities include oil storage and refineries, marine dredged aggregates, landfill (waste transported by barge from London), manufacturing (materials arriving by sea) and cruise liners. There is also significant infrastructure required in the area for the onward distribution of cargo, such as depots and warehouses.

6.25 Annual data were available for the Medway and Swale ports with vessel numbers peaking in 2006 at 7,546 movements (Map 36). Since 2006 vessel numbers have declined due to the recession, with a 40% decrease between 2006 and 2009 (predicted figures for 2009). The impact of the shipping infrastructure on the SPAs and future plans under the Thames Gateway regeneration programme, with major expansion at Shell Haven, is an area for further research.

Fishing

Commercial

6.26 The Thames Estuary supports several important commercial fisheries with over 180 commercial fishing boats operating within the estuary from 20 locations. Water quality in recent years has greatly improved and the number of fish species found has risen to 121 (Environment Agency 2004). The main fin fisheries include species such as sole, cod, bass, ray, sprats, plaice, herring and eels.

6.27 Juvenile fish utilise the estuary as a feeding ground and refuge from the more intensively fished areas of the outer estuary and southern North Sea. The provision of nursery and spawning areas for commercial species is under threat due to a reduction in suitable habitat. For example, the relative abundance of bass which requires vegetated creeks for feeding may be restricted due to the lack of intertidal habitats (Thames Estuary Partnership 2005).

6.28 Cockles are the predominant shellfishery industry in the North Kent Marshes and the Greater Thames supports the largest cockle fishery in the UK – representing 65% of all UK landings (Thames Estuary Partnership 2005). The main areas for commercial cockle harvesting are Maplin and Foulness sands.

6.29 There are many factors that affect the health and abundance of shellfish, including temperature, severe weather and food supply. Anthropogenic effects include coastal development, for example, dredging and offshore wind farm development, waste disposal and nutrient loading/sewage pollution (Thames Estuary Partnership 2005). Pathogen levels are monitored by the Environment Agency to ensure shellfish are suitable for human consumption.

6.30 Over exploitation poses a threat to the availability of shellfish and fin fish as prey for birds. Despite extensive controls on vessels and equipment there is concern that beam trawlers may be too efficient (Thames Estuary Partnership 2005). There is a also a need to consider means of developing shellfisheries in a sustainable manner that will meet the needs of the interest feature bird species in the future (Bailey and Wiggins 2009).

Recreational

6.31 Improvement to water quality resulting in fish species returning to the Thames has reinvigorated interest from recreational anglers over the last decade. There are approximately 40 angling charter vessels and 131 angling clubs operating in the area (excluding east of the Isle of Grain). An Environment Agency study found that 9% of households within the catchment own at least one rod (Thames Estuary Partnership 2005).

6.32 Recreational angling can displace shore birds from their preferred feeding areas (Bell and Austin 1985, Yalden 1992). With no restrictions on estuarine and sea fishing, there is no way of assessing the extent and location of rod and boat fishing around the three SPAs.

Additional information from WeBS counters and site staff

WeBS counter questionnaires

6.33 Six WeBS counters filled in the questionnaire, providing comments on 16 WeBS sectors out of 61 in the study area. This is a relatively small sample, enough to provide some useful information but insufficient to allow detailed analysis. The most commonly cited activity causing disturbance to birds was light aircraft, microlights and helicopters. Over 80% of counters noted that planes cause flushing of birds on their sectors with more low level flights to practice landing occurring in recent years. Birdwatchers were recorded as the second most common activity which causes disturbance in the area.

6.34 Since the 1980s development has been seen by WeBS counters as a continual threat. In addition the population has increased around the surrounding villages and towns, resulting in more traffic on the roads. There were general comments that the number of people using the sea wall and beaches had increased, and in particular there was a perception that the number of dog walkers had increased. The plans to open up coastal access in the area raised concerns with most counters.

6.35 Other shore based threats mentioned include vehicles along the sea wall, motorbike scrambling on the foreshore and an increase in horse riding (and the number of paddocks and stables). Gamekeeping activities were also cited, including the releasing and feeding of pheasants and

ducks which were perceived to have increased on the Isle of Grain. Bait digging, photographers, fishing from the banks with rods and cycling were also mentioned as activities causing disturbance to birds in certain sectors.

6.36 In terms of water based recreation, some counters noted that the number of boats had increased, especially power boats, ribs and jet skis. Other counters felt that boating had stayed the same in the last 10 years. It was noted that most moorings are unused in the winter months.

6.37 A number of water management issues were raised by counters, including the loss of roosting habitat due to higher tides which push birds on to the sea wall where they are more prone to disturbance. Counters observed that over the last 25 years the marshes have become drier due to reduced winter rains and ditches have suffered from a lack of regular dredging. One counter noted that the Environment Agency's suggestion in the TE2100 plan to turn freshwater marsh into salt marsh would lead to less diverse birdlife and a less distinctive habitat.

Interviews with site staff

6.38 The proposed coastal path was mentioned by a number of staff as a threat to the area. Most staff commented that there had been an increase in the number of people in general, particularly those walking on the intertidal and with dogs. Staff pointed out that even dogs on leads may be a threat to birds. There is also a problem with associated increase in dog faeces. There are more cyclists using the paths and new cycle routes have been proposed through Harty Marshes on the Isle of Sheppey.

6.39 Microlights between Grain and Kingsnorth were mentioned by some staff but KWT report that they currently seem to be less of a problem than previously.

6.40 Management of antisocial behaviour is an ongoing challenge for site staff. Problems are caused by car dumping, use of motorbikes and fly-tipping.

6.41 Site staff felt that there has been an increase in the number of pleasure boats - particularly in the Medway where boats pass close to the islands at high tide. Staff commented that they do not have any data on the increase in the number of boats using the estuary and how this may impact upon birds in the area. There is a problem with small watercraft landing on Castle Coote shingle bank which has previously been used for nesting by little terns.

6.42 There are two authorised launch sites for jet skis within the study area and two restricted areas, one each in the Swale and Medway. However, site staff commented that jet skis are being launched from unofficial locations and are less likely to follow the Port of London Authority Code of Conduct for personal watercraft.

6.43 Many staff felt they had little knowledge on the extent of wildfowling in the area and that this activity challenged their decision making ability. Both RSPB and KWT reserve staff felt that the general public did not understand why shooting was taking place on the reserves and several incidents of wildfowling outside permitted areas have been reported each year.

6.44 Commercial cockle dredging off the KWT South Swale reserve and bait digging were listed as disturbance sources on the mudflats.

6.45 A number of developments that are currently in the planning process were mentioned by staff as potential threats to the SPAs. These include Lodge Hill housing development (middle of Hoo Peninsula), Grain Business Park, Kingsnorth warehousing development, housing at Iwade, Queenborough Rushenden commercial development, Ridham and Kemsley dock and the road from Kemsley to Sittingbourne.

7 Further Research

Gaps in our understanding

7.1 The previous chapters indicate that:

- There have been significant declines for some wintering bird species, especially on the Medway. The reasons for these are not fully understood.
- There is a lack of information on the Ramsar interest features, particularly for some of the invertebrates.
- Predicted changes in habitat as a result of coastal squeeze will mean a loss of mudflat habitat, particularly on the Medway.
- There is relatively little data on shore-based recreation. An audit of car-parks and access points undertaken as part of this report indicates that the Medway has the least amount of parking spaces and the Thames the most. Such information, on access infrastructure, is a useful guide but is no substitute for detailed information on visitor access patterns.
- Recreational use of the area appears to be increasing (at least anecdotally) and includes a wide range of shore based, water based and air-borne activities. Anecdotal reports indicate that microlights, helicopters and small aeroplanes; pleasure boats; birdwatchers; bait diggers; cyclists, dog-walkers and fishermen all cause disturbance to wintering waterfowl.
- Existing levels of housing are high, with the Medway having the most amount of current housing directly adjacent to the SPA boundary
- Future changes to the general area will include high levels of new development, resulting in new housing, employment sites and infrastructure. Enhanced access is likely as part of the Marine and Coastal Access Act.

7.2 Given the pressures on the three SPAs and evidence of site-specific declines in some of the wintering waterfowl, a clear understanding of the current issues is urgently required and research to predict the consequence of future changes is needed. The issues are complex and may well operate synergistically.

7.3 For example disturbance is clearly an issue of concern. There is the potential for disturbance to result in birds being repeatedly flushed, resulting in a loss of feeding time and increased energy expenditure. Disturbance may also cause birds to avoid feeding in preferred areas and force them to feed at higher densities in less profitable areas. This in turn may lead to intensified competition for limited food resources and reduce the energy intake rate of some or all birds. Such effects, if severe enough can lead to increased risk of starvation for some birds and, in extremis have consequences for the size of population that the site can support (see Stillman and Goss-Custard, 2002, Stillman *et al.*, 2001, Stillman *et al.*, 2007, West *et al.*, 2002).

7.4 During the winter disturbance can have a particular effect, as this is when the number of birds peaks and weather conditions can mean additional stress (Clark *et al.*, 1993). Although boat traffic is likely to be reduced in winter (anecdotal evidence suggests that most moorings are not used in the winter), other activities may increase. While these activities taken individually may engender acceptable levels of disturbance under normal tidal and weather conditions, when birds can move to undisturbed areas to feed, taken in combination they could have a profound effect, particularly during hard weather.

7.5 The interactions between disturbance and other factors will be highly complex and difficult to tease apart. If disturbance impacts only occur in combination in cold weather and with particular tide heights, then it may be that no effects are discernable in most years. In the medium to longer term, milder winters could encourage greater year-round recreational activities with consequent disturbance both alone and in-combination with other activities. Coastal squeeze

may result in certain roosting sites being made unavailable, or birds pushed closer to sea-walls, with implications for disturbance.

7.6 Different activities that may temporally and spatially have little effect on their own may therefore, when combined, and particularly in cold weather, have serious effects on the foraging or roosting activities of wintering waders and wildfowl. Thus wildfowling on the edge of the saltings, shooting from the shore, boating, bait digging and birdwatching activities may all be taking place simultaneously within an area of coast / estuary, such that large numbers of birds are being disturbed from their feeding grounds in a number of places by one of these activities and are effectively prevented from moving to other foraging areas by disturbance from other activities.

7.7 In this section we therefore set out a plan for further research whereby the different issues can be explored in a strategic fashion. A variety of different threads of further work are required, involving social research (visitor access patterns) and detailed ecological fieldwork. It is essential these are planned carefully and conducted in a fashion that the different elements can be combined to allow comprehensive analysis and predictions of future impacts.

Overview of different research threads

7.8 In Figure 5 we provide an overview of the main areas of suggested research. We suggest that an individual-based model is derived for a selection of key wintering bird species, following work on other estuary sites in the UK. These models predict how individual birds change their behaviour (for example, where they feed and what they feed on) in response to changes in their environment. They predict the population consequences of environmental changes from the behaviour and fates of all individuals in the population (for example, the mortality rate within a population is predicted from the proportion of individuals that die). Such models can accurately predict the responses of wading bird populations to environmental change, and have been used to advise SPA management for these species throughout the country (Stillman *et al.* 2000, Stillman *et al.* 2001, West *et al.* 2002, Stillman *et al.* 2003, Durell *et al.* 2006, Stillman *et al.* 2007, West *et al.* 2007). Such a model, constructed to encompass the three SPAs, will provide a means to predict the number of birds that the three sites can support at present and under future environmental change scenarios, such as increases in disturbance and changes in habitat extent or habitat quality.

7.9 The following types of data are required in order to develop and test the model:

a) Bird population sizes and distribution – this information is available from existing WeBS data;

b) Duration and area of exposure of intertidal feeding grounds – we describe two options for obtaining this information;

c) Distribution and abundance of the intertidal invertebrate prey species of the birds – only very limited data are available at present and so we describe and cost a survey to collect these data;

d) Behavioral responses of the birds to disturbance – only limited data are available at present and so we describe methods to collect these data to determine how disturbance impacts the birds.

In order to determine long term changes in environmental conditions, further work is required to assess changes in the overall extent of intertidal habitat and the amount of recreational access. These individual threads can then be combined to address the consequences of future change, such as housing development or increased disturbance, for the birds. As the conservation objectives of SPAs are defined in terms of the population sizes of bird interest features, it is essential that the work predicts the population consequences (for example, the number of birds that can be supported) of any future environmental change scenarios.

7.10 Visitor survey work and systematic monitoring of access levels throughout the year is important in order to: provide a means of relating bird abundance to access; determine where visitors come from and therefore the links between new development and visitor rates; identify potential means of resolving any conflicts between access and nature conservation; and identify how access levels might change in the future. Given the wide range of different types of access that occur in the area, including shore-based, water-based and air-born activities, different monitoring methods are likely to be necessary in order to determine current levels of use of each activity .

7.11 Some visitor survey work is recommended during the summer to assess summer visitor use, to predict how visitor use will change in the future and to consider the scale and likelihood of recreational disturbance to birds during the summer. We have not included any targeted ornithological work for the summer as the breeding interest are largely increasing (for example, marsh harrier, avocet, Mediterranean gull) or erratic in their occurrence (little tern). Most of these species are already the subject of on-going monitoring, protection and regular national surveys.

7.12 Additional and separate studies are required for the non-avian Ramsar interest features.

7.13 Regular monitoring will also be required, with elements such as some of the visitor work, the habitat work and sampling of the prey availability within intertidal habitats needing to be on-going or repeated at regular intervals.

7.14 Detailed methods for each of the different elements within the flowchart are set out in Appendix 2, where potential costs for the work are also tentatively set out.

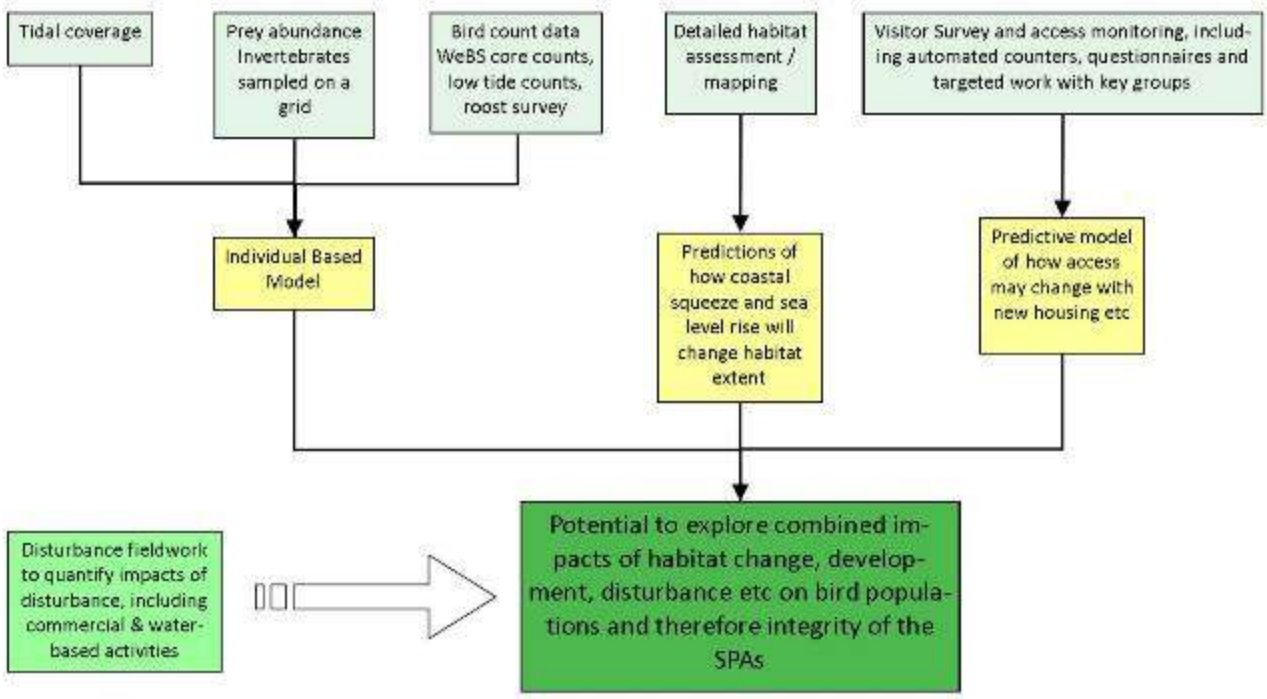

Figure 5 Overview of suggested research relating to the SPAs

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Appendix 1 Summary of SPA interest features

Table A Summary details for the three SPAs (data downloaded from JNCC website)

SPA	Common name	Species	Population name	Season	Population plus units	Importance	Assemblage component only
Medway Estuary and Marshes	Red-throated diver	Gavia stellata	(North-western Europe - wintering)	Winter			AC
	Great crested grebe	Podiceps cristatus	(North-western Europe - wintering)	Winter	67 individuals		
	Great cormorant	Phalacrocorax carbo	(North-western Europe)	Winter	231 individuals		AC
	Tundra swan	Cygnus columbianus bewickii	(Western Siberia/North-eastern & North-western Europe)	Winter	16 individuals	0.2% of JNCC defined GB population (wintering)	
	Dark-bellied brent goose	Branta bernicla bernicla	(Western Siberia/Western Europe)	Winter	3205 individuals	1.1% of JNCC defined international population (wintering)	
	Common shelduck	Tadorna tadorna	(North-western Europe)	Winter	4465 individuals	1.5% of JNCC defined international population (wintering)	
	Eurasian wigeon	Anas penelope	(Western Siberia/North-western/North-eastern Europe)	Winter	4346 individuals	1.6% of Great Britain (Wintering)	
	Eurasian teal	Anas crecca	(North-western Europe)	Winter	1824 individuals	1.3% of Great Britain (Wintering)	
	Mallard	Anas platyrhynchos	(North-western Europe)	Winter	884 individuals		AC
	Northern pintail	Anas acuta	(North-western Europe)	Winter	697 individuals	1.2% of JNCC defined international population (wintering)	
	Northern shoveler	Anas clypeata	(North-western/Central Europe)	Winter	76 individuals	0.8% of Great Britain (Wintering)	
	Common pochard	Aythya ferina	(North-western/North-eastern Europe)	Winter	4 individuals		AC
	Hen harrier	Circus cyaneus		Winter			AC
	Merlin	Falco columbarius		Winter			AC

Table continued...

SPA	Common name	Species	Population name	Season	Population plus units	Importance	Assemblage component only
	Eurasian oystercatcher	Haematopus ostralegus	(Europe & Northern/Western Africa)	Winter	3672 individuals	1% of Great Britain (Wintering)	
	Pied avocet	Recurvirostra avosetta	(Western Europe/Western Mediterranean - breeding)	Winter	314 individuals	24.7% of JNCC defined GB population (wintering)	
	Pied avocet	Recurvirostra avosetta	(Western Europe/Western Mediterranean - breeding)	Breeding	28 pairs	6.2% of JNCC defined GB population (breeding)	
	Ringed plover	Charadrius hiaticula	(Europe/Northern Africa - wintering)	Winter	768 individuals	1.6% of JNCC defined international population (wintering)	
	Grey plover	Pluvialis squatarola	(Eastern Atlantic - wintering)	Winter	3406 individuals	2% of JNCC defined international population (wintering)	
	Red knot	Calidris canutus	(North-eastern Canada/Greenland/Iceland/North-western Europe)	Winter	541 individuals	0.2% of JNCC defined international population (wintering)	
	Dunlin	Calidris alpina alpina	(Northern Siberia/Europe/Western Africa)	Winter	25936 individuals	1.9% of JNCC defined international population (wintering)	
	Black-tailed godwit	Limosa limosa islandica	(Iceland - breeding)	Winter	957 individuals	12.9% of Great Britain (Wintering)	
	Eurasian curlew	Numenius arquata	(Europe - breeding)	Winter	1900 individuals	1.7% of Great Britain (Wintering)	
	Common redshank	Tringa totanus	(Eastern Atlantic - wintering)	Winter	3690 individuals	2.1% of JNCC defined international population (wintering)	
	Common greenshank	Tringa nebularia	(Europe/Western Africa)	Winter	10 individuals	2.6% of Great Britain (Wintering)	
	Ruddy turnstone	Arenaria interpres	(Western Palearctic - wintering)	Winter	561 individuals	0.9% of Great Britain (Wintering)	
	Common tern	Sterna hirundo	(Northern/Eastern Europe - breeding)	Breeding	77 pairs	0.6% of JNCC defined GB population (breeding)	
	Little tern	Sterna albifrons	(Eastern Atlantic - breeding)	Breeding	28 pairs	1.2% of JNCC defined GB population (breeding)	

Table continued...

SPA	Common name	Species	Population name	Season	Population plus units	Importance	Assemblage component only
	Short-eared owl	Asio flammeus		Breeding			AC
	Common kingfisher	Alcedo atthis		Breeding			AC
	Breeding bird assemblage	Breeding bird assemblage		Breeding			
	Waterfowl assemblage	Waterfowl assemblage		Winter	65496 individuals		
Thames Estuary and Marshes	Hen harrier	Circus cyaneus		Winter	7 individuals	1% of Great Britain (Wintering)	
	Pied avocet	Recurvirostra avosetta	(Western Europe/Western Mediterranean - breeding)	Winter	283 individuals	28.3% of Great Britain (Wintering)	
	Ringed plover	Charadrius hiaticula	(Europe/Northern Africa - wintering)	Passage	1324 individuals	2.6% of JNCC defined international population (passage)	
	Grey plover	Pluvialis squatarola	(Eastern Atlantic - wintering)	Winter	2593 individuals	1.7% of JNCC defined international population (wintering)	
	Red knot	Calidris canutus	(North-eastern Canada/Greenland/Iceland/North-western Europe)	Winter	4848 individuals	1.4% of JNCC defined international population (wintering)	
	Dunlin	Calidris alpina alpina	(Northern Siberia/Europe/Western Africa)	Winter	29646 individuals	2.1% of JNCC defined international population (wintering)	
	Black-tailed godwit	Limosa limosa islandica	(Iceland - breeding)	Winter	1699 individuals	2.4% of JNCC defined international population (wintering)	
	Common redshank	Tringa totanus	(Eastern Atlantic - wintering)	Winter	3251 individuals	2.2% of JNCC defined international population (wintering)	
The Swale	Dark-bellied brent goose	Branta bernicla bernicla	(Western Siberia/Western Europe)	Winter	1961 individuals	0.7% of JNCC defined international population (wintering)	
	Common shelduck	Tadorna tadorna	(North-western Europe)	Breeding			AC
	Gadwall	Anas strepera	(North-western Europe)	Winter	86 individuals		AC

Table continued...

SPA	Common name	Species	Population name	Season	Population plus units	Importance	Assemblage component only
	Eurasian teal	Anas crecca	(North-western Europe)	Winter	2969 individuals		AC
	Mallard	Anas platyrhynchos	(North-western Europe)	Breeding			AC
	Common moorhen	Gallinula chloropus	(Europe/Northern Africa)	Breeding			AC
	Common coot	Fulica atra	(North-western Europe - wintering)	Breeding			AC
	Eurasian oystercatcher	Haematopus ostralegus	(Europe & Northern/Western Africa)	Winter	3731 individuals		AC
	Ringed plover	Charadrius hiaticula	(Europe/Northern Africa - wintering)	Winter	269 individuals		AC
	Grey plover	Pluvialis squatarola	(Eastern Atlantic - wintering)	Winter	2021 individuals		AC
	Northern lapwing	Vanellus vanellus	(Europe - breeding)	Breeding			AC
	Dunlin	Calidris alpina alpina	(Northern Siberia/Europe/Western Africa)	Winter	12394 individuals	2.3% of Great Britain (Wintering)	
	Eurasian curlew	Numenius arquata	(Europe - breeding)	Winter	1622 individuals		AC
	Common redshank	Tringa totanus	(Eastern Atlantic - wintering)	Winter	1640 individuals	0.9% of JNCC defined international population (wintering)	
	Common redshank	Tringa totanus	(Eastern Atlantic - wintering)	Breeding			AC
	Eurasian reed warbler	Acrocephalus scirpaceus		Breeding			AC
	Reed bunting	Emberiza schoeniclus		Breeding			AC
	Waterfowl assemblage	Waterfowl assemblage		Winter	65588 individuals		
	Breeding bird assemblage	Breeding bird assemblage		Breeding			

The list of species for each site includes only those listed on the Natura 2000 Data Form submitted to the European Commission. It does not yet take account of the amendments published in the SPA Review.

Appendix 2 Detailed methods and costs for further work

Intertidal habitat: Tidal exposure

Key factors determining the survival rates and population sizes of intertidal-feeding birds are the amount and quality of food available in their intertidal habitat, and how this food is exposed by the tide. It is also important to know the amount of food available and its exposure in order to understand how bird populations will be influenced by disturbance, or other forms of environmental change. For example, the consequences of birds being displaced by disturbance from one area of intertidal habitat depends on whether other suitable feeding habitat is available, and whether the increased number of birds in this area can be supported by the food supply available. In order to make such predictions it is important to know the abundance of food resources, not only in locations currently used by the birds, but also in areas that are currently not used (or less used), as these may be used in the future in response to environmental change.

Tidal exposure can be estimated in two main ways of differing complexity: (i) prediction from a purpose-built, and complex, tidal simulation model; or (ii) more simply based on a combination of observation, local knowledge and height of habitat on the shore. Predictions using a tidal model are the ideal as they are more precise and can be tailored to specific environmental change scenarios, but usually rely on the existence and availability of such a model for the study site. This is because developing and calibrating these models for a site is itself a complex and specialist task. We have not been able to determine whether a suitable tidal model exists for the Thames, Medway and Swale. In the absence of such a model it is proposed that the second option is adopted. It is proposed that this information be collected during other parts of the proposed work (i.e. invertebrate and disturbance surveys) in order to minimise costs.

It is proposed that Admiralty bathometric charts of the study sites are initially used to determine variation in shore level. Each of the sampling locations within the invertebrate survey (see below) will then be allocated a shore level. By comparing this shore level with tidal height predictions it will be possible to estimate the duration of exposure of each invertebrate sampling location, and hence estimate the proportion of habitat exposed throughout the tidal cycle. The problem with this approach is that Admiralty data tends to be of higher resolution in channels used by shipping, than in the intertidal habitats used by the birds. Additionally, the approach ignores any lags in the movement of water throughout a site, and any associated lags in tidal exposure. These are the type of details that are included in the more complex tidal models. In order to assess the accuracy of the simple method proposed, and correct for any errors, the area of intertidal habitat exposed at specific times will be notes during the invertebrate and bird disturbance studies. This will provide a set of observations of intertidal extent throughout the study sites that can be compared to the predictions of the simple approach. Although a compromise relative to using complex tidal models, this approach has been used successfully in other sites in which individual-based models have been developed.

