ESTUARINE WATERBIRDS AT LOW TIDE

The WeBS Low Tide Counts 1992–93 to 1998–99

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ABBREVIATIONS USED IN THE BOOK

- **ASSI** Area of Special Scientific Interest (Northern Ireland only)
- **BoEE** Birds of Estuaries Enquiry
- **BTO** British Trust for Ornithology
- **CCW** Countryside Council for Wales
- **CRoW** Countryside and Rights of Way Act 2000
- **EHS** Environment and Heritage Service of Northern Ireland
- **EN** English Nature
- **GIS** Geographical Information System
- **JNCC** Joint Nature Conservation Committee
- **LTC(s)** WeBS Low Tide Count(s)
- **RSPB** Royal Society for the Protection of Birds
- **SNH** Scottish Natural Heritage
- **SSSI** Site of Special Scientific Interest
- **SPA** Special Protection Area
- **WeBS** Wetland Bird Survey
- **WWT** The Wildfowl and Wetlands Trust

1 Introduction

Andy Musgrove and Niall Burton

***Estuarine Waterbirds at Low Tide* is a summary of the results achieved from the first seven winters of the WeBS Low Tide Counts (1992–93 to 1998–99). The book first sets out the methods used to carry out the scheme. It then summarises the results of the counts, first on a site-by-site basis and then species-by-species. Issues of data interpretation are then addressed, along with the potential uses of the data. It is hoped that the book will be of interest and of use to those people involved in the conservation of estuarine wildlife, to those counters involved in estuarine bird monitoring and all naturalists who appreciate the value of estuaries, one of the UK's greatest natural resources.**

The wetlands of the UK are vitally important for millions of migrant waterbirds which either spend the winter here or use the UK as a staging post on the way to and from wintering grounds further south. The numbers of birds involved have considerable international significance (Kershaw & Cranswick 2003, Rehfisch *et al* 2003, Stroud *et al.* 2001). Some of these birds breed in the UK, especially in upland regions. However, the majority spend the summer months in Arctic and sub-Arctic regions from north-east Canada, through Greenland, Iceland, Svalbard, Fennoscandia and along the northern coasts of Russia. Large numbers also come from north-eastern Europe (Wernham *et al.* 2002). These areas, although teeming with food in the summer months, are too cold in the winter to support large numbers of birds which thus have to migrate to areas with warmer climates. Such a journey can be energetically costly, often involving long sea-crossings (Gudmundsson *et al.* 1991, Gudmundsson and Lindstrom 1992, Alerstam *et al.* 1992). Since the UK is warmed by the Gulf Stream, its climate is abnormally mild for such a northerly latitude. As a result, waterbirds are better able to find food and are less likely to suffer cold-induced mortality than would be the case otherwise. Therefore, the distance required for their migration is minimised.

There are many different types of habitats in the UK that could be classified as wetlands, including the open ocean, rocky coastlines, lakes, reservoirs, rivers, ditches, marshes, sewage farms and even garden ponds. All of these habitats support non-breeding waterbirds. However, in terms of the sheer numbers of birds supported, the UK's estuaries are clearly the outstanding sites. Much of the following background information concerning estuaries is based on the standard work on estuary birds by Prater (1981), unless otherwise referenced.

ESTUARINE HABITATS

An estuary can be defined as 'a partially enclosed area at least partly composed of soft tidal shores, open to saline water from the sea, and receiving freshwater from rivers, land run-off or seepage' (NERC 1975, Davidson and Buck 1997). Many estuaries are clearly recognisable as such, but problems of delimitation occur in two ways. Firstly, the upstream and downstream limits of an estuary are not clear-cut, which is inevitable since an estuary is a transitional zone between river and sea. Secondly, one estuary can merge into another (as different rivers reach the sea in close proximity) and the definition of an individual site can be problematic as a result. Therefore, site definition can be subjective to a degree and different sites are treated on a case-by-case basis within this book with such issues discussed as appropriate.

There is a great deal of variety in estuaries, both between and within sites. Important factors include the rate of flow of the freshwater input, the degree of exposure to the marine environment, the tidal range, the gradient of the surrounding land and the local geology. The intertidal flats can be formed from sediments brought in from the sea and/or inland sediments transported downstream by rivers. The nature of the flats depends upon the size of the individual particles present, which in itself is dependent upon the amount of energy in the water at any given place within an estuary. At the mouth of an estuary, the relatively high energy as a result of wave action means that only the large, heavier particles can settle out, leading to sandier sediments or even shingle. Finer sediments are deposited only in less exposed areas, usually in the sheltered inner estuary, thus forming mudflats. Conversely, sediment borne downstream by a river will settle out at a rate determined by the speed of flow of the water, with coarser sediments deposited first and finer sediments later as the speed of flow decreases.

Marine and riverine habitats support very different, often specialised, organisms. The major factor leading to this difference is salinity, which is the amount of inorganic material dissolved in the water expressed as parts per thousand (‰). In the sea, mean salinity is about 35‰, but in rivers it is generally less than 0.5‰. Few riverine animals can tolerate salinity levels higher than 5‰ whereas few marine animals can survive salinity less than 10‰. Therefore, there is a zone within estuaries which is inhospitable to most animal life, not only due to the absolute value of the salinity level but also due to its variability with each tide.

Although familiar enough to people in the UK, in international terms estuaries are a relatively scarce habitat. The UK is fortunate in having an estuarine resource which is large and varied, particularly in comparison with much of the rest of Europe (the main exceptions being parts of the French coast and the Wadden Sea, the huge intertidal zone on the North Sea shores of the Netherlands, Germany and Denmark).

ESTUARINE WILDLIFE

Although the diversity of species present within estuaries is relatively low, the total biomass of organisms present is extremely high. In most terrestrial ecosystems, the food-webs present are based upon the photosynthesis carried out by plants in that particular area. However, the intertidal zones of estuaries support little plant life, due largely to the physiological difficulties in coping with high and variable levels of salinity, but also due to the turbidity of the water and to the lack of suitable anchorage points in the sediments. Instead, the majority of production within an estuary is based upon the massive importation of nutrients into the system from the rivers and the sea.

Within the intertidal zone of UK estuaries, the principal plants able to survive are the eel-grasses *Zostera* and algae of the genus *Enteromorpha*. These species can form an important food-source for certain species of wildfowl. In rockier areas, seaweeds such as the brown wracks (*e.g. Fucus* spp.) may be present. Although the latter do not form a food resource in themselves, they provide shelter for numerous invertebrates which are preyed upon by waterbirds. Higher up the shore, a distinctive saltmarsh community of plants occurs, different species being found at different heights above mean high water, depending upon the frequency of inundation by salt water. Saltmarshes are important for certain estuarine waterbirds for both feeding and roosting, with the upper parts of the marsh also being used for nesting by some species, notably Redshank. At places around many UK estuaries, sand-dunes have formed and also support a distinctive vegetation, as do shingle structures at some sites.

The invertebrate species that have evolved to tolerate estuarine conditions are relatively few but can be exceedingly abundant in numbers. Some of these species are very important as a food resource for waterbirds, especially waders and, most notably amongst the wildfowl, Shelduck. Some of the most important prey items are the polychaete worms *Arenicola marina* (lugworm) and *Nereis diversicolor* (ragworm), the crustacean *Corophium volutator* and the molluscs *Mytilus edulis* (common mussel), *Cerastoderma edule* (common cockle), *Hydrobia ulvae*, *Scrobicularia plana* and *Macoma balthica*. Some wader species are generalists, taking a wide variety of prey species, whilst others are highly specialised, concentrating mainly on just one or two species. For example, Oystercatchers prefer mussels and cockles. Moreover, many species specialise as much by foraging method as by food species. Fish form another major group of animals frequenting estuaries and species such as Flounder *Platichthys flesus* may act as competitors with waterbirds for many of the smaller prey items (Furness *et al.* 1986, Raffaelli and Milne 1987). Fish themselves are taken as food by certain estuarine waterbirds, with particular specialist fish-eaters being grebes, herons, cormorants, sawbill ducks (*Mergus* spp.) and Kingfisher.

Large numbers of waterbirds come to UK estuaries in the winter because the climate is relatively mild, because there is a large resource of estuarine habitat and because this habitat supports abundant food. The species involved are discussed in detail within this book. Food intake rates can vary depending upon a number of factors. Cold weather leads to higher energy requirements from the birds and can also cause a reduction in activity and availability of invertebrate prey (Zwarts and Wanink 1993). Although most waterbirds can cope with short periods of cold weather, longer periods can be more serious, particularly towards the end of a winter (Clark *et al* 1993, Dugan *et al.* 1981, Davidson 1982, Davidson and Evans 1982).

Windy weather can have a similar effect, chilling birds and drying out intertidal habitats, thus affecting feeding success (Dugan *et al.* 1981, Pienkowski 1983, Wiersma and Piersma 1994). The short day length in mid-winter, particularly in the north of the UK, can have an effect on those species which hunt by sight, although many species will also feed by night if necessary, albeit sometimes with reduced efficiency. For many species, a high density of birds can lead to interference and aggression between individuals, with dominant birds expelling others from favoured feeding areas (Goss-Custard 1980, Ens and Goss-Custard 1984, Cresswell 1994). Feeding efficiency is also age-related, with younger birds being less efficient at finding food (Groves 1978, Goss-Custard 1980). As well as maintaining body condition during the winter, large fat reserves need to be built up in the spring and autumn as migratory fuel (Metcalfe and Furness 1984). However, at all times there is a conflict between a bird having enough energy for survival (Pienkowski *et al.* 1979, Johnson 1985, Norman and Coffey 1994) and yet not so much additional body mass so as to unduly slow the bird down when escaping from a predator (Cresswell 1999).

HUMAN INFLUENCES ON ESTUARIES

Estuaries have always been favoured areas for human activities, many of which are potentially damaging to waterbirds and their habitats (Davidson *et al.* 1991). Estuaries often have cities associated with them and many support major industrial installations, such as oil refineries, docks and power stations. The level of industrialisation commonly found around estuaries leads to a particular risk of pollution, for example from chemical factories and oil spills (Armitage *et al.* 2000). Use of river channels for shipping often requires dredging for access by larger vessels, which can affect sedimentation patterns within an estuary. Around many estuaries, saltmarshes and intertidal flats have been claimed for agricultural land or for the building of industrial sites. Elsewhere, estuarine habitat has been used for refuse disposal. Over the last few decades, a number of schemes have been proposed for impounding estuaries to create freshwater reservoirs (a scheme on the Wash progressed as far as building trial bunds) or for tidal power generation. To date, none of these schemes have gone ahead, although Cardiff Bay on the Severn Estuary was dammed in 1999, to attract financial investment into Cardiff by a perceived improvement in its appearance and amenity value (Burton *et al.* 2001).

The natural resources present in and around estuaries are also attractive to human exploitation, with fish and shellfish (and even waterbirds themselves in some parts of the world) harvested at many sites. Although these are traditional activities, the potential for over-exploitation, particularly as a result of modern (often mechanised) techniques, is a real problem (Atkinson *et al* 2003, Bell *et al.* 2001). Estuaries are also enjoyed by many people for a variety of leisure pursuits, such as walking, sailing, windsurfing and bird-watching. The effect of such pursuits on birds, through disturbance, is one which is not fully understood but again it has a potential negative impact on estuarine birds (Burton *et al.* 2002a and b, Gill *et al.* 2001, Holloway 1997, Liley 2000). Such casual disturbance increases as people gain more leisure time. Finally, the most significant impact on estuarine habitats over the decades to come is likely to be sea-level rise caused by global warming, which is largely considered to be a result of human activities (Austin & Rehfisch 2003, Austin *et al.* 2001). Most estuaries are surrounded by sea-walls, created as flood defences. If the sea-level rises, but the estuary cannot 'migrate' landwards, the amount of estuarine habitat remaining will be reduced as a result, a phenomenon known as 'coastal squeeze'.

All these factors lead to increasing pressures and potential conflicts between human demands on estuaries and waterbird dependence upon the same areas. In response to the potential threats to the conservation of estuaries, there are a number of key pieces of legislation which the UK has enacted, some effective at a national level and others international in scope. Most of these are based on the identification and designation of sites of importance for nature conservation. The number of different conservation designations on UK estuaries is large and it is beyond the scope of this volume to discuss them all in detail, although some, especially Special Protection Areas (SPAs), will be discussed where relevant throughout the book; a good summary of the different designations is to be found in Davidson and Buck (1997).

MONITORING OF ESTUARINE WATERBIRDS

To determine which sites are of importance for estuarine birds, it is first necessary to gather information on the numbers of individuals of each species using each site. However, in order to place a site's importance into its proper national and international context, the numbers present in the country and the size of the relevant international biogeographical population, respectively, also need to be determined. A site is considered internationally important if it regularly holds at least 1% of the individuals in a population of one species or subspecies of waterbird, or if it regularly supports 20,000 or more individual waterbirds (Ramsar Convention Bureau 1988). Similarly, a site is considered nationally important if it regularly holds 1% or more of the estimated national (British or all-Ireland) population of a species or subspecies of waterbird.

Within the UK, there is a tradition of voluntary monitoring of estuarine birds dating from the late 1960s (and earlier at some sites). For most of the ensuing period, two monitoring schemes were in place. The *Birds of Estuaries Enquiry* (BoEE) was designed specifically to assess bird populations on estuaries and was run by the British Trust for Ornithology (BTO) from the winter of 1969–70 onwards. The longer-running *National Wildfowl Counts* were targeted towards wildfowl at sites throughout the country, including many estuaries; this latter scheme was administered by The Wildfowl and Wetlands Trust (WWT). In the summer of 1993, these two schemes were merged into a combined monitoring scheme, the Wetland Bird Survey (WeBS). WeBS is now jointly administered on a day-to-day basis by the WeBS Secretariat, based at WWT, and BTO. In addition to these two organisations, the scheme is also jointly funded and steered by the Royal Society for the Protection of Birds (RSPB) and the Joint Nature Conservation Committee (JNCC), the latter on behalf of the four statutory country agencies, English Nature (EN), Scottish Natural Heritage (SNH), the Countryside Council for Wales (CCW) and the Environment and Heritage Service in Northern Ireland (EHS).

The WeBS Core Counts, as the combined scheme is more correctly termed, involve monthly co-ordinated counts, mostly by volunteers, made every year at around 2,000 wetland sites of all habitats. Within this framework, there is almost complete coverage of the UK's estuaries during the winter months, an impressive achievement. Most large inland waterbodies are also well surveyed, along with a selection of smaller inland wetlands plus some stretches of non-estuarine coastline. Additionally, an increasing number of counts are now carried out during the summer months, which can be useful in assessing the immature component of several migratory species. The Core Counts have enabled the identification of important sites and, subsequently, this assessment has made possible the designation of such sites for conservation.

The results of the WeBS Core Counts are reported upon annually in *Wildfowl and Wader Counts*, with summaries of important sites for each species as well as evidence of any trends in the numbers of each species, both at the site level or nationally (*e.g.* Pollitt *et al.* 2000, Pollitt *et al* 2003, Musgrove *et al.* 2001a). From the WeBS Core Counts, it is clear that estuaries are extremely important for non-breeding waterbirds. Some species are almost entirely confined to estuaries, such as Brent Goose, Shelduck and many of the waders such as Knot and Bar-tailed Godwit. However, even species with a wider habitat usage, such as Teal, may occur in estuaries in very large numbers. For the five winters between 1994–95 and 1998–99, of the 20 sites (out of about 2,000 monitored by WeBS) holding the highest overall numbers of waterbirds, 17 were estuaries, including all of the top nine (with Loughs Neagh and Beg in Northern Ireland being the most important inland site, in tenth place).

Estuaries differ from the large number of inland sites counted for WeBS due to the influence of the tide. This means that the time of day and, especially, the state of the tide very much influence how the birds will be distributed within a site. In contrast, wildfowl on an inland gravel pit are clearly much less likely to be influenced by the time at which a count is carried out. On the majority of estuaries, the WeBS Core Counts are made at or around high tide. At such times, most estuarine birds gather at high density in relatively localised flocks, usually at traditionally favoured roost sites. Counters can then count the birds in the roost or, if the visibility of the roost is restricted (such as a roost in saltmarsh, for example) can count birds either entering or leaving the roost. Another way in which estuaries differ from inland sites, so far as waterbirds are concerned, is that the higher salinity of estuarine water means that estuaries are far less prone to freezing.

Such counts are often an excellent way to assess the number of birds in a particular area. However, there are a number of drawbacks. Firstly, although in many cases birds will roost close to favoured feeding grounds, it is not always possible to assume that birds roosting at a site are also feeding at the same site. In some cases, particularly along highly disturbed or highly industrialised shorelines, suitable roosting sites may be limited and birds may fly a long distance to a favoured roost (Rehfisch *et al* 1996, Scheiffarth 1996, Symonds *et al* 1984, Tubbs *et al.* 1992, Warnock and Takekawa 1996,). Also, birds feeding in a dispersed fashion along nearby non-estuarine coasts or even inland can make use of roosts within estuaries.

Secondly, even when (as in most cases) birds at estuarine roosts are feeding within the estuary, it is not possible to say anything about where within the estuary they are feeding. Therefore, the effect of a potentially damaging development on part of a site cannot be fully evaluated. Finally, there are some sites where the high tide roosts are either not fully known or not easily observed and here populations may be estimated on the basis of counts made at low tide (*e.g.* Da Prato and da Prato 1979, Moser 1987, Moser and Summers 1987, Bento and Rufino 2001, Dinsmore *et al.* 1998). At large estuarine sites, aerial surveys undertaken at low tide have also been used to estimate population sizes (Dunne *et al.* 1982, Zwarts 1988, Salvig *et al.* 1994, 1997). There may, however, be a level of discrepancy between counts undertaken at high and low tide (Yates and Goss-Custard 1991, Musgrove 1998). This may be for methodological reasons (*e.g.* difficulties in counting birds on distant mudflats at low tide) but it may also be for valid biological reasons (*e.g.* the birds may leave the counted site at high or low tide).

Given that the primary reason for non-breeding waterbirds to be present at an estuary is to feed, understanding their distribution away from the high tide period is of great importance. For this reason, the WeBS Low Tide Counts were initiated in the winter of 1992–93, initially by the BTO and RSPB, but integrated within WeBS the following year. The aim of the survey was to investigate the low tide distribution of estuarine waterbirds within sites, not with the intention of replacing the WeBS Core Counts but to add a further dimension to our understanding of estuaries, given both their dynamic nature and their critical importance to many species. This book describes the methods, results and conclusions from the first seven winters (1992–93 to 1998–99) of the WeBS Low Tide Counts.

2 Methods

Andy Musgrove

SITE SELECTION

The scope of the WeBS Low Tide Counts (LTCs) is estuarine sites throughout the United Kingdom. When the LTCs were originally planned, the aim was to 'systematically census each of the 59 main UK estuaries (defined as those supporting more than 5,000 wintering waders) on a five-year rotational basis using standardised methods'. However, this initial plan was modified in subsequent years, for a number of reasons. The waders-only emphasis was removed and monitoring of all waterbirds (notably including ducks and Brent Geese) was considered equally important. Also, as well as the main sites initially chosen, a number of smaller sites were also covered, due to local enthusiasm by counters or local management plans and/or development pressures on those sites leading to a requirement for data. The five-year rotation was extended to a seven-year cycle, to permit coverage of several sites where there were logistical difficulties in establishing a new counting scheme within the original time allocation and to cover an increased number of sites. Conversely, at a number of sites repeat counts were carried out on the initiative of the local counters, some even instigating LTCs on an annual basis.

It was always recognised that several very large sites (notably the Wash and Morecambe Bay) would be difficult to count. The problem with large estuaries (or rather, wide expanses of intertidal habitat) is that many birds may be present at very great distances, thus reducing an observer's ability to accurately determine the number and identity of birds present on the count section. Safety of counters has to be paramount and so they are discouraged from venturing out on to potentially dangerous intertidal habitats to record more distant birds. Although covering large sites requires the recruitment and co-ordination of large numbers of volunteers, this is not always an insurmountable obstacle. For example, excellent counts of the Moray Firth and Firth of Forth were achieved, both of which are large but relatively linear in shape. The potential of using aerial counts for counting waterbirds on estuaries like the Wash at low tide was examined (Musgrove and Holloway 1997). However, the conclusions were that any attempts to count large estuaries from the air were likely to lead to results which were not comparable with shore-based counts, owing to the possibility of missing a very large proportion of the numbers of some species. The WeBS partners are reviewing how to tackle LTCs of large intertidal areas, including reconsideration of aerial survey techniques.

SPECIES COVERAGE

The principal groups of waterbirds of interest for the LTCs are waders and wildfowl, along with additional species characteristic of wetland habitats such as divers, grebes, cormorants, herons, rails, gulls, terns and Kingfisher. The species involved are discussed individually in the Species Accounts. As well as recording at the species level, separation at subspecific level is requested of counters for Brent Goose and White-fronted Goose. Recording the presence or absence of raptors is also requested, although treated as a category of 'activity/disturbance' (see below) as opposed to a bird count.

Although data collection for all waterbird species is encouraged, recording of gulls and terns is optional at the discretion of the individual counter, as they are not priority species for the survey. This is because the counting and identification of gulls can be very time-consuming and consequently may compromise the quality of counts of the priority LTC species. Numbers of gulls on most estuaries vary more with the time of the day than with the state of the tide and many estuaries support important night-time roosts (Burton *et* *al.* 2002c). Since the LTCs take place between November and February very few terns are recorded.

COUNTERS AND LOCAL ORGANISERS

Most LTCs are carried out by volunteers with a keen interest in and knowledge of their local estuary. Many of these counters also take part in WeBS Core Counts at the same site. Each counter takes responsibility for a number of count sections, depending on the amount of time they can commit to the survey. To enable efficient administration of the survey, a 'local organiser' is selected to co-ordinate the counts at the site level and to provide a single point of contact for the national organiser. At the end of a winter, counters are requested to return their forms to their local organiser who can then check for completeness and for any obvious mistakes before returning them to the national organiser. In some cases, the local organiser is a local professional ornithologist, often a reserve warden, although many local organisers work purely in a voluntary capacity. At some sites, local nature reserve staff are among the counters. This has been especially helpful in situations where special equipment (such as boats) has been required or where public access is generally restricted.

The co-ordinated network of volunteer fieldworkers forms the backbone of UK bird monitoring and is widely envied in other countries. Counters are experienced and skilled local birdwatchers and include many individuals possessing the most in-depth knowledge of the birds using UK estuaries. The LTCs appear to have been a generally popular survey, partly because the local counters could see the obvious value of the counts and partly because the plan was to count each site at low tide only on a periodic basis, thereby time-limiting the substantial commitment required.

SUBDIVISION OF SITES

The LTCs are organised around recognisable sites, which are then subdivided into smaller sections, leading to a two-tier count-unit hierarchy. Given their differing methodologies, a site counted for the Core Counts is not considered an identical entity to the same broad geographical site counted for the LTCs (although, clearly, there is a close relationship between the two). The principal distinction between Core Count and LTC site boundaries is their downshore limit. LTC sites are, by their very nature, precisely defined in terms of intertidal habitat, much of which may not be visible during Core Counts if the latter take place at high tide.

WeBS Core Count site boundaries on estuaries are more likely to incorporate adjacent nontidal habitats, especially where these are important roost sites. Such nontidal habitats are also frequently surveyed during LTCs, especially where the area is used by waterbirds during the low tide period. Additionally, at low tide some estuarine species, such as grebes and diving ducks, are present on the water below the tideline. Counters are encouraged to record these species and to assign such counts to the nearest section.

In general, the subdivision of a site into sections has been determined by local geography, identifiable features (natural and man-made), accessibility, ease of counting and existing Core Count sections, with a broad stipulation that sections should be relatively similar in size to one another. Generally, sections have been selected by the local organiser and counters themselves. A map of the subdivisions is then discussed with the national organiser. It is stressed that the same count sections should be used in subsequent count years. However, in a few cases, the experience gained from the first winter's survey led to the splitting of larger sections into several smaller ones, or *vice versa*, or sometimes to the addition of new count sections. Such details are fully described within the Site Accounts.

COUNT DATES AND TIMES

The LTCs take place during the four months of November to February inclusive and counters are asked to make one visit per month during this period. The mid-winter period was chosen partly because waterbird numbers on estuaries are at their highest then, partly to minimise between-month variation in counts and partly because this is the time of year when feeding constraints are likely to be at their greatest. Although three dates were initially considered to be satisfactory, it was decided that using four would allow for a certain amount of redundancy for missing counts due to factors such as poor weather. Although only one visit per month is requested, some counters do carry out more. In such cases, care is taken to select one count only in an unbiased fashion (*i.e.* without examining the actual numbers of birds counted). In most cases where multiple visits are made to a count section in a particular month, the visit on the date most consistent with the counts on neighbouring sections is taken to be the visit to use for analysis.

Unlike the WeBS Core Counts, no pre-determined count dates are set at a national level but are decided upon by local organisers. Additionally, although simultaneous counts of all sections within a site are preferable, they are not compulsory. The principal reason for this is that the primary purpose of the scheme is to investigate relative distribution, averaged over several dates, and not to determine overall population sizes. Secondly, although weather conditions can affect the ease of carrying out any bird monitoring, conditions of fog, rain or strong winds make the counting of birds on distant mudflats particularly difficult and so the flexibility in count dates makes it possible to make best use of suitable counting conditions. Finally, given that most LTC participants also take part in the WeBS Core Counts which do occur on a pre-determined date each month, it was thought useful to allow a degree of flexibility to encourage a high level of participation.

LTC participants are asked to count during the two hours either side of low tide. There were several reasons for low tide being selected as the counting period. A key objective of the scheme is to record feeding distributions and studies have shown that for many of the specialist estuarine species, a high proportion of birds feed during this period (although this proportion varies between species – see Discussion). Also, since the position of the tideline (and thus the availability of food) is relatively stable during this period, changes in the numbers and distribution of waterbirds are consequently relatively small. Although the tideline varies between neap tides and spring tides, the fact that a mean low water (and high water) mark is shown on Ordnance Survey maps means that a standardised, repeatable measurement of area can be achieved. Finally, it is easiest to assign birds in the field to pre-defined count sections when all the features of the intertidal area are visible.

FIELD METHODS AND THE RECORDING FORM

Counters are provided with pre-prepared count forms (reproduced here as Figure 2.1) on which to record counts of feeding and roosting birds, along with the date, section code and the start and finish times of the count. Additional details on count accuracy, weather, human activities, raptors and disturbance are also requested. The count forms include the basic instructions on how to carry out the survey. Some counters use their forms in the field whereas others record counts in their notebooks and transfer details to the form later.

DATA STORAGE AND VALIDATION

Once the count forms for a site over a winter have been received, they are checked for completeness and any apparent irregularities are discussed with the local organiser. The data from all forms are then input independently by two different people, using a customised inputting form. The two resulting sets of digital data are then checked against one another by computer and any discrepancies are flagged, investigated and resolved. This ensures the virtual elimination of errors in the dataset due to inputting mistakes, since the chances of both people making the same inputting error are very small. Once both sets of data are the same, one set is loaded into the purpose-built LTC database.

Double-inputting, whilst effectively eliminating keyboard errors, cannot pick out other types of error. The most common of these are when a counter records a count against the wrong species (usually that adjacent on the count form to the intended target). Such errors can be easy to spot if, for example, an abnormally high count of an unlikely species occurs (*e.g.* a count of 50 Ringed Plovers mistakenly recorded as 50 Little Ringed Plovers). However, other mistakes in recording can be much less obvious and in some cases are probably undetectable (*e.g.* a count of 20 Mallards mistakenly recorded as 20 Teal). The only chance of discovering such errors is to create tables of summary data and distribution maps of each species on the site (as discussed below) and to return these to the local organiser and counters for checking, which generally identifies any gross errors outstanding. At the end of the process of checking, inputting, validation and loading, the end result is a rigorously-derived definitive dataset.

AREAS AND DENSITIES

Whilst the collection of LTC data is concerned

WeBS

British Trust for Ornithology · The Wildfowl & Wetlands Trust · RSPB · Joint Nature Conservation Committee

LOW TIDE COUNTS

INSTRUCTIONS FOR WeBS LOW TIDE COUNTS RECORDING FORM

This form is for recording numbers of wildfowl and waders on estuaries at low tide as part of the WeBS Low Tide Counts scheme and should not be used for the core WeBS counts. Numbered sections below refer to those on the following pages. **Please use a new form for each count.** If you have more than three mudflats on your section, use more forms. For further guidance on how to sub-divide your section, please refer to the *Additional Instructions* sheet. Please make all counts in the period between two hours before and two hours after low tide.

1 **COUNTER DETAILS:** Please provide all details requested, particularly if you feel we may not have the information already.

2 **SITE DETAILS:** Please enter the name of the estuary and the number of the section you are counting. All counts should relate to the mudflats marked on your master map using the number given to each mudflat. Use recognised nmes and numbers and adhere to the count boundaries while counting.

3 **TIME:** For each mudflat, please enter the approximate start and finish times of the count (e.g. 0900/1300).

4 **BIRD COUNTS:** Please record **all** birds in the "number feeding" column **except those birds that are definitely roosting**. Roosting birds, including wildfowl 'loafing' on the water, should be recorded in the "number roosting" column. All birds should be recorded. If you are not sure which category to choose, use the "number feeding" column.

- Please give an accuracy code for each species to indicate how accurately you felt your count reflected the actual number present:
  - 1 - Count accurate to within 10% of total number present (e.g. every individual counted separately if few present or accurate estimate of size of large flocks).
  - 2 - Count considered to under-represent the total numbers believed to be present (e.g. birds seen at a distance, visibility poor due to weather, significant numbers out of sight in creeks or saltmarsh, etc.).
  - 3 - Order of magnitude only. Try to avoid using this code except for gulls, when counting individuals would be too time consuming, or when visibility is exceptionally bad.
  - 4 - Estimate by deduction. Only to be used as a last resort when the intertidal area is very large and has been divided into 'upper' and 'lower' mudflats (see *Additional Instructions* sheet).
- Movements of birds between mudflats often occur. Please record the birds present on a mudflat **while you are recording it** regardless of whether you suspect they have moved from a mudflat you have already counted. It is the **relative** importance of different parts of the site that is being recorded rather than an accurate count of numbers present on the whole site.
- Write "NC" (No Count) in the appropriate box if a species was present which you were unable to count.
- Write "Nil" in the "Nil birds" row of each group if you looked for those species but none was present. This will allow us to distinguish Nil Returns (no birds present) from No Counts (birds not counted), particularly in the case of gulls and terns since recording these groups is optional.
- Circle counts of Brent or White-fronted Geese if you could not identify the race involved e.g. 80.
- Blank lines are provided to record additional species not listed on the form.

5 **DISTURBANCE:** Please indicate the level of disturbance on each mudflat. These examples may help to assess levels of disturbance: **Low** - birds moving in response to a walker; **Moderate** - birds reacting to an aircraft by temporarily flying up; **High** - birds continually moving around in response to windsurfers. Under *Activity type*, please circle the number corresponding to the type of activity present at the site during the count and also cross those that were affecting the birds. Please record this information for birds of prey in the same way.

6 **WEATHER:** Using the keys provided, please circle the appropriate numbers to indicate rainfall and windstrength, and give an appropriate value for the percentage of your count area covered by ice.

7 **ADDITIONAL INFORMATION:** Please provide any other additional information you feel is relevant. Information leaflets, reports or articles about the site would also be welcome.

SAFETY: Counters should not put themselves in a position which could place them, or others, in danger. The WeBS partners do not take any responsibility or liability for any actions and subsequent consequences from the activities of counters.

Please return completed forms promptly to your local WeBS Low Tide Counts Organiser
Thank you for your help

WeBS Low Tide Counts Organiser, British Trust for Ornithology, The Nunnery, Thetford, Norfolk, IP24 2PU.

MUDFLAT NUMBER:			

5 **DISTURBANCE:** Please complete this section, even if no disturbance occurred at the site.

Please indicate the level of disturbance on each mudflat: 1 None, 2 Low, 3 Moderate, 4 High

Disturbance level	1 2 3 4	1 2 3 4	1 2 3 4

Activity type: Please circle the numbers corresponding to those activities occurring at the site, e.g. ⑦, and cross those affecting the birds, e.g. ⑥

	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6
	7 8 9 10 11 12	7 8 9 10 11 12	7 8 9 10 11 12
	13 14 15 16	13 14 15 16	13 14 15 16

1 Walkers · 2 Dogs · 3 Horse riders · 4 Anglers · 5 Shooters · 6 Bait-diggers · 7 Shellfishers
8 Unpowered boats · 9 Powered boats · 10 Vehicles · 11 Micro-lights · 12 Windsurfers · 13 Jet skis · 14 Aircraft
Others (please specify) 15 · 16

Birds of Prey: Circle species codes for the birds of prey present at the site, indicating which were disturbing waterfowl with a crossed circle

Birds of Prey	MR HH SH	MR HH SH	MR HH SH
	K. ML PE	K. ML PE	K. ML PE
	BZ SE O.	BZ SE O.	BZ SE O.

MR Marsh Harrier · HH Hen Harrier · SH Sparrowhawk · K. Kestrel · ML Merlin · PE Peregrine · BZ Buzzard · SE Short-eared Owl
O. Other species (please specify)

6 **WEATHER:** Please circle appropriate number (refer to key below line)

Wind	1 2 3 4	1 2 3 4	1 2 3 4
	1 None · 2 Light · 3 Moderate · 4 Strong		
Rainfall	1 2 3 4	1 2 3 4	1 2 3 4
	1 None · 2 Light · 3 Moderate · 4 Heavy		
% Ice cover			

7 **ADDITIONAL INFORMATION:** Please continue on a separate sheet if necessary

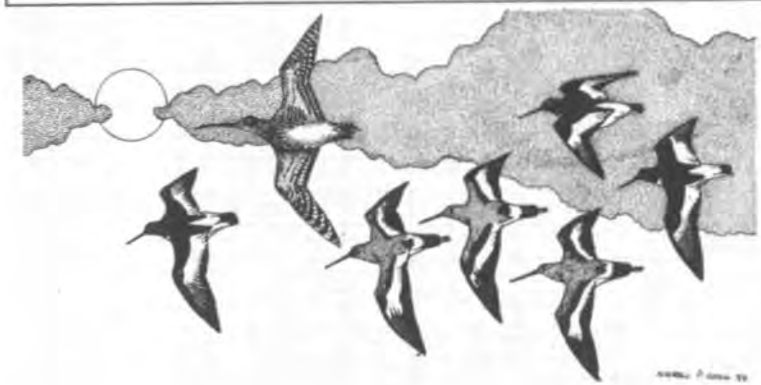
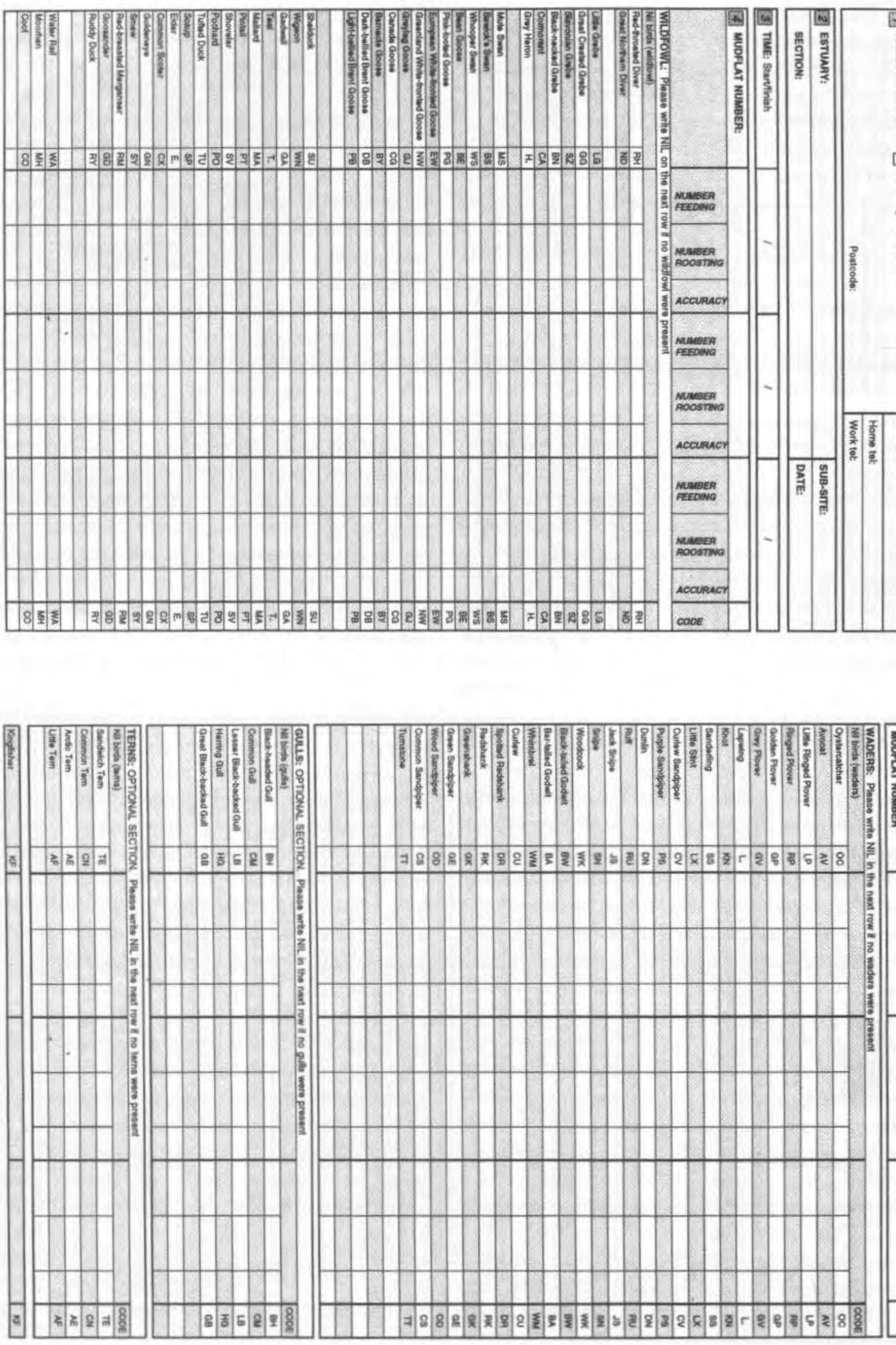


Figure 2.1 (i): WeBS Low Tide Counts recording form (front and back pages)



1 NAME AND ADDRESS - ☐ ✓ if change of address	Office use:
Postcode:	Home tel:
	Work tel:

2 ESTUARY:	SUB-SITE:
SECTION:	DATE:

3 TIME: Start/finish	/	/	/

4 MUDFLAT NUMBER:											
		NUMBER FEEDING	NUMBER ROOSTING	ACCURACY	NUMBER FEEDING	NUMBER ROOSTING	ACCURACY	NUMBER FEEDING	NUMBER ROOSTING	ACCURACY	CODE
WILDFOWL: Please write NIL on the next row if no wildfowl were present											
Nil birds (wildfowl)											
Red-throated Diver	RH										RH
Great Northern Diver	ND										ND
Little Grebe	LG										LG
Great Crested Grebe	GG										GG
Slavonian Grebe	SZ										SZ
Black-necked Grebe	BN										BN
Cormorant	CA										CA
Grey Heron	H.										H.
Mute Swan	MS										MS
Bewick's Swan	BS										BS
Whooper Swan	WS										WS
Bean Goose	BE										BE
Pink-footed Goose	PG										PG
European White-fronted Goose	EW										EW
Greenland White-fronted Goose	NW										NW
Greylag Goose	GJ										GJ
Canada Goose	CG										CG
Barnacle Goose	BY										BY
Dark-bellied Brent Goose	DB										DB
Light-bellied Brent Goose	PB										PB
Shelduck	SU										SU
Wigeon	WN										WN
Gadwall	GA										GA
Teal	T.										T.
Mallard	MA										MA
Pintail	PT										PT
Shoveler	SV										SV
Pochard	PO										PO
Tufted Duck	TU										TU
Scaup	SP										SP
Eider	E.										E.
Common Scoter	CX										CX
Goldeneye	GN										GN
Smew	SY										SY
Red-breasted Merganser	RM										RM
Goosander	GD										GD
Ruddy Duck	RY										RY
Water Rail	WA										WA
Moorhen	MH										MH
Coot	CO										CO

MUDFLAT NUMBER					
WADERS: Please write NIL in the next row if no waders were present					
Nil birds (waders)					CODE
Oystercatcher	OC				OC
Avocet	AV				AV
Little Ringed Plover	LP				LP
Ringed Plover	RP				RP
Golden Plover	GP				GP
Grey Plover	GV				GV
Lapwing	L.				L.
Knot	KN				KN
Sanderling	SS				SS
Little Stint	LX				LX
Curlew Sandpiper	CV				CV
Purple Sandpiper	PS				PS
Dunlin	DN				DN
Ruff	RU				RU
Jack Snipe	JS				JS
Snipe	SN				SN
Woodcock	WK				WK
Black-tailed Godwit	BW				BW
Bar-tailed Godwit	BA				BA
Whimbrel	WM				WM
Curlew	CU				CU
Spotted Redshank	DR				DR
Redshank	RK				RK
Greenshank	GK				GK
Green Sandpiper	GE				GE
Wood Sandpiper	OD				OD
Common Sandpiper	CS				CS
Turnstone	TT				TT

GULLS: OPTIONAL SECTION. Please write NIL in the next row if no gulls were present					
Nil birds (gulls)					CODE
Black-headed Gull	BH				BH
Common Gull	CM				CM
Lesser Black-backed Gull	LB				LB
Herring Gull	HG				HG
Great Black-backed Gull	GB				GB

TERNS: OPTIONAL SECTION. Please write NIL in the next row if no terns were present					
Nil birds (terns)					CODE
Sandwich Tern	TE				TE
Common Tern	CN				CN
Arctic Tern	AE				AE
Little Tern	AF				AF

Kingfisher	KF				KF

Figure 2.1 (ii): WeBS Low Tide Counts recording form (inside pages)

with making counts of birds, further presentation and analysis of results is based mostly around bird densities, for the simple reason that count sections are not of equal size. To calculate a density, it is clearly necessary to have an area measurement to divide a count by. Throughout the LTCs, areas are measured in hectares (1 ha = 100 m x 100 m) and consequently densities are given as birds per hectare (b/ha).

To derive the areas of count sections, a map of the site is drawn carefully onto a photocopy of a 1:25,000 map of the area, although for Northern Ireland only maps at the 1:50,000 scale are available. A digitising tablet is then used to transfer the relevant features of each paper map into digital form for incorporation into a Geographical Information System (GIS). One of the many advantages of the use of a GIS for storing and manipulating maps is that the area of each section can be calculated automatically. This is not only far faster than using traditional methods, but is also less prone to error and, importantly, completely repeatable.

For the purposes of determining useful area measurements, each count section is subdivided into up to three zones. The **intertidal** zone is that situated between mean low water and mean high water, the **subtidal** zone is below mean low water (both in creeks and 'offshore') and the **nontidal** zone is found above mean high water – often saltmarsh (so strictly not entirely lacking a tidal influence) but sometimes grazing marshes, higher areas of sandflats, adjacent freshwater reserves, *etc.* It is important to note that these definitions apply only within the context of the LTCs and these terms may (and do) have different meanings elsewhere. Although it is usually straightforward to define the intertidal and nontidal extent of a count section on a map, the subtidal zone being surveyed is less readily delineated. It is taken throughout that the subtidal zone of a count section extends half way across a channel or, where the channel is wide or the section has a more 'open-coast' aspect, the subtidal zone is taken to extend an arbitrary 500m offshore.

The area of each zone of each section is calculated separately by the GIS. To achieve this, the mean low water and mean high water marks around each site are also digitised. It should be noted, however, that on Ordnance Survey maps, whereas mean low water and mean high water are mapped for England and Wales, for Scotland the equivalent lines on the maps represent mean low water springs and mean high water springs. Thus, for the same actual area of intertidal habitat, a larger area will be depicted on a Scottish map than on an English or Welsh one. Unfortunately, there is no straightforward conversion factor, the difference between the two depending upon the gradient of the substrate between the two lines.

Estuaries are mobile systems and although intertidal flats, saltmarshes and channels are often of relatively stable shape between years, at some sites major changes occur. This means that commercially available maps may diverge increasingly from reality over the years. Although a counter can inform the national organiser that, for example, a particular saltmarsh has decreased in extent by 50% compared to that mapped, it is not straightforward to incorporate such information in a systematic fashion. Therefore, the commercial maps have to be taken as a standard, even where divergences are known to occur. This issue is discussed within the Site Accounts for those individual sites most affected. Aerial photographs have been suggested as a way to counteract this problem but in reality these are seldom taken frequently enough to allow a systematic determination of a mean low water mark.

Although the density of birds on a count section is expressed as a count divided by an area, with a basic knowledge of the ecological differences between species it is clear that it is not sensible to use the same area measurement for all species. For example, consider a count section of 100 ha in size, composed half of open mudflat and half of saltmarsh, on which a flock of 100 Knot was present. One might make the assumption that the Knot were evenly distributed over that count section, leading to a density of 1 b/ha. However, a basic knowledge of the feeding habits of Knot would tell us that they are seldom found feeding in saltmarsh and all or the majority would have been present on the mudflat, suggesting that the real density should be 2 b/ha. Throughout this book, densities have been calculated in such a way so as to take into account such species-specific habitat associations.

DISTRIBUTION MAPS

When data can be assigned to well-defined geographical areas, as is the case with the LTCs, the presentation of results in map form has many advantages over a simple tabulation of statistics since it enables an appreciation of the relationship between different count sections. The production of maps depicting bird distribution has been a major theme from the beginning of the LTCs, with GIS technology providing great versatility in the range of presentational options available. After examining the possibilities, 'dot-density' maps were chosen as the preferred means of presentation.

To create a dot-density map, the GIS is instructed to take a number of dots equal to the mean number of individuals of a species present in a count section and to place them randomly within the polygon representing the count section. Although the information presented is actually a **number** of dots, the fact that the number is spread across an area makes it equivalent to a **density**. It is thus immediately apparent to anyone examining the map how the species is distributed across the site at low tide. Since the actual mean numbers are used for the display there is a continuous, not discrete, depiction of densities. The main potential misunderstanding arising from dot-density maps is that there is a tendency to equate the precise position of each dot with the precise position of a bird, whereas no conclusions should actually be drawn at a resolution greater than that of the count section. The higher the number of birds present, the less this is an issue. Ideally, one would distribute dots evenly within a count section, rather than randomly, but this has not been possible to date with the available software.

On some distribution maps, there appear to be artificially sharp boundaries between the dots representing one count section and those representing a neighbouring one. Clearly, these sharp demarcations are a product of the count sections selected and, in many cases, the change from a high density to a low density would be far less marked in reality. However, such marked changes in density may be realistic where there is a distinct change in habitat (such as with an isolated mussel scar, for example). It is thus important to assess maps on a case-by-case basis, with reference to any other available sources of information.

In some cases, slight modifications have to be made. For example, there may be such large numbers of a species (*e.g.* Dunlin) on many count sections that it is not possible to differentiate between densities. In such a case, either the size of the individual dots can be reduced or else the GIS can be instructed to display, for example, one dot for every ten Dunlin.

As with the calculation of densities discussed above, species-specific habitat associations have been applied in production of distribution maps and so, for example, Knot are plotted only on intertidal parts of a count section. Similarly, Great Crested Grebes would be plotted in the subtidal zone. Other species, less specialised in habitat use, have been assigned to more than one zone for mapping purposes (*e.g.* Curlew on both saltmarsh and mudflats).

3 Coverage

Andy Musgrove

SITE COVERAGE

At the end of the seven-year cycle, encompassing the winters from 1992–93 to 1998–99 inclusive, a total of 62 sites had been included in the scheme (Figure 3.1), although it was not possible to achieve full coverage in all cases. These sites were subdivided into almost 2,000 count sections. The coverage achieved at individual sites is detailed in the Site Accounts. JNCC (1993–1997) lists a total of 163 estuaries of varying sizes. A closer examination shows that, as planned, the majority of those sites holding important numbers of wintering waterbirds have been included within the scheme, as shown in Table 3.1. (It should be noted that a small number of sites were defined differently by the JNCC Inventory from the definitions adopted by the WeBS Low Tide Counts, explaining why a total of 65 sites are listed in Table 3.1 as having been covered.)

Table 3.1: Numbers of sites in JNCC (1993–1997) which were covered and not covered by the WeBS Low Tide Counts during the winters 1992–93 to 1998–99, grouped by the numbers of wintering waterbirds per site

No. of waterbirds	Covered by scheme	Not covered by scheme
100,000+	4	2
50,000 - 99,999	10	1
10,000 - 49,999	33	6
5,000 - 9,999	8	11
1,000 - 4,999	7	28
<1,000	3	50
TOTAL	65	98

There were only 20 sites not covered by the scheme during the period under review that regularly support in excess of 5,000 wintering waterbirds. Of those, eight have subsequently been included in the scheme, namely Carmarthen Bay (in part), Dyfi Estuary, Firth of Clyde, Loch Fleet, Dornoch Firth, Cromarty Firth, Alde Complex and Newtown Harbour. At two further sites on Islay (Bridgend Flats and Loch Gruinart) the large numbers of waterbirds comprise largely flocks of Barnacle Geese, which are already well-monitored. The remaining sites of interest are Tyninghame Estuary, the Wash, Maplin Sands (generally considered as part of the Thames within WeBS), Rother Estuary/Rye Harbour, The Fleet/Portland Harbour, Swansea Bay/Tawe Estuary, Morecambe Bay, Rough Firth/Auchencairn Bay, Lough Foyle and Carlingford Lough. Continued efforts will be made in the future to achieve coverage of these sites at low tide.

Coverage problems are posed by the sheer size of the Wash, Morecambe Bay and Maplin Sands, where the width of the intertidal flats is such that not all birds can be accurately identified and counted at low tide by a counter standing on the high water mark. Moreover, there are serious safety implications involved in venturing out onto extensive intertidal flats. A series of surveys of the Wash have been carried out in the past by professional fieldworkers (Goss-Custard *et al.* 1977, 1988) and these provide some useful baseline data. At Morecambe Bay, subsequent to the period under review in this book, the feeding distribution of waterbirds around parts of the site has been investigated by a series of mid-tide counts (roughly three hours after high water), although one problem with this approach is the lack of readily available maps describing the shape of the estuary at this state of the tide.

As well as entire sites that have not yet been covered by the scheme, at some of the sites included it has been possible to carry out only partial surveys to date, as detailed further in the individual Site Accounts. Some of these issues have been addressed in years subsequent to this review but particular areas that need to be included in the future are the outer south Humber

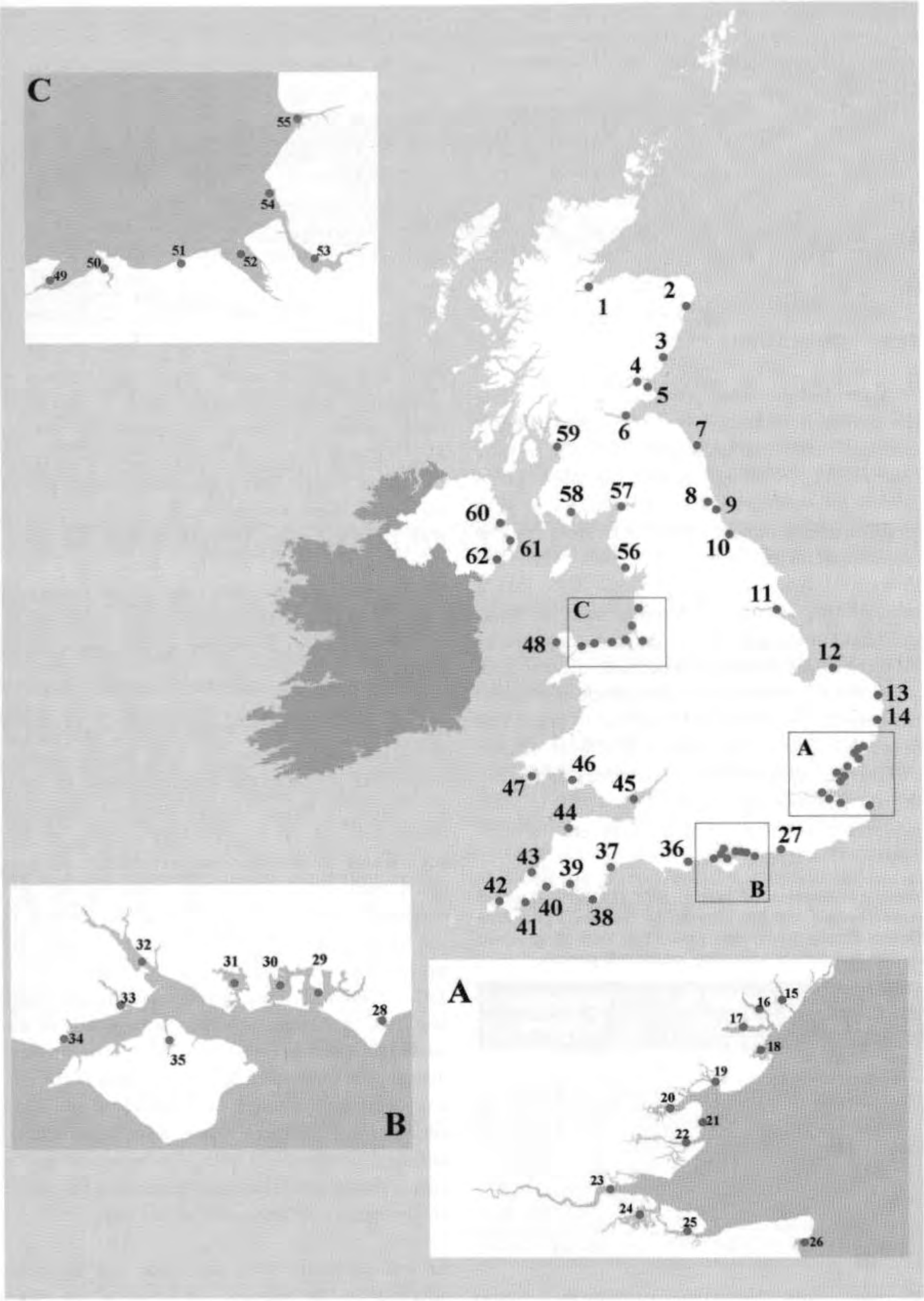


Figure 3.1: ***Estuaries covered by the WeBS Low Tide Counts, 1992–93 to 1998–99***

1 Moray, 2 Ythan, 3 Montrose, 4 Tay, 5 Eden, 6 Forth, 7 Lindisfarne, 8 Tyne, 9 Wear, 10 Tees, 11 Humber, 12 North Norfolk, 13 Breydon, 14 Blyth, 15 Deben, 16 Orwell, 17 Stour, 18 Hamford, 19 Colne, 20 Blackwater, 21 Dengie, 22 Crouch/Roach, 23 Thames, 24 Medway, 25 Swale, 26 Pegwell, 27 Adur, 28 Pagham, 29 Chichester, 30 Langstone, 31 Portsmouth, 32 Southampton, 33 Beaulieu, 34 North-west Solent, 35 Medina, 36 Poole, 37 Exe, 38 Kingsbridge, 39 Tamar, 40 Fowey, 41 Fal, 42 Hayle, 43 Camel, 44 Taw/Torridge, 45 Severn, 46 Burry, 47 Cleddau, 48 Inland Sea, 49 Lavan, 50 Conwy, 51 Clwyd, 52 Dee, 53 Mersey, 54 Alt, 55 Ribble, 56 Duddon, 57 Solway, 58 Wigtown, 59 Irvine/Garnock, 60 Belfast, 61 Strangford, 62 Dundrum

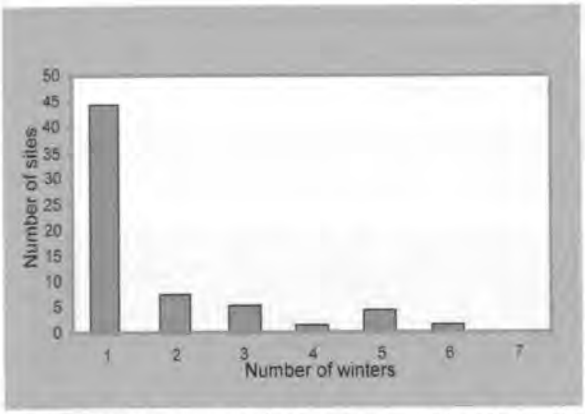


***Figure 3.2:** Frequency of site count repetition during the first seven winters of the WeBS Low Tide Counts*

Estuary, much of Hamford Water, parts of the Thames Estuary, much of Carmarthen Bay and the outermost parts of the Solway Firth.

At most sites covered by the scheme during the period under review, data were collected in only a single season, as originally envisaged for the first cycle, but counts in additional winters were collected at some sites (Figure 3.2).

SPECIES COVERAGE

During the period under review, a total of 96,381 species counts were carried out by volunteers. The Species Accounts set out a summary of the information obtained for each species by the scheme during the period under review. The level of occurrence of different species is summarised in Table 3.2. Table 3.2 (i) lists the most frequently recorded species, by the proportion of visits to count sections (of a total of 11,915 visits) on which the species was recorded (not taking numbers of birds into account). There is a noticeably rapid decline from the ubiquitous Curlew, Redshank and Oystercatcher to more localised species.

Table 3.2 (ii) lists the 30 species most abundantly recorded by the scheme, derived by summing all counts made of each species. The numerical dominance of Dunlin is apparent, well ahead of all other species and representing over a quarter of all birds recorded (out of a total of 8,775,151). However, it is interesting to note how the pre-eminence of Dunlin changes when the numbers are weighted by the biomass of the species (*i.e.* number of birds of a species multiplied by the mass of a single bird of that species), as shown in Table 3.2 (iii), where the importance of the UK's estuaries for Brent Goose is highlighted.

In general, Table 3.2 confirms that there is a general pattern that more abundant species are more widespread. However, certain species are ranked more highly by numbers (column ii) than by ubiquity (column i) and thus tend to display more clumped distributions; notable examples are Wigeon, Eider, Golden Plover, Lapwing and Knot. Conversely, other species are more widespread than would be suggested by a simple consideration of numbers, such as Cormorant, Grey Plover, Curlew and Redshank.

Counters were asked to record all birds in the 'number feeding' column of the count form except those birds that were definitely roosting. The percentages of individuals of each species that were recorded separately as feeding and roosting is given in Table 3.3. It is clear that differences in feeding *vs* roosting proportions tended to occur between different species groups but less so within them. The species found most frequently feeding at low tide were mostly waders, sea-ducks, grebes and divers. Conversely, those species most frequently found roosting at low tide were geese, dabbling ducks and gulls, although exceptions were two waders (Lapwing and Golden Plover) and one sea-duck (Eider). Of course, it may be that some species feed at any state of tide, so no implications about other tidal states should be drawn. The feeding *vs* roosting proportions are discussed as appropriate within the individual species accounts.

TEMPORAL COVERAGE

During the period under review, LTCs took place throughout all available daylight hours, without the emphasis on the morning required for most terrestrial bird surveys. Most estuarine birds have activity rhythms based more around the tide than the time of day. Whilst the timing of LTCs at a site was thus largely dictated by the time at which low tide occurred on a site, local organisers had some leeway in determining the date on which they counted and could thus make allowance for local factors, notably the position of the sun in relation to the observer. In general, there is little reason to suppose that estuarine bird distributions would be affected by the time of day at which they were recorded, over and above the influence of the tide (although at any particular locality spring tides and neap tides tend to occur at a particular time of day). The main reason for a time-related change in distribution probably would be related to human disturbance (see further below) but such issues would be local in nature

***Table 3.2:** The top 30 species recorded by the WeBS Low Tide Counts during the winters 1992–93 to 1998–99, ranked by:*
(i) proportion of section visits on which species was recorded
(ii) proportion of the total count of all individuals referable to a species
(iii) proportion of the total count, weighted by biomass
Note that the five listed species of gulls (*) were counted optionally so the tabulated percentages for those species are always minima. Consequently, for columns (ii) and (iii) the percentages listed for non-gull species are maxima. The values listed for Brent Goose represent the combination of the nominate race and the subspecies hrota.

POSITION	(i) % of visits on which recorded		(ii) % of total numbers recorded		(iii) % of total numbers, weighted by biomass	
	Species	%	Species	%	Species	%
1	Curlew	73.2	Dunlin	28.5	Brent Goose	14.8
2	Redshank	73.0	Lapwing	8.9	Oystercatcher	10.7
3	Oystercatcher	66.4	Oystercatcher	8.5	Shelduck	9.0
4	Dunlin	45.9	Black-headed Gull*	7.1	Wigeon	8.7
5	Shelduck	44.3	Knot	7.0	Herring Gull*	5.6
6	Black-headed Gull*	37.8	Wigeon	4.9	Curlew	5.0
7	Grey Plover	32.7	Golden Plover	4.6	Black-headed Gull*	4.9
8	Herring Gull*	29.9	Brent Goose	4.4	Lapwing	4.8
9	Mallard	28.7	Redshank	4.2	Dunlin	3.6
10	Brent Goose	28.3	Shelduck	3.3	Eider	3.3
11	Lapwing	27.5	Curlew	2.6	Mute Swan	3.3
12	Cormorant	23.1	Teal	2.4	Mallard	3.1
13	Wigeon	22.2	Herring Gull*	2.2	Knot	2.5
14	Turnstone	19.6	Grey Plover	1.7	Golden Plover	2.2
15	Common Gull*	18.7	Bar-tailed Godwit	1.6	Pink-footed Goose	2.1
16	Teal	18.1	Mallard	1.2	Teal	2.0
17	Ringed Plover	17.0	Common Gull*	0.9	Greylag Goose	1.6
18	Great Black-backed Gull*	16.9	Black-tailed Godwit	0.8	Redshank	1.4
19	Bar-tailed Godwit	16.5	Eider	0.6	Commorant	1.3
20	Grey Heron	15.6	Pintail	0.6	Pintail	1.3
21	Red-breasted Merganser	14.4	Turnstone	0.5	Canada Goose	1.2
22	Black-tailed Godwit	12.7	Pink-footed Goose	0.3	Bar-tailed Godwit	1.0
23	Goldeneye	11.8	Ringed Plover	0.3	Common Gull*	1.0
24	Knot	10.6	Great Black-backed Gull*	0.2	Great Black-backed Gull*	0.9
25	Mute Swan	9.9	Cormorant	0.2	Grey Plover	0.8
26	Great Crested Grebe	8.1	Greylag Goose	0.2	Black-tailed Godwit	0.5
27	Golden Plover	8.0	Sanderling	0.2	Great Crested Grebe	0.4
28	Little Grebe	7.5	Goldeneye	0.2	Goldeneye	0.4
29	Pintail	7.0	Great Crested Grebe	0.2	Red-breasted Merganser	0.3
30	Lesser Black-backed Gull*	6.8	Canada Goose	0.1	Lesser Black-backed Gull*	0.3

and not impact upon the overall dataset.

However, one important issue to consider is that many estuarine species also feed at night. In some cases, this may be in order to fulfil any shortfall resulting from inadequate feeding opportunities during the day, but in other cases, nocturnal feeding may be a preferred strategy (Dugan *et al.* 1981, Ward 1991). The degree to which night-feeding occurs depends upon the energetic requirements of an individual bird, the nocturnal activity of prey species (Pienkowski 1981), the amount of light available and the feeding techniques of the species in question (*e.g.* touch-feeders are generally more capable than visual feeders (Pienkowski 1983, Wood 1984)). The ability of the LTCs to predict the likely night-time feeding distribution of birds depends upon the reason as to why the birds are feeding at night. For example, if additional foraging is required due to disturbance of favoured feeding grounds during the day the distribution may differ from that recorded during the day (*e.g.* Burton *et al.* 2001, Burger & Gochfeld 1991). Therefore, it is important to recognise that the LTCs do not necessarily provide information on night-time distributions.

The majority of LTCs during the period under review were carried out during the weekend, especially on Sundays, which could clearly influence the data collected, with most sites likely to experience higher levels of recreational disturbance during the weekend (although industrial disturbance may be lessened). In Scotland, there is no shooting on Sundays and this was a factor influencing the choice of count day at the Moray Firth at least (D. Butterfield pers. comm.). The difference between weekdays and weekends is likely to be analogous to disturbance-related night-time *vs* day-time differences, in that otherwise suitable feeding habitat can become variably available dependent upon the level of disturbance (Burton et al. 2002b, Kershaw 1997). Thus, whilst LTCs give a good indication of the relative importance of parts of an estuary, this will represent the weekend distribution most closely. For a more detailed understanding of the use of a site, counts should be made during both weekdays and weekends.

Within the LTCs, there is no requirement for all sections at a site to be counted on a single date within a month, as this is not necessary for the determination of the relative use of different count

***Table 3.3:** Proportions of individuals of each species recorded separately as feeding and roosting (omitting species with less than 20 individuals observed)*

Species	% feeding	% roosting	Species	% feeding	% roosting
Red-throated Diver	95	5	Water Rail	95	5
Great Northern Diver	97	3	Moorhen	95	5
			Coot	94	6
Little Grebe	99	1			
Great Crested Grebe	95	5	Oystercatcher	90	10
Slavonian Grebe	97	3	Avocet	91	9
Black-necked Grebe	100	0	Ringed Plover	92	8
			Golden Plover	25	75
Cormorant	44	56	Grey Plover	93	7
Shag	60	40	Lapwing	30	70
			Knot	85	15
Little Egret	95	5	Sanderling	98	2
Grey Heron	68	32	Little Stint	99	1
			Purple Sandpiper	98	2
Mute Swan	73	27	Dunlin	98	2
Bewick's Swan	96	4	Ruff	63	37
Whooper Swan	73	27	Jack Snipe	92	8
Pink-footed Goose	8	92	Snipe	85	15
White-fronted Goose	81	19	Black-tailed Godwit	75	25
Greylag Goose	35	65	Bar-tailed Godwit	96	4
Canada Goose	67	33	Whimbrel	77	23
Barnacle Goose	59	41	Curlew	83	17
Brent Goose	82	18	Spotted Redshank	99	1
Shelduck	85	15	Redshank	96	4
Wigeon	42	58	Greenshank	95	5
Gadwall	68	32	Common Sandpiper	88	12
Teal	39	61	Turnstone	99	1
Mallard	56	44			
Pintail	40	60	Mediterranean Gull	77	23
Shoveler	73	27	Black-headed Gull	60	40
Pochard	60	40	Common Gull	52	48
Tufted Duck	73	27	Lesser Black-backed Gull	44	56
Scaup	88	12	Herring Gull	52	48
Eider	42	58	Yellow-legged Gull	48	52
Long-tailed Duck	94	6	Great Black-backed Gull	38	62
Common Scoter	71	29			
Velvet Scoter	94	6	Kingfisher	98	2
Goldeneye	95	5			
Smew	92	8			
Red-breasted Merganser	91	9			
Goosander	88	12			

units. However, two-thirds of monthly counts at a site involved the whole site being counted simultaneously on one or two consecutive dates.

Although counters were encouraged to make four monthly visits to each section over a winter, coverage was not always complete due to a variety of factors, such as weather conditions, illness of counters, access difficulties, *etc.* In most cases, only individual sections were left uncounted in particular months, but sometimes whole sites were uncounted in a particular month. There were 103 site/winter count combinations undertaken and thus a theoretical 412 site-months. In practice, counts were made for 377 of these (92%).

HUMAN ACTIVITIES, RAPTORS AND DISTURBANCE

Counters were asked to specify the types of activities noted on each visit and to indicate whether they considered such activities to be affecting the birds. The occurrence of raptors was treated in an entirely analogous manner. Table 3.4 lists the frequency of recording of each activity and raptor. Additionally, the table indicates the proportion of occasions when each activity or raptor was perceived by the counter to be 'affecting the birds'. The most frequently recorded activities were walkers, dogs and bait-diggers, with the most commonly observed raptors being Kestrel, Peregrine and Sparrowhawk (in descending frequency). Certain activities were more frequently perceived to cause disturbance, notably vehicles, shellfishers, shooters and boats (powered and unpowered). Angling was seldom considered to be affecting the birds. Of the raptors, Marsh Harrier (although only a single observation), Hen Harrier, Merlin and Peregrine were the most disturbing species, with Sparrowhawk somewhat less so. Kestrel was the most frequently recorded raptor but seldom appeared to affect the birds (and neither did Buzzard). To some extent it would appear that the disturbance caused by different raptor species was broadly proportionate to the predation risk posed by each species.

Table 3.4: ***Numbers and proportions of total recorded activities/raptors assignable to each category and the proportion of occasions for each that the activity/raptor was considered by the counter to be affecting the birds***

Activity/Raptor	No of records	% of total records	%'affecting' birds
Walkers	695	28.32	26
Dogs	476	19.40	25
Horse Riders	33	1.34	12
Anglers	129	5.26	8
Shooters	32	1.30	44
Bait diggers	268	10.92	33
Shellfishers	63	2.57	48
Unpowered boats	53	2.16	40
Powered boats	119	4.85	38
Vehicles	36	1.47	67
Microlights	14	0.57	7
Windsurfers	7	0.29	29
Jet skis	1	0.04	0
Aircraft	58	2.36	28
Others	78	3.18	52
Marsh Harrier	1	0.04	100
Hen Harrier	12	0.49	50
Sparrowhawk	85	3.46	24
Buzzard	38	1.55	5
Kestrel	115	4.69	3
Merlin	28	1.14	36
Peregrine	91	3.71	36
Short-eared Owl	10	0.41	0
Unspecified raptor	12	0.49	33
TOTAL	2454	100	Overall = 28%

4 Site Accounts

Andy Musgrove

The following site accounts describe the principal findings from the WeBS Low Tide Counts carried out on 62 estuarine sites between the winters of 1992–93 and 1998–99. The accounts are numbered in accordance with Figure 3.1, *i.e.* clockwise from north-east Scotland to north-west Scotland and then south down the coast of Northern Ireland. The aim of the accounts is to bring to attention the main factors to consider when investigating the conservation status of a part of the estuary concerned. Emphasis is therefore given to the overlap with statutory sites and to species considered to be of key importance. As a great deal of information is presented, it is important that the following interpretative notes are consulted in conjunction with the site accounts themselves.

TABULATED INFORMATION

For each site, the following information is tabulated:

LTC site code. This two-letter code is used internally within the scheme to identify the site and precedes the three digit count section number to produce an official LTC section code (*e.g.* the first section of the Alt Estuary is BA001).

Centre grid. A central grid reference for the site: this is not a mathematically derived central point, simply an approximation for ease of location or plotting.

JNCC estuarine review site. The number(s) of any sites from 'An inventory of UK estuaries' (JNCC 1993–1997) which overlap the LTC site.

Habitat zonation. The total area of the site ever covered by the LTCs during the seven winters under review (1992–93 to 1998–99), subdivided into three broad zones – intertidal, subtidal and nontidal. These three zones are as defined for the purposes of this book in Methods.

Statutory status. The names and codes of any SPAs and/or Ramsar sites overlapping the area covered by the LTCs, even if the degree of overlap is relatively minor. If no SPA or Ramsar sites are present, then any overlapping biological SSSIs (or ASSIs in Northern Ireland) are listed instead. In a few cases, the names and codes of potential SPAs and/or proposed Ramsar sites (*i.e.* pSPA and pRamsar respectively) are also listed.

Winter waterbird interest. The waterbird species listed here are a combination of those wintering species named on any relevant SPA citations (and for any pSPAs) and any additional species recorded in nationally important numbers on the site during the five-year period 1994–95 to 1998–99 (as listed in Pollitt *et al.* 2000). Species are listed in systematic taxonomic order, not in order of importance. SPA citations for a combined 'waterbird assemblage' are also noted here. Due to the current incomplete state of knowledge of their wintering populations, gulls are not included in this list.

SITE DESCRIPTION

This paragraph is intended to give broad information on the site's general geographical position, its habitat types, and any prominent human activities and conservation issues at the site. However, only a brief outline is provided and more detailed information should be sought elsewhere if the subject is of interest. General references used throughout were JNCC (1993–1997) and Barne *et al.* (1995–1998).

COVERAGE AND INTERPRETATION

The first paragraph describes the geographical and temporal coverage of the site achieved during the first seven winters of the scheme (1992–93 to 1998–99). For sites which have been surveyed during more than one winter, any differences in coverage are described, although for a small number of more complex situations it is advised that the National Organiser of the scheme is contacted. Attention is drawn to the number of months during each winter (out of the possible four from November to February) during which the site was counted. It should be noted that the coverage of a site during a month does not imply that every section at that site was counted during that month.

The first map for each account depicts the count sections used for the survey (without any division into habitat types, as discussed in Methods, although the underlying habitat is depicted using background colours of yellow and green to represent intertidal and nontidal habitats respectively). Sections which are relatively small compared to the size of the site may not be displayed clearly at the scale used; more detailed outlines of the count sections in printed or digital form may be requested from the National Organiser.

For the majority of sites, a second map depicts the boundaries of the combined area covered by the LTCs during any winter under review, the boundaries of any SPAs overlapping the LTC site and the degree of overlap between the two areas. For those sites not overlapping an SPA, the combined area of any relevant biological SSSIs (or ASSIs) is shown instead. The maps thus clearly draw attention to areas covered by the LTCs but outwith a statutory site boundary and areas which are within a statutory site boundary but which were not covered by the scheme. It should be noted that narrow strips of non-overlap may represent slight differences in mapping. Additionally, it should be remembered that, in most cases, SPA boundaries do not currently extend below mean low water, whereas the LTC sections do (either to half way across a channel, or to an arbitrary 500m offshore, as described in Methods). Thus, many sites show these offshore zones of non-overlap.

The following paragraph describes the areas of overlap and non-overlap depicted in the second map and discusses any major discrepancies. Ramsar site boundaries are usually very close to those of SPAs but any differences are noted here also.

The final paragraph of the section discusses any known or likely regular movements of waterbirds in and out of the LTC site. 'Regular movements' are considered to be those taking place over every tidal cycle or at least every day, and not to movements of birds between sites over the course of a winter. It should be emphasised that much remains to be learnt about inter-site movements of birds and this brief discussion should be seen only as a pointer to further investigation.

WATERBIRD DISTRIBUTION

This section discusses the principal findings of the scheme relating to the low tide bird distribution at the site. Emphasis is given to the species tabulated at the beginning of the account under 'Winter Waterbird Interest' (as described above) and distribution maps are presented for most of these species. In cases where it was not considered necessary to present a species map, the reasons are given. There then follows a relatively brief description of the broad patterns of occurrence of the key species. Although the maps themselves are presented, this text tries to draw together patterns of occurrence of groups of ecologically similar species for the reader's consideration. In general, however, it is envisaged that the reader will want to study the maps themselves. For more detailed analyses of bird densities, data may be requested from the National Organiser at the BTO.

There then follows the set of dot-density species distribution maps (derived as discussed in Methods). Most species maps are presented at a standard dot size with one dot representing one 'averaged' bird, *i.e.* a count section supporting a mean count of 40 Redshank over a winter will contain 40 dots on the map. In some cases, mapped densities were so high that it was not possible at the scale of map production to visually differentiate between the densities on different sections; hence 400 dots in a small section may appear identical to 4000 dots in that section, if the effect of both is simply to shade the entire section black. In such cases, either the size of individual dots was reduced, or one dot was set to represent, for example, five birds, to aid interpretation. Such instances are fully described. To enhance clarity, the boundaries of the count sections are omitted from the species distribution maps. Again, background colours of yellow and green are added to represent intertidal and nontidal habitats respectively (as defined within Methods).

Additionally, two maps are presented which represent 'total waterbirds'. The first displays the combined number of individuals of all species, with the exception of gulls (for which counting is optional) and naturalised species. The second displays a weighted total, which gives greater emphasis to less common species. To derive the data underlying this map, the mean number of a species on a section was inversely weighted by its national 1% threshold value to yield a weighted total in threshold importance units (TIU). All species with a national 1% threshold value of less than 50 were assigned a nominal value of 50, in order to prevent individuals of some species, notably Greenshank and Spotted Redshank, exerting a disproportionate influence over the overall maps. The TIU for each species on a section were then summed to produce a value of summed threshold importance units (STIU). As the resulting value of STIU is low, the values are scaled up to yield a map which has the same number of dots on it as the 'total waterbirds', for ease of comparison. This second map also excludes gulls and naturalised species. The weighted total maps illustrate an alternative approach to presenting the data by taking into account national population sizes and so augment information on concentrations of distribution from unweighted totals. This method helps to pinpoint areas that may be important for the less numerous species but that may not necessarily hold high combined densities of all species. The concepts behind TIU maps are further explored in Austin *et al.* (2002).

4.1 MORAY FIRTH

LTC site code:	EM
Centre grid:	NH7152
JNCC estuarine review site:	77
Habitat zonation:	4504 ha intertidal, 4655 ha subtidal, 332 ha nontidal
Statutory status:	Inner Moray Firth SPA (UK9001624), Moray and Nairn Coast SPA (UK9001625), Inner Moray Firth Ramsar (7UK135), Moray and Nairn Coast Ramsar (7UK107)
Winter waterbird interest:	Red-throated Diver, Slavonian Grebe, Cormorant, Pink-footed Goose, Greylag Goose, Barnacle Goose, Wigeon, Teal, Scaup, Long-tailed Duck, Common Scoter, Velvet Scoter, Goldeneye, Red-breasted Merganser, Goosander, Oystercatcher, Knot, Dunlin, Bar-tailed Godwit, Curlew, Redshank, Waterbird assemblage

SITE DESCRIPTION

The Inner Moray Firth comprises, for the purposes of this survey, the coastline from Findhorn Bay to just north of Chanonry Point, including the Beauly Firth. There are wider areas of sand and mud flats in the Beauly Firth, Longman Bay, Munlochy Bay and Findhorn Bay, but much of the rest of the site comprises fairly open coast. There are several extensive areas of saltmarsh, particularly behind the sand-bars between Whiteness Head and Culbin Forest. Much of the area is backed by natural habitats and human population density is generally low, with the main built-up areas being at Inverness and Nairn. Wildfowling is widespread in the area in addition to fishing and bait-digging. A former oil platform yard at Whiteness is now closed (D. Butterfield pers. comm.).

COVERAGE AND INTERPRETATION

Low tide counts were carried out at Findhorn Bay during the winter of 1996–97 (no November count), but more complete counts of the whole firth were achieved in 1998–99 (all four months). Figure 4.1.1 shows the positions of the 64 sections counted for the survey in the latter winter.

Figure 4.1.2 shows the degree of overlap of the LTC site with the boundaries of two separate SPAs. In general, the LTCs achieved almost complete coverage between Rosemarkie Bay and Findhorn Bay, whereas the two SPAs include only a number of discrete sections without the (quite extensive) areas of intervening habitat. Areas of SPA not covered by the counts were the innermost Beauly Firth, part of the southern shore of Munlochy Bay, Whiteness Head dunes, Culbin Bar dunes, the marshes around the southern edge of Findhorn Bay and, much further east, the Spey Estuary. The boundaries of the two Ramsar sites present are entirely coincident with their respective SPAs.

With such an extensive site, the degree of regular movement in and out of the site is likely to be far less than the movement within the site for most estuarine species. However, it is known, largely from data collected by the Highland Ringing Group, that some interchange with the Cromarty Firth does occur, especially of Knot, Bar-tailed Godwits

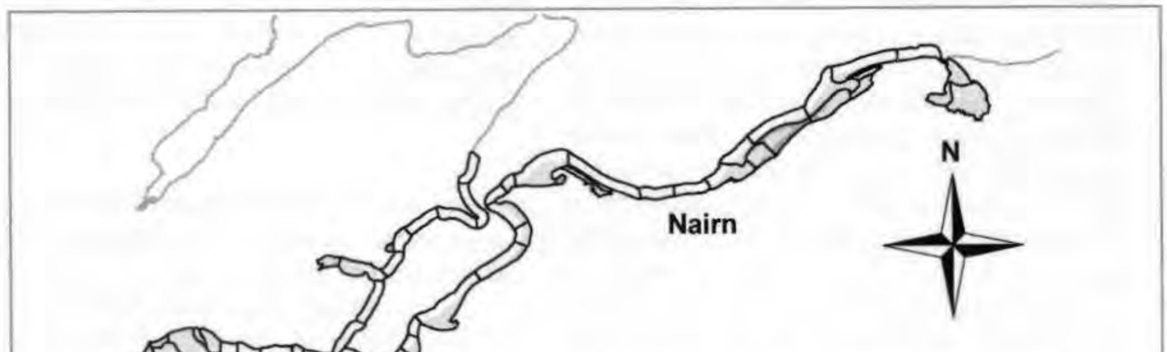


Figure 4.1.1. *LTC sections at the Moray Firth, winter 1998-99*

Figure 4.1.2. LTC and SPA boundaries, with overlap, at the Moray Firth

and perhaps Scaup. Some species may even move as far as the Dornoch Firth (D. Butterfield pers. comm.). Grey geese and grassland plovers will disperse to adjacent inland areas to feed. Similarly, sea-ducks, especially Long-tailed Ducks, can disperse far offshore into the outer Moray Firth and numbers recorded by the LTCs, or any land-based scheme, are unlikely to record their numbers accurately.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1998–99 are presented for 19 of the 21 species of principal interest listed above. For clarity, smaller dots are used to display the distributions of Greylag Goose, Wigeon, Teal, Common Scoter, Oystercatcher, Knot and Dunlin. Additional maps of total birds and total birds weighted by 1% threshold values are also presented (Figure 4.1.3). Of the remaining species, no more than two Slavonian Grebes were recorded in any month at low tide and Barnacle Goose was unrecorded. The latter species passes through the site usually in only small numbers on the way to and from the Solway Firth, although there was an abnormally high count of 492 birds in October 1995.

The totals map shows that the highest overall densities of birds occurred at Munlochy Bay, to the east of Ness Mouth, on the flats north of Fort George and at Findhorn Bay. Much the same general pattern is shown by the weighted total map, although with Findhorn less emphasised and the waters off Nairn and Culbin Bars highlighted. The Moray Firth supports important concentrations of sea-duck, the maps showing that these species had different distributions (although it should always be borne in mind that some species, notably Long-tailed Duck, are likely to be under-recorded due to some birds occurring further offshore). Long-tailed Ducks were noted widely along the shores of the outer parts of the site but much more locally upstream of Chanonry and Fort George. Common and Velvet Scoters were more localised, almost all being found off Nairn and Culbin Bars. Most of the Scaup, on the other hand, were on the inner firth at Longman Bay. Red-breasted Mergansers and Goosanders were mostly found on the Beauly Firth and Goldeneyes were widespread through the inner firths but were most concentrated around Ness Mouth around a sewage outfall; subsequently, this outfall has been closed down with most of the Goldeneyes moving to the new outfall off Alturlie (D. Butterfield pers. comm.). Cormorants occurred more on the inner firth and Red-throated Divers the outer firth. Wigeon were widespread but Teal more local, especially at Munlochy, Beauly and Longman. All six waders of note occurred throughout, although Knot and Bar-tailed Godwits were more patchily distributed. As at other sites, the low tide distribution recorded for Greylag and Pink-footed Geese was potentially misleading, given the major use of the site being at night for these species.

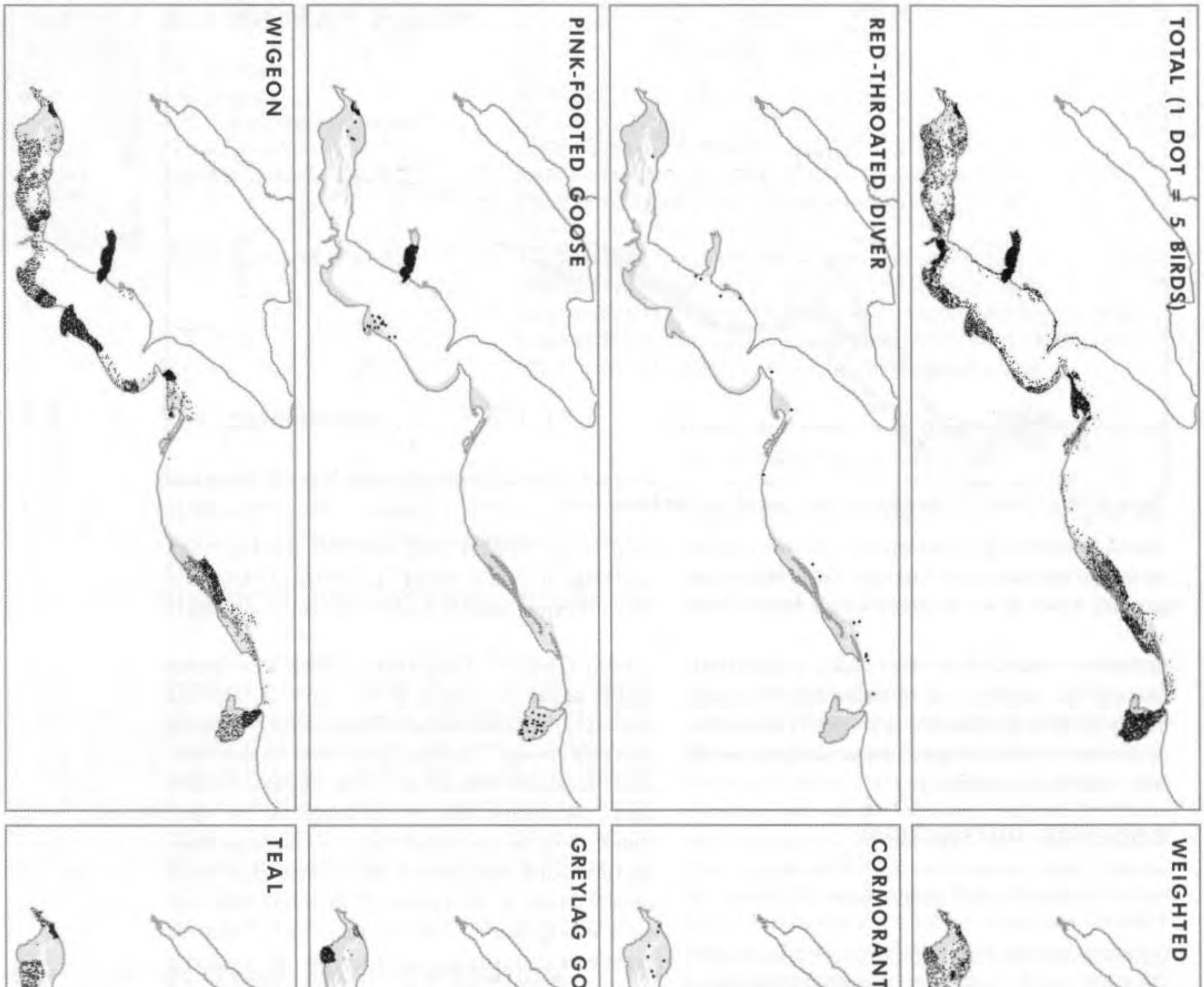


Figure 4.1.3 (i): Low tide waterbird distributions recorded at the Moray Firth, winter 1998-99

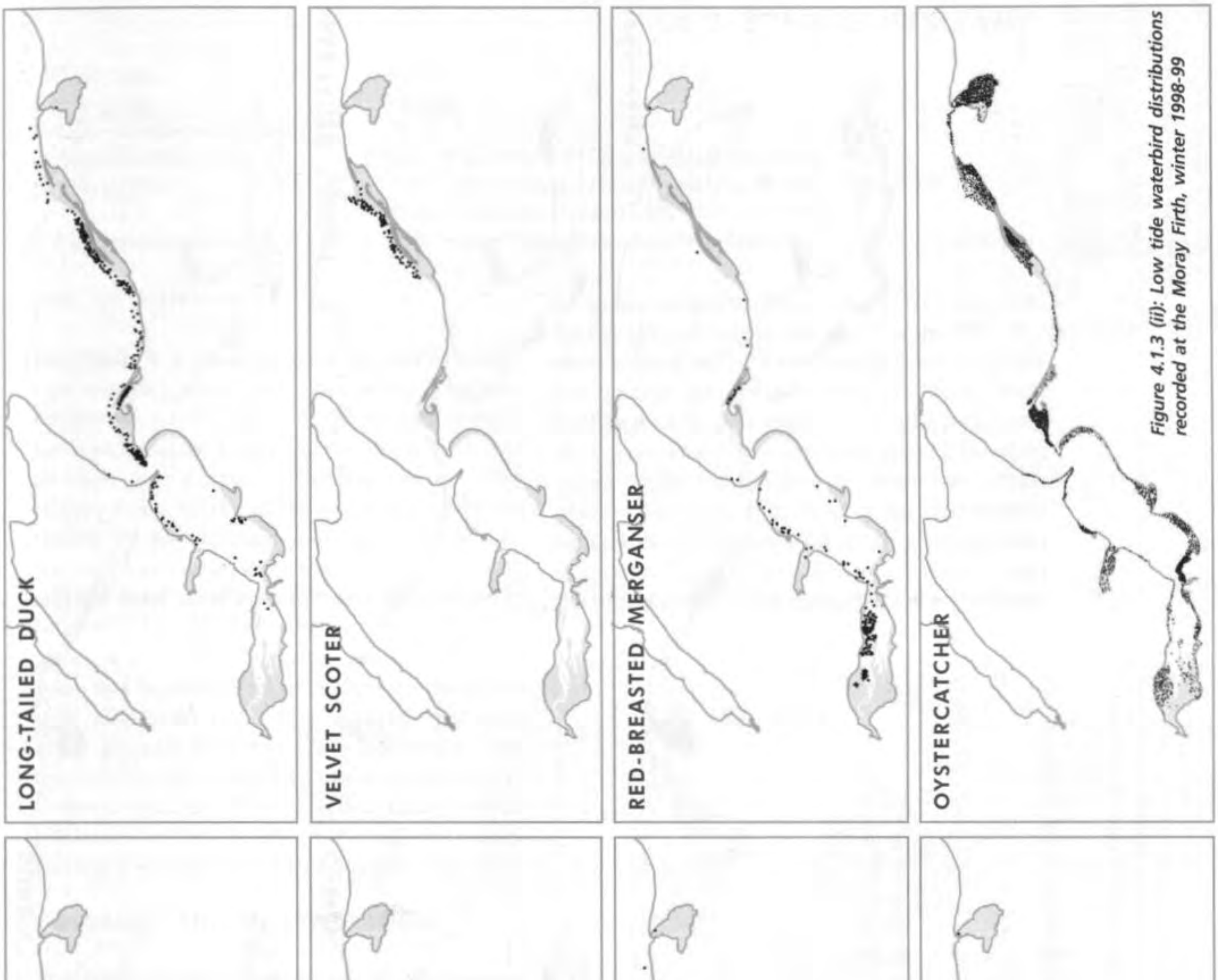


Figure 4.1.3 (ii): Low tide waterbird distributions recorded at the Moray Firth, winter 1998-99

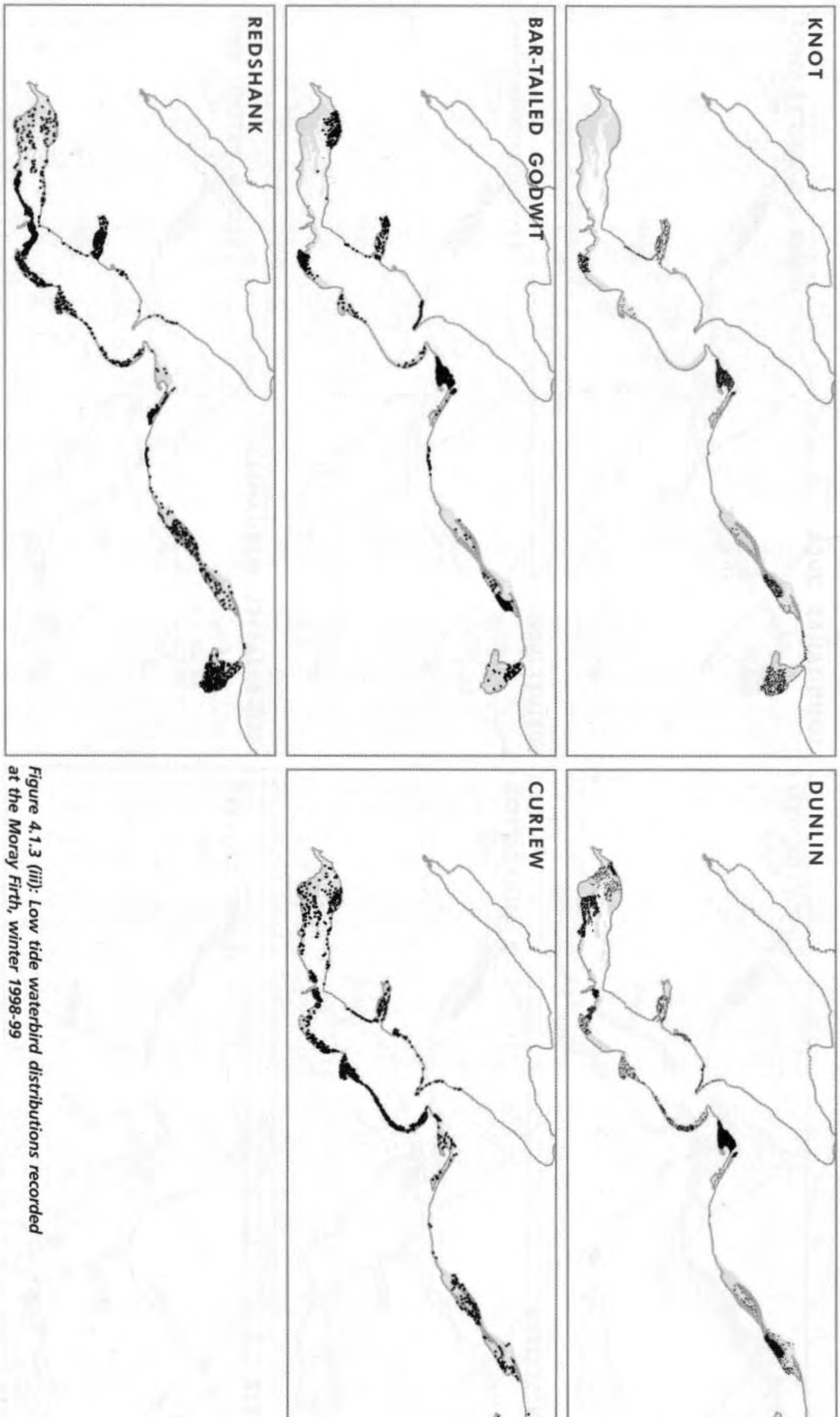


Figure 4.1.3 (iii): Low tide waterbird distributions recorded at the Moray Firth, winter 1998-99

4.2 YTHAN ESTUARY

LTC site code:	BY
Centre grid:	NK0026
JNCC estuarine review site:	81
Habitat zonation:	201 ha intertidal, 50 ha subtidal, 2 ha nontidal
Statutory status:	Ythan Estuary, Sands of Forvie and Meikle Loch SPA (UK9002221), Ythan Estuary and Meikle Loch Ramsar (7UK122)
Winter waterbird interest:	Pink-footed Goose, Eider, Lapwing, Redshank, Waterbird assemblage

SITE DESCRIPTION

The Ythan is a relatively small estuary in north-east Scotland, about ten miles north of Aberdeen. Despite its small size, it is the largest estuary between Montrose Basin and the Moray Firth and as such is important in a local context. The estuary has a narrow shape and is shielded from the sea by the important dune system known as the Sands of Forvie. The inner estuary is muddy and the outer stretches more sandy, but there is relatively little in the way of saltmarsh. The principal issue of conservation concern in recent years has been the level of nitrogen leaching into the Ythan from surrounding farmland, leading to algal growth covering the sediments; the catchment was recently designated a Nitrate Vulnerable Zone. Otherwise, the main human influences on the estuary are through recreation, including wildfowling (A. Duncan pers. comm.).

COVERAGE AND INTERPRETATION

The Ythan Estuary was counted for the scheme during the winter of 1997–98, although no November count was made. Figure 4.2.1 shows the positions of the 12 sections counted for the survey.

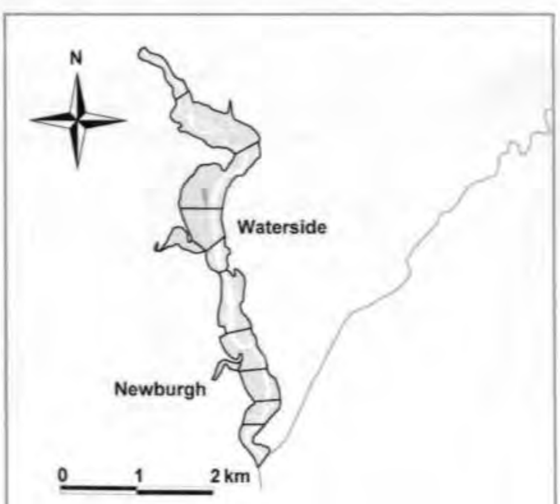


Figure 4.2.1: LTC sections at the Ythan Estuary, winter 1997–98

It can be seen in Figure 4.2.2 that the area covered for the LTCs is only a part of the larger SPA. The main parts of the SPA which were not counted for the scheme are the non-estuarine Meikle Loch (included for its importance to roosting geese) and the Sands of Forvie (an important area for breeding terns). These two areas aside, there was a high degree of overlap, with most of the discrepancy being areas of surrounding rough grassland and saltmarsh. None of the counted area was outwith the SPA (apart from the main channel below mean low water). The Ramsar site agrees more closely with the area covered by the LTCs, since it does not include the Sands of Forvie, although Meikle Loch is still a discrepancy.

Figure 4.2.2: LTC and SPA boundaries, with overlap, at the Ythan Estuary

The Ythan Estuary is a long distance from other estuaries and no interchange is likely on a daily basis. However, much of the nearby non-estuarine coast is suitable for waterbirds and regular interchange seems likely. Additionally, some species will move onto surrounding terrestrial habitats (A. Duncan pers. comm.).

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1997–98 are presented for three of the four species of principal interest listed above. For clarity, smaller dots are used to display the distribution of Eider and Lapwing. Additional maps of total birds and total birds weighted by 1% threshold values are also presented (Figure 4.2.3). Pink-footed Geese, the other listed species of interest, use the site (and Meikle Loch) as an overnight roost but most birds vacate the estuary by day and none were recorded during the counts.

The totals map suggests a fairly even all-bird density across much of the site, but with higher densities at the mouth of the estuary, to the north of Waterside Bridge and towards the northern end of the site. The estuary mouth was emphasised by the weighted total map, mostly due to the large flock of Eiders present here, although all of the Knot and the majority of the Red-breasted Mergansers were also found at the mouth. Lapwings and Redshanks were both widespread with Lapwings being more concentrated at the northern end but Redshanks occurring more densely in the central region.

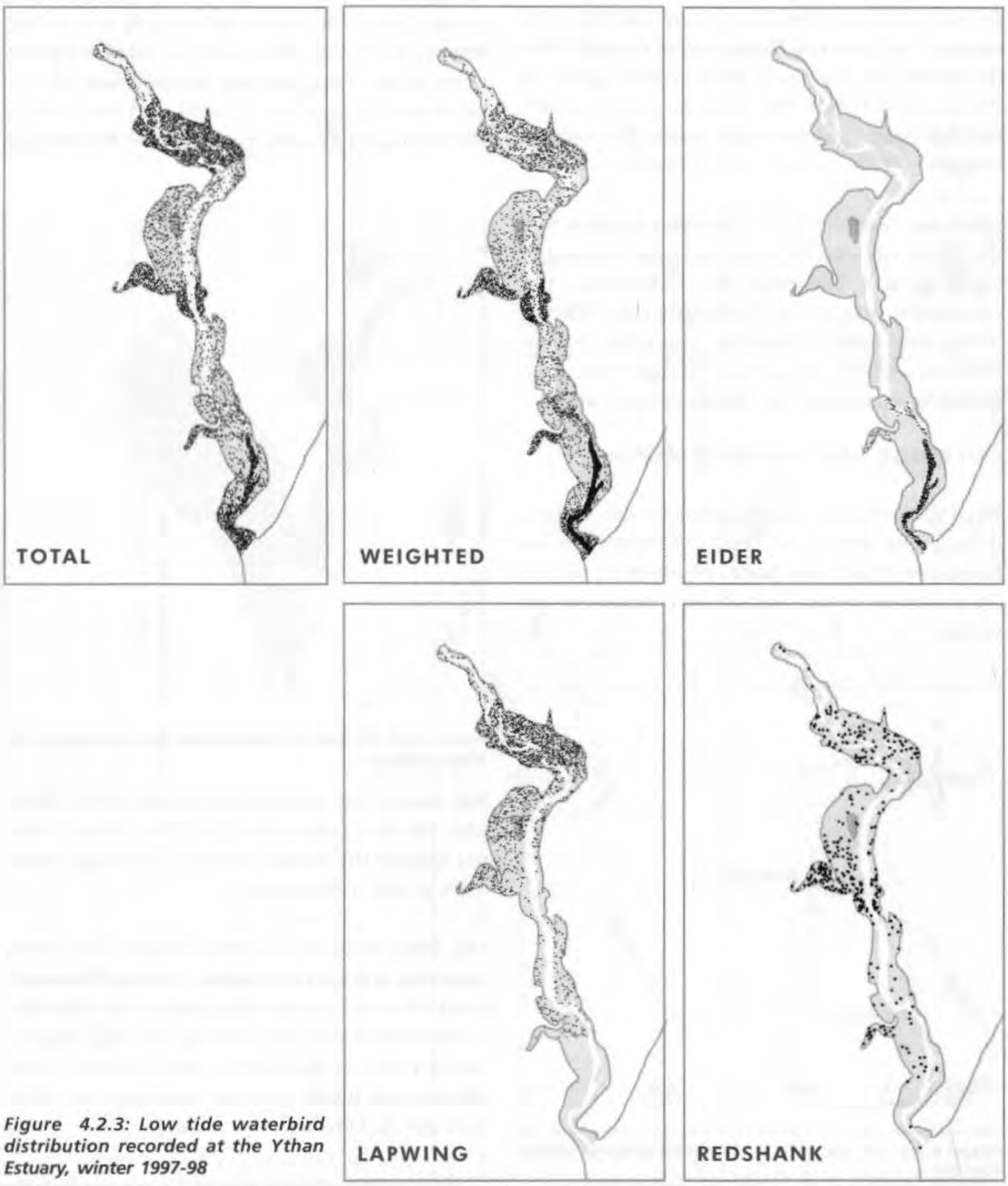


Figure 4.2.3: Low tide waterbird distribution recorded at the Ythan Estuary, winter 1997-98

4.3 MONTROSE BASIN

LTC site code: DM
Centre grid: NO6957
JNCC estuarine review site: 85
Habitat zonation: 718 ha intertidal, 43 ha subtidal, 2 ha nontidal
Statutory status: Montrose Basin SPA (UK9004031), Montrose Basin Ramsar (7UK082)
Winter waterbird interest: Mute Swan, Pink-footed Goose, Greylag Goose, Shelduck, Wigeon, Eider, Red-breasted Merganser, Goosander, Oystercatcher, Knot, Dunlin, Redshank, Waterbird assemblage

SITE DESCRIPTION

Montrose Basin, the estuary of the South Esk River, is an almost circular basin about 3 km across. The basin is separated from the sea by a broad spit on which the town of Montrose is situated; the river discharges to the sea through a narrow channel at the southern end of the spit. The intertidal flats range from sand to mud and shingle and there are also extensive mussel beds. Eelgrass and algae are also present on the basin, providing a food source for some of the waterfowl. There are areas of saltmarsh on the inner edge of the basin and grazing fields nearby. Pressure from wildfowling used to be heavy on this site but has been restricted since 1981 when a Local Nature Reserve was created; this led to a dramatic rise in the numbers of waterfowl using the site, particularly Pink-footed Geese. Although there has been some land-claim for waste disposal, the site is mostly untouched by industrial development or pollution (R. Goater pers. comm.).