Intertidal habitat: Prey abundance

We have proposed a large-scale intertidal invertebrate survey of the North Kent SPA and Ramsar sites. The purpose of the survey is to assess spatial variation in the food supply available to birds, and so sampling stations are spread throughout the study sites using a regular grid. A similar approach has been used to assess bird food resources in other sites (for example, Durell *et al.*, 2006; Durell *et al.*, 2007; West *et al.*, 2003). Further details and costed options based on different grid sizes are given below.

One of the major difficulties of conducting intertidal surveys of large sites, such as the North Kent SPA and Ramsar sites, is gaining access to the sampling locations. It therefore makes sense to collect as

much information as is feasible from each sampling location once it has been reached. Bournemouth University has recently conducted a large-scale intertidal survey of Poole Harbour, contracted by Natural England. Although one aim of the survey was to assess bird food resources, another was to conduct a biotope survey of the intertidal habitat features and invertebrate populations. This has set a baseline for assessing the condition of the non-bird interest features of the site. It is suggested that if an intertidal survey of the North Kent SPA and Ramsar sites is conducted, it should follow the common standards monitoring procedures for intertidal sites, as per Poole Harbour, which cover a wide range of interest features. Further details and costed options are given below.

Methods: Survey grid size

While the grid size should ideally be as small as possible, in practice it is usually determined by the size of the study site and the resources available to conduct the survey. Previous survey grid sizes were 250 m for the Exe estuary (Durell *et al.* 2007) and 500 m for Poole Harbour (Durell *et al.* 2006). Both of these surveys were performed by the Centre for Ecology and Hydrology funded by Natural England (Stillman *et al.* 2005). Two grid sizes are considered for the North Kent SPA and Ramsar sites, 500m and 1km. The total number of sampling stations was determined by the number of intersections on the UK National Grid based on either a 500m or 1km grid. Sampling station number is approximately 300 with a 500m grid size, and approximately 130 with a 1 km grid size. The number of sampling stations was 120 on the Exe estuary (Durell *et al.* 2007) and 80 in Poole Harbour (Durell *et al.* 2006). This suggests that a grid size of 1km would lead to a survey with similar effort to that conducted on the Exe estuary, but costs for both options are given below.

Methods: Sampling procedure

It is proposed that the sampling procedure at each sampling station should follow the standard methodologies defined in the JNCC Marine Monitoring Handbook (Davies *et al.* 2001). The methodology of the Natural England Poole Harbour survey followed Procedural Guidance 3-1 and 3-6 (Davies *et al.* 2001). These methods differ in whether invertebrate samples are collected from each sampling station and hence the amount of time required to process samples collected during the survey. PG 3-1 provides a more rapid assessment, but as it does not involve the collection invertebrate samples, does not quantify the food resources available to the birds. Hence, it is proposed that PG 3-6 be adopted for the survey (see below for details) – this approach both quantifies the bird food and provides an overall assessment of the biotope condition at each sampling location. PG 3-6 as adopted in the Poole Harbour survey required 5 invertebrate samples to be collected from each sampling station. As subsequent processing of samples is a time consuming process, reducing the number of samples is one way of reducing costs. An analysis of the Poole Harbour data could be performed when these data are complete to determine the relative accuracies of surveys based on fewer than 5 samples per sampling station. Two sets of costs are provided below, assuming that either 5 or 3 samples are collected per sampling station.

Methods: Field and laboratory work

Following Procedural Guidance 3-6 the following methodology is proposed:

1) *Extent of habitat*. The extent of the intertidal habitat should be assessed using a combination of aerial photographs maps provided and field observation, which should be incorporated into GIS to compare with archived information.
2) *Survey design*. The location and number of sampling stations should be determined by dividing the intertidal area into either a 500 m (circa 300 sampling stations) or 1 km grid (circa 130 sampling stations) based on the National Grid. Sampling stations should be visited at low tide. It is assumed in the costs below that transport between sampling stations will be by hovercraft, and that the survey will be conducted by two people, in addition to the hovercraft pilot. Experience in Poole Harbour has shown that two people are required to efficiently

collect the data required from each sampling station. Steps 3 to 6 (see below) should be conducted at each sampling station.

3) *Summary of the sampling station*. Obtain a visual estimate of the habitat surrounding the sampling station (for example, sediment type, sediment structure, percentage cover of algae, other features), as described in PG 3-6. Take digital photographs of the sampling station. Note the position of any transitional biotope features and other notable and relevant information for subsequent mapping.
4) *Invertebrate sampling*. Obtain 3 or 5 (see options in costs) x 0.01m^2 cores to a depth of 15cm. For larger invertebrates (for example, worms (*Nereis virens*) and molluscs (*Mya arenaria*)), dig 3 25x25 cm patches to a depth of 30cm, sort large fauna on site and retain. The procedure for larger invertebrates is an adaptation of PG 3-6 that was adopted in Poole Harbour.
5) *Measuring invertebrate mass.* Ideally, the survey should measure the relationships between the length of intertidal invertebrates and their ash-free dry mass (i.e. the mass of organic matter within the invertebrate). This is because the food value of invertebrates to birds depends on the amount of mass (energy) they contain. Full details of the methodology is given in West *et al.* (2004), a copy of which is included. In short, 30-50 invertebrates of each species should be collected during the survey from a range of sampling stations throughout the overall study area. In the laboratory both the length and ash-free dry mass of each individual invertebrate, or several individuals for very small species, should be obtained. These data are used to generate relationships between the length and mass of different species. Measurement ash-free dry mass required both a drying oven and a muffle furnace.
6) *Sediment sampling.* Sediment samples should be obtained with a 50mm diameter core at each station.
7) *Laboratory work*. All laboratory processing should be conducted as per CORE Methods (PG 3-6). In short, the samples should be sieved as soon as possible after collection, and the invertebrates within each core preserved. Sieved and preserved samples are processed in the laboratory to identify each invertebrate to species and measure its length. For abundant small invertebrates, measurement may not be possible. Measurement of length is required as different bird species consumed different sizes of invertebrates, and so size-specific information is required to assess the food supplies of different species.

Estimated cost

The following table is intended to give an indication of the relative costs of different survey options, based on expected day rates for the type of work involved. Costs have been derived assuming that a survey grid size of 500m or 1km, and that either 3 or 5 cores are collected per sampling station. The number of stations visited per tide (day) has been assumed to be 12; eight were visited per tide in Poole Harbour, but this site has a relatively short low tide period. Based on previous experience it has been assumed that 3 cores can be processed per day. Daily rates for surveying and laboratory work have been assumed to be £300. Based on quotes received for the Poole Harbour survey, the daily rate for hovercraft (and pilot) hire has been set to be £800. Costs have been directly estimated for ash-free dry mass and sediment processing.

Table B Indication of the relative costs of different survey options, based on expected day rates for the type of work involved

	500 m grid 5 cores per station	1 km grid 5 cores per station	500 m grid 3 cores per station	1 km grid 3 cores per station
Number of sampling stations	300	130	300	130
Total number of samples	1500	650	900	390
Number of days to complete survey (no. stations / 12)	25	11	25	11
Number of days to process samples (no. samples / 3)	500	217	300	130
Cost of survey (no. days x (£800 + 2 x £300)	£35,000	£15,400	£35,000	£15,400
Cost of processing invertebrate samples (no. days x £300)	£150,000	£65,100	£90,000	£39,000
Cost of processing ash-free dry mass samples	£5,000	£5,000	£5,000	£5,000
Cost of processing sediment cores	£2,000	£2,000	£2000	£2,000

The above costs are for a one-off survey. Ideally the sampling should be repeated at regular intervals to allow change in the prey availability to be determined. We suggest that repeat surveys every five years would be the ideal. Repeat surveys should ideally be synchronised with the habitat work to allow the potential for ground-truthing the results from digitising the inter-tidal habitats.

Bird survey data: WeBS and roost survey

WeBS Core Counts on estuaries have, in general, been conducted around or close to high tide, when birds tend to be congregated, often at regular roost sites. Birds may feed well away from where they roost and therefore WeBS core counts only provide part of the picture. The WeBS Low Tide Counts scheme, which was initiated in the winter of 1992-93, aims to monitor, assess and regularly update information on the relative importance of intertidal feeding areas of UK estuaries for wintering waterbirds and thus to complement the information gathered by WeBS Core Counts on estuaries. The scheme provides information on the numbers of waterbirds feeding on subdivisions of the intertidal habitat within estuaries. Given the extra work that Low Tide Counts entail, often to the same counters that carry out the Core Counts, WeBS aims to cover most individual estuaries about once every six years, although on some sites more frequent counts are made. Co-ordinated counts of feeding and roosting waterbirds are made by volunteers each month between November and February on pre-established subdivisions of the intertidal habitat in the period two hours either side of low tide.

WeBS core counts are on-going, and conducted each year. It would be ideal to have low-tide counts conducted more frequently than every 6 years and it would also be ideal for the low tide counts to be conducted across all three SPAs in the same year. Complete low-tide count coverage every three years would provide detail on the key areas for feeding birds. Plots of bird density in relation to prey abundance should also provide a means of determining which count sections support fewer birds than expected, and therefore potentially highlight where factors such as disturbance may be having an impact.

Apart from the WeBS, the other piece of bird survey work that would be useful would be a targeted assessment of all wader roost sites across all three SPAs and adjacent areas. Information on the locations of roosts can be ascertained from local WeBS counters and other birders. A single GIS layer showing all roost sites can then be constructed. Within the GIS certain data can then be extracted for each roost, such as height above MHWM, proximity to public rights of way, habitat etc. Bird species which use each roost can be determined from interviews with local birders / WeBS counters. Each roost should however be visited (ideally at least twice) and a standard assessment made in the field of each roost, documenting:

- Species present
- Exact locations used by roosting birds
- Aspect
- Habitat
- Vulnerability to flooding
- Vulnerability to disturbance from shore based access
- Vulnerability to disturbance from water based activities
- Potential to manage site – for example to reduce disturbance impacts

The aim of the roost survey would be to provide a dedicated map that pinpoints important locations for the birds and identifies which are likely to be vulnerable to any changes, such as increased disturbance or changes in habitat. The data will be useful for informing potential scenarios to explore with the modelling.

We have not estimated any costs for the WeBS counts as these are conducted by volunteers and are on-going. In order to obtain the additional low-tide coverage it may be necessary to find additional surveyors, which may have some cost implications.

We estimate that the roost survey could potentially take around 30 days of fieldwork, allowing an additional 10 days to write-up (i.e. 40 days total) and assuming a daily rate of £220 per day the survey would cost £8,800.

Habitat assessment

Existing GIS data describes the extent of key habitats. Habitats such as lowland wet grassland are unlikely to change too much in extent and therefore there is no need to accurately record changes in extent. There are however clearly some major changes likely in the future for the extent of mudflat and salt marsh habitats. It is important that these changes are tracked and that there is the ability to link the changes to the birds. Aerial photography provides the best means of plotting the extent of salt marsh and intertidal habitats (assuming that the aerial coverage is at an appropriate stage of the tide). We suggest that detailed habitat maps are digitised from aerial photographs at five year intervals. Ideally the habitat mapping could be synchronised with the invertebrate prey monitoring, and the habitat sampling in the field could be used to ground-truth the digitised maps. Assuming that the aerial photography will be held by Natural England and therefore will not need to be purchased, the cost of the mapping would be staff time. We estimate that the digitising would require around 20 days each year of an experienced ecologist's time. Assuming a day rate of £350 this would equate to £7000. The cost would greatly increase were aerial photographs to be commissioned especially for this purpose.

Visitor survey / access monitoring

Visitor survey work and systematic monitoring of access levels is important in order to:

- Derive estimates of visitor rates (for different activities) for different parts of the three SPAs, providing a means of relating bird abundance to access.

- Determine where visitors come from and therefore the links between new development and visitor rates.
- Identify how access levels might change in the future, given the context of improved coastal access and new development.
- Determine why people visit particular areas and identify potential means of resolving any conflicts between access and nature conservation (for example, mitigation measures necessary in relation to new housing or enhanced coastal access).
- Identify where people park, which slipways etc they use in order to inform strategic management of access and potentials to enhance access and reduce disturbance.
- Establishing a repeatable monitoring approach to inform success of mitigation measures etc.

There are a wide range of different types of access that occur in the area, including shore-based, water-based and air-borne activities. Different types of access will vary both spatially and temporally, for example some activities (for example, sun-bathing, swimming) will be more popular in the summer, others (such as bait digging) are tide dependent. Different areas will be more suitable for each activity, and the intensity with which each activity occurs will vary, for example dog walkers outnumber fishermen. This variation means that different monitoring methods are likely to be necessary in order to determine current levels of use of each activity.

An initial starting point to collating information would be a desk-based study, drawing together information from particular user groups. Some types of activity are focussed around local groups, clubs or institutions. Canoeists / kayak-ers, windsurfers, sailors, bait diggers and fishermen all have clubs, societies or representative groups. Some activities also have bodies providing training – for example sailing schools. Each group should be contacted and key information collected such as the structure of the group, the number of members / people on mailing list, number of group outings / events, club guidelines and contacts for each group.

The desk study should also contact all marinas and try to gather information on the number of berths, extent to which number of berths has changed over time and any information on boat use. Postcodes (not names and addresses) of all people with boats berthed would provide an indication of the extent to which marina use is linked to the local population.

The desk study should try to determine useful metrics – such as club membership, mailing lists etc – that can be used to gain a repeatable measure of Harbour useage. These data would then be collected at regular intervals (for example, every 5 years). This desk collation will provide a broad overview and will provide contact details and a focus for directly contacting key users. It will also help to highlight those activities which lack any coherent body or representative group.

On-site monitoring of particular activities will need to be carefully established in order to ensure representative samples / counts can be collected. For example, in order to record levels of windsurfing or kite surfing, which are very much dependent on certain tide and weather conditions, any survey methodology would need to ensure that the sampling protocol allowed for variations in weather and tide.

It should be possible to devise standardised counts of visitors and craft. We advocate a suite of different methods in combination. Automated counters, such as pressure pads, on shore paths provide a cost effective means of getting large, continuous data sets, allowing change over time to be determined. Such methods are however crude in that it is difficult to separate individual types of access (such as the relative proportions of dog walkers, walkers, joggers etc).

A larger sample of more detailed counts is therefore necessary to provide calibration to the automated counters and detail as to different types of use. A series of vantage points should be established and ‘snap shot’ counts conducted from these locations throughout the year. Ideally all points would be surveyed simultaneously and all activities mapped. These counts would take place at various times of

day, over a range of different days (weekday / weekend), and at different states of the tide. The data will provide repeatable counts that show the range of activities taking place at different locations, their frequency etc. Both water-based and shore based activities would be mapped. The mapping would record the activity and the location (as point data, for example the location when first observed). The mapping will produce spatially explicit data that can then be linked to the bird data and the invertebrate sampling to provide a means of relating the different data sets. Mapping should take place all year.

A further element to the visitor work is the need for direct interviews at a sample of locations. These interviews would ascertain where the respondents had travelled from (home postcode), where they had parked, reason for visit, why they had chosen the particular location, group size, awareness of nature conservation importance etc. The questionnaire would need to be carefully designed and potentially different for different groups of people (such as bait diggers, anglers, etc). The direct interviews would establish what proportion of particular activities were being undertaken by local residents compared to tourists and the underlying reasons for any changes in access identified in the other surveys. Route data should be collected, either in the form of a line on a map or by handing out GPS units. GPS units have the advantage of providing accurate data for activities that are otherwise hard to map, such as windsurfing or kite surfing. They also provide data on speed.

Locations for the visitor monitoring should be carefully selected to tie with the bird count locations and with the locations for the behavioural work on disturbance impacts to waterfowl (see below). The design of the survey work will need to derive a suitable sampling regime, potentially conducting visitor monitoring and disturbance work in every third WeBS sector or at a regular distance around the shore. The visitor monitoring should take place throughout the year.

The different elements of the visitor work, along with indicative costs, are set out in Table C.

Table C Summary of different elements of visitor work and associated costs

Description	Detail	How costs estimated	Total Cost (ex VAT)	Notes
Initial contact with key groups, mainly desk-based work	Estimated 20 days time to identify groups, contact them and obtain basic data	20 days at £300 per day	£6,000	
On-site monitoring – counts of boats and people from vantage points	30 count locations estimated, each counted 25 times over a year. 1 hour assumed for each count.	750 hours of fieldwork, costed at £15 per hour	£11,250	Logistics will be very difficult to organise and method may need to be adapted
Automated counters	Twelve locations assumed. Pressure pads buried beneath paths (other types of device could also be appropriate and costs likely to be equivalent).	Estimated using costs from Linetop Ltd: 13 counters (providing a spare) at £220 each, 13 memory cubes with data loggers at £165 each, 13 spare memory cubes (allowing 2 cubes per counter) at £20 each, buzzer box for testing (one box at £30), software and cables (1 set at £495) and one LCD control box for setting up the counters (1 box at £165). An additional £2000 covers the cost of set-up, including labour, testing, access furniture etc . A further £1000 per annum for labour costs (checking and switching memory cubes)	£15,884 capital cost, plus £1000 per annum to maintaint	
Interviews with visitors	30 locations, each surveyed for a weekday and a weekend day (16 hours at each) in the winter and repeated (the same level of survey effort) during the summer.	960 hours fieldwork at £15 per hour; 35 days to organise, collate data and analyse at £350 per day.14400	£26,650	30 locations would equate to approximately every 3rd WeBS sector

Behavioural work on the impacts of disturbance to wintering waterfowl

A recreational disturbance study is currently being undertaken by the Medway Swale Estuary Partnership to look at bird movements caused by a range of different disturbance sources within the Medway Estuary and Marshes SSSI, with a focus on recreational activity. Four sites have been studied each year (2008-2010)- Hoo Marsh, Riverside Country Park, Dead Man's Island and Chetney Marshes. Eight species were selected for individual counts: great crested grebe, dark bellied brent goose, shelduck, wigeon, redshank, dunlin, grey plover and ringed plover. Surveys of recreational activity

include recording type of recreational activity, number of individuals in group, nature of disturbance, approximate number of birds affected, flush distance (species specific), direction of displacement and position of resettlement (if known). The expected outcome of the project is to determine if there is a relationship between recreational activity disturbance and bird declines within the Medway Estuary and Marshes. Findings will be available later in 2010 and will inform how the bird declines can be remedied.

The findings should be used to guide further work, encompassing a wider range of sites and potentially more detailed fieldwork. Behavioural responses to people, such as birds flying away when disturbed, are notoriously poor indicators of likely population level impacts of disturbance (Gill, 2007, Gill *et al.*, 2001b, Gill *et al.*, 1996) and without context can actually be misleading (Beale and Monaghan, 2004). The important context is the actual impact of the disturbance in terms of lost feeding time, increased energy expenditure, etc. Ornithological fieldwork should therefore focus on determining the full implications of disturbance, in terms of how birds modify their foraging behaviour, how long it takes to return to a given location etc. It is difficult to combine such data collection with detailed access monitoring data, and therefore we have separated most of the access monitoring from the bird monitoring.

We advocate standardised counts at set locations where all bird species (or if necessary a focussed list of key species if trials show all species to be unfeasible) are counted at regular intervals. Each count would allocate birds to particular, relatively simple behaviour categories that included roosting, feeding, alert, preening / bathing. Any visible responses to disturbance would also be recorded: birds stopping feeding, moving a short distance or leaving the area altogether. Each “incident” would be an individual data point, whereby the source of disturbance (walker, boat, engine noise, gun fire etc) was recorded, the species affected, the behavioural response and the time taken for the birds to resume their original behaviour.

These counts would take place at roosts and key foraging areas, and at both high and low tides, encompassing spring and neap tides. Weekends and weekdays would need to be sampled, throughout the winter. At each location a defined count area would be necessary, potentially encompassing the bay, inlet or particular area of mudflat. Sampling locations should be carefully selected to provide a stratified sample from all three SPAs, with survey locations coinciding with the locations for the visitor survey work.

These counts would provide baseline information on disturbance, identifying which activities cause the most disturbance, under what conditions and for which species. It would be possible to repeat the work in future years and the baseline data would provide the parameters for predictive modelling of the population impacts of disturbance. Similar surveys are being undertaken currently on the Exe Estuary and along the Solent, and therefore the design and precise fieldwork methodologies could be adapted from these surveys.

Following the Solent work we suggest two hour survey periods. We suggest that fieldwork takes place at 30 locations (i.e. approximately every 3rd WeBS sector, to match the visitor locations). We suggest each location is surveyed 20 times over the winter, with the survey times stratified to include weekend and weekdays and a range of different times of day. This level of survey effort would require 1,200 hours of fieldwork. Assuming a rate of £20 per hour for this fieldwork, and adding a further 600 hours for surveyors to reach survey points, collate paperwork etc, the fieldwork element would cost £36,000. The organisation, logisitics and analysis we estimate at a further 30 days (£10,500 at £350 per day), giving a total cost for this area of work at £46,500.

Predictive modelling

The previous sections describe work required to assess (i) the food supply of the birds, and its exposure through the tidal cycle, (ii) the responses of birds to different forms of human disturbance and (iii) current and future changes in the area of intertidal habitat and amount of human disturbance. In isolation knowledge of the amount of food available and the behavioural responses of birds to disturbance do not indicate how the population size of birds that can be supported depends on the amount of habitat and

disturbance. The purpose of the individual-based model is to bring the strands of the project together to make such predictions. This approach mimics that used in other sites.

The model will represent the three SPAs as a number of discrete patches, each of which will be assumed to represent an area of uniform habitat, at one shore level. The precise way in which the sites are divided into patches will be decided using information on the distribution of invertebrates and changes in shore level and habitat throughout the sites. Once defined, each patch will contain a certain density of prey species at the start of winter (derived from the invertebrate sampling within the patch), and will have a set pattern of tidal exposure during the course of winter (based on the patch's shore level and location). The model will have a one hour time step, meaning that the distribution and behaviour of birds will be predicted every hour. Birds will be introduced into the model at the start of winter, and will feed and roost within the model until the end of winter, or until they die.

The behaviour of model birds will be determined by rules similar to those used by real birds. For example, they will feed in the locations containing the highest abundance of their preferred prey species, and roost when they have met their daily requirements, or when their feeding habitat is exposed by the tide. The responses of birds to disturbance (for example, distance over which and time for which they are disturbed) will be determined from the disturbance survey (see above), and the number of sources of disturbance obtained from the visitor survey (see above). If disturbance prevents birds feeding in their preferred patch, they will feed in their second most preferred patch and feed for longer, if possible, to compensate for any lost feeding time. If habitat loss causes birds to feed at higher densities, they will compensate for increased competition by feeding for longer, if possible. If model birds are unable to compensate for deteriorating feeding conditions by increasing the time spent feeding, they will draw on their energy reserves, but will die if these reserves become exhausted. In effect the model will represent a simplified version of the real world, in which scenarios can be run to determine the consequences of different forms of environmental change, and ways of managing the environment.

The precise range of predictions to be generated will be determined in consultation, but could include the following. How will future increases in coastal access, due to increased housing and coastal path development, affect the number of birds that can be supported by the SPAs? How will future habitat loss affect the number of birds that can be supported by the SPAs? How will these predictions be influenced by predicted increases in temperature and sea level rise?

Indicative costs for the modelling element of this work would be in the region of £25,000, depending on the number of species, complexity of the scenarios etc.

Non-Avian Ramsar Interest Features

It is clear that there are gaps in the recording of the non-avian Ramsar interest features and that further survey work is required to fill these gaps. Regular monitoring is also necessary to record changes in the status and distribution of key species. The distribution maps for the non-Avian Ramsar interest features suggest that there are a number of records of some species just outside the Ramsar boundary, and therefore survey work should potentially encompass land outside the boundary too.

An initial pulse of survey work is required to gather further baseline data and ensure that all records have been gathered and collated. One potential means of doing this would be a workshop / meeting involving local recorders, site staff (for example, RSPB, KWT, NNR staff), Kent Biological Records Centre and Natural England staff. The aim of the meeting would be to review the records held by the records centre, ensure all records had been included, identify potential gaps in coverage and identify priorities for further work.

Additional survey work should aim to target key species at known locations (particularly those that have not been surveyed in recent years), and ensure that counts of individuals, maps of locations etc are recorded in a standard fashion allowing direct comparison over time.

In addition a series of randomly selected points within and beyond the Ramsar site should be surveyed, with the sampling points potentially stratified using a grid. At each sampling point a series of visits will be necessary to record the presence / absence of a list of target species (plants and invertebrates) and for each of the target species present detailed mapping and counts should be conducted, using methods tailored to each species. These methods and results should be established as a baseline allowing repeat surveys in future years as part of a long term monitoring programme.

The costs for this element of the work are difficult to estimate, due to the range of species and potential survey methods involved. As a guide, there are 326 kilometre squares that intersect the Ramsar site boundary (much of these will be intertidal habitats and therefore sampled as part of the work detailed above). There are about 220 squares that include some lowland wet grassland (including a number of squares outside but close to the Ramsar boundary). It would therefore seem potentially feasible that around 200 sampling locations could be identified, to cover saltmarsh, ditch, wet grassland and other habitats outside the intertidal. There are 19 plant species and 39 invertebrate species listed in Table 2 and Table 3 that are included on the three Ramsar citations. We suggest that around 225 fieldwork days (£45,000 at £200 per day) would provide enough coverage to undertake the fieldwork (i.e. multiple trips to 200 sampling locations, plus targeted visits for key species to additional locations). Assuming a further 50 person days (£16,250 at £325 per day) to organise the fieldwork (potentially including an initial meeting / workshop) and survey logistics, collate the data and write the report, then the total cost for this element of the work would be in the region of £61,250.

Summary of further research

The different elements set out above are summarised in Table D. The total cost for all the elements listed in the table comes to a minimum of £270,000, a total which only includes the initial work. Establishing further repeat surveys and on-going monitoring will involve additional costs.