COVERAGE AND INTERPRETATION

Montrose Basin was counted for the scheme during the winters of 1992–93 (no January count) and 1997–98 (no February count). During 1992–93, 19 count sections were used for the survey but these were subdivided further for 1997–98 into the 33 sections shown in Figure 4.3.1. Precise details concerning the subdivision of sections can be obtained from the National Organiser.

Figure 4.3.2 shows that the whole area covered by the LTCs lies within the Montrose Basin SPA. In addition, some other non-estuarine areas, mostly fields, are included within the SPA boundary. The separate area of the SPA to the north-west is a small eutrophic loch called Dun's Dish, not included within the counts.

The boundaries of the Ramsar site are entirely coincident with those of the SPA. It is unlikely that many birds move on a daily basis between

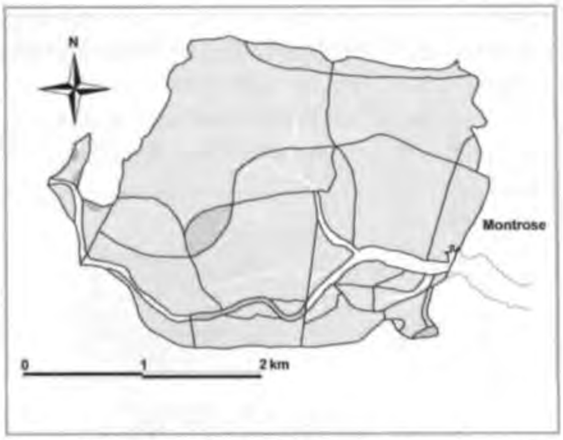


Figure 4.3.1: LTC sections at Montrose Basin, winter 1997–98

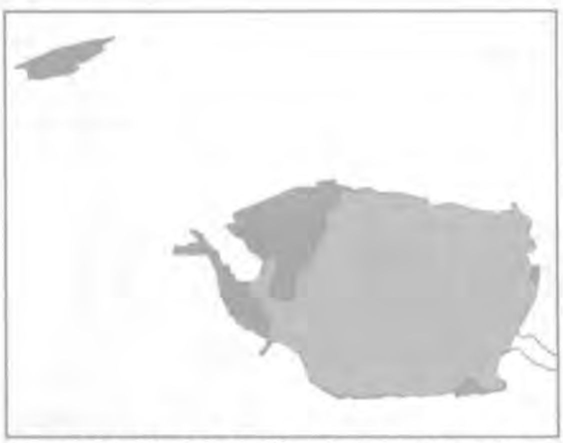


Figure 4.3.2: LTC and SPA boundaries, with overlap, at Montrose Basin

Montrose Basin and other estuarine sites, given the distance involved, but some may disperse to nearby stretches of non-estuarine coast. Geese and grassland plovers also use inland habitats for feeding.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1997–98 are presented for 11 of the 12 species of principal interest listed above. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.3.3). The species not mapped, Greylag Goose, has declined in numbers in recent winters at the site and was not even recorded during the survey (although the site is mostly used as an overnight roost by the species).

The totals map illustrates higher overall densities of birds in the eastern half of the basin, with little difference revealed by the weighted total map. For one count section, however, the overall high bird density was clearly strongly influenced by a flock of 15,000 Pink-footed Geese which were present on one occasion; there were otherwise just a handful of records of small numbers of this species which mostly uses the estuary as a nocturnal roost. Shelducks were mostly found in the north-east corner, with more Wigeon in the south-central parts. Red-breasted Mergansers and Eiders used the lower reaches of the main channels, while Mute Swans were present along the whole of the main river channel with a slight concentration upstream. Small numbers of Goosanders were found only on the upper reaches of the main channel, although this is a species which tends to disperse widely during the day and returns to favoured sites such as this at night. Dunlin were much more widespread than Knot, although both showed a general preference for the mid-south part of the basin. Redshanks and Oystercatchers were both more widespread throughout the whole site.

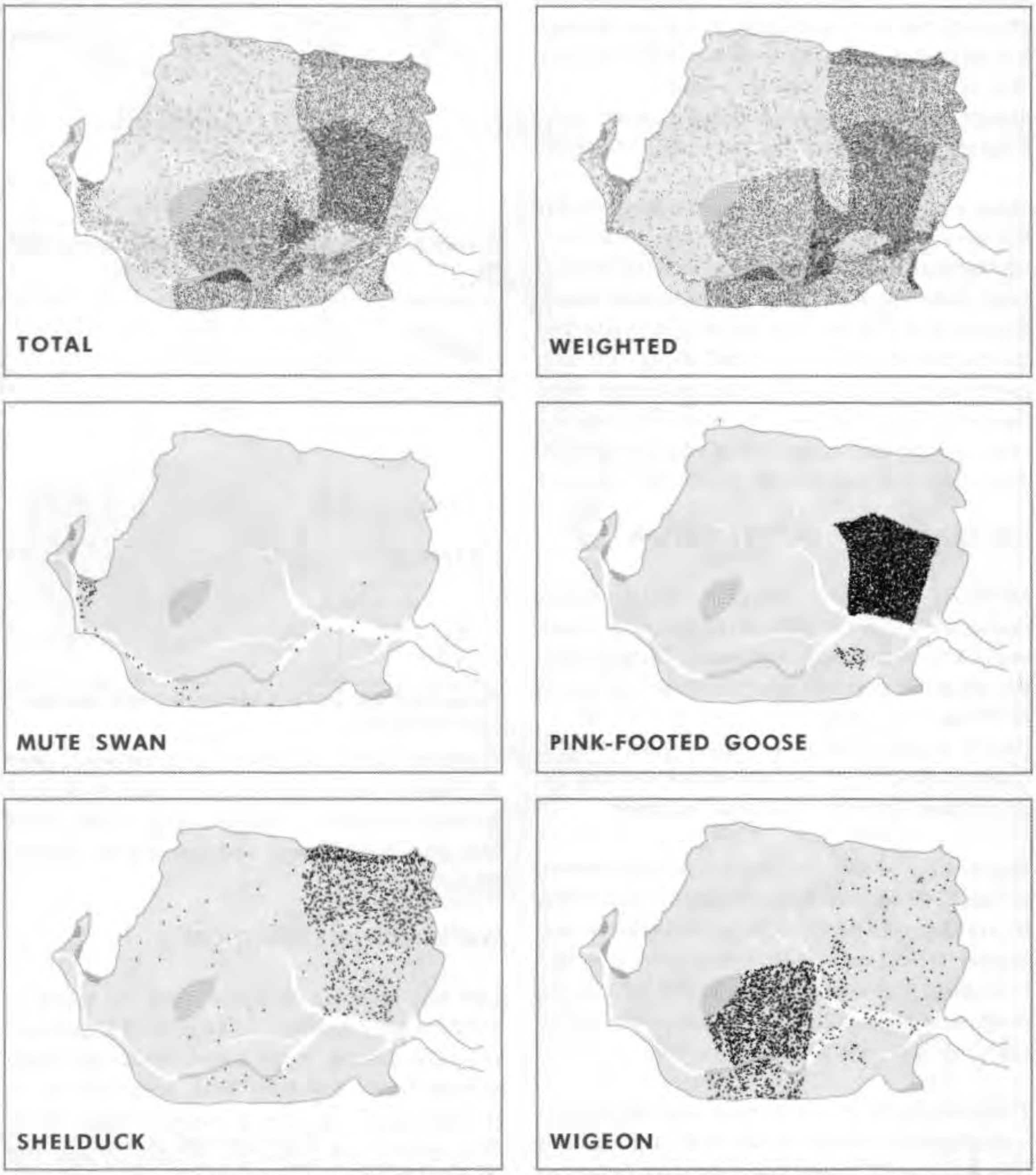


Figure 4.3.3 (i): Low tide waterbird distributions recorded at Montrose Basin, winter 1997-98

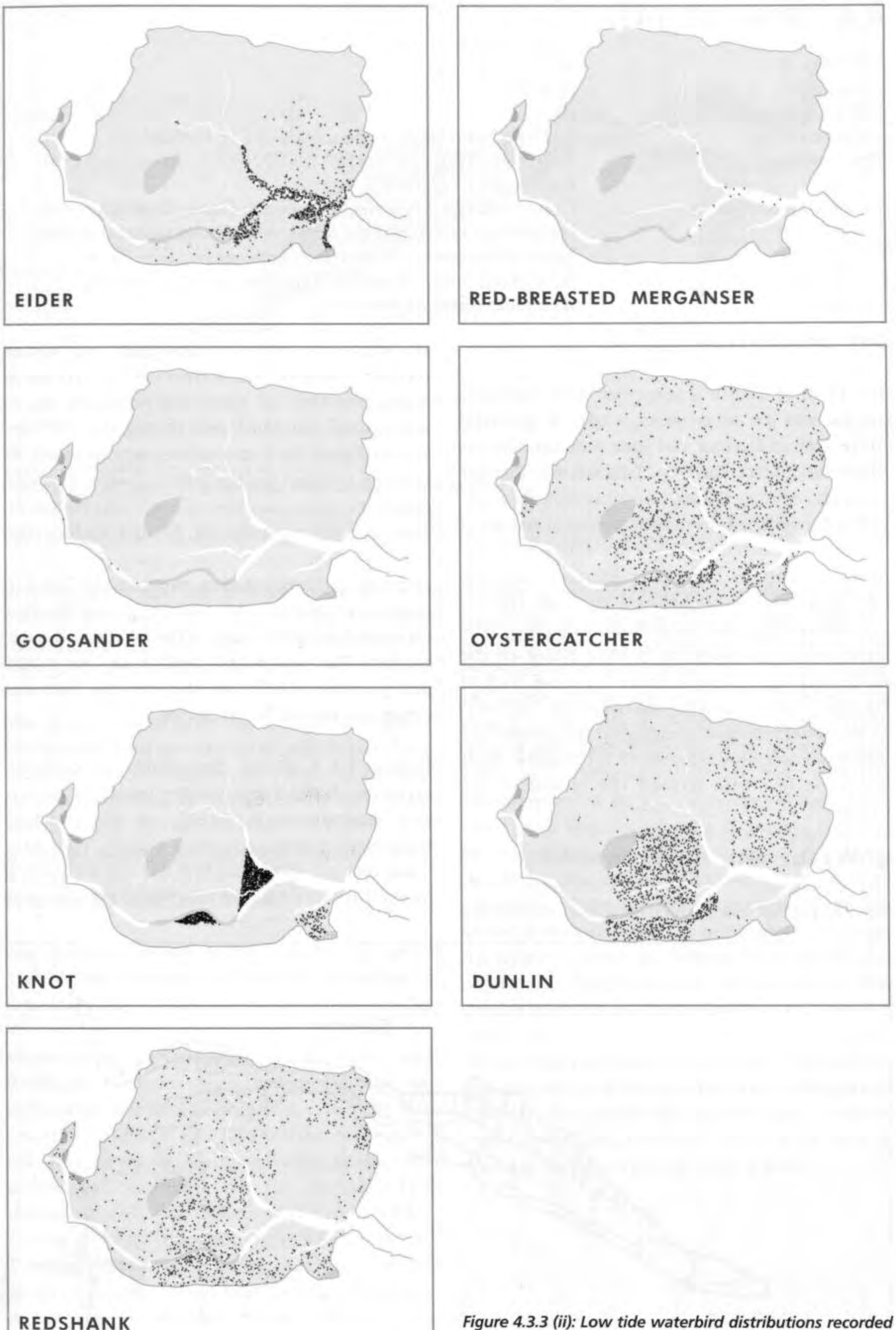


Figure 4.3.3 (ii): Low tide waterbird distributions recorded at Montrose Estuary, winter 1997-98.

4.4 FIRTH OF TAY

LTC site code:	BT
Centre grid:	NO3527
JNCC estuarine review site:	86
Habitat zonation:	5425 ha intertidal, 5417 ha subtidal, 87 ha nontidal
Statutory status:	Firth of Tay & Eden Estuary SPA (UK9004121), Firth of Tay & Eden Estuary Ramsar (7UK144)
Winter waterbird interest:	Cormorant, Pink-footed Goose, Greylag Goose, Shelduck, Eider, Long-tailed Duck, Common Scoter, Velvet Scoter, Goldeneye, Red-breasted Merganser, Goosander, Oystercatcher, Grey Plover, Sanderling, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Redshank, Waterbird assemblage

SITE DESCRIPTION

The Firth of Tay is a large site with extensive mudflats in the inner parts, a narrow intertidal fringe around Dundee and then wide sandflats at the mouth, notably forming a long spit at Tentsmuir Point and Abertay Sands. The inner flats are naturally impoverished due to the unstable nature of the coarse sediments. There are extensive areas of saltmarsh in the inner estuary and the northern shore is backed by the largest continuous brackish reedswamp in Britain. The outer estuary is bordered by sand dunes on the north and south shores. There is a large dock at Dundee and a smaller harbour at Tayport. Commercial sediment dredging occurs and further industrial activities are centred on Dundee. Most watersports occur around the mouth of the estuary.

COVERAGE AND INTERPRETATION

The Firth of Tay was counted for the scheme during the winter of 1993–94, during all four winter months. Following this, further counts were made during the 1996–97 winter (no November count) and a more restricted area during the 1997–98 winter. Figure 4.4.1 shows the positions of the 70 sections counted for the survey during 1996–97 (when the most complete coverage was obtained). Coverage during 1993–94 did not include the outermost sections, the innermost parts of the site and the area roughly between the Tay rail bridge and Tayport. The 1997–98 counts focused on several restricted parts of the middle and outer estuary. For precise information on the extent and position of LTCs on the Tay, the National Organiser should be consulted.

Figure 4.4.2 shows that, with the obvious exception of the Eden Estuary (which is treated as a separate site by WeBS), the SPA and LTC boundaries follow each other closely. The main areas that are within the SPA but not yet covered by the LTCs are Abertay Sands and the dunes at

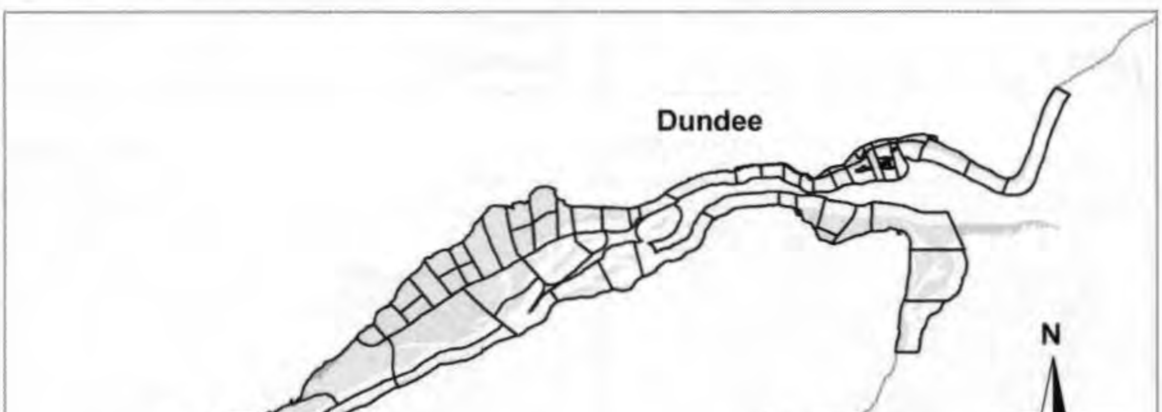


Figure 4.4.1: LTC sections at the Firth of Tay, winter 1996-97

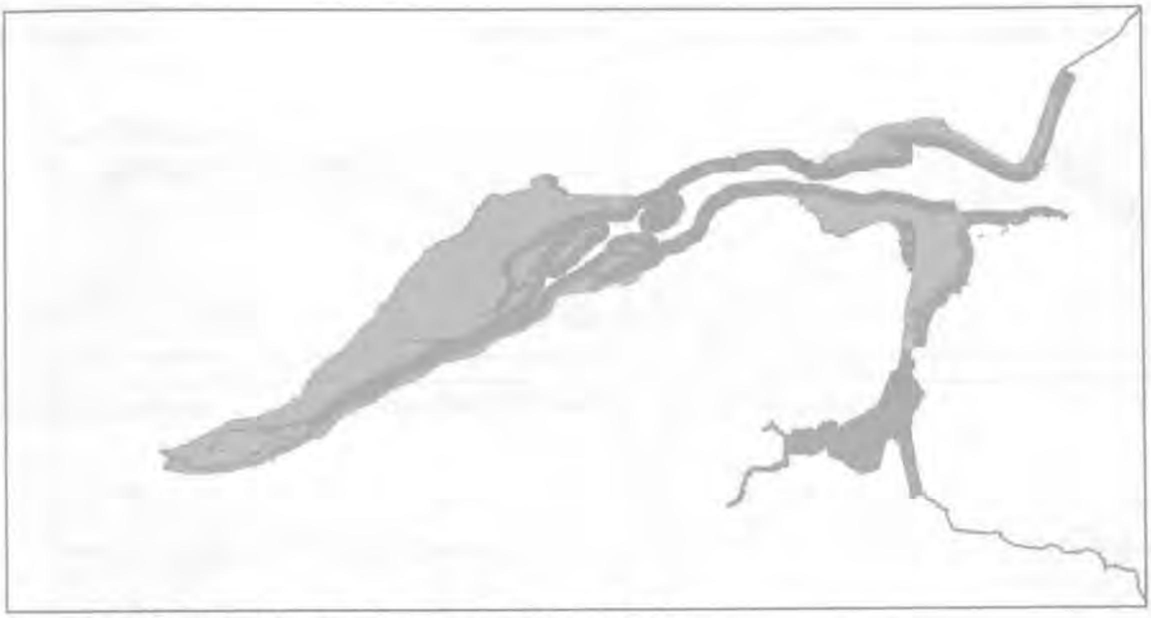


Figure 4.4.2: LTC and SPA boundaries, with overlap, at the Firth of Tay

Tentsmuir Point. Conversely, the area covered by the LTCs extended slightly further out on the northern shore and also covered central parts of the firth not designated as part of the SPA. The boundaries of the Ramsar site are entirely coincident with those of the SPA.

Movement of some birds between the Firth of Tay and the Eden Estuary occurs on a daily basis and there is also some dispersal north along the non-estuarine coastline of Angus (Elkins and Lynch 1997). Some species, notably wild geese and grassland plovers, also disperse inland to feed.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1996–97 are presented for 14 of the 18 species of principal interest listed above. For clarity, smaller dots are used to display the distributions of Eider, Oystercatcher, Dunlin, Bar-tailed Godwit and Redshank. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.4.3). The four interest species not mapped mostly occur elsewhere in the SPA, although Goosanders use the Tay as a late summer moult site (Elkins and Lynch 1997). During the 1997–98 LTCs of the Tay, up to 280 Common Scoters were recorded offshore to the south of Tentsmuir Point but the species was unrecorded during the 1996–97 winter.

The totals map clearly depicts the higher overall bird densities on the outer estuary. Although the birds using the inner firth were mostly found in the north-eastern parts, the weighted total map suggests that only the shoreline adjacent to Dundee Airport held weighted bird densities comparable to those on parts of the outer firth. The overall picture was strongly influenced by the distribution of Eider, which was found almost exclusively at low tide on the south side of the mouth of the Tay at Tentsmuir Point. Other species frequenting the outer firth were Long-tailed Duck (although these are more common elsewhere in the SPA at St Andrew's Bay), Grey Plover and Sanderling, with Bar-tailed Godwits also common on the outer firth as well as making use of the area south of Dundee Airport. A large proportion of the Goldeneyes occurred from the airport eastwards along the north shore, although the upper reaches of the inner firth were also occupied. Red-breasted Mergansers and Cormorants were much more widespread, as were Shelducks, although this latter species was found in only low numbers on the firth. Oystercatchers, Dunlin and Redshanks were widespread although few were found on the upper reaches. Pink-footed and Greylag Geese were widely recorded in the central parts of the site.

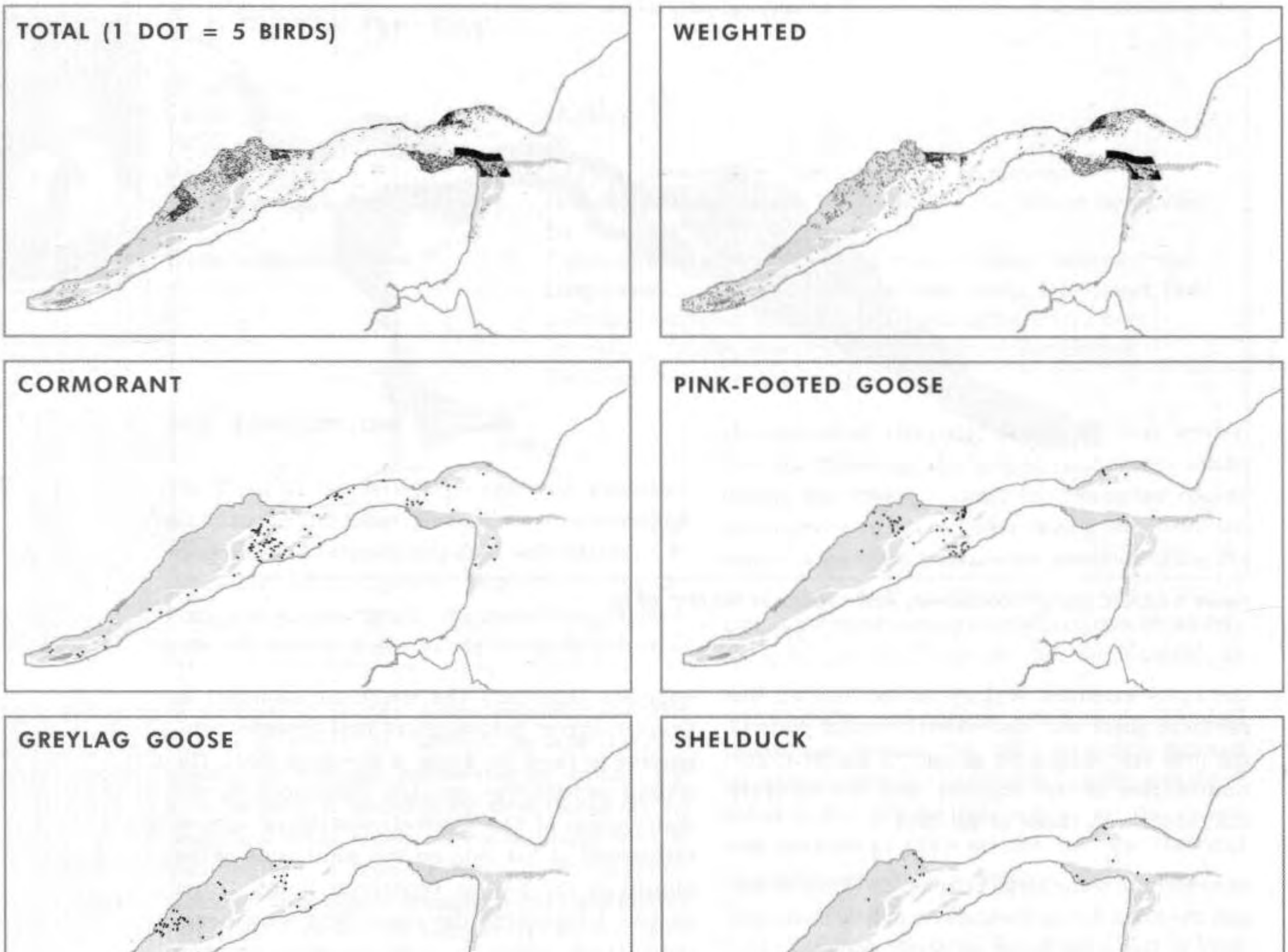


Figure 4.4.3(i): Low tide waterbird distributions recorded at the Firth of Tay, winter 1996-97

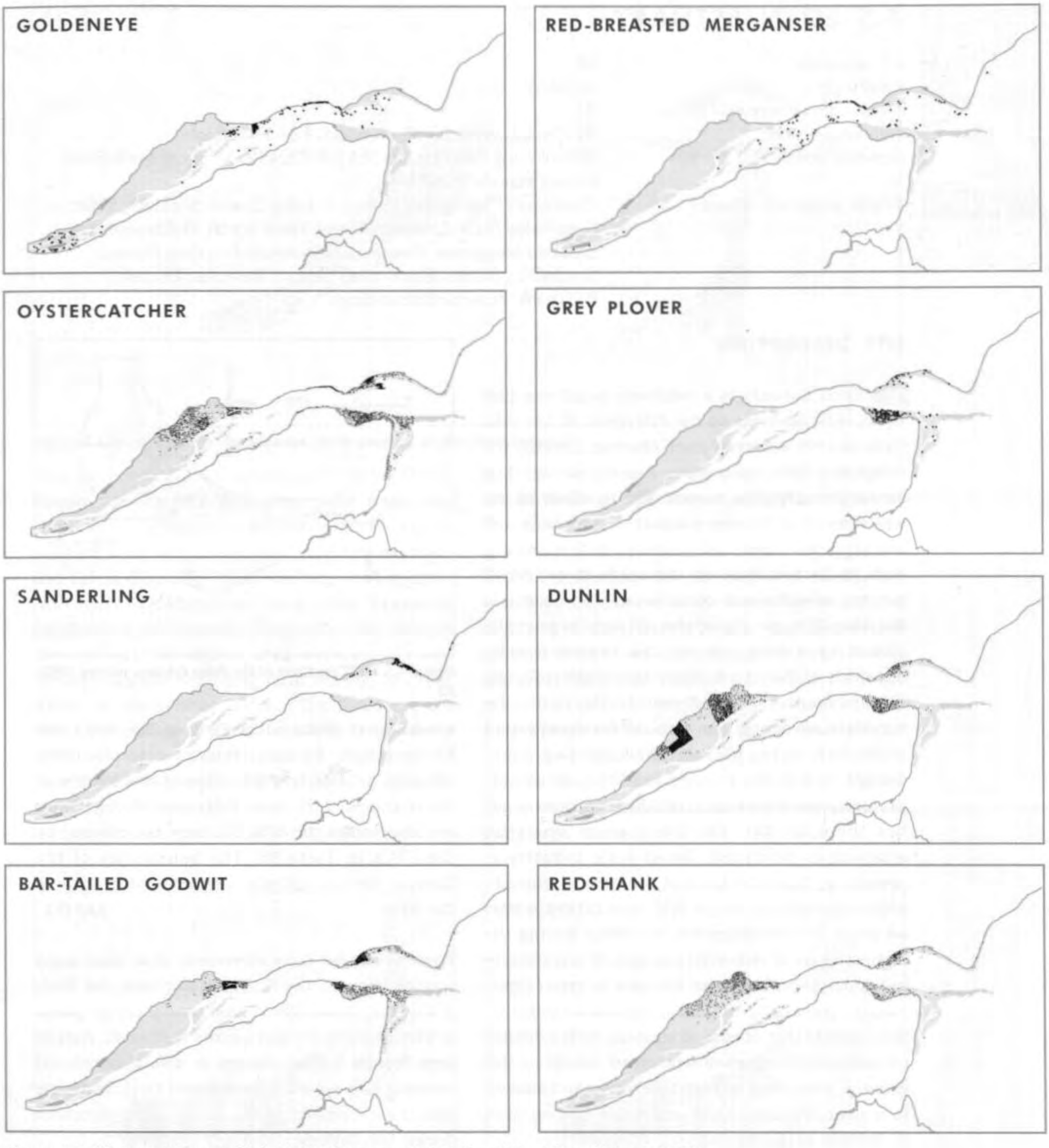


Figure 4.4.3(ii): Low tide waterbird distributions recorded at the Firth of Tay, winter 1996-97

4.5 EDEN ESTUARY

LTC site code:	BE
Centre grid:	NO4819
JNCC estuarine review site:	87
Habitat zonation:	821 ha intertidal, 278 ha subtidal, 13 ha nontidal
Statutory status:	Firth of Tay & Eden Estuary SPA (UK9004121), Firth of Tay & Eden Estuary Ramsar (7UK144)
Winter waterbird interest:	Cormorant, Pink-footed Goose, Greylag Goose, Shelduck, Eider, Long-tailed Duck, Common Scoter, Velvet Scoter, Goldeneye, Red-breasted Merganser, Goosander, Oystercatcher, Grey Plover, Sanderling, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Redshank, Waterbird assemblage

SITE DESCRIPTION

The Eden Estuary is a relatively small site just north of St Andrews on the Fife coast. At low tide, there is only a narrow river channel through the intertidal flats, which are mostly muddy but sandier towards the mouth. The mudflats at the western end of the site support mussel beds and the eel-grass *Zostera angustifolia*, with extensive beds of *Zostera noltii* on the north shore. Small patches of saltmarsh occur around the edges of the site. The mouth of the estuary is partially closed by a long spit on the southern side; seawards of this spit a sandy beach (West Sands) extends south to St Andrews. To the north, the sandflats are contiguous with the southern extent of the Firth of Tay LTC site. Watersports are prohibited within the estuary local nature reserve but occur on West Sands. Wildfowling does occur but there are two sanctuary areas where no shooting is permitted. Small-scale industry is present at Guardbridge and the area is immediately adjacent to a major RAF base. There is also an issue of eutrophication, the Eden having the highest levels of dissolved nitrogen of any estuary in Scotland, leading to an increase in green algae. Finally, potentially the most important conservation issue is that of coastal squeeze, with evidence of saltmarsh regression around much of the estuary, impacting on high tide roosts and leading to a concomitant loss of intertidal feeding area (L. Hatton pers. comm.).

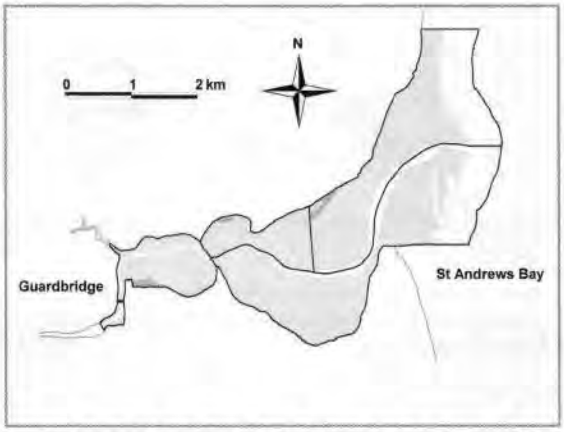


Figure 4.5.1: LTC sections at the Eden Estuary, winter 1992–93

COVERAGE AND INTERPRETATION

The Eden Estuary was counted for the scheme during the 1992–93 winter, with all four monthly counts carried out. Figure 4.5.1 shows the positions of the five sections counted for the survey.

As Figure 4.5.2 shows, the Eden LTC site is only a small part of the wider Firth of Tay and Eden Estuary SPA. Of most relevance to the Eden Estuary, the beach at West Sands and lengths of the channels of the River Eden and Motray Water are also within the SPA but were not covered by the LTCs in 1992–93. The boundaries of the Ramsar site are entirely coincident with those of the SPA.

There is regular daily movement of at least some species between the Eden Estuary and the Firth of Tay (Elkins and Lynch 1997) and there are plans to investigate such movements further (L. Hatton pers. comm.). The estuary is also a nocturnal roosting site for Pink-footed and Greylag Geese with these birds using the surrounding farmland during the daytime.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1992–93 are presented for eight of the 18 species of principal interest listed above. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.5.3). Of the remaining species, Cormorants were present in very low numbers and the other species

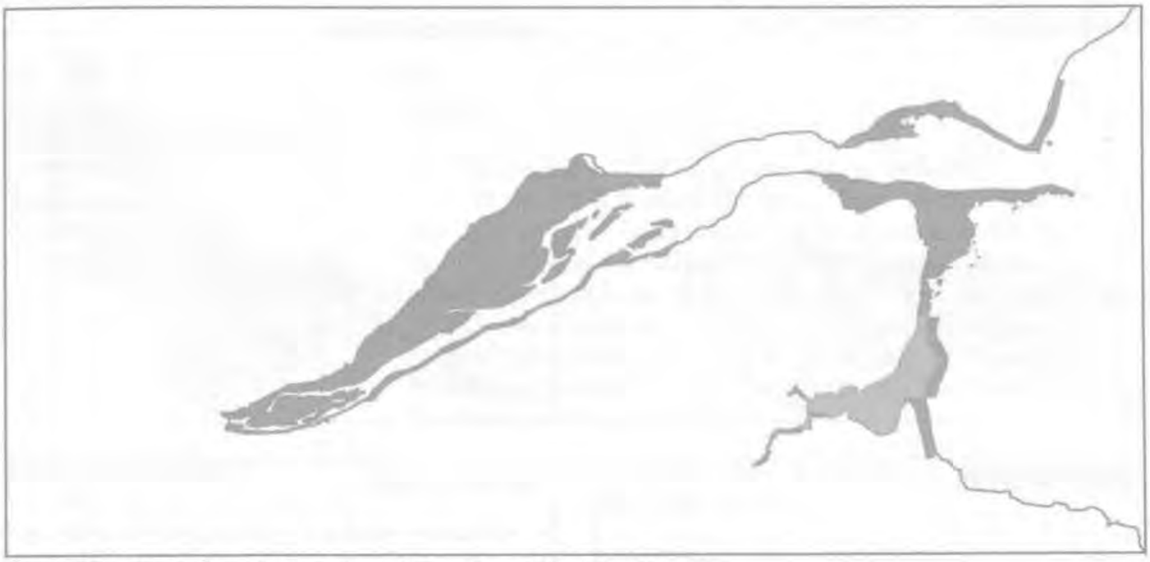


Figure 4.5.2: LTC and SPA boundaries, with overlap, at the Eden Estuary

were unrecorded. Pink-footed and Greylag Geese mainly use the SPA as an overnight roost and most of the remaining wildfowl species occur offshore from West Sands but were absent from the Eden Estuary itself during the counts. However, Goldeneyes and Red-breasted Mergansers are usually present on the estuary throughout the winter and were simply not recorded as the recording form during this first winter of the scheme did not list these species (the methodology of the scheme still being under development). The counters decided to concentrate only upon the intertidal species (L. Hatton pers. comm.).

Both the totals map and the weighted map suggest overall densities which were somewhat higher in the inner parts of the estuary, although the number of count sections was small, reducing the level of definition. Sanderlings and Shelducks were especially found in the outer northern parts of the site, but Grey Plovers and Bar-tailed Godwits showed an opposite pattern, with few in this area. Black-tailed Godwits, for which the Eden is one of the most important sites in Scotland, were mostly confined to the inner estuary, and Dunlin and Redshank, although both widespread, also occurred on the inner estuary at higher densities. Oystercatchers were widespread at a fairly even density.

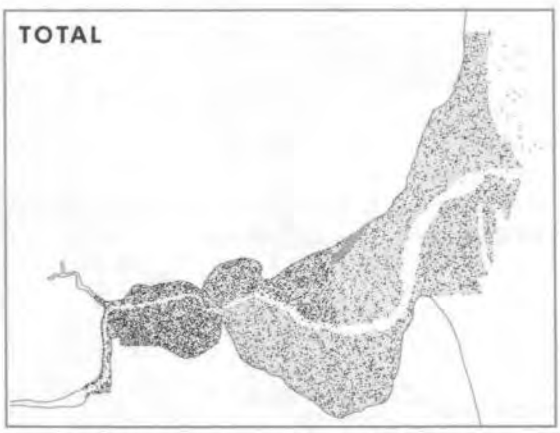


Figure 4.5.3 (i) Low tide waterbird distributions recorded at the Eden Estuary, winter 1992-93

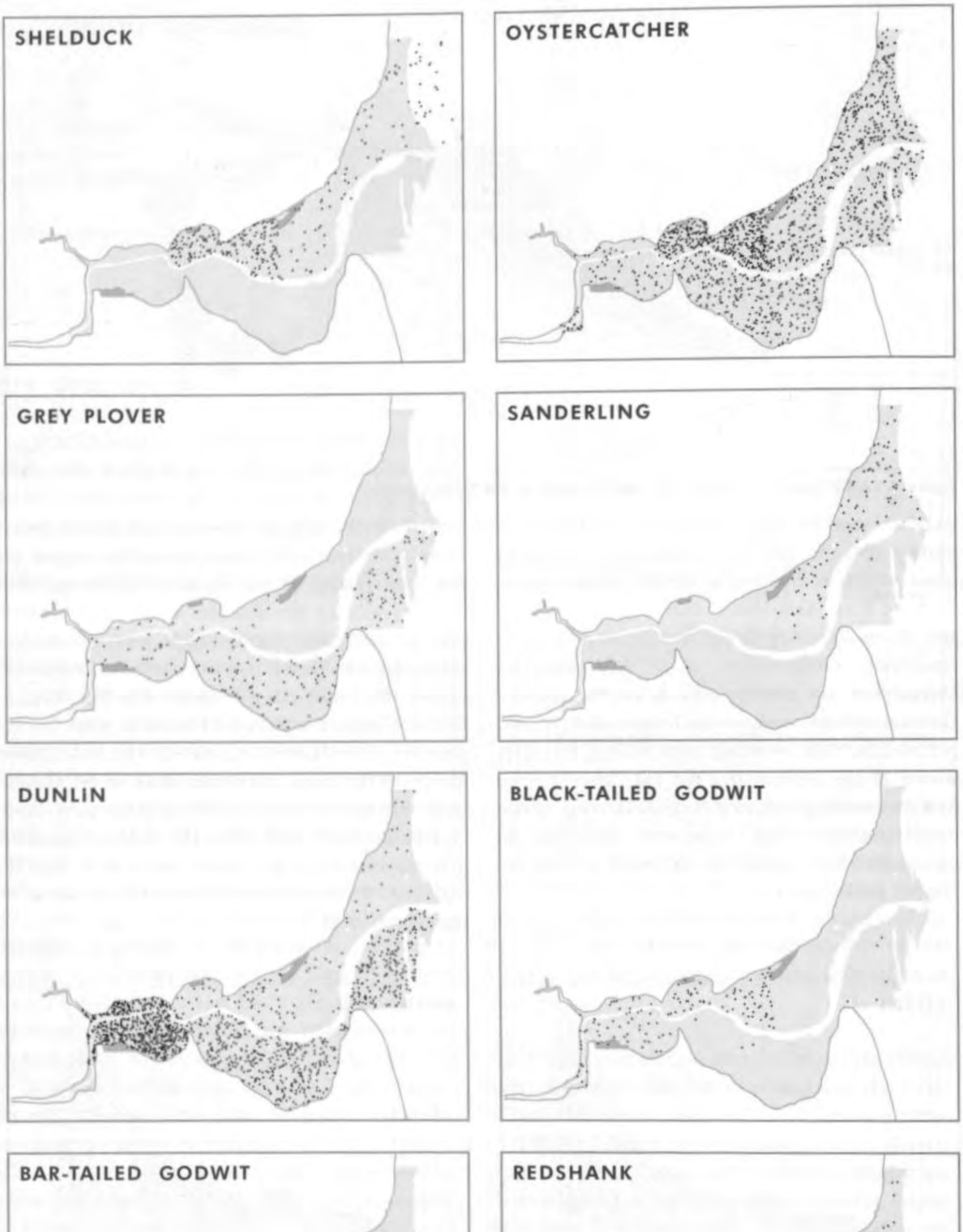


Figure 4.5.3 (ii) Low tide waterbird distributions recorded at the Eden Estuary, winter 1992-93

4.6 FIRTH OF FORTH

LTC site code:	BF
Centre grid:	NT0182
JNCC estuarine review site:	88
Habitat zonation:	5713 ha intertidal, 8032 ha subtidal, 64 ha nontidal
Statutory status:	Firth of Forth SPA (UK9004411), Firth of Forth Ramsar (7UK153)
Winter waterbird interest:	Red-throated Diver, Great Crested Grebe, Red-necked Grebe, Slavonian Grebe, Cormorant, Pink-footed Goose, Shelduck, Wigeon, Mallard, Scaup, Eider, Long-tailed Duck, Common Scoter, Velvet Scoter, Goldeneye, Red-breasted Merganser, Oystercatcher, Ringed Plover, Golden Plover, Grey Plover, Lapwing, Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Turnstone, Waterbird assemblage

SITE DESCRIPTION

The Firth of Forth occupies a large proportion of the coast of south-east Scotland, with the LTC site extending downstream from Stirling as far as Earlsferry on the north shore and North Berwick on the south shore. The inner parts of the site (upstream of the Forth Bridges) have extensive intertidal flats but much of the shore further downstream is essentially non-estuarine in character, with more isolated areas of flats, especially at Aberlady and Gosford Bays, Drum Sands and Musselburgh. Saltmarsh occurs in places around the site, notably between Alloa and Grangemouth and at Aberlady Bay. With such a large site, almost all types of possible human-related activities and disturbance occur, including leisure (onshore and offshore), industry (harbours, an offshore oil terminal, an oil rig repair site, *etc.*), dredging of sea-bed sand and exploitation of natural resources, whilst there is a history of reclamation for industrial uses (H. Dott pers. comm.).

COVERAGE AND INTERPRETATION

The Firth of Forth was counted during the winter of 1992–93, with all four months covered. The Forth is one of the largest sites covered by the LTCs. Figure 4.6.1 shows the positions of the 127 sections counted for the survey.

Figure 4.6.2 shows the overlap between the SPA and LTC areas. With such a large site, it is not feasible to discuss every slight departure in detail and a careful examination should be made by any user of the data. Broadly, however, the SPA extends further downstream than the LTC site, to Fife Ness on the north shore (although a long stretch of shore is not within the SPA) and to Dunbar on the south shore (including the Tyninghame Estuary). Additional areas at Gullane,

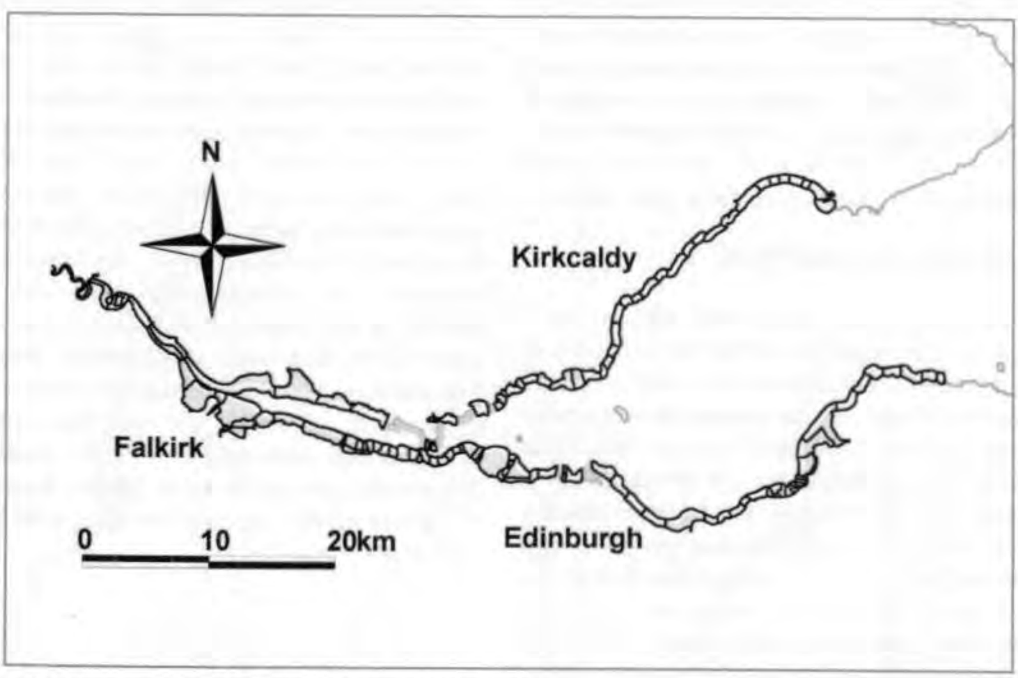


***Figure 4.6.1:** LTC sections at the Firth of Forth, winter 1992–93*

Figure 4.6.2: LTC and SPA boundaries, with overlap, at the Firth of Forth

Grangemouth and around the north end of the Forth Bridges are also included within the SPA. There are a few areas of the firth for which LTCs were carried out but which are not part of the SPA, such as west of Burntisland, parts of the inner firth upstream of the Kincardine Bridge and the south shore just west of the Forth Road Bridge. The boundaries of the Ramsar site are entirely coincident with those of the SPA.

Given that the Forth is such a large site, most bird movements take place within the site (*e.g.* Symonds *et al.* 1984), not to other neighbouring sites. There is no evidence for a daily interchange of birds between the Forth and the Eden Estuary to the north or the Tyninghame Estuary to the south-east (H. Dott pers. comm.). As with most sites, the wild geese on the site are mostly present at night-time roosts, spending the day feeding on surrounding farmland. Sea-duck movements are less clear, with the size of the site giving plenty of opportunity for birds to disperse far offshore.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1992–93 are presented for 22 of the 28 species of principal interest listed above. For clarity, smaller dots are used to display the distributions of several of these species. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.6.3). Of the remaining species, Red-necked and Slavonian Grebes, Scaup and Velvet Scoters were unrecorded during the counts and Red-throated Divers and Common Scoters were recorded in only small numbers. It is unlikely that any of these species were entirely absent. During the 1992–93 winter the methodology of the scheme was still under development and the count form did not list any of the diving ducks or other more marine species. Although some counters recorded some of these species in the 'additional species' boxes on the recording forms, other evidently did not, as the focus of the scheme was on the intertidal habitat. As a result, the distribution maps for Eider, Long-tailed Duck, Goldeneye and Red-breasted Merganser probably should be considered incomplete to varying degrees.

The totals maps show a complex pattern around the site, but do reveal higher overall densities of birds around Aberlady Bay to Port Seton, Edinburgh to the Forth Bridge, either side of Grangemouth and in Largo Bay. Many species were widely distributed although perhaps localised at the smaller scale. Species found mostly on the outer estuary were Eider, Long-tailed Duck, Ringed Plover, Turnstone and Grey Plover. Species more restricted to the inner estuary were Great Crested Grebe and Pink-footed Goose, the latter species using the site mostly as a nocturnal roost. Shelducks and Wigeon were mostly found on the inner firth but also at Aberlady Bay and Burntisland. Black-tailed Godwits were almost exclusively recorded on the flats east of Grangemouth. Although widespread throughout the estuary, concentrations of Golden Plovers and, to a lesser extent, Lapwings were typically highly localised.