Table D Summary of further research elements

Work area	Description	Cost	Notes
Intertidal habitat: prey abundance	Collection of samples across mudflats to determine invertebrate abundance and prey availability for birds	£61,400 – £192,000	Costs depend on sampling protocol. Cost is for one-off survey rather than on-going monitoring.
WeBS	Regular standardised counts of birds	none	On-going work, already established and funded, fieldwork undertaken by volunteers and collated by BTO
Roost survey	Focused survey of roost locations and potential issues at roost sites	£8,800	
Habitat Assessment Work	Mainly digitising from aerial photographs	£7,000	Will need to be repeated at regular intervals, for example, every 5 years.
Initial contact with key recreation groups, mainly desk-based work	Estimated 20 days time to identify groups, contact them and obtain basic data	£6,000	

Table continued...

Work area	Description	Cost	Notes
On-site monitoring of visitors – counts of boats and people from vantage points	30 count locations estimated, each counted 25 times over a year. 1 hour assumed for each count.	£11,250	Logistics will be very difficult to organise and method may need to be adapted
Automated counters	Twelve locations assumed. Pressure pads buried beneath paths (other types of device could also be appropriate and costs likely to be equivalent).	£15,884 capital cost, plus £1000 per annum to maintain	
Interviews with visitors	30 locations, each surveyed for a weekday and a weekend day (16 hours at each) in the winter and repeated (the same level of survey effort) during the summer.	£26,650	30 locations would equate to approximately every 3rd WeBS sector
Behavioural work on the impacts of disturbance to waterfowl	Detailed ornithological work to determine impacts of disturbance	£46,500	
Predictive modelling	Modelling would combine the ornithological work, prey abundance work and visitor work to predict how changes in housing, access etc will impact on the ability of the sites to support the relevant interest features	£25,000	
Surveys of Non-avian Ramsar interest features	Detailed surveys and sampling across the three Ramsar sites, designed to provide robust baseline data on the status and distribution of interest features	£61,250	Additional costs to repeat as part of long-term monitoring

Appendix 3 Maps

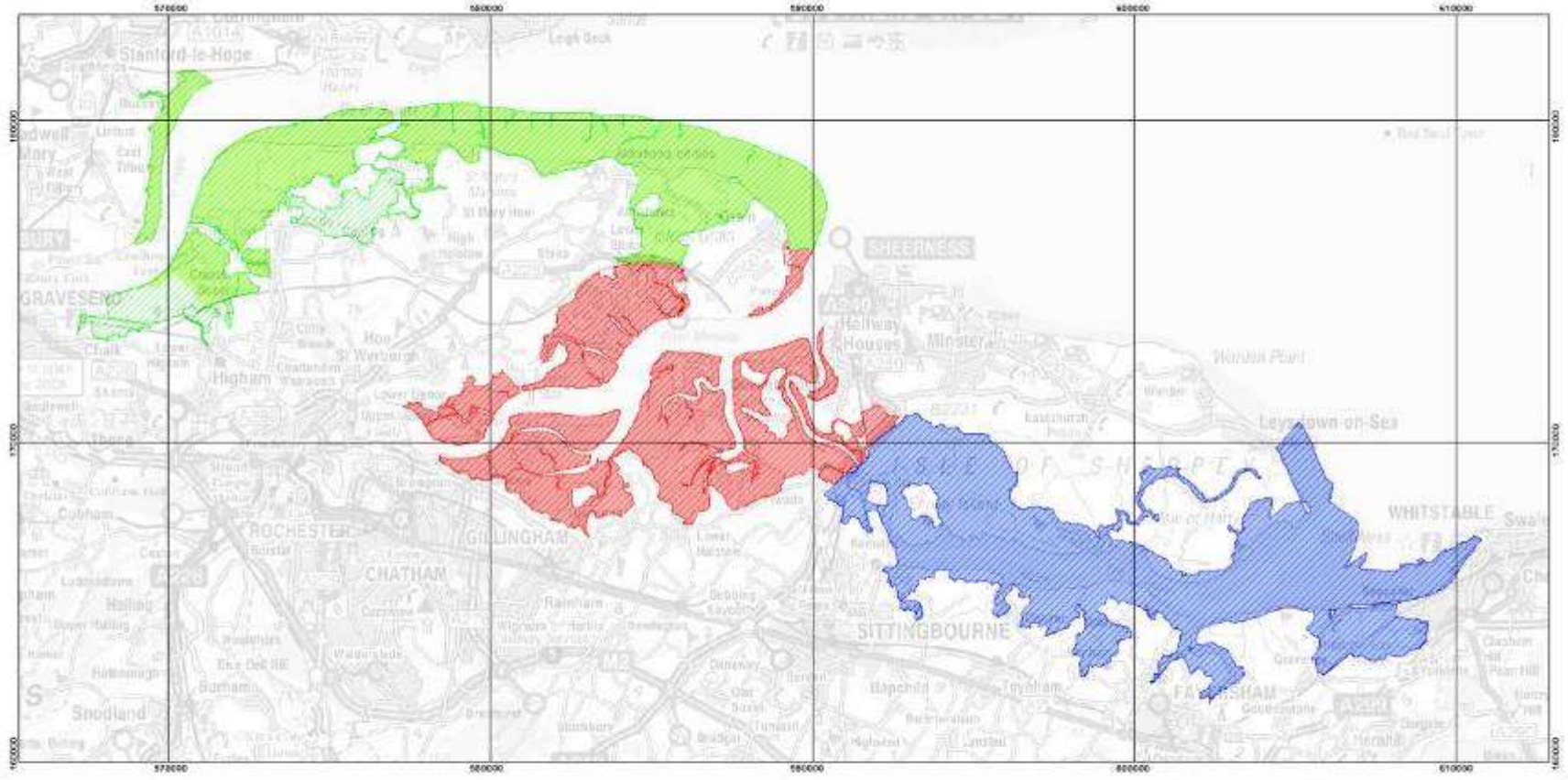
Map 1: Overview of location of the three SPA/Ramsar sites

North Kent Baseline Data Collection and Analysis

22 February 2010

Scale 1:176100

footprint ECOLOGY

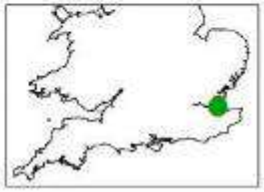


SPA

- Medway Estuary & Marshes
- Thames Estuary & Marshes
- The Swale

Ramsar

- Medway Estuary & Marshes
- Thames Estuary & Marshes
- The Swale



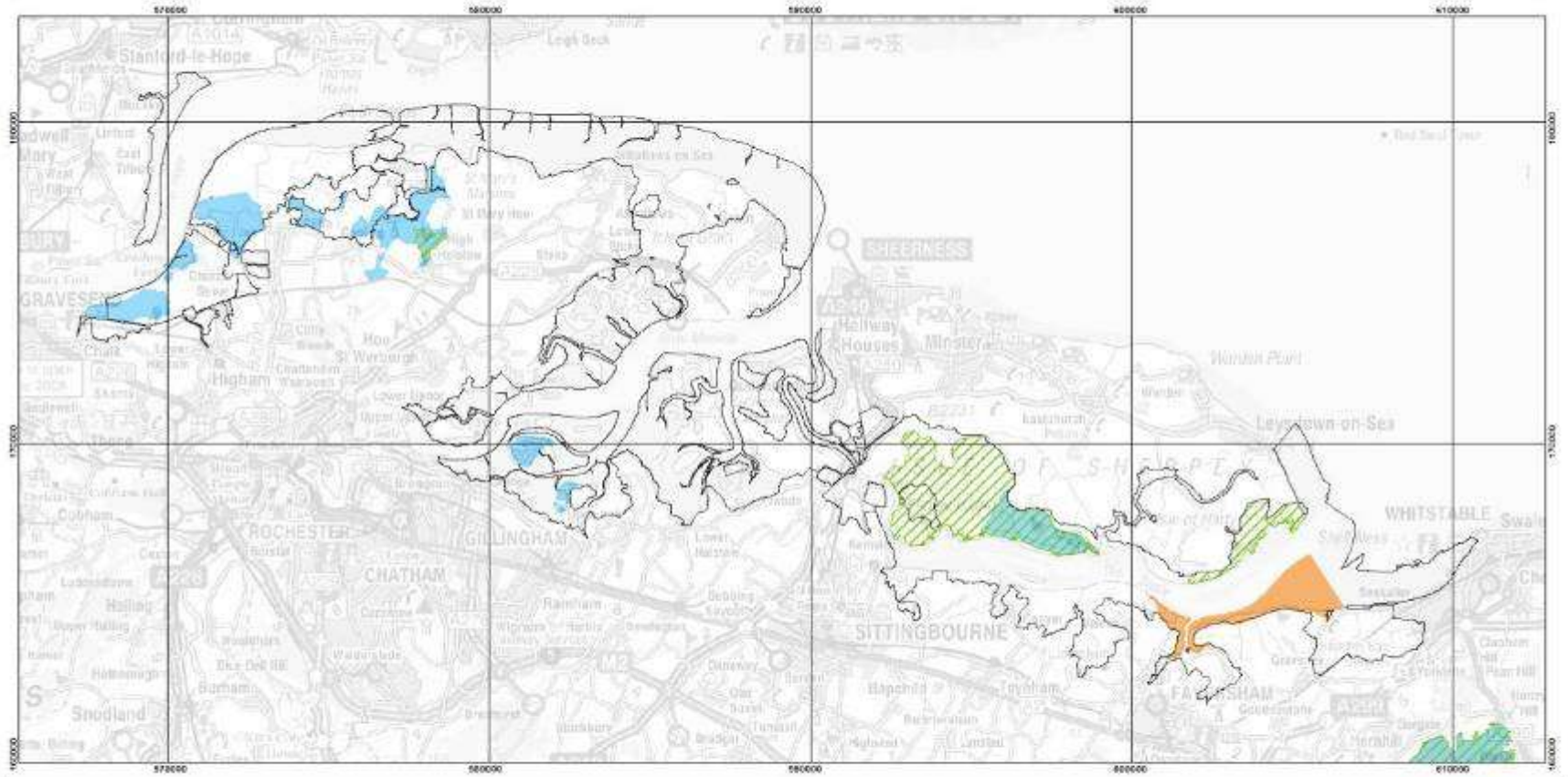
Map 2: National Nature Reserves, and RSPB and Kent Wildlife Trust Reserves

North Kent Baseline Data Collection and Analysis

22 February 2010

Scale 1:176100

footprint ECOLOGY

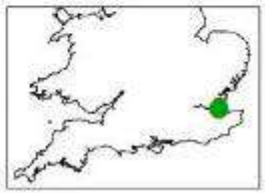


SPA and Ramsar boundaries

RSPB Reserves

National Nature Reserves

Kent Wildlife Trust Reserves



Map 3: WEBS data, mean peak count: European White-fronted Goose

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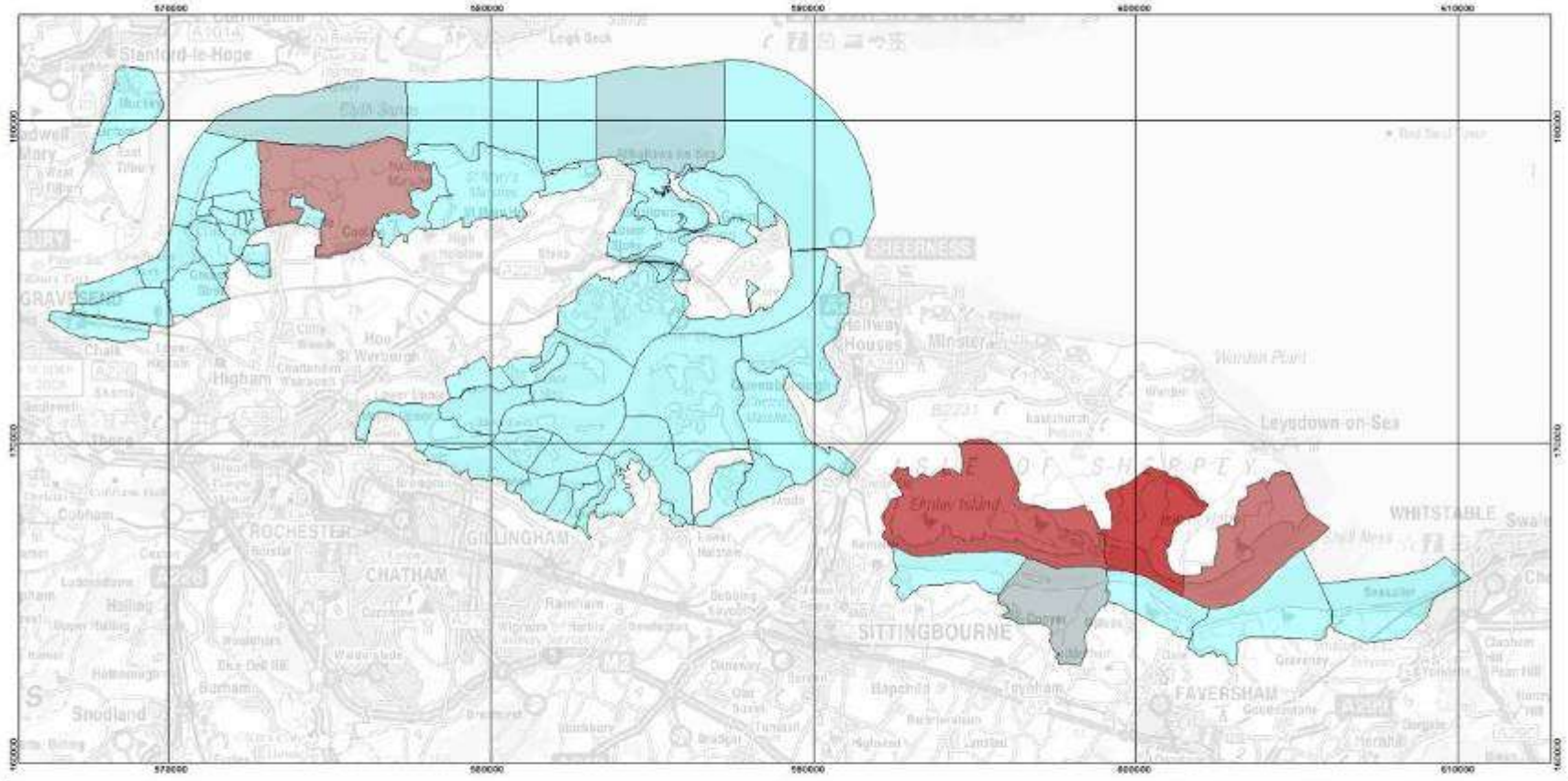
footprint ECOLOGY

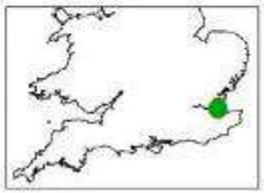


European White-fronted Goose

500 to 700	4 to 9
300 to 499	2 to 3
58 to 299	1
10 to 57	0

International threshold: 10,000

Great Britain threshold: 58



Map 4: WEBS data, mean peak count: Dark-bellied Brent Goose

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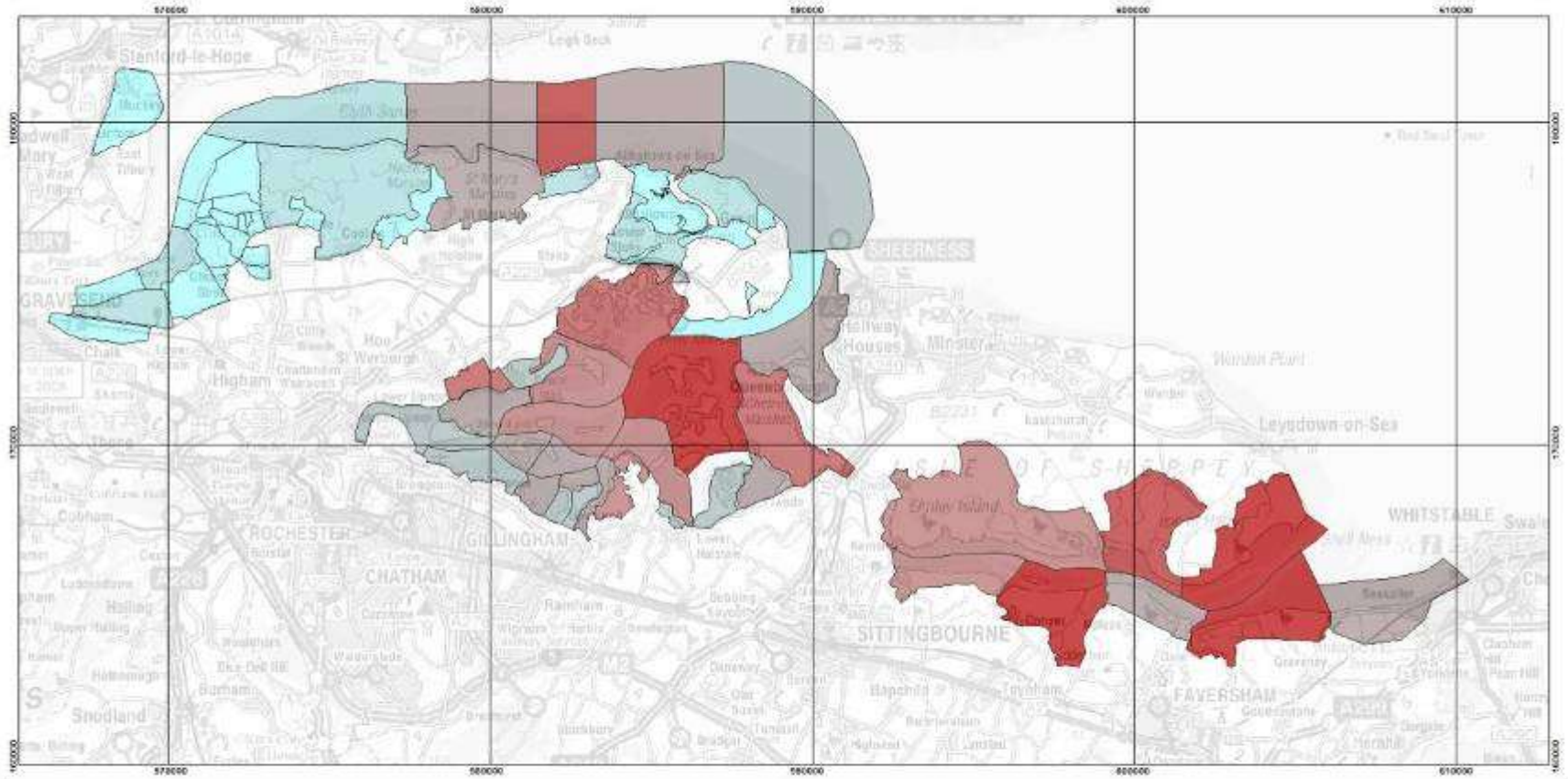
footprint ECOLOGY

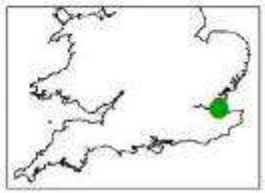


Dark-bellied Brent Goose

- 750 to 981
- 500 to 749
- 300 to 499
- 150 to 299
- 50 to 149
- 10 to 49
- 1 to 9
- 0

International threshold: 2,000

Great Britain threshold: 981



Map 5: WEBS data, mean peak count: Shelduck

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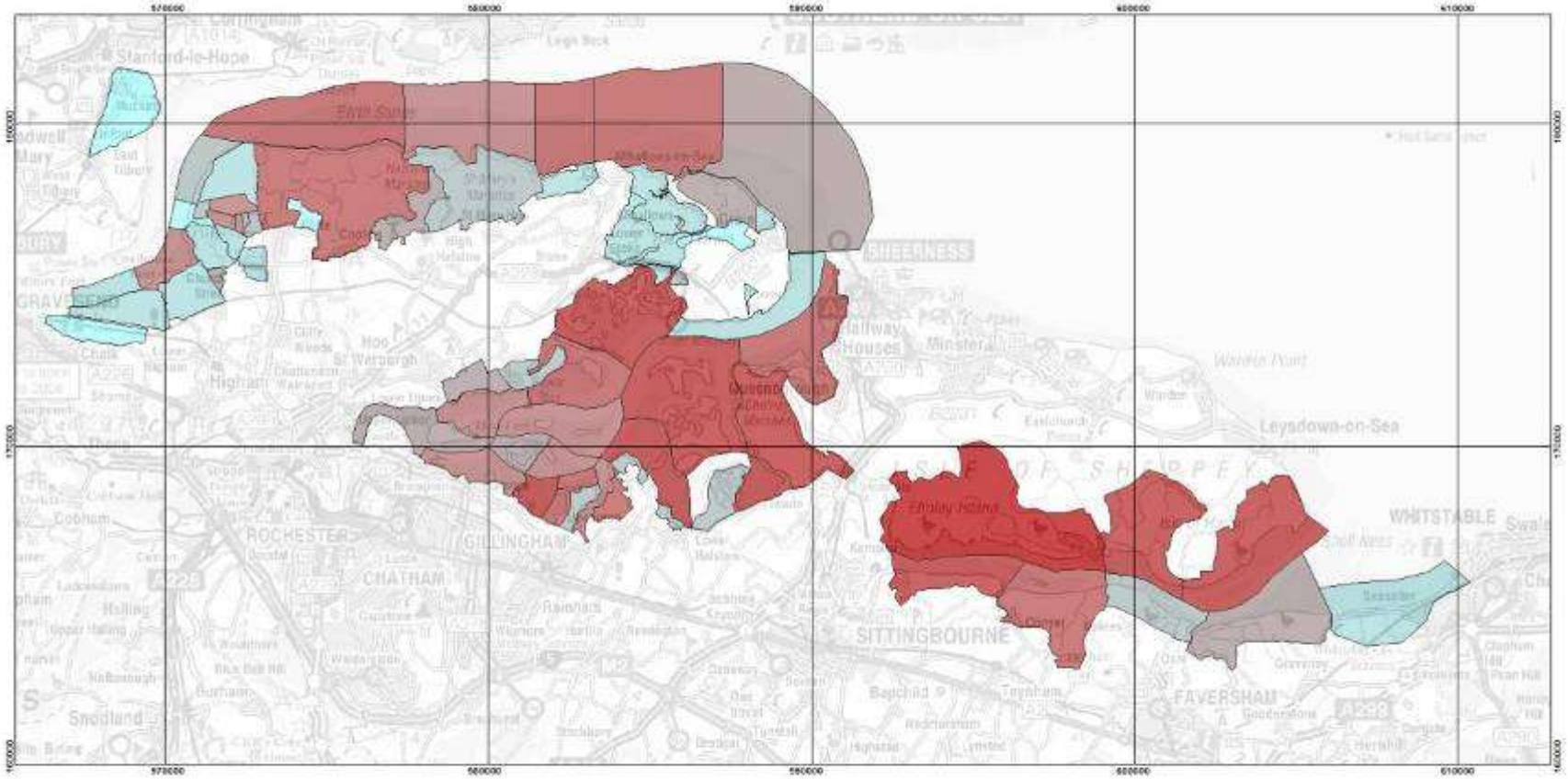
footprint ECOLOGY

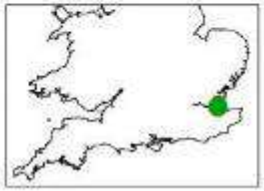


Shelduck

782 to 1,300	50 to 99
300 to 781	10 to 49
150 to 299	1 to 9
100 to 149	0

International threshold: 3,000

Great Britain threshold: 782



Map 6: WEBS data, mean peak count: Northern Shoveler

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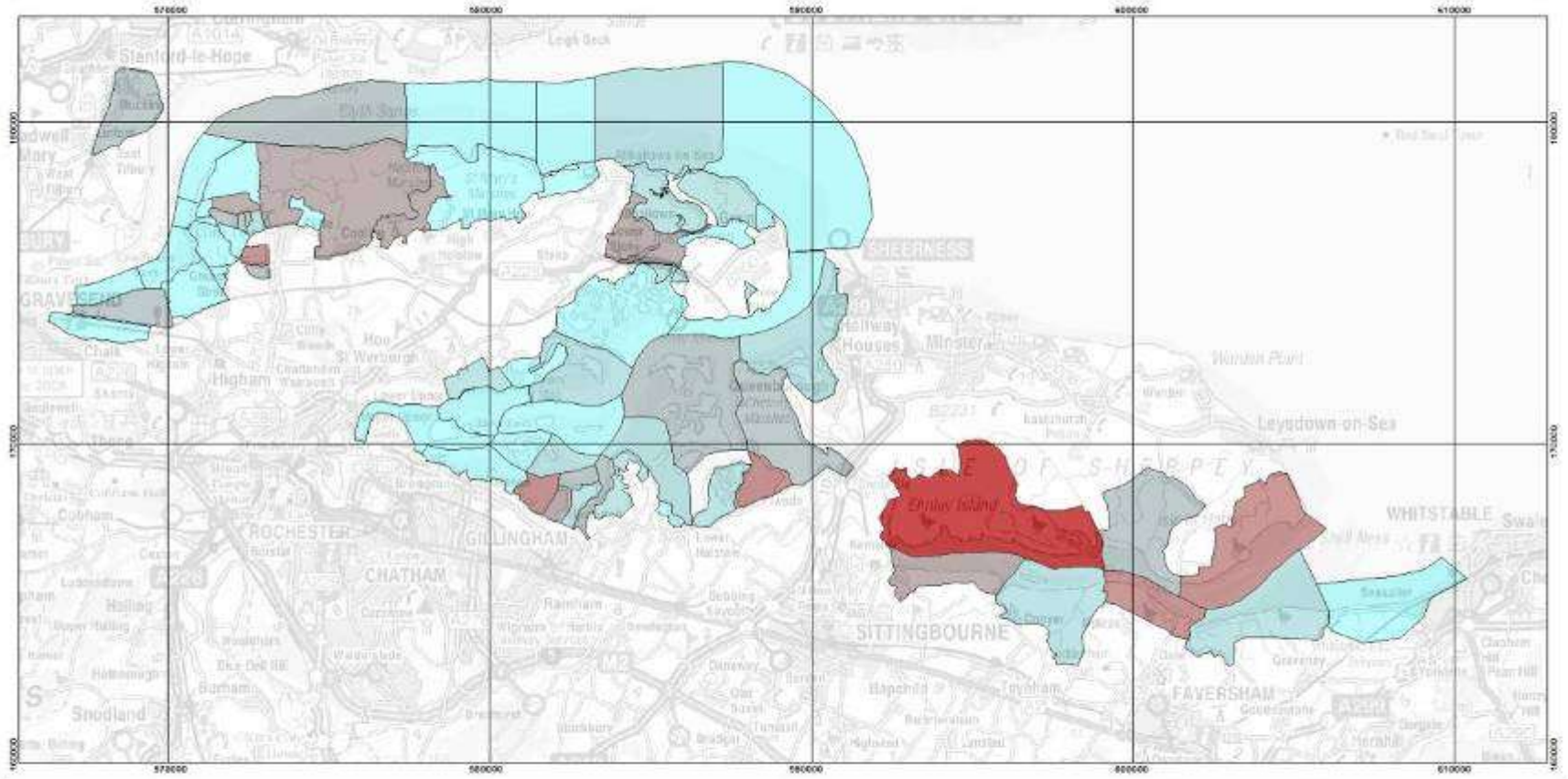
footprint ECOLOGY