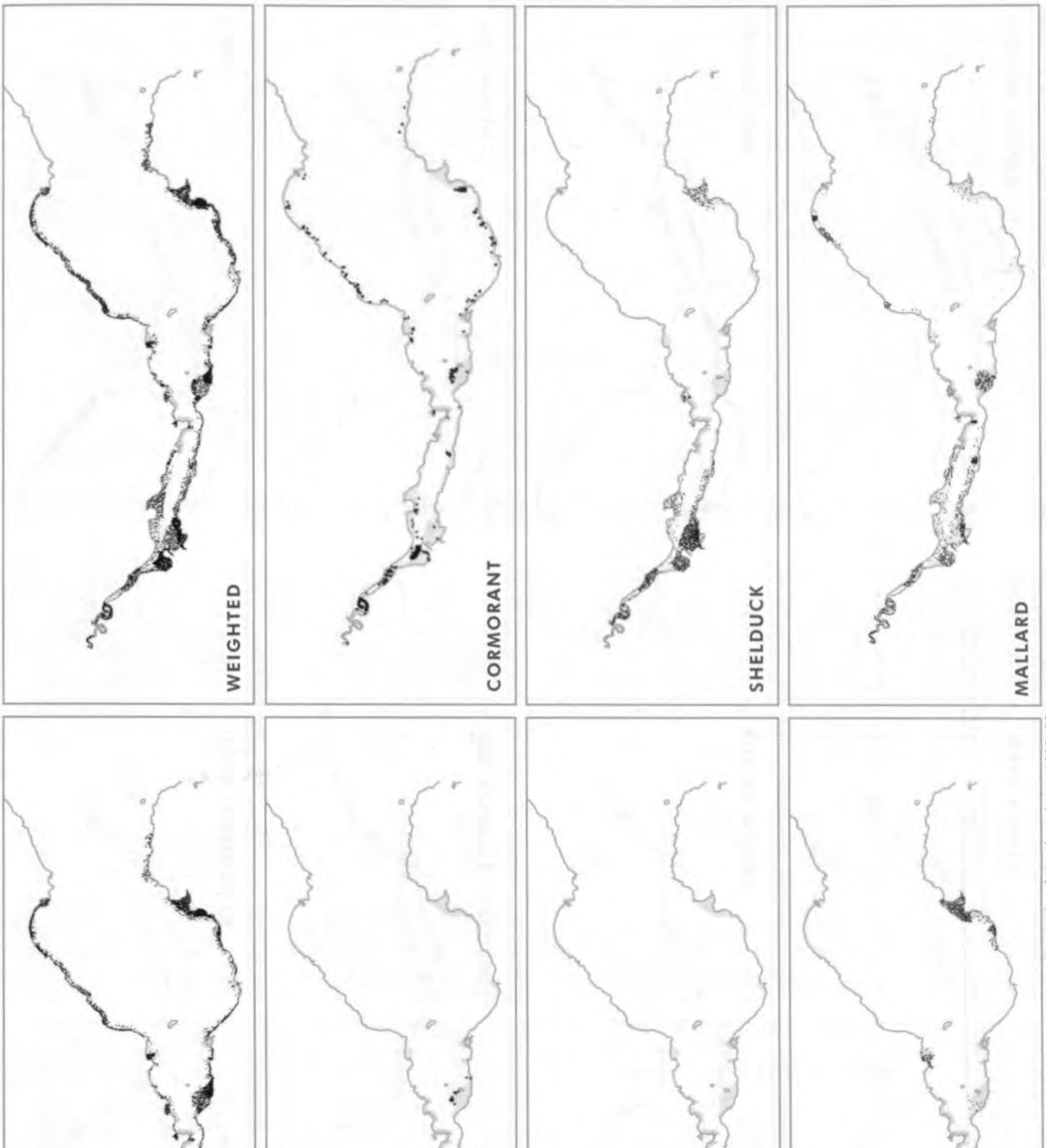


Figure 4.6.3 (i): Low tide waterbird distributions recorded at the Firth of Forth, winter 1992–93

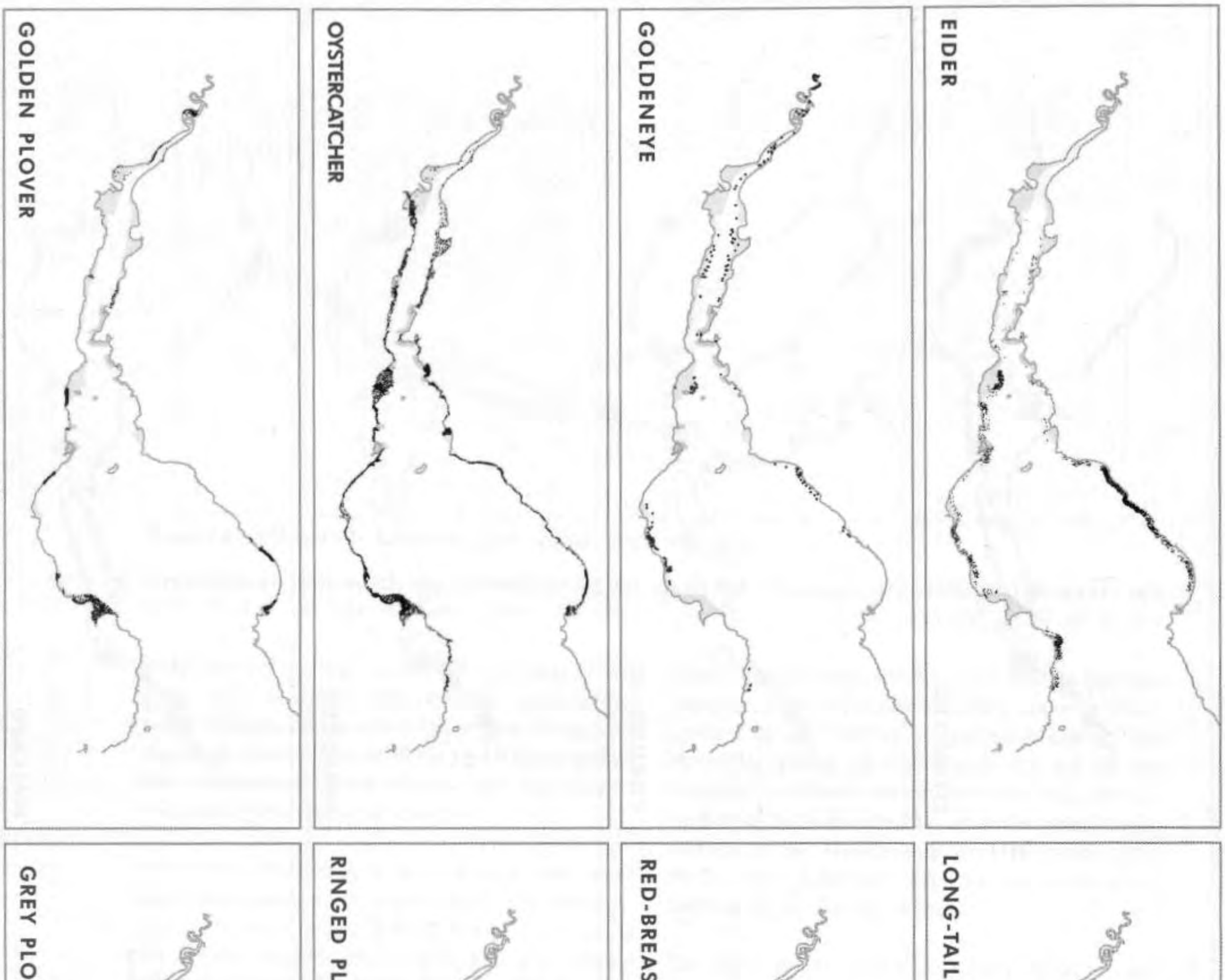


Figure 4.6.3 (ii): Low tide waterbird distributions recorded at the Firth of Forth, winter 1992–93

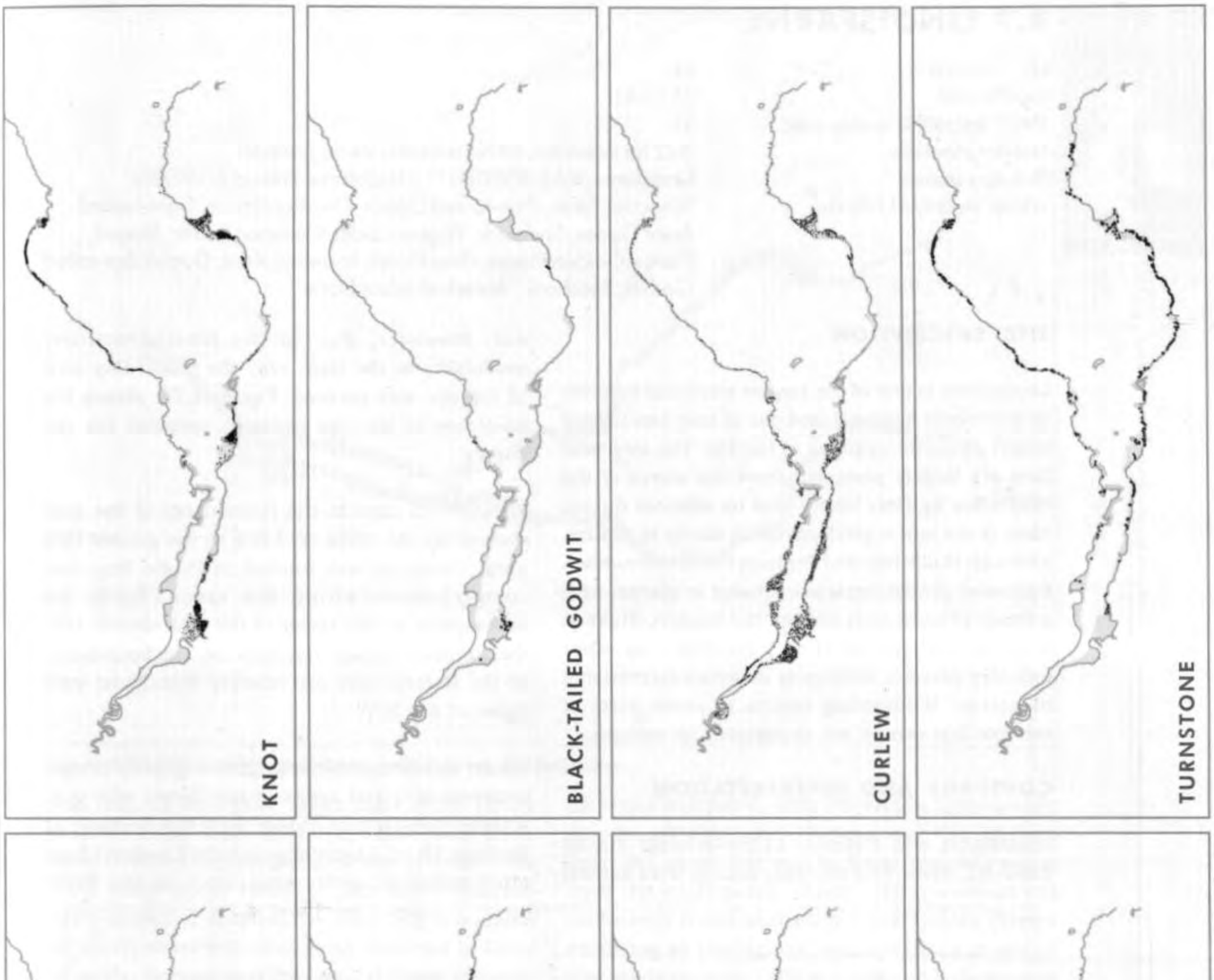


Figure 4.6.3 (iii): Low tide waterbird distributions recorded at the Firth of Forth, winter 1992–93

4.7 LINDISFARNE

LTC site code: DL
Centre grid: NU1141
JNCC estuarine review site: 91
Habitat zonation: 322 ha intertidal, 19 ha subtidal, 24 ha nontidal
Statutory status: Lindisfarne SPA (UK9006011), Lindisfarne Ramsar (7UK005)
Winter waterbird interest: Whooper Swan, Pink-footed Goose, Greylag Goose, Light-bellied Brent Goose, Shelduck, Wigeon, Eider, Common Scoter, Ringed Plover, Golden Plover, Grey Plover, Lapwing, Knot, Dunlin, Bar-tailed Godwit, Redshank, Waterbird assemblage

SITE DESCRIPTION

Lindisfarne is one of the largest intertidal systems in north-east England and one of only two barrier beach estuarine systems in the UK. The intertidal flats are largely protected from the waves of the North Sea by Holy Island and by offshore dunes. Most of the site is predominantly sandy in nature, although Budle Bay and Fenham Flats are muddier. Extensive *Zostera* beds are present in places, with a fringe of saltmarsh around the margin. There is a small harbour on Holy Island but no other industry present, with most activities recreational in nature. Wildfowling occurs in some parts of the site but others are designated as refuges.

COVERAGE AND INTERPRETATION

Lindisfarne was included in the scheme during 1992–93, when four monthly counts were carried out. However, due to the limited counter availability at the time, only the Budle Bay area of the site was covered. Figure 4.7.1 shows the positions of the five sections counted for the survey.

Figure 4.7.2 depicts the relationship of the area covered by the 1992–93 LTCs to the greater SPA area. Coverage was limited to Budle Bay, but comprehensive within this area. Clearly, an assessment of bird usage of the SPA should take this limited coverage into account. The boundaries of the Ramsar site are entirely coincident with those of the SPA.

Whilst movement of waterbirds regularly occurs between different areas of the larger site (e.g. waders roosting at Budle Bay but feeding at Fenham Flats), Lindisfarne is rather isolated from other major estuarine sites, such as the Forth

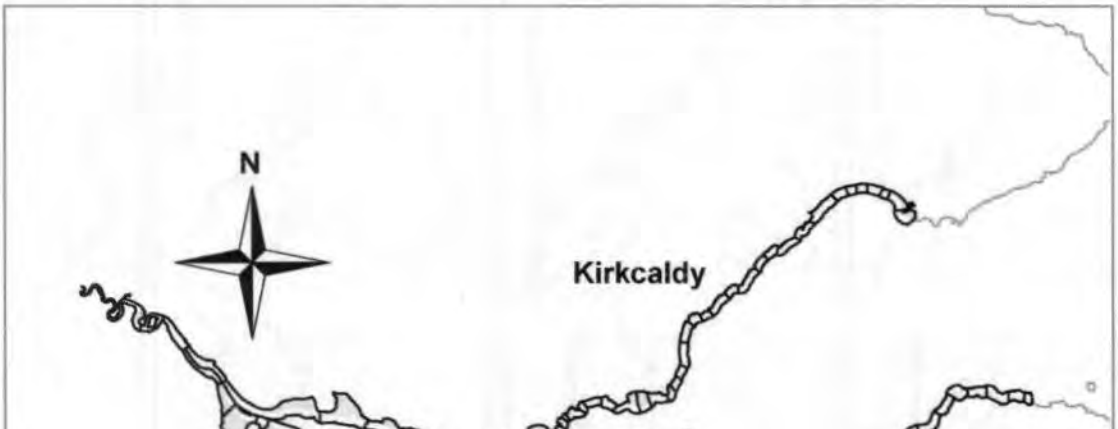


***Figure 4.7.1:** LTC sections at Lindisfarne, winter 1992–93*

ERRATA Lindisfarne pages 44/45

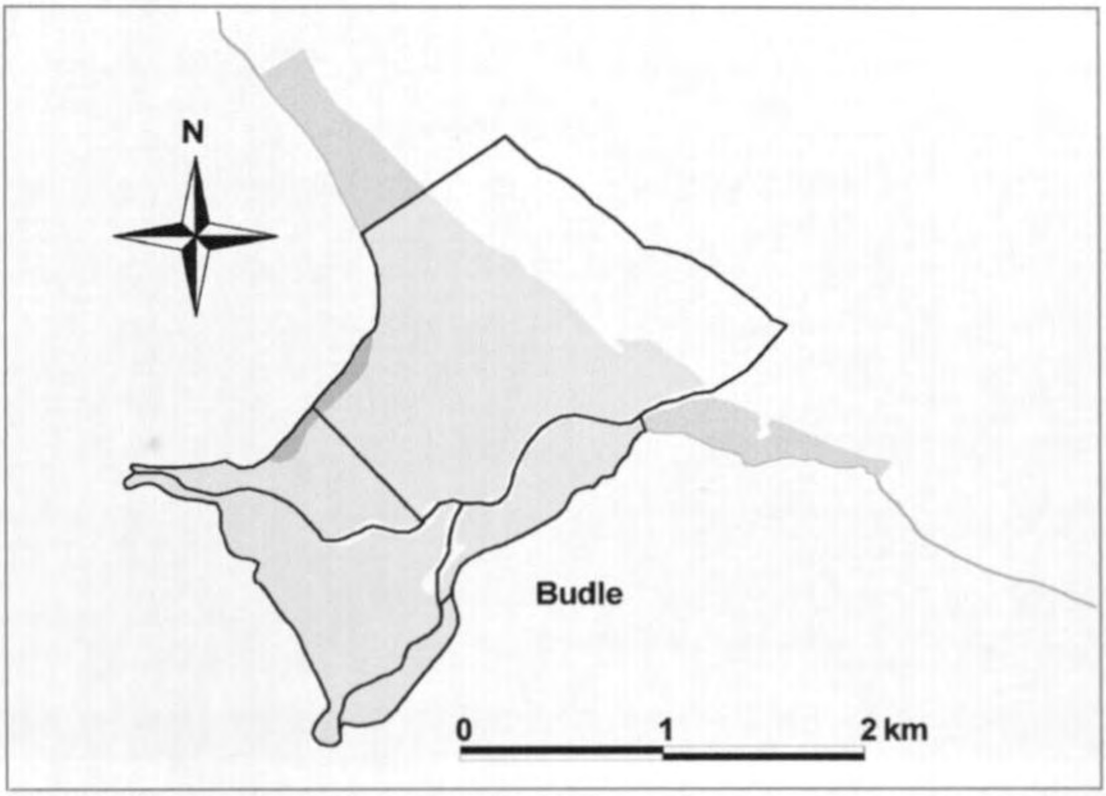


Figure 4.7.1: LTC sections at Lindisfarne, winter 1992-93

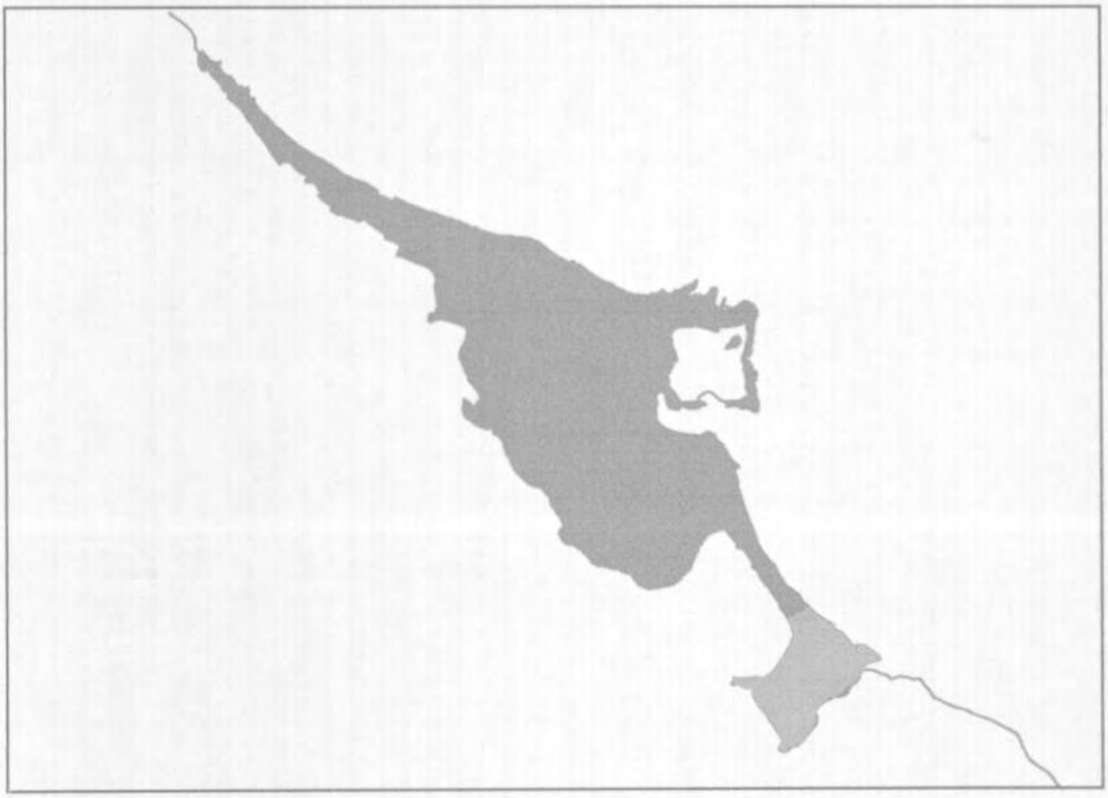


Figure 4.7.2: LTC and SPA boundaries, with overlap, at Lindisfarne

*Figure 4.7.2: **LTC and SPA boundaries, with overlap, at Lindisfarne***

and Tees, or even more minor ones at the Tweed and Alnmouth. It seems unlikely that many birds move between Lindisfarne and any of these sites on a daily basis. However, the non-estuarine coast north and south of the site is highly suitable for many waterbirds and some dispersal is likely to occur. Greylag and Pink-footed Geese disperse inland to feed and also use nearby Holburn Moss as an alternative roost site. Common Scoters and, to a lesser extent, Eiders may move well offshore at times (M. Hodgson pers. comm.).

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1992–93 are presented for 11 of the 16 species of principal interest listed above. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.7.3). Of the remaining species, Whooper Swan, Light-bellied Brent Goose and Common Scoter were not recorded on the part of the site covered by the counts, whilst Pink-footed Goose and Ringed Plover were noted in only very small numbers.

The totals and weighted totals maps shows that the inner part of Budle Bay, especially east of the Waren Burn, was much more densely occupied than the outer bay. The only species mapped showing a preference for the outer bay was Eider (in small numbers), with Redshank fairly evenly distributed. Bar-tailed Godwits and Dunlin both used the outer bay but in lower concentrations than the inner parts. Other waders were almost exclusively found on the inner bay, Golden Plovers occurring in the highest concentrations of any of the waders here. Wigeon was the dominant species of wildfowl, found on all count sections but mostly on the north-west and south-east sections of the inner bay. Small numbers of Greylag Geese (and the few Pink-footed Geese) occurred in the north-west inner bay and Shelducks were found evenly around the inner bay.

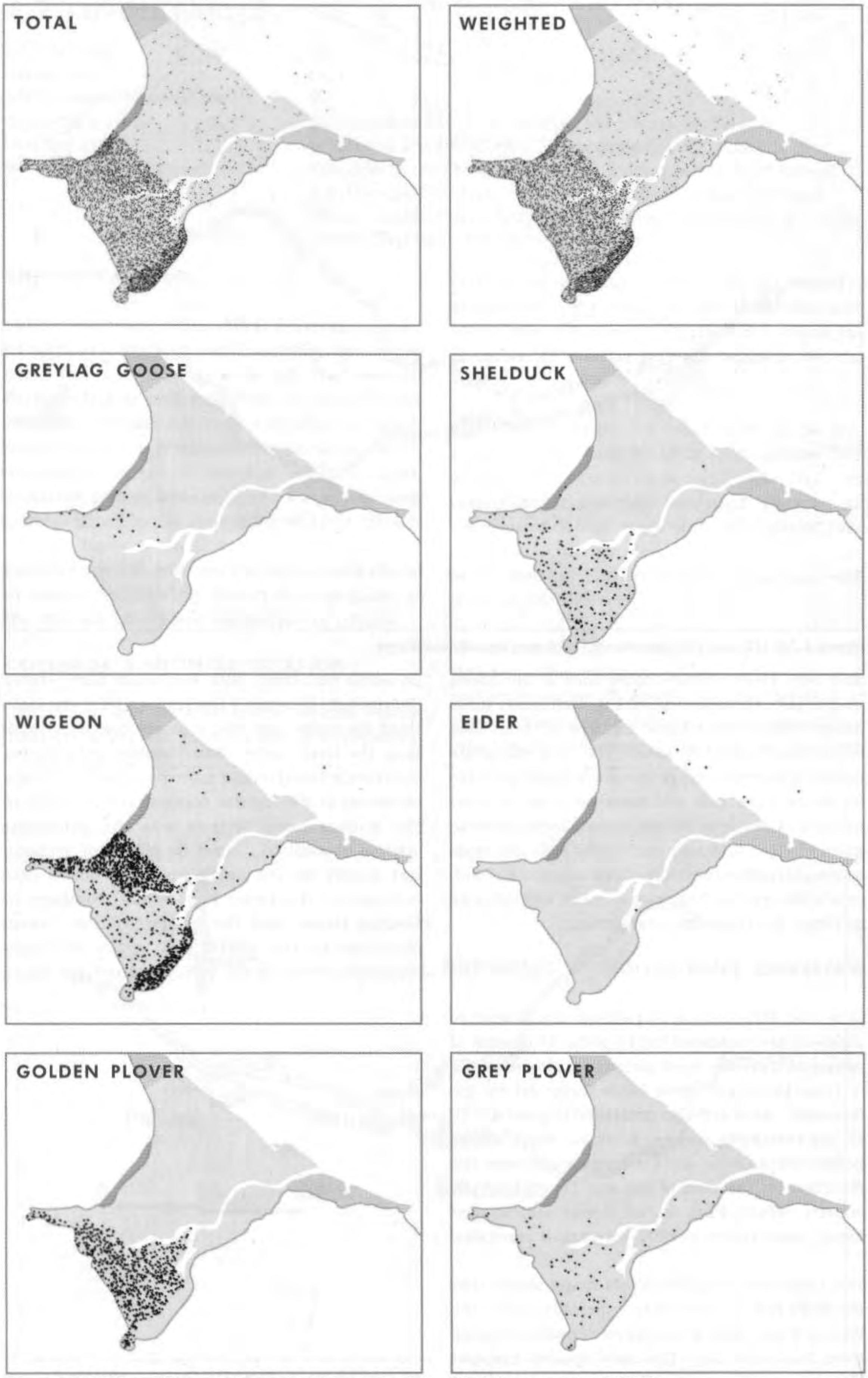


Figure 4.7.3 (i) Low tide waterbird distributions recorded at Lindisfarne, winter 1992-93

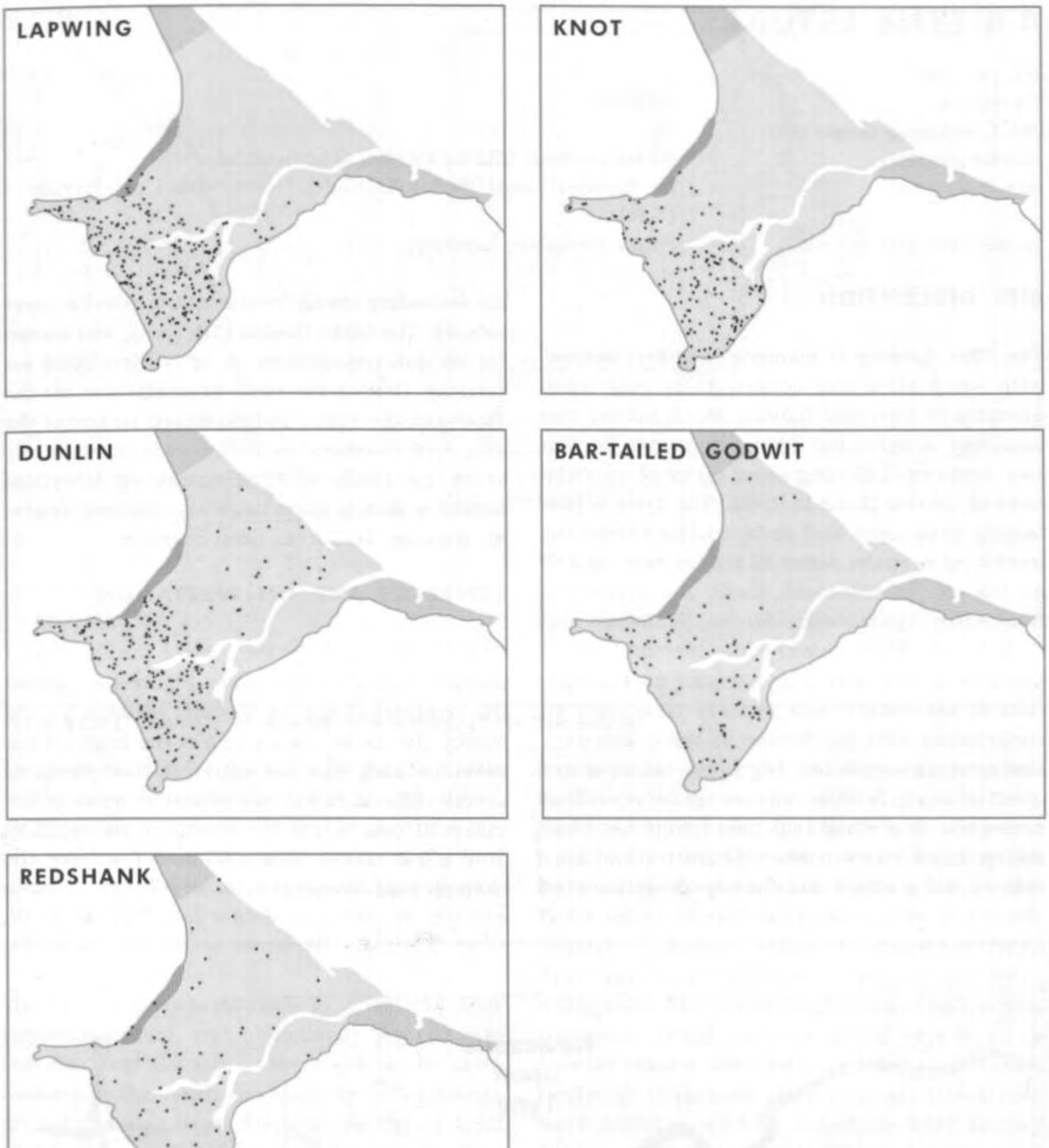


Figure 4.7.3 (ii) Low tide waterbird distributions recorded at Lindisfarne, winter 1992-93

4.8 TYNE ESTUARY

LTC site code: ET
Centre grid: NZ3466
JNCC estuarine review site: 96
Habitat zonation: 89 ha intertidal, 283 ha subtidal, 0 ha nontidal
Statutory status: Northumbria Coast SPA (UK9006131), Northumbria Coast Ramsar (7UK140)
Winter waterbird interest: Purple Sandpiper, Turnstone

SITE DESCRIPTION

The Tyne Estuary is relatively long and narrow, with steep sides and consequently only small amounts of intertidal habitat. Much habitat has been lost to industrial development over the last two centuries, including about 60 ha of intertidal mud at Jarrow Slake in 1992. The Tyne is now largely urbanised and industrialised from the mouth up to Ryton, some 20 km up river. As well as the city of Newcastle itself, the estuary is flanked by Tynemouth, Jarrow, Wallsend and Gateshead. Water quality has inevitably been poor, but is now improving following implementation of secondary and tertiary treatment in conjunction with the decline in heavy industry. Disturbance levels are high and better water quality may further increase recreational pressures. One small high tide refuge has been incorporated in the redevelopment in the upper estuary and a refuge was recently incorporated in the secondary sewage treatment works in the lower estuary. The North Shields Fish Quay, well known for its gull populations, is to be developed for housing. Despite the small intertidal area on the Tyne and the highly industrialised nature of the site, bird numbers have increased dramatically since the 1980s and the remaining intertidal habitat is thus of importance in a regional context (R. Norman, D. Turner pers. comm.).

COVERAGE AND INTERPRETATION

Counts were made for the scheme during all four months of the 1998-99 winter. Figure 4.8.1 shows the positions of the 14 sections counted for the survey. As can be seen, much of the length of the lower estuary was not counted, due partly to access difficulties but also because most of the intertidal flats in the lower estuary are typically only a few metres wide and hold few birds (R. Norman pers. comm.).

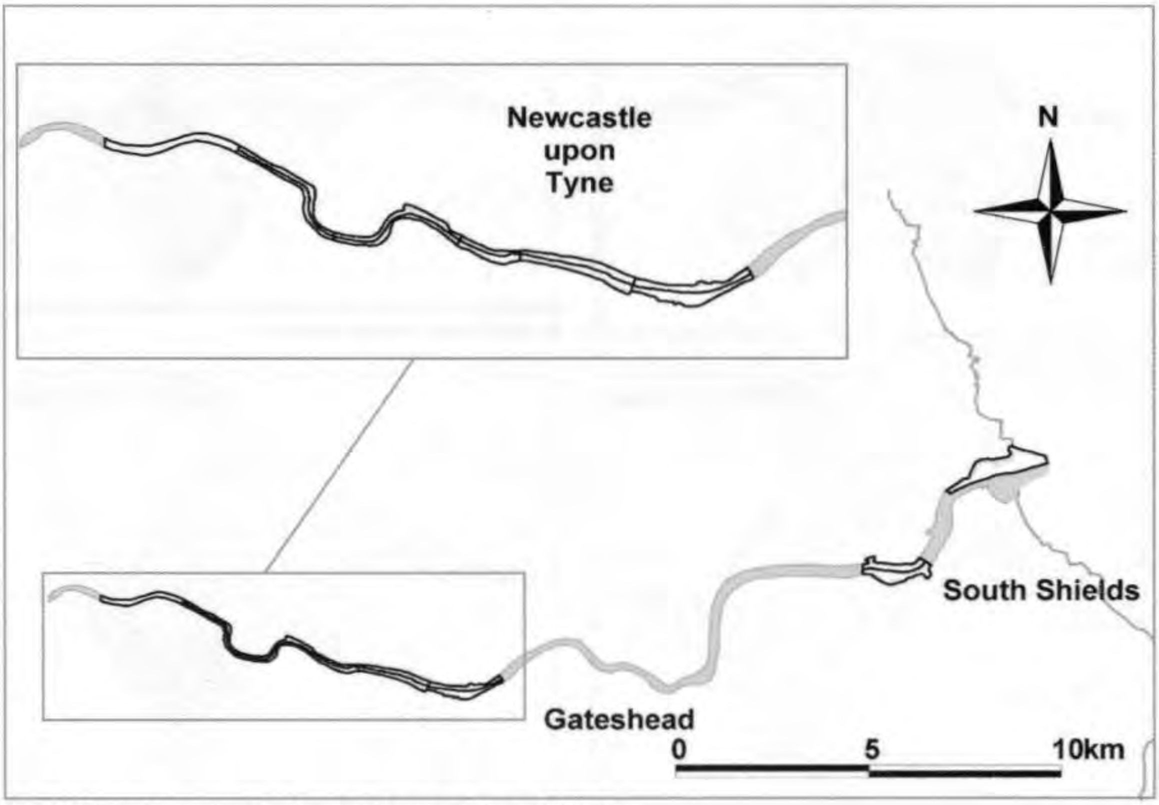


Figure 4.8.1: LTC sections at the Tyne Estuary, winter 1998-99

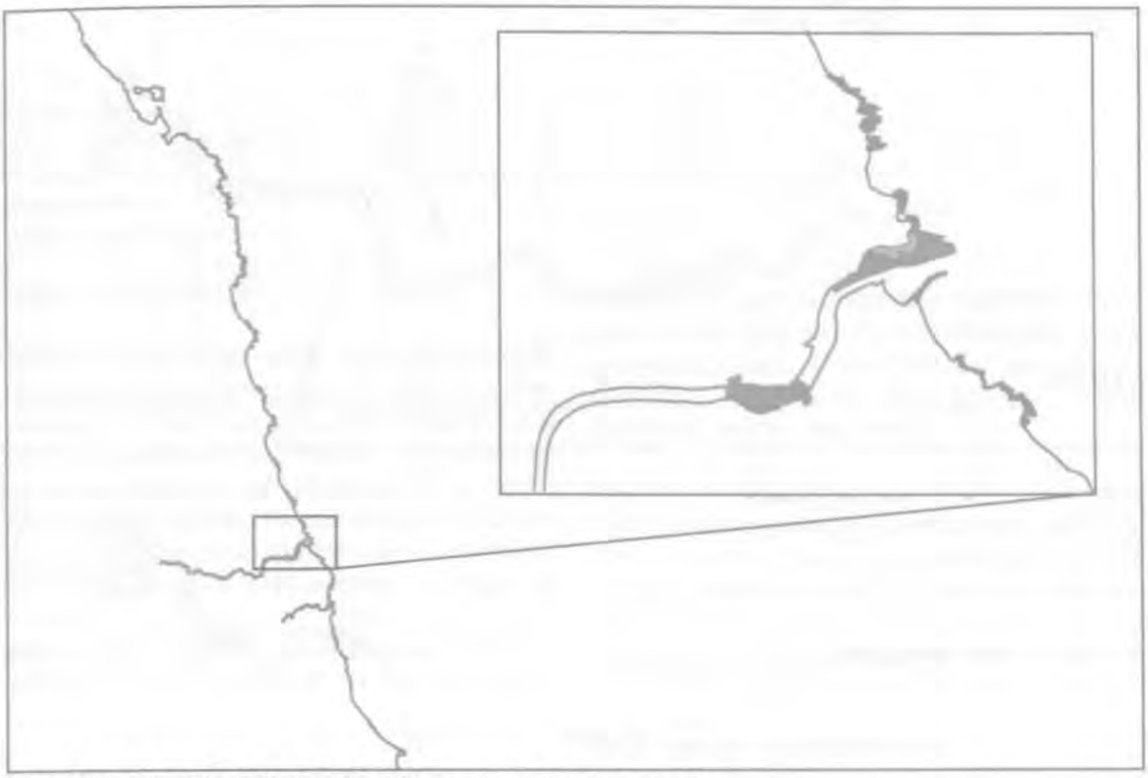


Figure 4.8.2: LTC and SPA boundaries, with overlap, at the Tyne Estuary

The area covered for the LTCs overlaps with the Northumbria Coast SPA but only marginally so, at Tynemouth (Figure 4.8.2). Clearly the LTCs provide few data for an assessment of the bird usage of the SPA (or the equivalent Ramsar site, the boundaries of which are almost entirely coincident with those of the SPA).

The Tyne Estuary is relatively isolated from other estuarine habitat, with interchange between here and the Wear Estuary to the south or the Blyth Estuary to the north not likely to be significant on a day-to-day basis. However, as Figure 4.8.2 shows, the mouth of the estuary overlaps with a stretch of non-estuarine coast which is important for wintering waterbirds and so some interchange here is likely. As at other estuaries, Lapwings and Golden Plovers making use of the estuary also use the surrounding countryside for feeding.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1998–99 are presented for the two species of principal interest listed above. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.8.3).

Given the very narrow shore width over much of the site, bird densities can be relatively high. The key area in the upper estuary was between Redheugh Bridge and Derwenthaugh, with large flocks of waders using the mudflats on the south bank at low tide. The maps show that all of the Purple Sandpipers and almost all of the Turnstones recorded at the site occurred at North Shields, the area which overlaps the SPA. Amongst other species, Cormorants were widespread, with slightly higher densities towards the mouth. Small numbers of Teal were found in several places, the majority located between Redheugh Bridge and Derwenthaugh. Redshanks were widespread but densities were higher towards the mouth. Golden Plovers were localised into a few dense flocks, as is typical for this species.

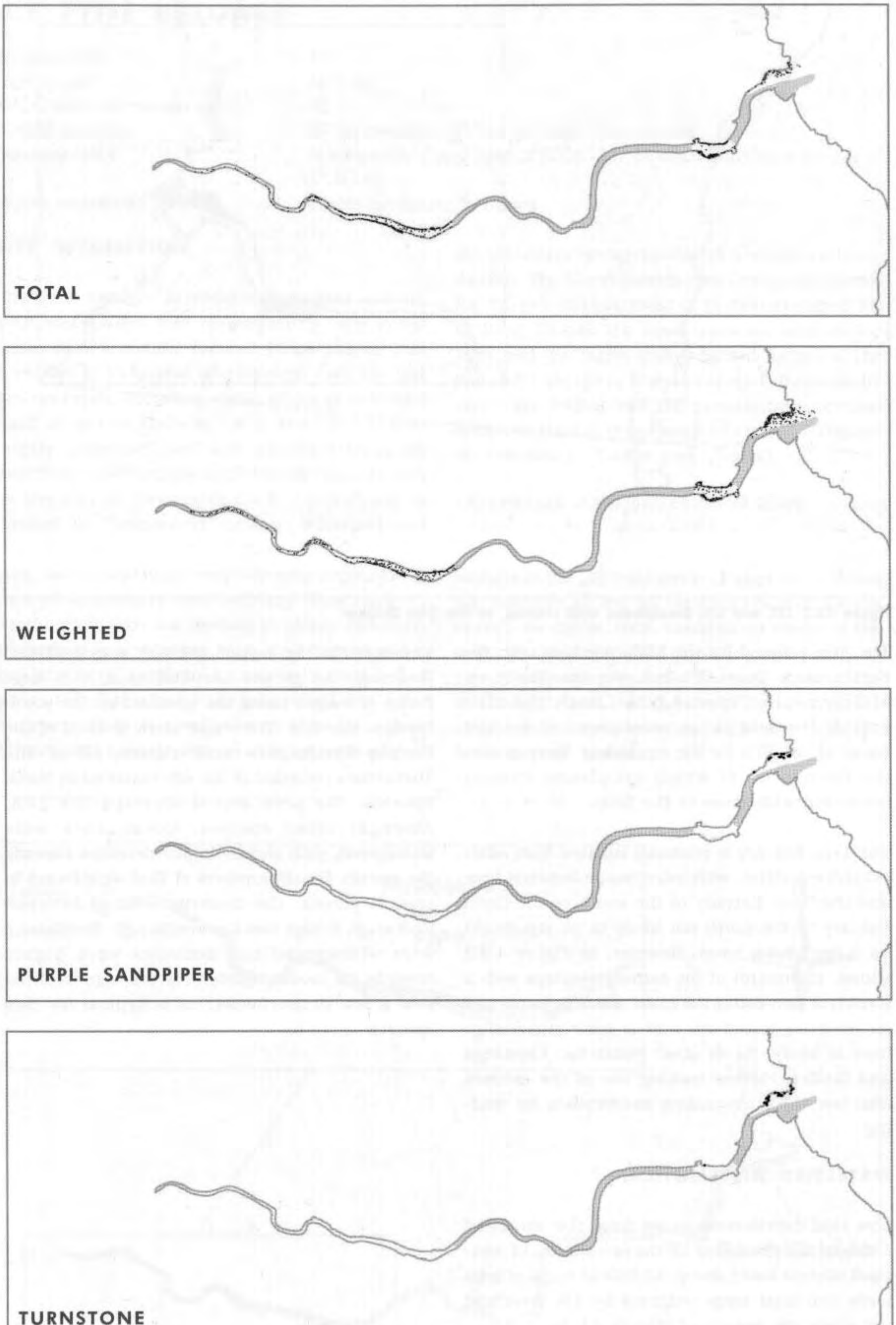


Figure 4.8.3: Low tide waterbird distributions recorded at the Tyne estuary, winter 1998-99

4.9 WEAR ESTUARY

LTC site code: CW
Centre grid: NZ3958
JNCC estuarine review site: 97
Habitat zonation: 20 ha intertidal, 42 ha subtidal, 0 ha nontidal
Statutory status: N/A
Winter waterbird interest: N/A

SITE DESCRIPTION

The river Wear flows down from the northern Pennines through the county of Durham before entering the North Sea at the port of Sunderland. The river is estuarine in character up to about as far as the Wildfowl and Wetlands Trust (WWT) centre at Washington. The estuary is very narrow and no mudflats of appreciable size are present. Around Washington WWT reserve, the estuary is flanked by parkland and farmland, but it soon enters the highly industrialised city of Sunderland, where pollution and general disturbance are an issue.

COVERAGE AND INTERPRETATION

The Wear Estuary was counted for the scheme during the four months of the 1995–96 winter. Figure 4.9.1 shows the positions of the 19 sections counted for the survey. It should be noted that coverage was patchy, partly due to access and partly due to a perceived lack of birds on some parts of the site.

The Wear Estuary overlaps with one SSSI but this (Wear River Bank SSSI) is designated only for its geological interest. At the mouth of the estuary, the area covered for the LTCs does not overlap the Northumbria Coast SPA.

The site is quite isolated from other estuaries and daily movements between here and the Tyne (to the north) or Tees (to the south) would seem unlikely. Interchange with adjacent non-estuarine habitats is likely, such as along the adjacent non-estuarine coastal shorelines, or with the Washington WWT reserve and other terrestrial habitats.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1995–96 are presented for total birds and total birds weighted by 1% threshold value (Figure 4.9.2).

The totals maps suggest that most bird interest was between the A19 bridge and the Queen

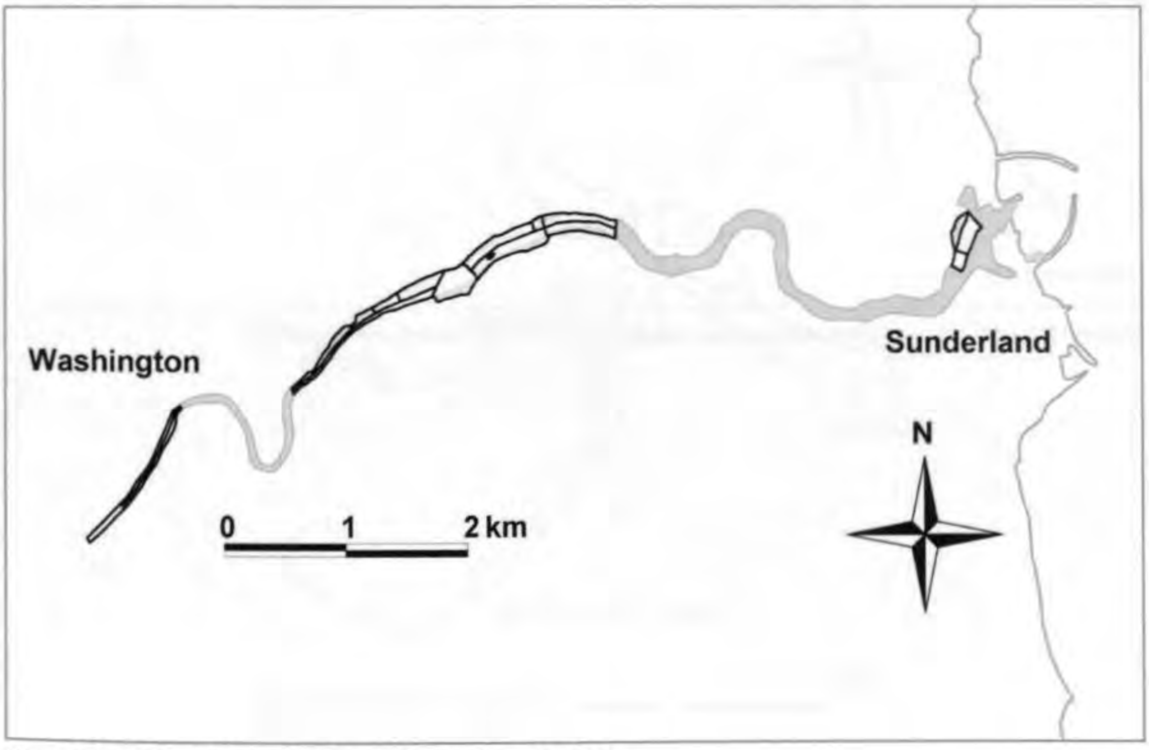


Figure 4.9.1: LTC sections at the Wear Estuary, winter 1995–96

Alexandra bridge, although they should be interpreted with care, given the partial coverage of the site. Overall density on the count sections near the mouth of the estuary was very low. Amongst the individual species, Goldeneyes were very localised along the north shore north of Pallion, with Lapwings concentrated along the south shore just upstream of here. Dunlin were more widely distributed within the area between the A19 and Queen Alexandra bridge. Curlews and Redshanks were found over most of the parts of the site that were counted.

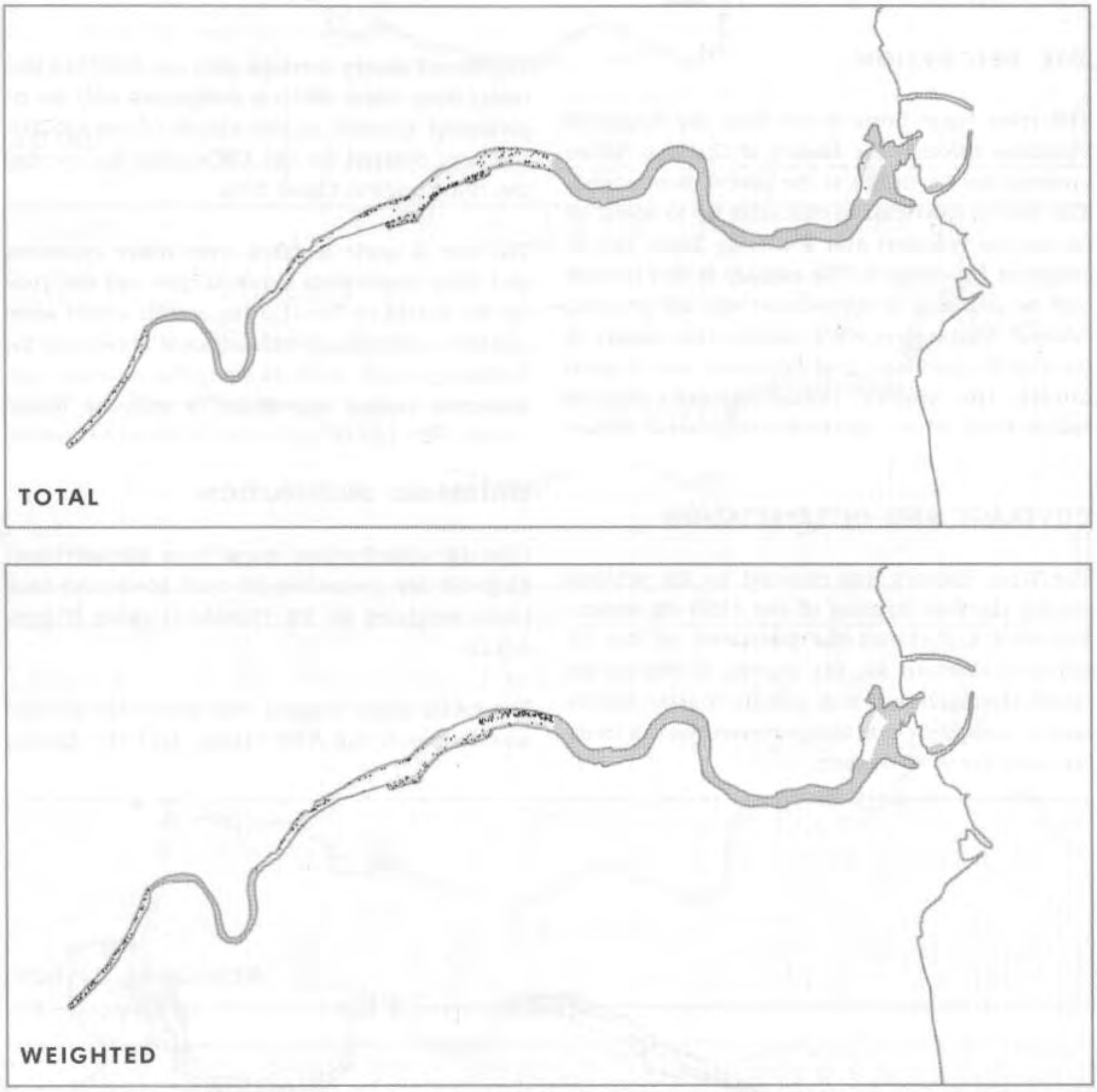


Figure 4.9.2: Low tide waterbird distributions recorded at the Wear Estuary, winter 1995-96

4.10 TEES ESTUARY

LTC site code:	DT
Centre grid:	NZ5326
JNCC estuarine review site:	98
Habitat zonation:	574 ha intertidal, 1172 ha subtidal, 82 ha nontidal
Statutory status:	Teesmouth and Cleveland Coast SPA (UK9006061), Teesmouth and Cleveland Coast Ramsar (7UK089)
Winter waterbird interest:	Little Grebe, Cormorant, Shelduck, Shoveler, Lapwing, Knot, Sanderling, Redshank, Waterbird assemblage

SITE DESCRIPTION

The Tees Estuary is the largest and most important estuarine site on a long stretch of the east coast between the Humber and Lindisfarne. The surveyed site includes the lower estuary of the River Tees, the adjacent Greatham Creek and Seal Sands, along with the associated sandy beaches of Tees Bay between Hartlepool and Redcar. The Tees Estuary has suffered greatly from habitat loss caused by land-claim; around 3,300 hectares of intertidal land have been lost since 1720, initially for agriculture but latterly for industrial and port-related development, including the Tees Barrage. The result is a highly industrialised estuary, dominated by heavy industry and petrochemical plants, which pose a potential pollution threat to the site's wintering waterfowl. However, given that little or no new land-claim is likely, more serious long-term impacts are thought to derive from sediment change (the incursion of coarser marine sediments) and the development of dense mats of *Enteromorpha* algae. Bran Sands, which lies close to the South Gare breakwater, is very heavily exploited by bait collectors. There is also disturbance from watersports around the estuary mouth and from beach recreation along some stretches of Tees Bay (M. Leakey, R. Ward pers. comm.).

COVERAGE AND INTERPRETATION

Low tide counts of the Tees took place during the four months of the 1996–97 winter. Figure 4.10.1 shows the positions of the 28 sections counted for the survey. The peripheral non-tidal wetlands were not counted for the LTCs.

Figure 4.10.2 shows how the LTC and SPA

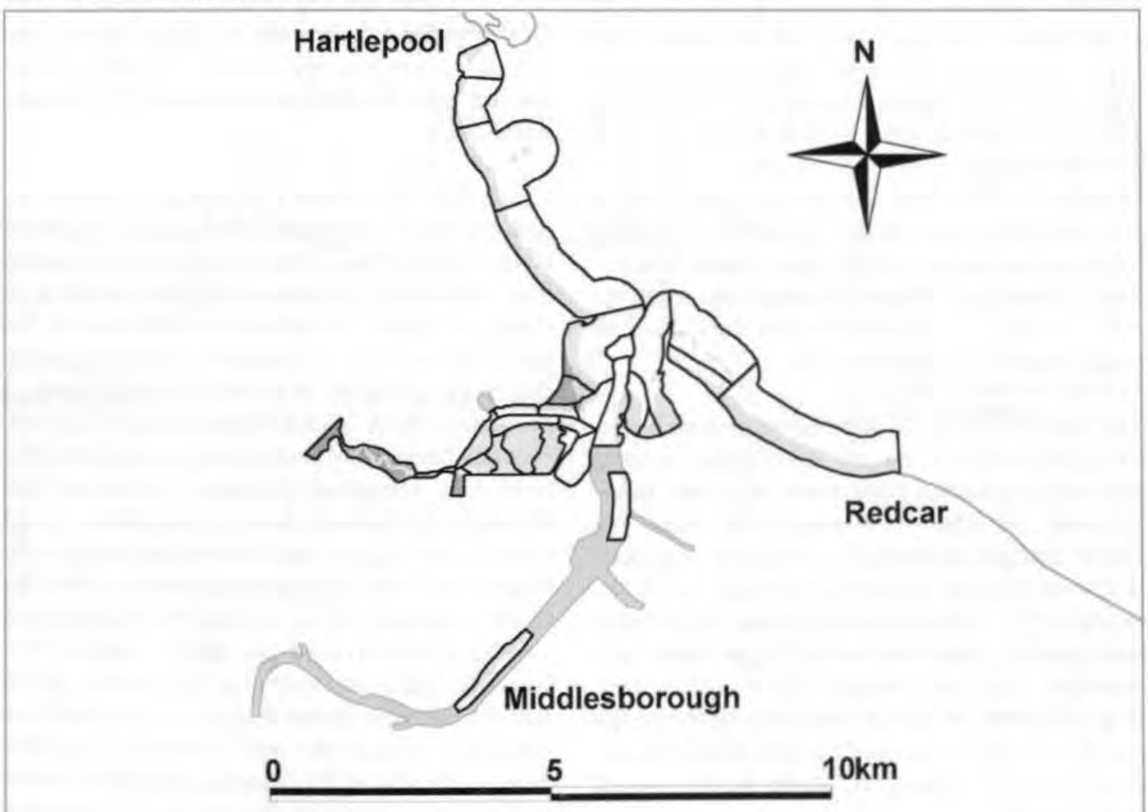


Figure 4.10.1: LTC sections at the Tees Estuary, winter 1996–97

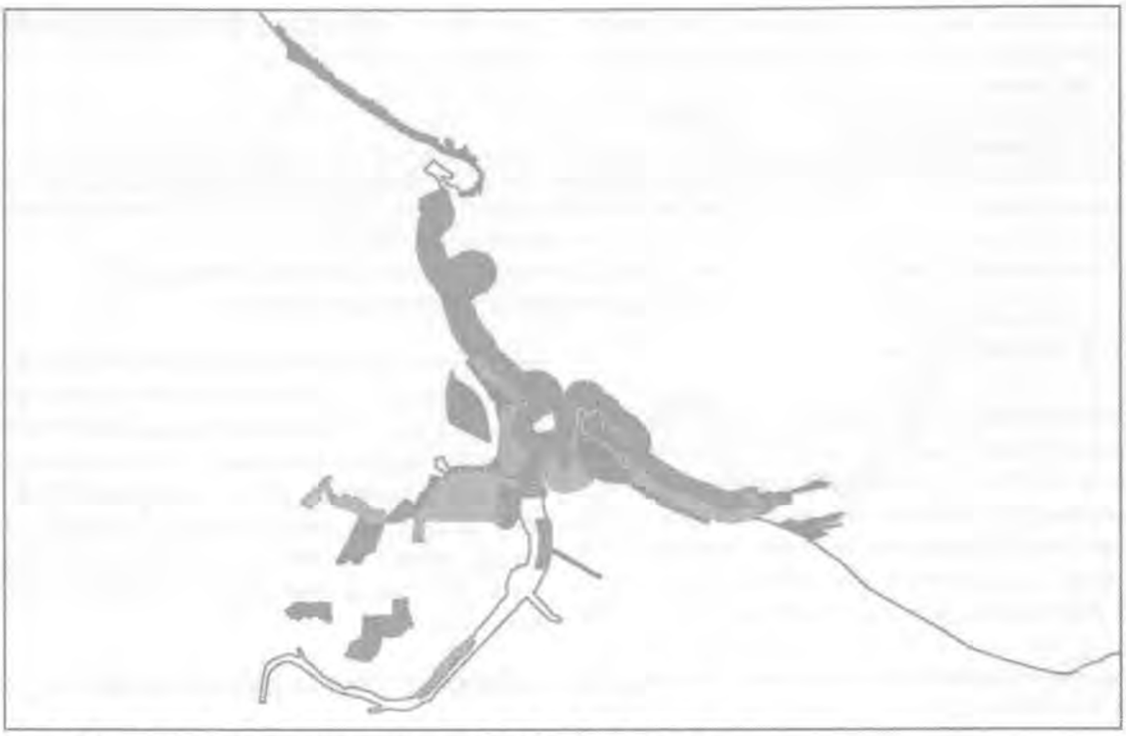


Figure 4.10.2: LTC and SPA boundaries, with overlap, at the Tees Estuary

boundaries overlap. The large amount of land-claim and industrial development around the Tees has led to a very fragmented estuarine system, as can be seen from the SPA boundary. Much of the area designated as SPA is covered by the counts. The major areas which were not covered were the non-estuarine shore on and to the north of Hartlepool headland, some of the rocky scars off Redcar and the non-tidal marshes and freshwater pools. Areas covered by the LTCs but not designated as SPA included the shoreline between Seaton Carew and Hartlepool, the east bank of the River Tees around Dabholm Gut and the mudflats on the north bank of Seaton Channel, adjacent to Hartlepool Power Station. The Ramsar site covers a smaller area than the SPA, notably not including the mudflats along the main channel of the River Tees.

The Tees Estuary is very isolated from other estuarine systems and no interchange of birds with other estuaries takes place on a daily basis. However, the adjacent non-estuarine shores are highly suitable habitats for a number of species and interchange occurs on a daily basis, as evidenced by observations of colour-ringed birds and general observation of flight-lines. For example, Knot are known to feed and roost in large numbers on and to the north of Hartlepool Headland as well as to Coatham Rocks to the south-east (M. Leakey, R. Ward, M. Pienkowski pers. comm.).

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1996–97 are presented for six of the eight species of principal interest listed above. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.10.3). Of the remaining species, no Little Grebes and very few Shovelers were recorded, these species making more use of the adjacent non-tidal wetland habitats.

The totals map shows the highest densities on Seal Sands, at Greatham Creek and upstream along the river Tees, whilst the weighted map gives less emphasis to Greatham Creek but more to Coatham Sands, as well as an area towards the mouth of the river at Teesport, the latter largely due to the presence of a flock of Scaup there in February 1997. The northern outer beaches, between North Gare and Hartlepool, appeared to hold low densities of birds, although the difficulties of viewing birds on the offshore Long Scar may have given a somewhat false impression. Cormorants were widespread, especially around South Gare and Bran Sands. Shelducks were mostly concentrated on Seal Sands, with Lapwings highly concentrated at Greatham Creek and Sanderlings showing a clear preference for the outer parts of the site, especially Coatham Sands. Knot and Redshank were both more widespread, although the former showed a tendency towards the outer estuary and the latter towards the inner estuary.

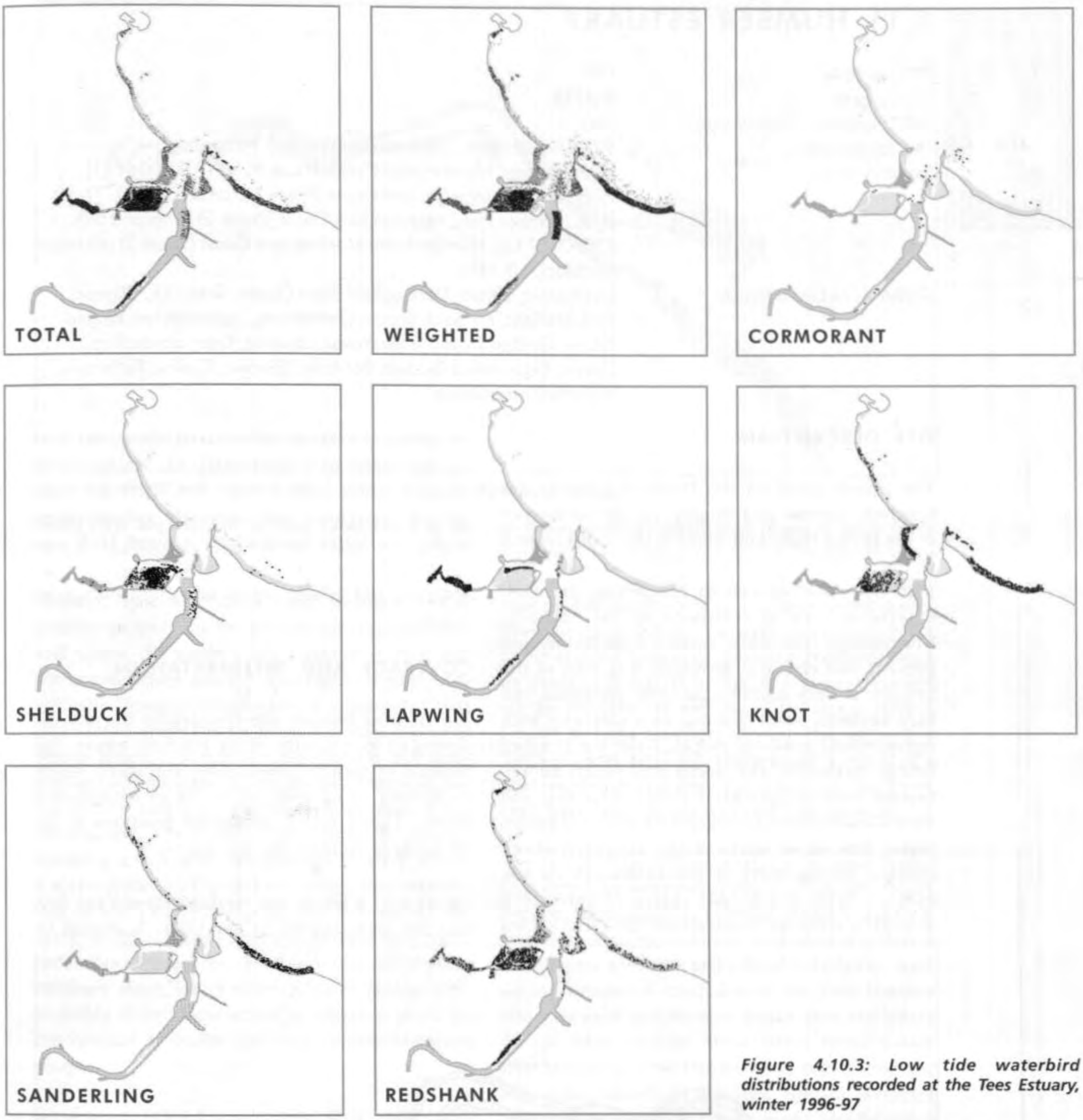


Figure 4.10.3: Low tide waterbird distributions recorded at the Tees Estuary, winter 1996-97

4.11 HUMBER ESTUARY

LTC site code:	CH
Centre grid:	TA2118
JNCC estuarine review site:	100
Habitat zonation:	9246 ha intertidal, 7525 ha subtidal, 863 ha nontidal
Statutory status:	Humber Flats, Marshes and Coast (Phase 1) SPA (UK9006111), Humber Flats, Marshes and Coast (Phase 1) Ramsar (7UK077) [Also Humber Flats, Marshes and Coast (Phase 2) proposed SPA (UK9006112), Humber Flats, Marshes and Coast (Phase 2) proposed Ramsar (7UK145)]
Winter waterbird interest:	Cormorant, Bittern, Dark-bellied Brent Goose, Shelduck, Wigeon, Teal, Mallard, Pochard, Scaup, Goldeneye, Oystercatcher, Ringed Plover, Golden Plover, Grey Plover, Lapwing, Knot, Sanderling, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Waterbird assemblage

SITE DESCRIPTION

The upper parts of the Humber estuary are relatively narrow and muddy. At the confluence of the Rivers Ouse and Trent is the RSPB reserve of Blacktoft Sands which acts as an important high tide roost as well as comprising the most extensive area of reedbeds in the estuary. Downstream from here, several large islands are present mid-channel, although this part of the estuary is very mobile and their positions can vary between years (leading to a disparity with commercially available maps). From the Humber Bridge outwards, the north and south shores become increasingly distant from one another and the mudflats widen, reaching their widest at Spurn Bight. The outer parts of the southern shore contain the majority of the saltmarsh on the estuary, with the actual extent of saltmarsh around Grainthorpe much greater than that shown on currently available commercial maps (and thus on the maps here presented) (J. Walker pers. comm.). Being such a large site, there are both natural shorelines and extremely industrialised areas, the latter particularly around Hull and Grimsby. The petrochemical industry, commercial shipping and fishing are all important industries locally.

COVERAGE AND INTERPRETATION

The Humber Estuary was counted for the scheme during all four months of the 1998–99 winter. For reasons of counter availability, the south shore could only be covered out as far as Grainthorpe Haven. Figure 4.11.1 shows the positions of the 43 sections counted for the survey.

Figure 4.11.2 shows the overlap between the SPA and the area covered by the LTCs. It should be

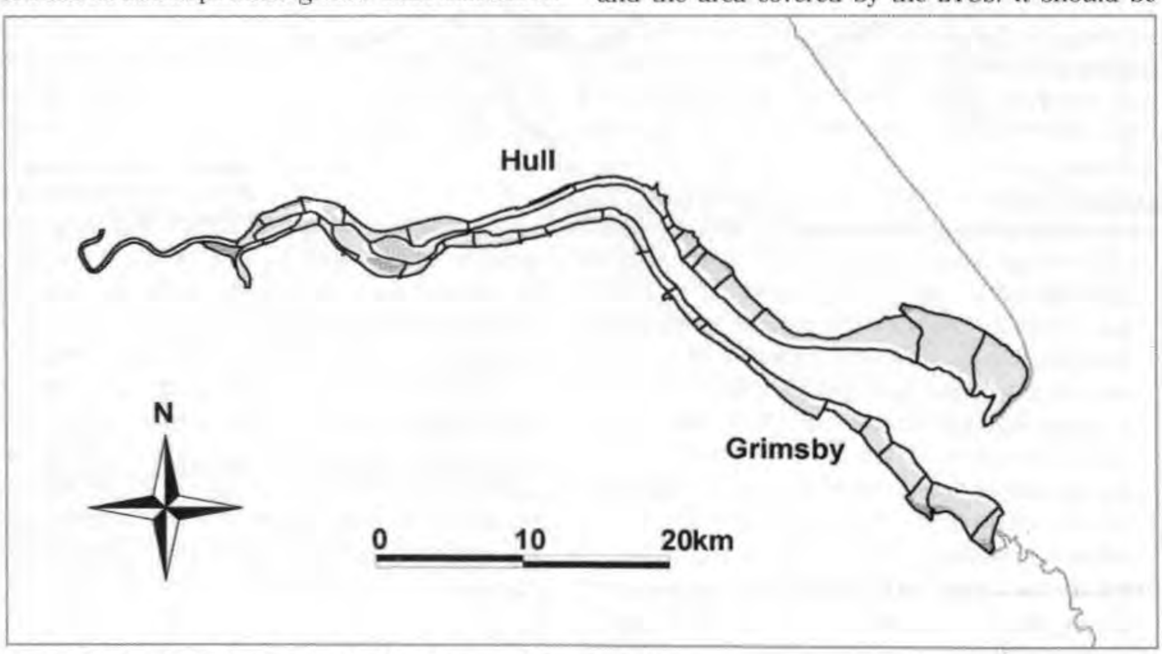


Figure 4.11.1: LTC sections at the Humber Estuary, winter 1998–99

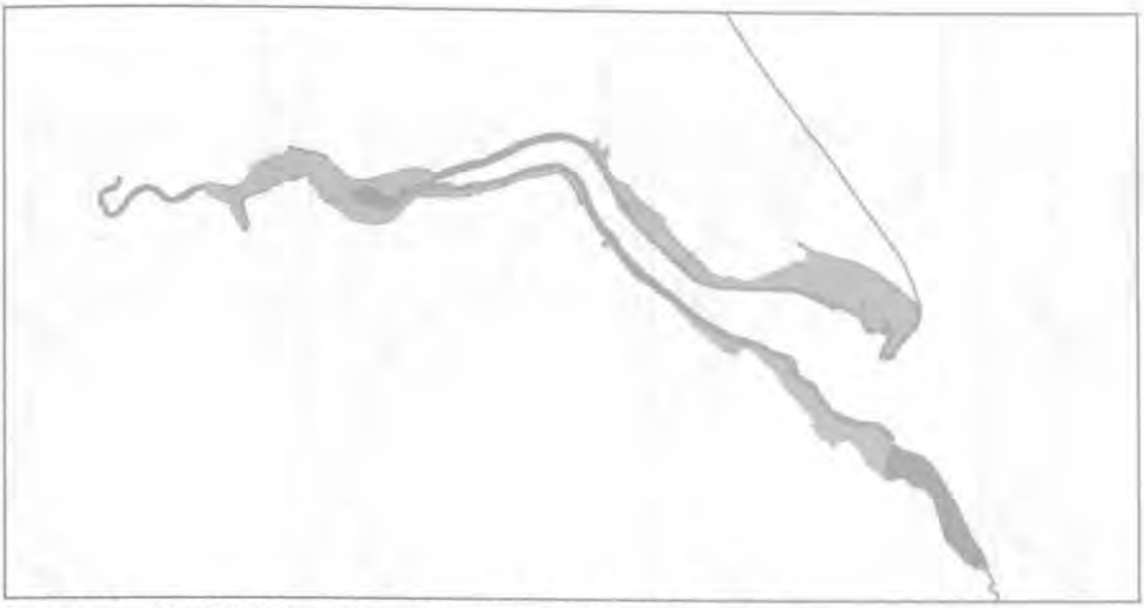


Figure 4.11.2: LTC and SPA boundaries, with overlap, at the Humber Estuary

noted that the Humber is being designated as an SPA in two phases. Most of the Phase 1 area was covered by the LTCs, except for the outer south Humber. However, some areas counted for the scheme (notably the River Ouse between Blacktoft and Goole, the north shore adjacent to Hull and the south shore around Immingham) were outwith the Phase 1 designation. It is intended that these latter areas will be, in part at least, included within Phase 2 of the SPA designation (following preliminary designation as SSSIs), although the boundary has not, at time of writing, been determined. The Ramsar site status is similar, involving a two-phase designation, of which Phase 1 is complete and Phase 2 is ongoing. The boundaries of the Phase 1 Ramsar site are almost the same as those of the equivalent SPA, the slight differences being due to digitisation of slightly different mean low water marks in places, presumably from maps made in different years as the estuary is mobile and has an ever-changing shape.

With such a large site, most short-term bird movements take place within the site as opposed to movements to other sites. Some dispersal takes place north and south along the coast and upstream along the Rivers Ouse and Trent. The large flocks of grassland plovers also disperse inland to feed during the day.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1998–99 are presented for 20 of the 22 species of principal interest listed above. For clarity, smaller dots are used to display the distributions of many of these species. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.11.3). Of the remaining species, low numbers of Scaup were noted during the counts and Bitterns were unrecorded; the latter species frequents adjacent reedbeds such as those at Blacktoft Sands. Scaup were present on the Humber (as well as on the North Norfolk Coast) in high numbers during the winters of 1995–96 and 1996–97, perhaps as a result of a cold-weather influx from the continent, but numbers have been much reduced subsequently.

The totals maps shows that the highest overall bird densities occurred at Blacktoft Sands, South Ferriby, Goxhill Haven, Pyewipe, Saltend and Little Humber. The weighted total map generally mirrors this picture with only slight local differences, such as an increased emphasis of the New Holland shore. Several species were found more commonly on the outer estuary, these being Brent Goose, Oystercatcher, Grey Plover, Knot, Sanderling and Bar-tailed Godwit. In contrast, species occurring completely or predominantly on the inner estuary were Wigeon, Teal and Mallard. The latter species, along with Pochard, Tufted Duck, Goldeneye and Mute Swan, were present in their highest concentrations around the jetty at New Holland where grain is spilt during unloading of ships. Black-tailed Godwits were highly localised, although numerous, in the Pyewipe area, a relatively recent development. Cormorant, Shelduck, Ringed Plover, Golden Plover, Lapwing, Dunlin, Curlew and Redshank were more widespread.

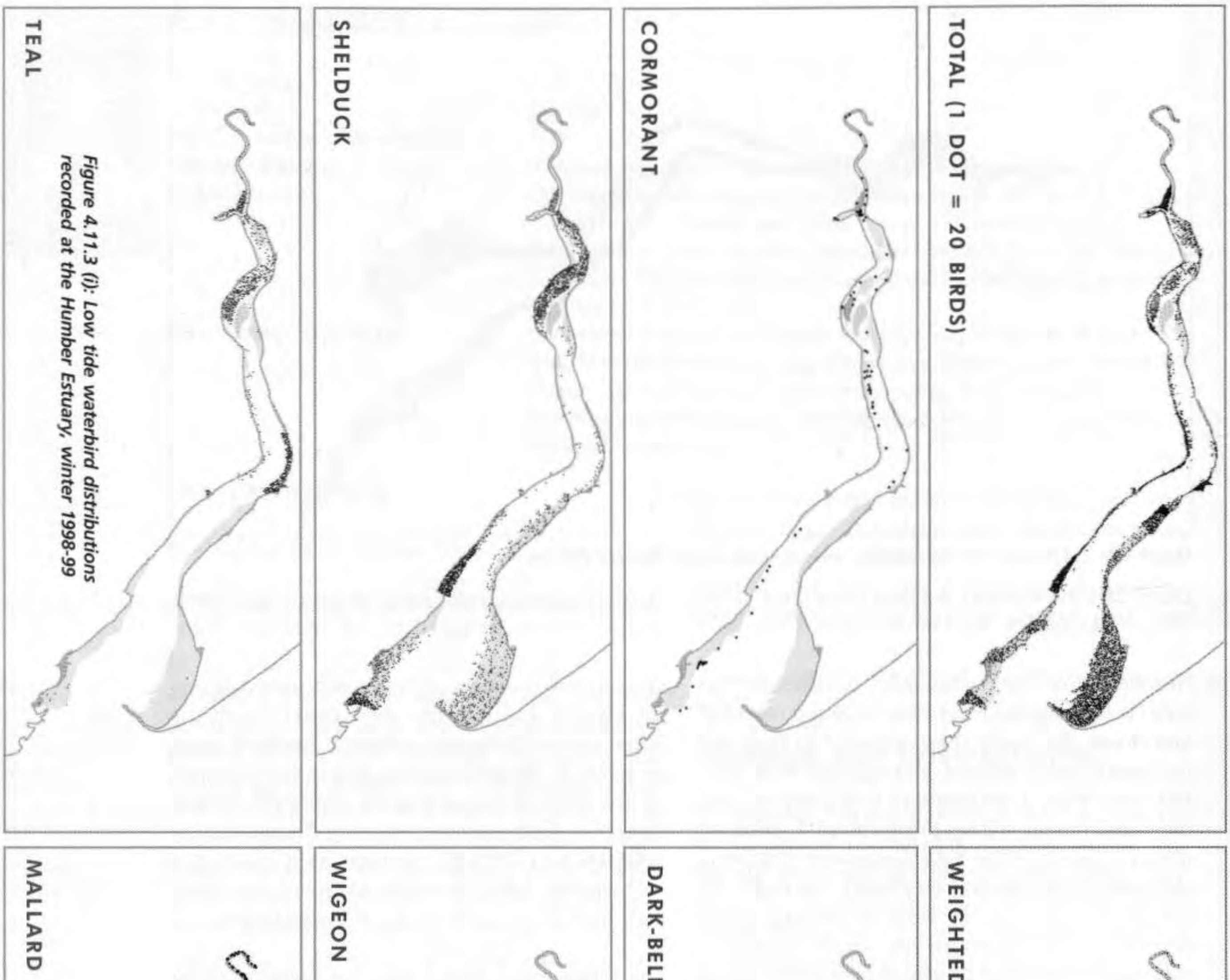


Figure 4.11.3 (i): Low tide waterbird distributions recorded at the Humber Estuary, winter 1998-99

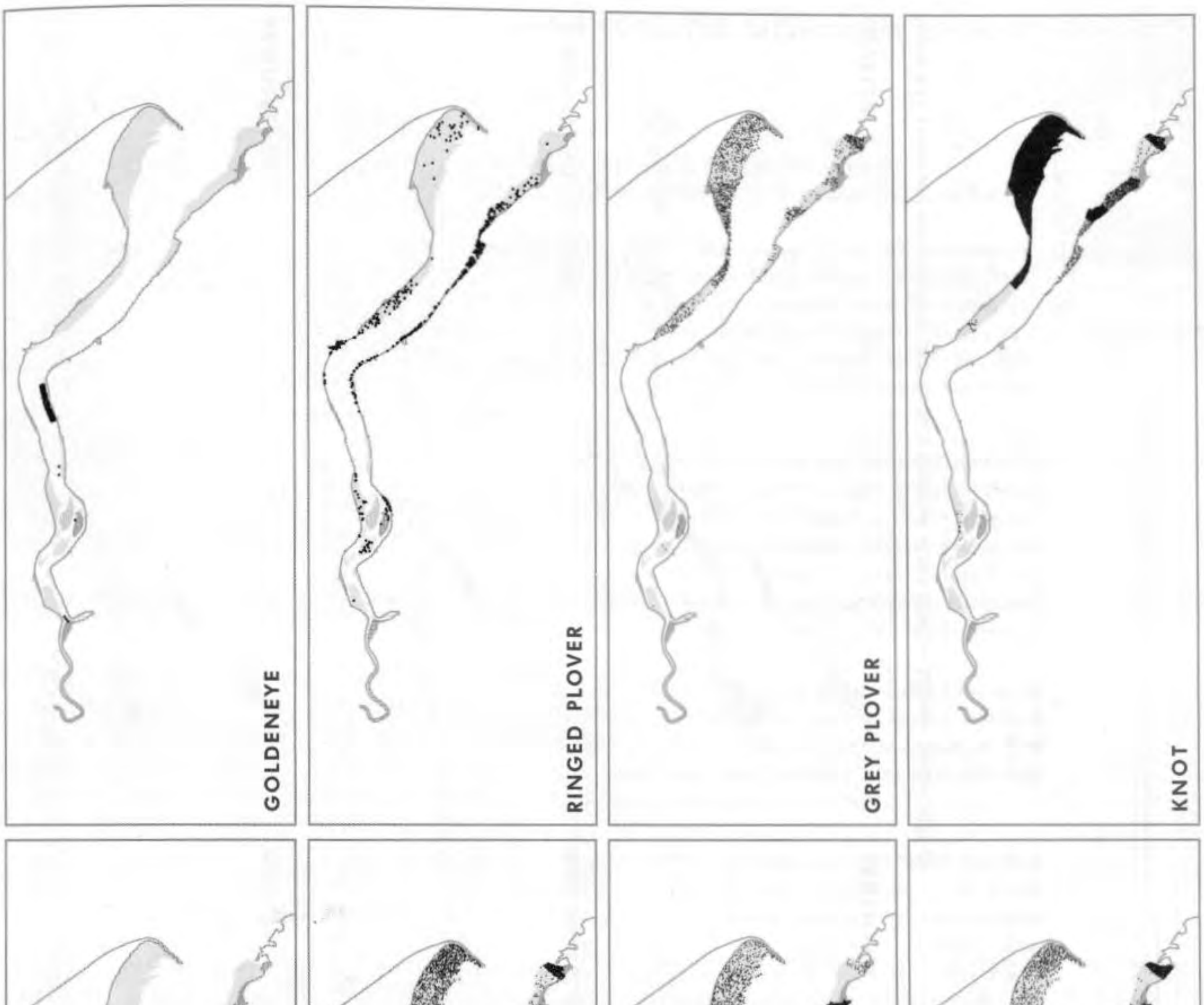


Figure 4.11.3 (ii): Low tide waterbird distributions recorded at the Humber Estuary, winter 1998-99

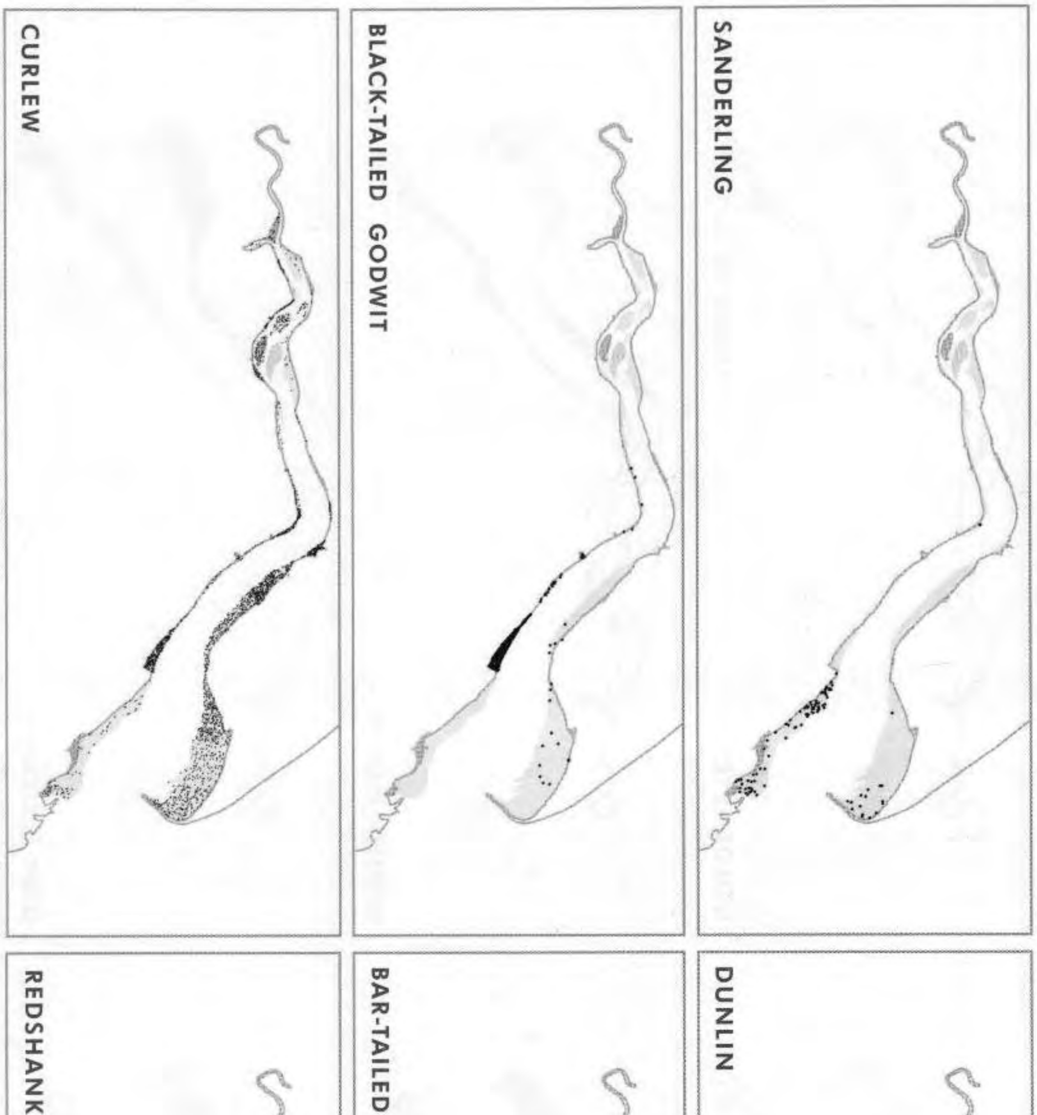


Figure 4.11.3 (iii): Low tide waterbird distributions recorded at the Humber Estuary, winter 1998-99

4.12 NORTH NORFOLK COAST

LTC site code:	CN
Centre grid:	TF8946
JNCC estuarine review site:	102
Habitat zonation:	3447 ha intertidal, 2490 ha subtidal, 2701 ha nontidal
Statutory status:	North Norfolk Coast SPA (UK9009031), North Norfolk Coast Ramsar (7UK011)
Winter waterbird interest:	Little Grebe, Cormorant, Bittern, Pink-footed Goose, White-fronted Goose, Dark-bellied Brent Goose, Shelduck, Wigeon, Gadwall, Teal, Pintail, Shoveler, Scaup, Common Scoter, Velvet Scoter, Goldeneye, Red-breasted Merganser, Oystercatcher, Avocet, Ringed Plover, Golden Plover, Grey Plover, Lapwing, Knot, Sanderling, Dunlin, Ruff, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Waterbird assemblage

SITE DESCRIPTION

The North Norfolk Coast comprises the coastline from the northern edge of Hunstanton in the west to Salthouse Marshes in the east and forms what is arguably the most diverse and complex estuarine system in the UK. There is no single principal river, but several small streams enter the sea here. The coast is the most extensive example of a barrier beach system in the UK, and the large areas of saltmarsh (over 2,000 hectares) are the most diverse in the UK in terms of geomorphology and biology. There is virtually no direct industrial influence on the site at all, with the main pressures being through recreational disturbance and exploitation of natural resources. Longer-term threats from sea-level rise may be a more serious problem in the future, however, leading to the need for careful consideration of how best to provide sea defences (M. Rooney pers. comm.).

COVERAGE AND INTERPRETATION

The North Norfolk Coast was counted for the scheme during the winter of 1997–98, data being submitted for all four months. Figure 4.12.1 shows the positions of the 95 sections counted for the survey.

The LTC area was chosen with the SPA boundary in mind, so the amount of agreement between the boundaries is close (Figure 4.12.2). However, a few areas of non-estuarine habitat within the SPA were not counted for the survey, these being at Holme, Titchwell, Burnham Norton, Holkham, Blakeney, Cley and Salthouse. With greater manpower resources, it would be ideal to cover these areas at the same time in the future. In addition, no effort was made to survey offshore birds at this site owing to time constraints. The boundaries of the Ramsar site are entirely coincident with those of the SPA.

In addition to the adjacent non-tidal habitats within the SPA, the site is adjacent to the Wash to the west, with which much interchange of birds takes place. On very large tides, at least, substantial numbers of birds feeding in the Wash will roost around on the North Norfolk Coast (M. Rooney pers. comm.) and this must be taken into account when interpreting bird usage of these two sites. There is unlikely to be much daily dispersal eastwards, however, along the long, narrow, non-estuarine shore. Pink-footed Geese, some duck (e.g. Wigeon) and grassland plovers use inland areas to feed, and the numbers of sea-duck recorded by various schemes depend greatly on count conditions. Most movements of waterbirds

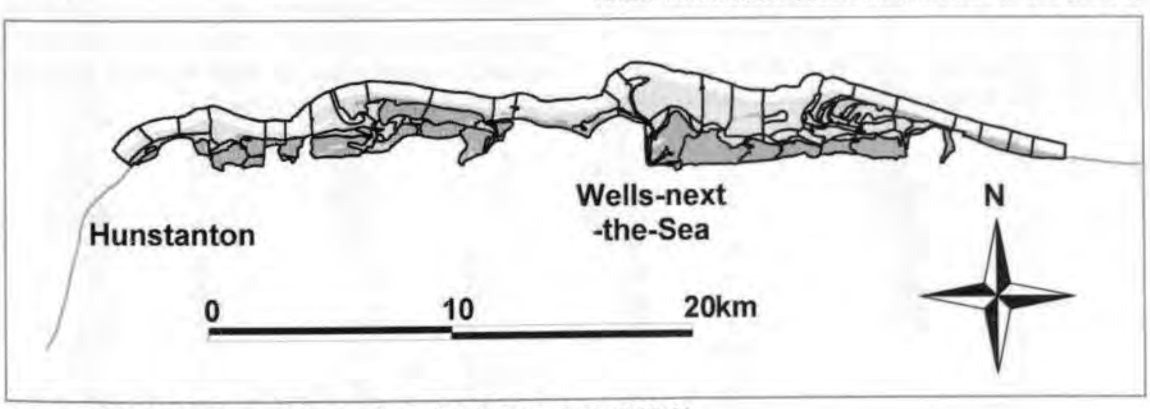


Figure 4.12.1: LTC sections at the North Norfolk Coast, winter 1997–98

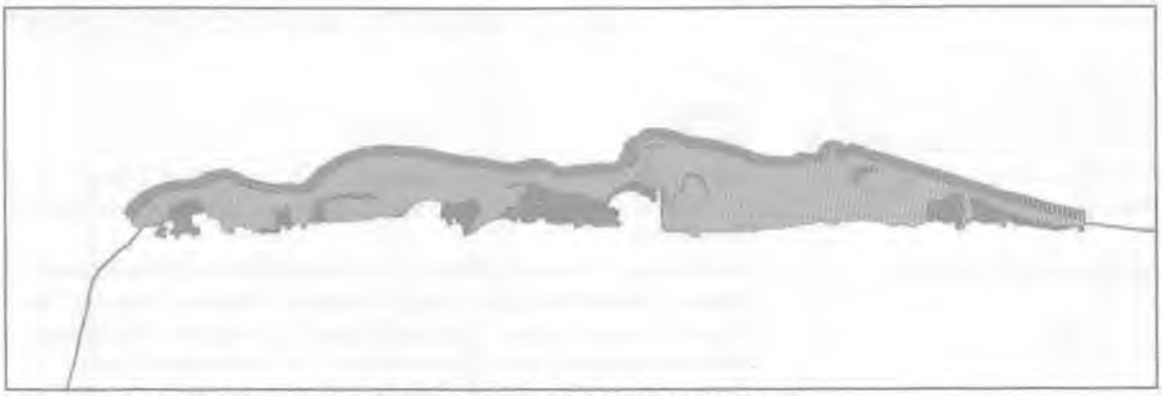


Figure 4.12.2: LTC and SPA boundaries, with overlap, at the North Norfolk Coast

in and out of the site appear to result from day vs night differences rather than those related to the state of the tide, although there is much still to learn about the movements of some species (M. Rooney pers. comm.).

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1997–98 are presented for 24 of the 31 species of principal interest listed above. For clarity, smaller dots were used to display the distributions of many of these species. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.12.3). Of the remaining species, Bittern, Gadwall, Shoveler and Common Scoter were noted in only very small numbers and White-fronted Goose, Scaup and Velvet Scoter were unrecorded. These species occur principally on non-surveyed parts of the SPA, such as the freshwater marshes at Holkham, Titchwell and Cley, or offshore. As mentioned for the Humber Estuary account, numbers of Scaup were high during the 1995–96 and 1996–97 winters at these two sites, perhaps as a result of a cold-weather influx from the continent, but have declined substantially since then.

The totals map shows high densities of birds through much of the site, especially on many of the saltmarshes and in Blakeney Harbour. However, low densities of birds were present at low tide in the Holkham Gap area in the centre of the site. The weighted total map reveals a similar overall pattern. Many of the individual species were widespread but there was a division between those occurring more commonly on the inner, largely saltmarsh, sections (such as Little Grebe, Brent Goose, Shelduck, Wigeon, Teal, Golden Plover and Lapwing) and those on the outer intertidal flats (especially Oystercatcher, Ringed Plover, Grey Plover, Sanderling, Dunlin and Bar-tailed Godwit). Curlews and Redshanks were perhaps the mostly widespread of those species mapped, however, occurring throughout the inner and outer parts of the site. Numbers of Redshanks recorded at low tide were notably higher than those previously thought to be present; similarly, large numbers of Snipe were located during the intensive surveys of the saltmarshes. Knot were numerous but highly localised to Bob Hall's Sands. Pintail, Avocet and Ruff were largely confined to Blakeney and Brancaster Harbours. These two areas also held concentrations of Goldeneyes and Red-breasted Mergansers, although these two species were more widely distributed also. Black-tailed Godwits were mostly found near Brancaster and around Cley and Blakeney. Although most of the Pink-footed Geese feed away from the site during the day, a large roosting flock was noted on one occasion at Scolt Head. In addition, a concerted effort was made to record the occurrence of passerines using the site. The most numerous species proved to be Skylark followed by Rock Pipit (presumed to be of continental origin), Linnet and Reed Bunting, along with more specialist species such as Snow Bunting, Lapland Bunting, Shore Lark and Twite.

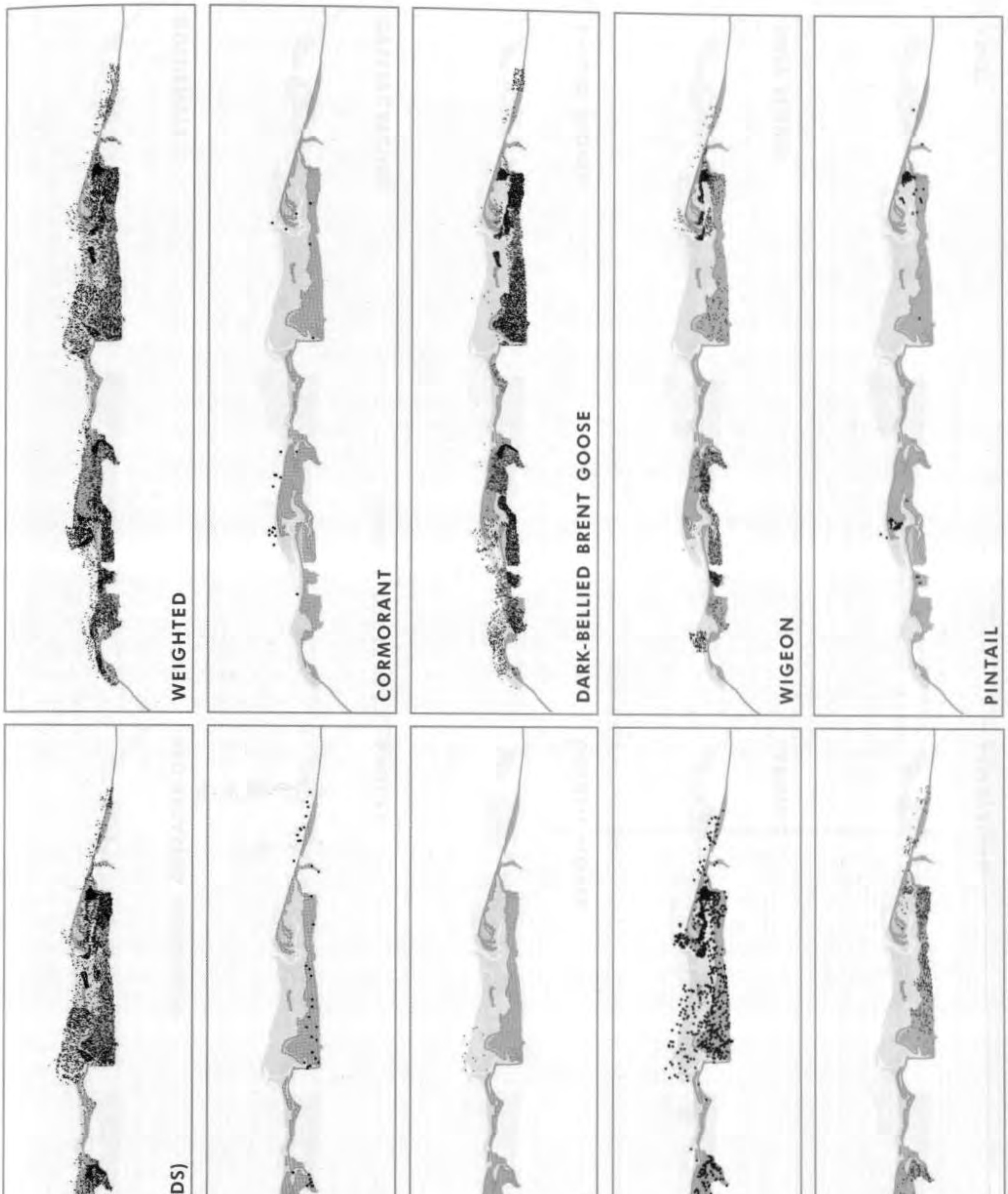


Figure 4.12.3 (i): Low tide waterbird distributions recorded at the North Norfolk Coast, winter 1997-98

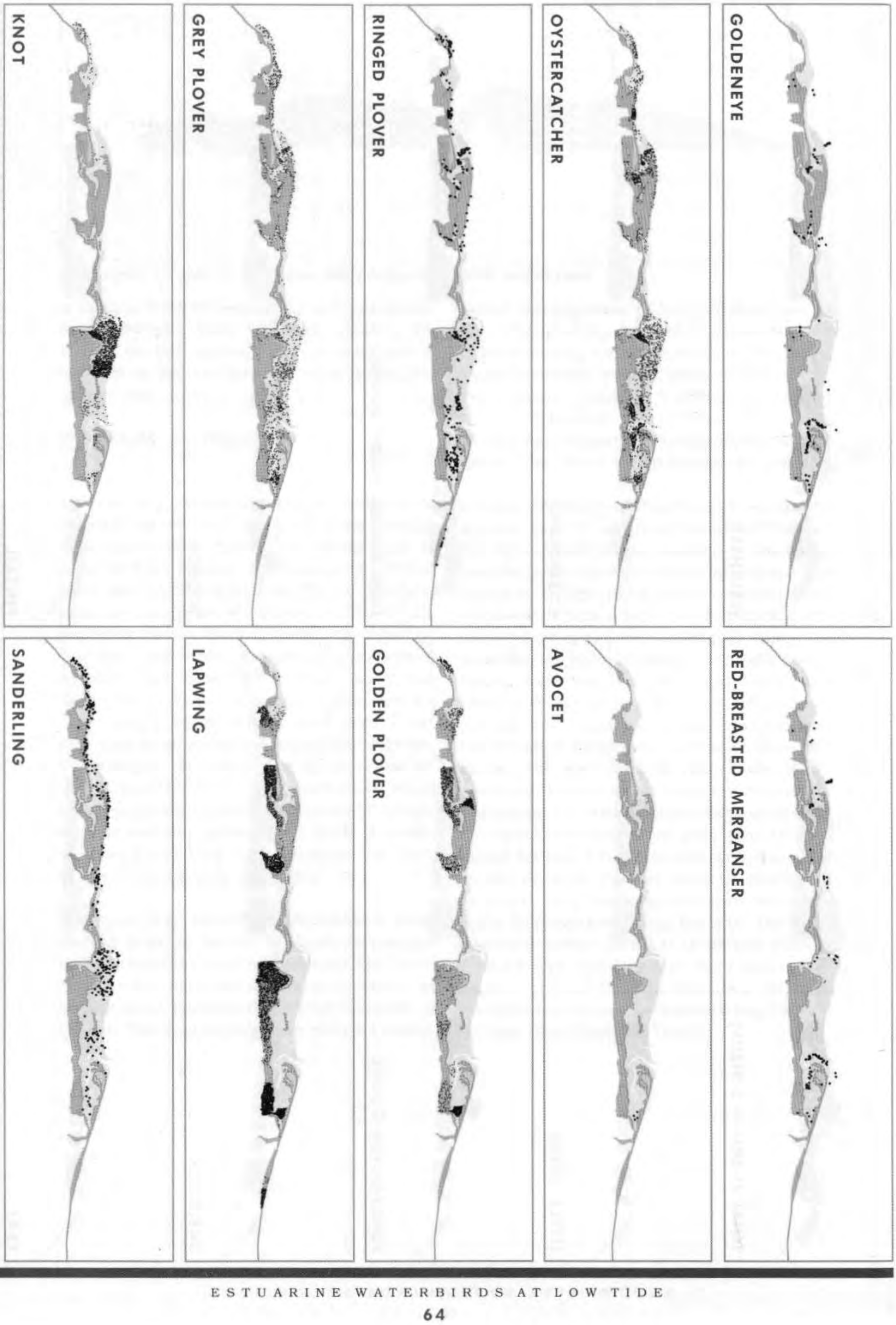


Figure 4.12.3 (ii): Low tide waterbird distributions recorded at the North Norfolk Coast, winter 1997-98

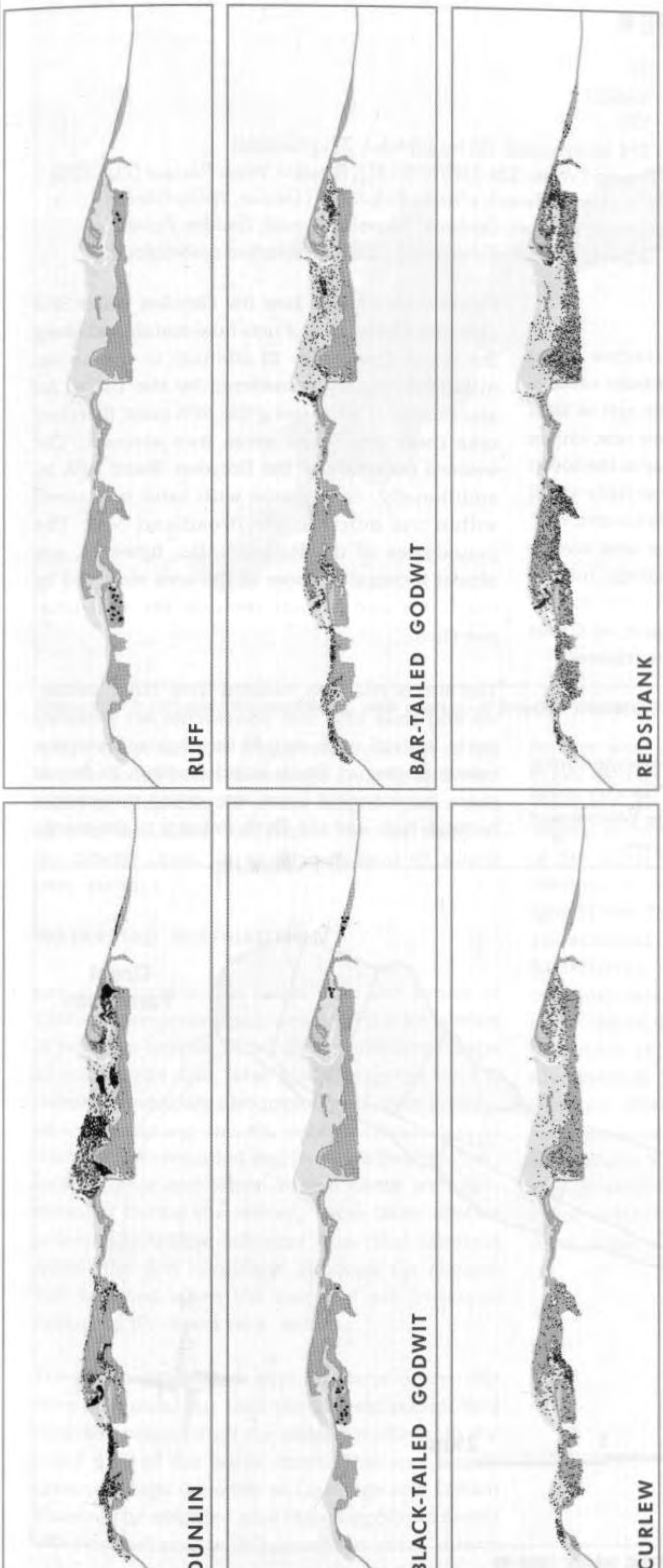


Figure 4.12.3 (iii): Low tide waterbird distributions recorded at the North Norfolk Coast, winter 1997-98

4.13 BREYDON WATER

LTC site code:	DY
Centre grid:	TG4907
JNCC estuarine review site:	103
Habitat zonation:	394 ha intertidal, 80 ha subtidal, 7 ha nontidal
Statutory status:	Breydon Water SPA (UK9009181), Breydon Water Ramsar (7UK100)
Winter waterbird interest:	Cormorant, Bewick's Swan, Pink-footed Goose, White-fronted Goose, Wigeon, Gadwall, Shoveler, Avocet, Golden Plover, Lapwing, Dunlin, Black-tailed Godwit, Waterbird assemblage

SITE DESCRIPTION

Breydon Water, forming the lower reaches of the Rivers Yare and Waveney, is a bar-built estuary separated from the North Sea by the spit of land on which Great Yarmouth sits. At low tide, only a narrow water channel remains, closer to the south shore than the north. There are some fairly small areas of saltmarsh, principally at the eastern end. The main conservation issues in the area involve boating, wildfowling and grazing marsh management, although the river channel leading out from Breydon through the port of Great Yarmouth to the sea is highly industrialised.