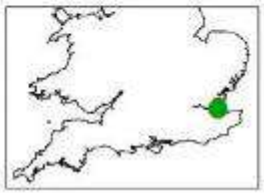


Northern Shoveler

250 to 400	25 to 49
148 to 249	10 to 24
100 to 147	1 to 9
50 to 99	0

International threshold: 400

Great Britain threshold: 148



Map 7: WEBS data, mean peak count: Pintail

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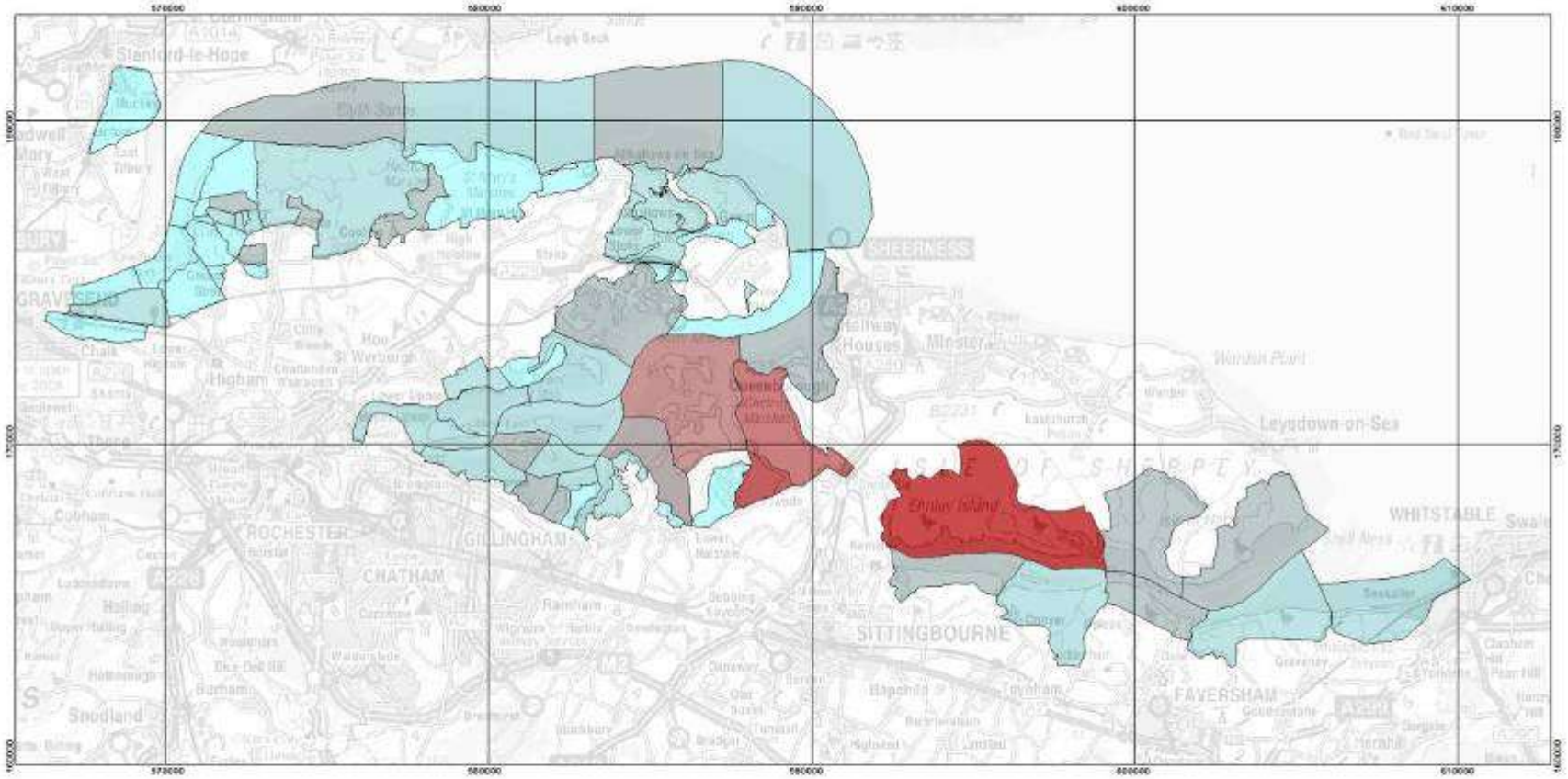
Scale 1:176100

footprint ECOLOGY

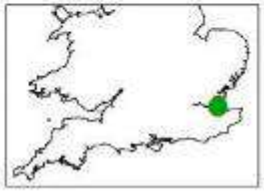


Northern Pintail

600 to 700	50 to 99
279 to 599	10 to 49
150 to 278	1 to 9
100 to 149	0

International threshold: 600

Great Britain threshold: 279



Map 8: WEBS data, mean peak count: Gadwall

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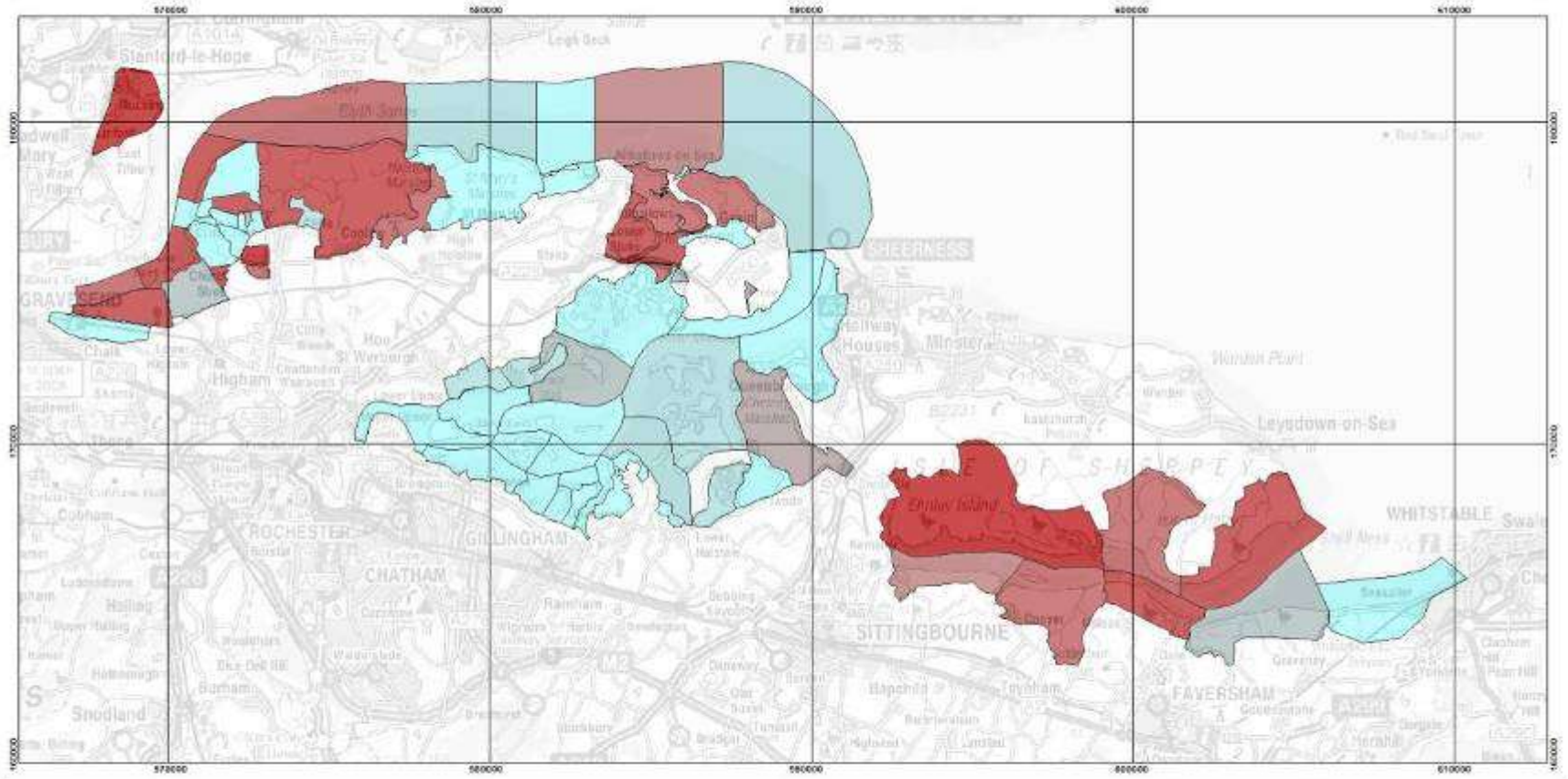
footprint ECOLOGY

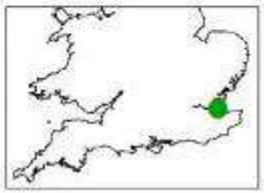


Gadwall

- 50 to 100
- 25 to 49
- 12 to 24
- 6 to 11
- 4 to 5
- 2 to 3
- 1
- 0

International threshold: 600

Great Britain threshold: 171



Map 9: WEBS data, mean peak count: Teal

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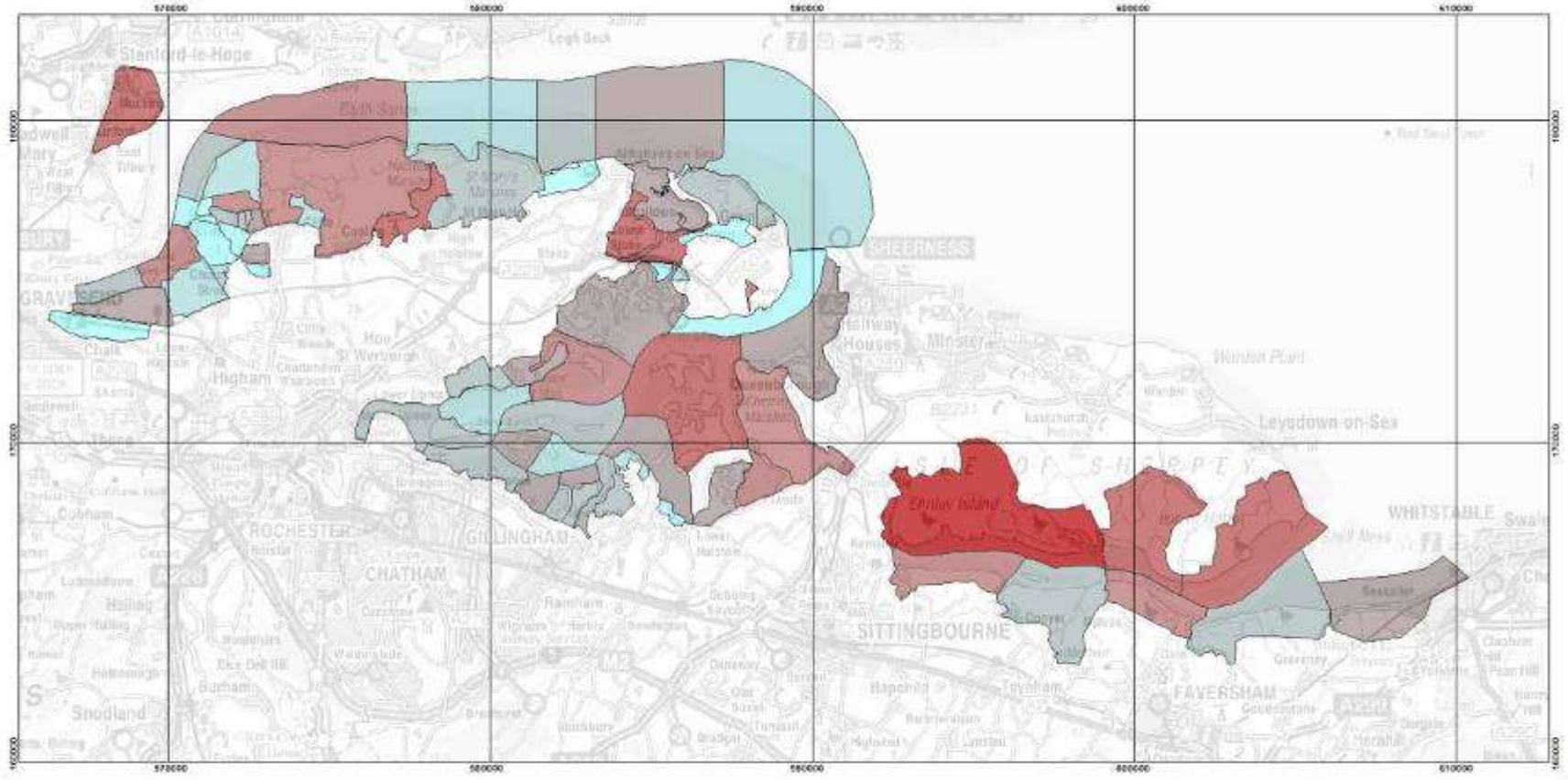
footprint ECOLOGY



Teal

1,920 to 2,700	50 to 149
800 to 1,919	10 to 49
400 to 799	1 to 9
150 to 399	0

International threshold: 5,000

Great Britain threshold: 1,920

Map 10: WEBS data, mean peak count: Wigeon

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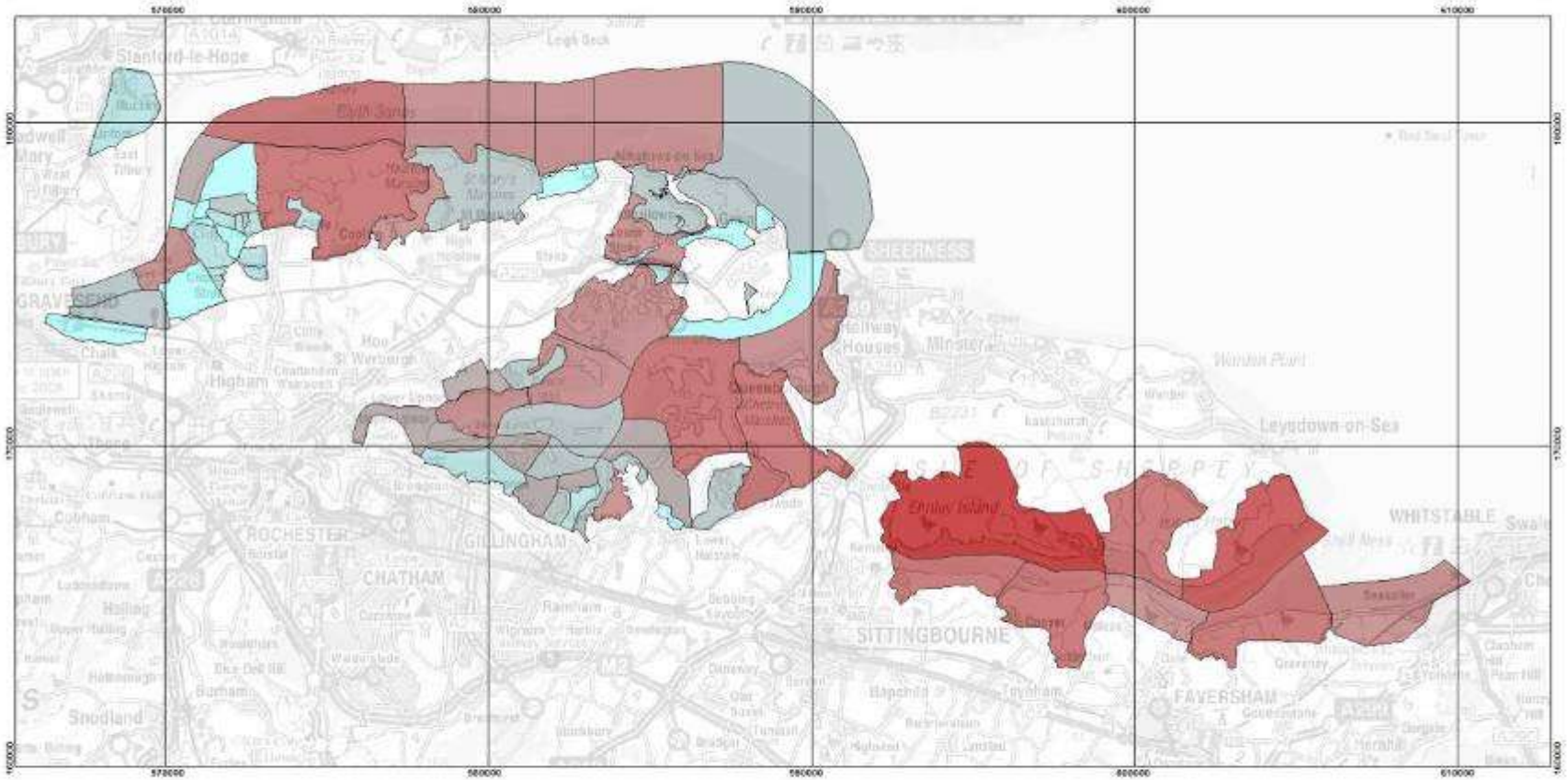
footprint ECOLOGY

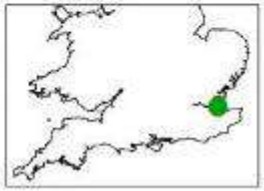


Wigeon

4,060 to 10,500	50 to 99
2,000 to 4,059	10 to 49
500 to 1,999	1 to 9
100 to 499	0

International threshold: 15,000

Great Britain threshold: 4,060



Map 11: WEBS data, mean peak count: Great Crested Grebe

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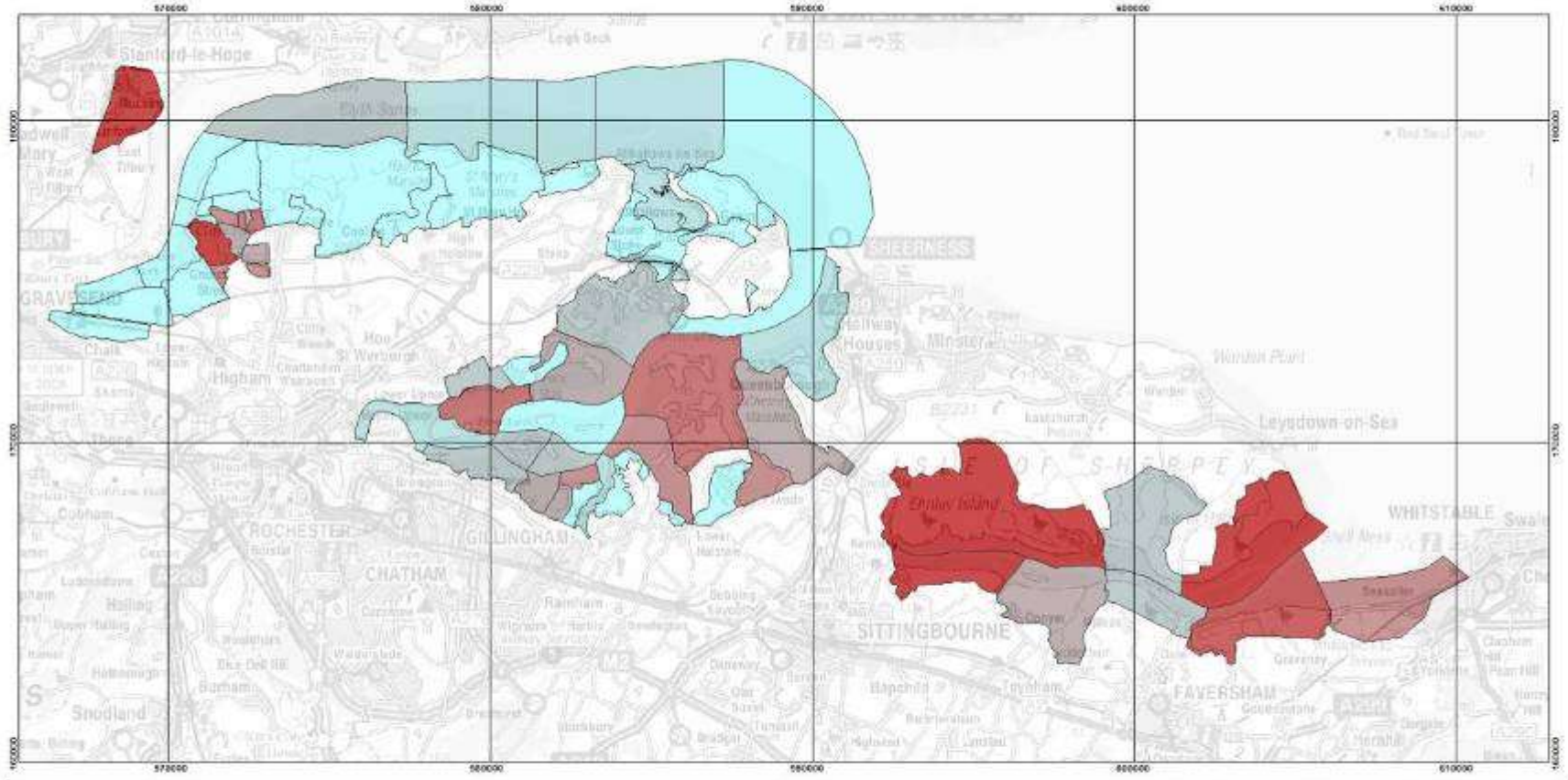
Scale 1:176100

footprint ECOLOGY



Map 12: WEBS data, mean peak count: Little Grebe

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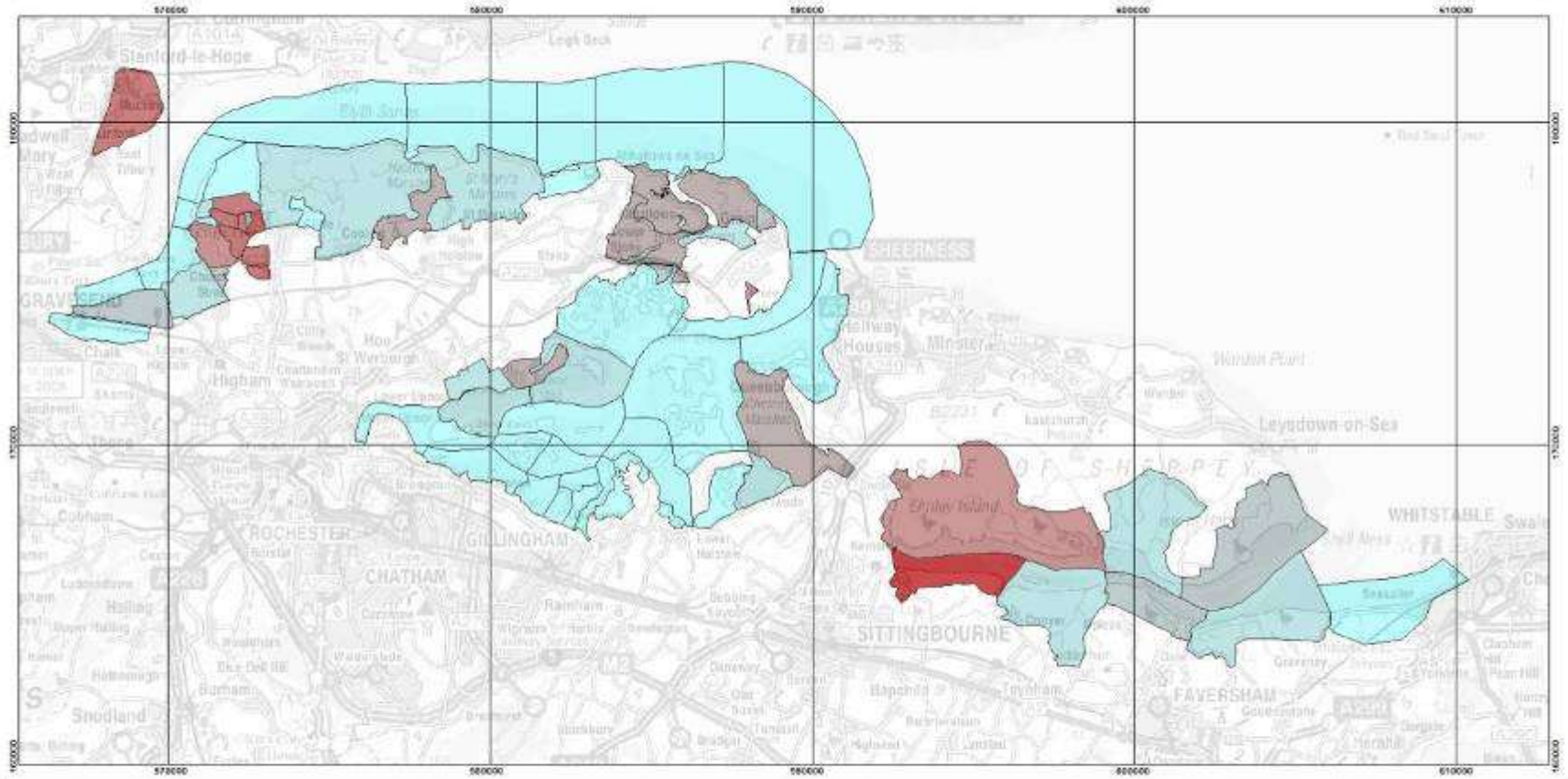
Scale 1:176100

footprint ECOLOGY



Little Grebe

- 78 to 115
- 40 to 77
- 20 to 39
- 15 to 19
- 10 to 14
- 5 to 9
- 1 to 4
- 0

International threshold: 4,000

Great Britain threshold: 78

Map 13: WEBS data, mean peak count: Cormorant

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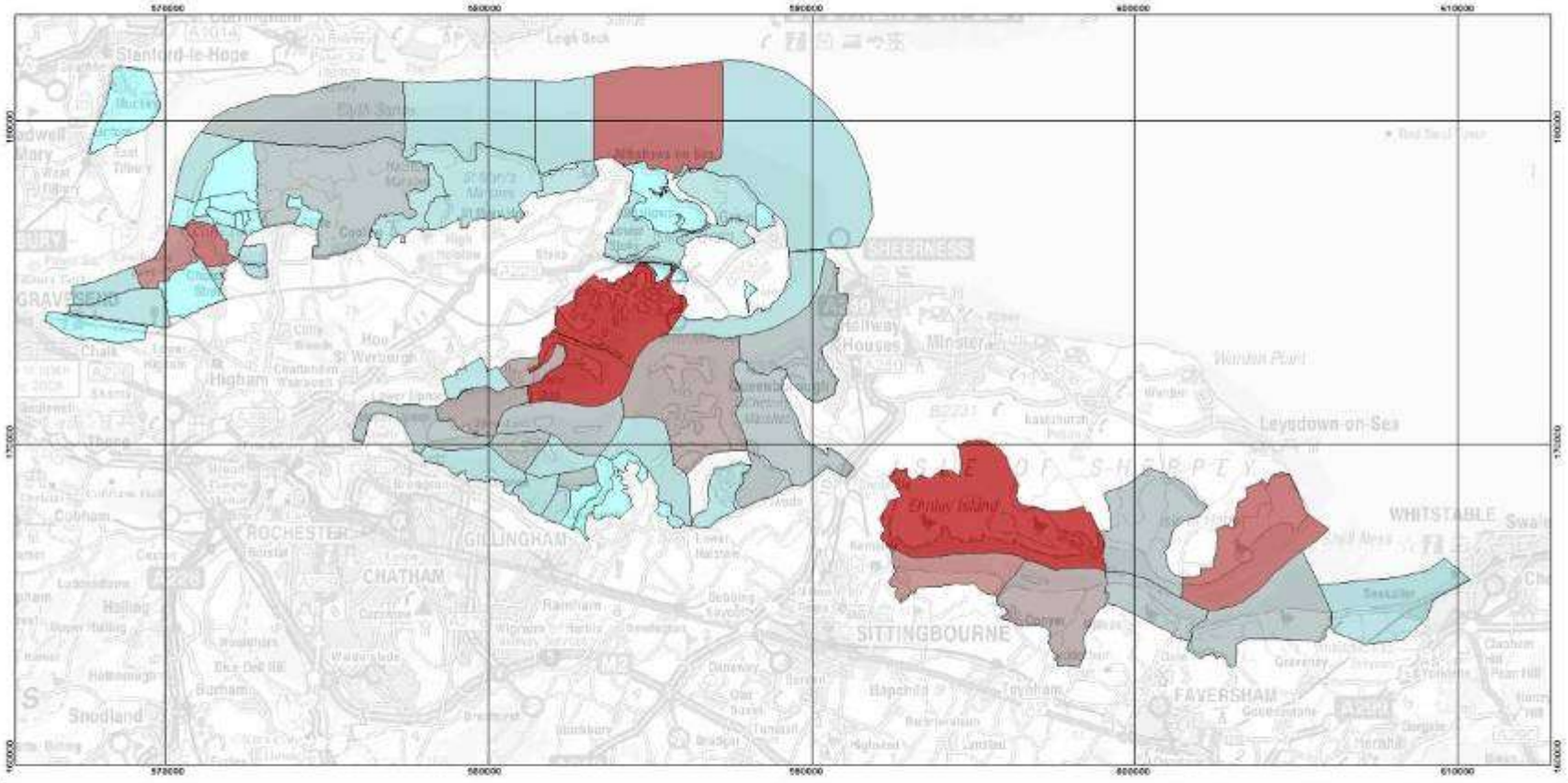
footprint ECOLOGY