COVERAGE AND INTERPRETATION

Breydon Water was counted for the scheme during the winter of 1998–99, although no February count was made. Figure 4.13.1 shows the positions of the 14 sections counted for the survey.

Figure 4.13.2 shows how the Breydon Water SPA contains a large area of non-tidal marshland along the lower Yare valley in addition to the actual intertidal estuary considered by the LTCs. An assessment of birds using the SPA must therefore take these additional areas into account. The western boundary of the Breydon Water SPA is, additionally, contiguous with land contained within the much larger Broadland SPA. The boundaries of the Ramsar site, however, are almost identical to those of the area surveyed by the LTCs and do not include the non-tidal marshes.

The site is relatively isolated from other estuaries and thus inter-site movements are probably fairly limited on a day-to-day basis. However, colour-ringing of Black-tailed Godwits in recent years has revealed some interesting movements between here and the Blyth Estuary to the south.

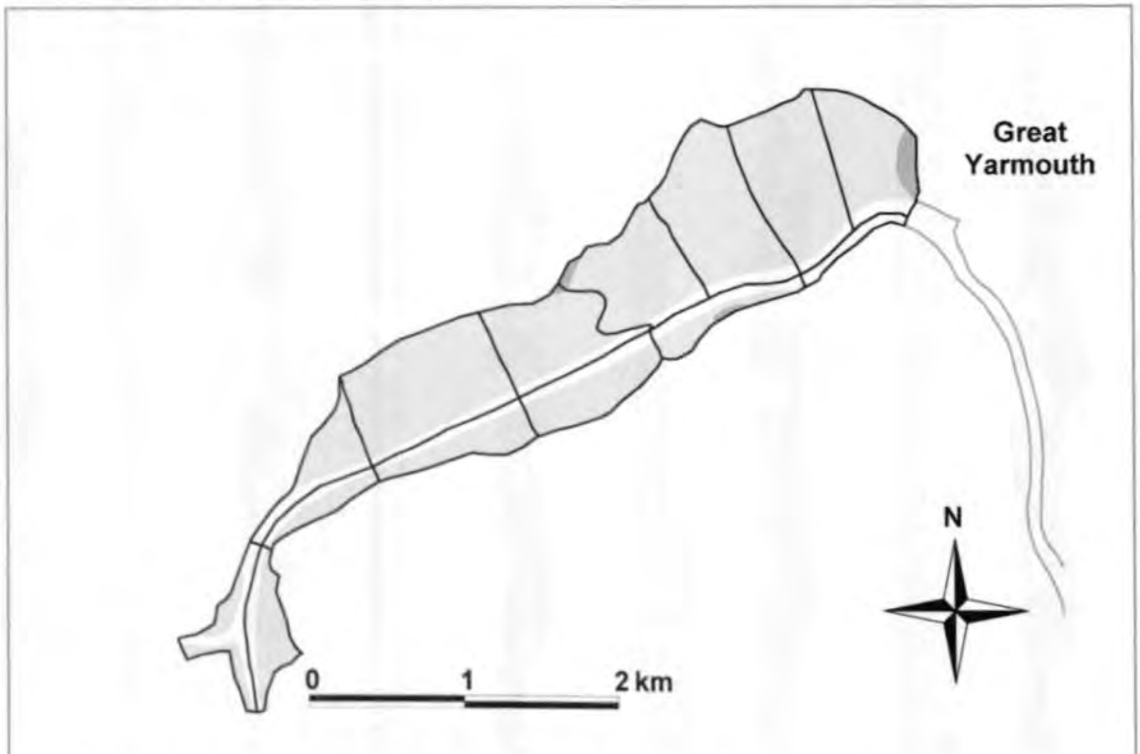


Figure 4.13.1: LTC sections at Breydon Water, winter 1998–99

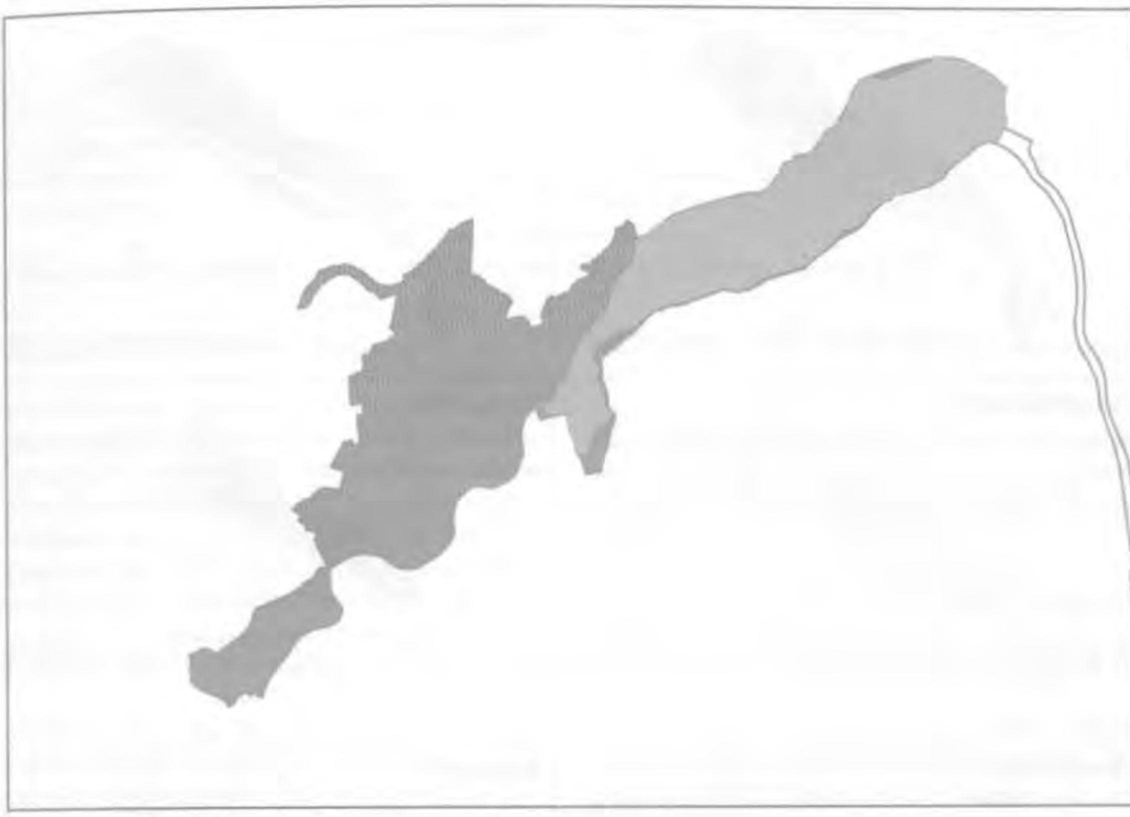


Figure 4.13.2: LTC and SPA boundaries, with overlap, at Breydon Water

Additionally, there is frequent interchange of the Wigeon flocks between this site and the mid-Yare valley to the west. All of the Ringed Plovers and some of the Dunlin that feed at Breydon roost on the nearby Great Yarmouth sea front (P. Allard pers. comm.).

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1998–99 are presented for eight of the 12 species of principal interest listed above. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.13.3). Of the remaining species, only small numbers of Gadwall were recorded and Bewick's Swans, Pink-footed Geese and White-fronted Geese were unrecorded during the survey. These latter species principally utilise adjacent non-tidal habitats within the SPA boundary, although the estuary can be used when the marshes are frozen or disturbed (P. Allard pers. comm.).

The totals map show that all parts of the site were occupied, but that the highest overall bird densities occurred on the widest mudflats, in the outer part of the north shore. This was largely driven by high densities of Lapwings and Golden Plovers. The weighted total map suggested a subtly different pattern, with highlighted areas a little further west along the north shore and in the upper estuary at the confluence of the Yare and Waveney. Dunlin, Black-tailed Godwits and Wigeon occurred more densely in the central parts of the north shore, although Dunlin were also common to the south of the channel, the only one of the SPA interest species making any substantial use of this stretch, although Redshanks also occurred in their highest densities here. Black-tailed Godwits will also make use of this stretch at times, although wind direction is often a factor in determining distribution from day to day (P. Allard pers. comm.). Avocets were mostly found on the innermost part of the site for feeding. Most of the Cormorants were noted in the outermost parts of the estuary. The small numbers of Shovelers noted occurred widely but the species is much more numerous at the adjacent Berney Marshes.

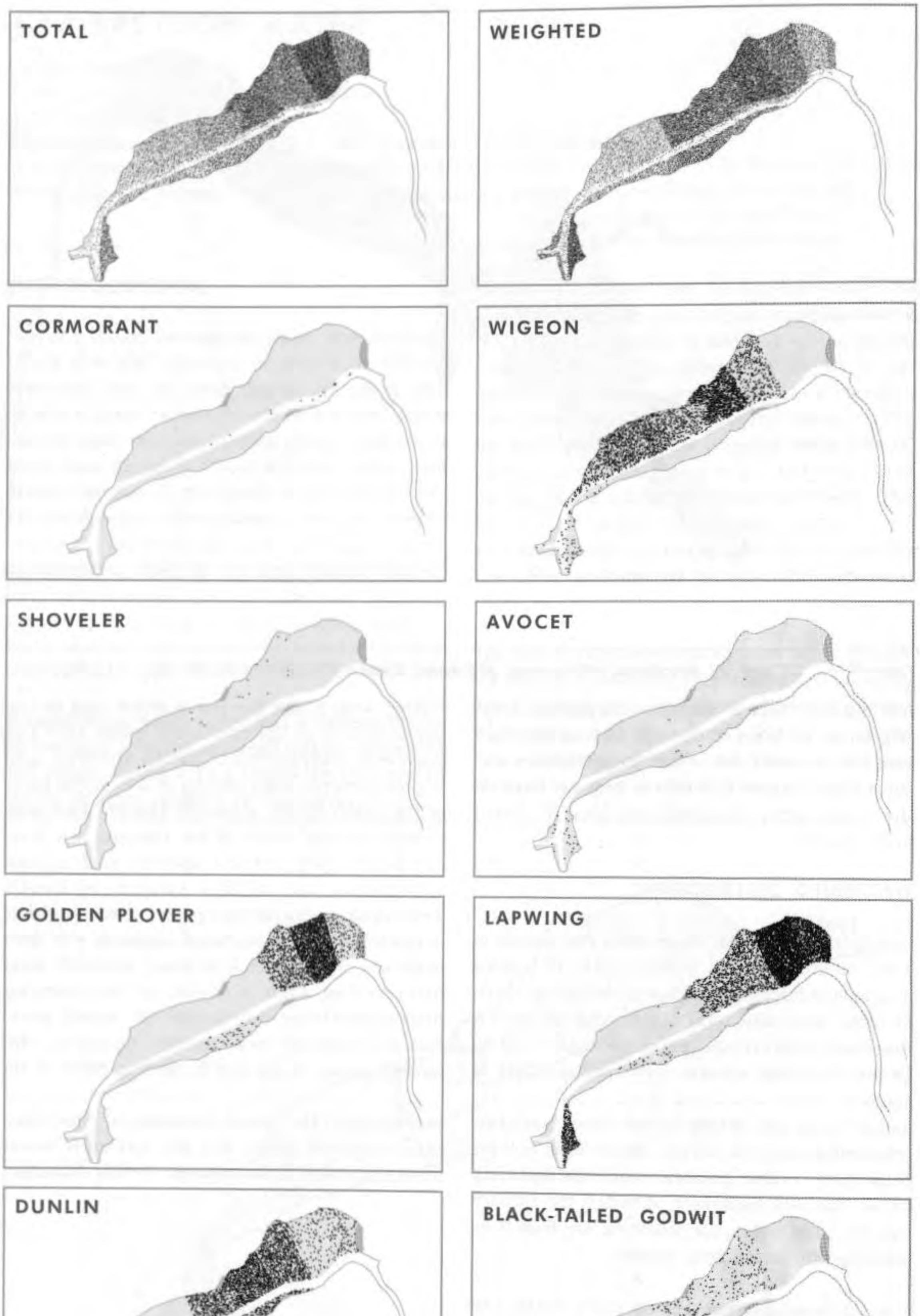


Figure 4.13.3 Low tide waterbird distribution recorded at Breydon Water, winter 1998-99

4.14 BLYTH ESTUARY (SUFFOLK)

LTC site code:	CY
Centre grid:	TM4776
JNCC estuarine review site:	105
Habitat zonation:	199 ha intertidal, 40 ha subtidal, 64 ha nontidal
Statutory status:	Minsmere–Walberswick SPA (UK9009101), Minsmere–Walberswick Ramsar (7UK010)
Winter waterbird interest:	Bittern, Avocet, Black-tailed Godwit, Redshank

SITE DESCRIPTION

The Blyth is a small estuary, situated immediately inland of Southwold in Suffolk. The inner estuary is a muddy basin but the lower reaches have been canalised since the early 19th century and have little in the way of intertidal substrate. Flanking the narrow lower river channel is a sizeable area of marshes: Tinker's Marshes to the south of the channel and Reydon Marshes and Town Marshes to the north. There have been numerous attempts in the past to 'reclaim' the mudflats and saltmarshes; the river was embanked all the way up to Blythburgh until the defences were breached in 1953 and then not reinstated, leaving a mosaic of breached bunds. The site is widely used for watersports, although this use is more intensive towards the river mouth. Wildfowling occurs across much of the site, although it has been very limited since 1990 around much of the western end of the estuary (A. Burrows pers. comm.).

COVERAGE AND INTERPRETATION

The Blyth Estuary in Suffolk was covered by the scheme during the winter of 1997–98, with counts made during all four months. Figure 4.14.1 shows the positions of the four sections counted for the survey.

Clearly, as Figure 4.14.2 shows, the LTC area forms a small part of the overall SPA, although the majority of the estuarine habitat lies within it. However, there is suitable habitat for waterbirds at Minsmere and at Dunwich/Walberswick beach pools so not all species will be confined to the estuary. The boundaries of the Ramsar site are entirely coincident with those of the SPA.

It seems likely that there will be frequent movement of some species between the estuary and nearby wetland habitats such as Southwold Town Marshes or Walberswick beach pools. However, the Blyth is relatively isolated from other

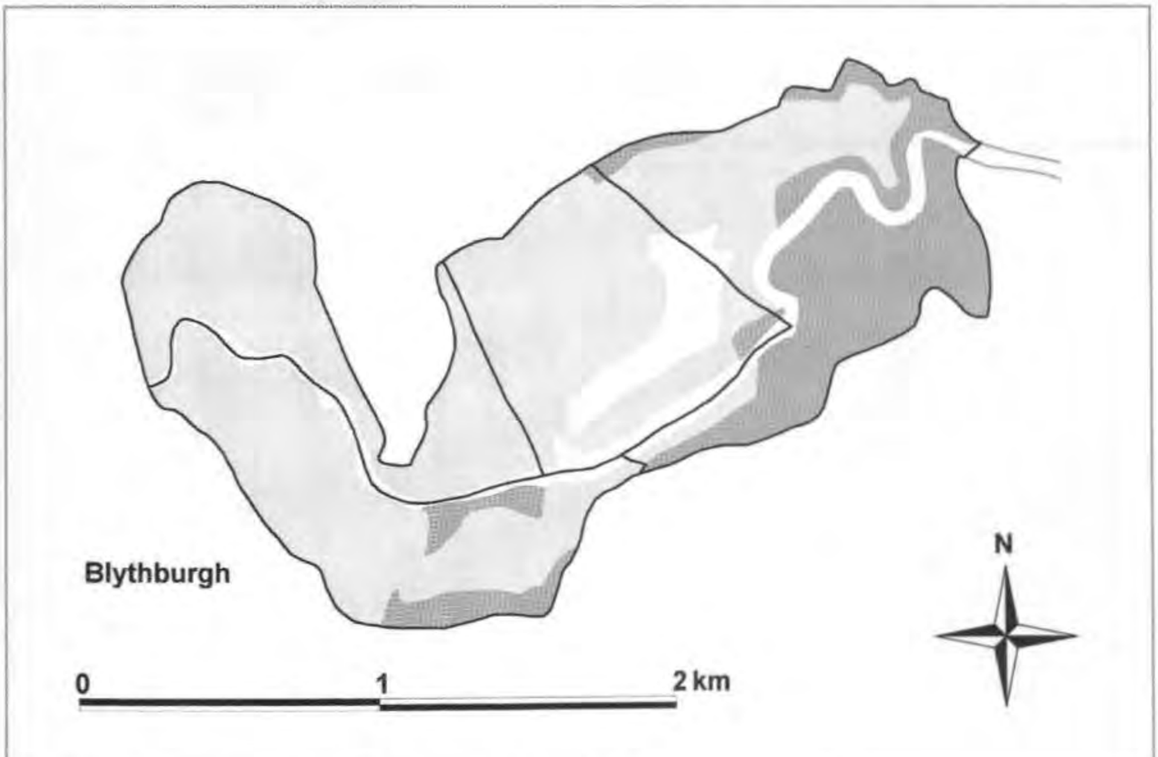


Figure 4.14.1: LTC sections at the Blyth Estuary, winter 1997–98

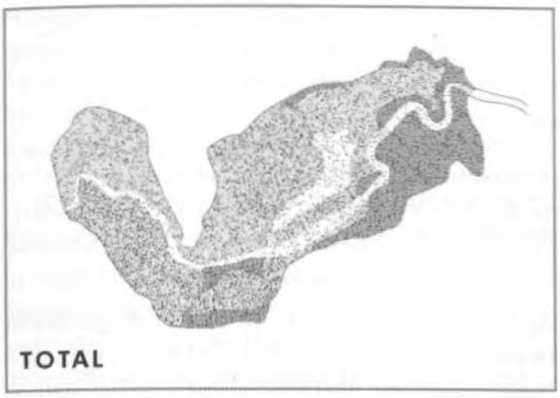
Figure 4.14.2: LTC and SPA boundaries, with overlap, at the Blyth Estuary

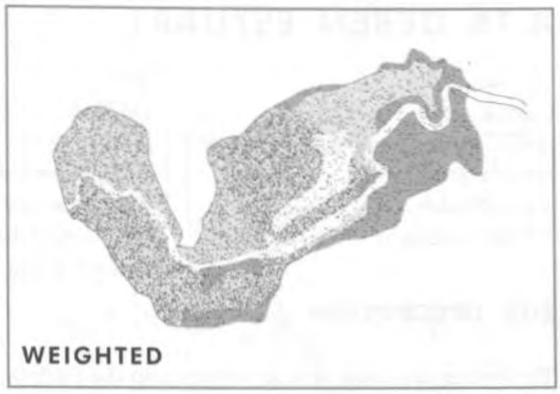
estuaries and movement of birds between here and Breydon Water to the north or the Alde Complex to the south would seem unlikely to occur on a daily basis.

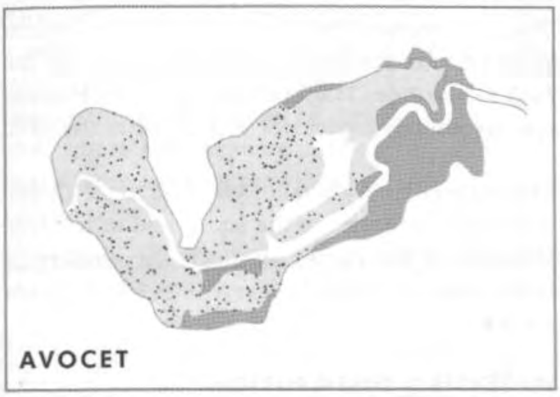
WATERBIRD DISTRIBUTION

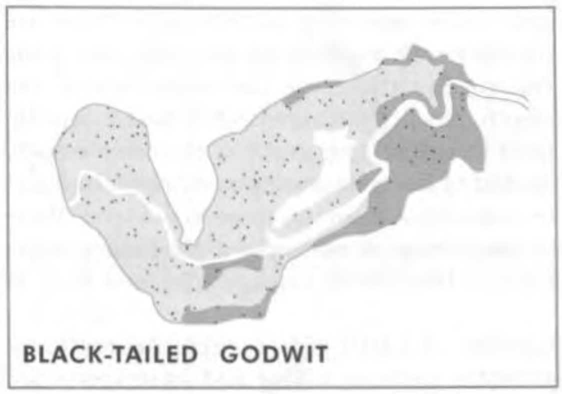
Low tide distribution maps from the winter of 1997–98 are presented for three of the four species of principal interest listed above. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.14.3). The remaining species, Bittern, occurs elsewhere within the SPA boundary in the extensive reedbeds.

The totals map suggests an extremely even spread of birds across the site, although only four sections were chosen. The weighted total map gives a somewhat lower emphasis to the easternmost section, due to the absence of Avocets from that part of the site during the survey. Redshanks were also present in lower density in the east of the estuary but most other species occurred fairly evenly across all of the sections.









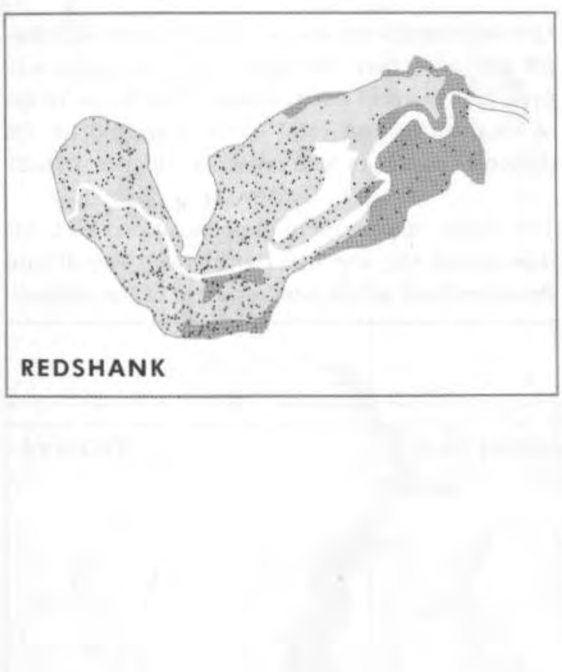


***Figure 4.14.3:** Low tide waterbird distributions recorded at the Blyth Estuary, winter 1997–98*

4.15 DEBEN ESTUARY

LTC site code:	BX
Centre grid:	TM2945
JNCC estuarine review site:	107
Habitat zonation:	518 ha intertidal, 286 ha subtidal, 214 ha nontidal
Statutory status:	Deben Estuary SPA (UK9009261) Deben Estuary Ramsar (7UK097)
Winter waterbird interest:	Little Grebe, Dark-bellied Brent Goose, Shelduck, Avocet, Black-tailed Godwit, Redshank

SITE DESCRIPTION

The Deben is a long, narrow estuary on the Suffolk coast, with its head at Woodbridge and its mouth just to the north-east of Felixstowe. There are relatively wide mudflats on the inner part of the estuary but these are narrower towards the mouth. Most of the surrounding land is agricultural in nature with much of the outer estuary flanked by low-lying grazing marshes which would be susceptible to any increase in sea-level. There is also a fringe of saltmarsh around much of the estuary. Martlesham Creek, on the west bank at the northern end of the site, is the largest of a number of small side-creeks. Recreational activities such as sailing and watersports are perhaps the most obvious sources of disturbance to waterbirds on the site.

COVERAGE AND INTERPRETATION

Low tide counts were carried out at the Deben Estuary during all four months of the 1998–99 winter. Figure 4.15.1 shows the positions of the 21 sections counted for the survey.

As Figure 4.15.2 shows, the level of agreement between the LTC site and the Deben Estuary SPA boundary was extremely high, with minor discrepancies only at the upper end of the site. The LTC results therefore provide an excellent description of the use made by waterbirds of the SPA at low tide. The boundaries of the Ramsar site are entirely coincident with those of the SPA.

The Deben Estuary is relatively close to the Orwell and Stour Estuaries to the south and to the Alde Complex to the north, although the amount of interchange of birds between these sites is not known.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1998-99 are presented for all of the six species of principal interest listed above. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.15.3).

The totals map depicts concentrations of birds throughout the site but the highest overall bird densities were at the northern end of the estuary.

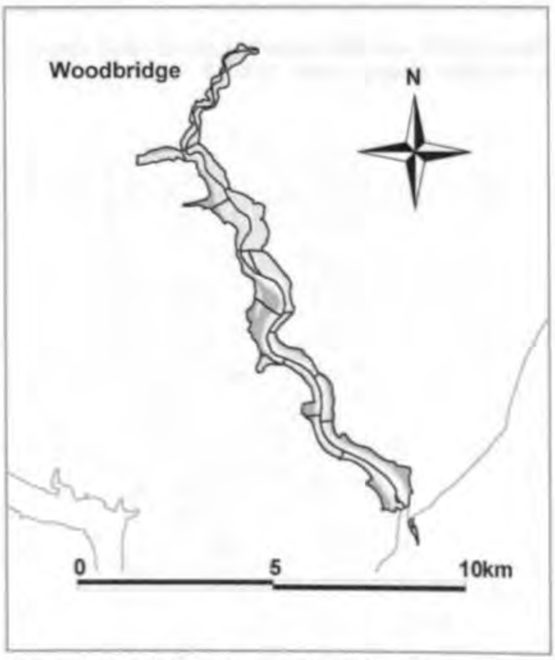


Figure 4.15.1: LTC sections at the Deben Estuary, winter 1998–99

Figure 4.15.2: LTC and SPA boundaries, with overlap, at the Deben Estuary

However, the weighted total map gives greater emphasis to an area further downstream near Ramsholt, clearly as a result of the highly localised distribution of Avocet at the site. Little Grebes were also highly localised, this species mostly found around Woodbridge, including Martlesham Creek. Brent Geese were generally found in higher densities on the lower estuary, especially south of Ramsholt, but Shelducks were more widespread, as were Redshanks. The latter species was most numerous at the northern end of the site, where the majority of the Black-tailed Godwits were also to be found.

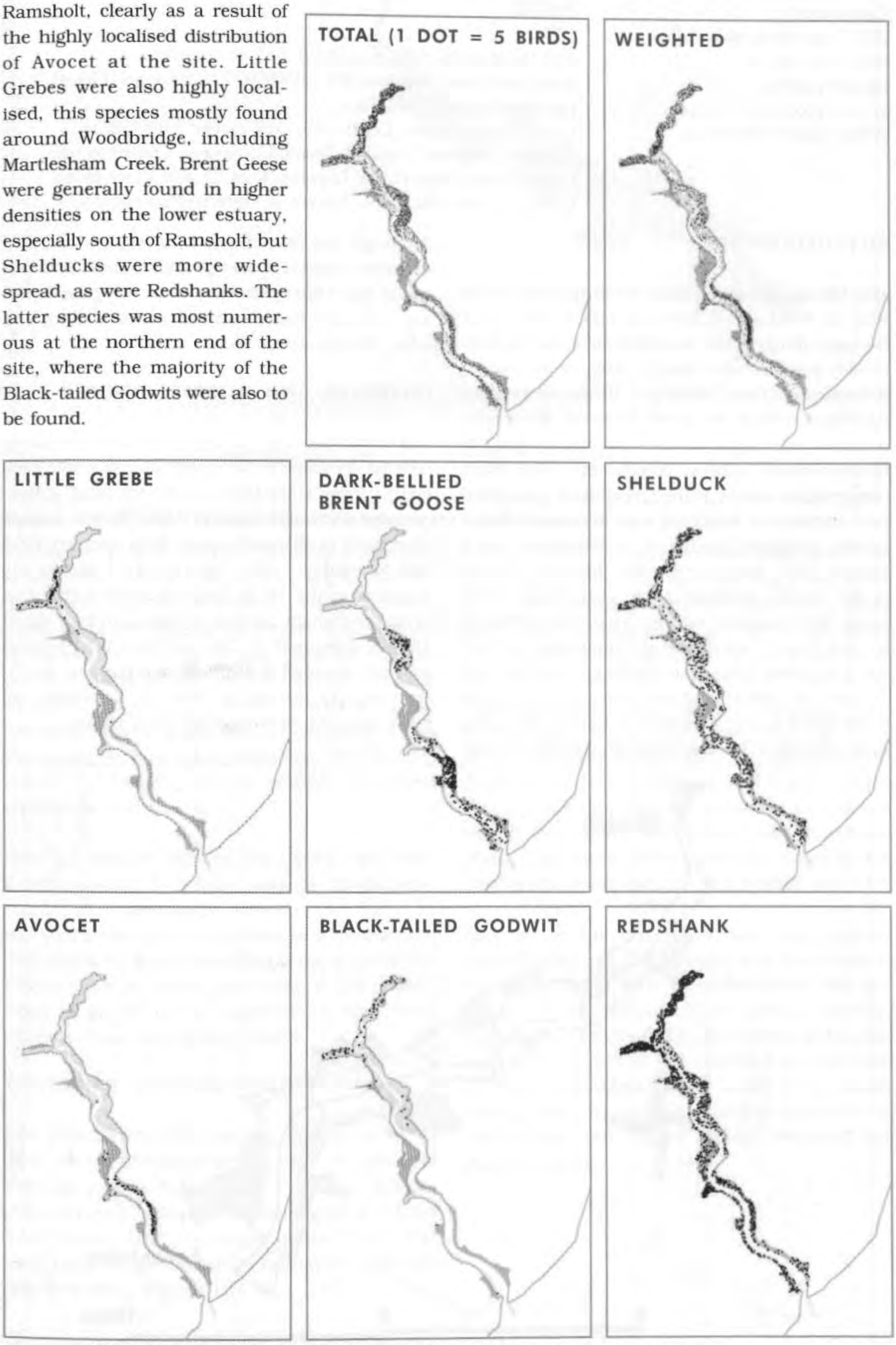


Figure 4.15.3: Low tide waterbird distribution recorded at the Deben Estuary, winter 1998-99

4.16 ORWELL ESTUARY

LTC site code: EW
Centre grid: TM2338
JNCC estuarine review site: 108
Habitat zonation: 656 ha intertidal, 519 ha subtidal, 559 ha nontidal
Statutory status: Stour and Orwell Estuaries SPA (UK9009121), Stour and Orwell Estuaries Ramsar (7UK076)
Winter waterbird interest: Great Crested Grebe, Cormorant, Dark-bellied Brent Goose, Shelduck, Wigeon, Gadwall, Pintail, Goldeneye, Oystercatcher, Ringed Plover, Grey Plover, Lapwing, Knot, Dunlin, Black-tailed Godwit, Curlew, Redshank, Turnstone, Waterbird assemblage

SITE DESCRIPTION

The Orwell Estuary extends from Ipswich to the Port of Felixstowe where it meets the Stour Estuary. Much of the intertidal substrate is fairly muddy but it becomes sandier towards the mouth. Saltmarshes have developed in places but the combined area is not great. However, freshwater marshes and fields around the estuary provide an important habitat component. The main conservation issues at the Orwell have concerned port expansion schemes and marina developments. Dockland expansion at Felixstowe, since around 1964, has claimed all of the outer reaches of the Orwell's northern shore. As a result of the latest development, and as legal compensation for the loss of an important intertidal habitat, the Felixstowe Dock and Railway Company had to lease an area of land and provide the finances to establish a nature reserve at Trimley Marshes, now managed by the Suffolk Wildlife Trust. Although the reserve does not replace the lost estuarine habitat it does provide a roost and safe refuge site. Other problems confronting the Orwell are pollution and disturbance from sailing and other leisure activities.

COVERAGE AND INTERPRETATION

The Orwell Estuary was one of the most frequently covered sites for the LTCs, with counts made each winter from 1994–95 to 1998–99 (and subsequently). During the period under review, counts were made in all months apart from January 1995 and November 1998. Figure 4.16.1 shows the positions of the 18 sections counted during this period (although further subdivision has taken place subsequently). The northernmost section was only counted in 1995–96 and the next northernmost was missed in 1994–95. Otherwise, all other sections were counted each winter.

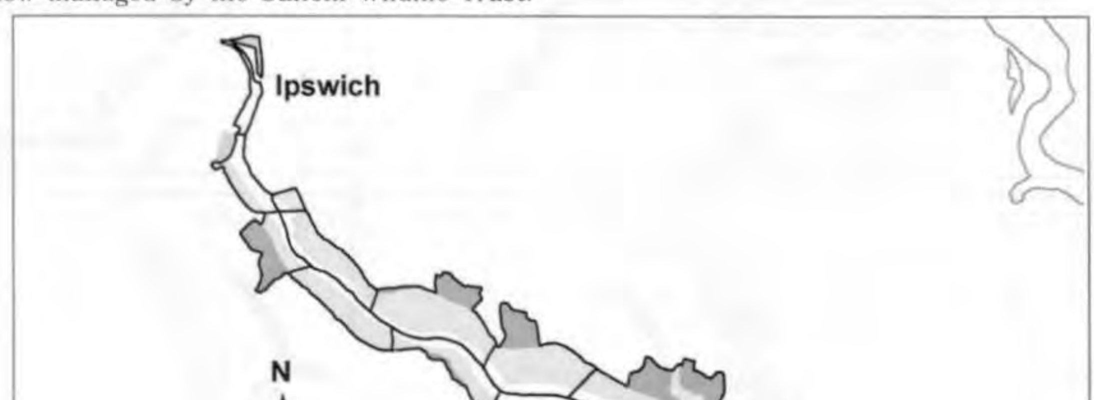


Figure 4.16.1: LTC sections at the Orwell Estuary, winters 1994–95 to 1998–99

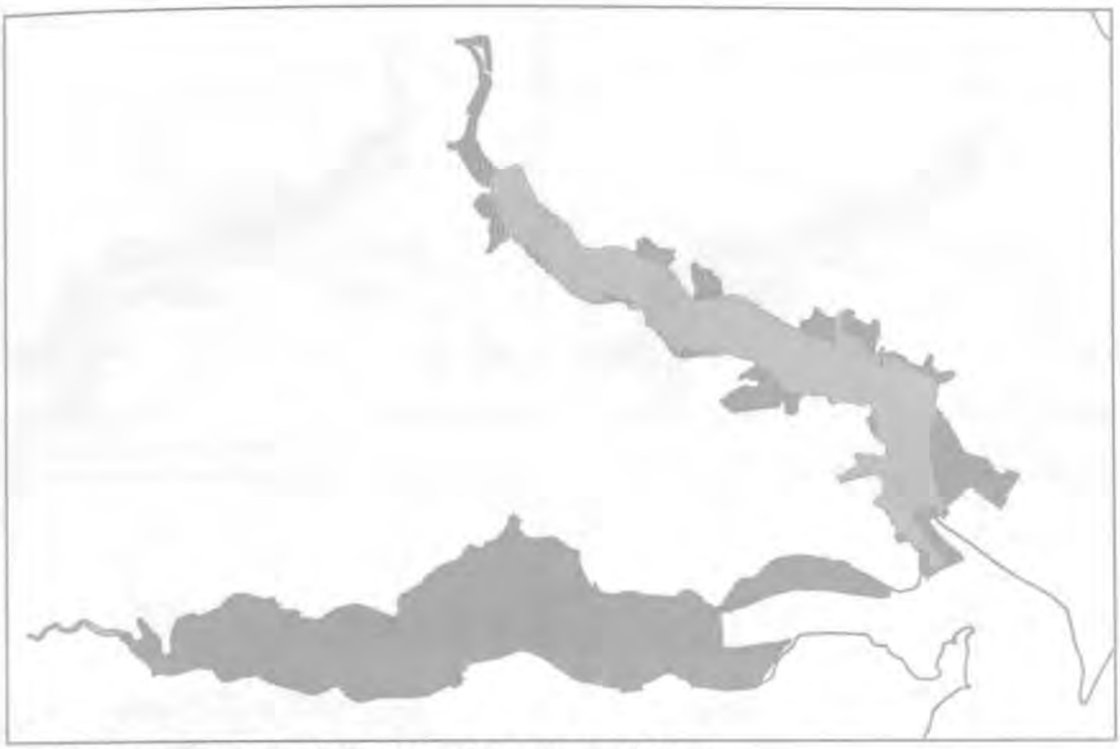


Figure 4.16.2: LTC and SPA boundaries, with overlap, at the Orwell Estuary.

As Figure 4.16.2 shows, the main difference between LTC and SPA boundaries is that the SPA also covers the Stour Estuary. This difference aside, all of the SPA on the Orwell was included in the counts. The counts also recorded birds at the head of the estuary and on adjacent non-tidal habitats, notably at Trimley Marshes. These differences are important to consider when discussing the bird usage of the SPA. The boundaries of the Ramsar site are entirely coincident with those of the SPA.

Bird movements between the Orwell and Stour Estuaries occur on a daily basis (M. Wright pers. comm.) and interchange with Hamford Water to the south also occurs (J. Novorol pers. comm.). The extent to which interchange occurs with the Deben Estuary, to the north-east, is not known. Some of the estuarine waterbirds on the Orwell may also use Alton Water nearby.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1997–98 are presented for all of the 18 species of principal interest listed above. For clarity, smaller dots are used to display the distributions of Knot and Dunlin. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.16.3).

The totals map shows a higher overall bird density further upstream along the estuary, as well as at Loompit Lake. This pattern was emphasised by the weighted total map, with the flats to the north of the Orwell Bridge at the very top of the estuary particularly highlighted. Many of the individual species were found in their highest densities in the upper estuary, such as Shelduck, Oystercatcher, Grey Plover, Knot, Dunlin, Redshank and Black-tailed Godwit, although some of these were widespread in smaller numbers downstream also. Goldeneye and Great Crested Grebe densities were also higher upstream, though Cormorants were more evenly distributed along the length of the estuary. Brent Geese displayed a lower estuary distribution and were the only species to do so; although many Lapwings roosted in the lower reaches, the highest concentration of this species was upstream at Redgate. Pintail were more localised into two zones, at the Nacton Shore and at Trimley Marshes/Loompit Lake, the latter area also supporting most of the Gadwall on the site. Curlews and Wigeon were found fairly evenly throughout, along with smaller numbers of Turnstones, but Ringed Plovers occupied two discrete zones.

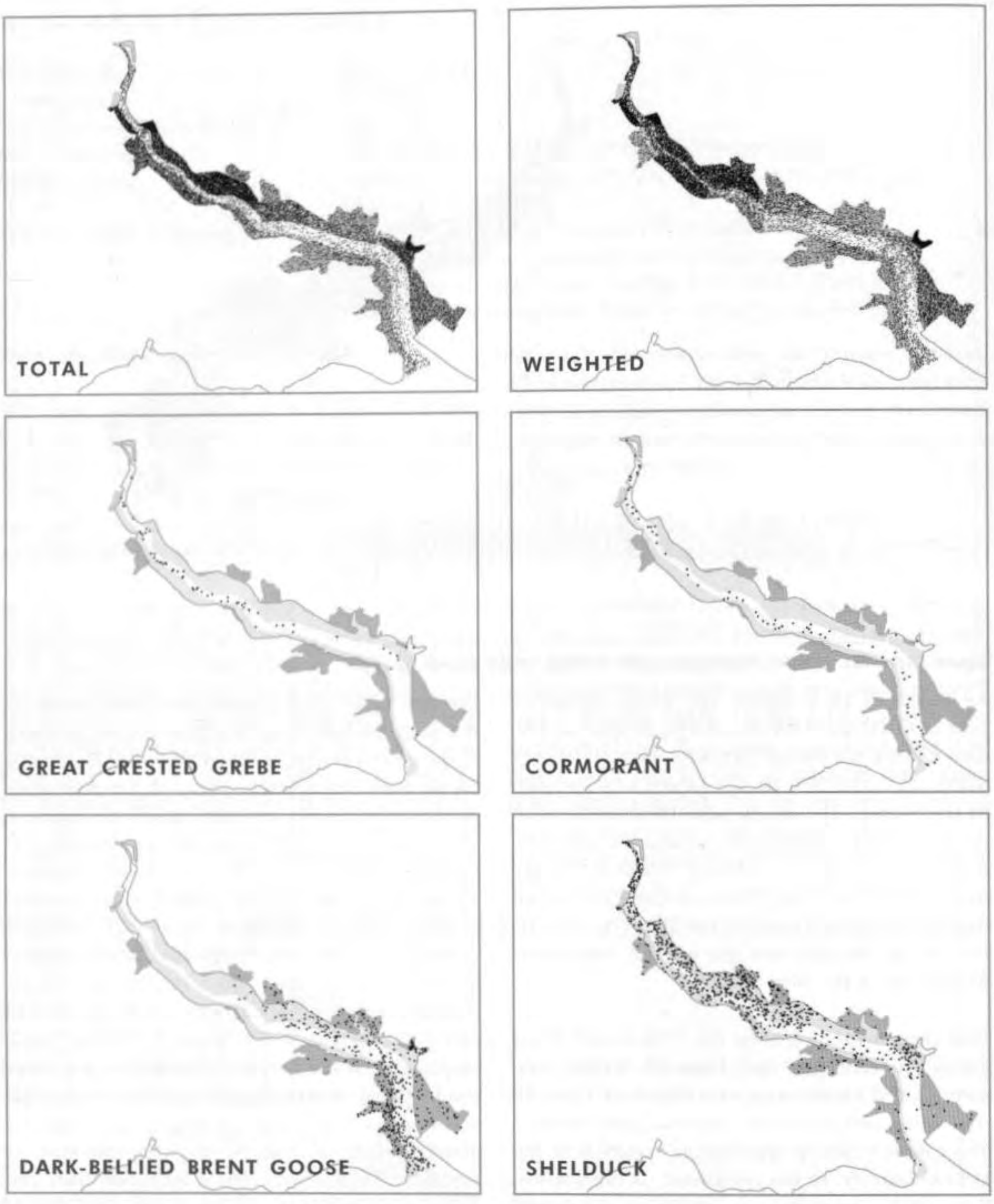


Figure 4.16.3 (i) Low tide waterbird distribution recorded at the Orwell Estuary, winter 1997-98

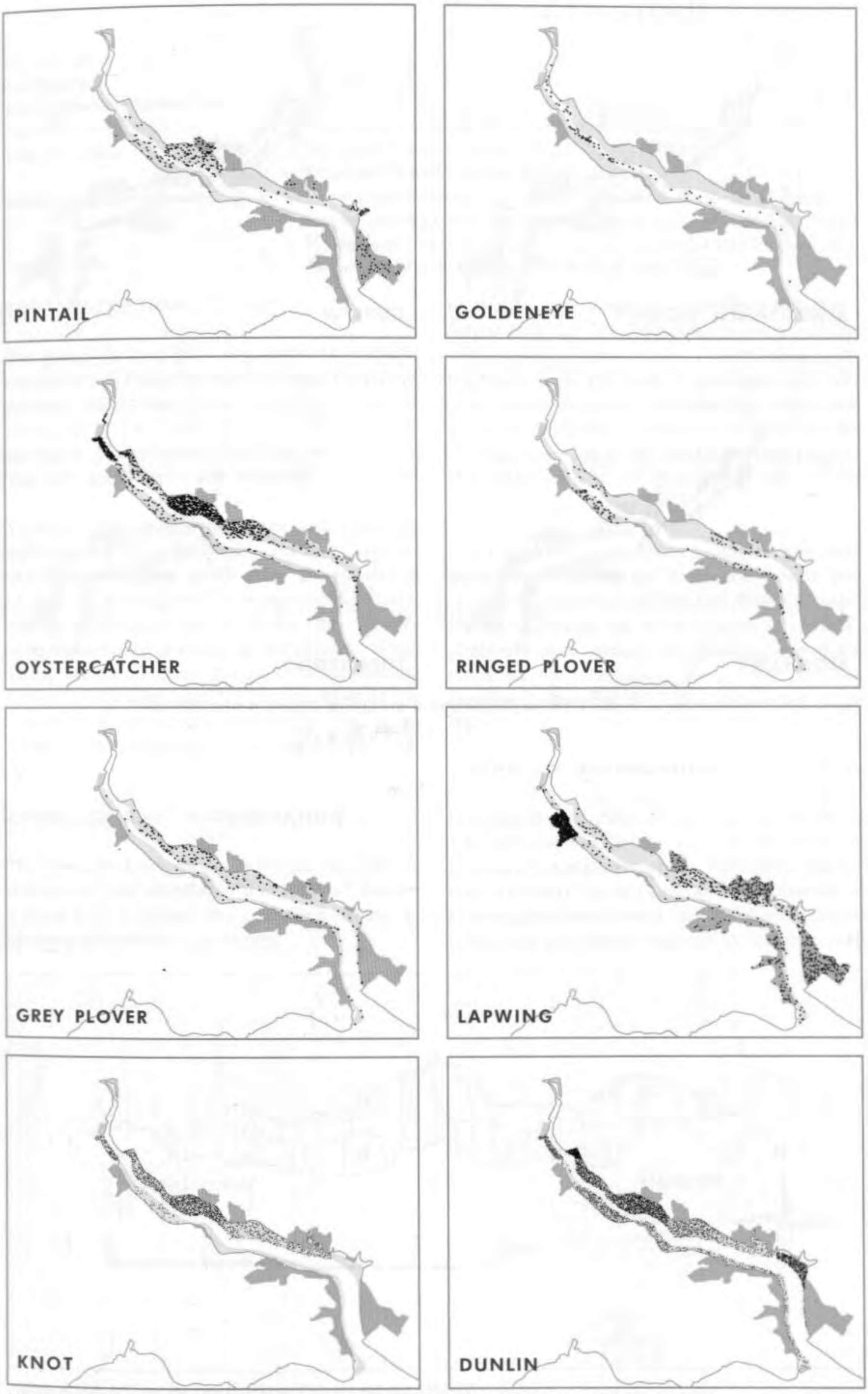


Figure 4.16.3 (ii) Low tide waterbird distribution recorded at the Orwell Estuary, winter 1997-98

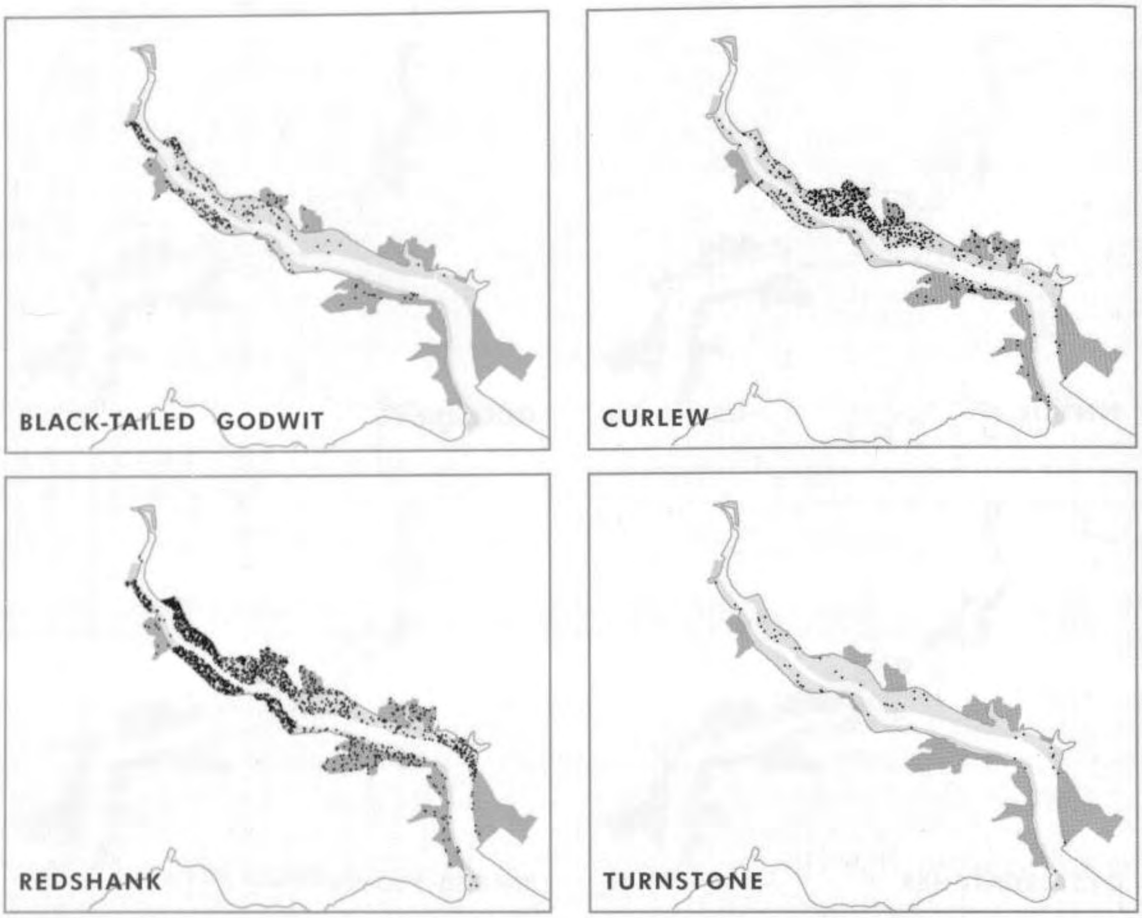


Figure 4.16.3 (iii) Low tide waterbird distribution recorded at the Orwell Estuary, winter 1997-98

4.17 STOUR ESTUARY

LTC site code: CU
Centre grid: TM1833
JNCC estuarine review site: 109
Habitat zonation: 1560 ha intertidal, 814 ha subtidal, 67 ha nontidal
Statutory status: Stour and Orwell Estuaries SPA (UK9009121), Stour and Orwell Estuaries Ramsar (7UK076)
Winter waterbird interest: Great Crested Grebe, Cormorant, Mute Swan, Dark-bellied Brent Goose, Shelduck, Wigeon, Pintail, Goldeneye, Oystercatcher, Ringed Plover, Grey Plover, Lapwing, Knot, Dunlin, Black-tailed Godwit, Curlew, Redshank, Turnstone, Waterbird assemblage

SITE DESCRIPTION

The Stour Estuary is a long, relatively straight estuary which forms the eastern end of the border between Suffolk and Essex. The estuary's mouth joins that of the Orwell as the two rivers enter the North Sea between Felixstowe and Harwich. The outer parts of the site are sandy, but shores become progressively muddier further upstream. There are five shallow bays: Seafield, Holbrook and Erwarton along the north shore and Copperas and Jacques on the south side. The estuary is backed by wooded cliffs and agricultural land. Since much of this land is private, there is very little disturbance to most of the estuary. Some sailing occurs but is not intensive and wildfowling occurs over several parts of the site. Most of the industrial activity occurs around Harwich, where further dock development is occurring at Bathside Bay.