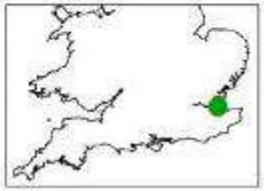


Cormorant

80 to 145	10 to 14
40 to 79	5 to 9
20 to 39	1 to 4
15 to 19	0

International threshold: 1,200

Great Britain threshold: 230



Map 14: WEBS data, mean peak count: Oystercatcher

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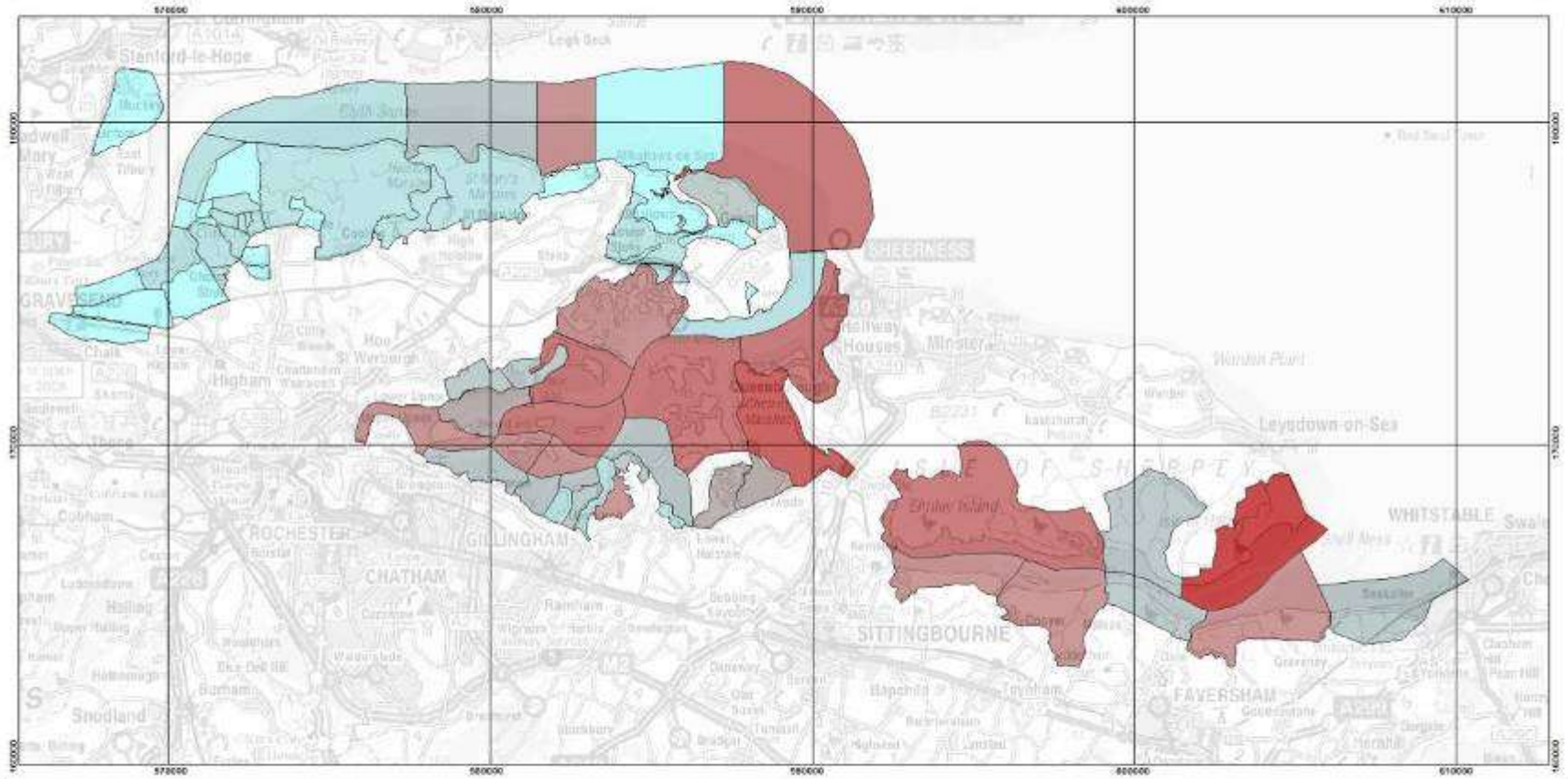
Scale 1:176100

footprint ECOLOGY

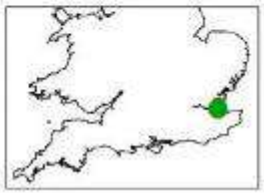


Oystercatcher

3,200 to 5,000	50 to 99
1,000 to 3,199	10 to 49
500 to 999	1 to 9
100 to 499	0

International threshold: 10,200

Great Britain threshold: 3,200



Map 15: WEBS data, mean peak count: Avocet

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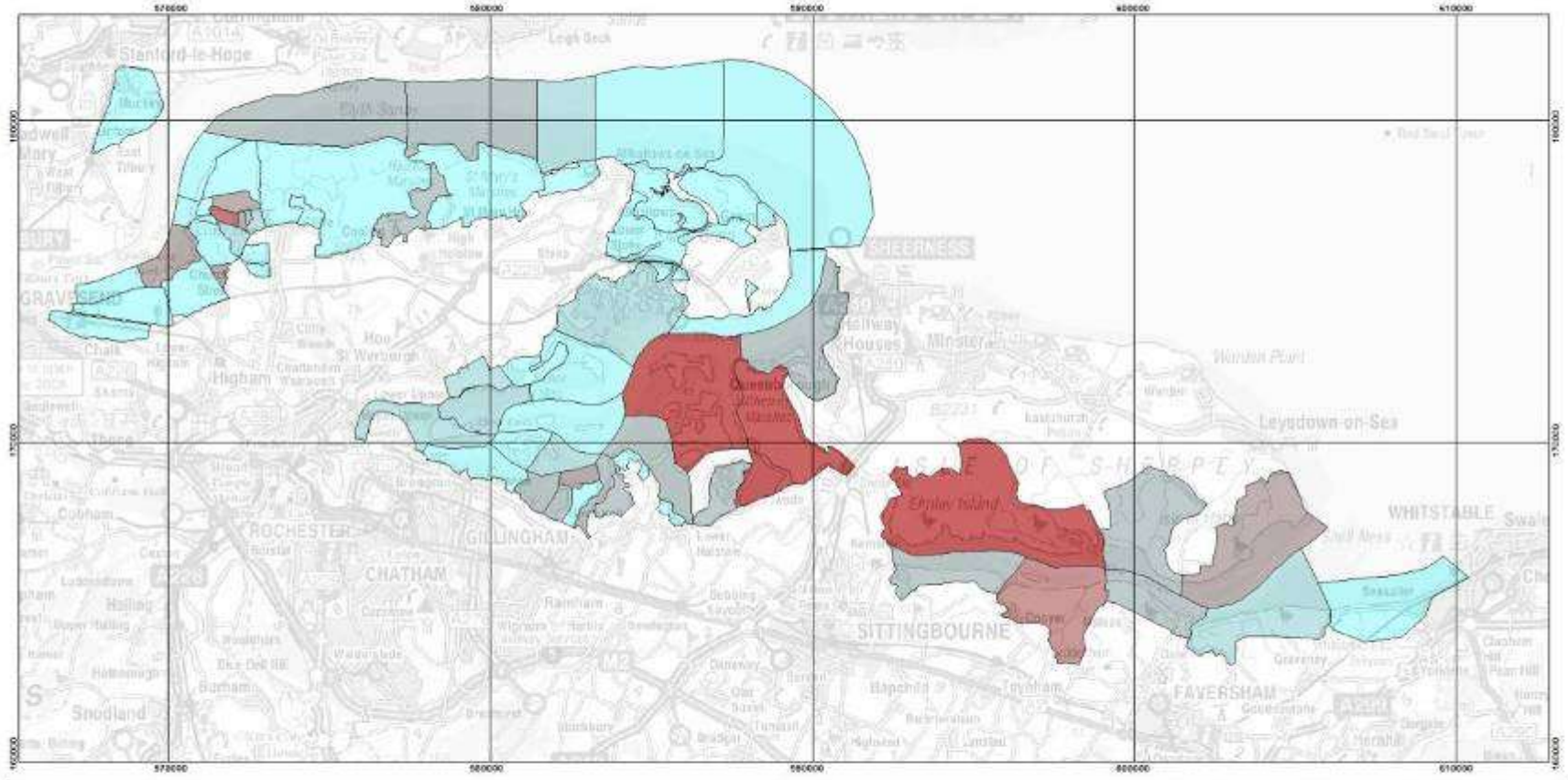
footprint ECOLOGY

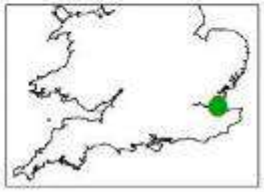


Mean Peak Count: Avocet

350 to 730	50 to 99
250 to 349	10 to 49
150 to 249	1 to 9
100 to 149	0

International threshold: 730

Great Britain threshold: 50



Map 16: WEBS data, mean peak count: Ringed Plover

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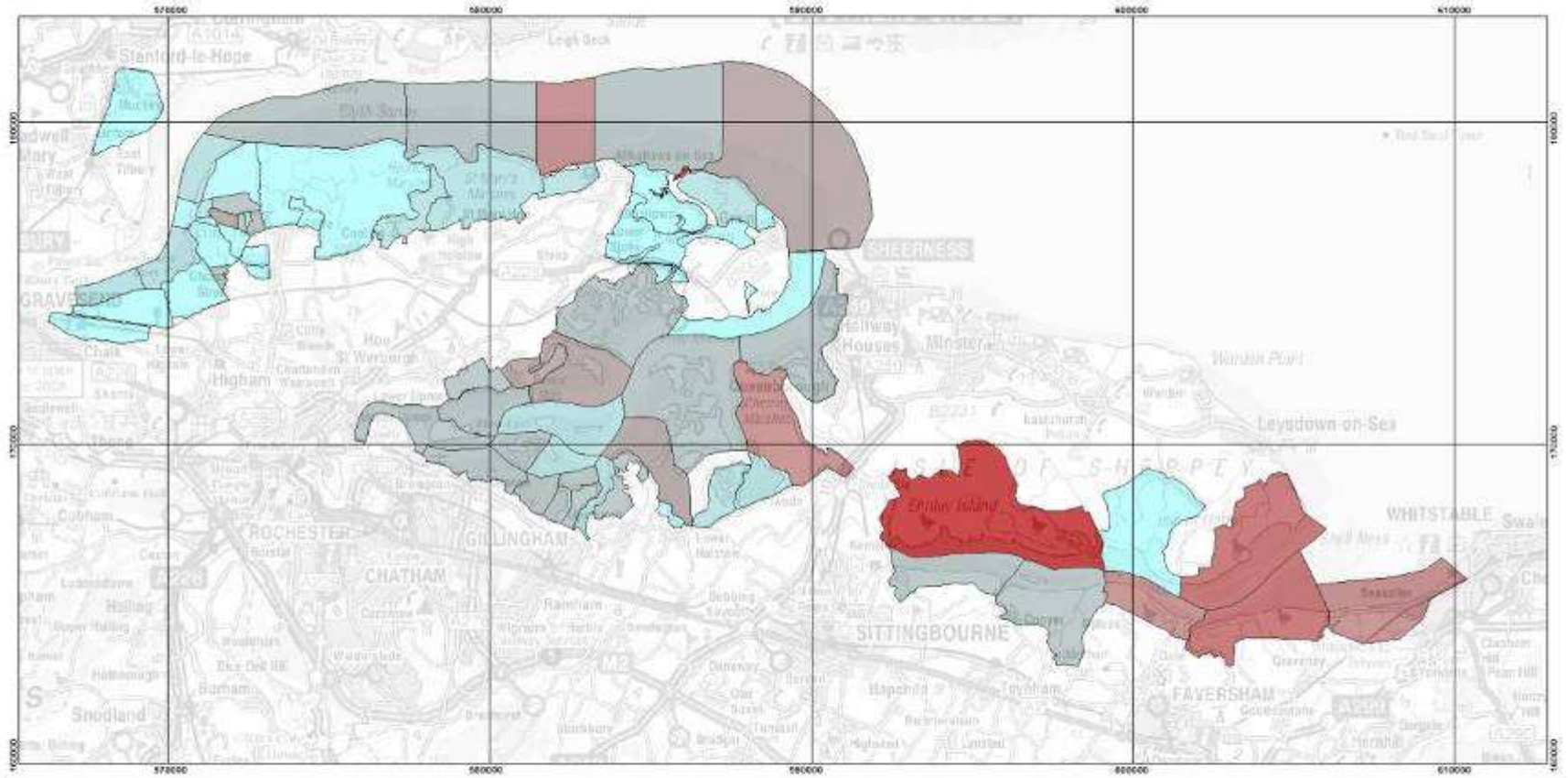
Scale 1:176100

footprint ECOLOGY

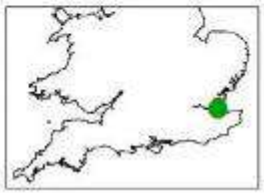


Ringed Plover

- 330 to 730
- 250 to 329
- 150 to 249
- 100 to 149
- 50 to 99
- 10 to 49
- 1 to 9
- 0

International threshold: 730

Great Britain threshold: 330



Map 17: WEBS data, mean peak count: Golden Plover

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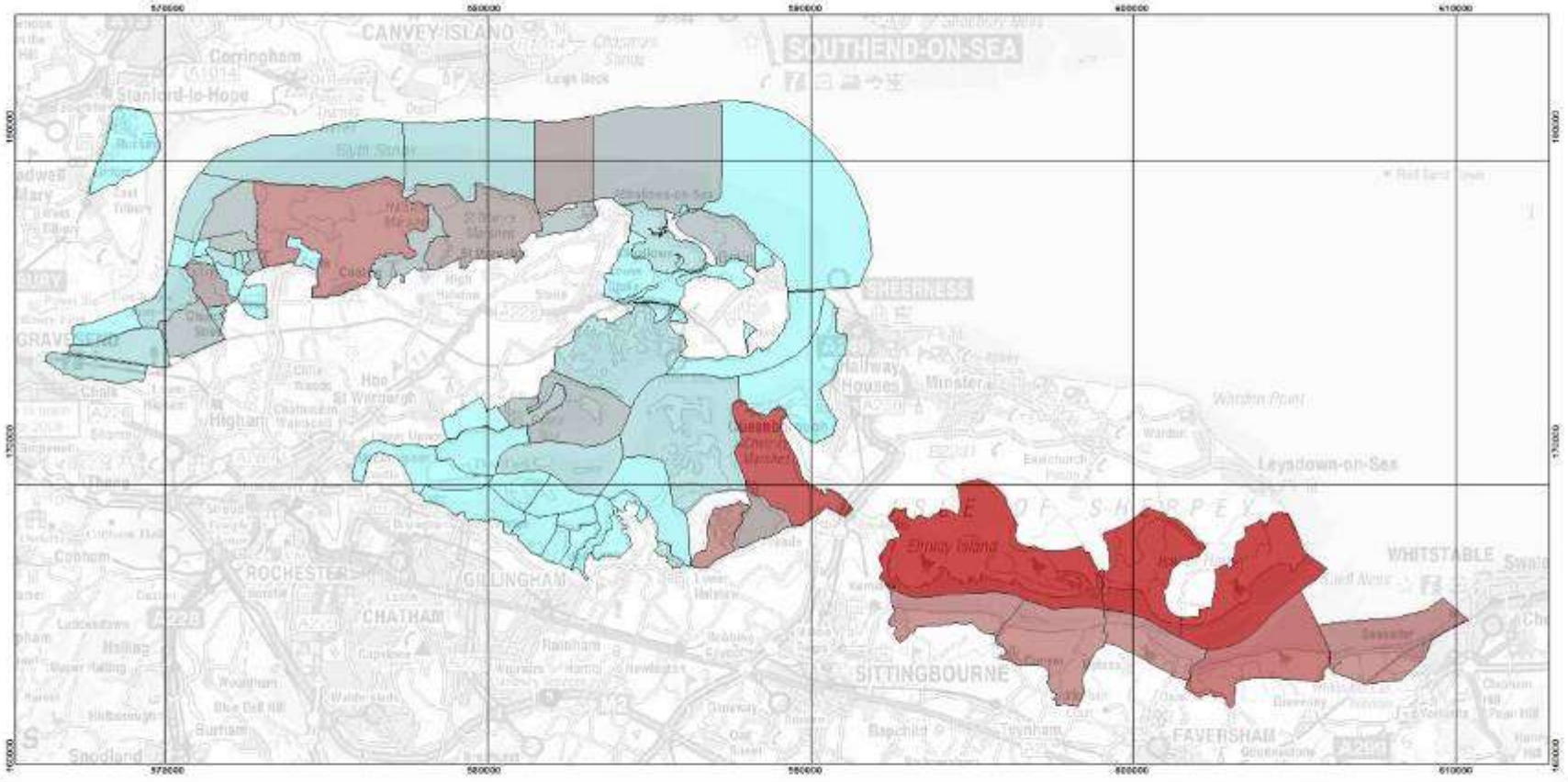
Scale 1:176100

footprint ECOLOGY

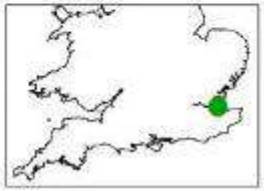


Golden Plover

2,000 to 4,000	50 to 99
1,000 to 1,999	10 to 49
500 to 999	1 to 9
100 to 499	0

International threshold: 9,300

Great Britain threshold: 4,000



Map 18: WEBS data, mean peak count: Grey Plover

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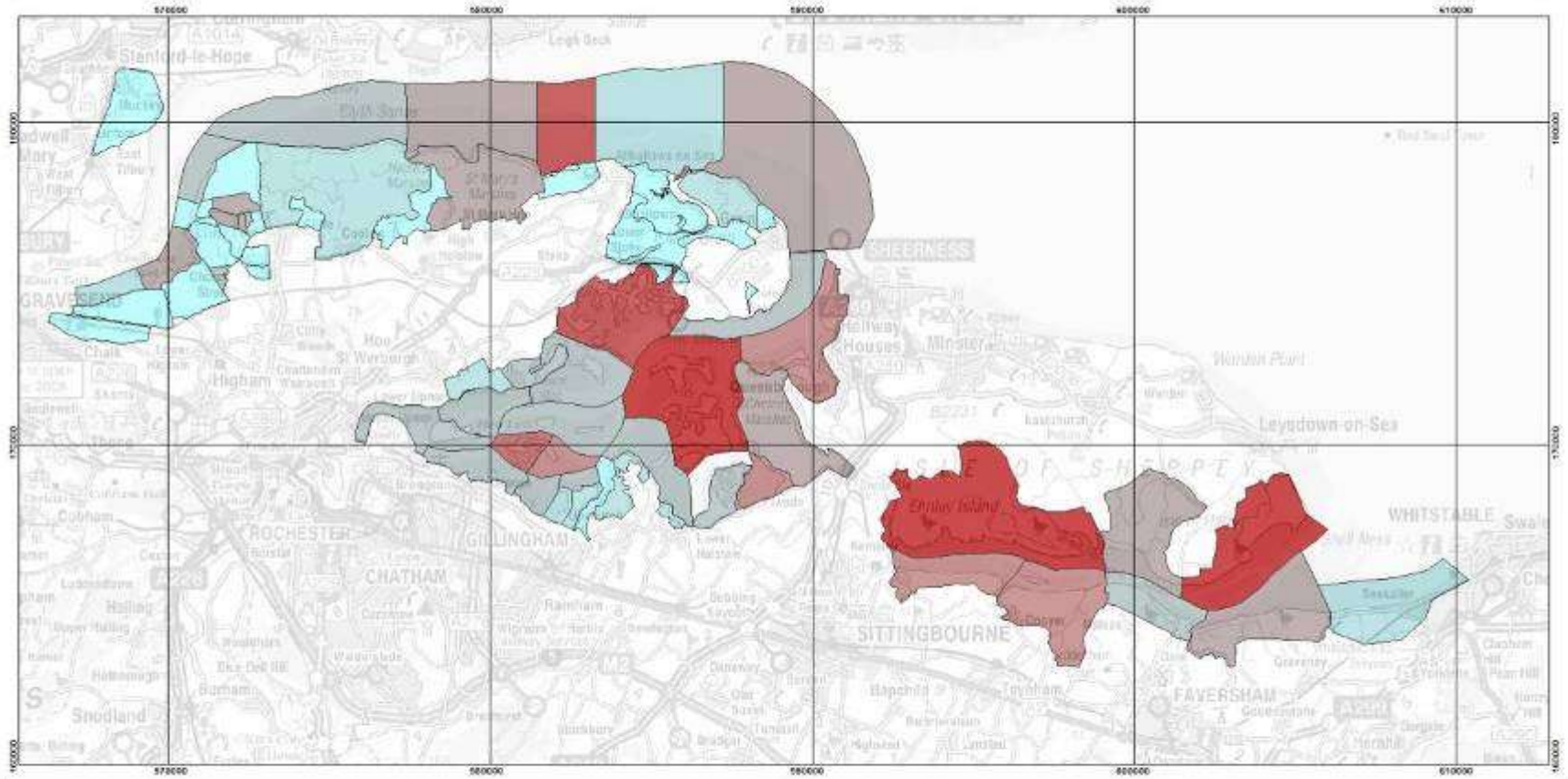
Scale 1:176100

footprint ECOLOGY



Grey Plover

750 to 1,499	50 to 149
530 to 749	10 to 49
300 to 529	1 to 9
150 to 299	0

International threshold: 2,500

Great Britain threshold: 530

Map 19: WEBS data, mean peak count: Lapwing

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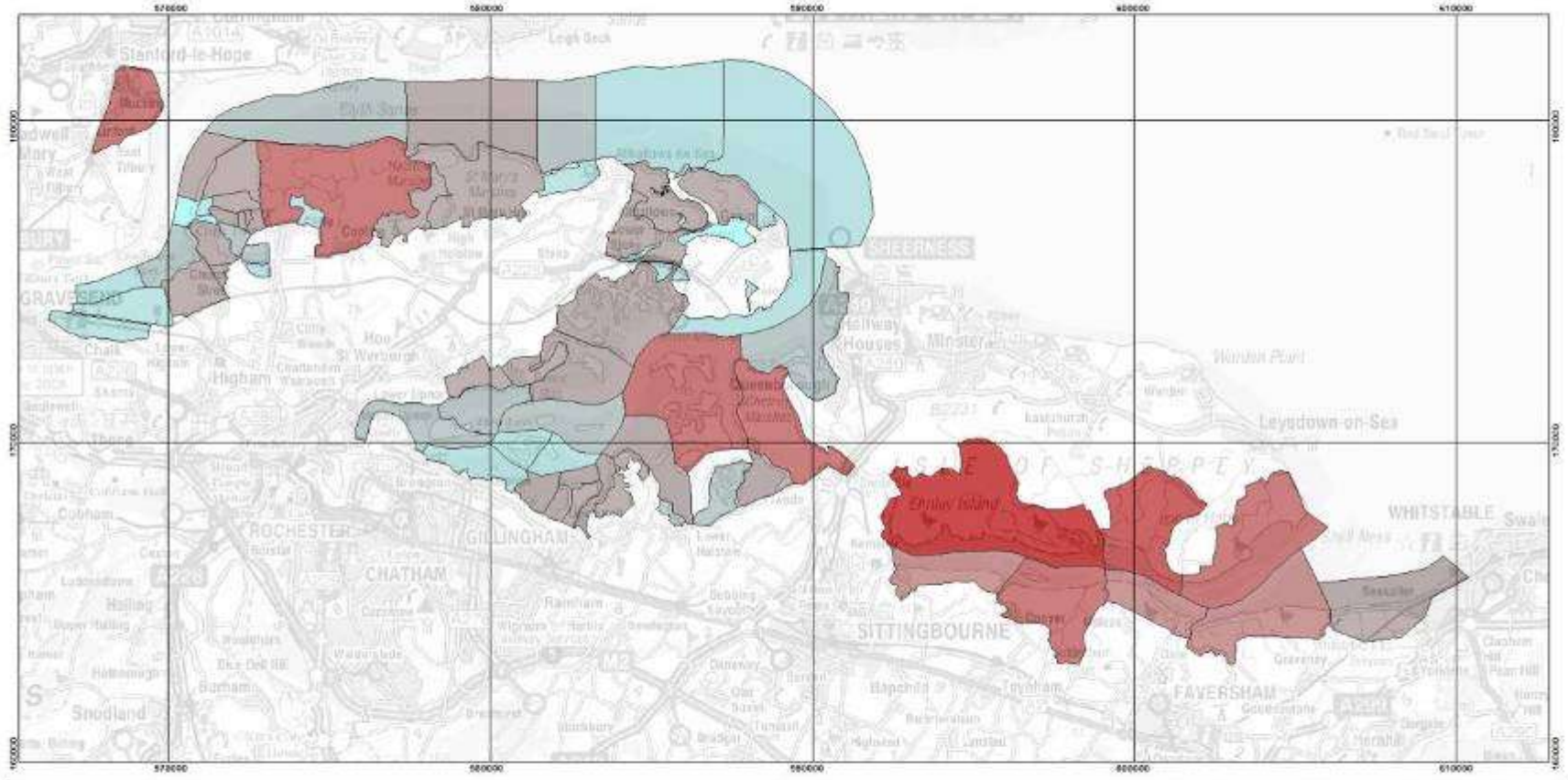
Scale 1:176100

footprint ECOLOGY

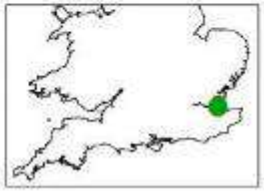


Lapwing

6,200 to 7,500	100 to 500
3,000 to 6,200	50 to 100
1,000 to 3,000	1 to 50
500 to 1,000	0 to 1

International threshold: 20,000

Great Britain threshold: 6,200



Map 20: WEBS data, mean peak count: Knot

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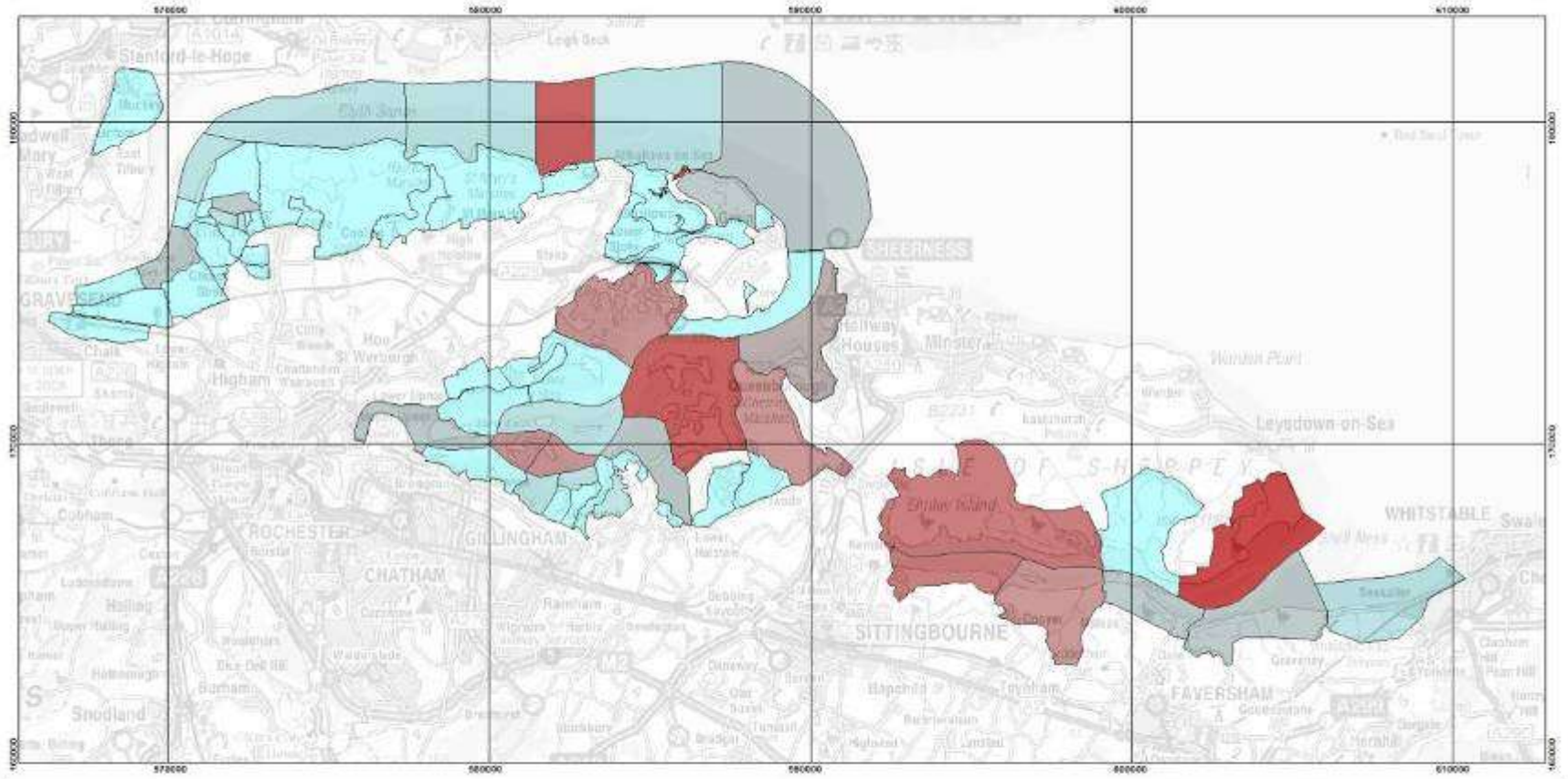
Scale 1:176100

footprint ECOLOGY

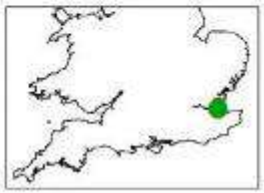


Knot

2,800 to 3,500	50 to 99
1,000 to 2,799	10 to 49
500 to 999	1 to 9
100 to 499	0

International threshold: 4,500

Great Britain threshold: 2,800



Map 21: WEBS data, mean peak count: Dunlin

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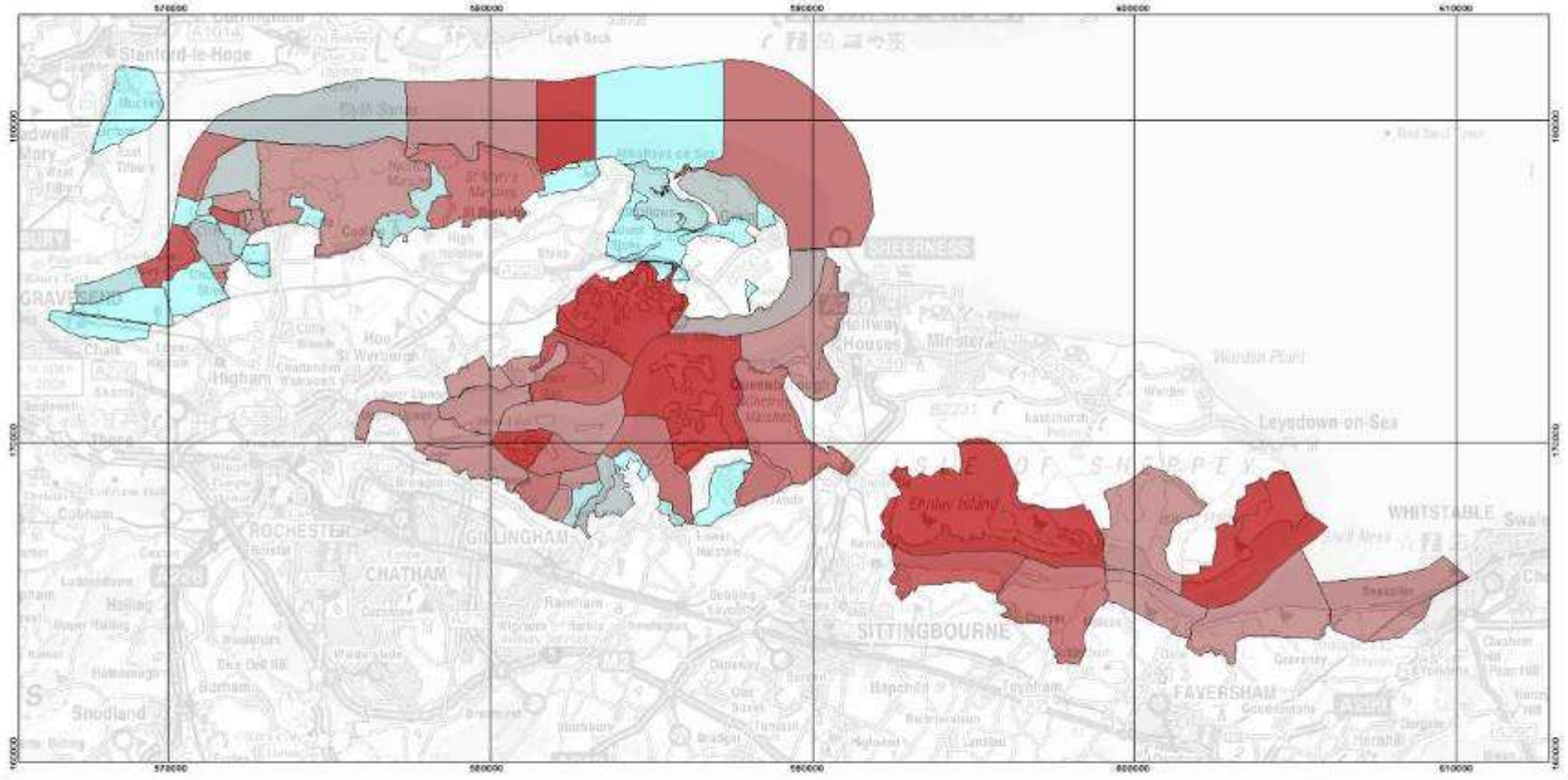
Scale 1:176100

footprint ECOLOGY

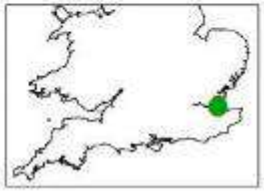


Dunlin

- 3,000 to 5,600
- 1,000 to 2,999
- 500 to 999
- 100 to 499
- 50 to 99
- 10 to 49
- 1 to 9
- 0

International threshold: 13,300

Great Britain threshold: 5,600



Map 22: WEBS data, mean peak count: Black-tailed Godwit

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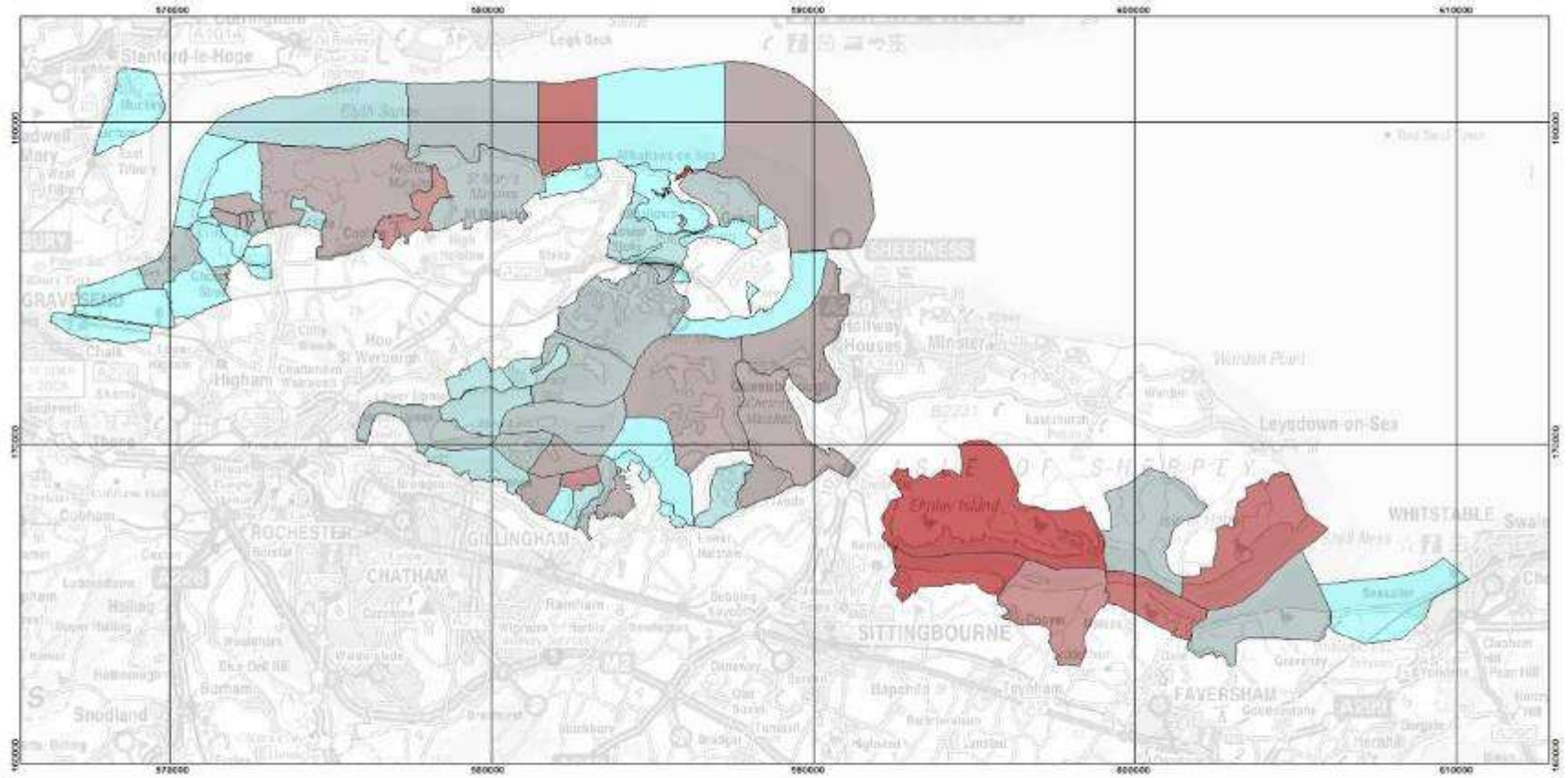
Scale 1:176100

footprint ECOLOGY

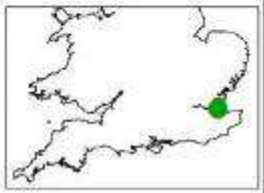


Black-tailed Godwit

750 to 1,200	50 to 149
470 to 749	10 to 49
300 to 469	1 to 9
150 to 299	0

International threshold: 470

Great Britain threshold: 150



Map 23: WEBS data, mean peak count: Whimbrel

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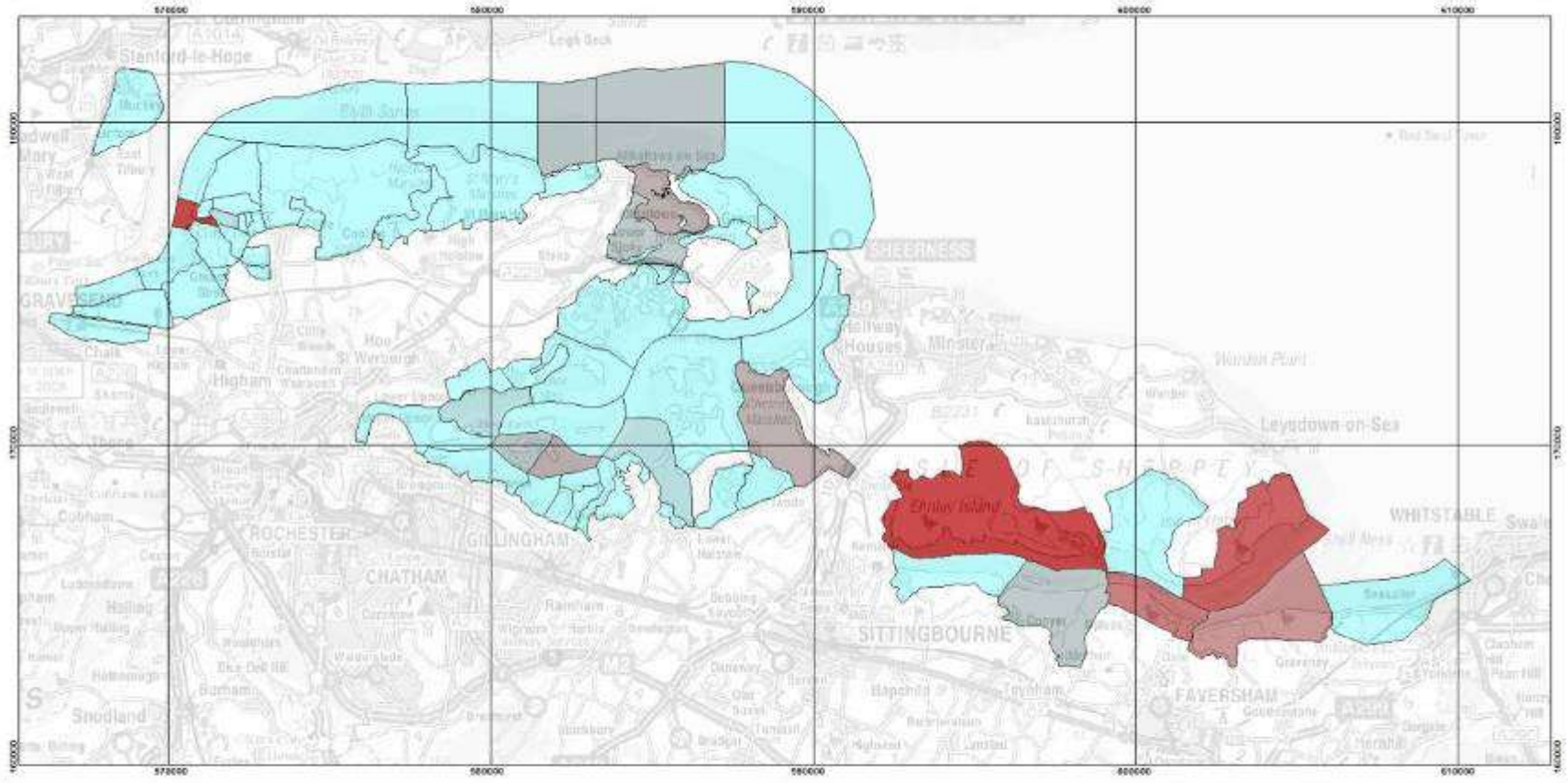
Scale 1:176100

footprint ECOLOGY

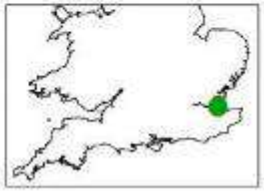


Whimbrel

- 20 to 25
- 15 to 19
- 10 to 14
- 7 to 9
- 5 to 6
- 3 to 4
- 1 to 2
- 0

International threshold: 6,800

Great Britain threshold: not set



Map 24: WEBS data, mean peak count: Curlew

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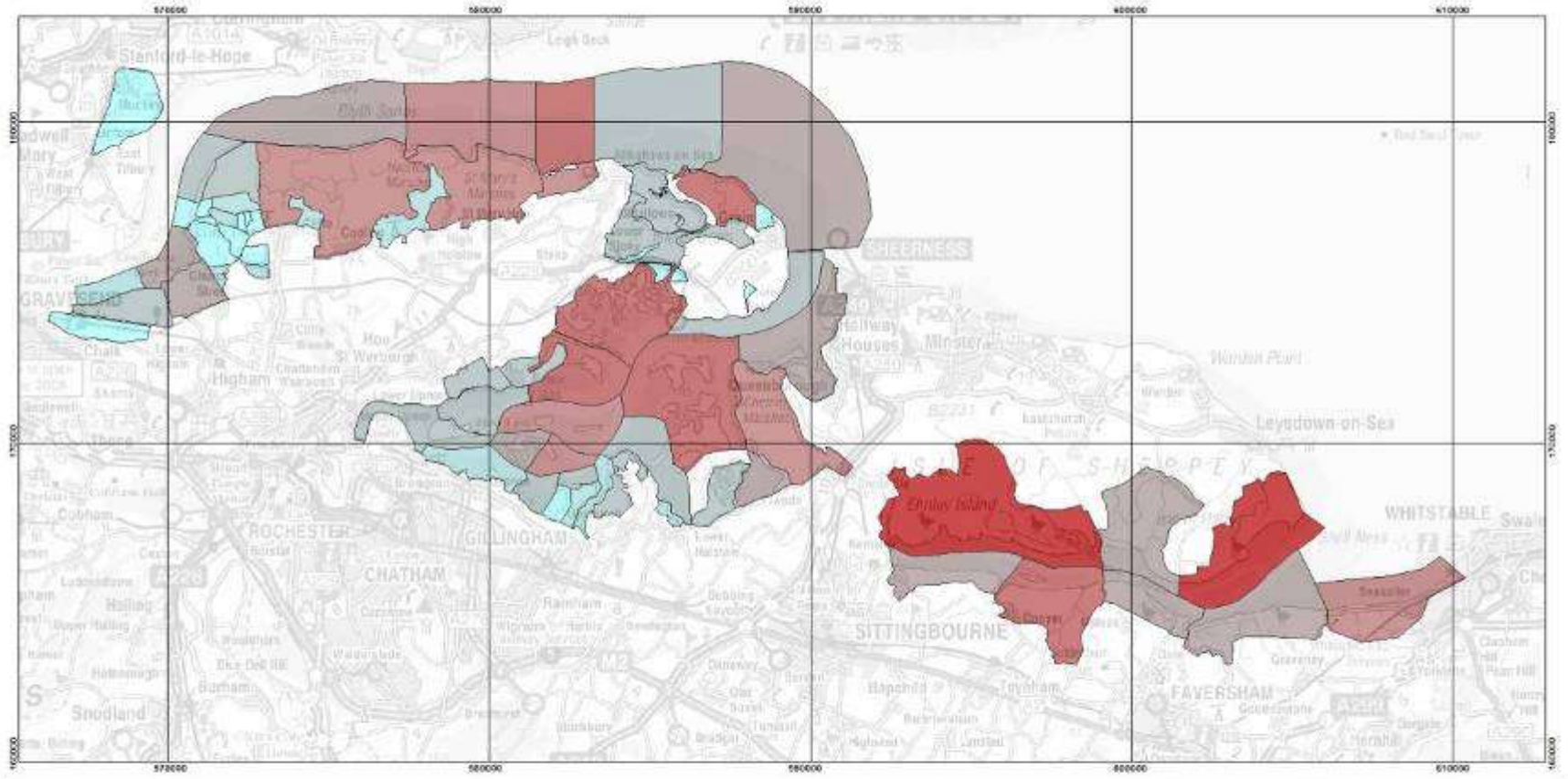
Scale 1:176100

footprint ECOLOGY

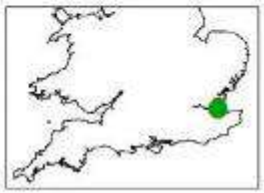


Curlew

- 750 to 1,500
- 500 to 749
- 300 to 499
- 150 to 299
- 50 to 149
- 10 to 49
- 1 to 9
- 0