COVERAGE AND INTERPRETATION

The Stour Estuary was counted for the scheme during all four months of the 1996–97 winter. Figure 4.17.1 shows the positions of the 40 sections counted for the survey.

As Figure 4.17.2 shows, the major difference between the LTC and SPA boundaries is that the SPA also covers the adjacent Orwell Estuary. On the Stour itself, the level of agreement was very close overall. However, Bathside Bay at Harwich was counted for the LTCs but is omitted from the SPA boundary, as is the most upstream section. The boundaries of the Ramsar site are entirely coincident with those of the SPA.

It is known that some species make regular daily movements between the Stour and Orwell, and some birds roosting on Hamford Water are also known to feed on the Stour Estuary (M. Wright, J. Novorol pers. comm.). In addition, some of the wildfowl, in particular, may make regular movements between the Stour and nearby Alton Water.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1996–97 are presented for all of the 18 species of principal interest listed above. For clarity, smaller dots are used to display the distributions of Lapwing, Knot and Dunlin. Additional maps of total birds and total birds weighted by 1% threshold

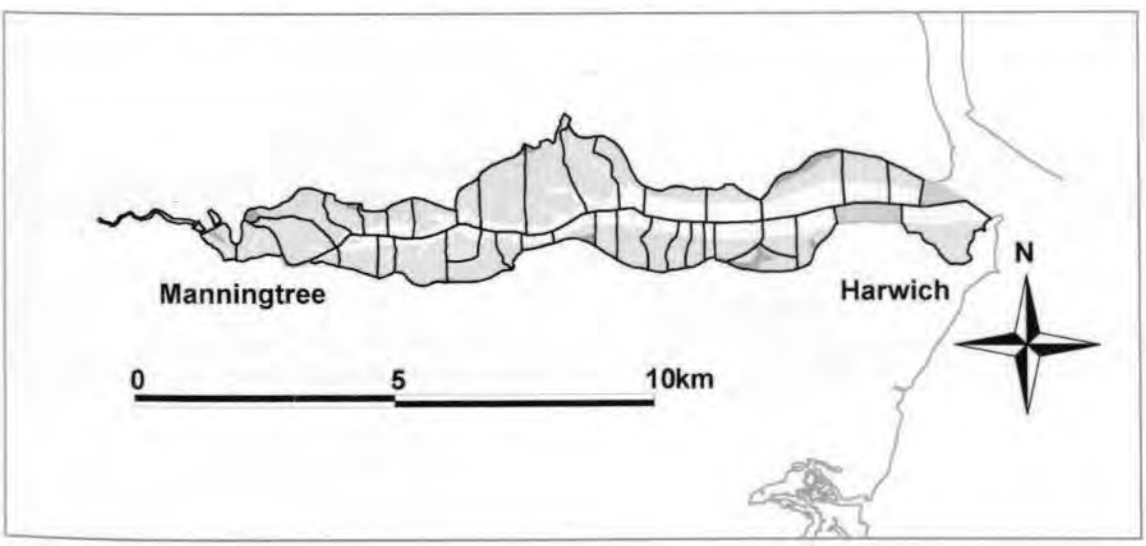


Figure 4.17.1: LTC sections at the Stour Estuary, winter 1996–97

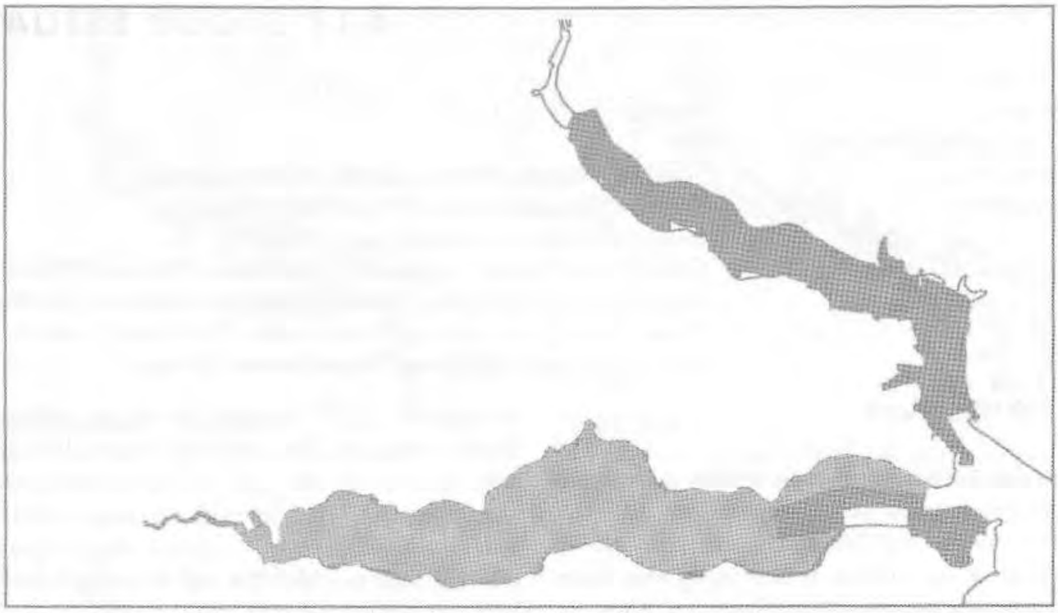


Figure 4.17.2: LTC and SPA boundaries, with overlap, at the Stour Estuary

value are also presented (Figure 4.17.3).

The totals map indicates significantly higher bird densities at the inner, western end of the site, the same broad pattern being repeated by the weighted total map. Most species were distributed throughout the site, but many showed distinct preferences for particular parts of the estuary. Species which individually occurred in higher densities in the inner (western) half of the site were Shelduck (especially at Seafield Bay), Wigeon, Pintail, Goldeneye, Grey Plover, Black-tailed Godwit and Redshank. Species which displayed a more even distribution along the length of the site were Great Crested Grebe, Cormorant, Brent Goose, Ringed Plover (although a cluster at Stutton Ness), Dunlin, Curlew and Turnstone. Some species were rather clumped in their distribution, such as Lapwing and Knot, the latter being the major species using the non-SPA area of Bathside Bay. The highest concentrations of Oystercatchers were found at Erwarton Bay on the outer estuary, although the species occurred throughout. Mute Swans were extremely concentrated in the upper estuary around Manningtree.

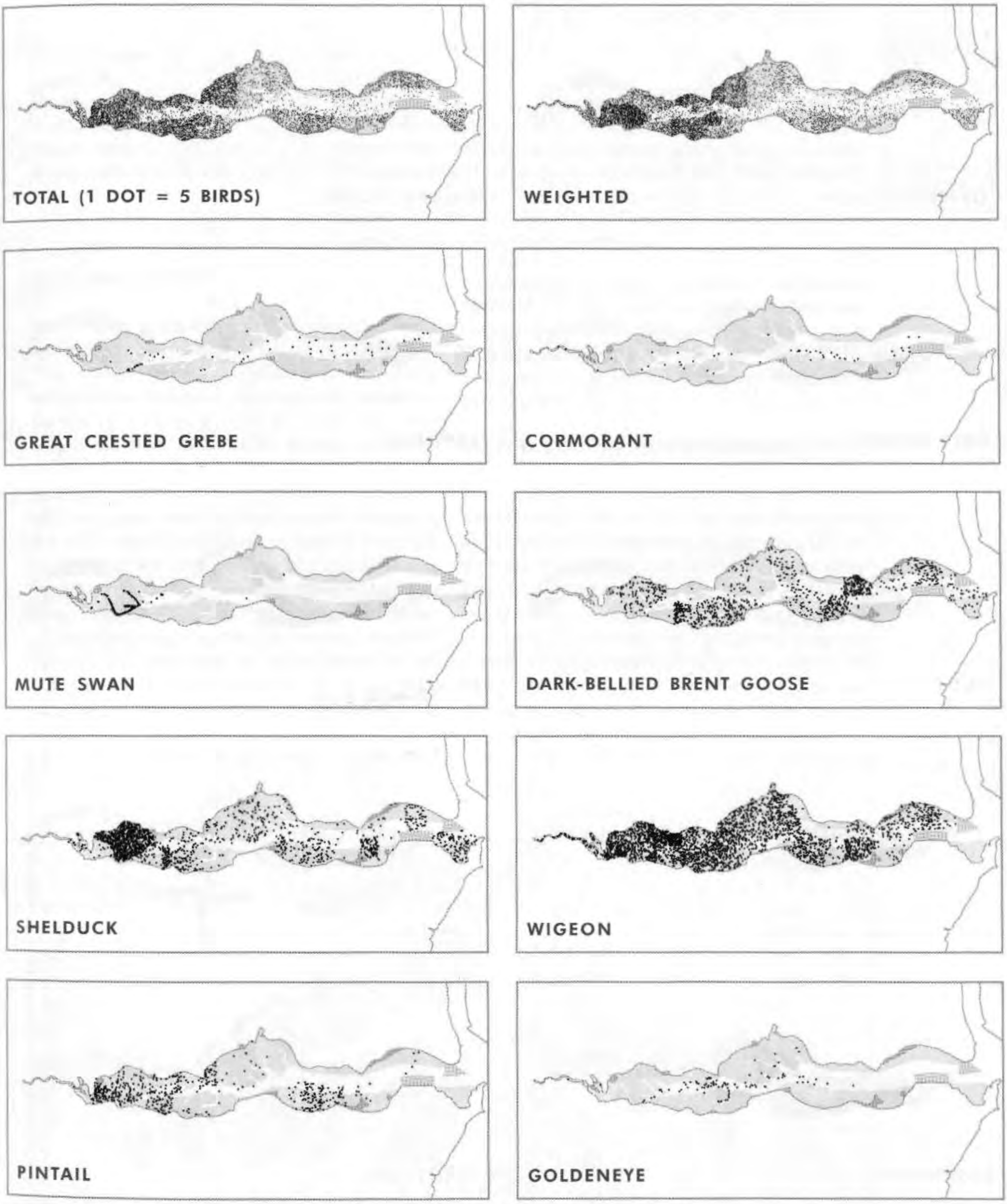


Figure 4.17.3 (i): Low tide waterbird distribution recorded at the Stour Estuary, winter 1996-97

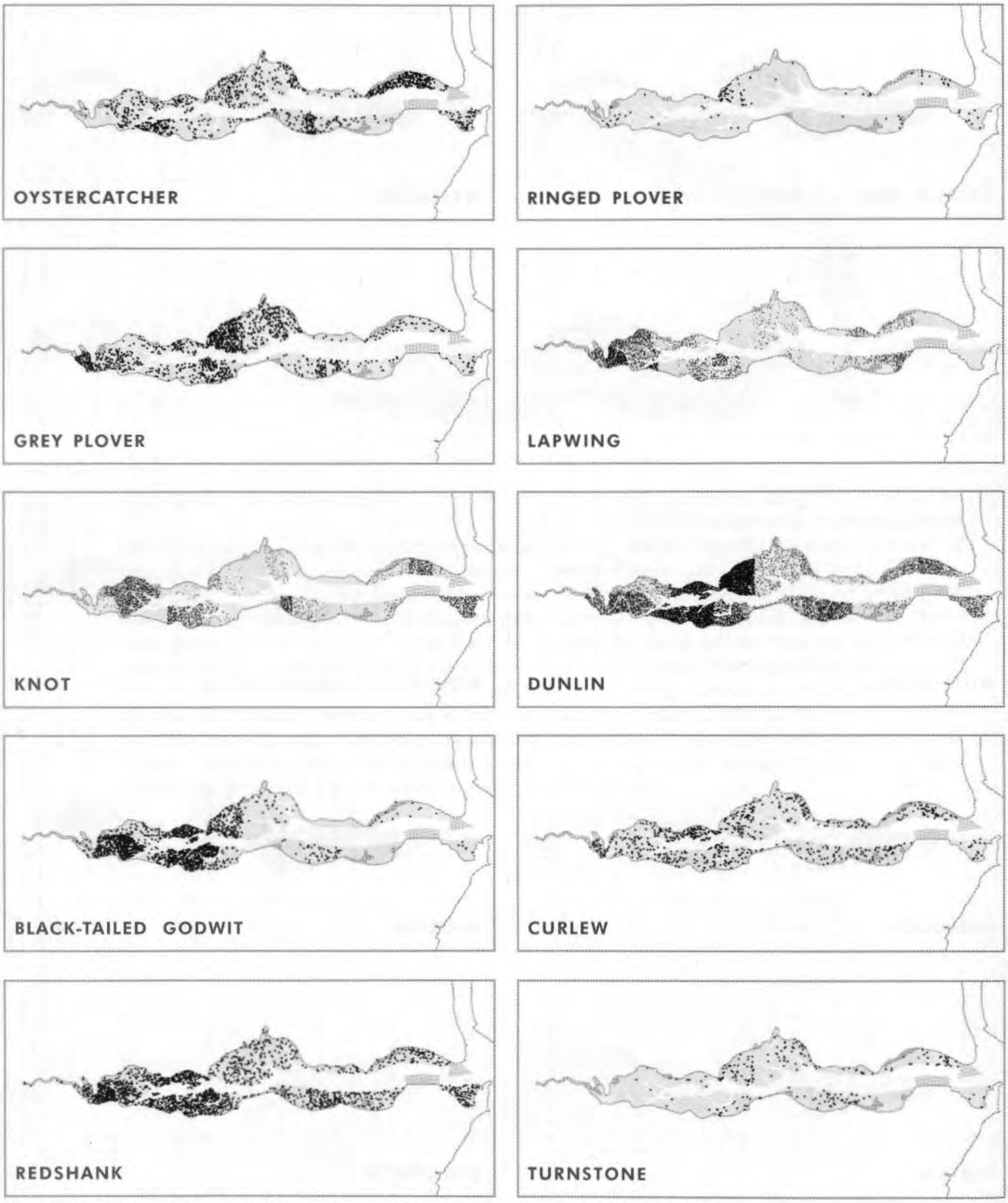


Figure 4.17.3 (ii): Low tide waterbird distribution recorded at the Stour Estuary, winter 1996-97

4.18 HAMFORD WATER

LTC site code:	BH
Centre grid:	TM2325
JNCC estuarine review site:	110
Habitat zonation:	367 ha intertidal, 106 ha subtidal, 58 ha nontidal
Statutory status:	Hamford Water SPA (UK9009131), Hamford Water Ramsar (7UK063)
Winter waterbird interest:	Dark-bellied Brent Goose, Shelduck, Wigeon, Teal, Pintail, Avocet, Ringed Plover, Golden Plover, Grey Plover, Lapwing, Knot, Sanderling, Dunlin, Ruff, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Waterbird assemblage

SITE DESCRIPTION

Hamford Water is a large, shallow, estuarine basin with an extremely diverse mix of habitat types. The whole site is a mosaic of dissected saltmarshes, islands, channels and mudflats backed by a range of brackish, fresh and reed-fringed marshes. Many of the islands are former saltmarshes embanked and converted to wet grassland, but some have reverted to saltmarsh after sea walls were breached around the end of the 19th century; saltmarsh comprises one third of the whole site. The mouth of the main channel into Pennyhole Bay is flanked on either side by dune-topped shingle spits. The principal cause of disturbance to waterfowl at Hamford Water is military helicopter training, whilst there is an explosives works on the north shore, along with other more usual potential sources of disturbance such as walkers, boats, aircraft and wildfowling. Much of the surrounding marshland has been converted to arable farmland. As with other sites along this stretch of coast, saltmarsh erosion from rising sea-levels is also a concern (J. Novorol pers. comm.).

COVERAGE AND INTERPRETATION

Hamford Water was included in the scheme in the winters of 1992–93 and 1997–98, counts being submitted for all months. Coverage was patchy, however. Figure 4.18.1 shows the positions of the nine sections counted for the survey during the two winters, clearly only representing a small part of the site. The northern two sections at Dugmore Sands were covered during both winters, the southern four at the Wade were only counted during 1992–93 and the western three only in

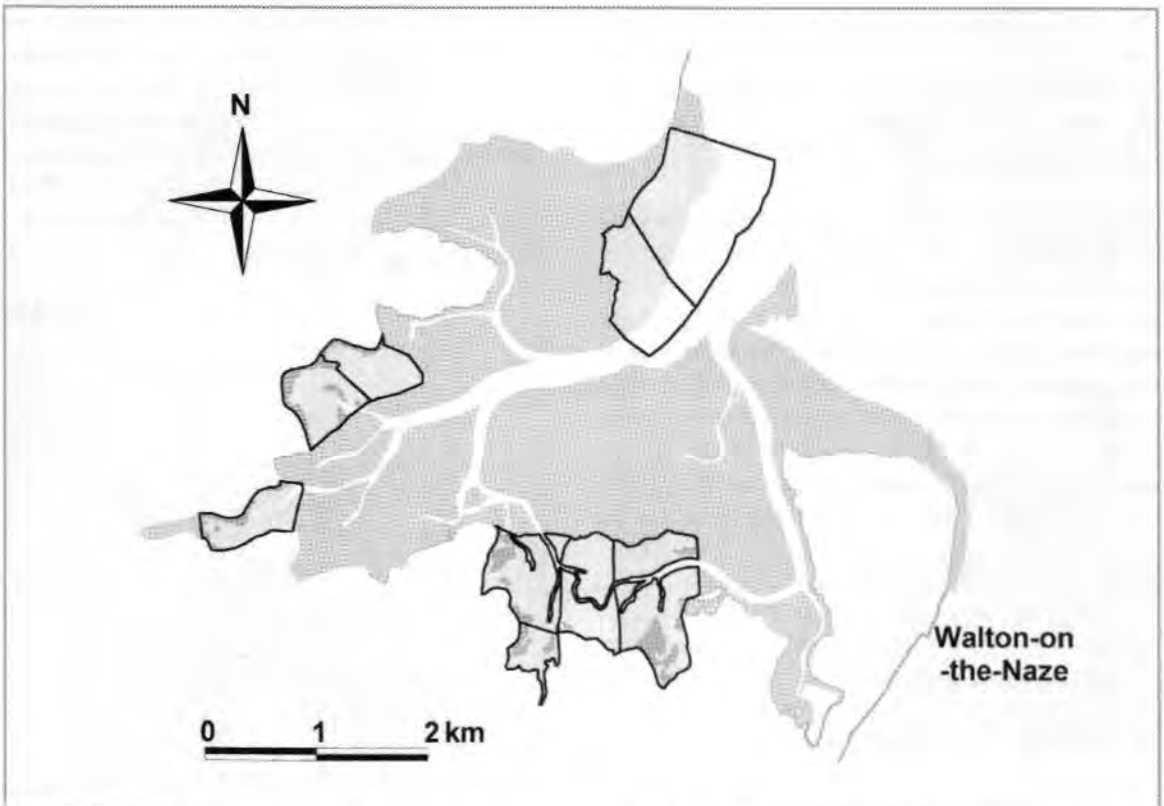


Figure 4.18.1: LTC sections at Hamford Water, winters 1992–93 and 1997–98

Figure 4.18.2: LTC and SPA boundaries, with overlap, at Hamford Water

1997–98. The low level of coverage was due mostly to the nature of the site which has very extensive areas of saltmarshes and creeks, making viewing very difficult.

Figure 4.18.2 shows that the SPA area was only partially covered during the LTCs. Large areas of the estuary remain unsurveyed which doubtless hold many birds. Therefore, the counts to date do not adequately describe the bird usage of the SPA. The boundaries of the Ramsar site are entirely coincident with those of the SPA.

The relationship of the numbers of birds roosting at Hamford with the numbers feeding is complicated by a complex pattern of movements between here and other nearby sites. Many Dunlin, Knot and Grey Plovers leave roosts at Hamford to feed on the Stour and Orwell to the north. A sizeable proportion of Hamford Water's Brent Geese make extensive use of Holland Marshes to the south-west, with Wigeon and Teal also moving there when it floods. Other Wigeon leave Hamford at dawn or as the tide ebbs to fly north to the Stour, whilst other wildfowl such as Mallard, Shoveler, Teal, Greylag Geese and Canada Geese fly north-east to roost at Trimley Marshes on the Orwell (J. Novorol pers. comm.).

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1997–98 are presented for all of the 18 species of principal interest listed above. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.18.3). The totals map shows that the southern part of Dugmore Sands held the highest concentration of birds during 1997–98 of those areas surveyed, but the weighted total map removes the emphasis on this section; the high bird density here was largely driven by Lapwing. Given the limited area covered, however, there is little to be said about the distributions of individual species. Although many species were relatively widespread on those sections covered, some (such as Teal, for example) showed distinct preferences for certain areas of the estuary.

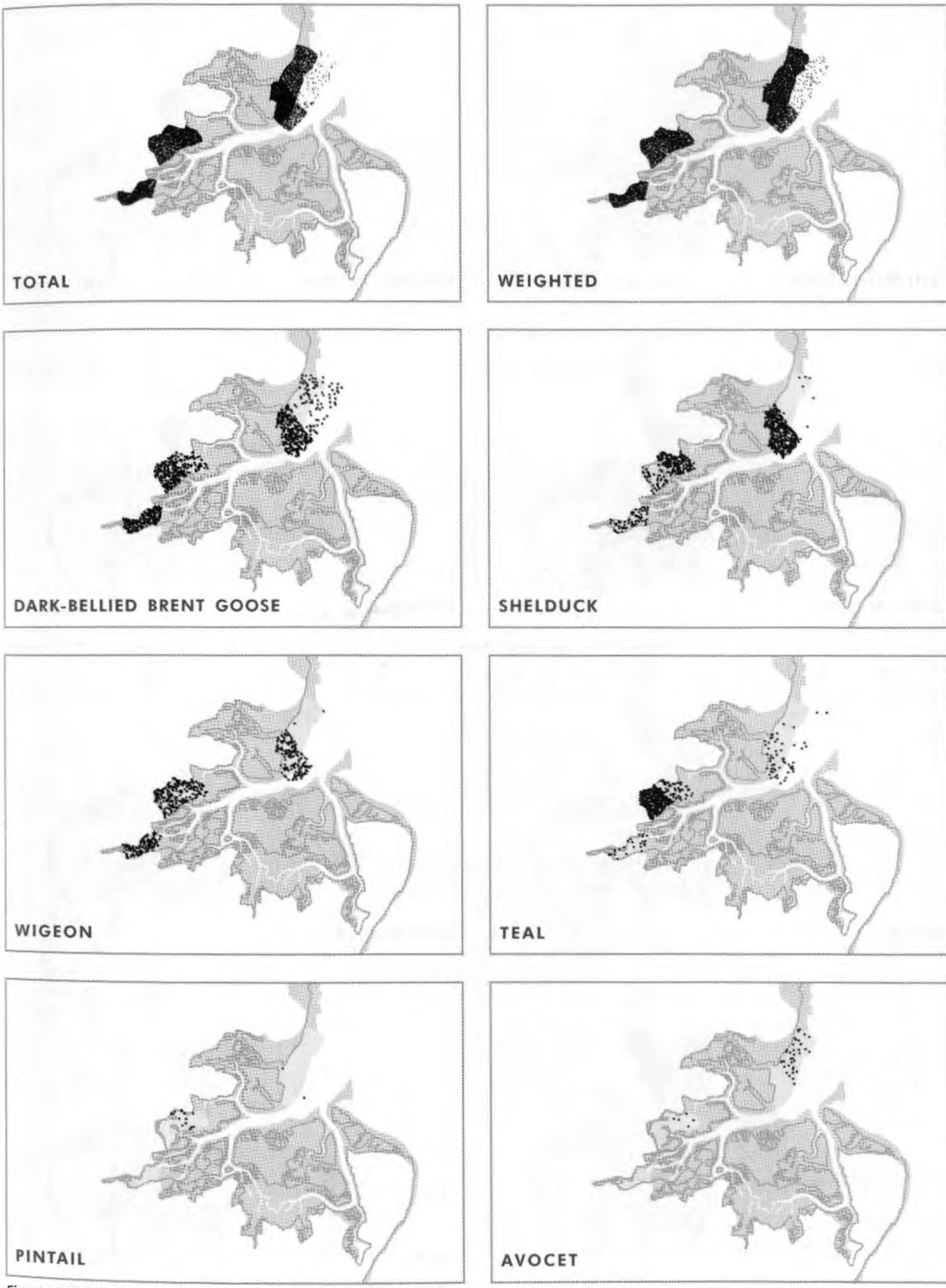


Figure 4.18.3 (i): Low tide waterbird distributions recorded at Hamford Water, winter 1997-98

Figure 4.18.3 (ii): Low tide waterbird distributions recorded at Hamford Water, winter 1997-98

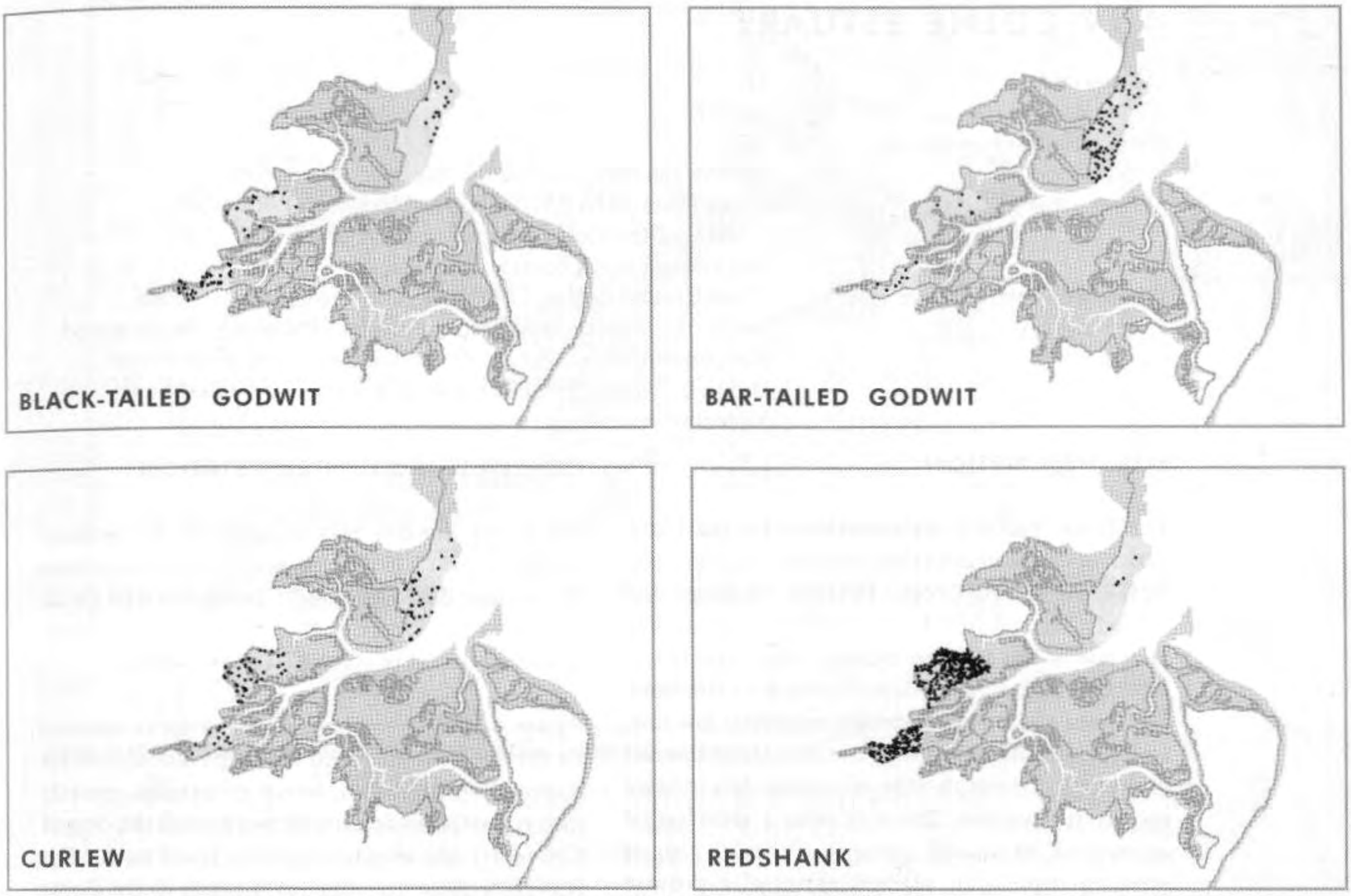


Figure 4.18.3 (iii): Low tide waterbird distributions recorded at Hamford Water, winter 1997-98

4.19 COLNE ESTUARY

LTC site code:	DC
Centre grid:	TM0617
JNCC estuarine review site:	111
Habitat zonation:	560 ha intertidal, 249 ha subtidal, 415 ha nontidal
Statutory status:	Colne Estuary SPA (UK9009243), Blackwater Estuary SPA (UK9009245), Colne Estuary Ramsar (7UK079), Blackwater Estuary Ramsar (7UK087)
Winter waterbird interest:	Great Crested Grebe, Cormorant, Dark-bellied Brent Goose, Shelduck, Wigeon, Teal, Pintail, Shoveler, Goldeneye, Red-breasted Merganser, Avocet, Ringed Plover, Golden Plover, Grey Plover, Lapwing, Dunlin, Ruff, Black-tailed Godwit, Curlew, Redshank, Waterfowl assemblage

SITE DESCRIPTION

The Colne Estuary, as considered for the LTCs, consists of the main river channel, Brightlingsea Creek, Alresford Creek, Pyefleet Channel and Strood Channel (north of Mersea Island) as well as some of the Geedon Saltings area. The site is adjacent to the Blackwater Estuary to the west. The main channels are mostly muddy at low tide; sandier sediments around the mouth of the site and along the south side of Mersea Island were mostly uncounted. There is also a substantial amount of saltmarsh present, although this is eroding rapidly in places, especially around Mersea Island. Leisure is the dominant human use of the site, especially water-based sports, although there are some small industrial sites. There is a relatively high human population around the estuary, leading to development pressures on parts of the site (A. Thompson pers. comm.).

COVERAGE AND INTERPRETATION

The Colne Estuary was counted for the scheme during 1994–95 (the same winter as the adjoining Blackwater Estuary), counts being received for all four months. Figure 4.19.1 shows the positions of the 12 sections counted for the survey.

Figure 4.19.2 shows how all of the areas counted for the LTCs are included within SPA designations (except for the main water channels), mostly within the Colne Estuary SPA although the Strood Channel in the west is part of the Blackwater SPA. However, there are significant areas of the Colne Estuary SPA which have not yet been included within the scheme. The most important of these are the Colne Point/Ray Creek area, Mersea Flats, St Osyth Creek, Fingringhoe Wick Nature Reserve, large areas of saltmarsh in the north-west of the site and an area of grazing marsh west

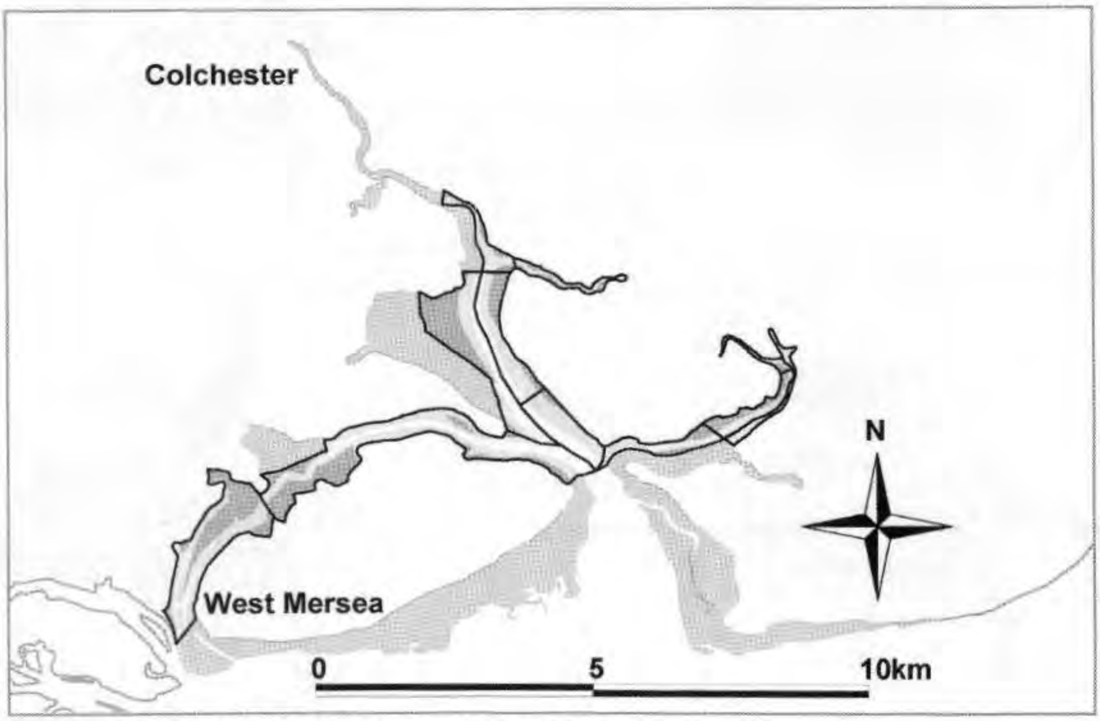


Figure 4.19.1: LTC sections at the Colne Estuary, winter 1994–95

Figure 4.19.2: LTC and SPA boundaries, with overlap, at the Colne Estuary

of Brightlingsea. Notably, however, the upstream limits of both SPA and LTC boundaries are roughly the same, despite the intertidal habitat extending north several more miles into Colchester. The boundaries of the Ramsar sites are entirely coincident with those of the SPAs.

Movements of birds between the Colne and Blackwater Estuaries (and perhaps also Dengie Sands) are likely to occur on a daily basis. Additionally, Abberton Reservoir is situated only a few miles west of the Colne and frequent interchange of some species (including Cormorant, Wigeon and Teal) is known to occur (A. Thompson pers. comm.).

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1994–95 are presented for 17 of the 20 species of principal interest listed above. For clarity, smaller dots are used to display the distributions of Lapwing and Dunlin. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.19.3). Of the remaining species, no Shoveler or Pintail and only small numbers of Ruff were recorded, these species mostly frequenting adjacent nontidal habitats.

The totals map and, to a greater extent, the weighted totals map highlight the lower reaches of the river Colne. Many species were found in high densities in this area, especially the west shore south of Fingringhoe Wick, including Brent Goose, Golden Plover, Grey Plover, Lapwing, Dunlin and Avocet, the latter species being found here exclusively during the survey but the other species occurring more widely. Redshank, Curlew and Wigeon were very widespread but the species displaying the most even spread was Shelduck. However, as with most other species apart from Redshank, few Shelduck were found at Alresford Creek. Ringed Plovers were restricted to the channel north of Mersea Island within the area surveyed (although more presumably occur at low tide at Mersea Flats and Colne Point). Both Black-tailed Godwits and Teal were largely localised to Brightlingsea Creek and the area south of Fingringhoe Wick. Small numbers of Great Crested Grebes, Cormorants, Red-breasted Mergansers and Goldeneyes were found throughout, with a small concentration of the latter species at the western end of Mersea Island in Strood Channel.

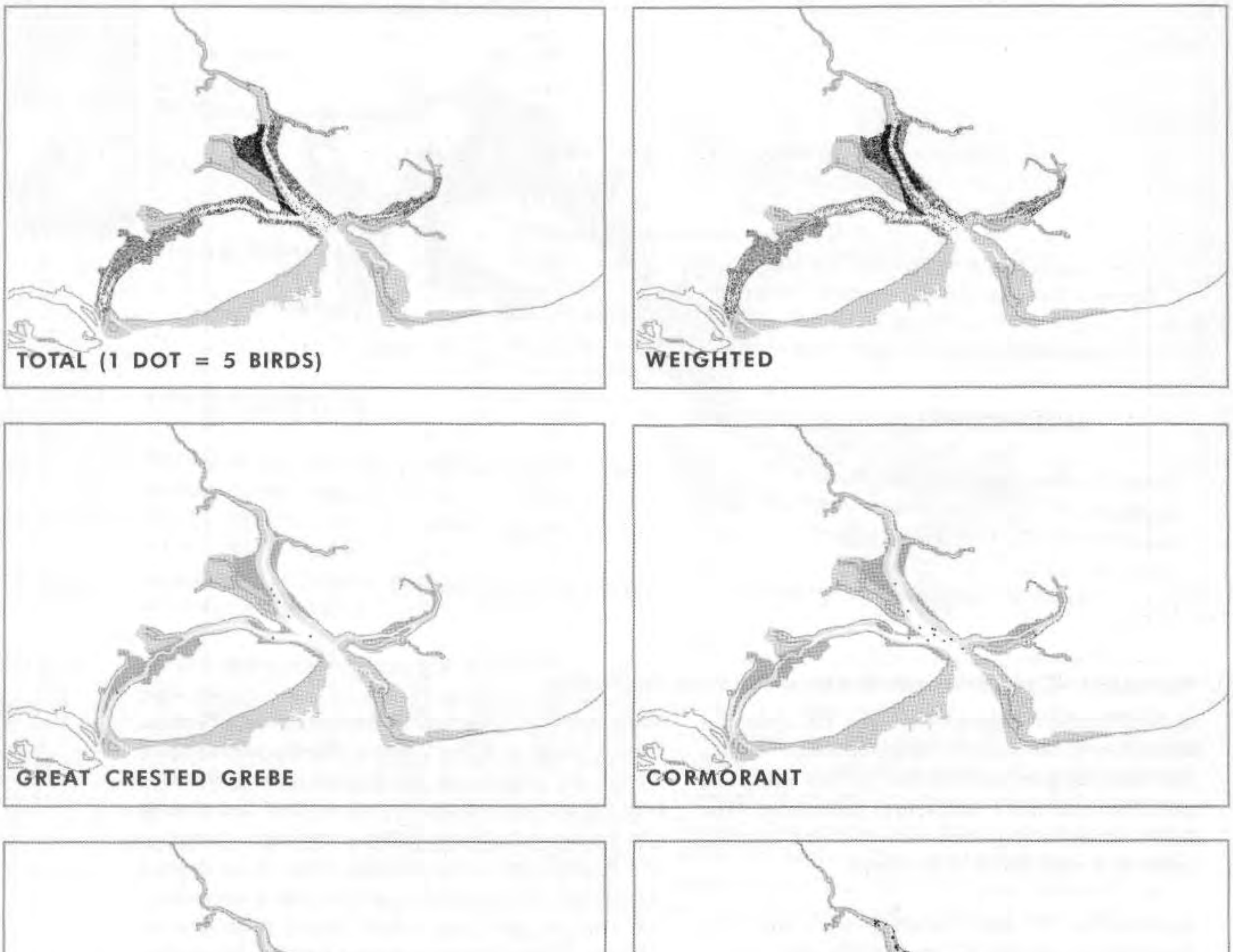


Figure 4.19.3 (i): Low tide waterbird distributions recorded at the Colne Estuary, winter 1994-95

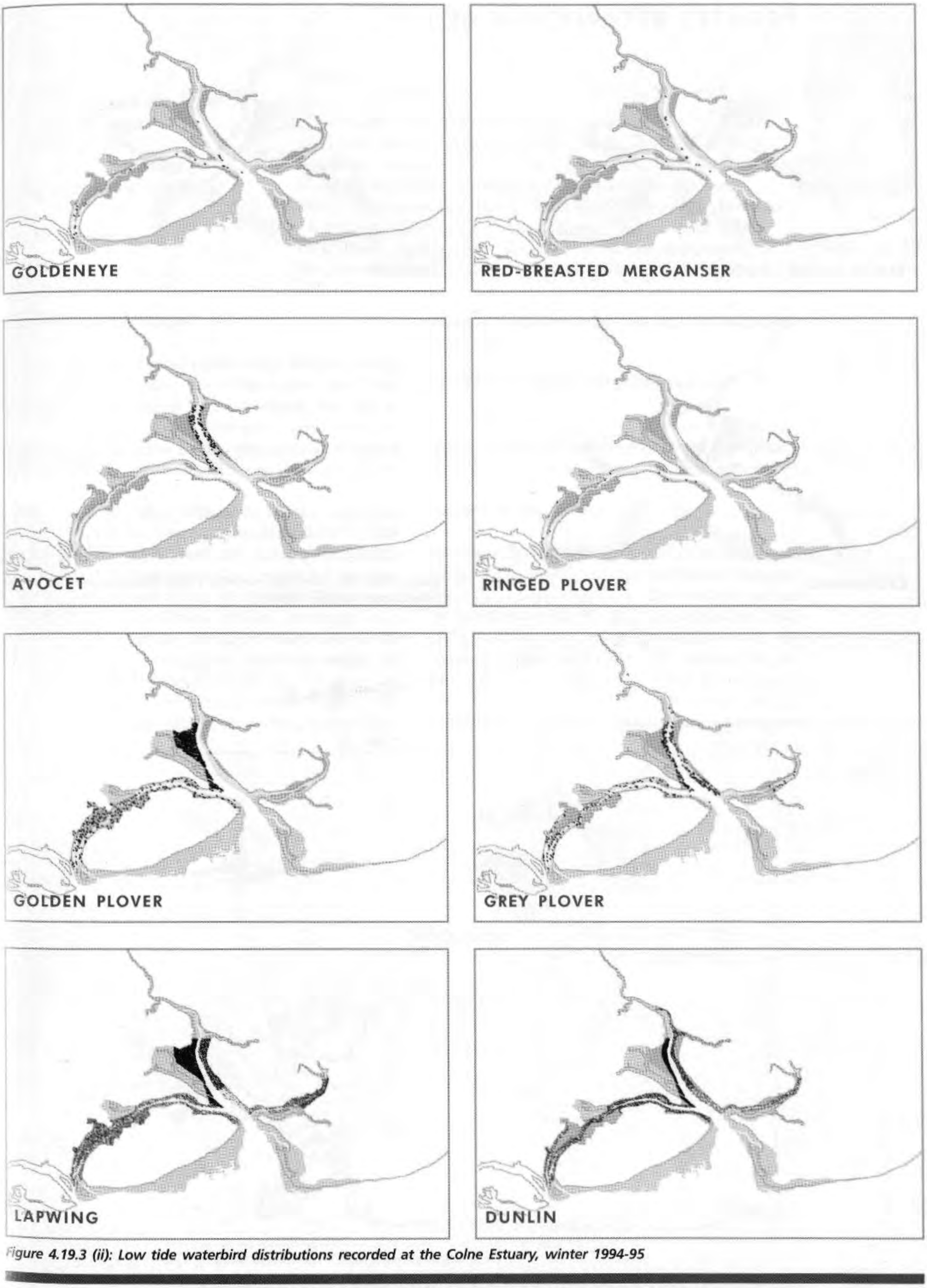


Figure 4.19.3 (ii): Low tide waterbird distributions recorded at the Colne Estuary, winter 1994-95

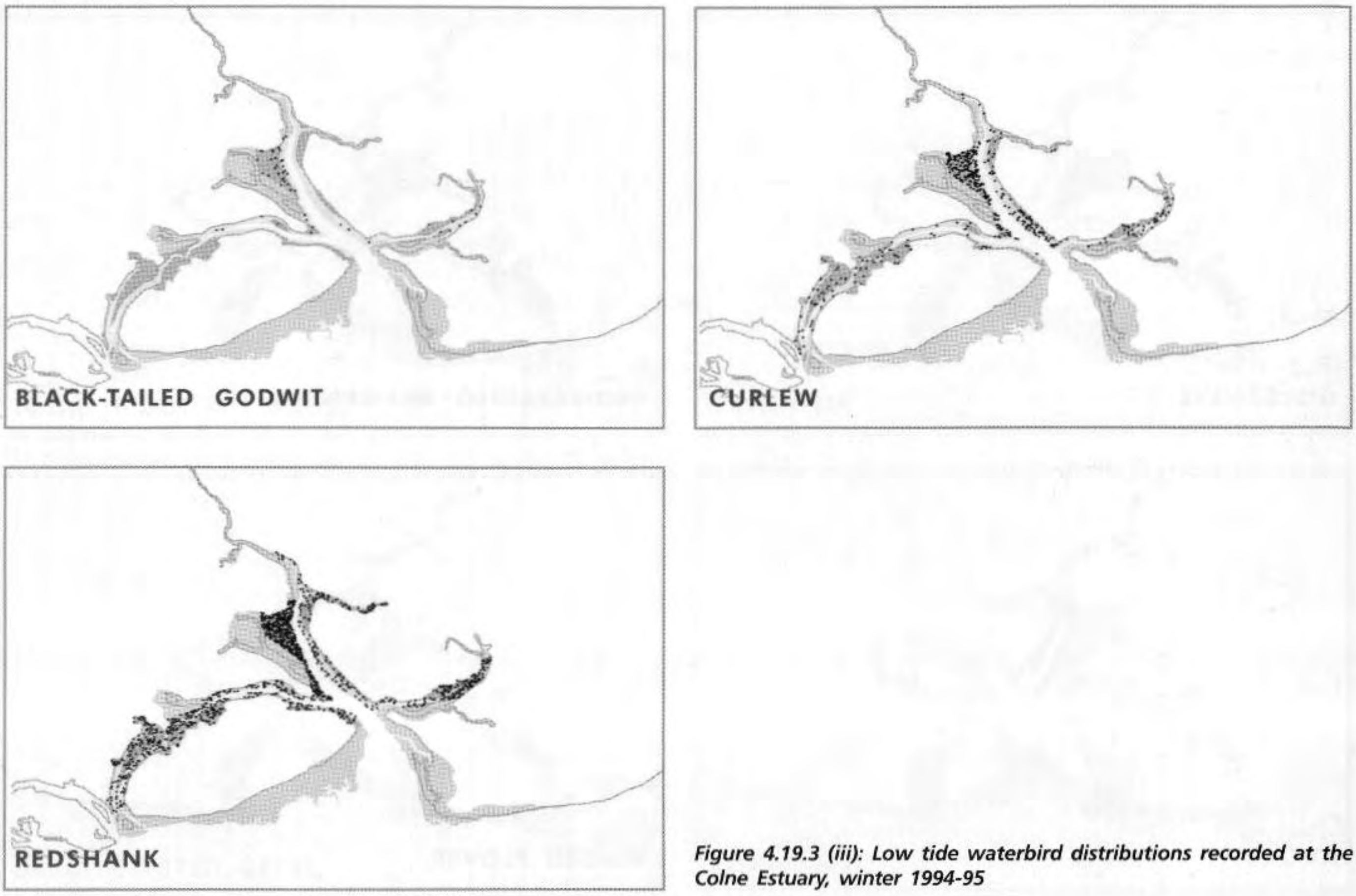


Figure 4.19.3 (iii): Low tide waterbird distributions recorded at the Colne Estuary, winter 1994-95

4.20 BLACKWATER ESTUARY

LTC site code:	CB
Centre grid:	TL9507
JNCC estuarine review site:	112
Habitat zonation:	2368 ha intertidal, 1587 ha subtidal, 766 ha nontidal
Statutory status:	Blackwater Estuary SPA (UK9009245), Dengie SPA (UK9009242), Blackwater Estuary Ramsar (7UK087), Dengie Ramsar (7UK073)
Winter waterbird interest:	Great Crested Grebe, Cormorant, Dark-bellied Brent Goose, Shelduck, Wigeon, Teal, Pintail, Shoveler, Goldeneye, Red-breasted Merganser, Oystercatcher, Avocet, Ringed Plover, Golden Plover, Grey Plover, Lapwing, Knot, Dunlin, Ruff, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Waterbird assemblage

SITE DESCRIPTION

The River Blackwater opens out at Maldon on the Essex coast to form one of the largest and most important estuaries in East Anglia. The site is adjacent to the Colne Estuary to the north and Dengie Flats to the south. Additionally, Abberton Reservoir lies only a few miles to the north. There is a wide diversity of habitats, with a large area of mudflats but also saltmarsh, creeks, channels and islands. Deposition of shingle and shell banks and exposed gravel beds are features of the tidal flats. Behind the sea-walls, important areas of coastal grassland occur. Much of the Blackwater saltmarsh is suffering erosion although in a number of locations managed realignment of the sea-defences is taking place which will create new estuarine habitat. Many of the human activities on the estuary are leisure-related, especially boating, but also beach recreation, wildfowling, fisheries and jet-skiing. The site is not heavily urbanised.

COVERAGE AND INTERPRETATION

The Blackwater Estuary was covered by the scheme during the winter of 1994–95, with counts being carried out during all four months. Figure 4.20.1 shows the positions of the 46 sections counted for the survey.