International threshold: 8,500

Great Britain threshold: 1,500



Map 25: WEBS data, mean peak count: Redshank

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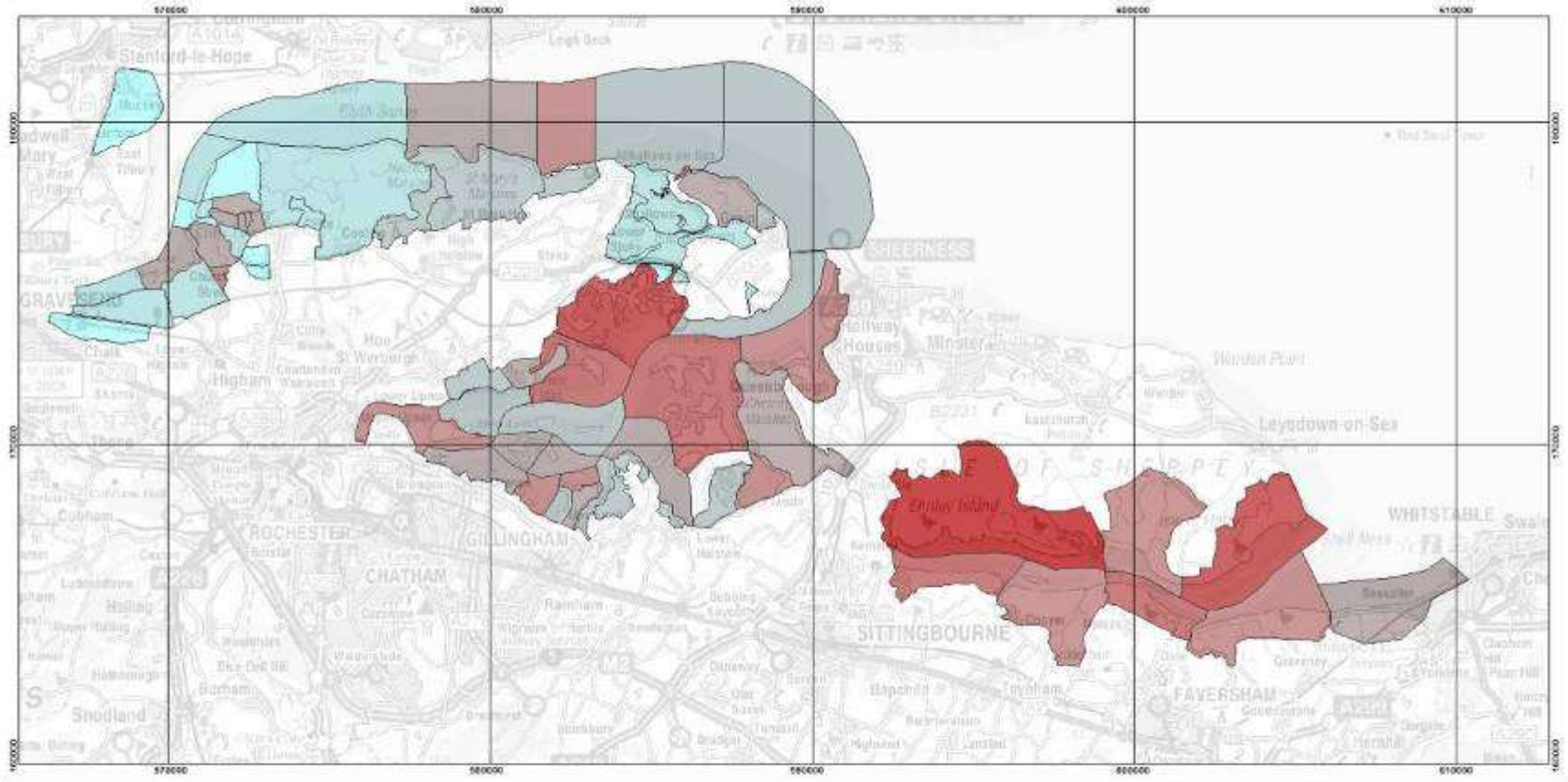
Scale 1:176100

footprint ECOLOGY

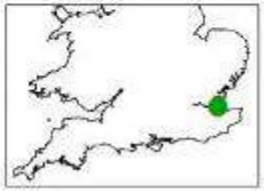


Redshank

750 to 1,200	50 to 149
500 to 749	10 to 49
300 to 499	1 to 9
150 to 399	0

International threshold: 2,800

Great Britain threshold: 1,200



Map 26: Indicative areas for breeding Marsh Harrier

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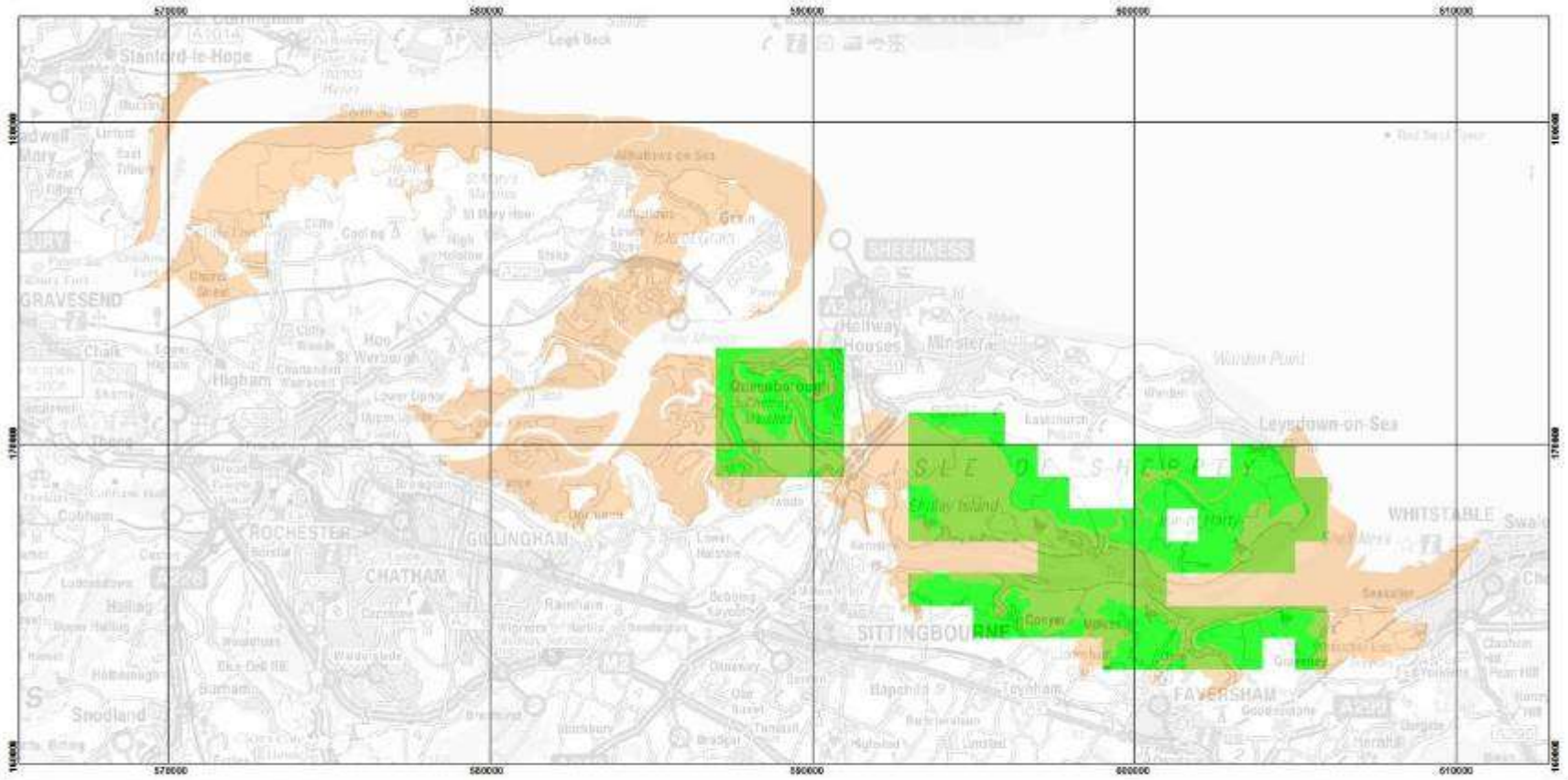
Scale 1:176100

footprint ECOLOGY



Areas indicative for breeding Marsh Harrier

North Kent SPAs

Map 27: WEBS data, mean peak count: Avocet

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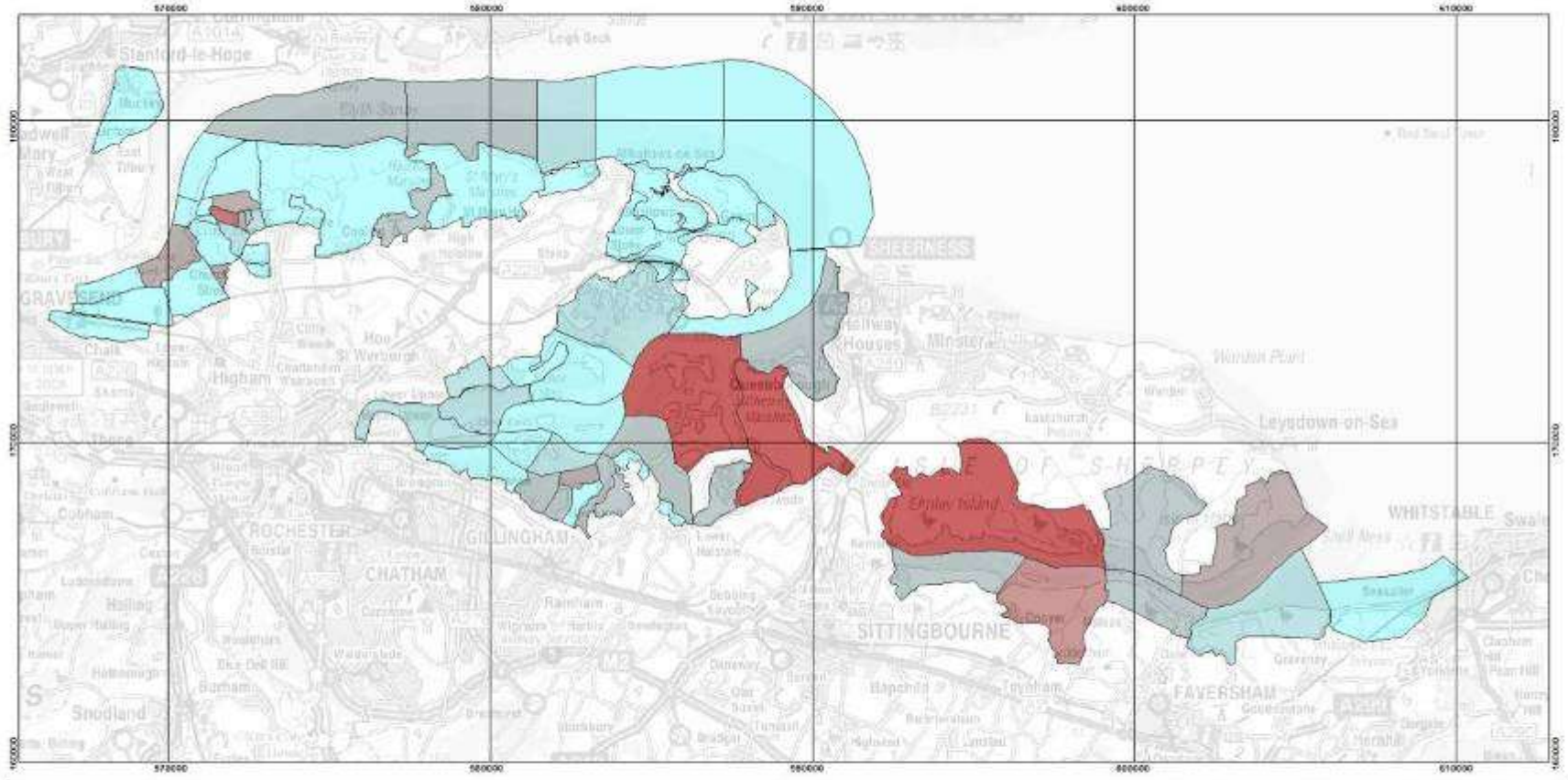
Scale 1:176100

footprint ECOLOGY

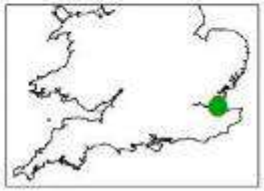


Mean Peak Count: Avocet

350 to 730	50 to 99
250 to 349	10 to 49
150 to 249	1 to 9
100 to 149	0

International threshold: 730

Great Britain threshold: 50



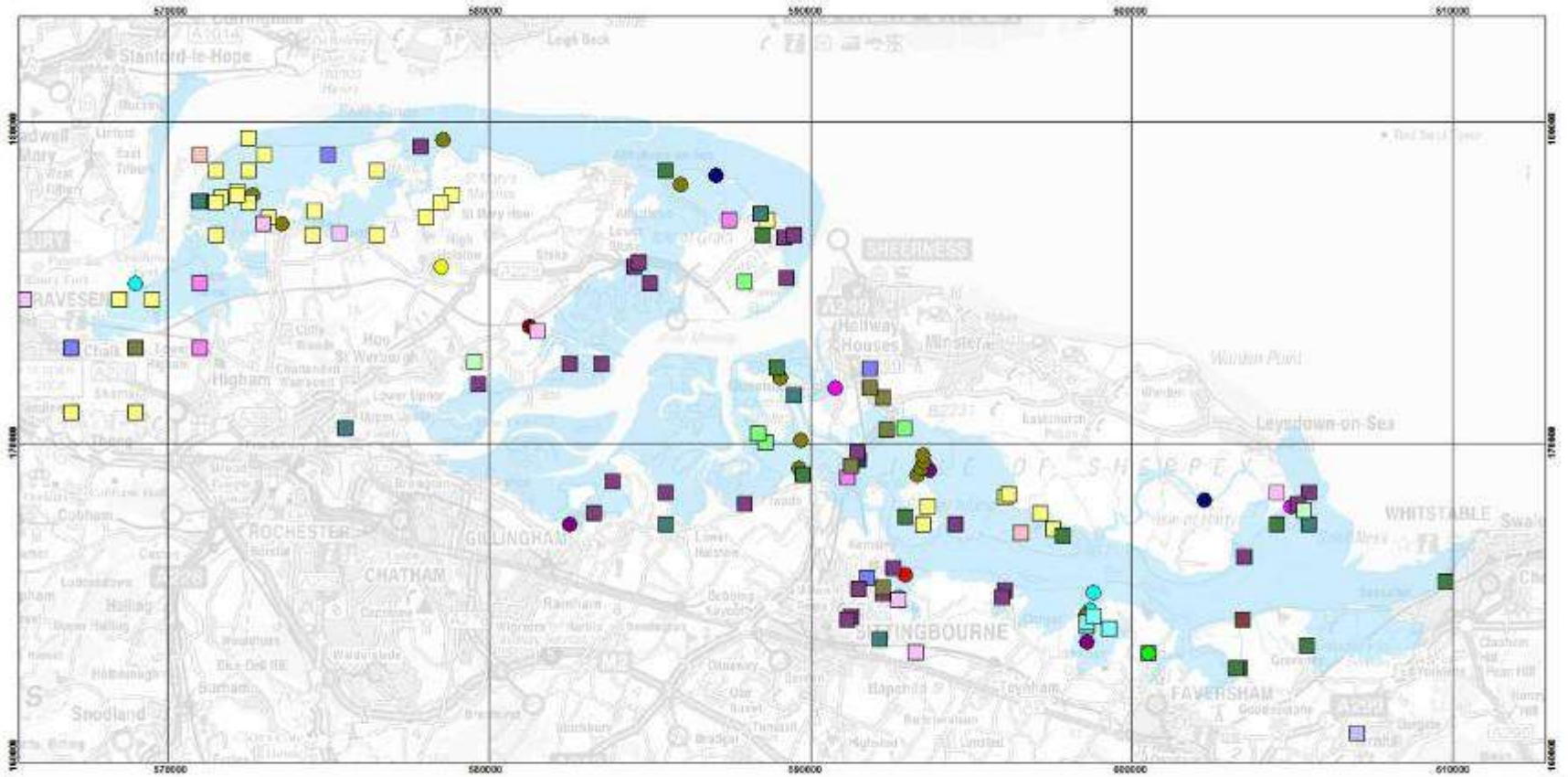
Map 28: RAMSAR interest features within or near the RAMSAR sites: Invertebrates

North Kent Baseline Data Collection and Analysis

23 February 2010

Scale 1:176100

footprint ECOLOGY



Invertebrates (number of records)

Anisodactylus poecilioid	(1)	Cercyon bifenestratus	(1)	Hydrophilus piceus	(12)	Myopites eximius	(35)
Atylotus latistriatus	(2)	Dicranomyia danica	(5)	Lejops vittata	(7)	Ochthebius exaratus	(7)
Bagous cylindrus	(2)	Elachiptera rufifrons	(5)	Lestes dryas	(40)	Philanthus triangulum	(10)
Baris scolopacea	(4)	Erioptera bivittata	(12)	Limnophila pictipennis	(4)	Philonthus punctus	(2)
Baryphyma duffeyi	(1)	Haematopota bigoti	(2)	Malachius vulneratus	(5)	Poecilobothrus ducalis	(2)
Campsicnemus magius	(7)	Henestaris halophilus	(1)	Malacosoma castrensis	(19)	Polistichus connexus	(1)
Cephalops perspicuus	(1)	Hybomitra expollicata	(6)	Myopites eximia	(2)	Stratiomys longicornis	(8)

Map 29: RAMSAR interest features within or near the RAMSAR sites: Plants

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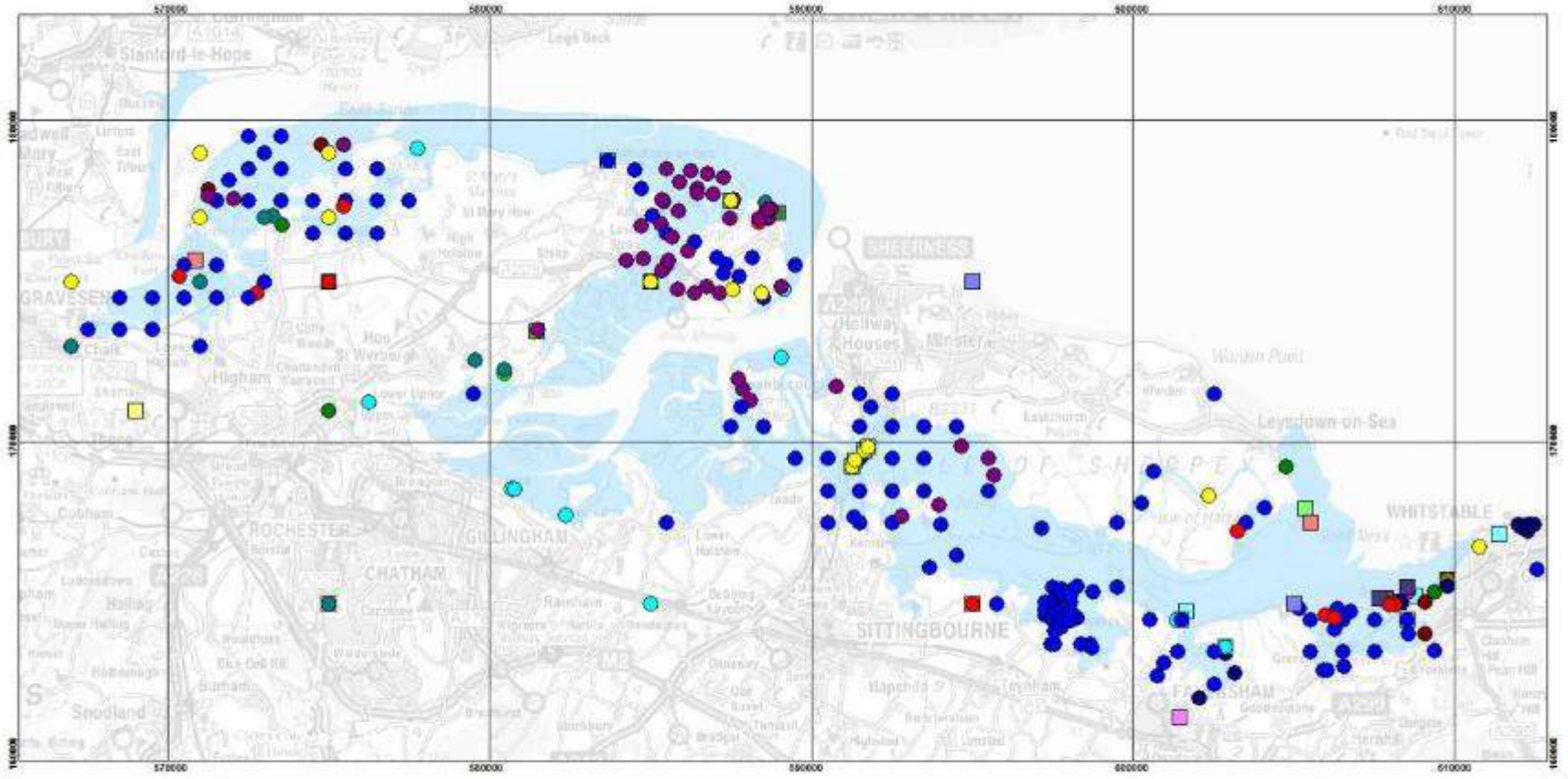
footprint ECOLOGY



Plants (number of records)

Alopecurus bulbosus	(15)	Parapholis incurva	(14)	Spartina maritima	(6)
Bupleurum tenuissimum	(22)	Peucedanum officinale	(17)	Spartina x townsendii	(1)
Carex divisa	(189)	Polypogon monspeliensis	(58)	Trifolium glomeratum	(2)
Chenopodium chenopodioid	(16)	Puccinellia fasciculata	(14)	Trifolium squamosum	(15)
Hordeum marinum	(24)	Puccinellia rupestris	(15)	Zostera angustifolia	(4)
Inula crithmoides	(18)	Salicornia pusilla	(5)	Zostera marina	(4)
Lactuca saligna	(8)	Sarcocornia perennis	(14)	Zostera noltii	(5)

Map 30: SSSI condition assessments, indicating issues

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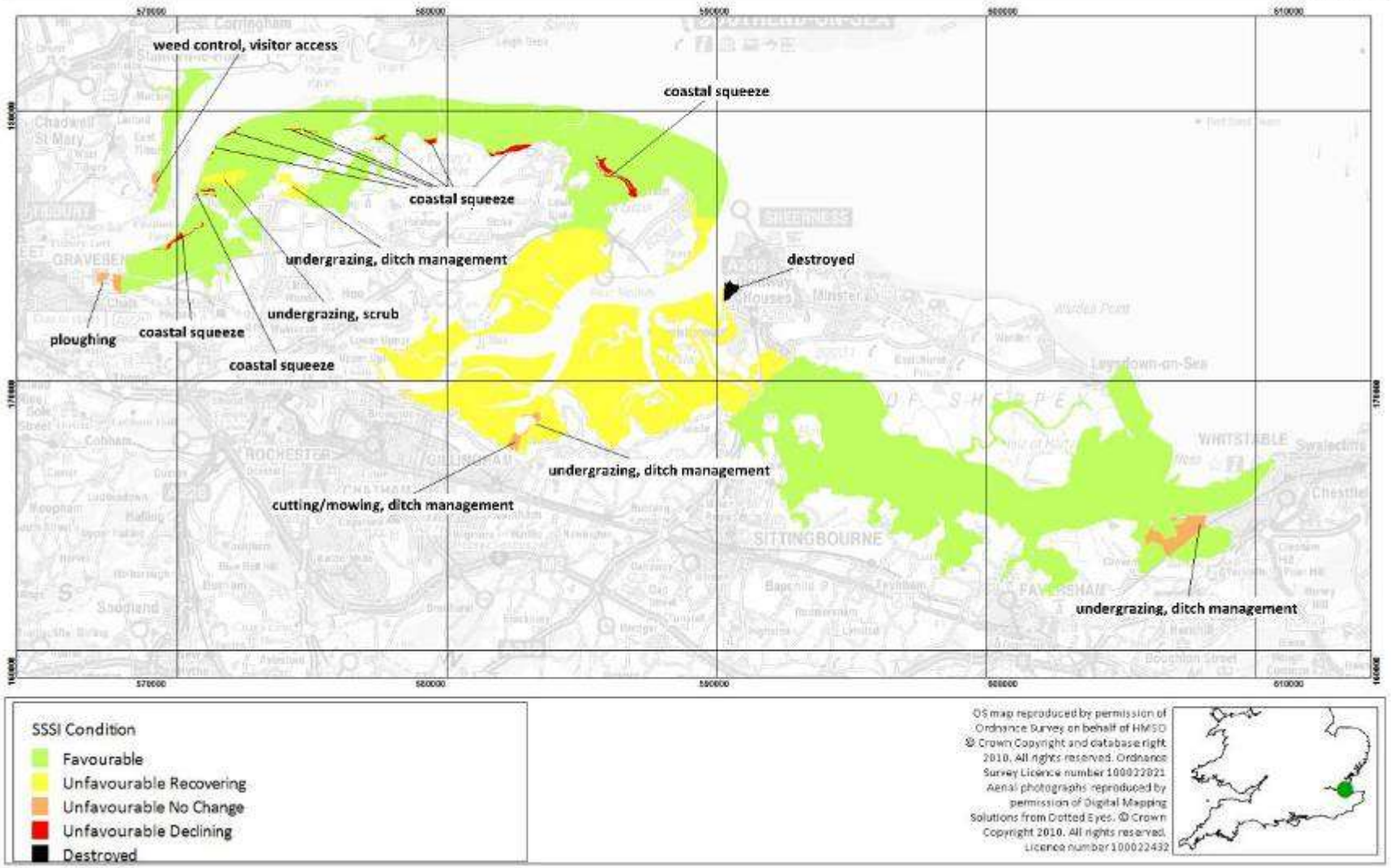
footprint ECOLOGY



Map 31: Housing around the SPA and Ramsar sites

North Kent Baseline Data Collection and Analysis

1 March 2010

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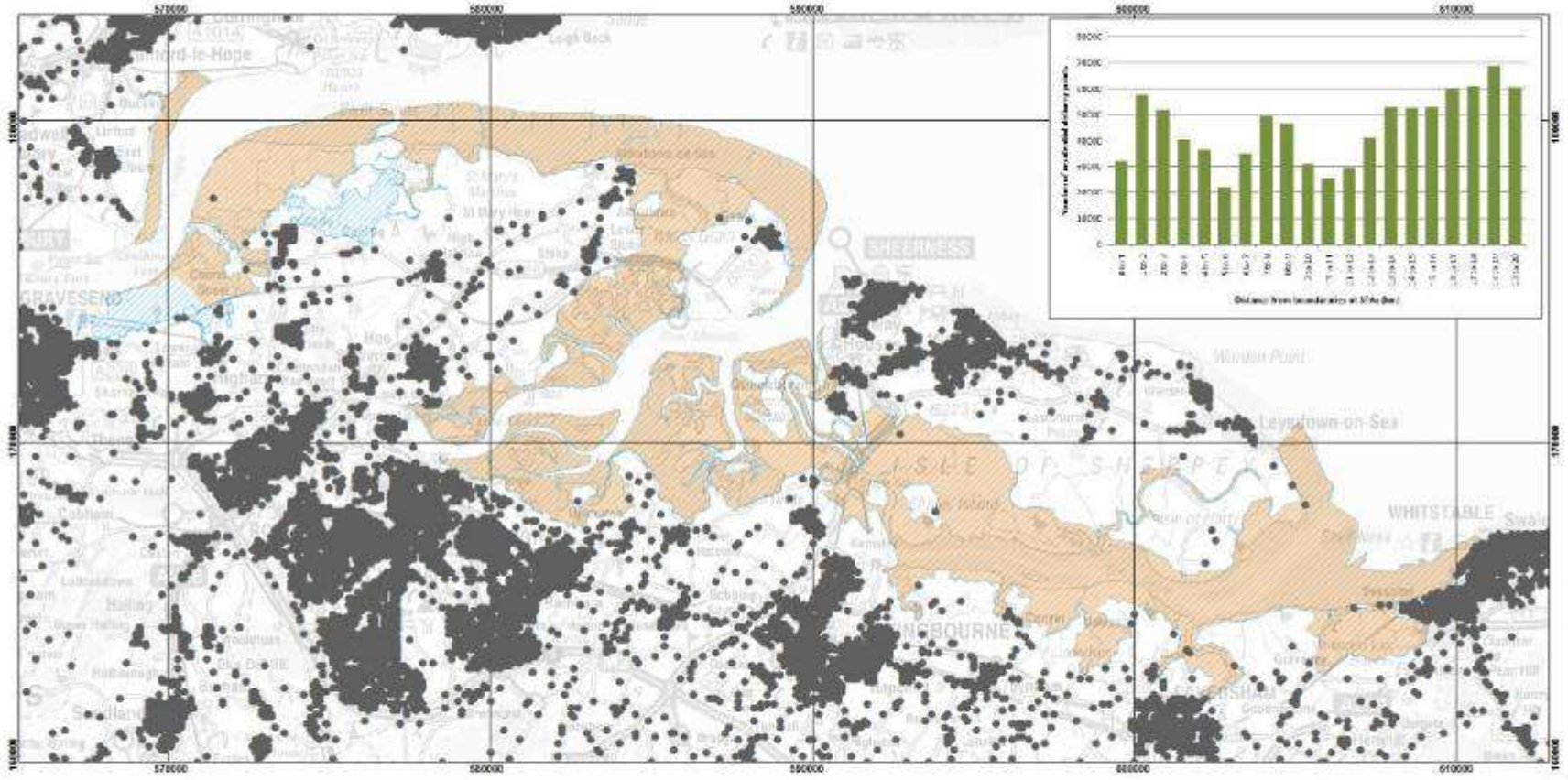
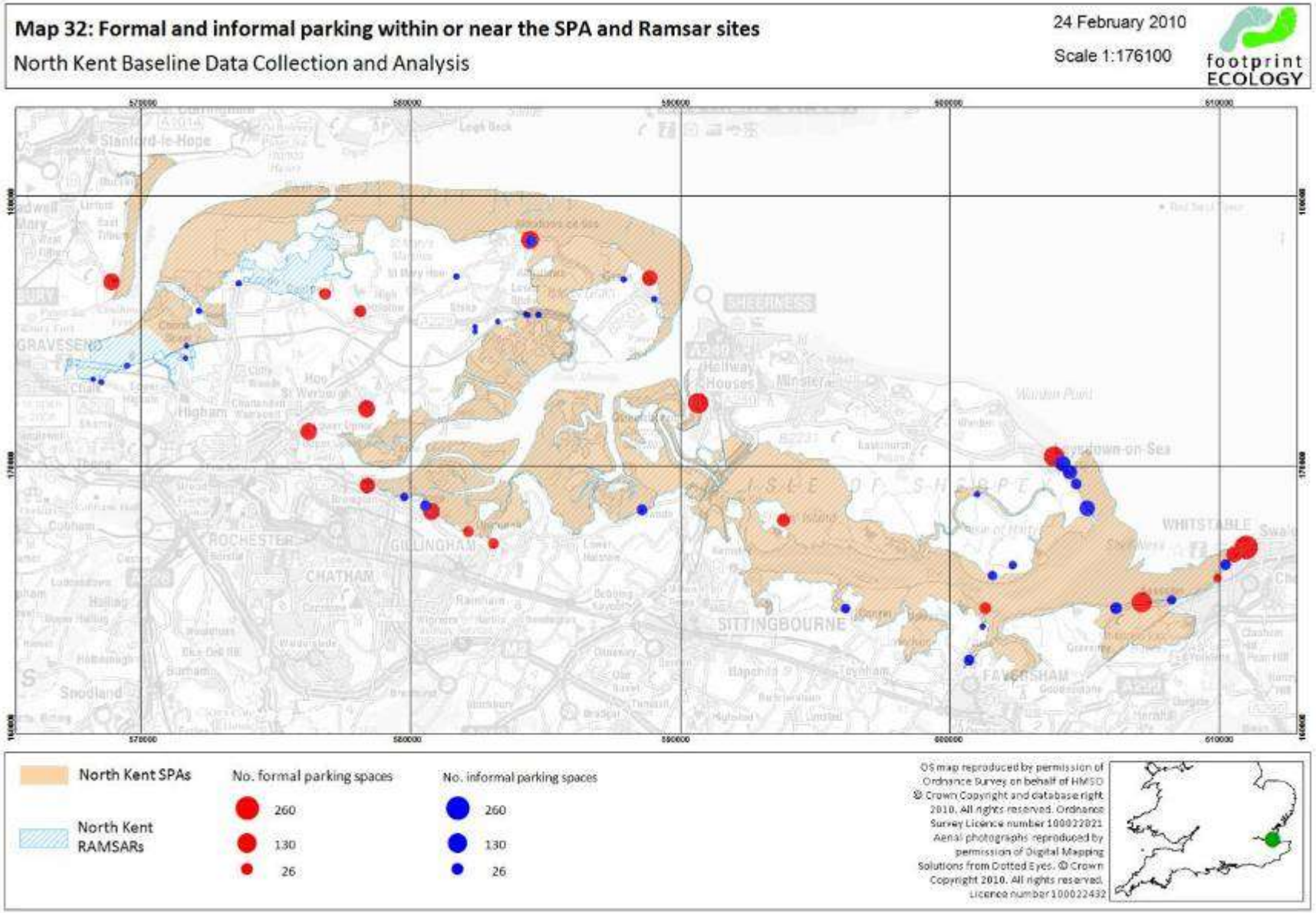
footprint ECOLOGY



North Kent SPAs

North Kent RAMSARs

Residential postcode


Map 32: Formal and informal parking within or near the SPA and Ramsar sites
North Kent Baseline Data Collection and Analysis
24 February 2010
Scale 1:176100
footprint ECOLOGY
North Kent SPAs
North Kent RAMSARs
No. formal parking spaces
260
130
26
No. informal parking spaces
260
130
26
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Map 33: Public rights of way within or near the SPA and Ramsar sites

North Kent Baseline Data Collection and Analysis

1 March 2010

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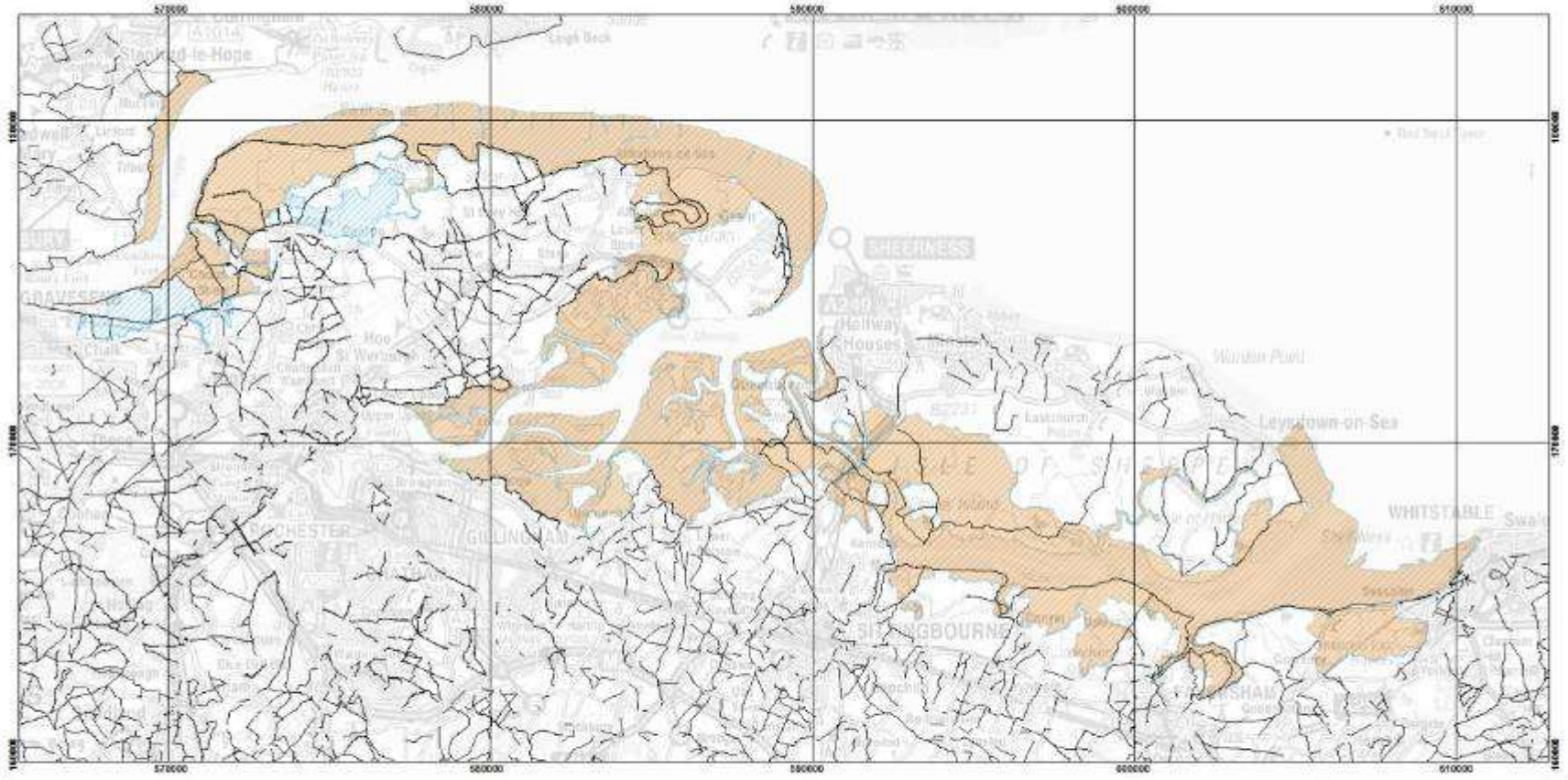
footprint ECOLOGY



North Kent SPAs

North Kent RAMSARs

Public rights of way

Map 34: Other access infrastructure: holiday parks and beach huts

North Kent Baseline Data Collection and Analysis

24 February 2010

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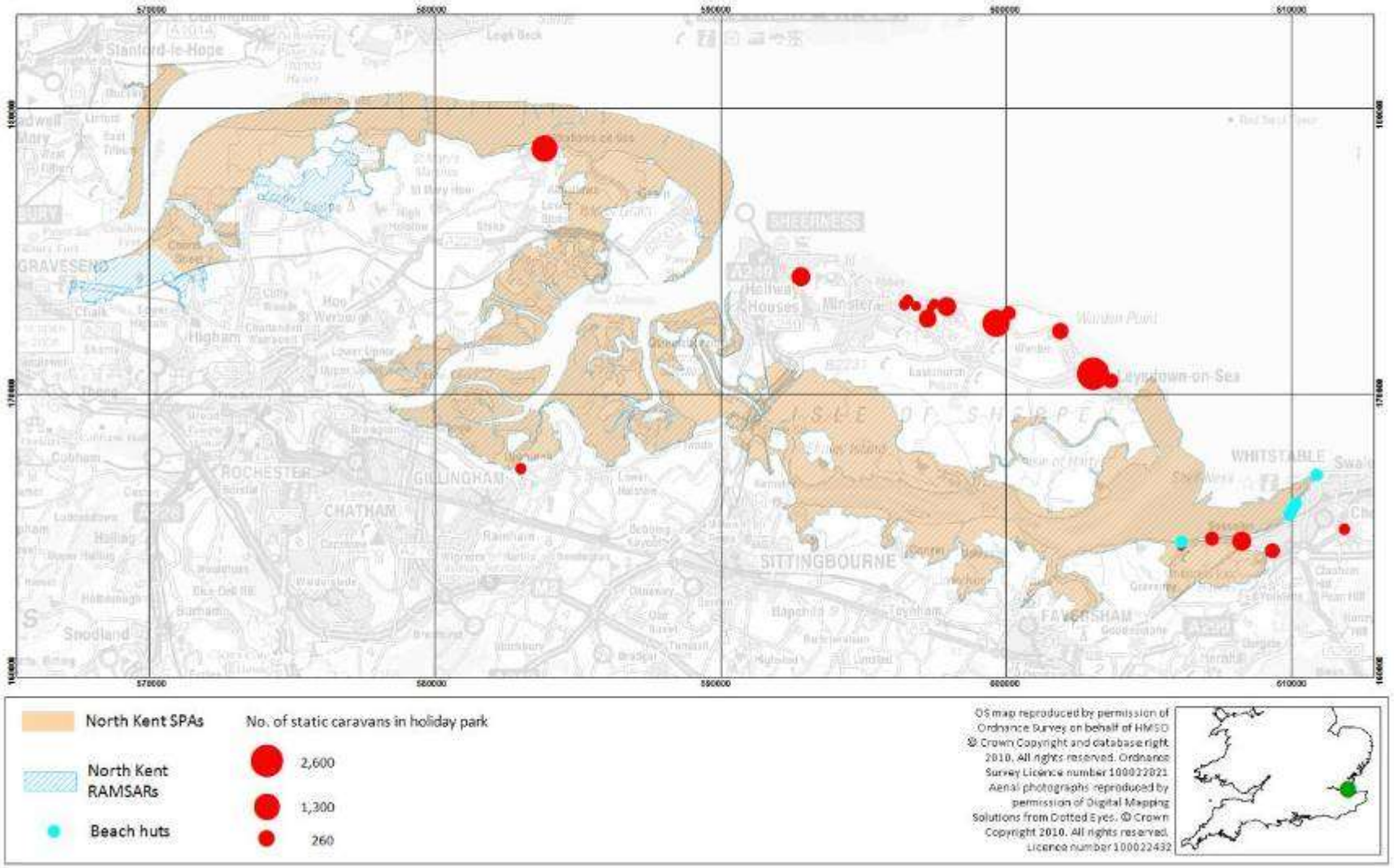
footprint ECOLOGY



North Kent SPAs

North Kent RAMSARs

Beach huts

No. of static caravans in holiday park

2,600

1,300

260

Map 35: Recreational sailing infrastructure and levels of use

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24 February 2010

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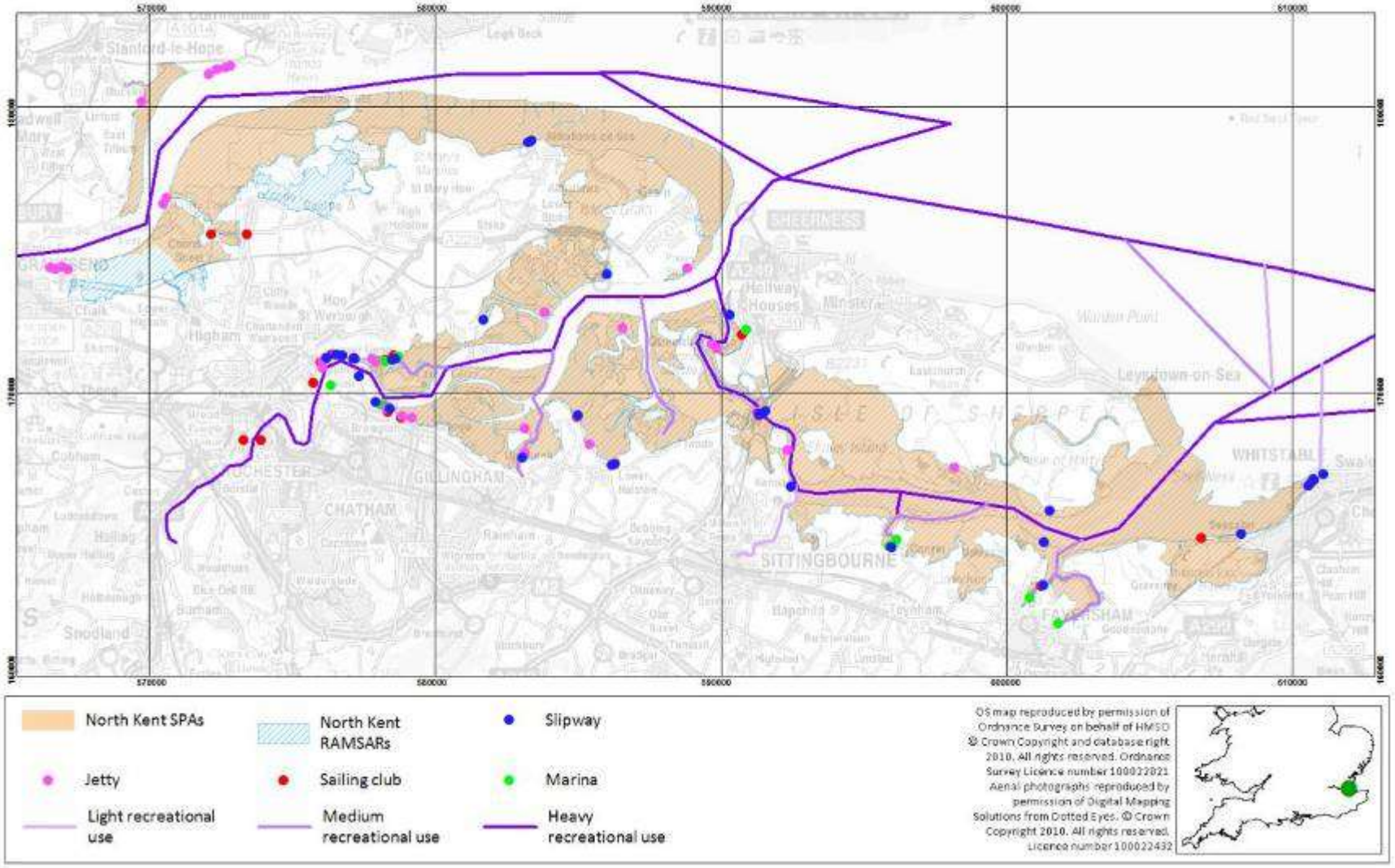
footprint ECOLOGY



North Kent SPAs

North Kent RAMSARs

Slipway

Jetty

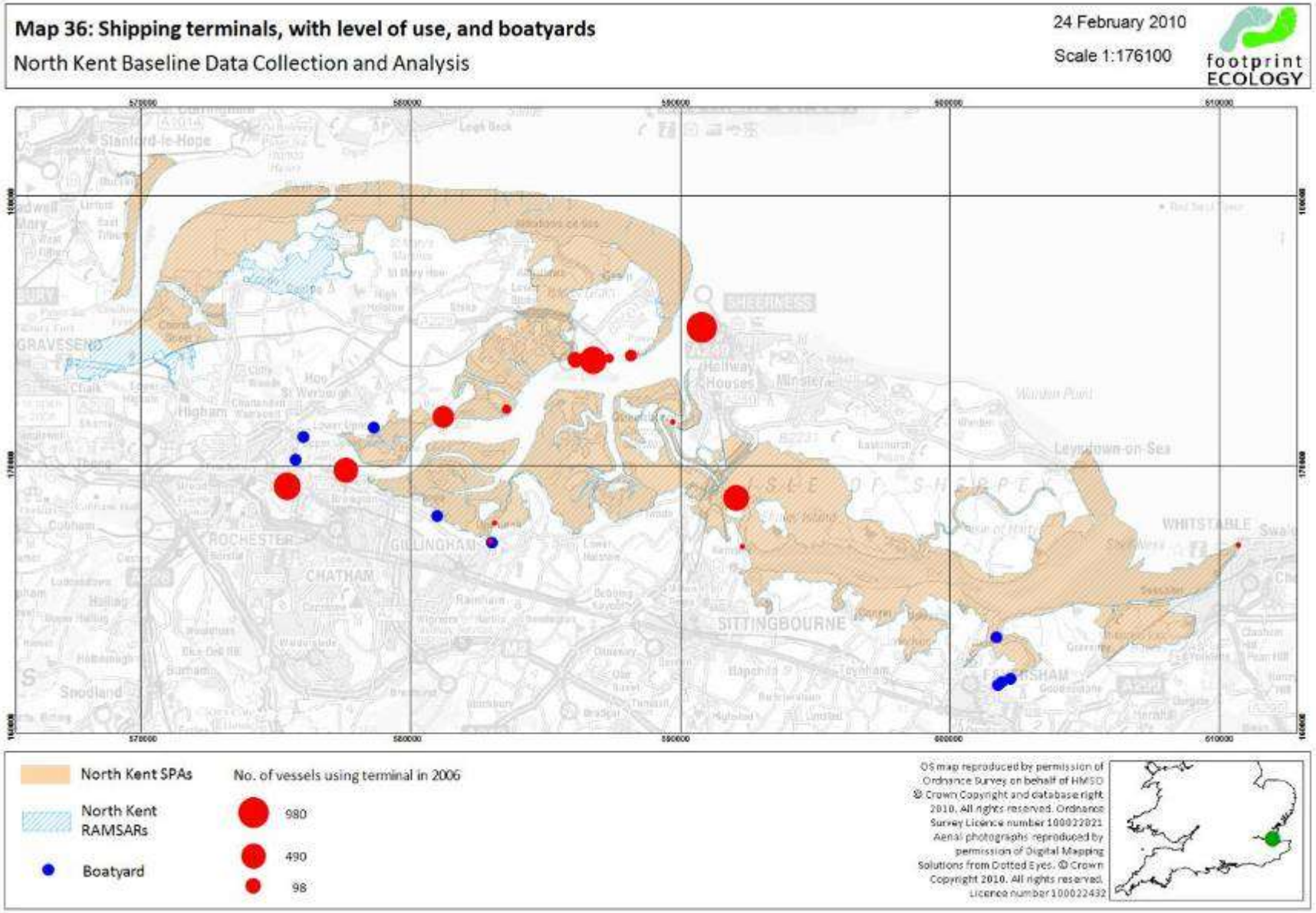
Sailing club

Marina

Light recreational use

Medium recreational use

Heavy recreational use


Map 36: Shipping terminals, with level of use, and boatyards
North Kent Baseline Data Collection and Analysis
24 February 2010
Scale 1:176100
footprint ECOLOGY
Stanford-le-Hope
GRAVESEND
Higham
ROCHESTER
CHATHAM
GILLINGHAM
SHEERNESS
Halfway Houses
Minster
Leysdown-on-Sea
WHITSTABLE
SITTINGBOURNE
Faversham
Snodland
North Kent SPAs
North Kent RAMSARs
Boatyard
No. of vessels using terminal in 2006
980
490
98
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Map 37: Industry

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24 February 2010

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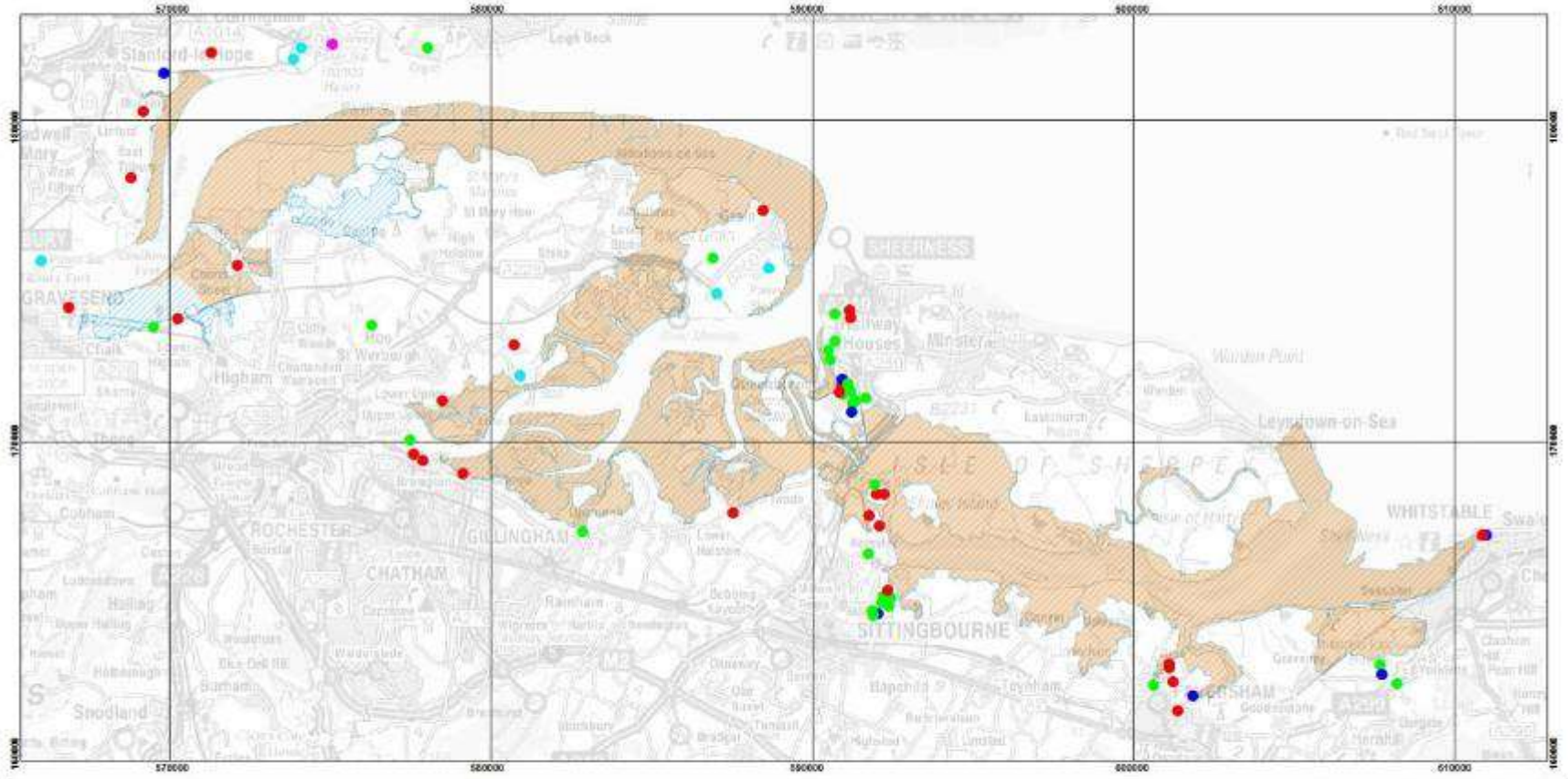
footprint ECOLOGY



North Kent SPAs

North Kent RAMSARs

Type of industry

- Factory/Depot (27)
- Industrial Estate (7)
- Oil Refinery (1)
- Power station (6)
- Works (27)