The majority of the LTC site is covered by SPA designation, mostly by the Blackwater Estuary SPA (which also extends a little further east on the north shore into the area covered by the Colne LTCs) but also by some of the Dengie SPA in the south-east (Figure 4.20.2). The Blackwater Estuary SPA also covers additional nontidal areas around the estuary, notably at Old Hall Marshes (initially designated as a separate SPA but later subsumed)

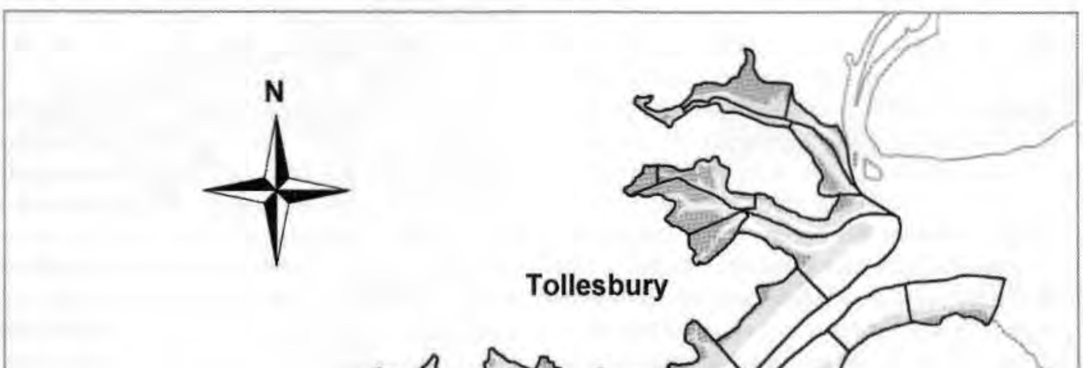


Figure 4.20.1: LTC sections at the Blackwater Estuary, winter 1994–95

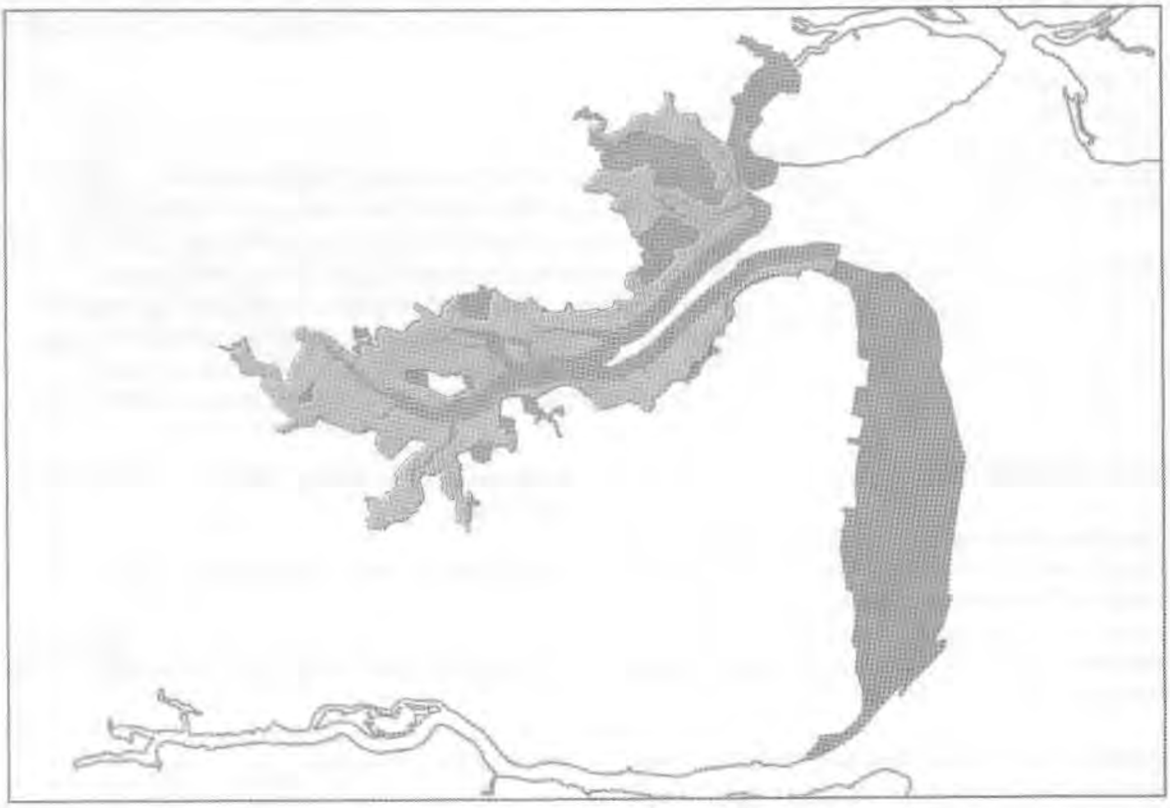


Figure 4.20.2: LTC and SPA boundaries, with overlap, at the Blackwater Estuary

and Tollesbury Wick Marshes. Any discussion of the birds of the sites and/or SPAs around this part of the Essex coast should be careful to take these boundary differences into account. In the future, the subdivision of the coast into separate sites should take the SPA boundaries into consideration. The boundaries of the Ramsar sites are entirely coincident with those of the SPAs.

Clearly, there is great scope for daily movements of birds between sites. For example, many of the Knot feeding in the south-east of the Blackwater appear to be roosting at Dengie (D. Wood pers. comm.). Similar movements of birds between the Blackwater and Colne are also likely. As well as movements between the estuary and the immediately adjacent nontidal habitats, such as Old Hall Marshes, the important site of Abberton Reservoir is situated only a few miles north of the estuary and it seems certain that birds, especially wildfowl, move between the two sites.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1994–95 are presented for 21 of the 23 species of principal interest listed above. For clarity, smaller dots are used to display the distributions of Golden Plover, Lapwing and Dunlin. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.20.3). Of the remaining species, very few Shovelers and no Avocets were recorded during the counts, these being found mostly on adjacent nontidal habitats such as at Old Hall and Tollesbury Wick Marshes.

The totals maps show that almost all of the site was used by large numbers of birds, although key areas appear to be the central parts of the north shore and the channels either side of Old Hall Marshes. Most of the key species were similarly widespread, such as Brent Goose, Shelduck, Oystercatcher, Ringed Plover, Lapwing, Dunlin, Curlew and Redshank. Wigeon, Teal and Pintail were more localised, with Old Hall Marshes clearly important for the first two as well as supporting the highest concentrations of Goldeneyes and Red-breasted Mergansers. Golden Plovers were distributed widely but locally around the site. Grey Plovers showed a clear preference for the central north shore, along with Bar-tailed Godwits. Black-tailed Godwits occurred in higher densities in the inner parts of the estuary. Knot were mostly found between St Lawrence Bay and Bradwell Waterside but with some on the inner estuary. Great Crested Grebes were present in small numbers with Cormorants more widespread. Ruff were only noted at Salcott Channel.

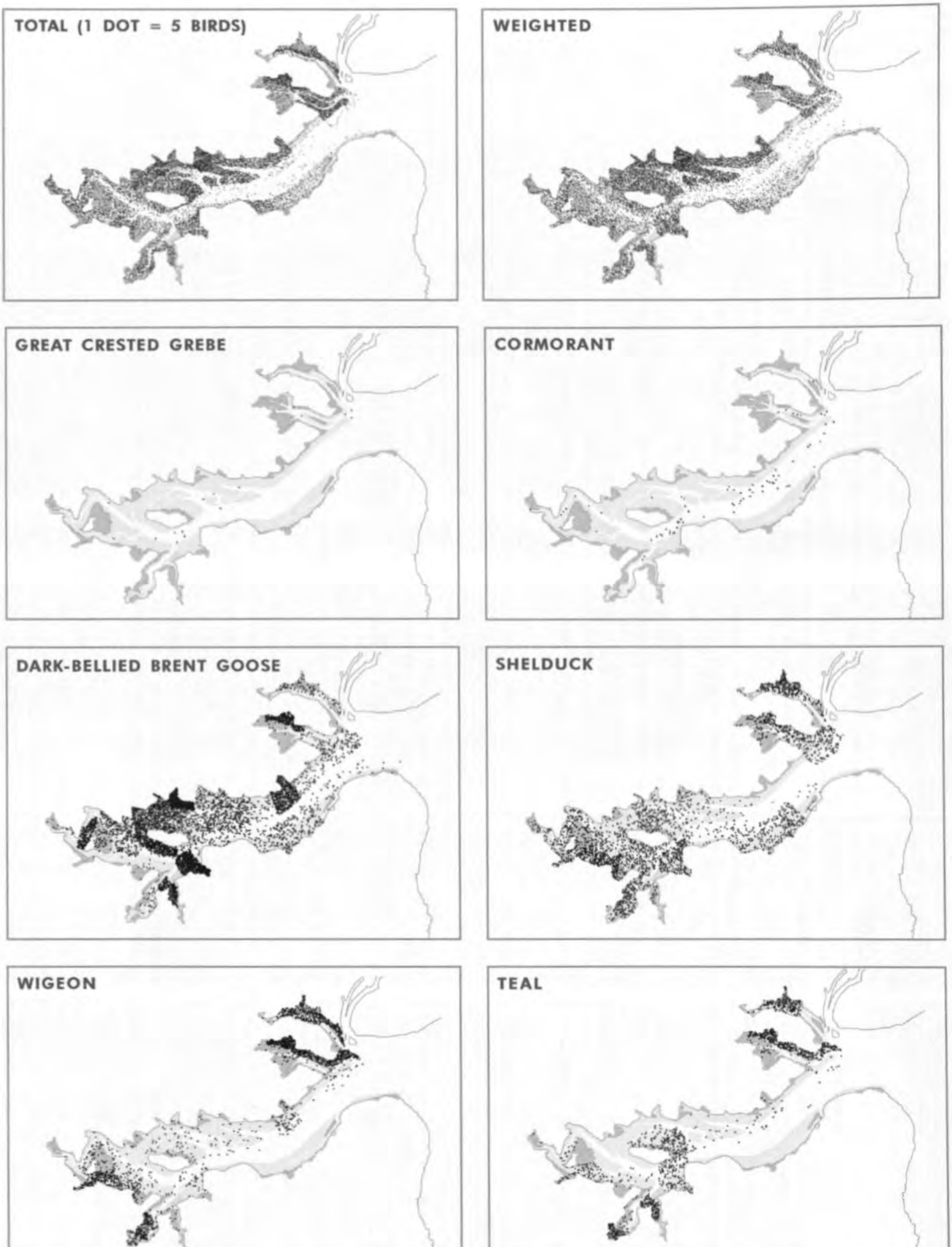


Figure 4.20.3 (i): Low tide waterbird distributions recorded at the Blackwater Estuary, winter 1994-95

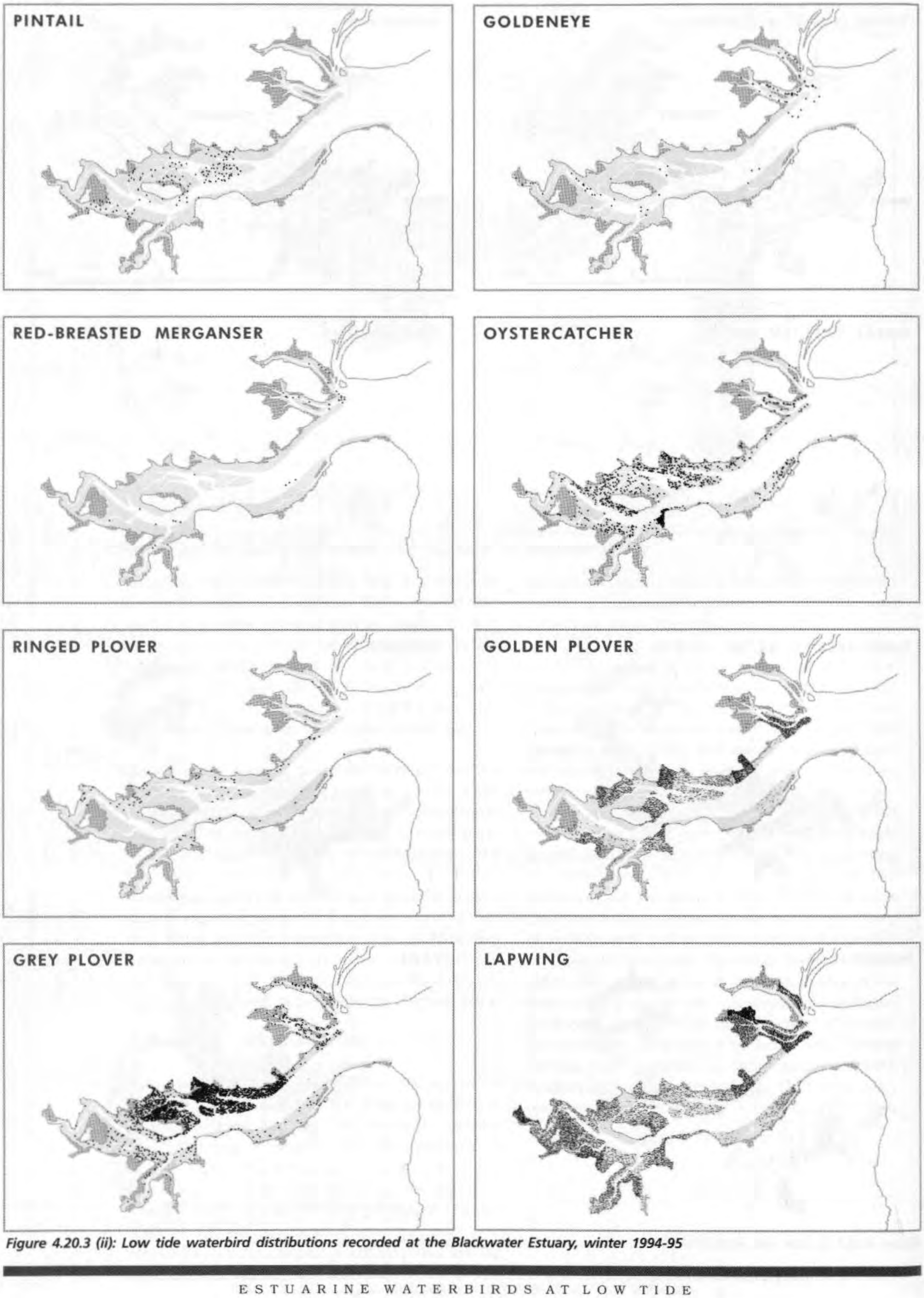
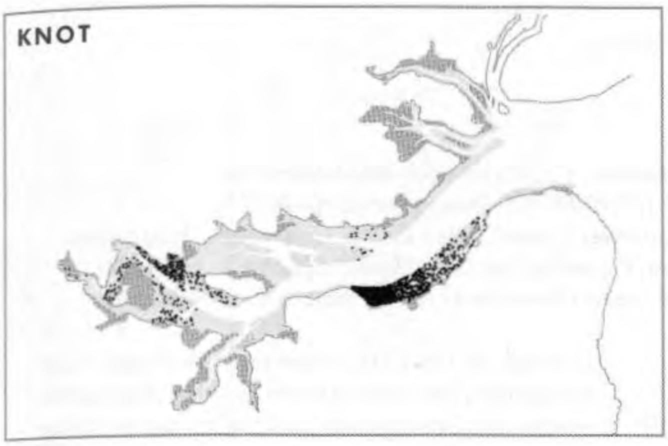
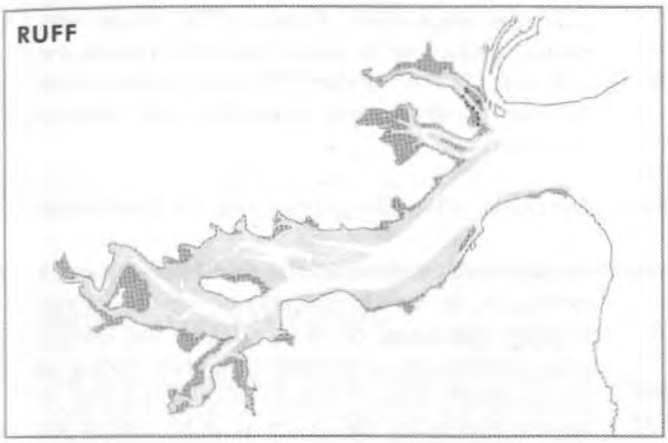
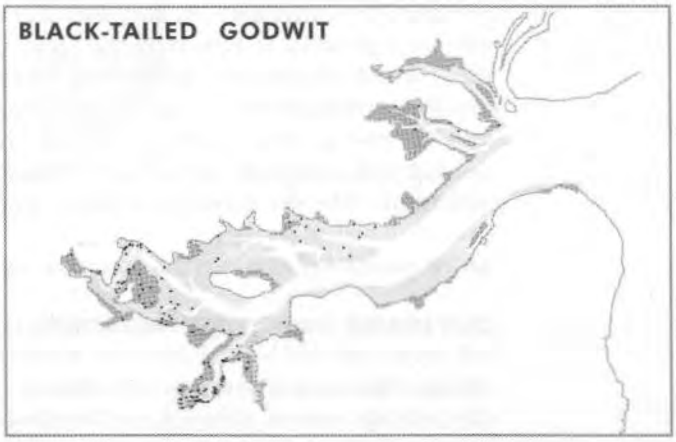
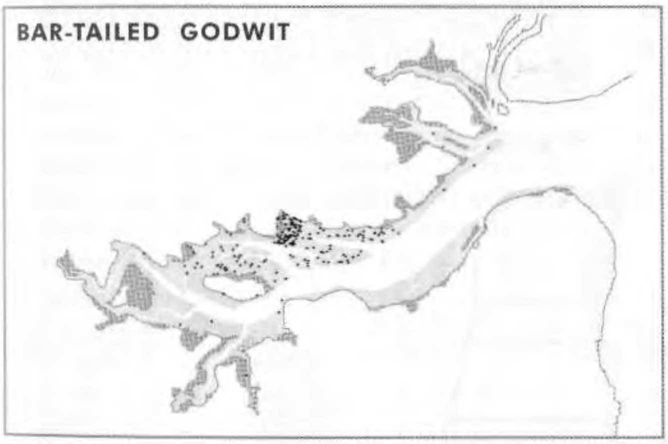


Figure 4.20.3 (ii): Low tide waterbird distributions recorded at the Blackwater Estuary, winter 1994-95









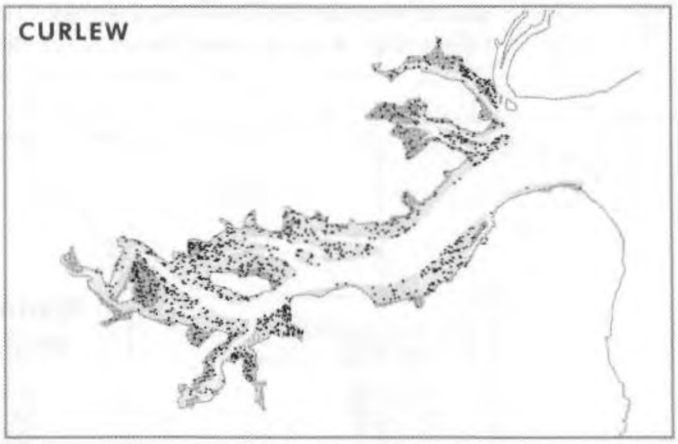


Figure 4.20.3 (iii): Low tide waterbird distributions recorded at the Blackwater Estuary, winter 1994-95

4.21 DENGIE FLATS

LTC site code:	CD
Centre grid:	TM0504
JNCC estuarine review site:	113
Habitat zonation:	2369 ha intertidal, 713 ha subtidal, 497 ha nontidal
Statutory status:	Dengie SPA (UK9009242), Dengie Ramsar (7UK073)
Winter waterbird interest:	Red-throated Diver, Great Crested Grebe, Cormorant, Dark-bellied Brent Goose, Oystercatcher, Grey Plover, Lapwing, Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Waterbird assemblage

SITE DESCRIPTION

Dengie Flats form a continuous mudflat on the Essex coast between the mouths of the Blackwater and Crouch–Roach Estuaries. There are extensive growths of *Enteromorpha* algae on the flats, which themselves grade into saltmarsh, relatively unusual in an open-coast situation. Most of the grazing marshes, which are now behind the sea-wall, have been claimed for agriculture. The site is relatively remote but some human activities do occur, including watersports, beach recreation, bait-digging and wildfowling.

COVERAGE AND INTERPRETATION

Dengie Flats was covered by the scheme during the 1992–93 winter, although no February count was made. Figure 4.21.1 shows the positions of the 12 sections counted for the survey.

Figure 4.21.2 shows that the whole of the area covered by the LTCs is within the Dengie SPA boundary. The SPA extends a little way northwards and southwards, taking in parts of the Blackwater Estuary and Crouch–Roach Estuary LTC sites respectively. Future LTCs in this area should endeavour to match up more closely the SPA and LTC boundaries. The boundaries of the Ramsar site are entirely coincident with those of the SPA.

Obviously, given the proximity of the Blackwater and Crouch–Roach Estuaries, a certain amount of movement between sites occurs. Notably, Knot feeding on the south-east part of the Blackwater Estuary make use of roost sites in the Dengie area. Additionally, a number of species feeding at the southern end of Dengie also make use of Maplin Sands to the south of the Crouch for feeding, and some roost on Foulness (J. Alderton, D. Wood pers. comm.). Similarly, some species (such as Lapwing) may utilise the non-estuarine hinterland.

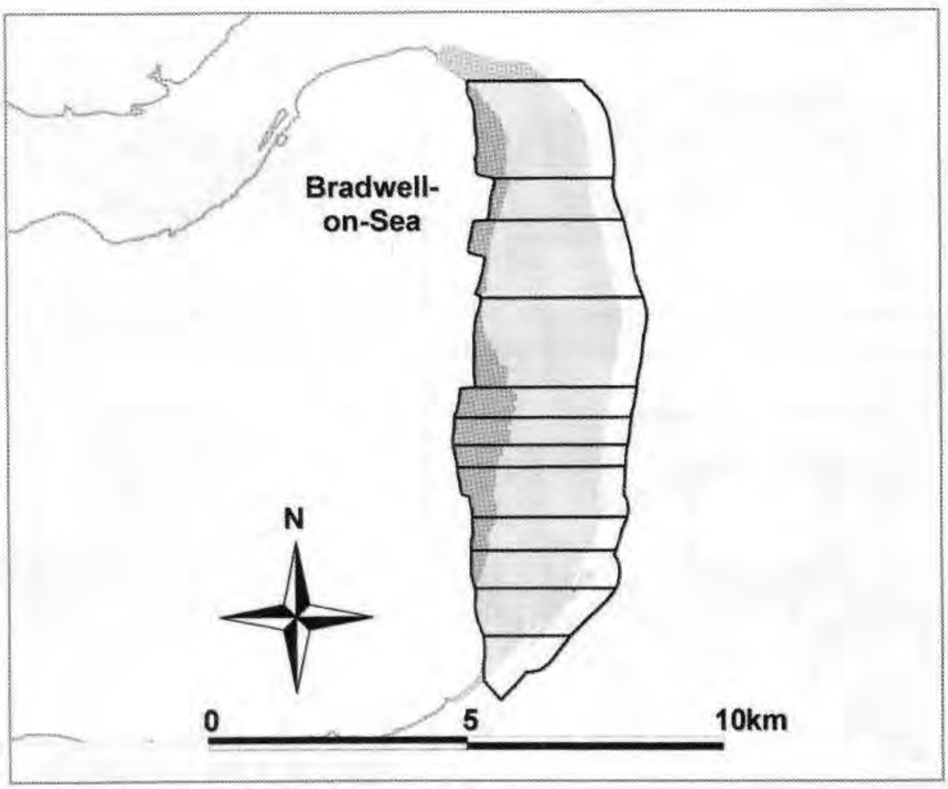


Figure 4.21.1: LTC sections at Dengie Flats, winter 1992–93

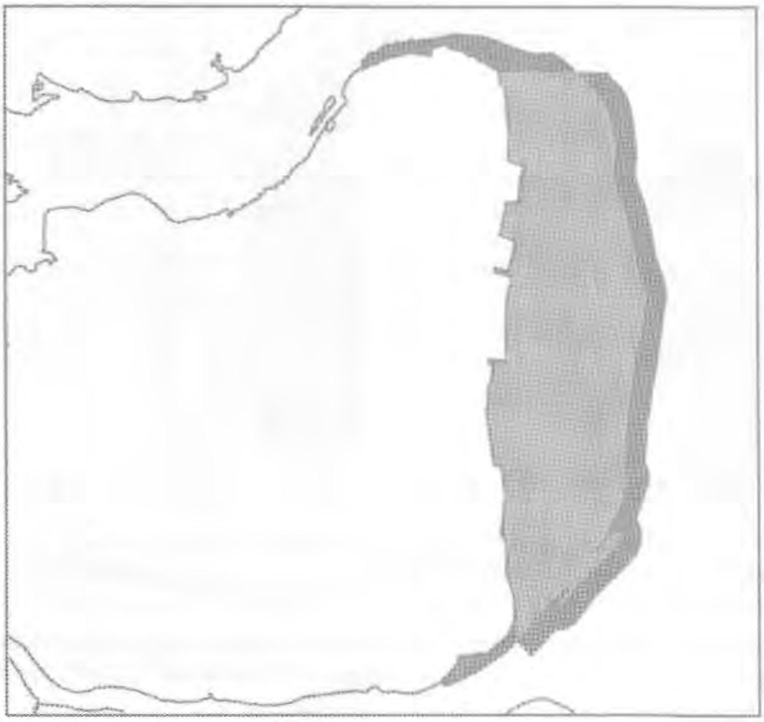


*Figure 4.21.2: **LTC and SPA boundaries, with overlap, at Dengie Flats***

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1992–93 are presented for eight of the 11 species of principal interest listed above. For clarity, smaller dots are used to display the distributions of Knot and Dunlin. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.21.3). Of the remaining species, no Red-throated Divers and only small numbers of Great Crested Grebes and Cormorants were noted, presumably due to the difficulties of viewing offshore species at the longer distances occurring at low tide.

Generally, the totals maps show relatively even distributions of birds across the site, with the higher density on the southernmost section presumably a result of the smaller shore width here. Most species of note occurred widely, with the maps showing slightly different preferences by different species. Perhaps most noteworthy was the separation of the two species of godwit into distinct areas with a relatively small degree of overlap between the two.

Figure 4.21.3 (i): Low tide waterbird distributions recorded at Dengie Flats, winter 1992-93

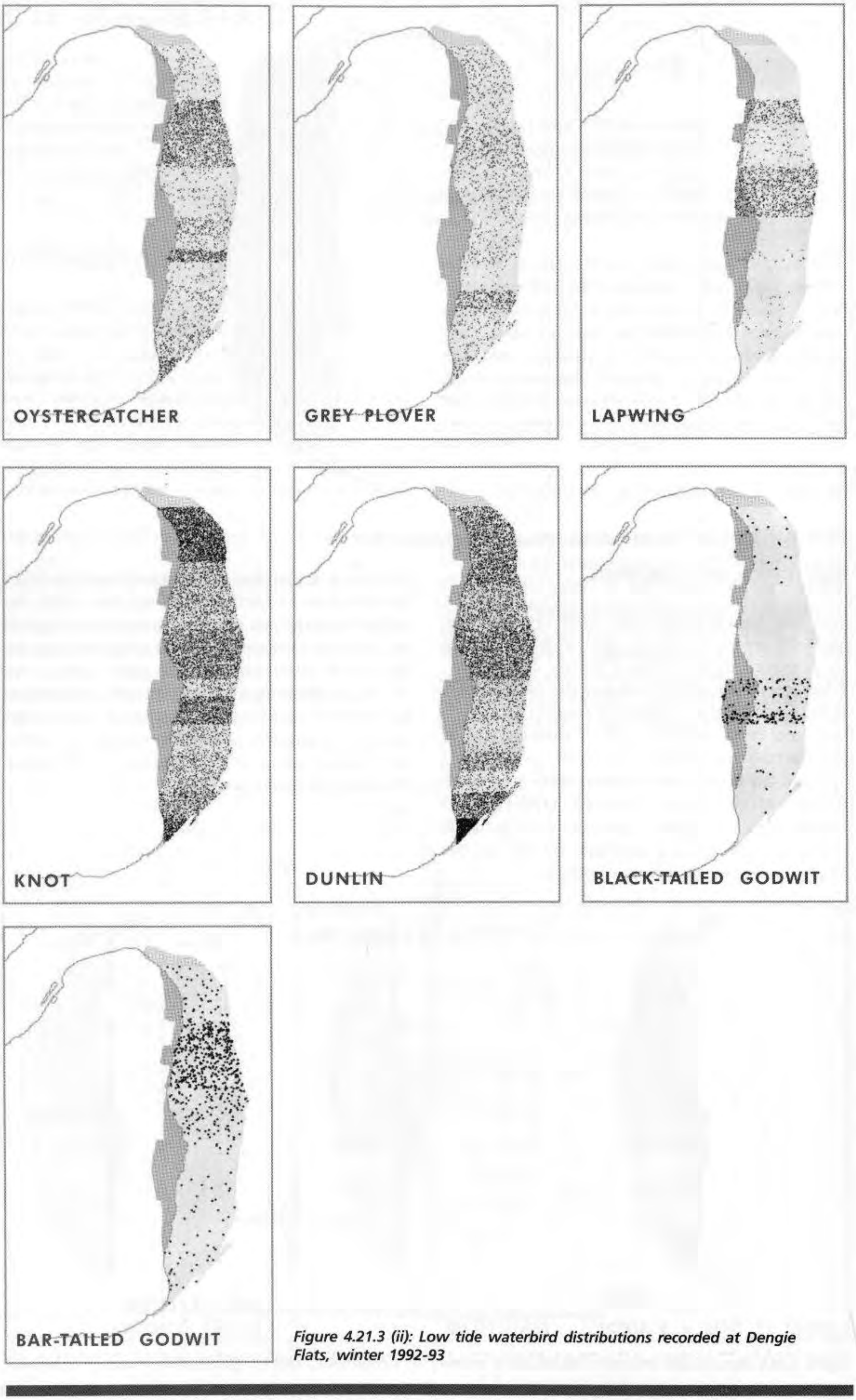


Figure 4.21.3 (ii): Low tide waterbird distributions recorded at Dengie Flats, winter 1992-93

4.22 CROUCH–ROACH ESTUARY

LTC site code: DR
Centre grid: TQ9694
JNCC estuarine review site: 114
Habitat zonation: 749 ha intertidal, 962 ha subtidal, 534 ha nontidal
Statutory status: Crouch and Roach Estuaries SPA (UK9009244), Foulness SPA (UK9009246), Dengie SPA (UK9009242), Crouch and Roach Estuaries Ramsar (7UK085), Foulness Ramsar (7UK102), Dengie Ramsar (7UK073)
Winter waterbird interest: Little Grebe, Great Crested Grebe, Cormorant, Dark-bellied Brent Goose, Shelduck, Wigeon, Oystercatcher, Avocet, Golden Plover, Grey Plover, Lapwing, Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Waterbird assemblage.

SITE DESCRIPTION

The Crouch Estuary and its southern tributary, the Roach, are both long, narrow, muddy estuaries which reach the Essex coast at the northern end of Foulness Island. The estuaries are largely flanked by farmland, much of it claimed from estuarine habitat, although there are some areas of saltmarsh also, especially at Bridgemarsh Island, Brandy Hole Creek and Stow Creek. The nature of the site means that the area of intertidal substrate is relatively small in comparison to the apparent size of the estuary. The southern parts of the Roach Estuary develop into a tangle of creeks, some of which extend through to Maplin Sands. The site has little urbanisation or industry, but it is widely used for watersports. Wildfowling occurs over most of the estuary.

COVERAGE AND INTERPRETATION

The Crouch–Roach Estuary was counted at low tide during 1995–96 with counts made in all four months. Figure 4.22.1 shows the positions of the 42 sections counted for the survey.

Figure 4.22.2 shows that almost the whole area covered by the counts is designated as SPA, mostly within the Crouch and Roach Estuaries SPA, but five of the count sections overlap with the Foulness SPA. Additionally, there is overlap of the site with the Dengie SPA but to a much lesser degree, involving half of the outermost section on the north shore of the Crouch. The boundaries of the Ramsar sites are entirely coincident with those of the SPAs.

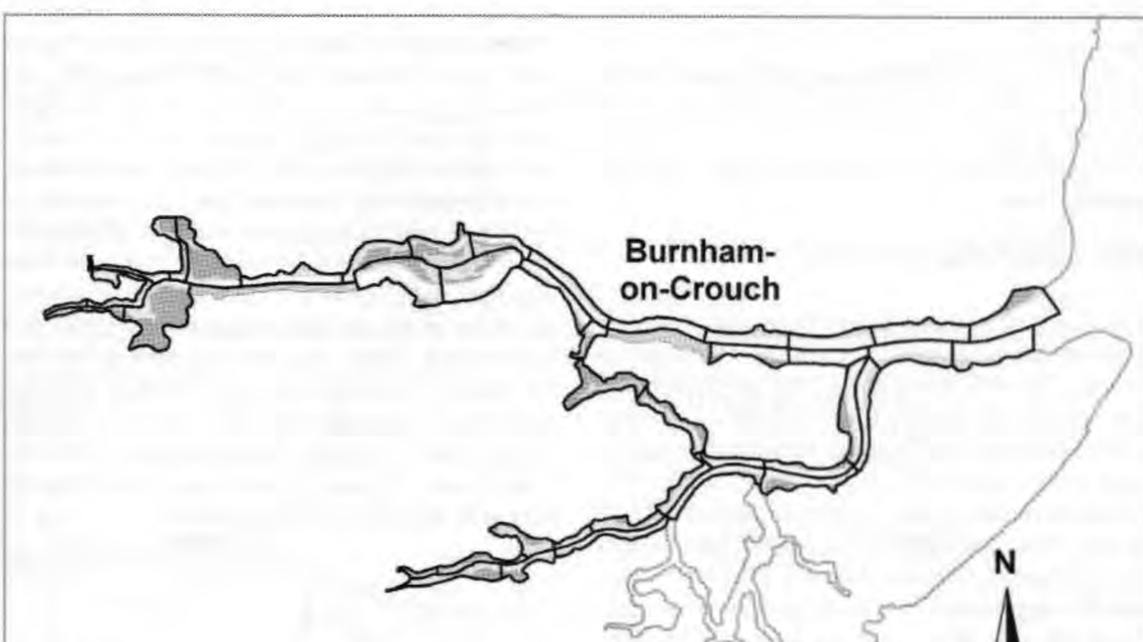


Figure 4.22.1: LTC sections at the Crouch–Roach Estuary, winter 1995–96

*Figure 4.22.2: **LTC and SPA boundaries, with overlap, at the Crouch–Roach Estuary***

An assessment of waterbird use of the Crouch–Roach and adjoining sites must take into account the likely frequent movement of birds between sites. At the mouth of the Crouch–Roach, daily movement is likely to and from both Dengie Sands and Maplin Sands, whereas along the southern edge of the site, movement will be frequent between here and the Foulness complex of creeks and marshes.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1995–96 are presented for 13 of the 17 species of principal interest listed above. For clarity, smaller dots are used to display the distributions of Brent Goose, Wigeon and Dunlin. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.22.3). Of the remaining species, only small numbers of Great Crested Grebes, Avocets and Bar-tailed Godwits were noted and Knot were not recorded. These species would not be expected in large numbers on the Crouch–Roach Estuary itself, and their inclusion (and that of many of the other species present) on the list of interest species above is due to the small degree of overlap with the Dengie SPA and Foulness SPA.

Overall, bird density was clearly higher on the inner parts of each river. Few species were found at high density at the mouth, although concentrations of Brent Geese and Golden Plovers were found around the confluence of the two 'arms' of the estuary. The Roach Estuary was generally less densely occupied than the Crouch, but the Roach did support higher concentrations of Redshanks and Curlews, plus the majority of the Black-tailed Godwits at the site. Shelducks, Brent Geese, Lapwings and Dunlin were also common along the Roach. The Crouch, especially the inner parts around Bridgemarsh Island and Brandy Hole Creek, was the key area at low tide for Wigeon, Lapwings and Little Grebes and also held high concentrations of Brent Geese, Shelducks, Golden Plovers and Dunlin. Cormorants, Oystercatchers and Grey Plovers were widespread in small numbers.

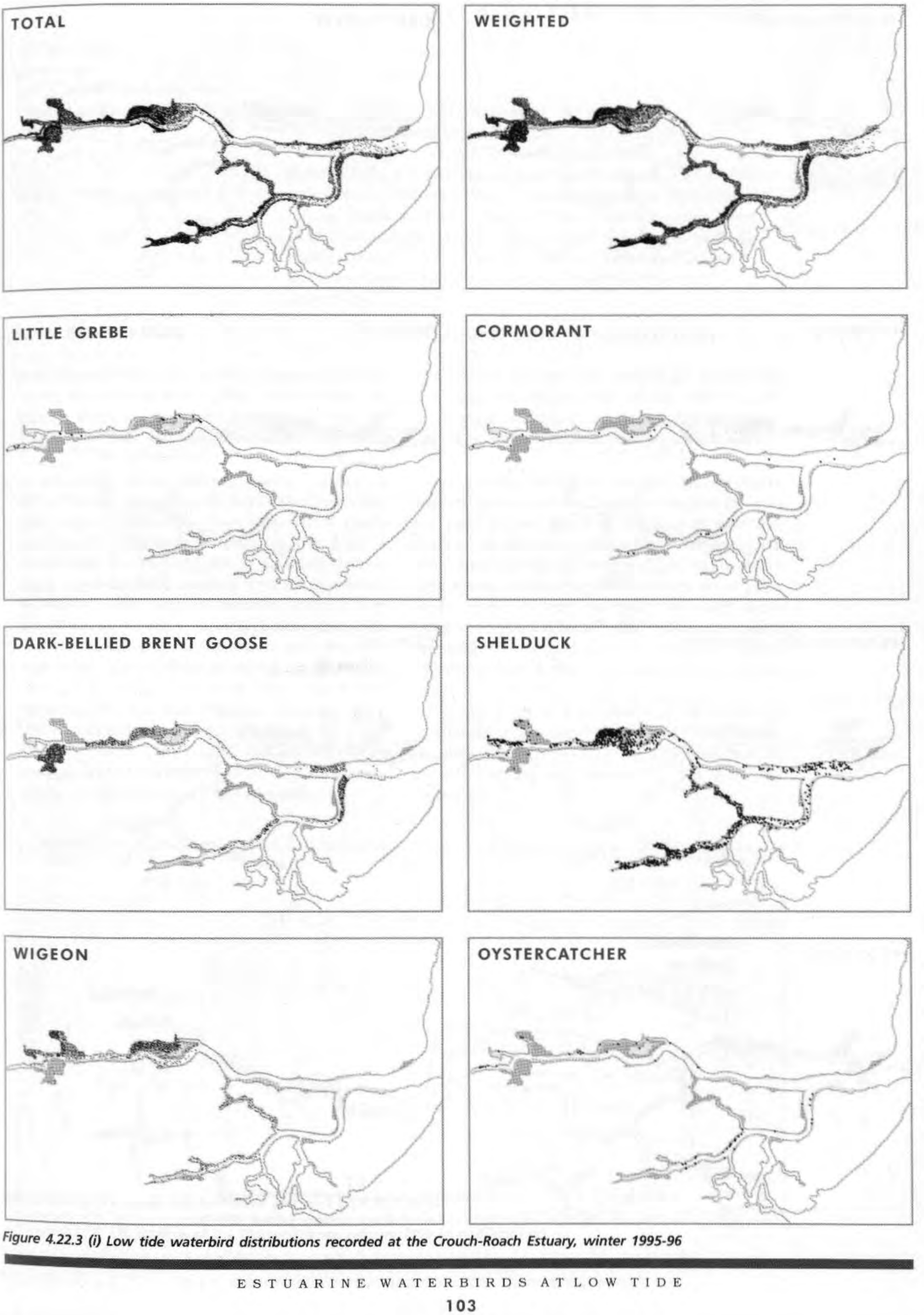
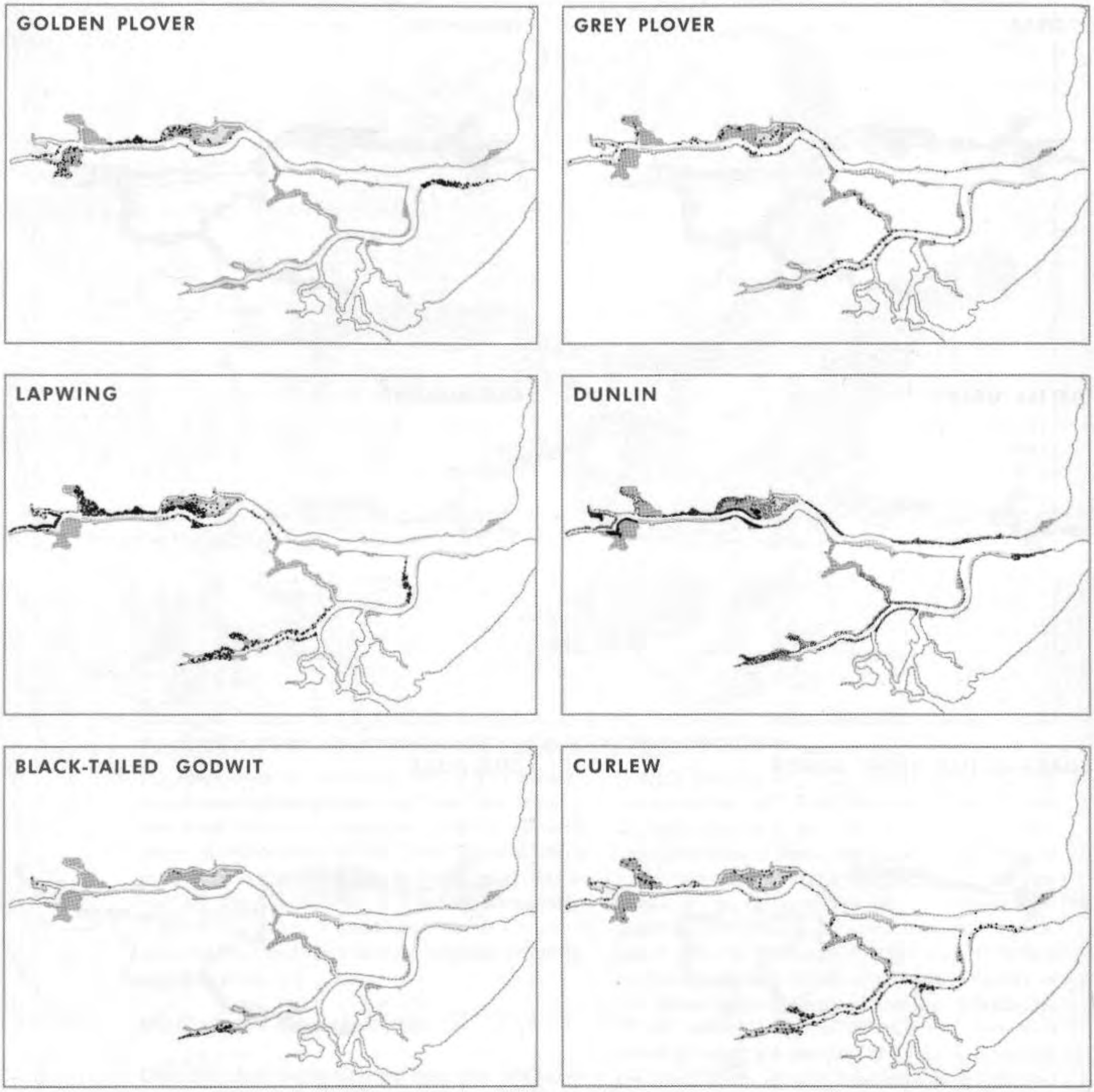


Figure 4.22.3 (i) Low tide waterbird distributions recorded at the Crouch-Roach Estuary, winter 1995-96



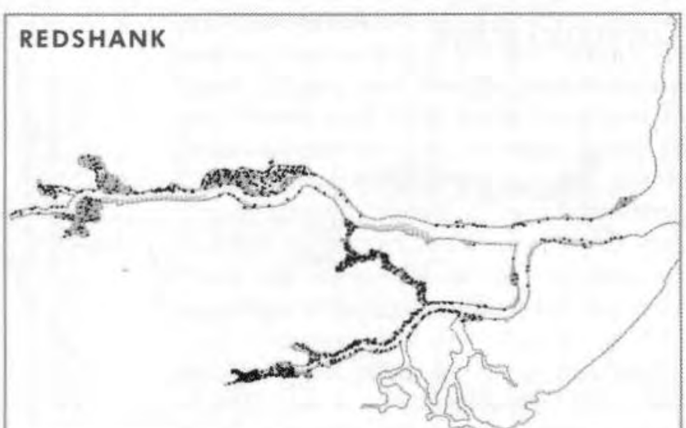


Figure 4.22.3 (ii) Low tide waterbird distributions recorded at the Crouch-Roach Estuary, winter 1995-96

4.23 THAMES ESTUARY

LTC site code: DA
Centre grid: TQ6675
JNCC estuarine review site: 115-118
Habitat zonation: 3492 ha intertidal, 3540 ha subtidal, 90 ha nontidal
Statutory status: Thames Estuary and Marshes SPA (UK9012021), Benfleet and Southend Marshes SPA (UK9009171), Thames Estuary and Marshes Ramsar (7UK141), Benfleet and Southend Marshes Ramsar (7UK071)
Winter waterbird interest: Little Grebe, Cormorant, White-fronted Goose, Dark-bellied Brent Goose, Shelduck, Wigeon, Gadwall, Teal, Pintail, Shoveler, Tufted Duck, Oystercatcher, Avocet, Ringed Plover, Golden Plover, Grey Plover, Lapwing, Knot, Sanderling, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Turnstone, Waterbird assemblage

SITE DESCRIPTION

The Thames Estuary, for the purposes of WeBS, is usually taken to include the coast between the Rivers Medway and Crouch and upstream to Barking in east London. Most of the intertidal habitat is muddy in character with extensive areas of saltmarsh around Canvey Island; the narrow strip of saltmarsh along the north Kent coast was once more extensive but was embanked to create coastal wet grassland. Much of the area is surrounded by sea-walls due to the relatively low-lying adjoining land coupled with rising relative sea-levels. Land claim has removed about 12% of the Thames Estuary, mostly before the 19th century. Much of the site is heavily industrialised with major ports, chemical works and extensive areas of housing. The north Kent coastline is more rural in character although there are still a few remaining open areas adjoining the inner Thames. Issues of particular conservation concern include port developments and proposals for a new airport at Cliffe Marshes.

COVERAGE AND INTERPRETATION

The Thames Estuary was covered for the scheme during the two winters 1993–94 and 1998–99, with no missing months. During the 1993–94 winter, only the inner Thames between Barking and Tilbury was covered, although the coverage was comprehensive along this stretch. A greater degree of coverage was achieved in 1998–99, but this was still only partial. Much of the area of intertidal creeks behind Canvey Island was not included, with other missing sections at Grain on the north Kent coast, at Mucking Flats and on some parts of the inner Thames, especially the south shore between Northfleet and Thamesmead. Importantly, the vast expanse of Maplin Sands was not covered during either winter. Figure 4.23.1 shows the positions of the count sections used in the two winters. It should be noted that a few of the sections counted during 1993–94 were lumped as larger sections in 1998–99; further details can be obtained from the National Organiser.

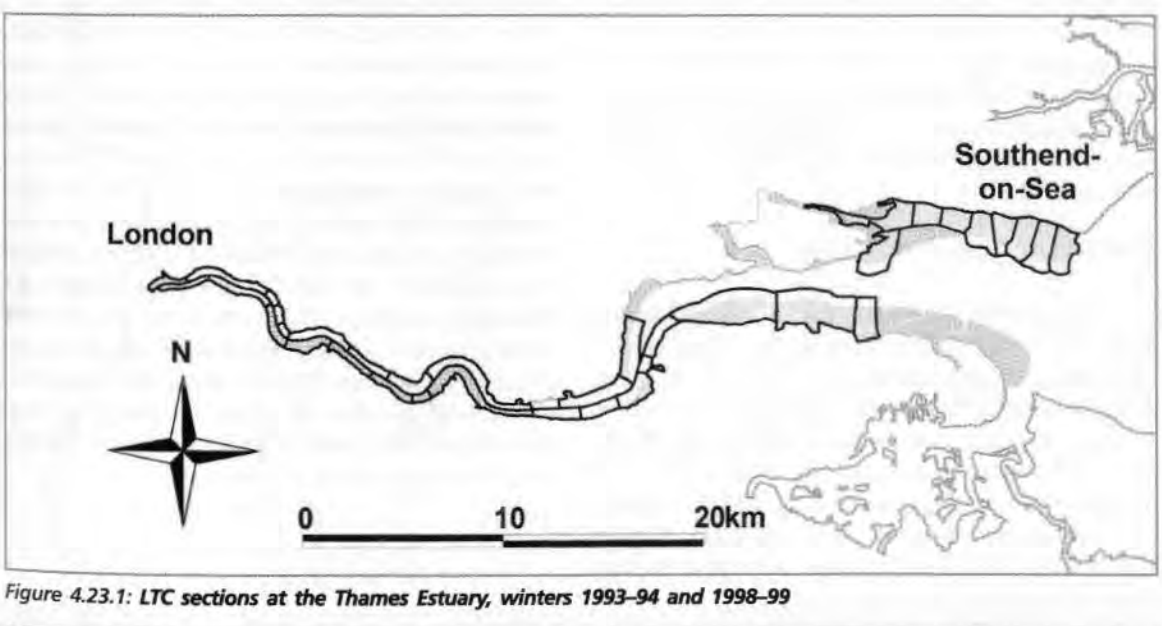


Figure 4.23.1: LTC sections at the Thames Estuary, winters 1993–94 and 1998–99

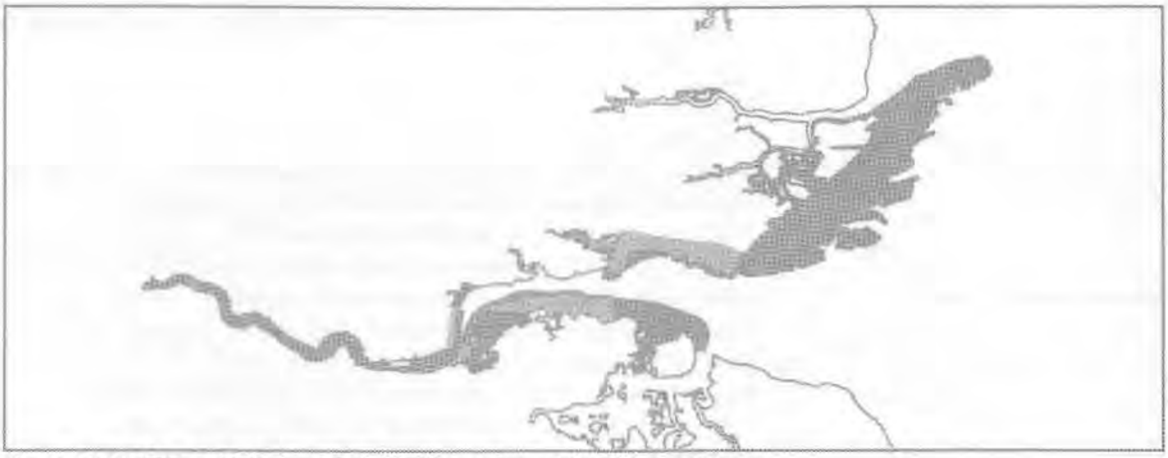


Figure 4.23.2: LTC and SPA boundaries, with overlap, at the Thames Estuary

Figure 4.23.2 shows how the Thames Estuary overlaps with the SPAs in the area. Of these, the area covered during this period by the LTCs did not overlap at all with the Foulness SPA (although the latter has been included in the figure as an integral part of the Thames Estuary). The Benfleet and Southend Marshes SPA was covered effectively by the counts, with the exception of the saltmarshes along Hadleigh Ray. The Thames Estuary and Marshes SPA was partially covered by the LTCs, but the easternmost parts of the Kent shore were uncounted, as was the northern part of Mucking Flats. In addition, adjacent nontidal marshes within the SPA were not covered by the LTCs. Conversely, none of the Thames upstream of East Tilbury Marshes is designated as SPA but this area was covered by the LTCs. The two Ramsar sites are mostly coincident with their respective SPA boundaries, with the exception that the Thames Estuary and Marshes Ramsar contains a somewhat more extensive area of non-tidal grassland than the SPA.

The Thames Estuary, as considered by WeBS, forms part of a larger complex of sites with the Medway and Swale Estuaries to the south and the Crouch-Roach and other sites to the north. Interchange between these sites can occur freely on a regular basis, especially around the extensive grazing marshes and muddy channels of Foulness.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1998–99 are presented for 22 of the 25 species of principal interest listed above. For clarity, smaller dots are used to display the distributions of many of these species. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.23.3). Of the remaining species, only small numbers of White-fronted Geese and Tufted Ducks were recorded during 1998–99, along with no Little Grebes; these species make use of the adjacent nontidal habitats. However, up to 166 Tufted Ducks were noted on the inner Thames during 1993–94 and the species was potentially missed during the incomplete coverage achieved of this area during 1998–99.

Due to the incomplete coverage achieved, care must be taken when attempting to interpret the maps. With this in mind, the totals and weighted totals maps pick out the shore north of Coalhouse Fort (off East Tilbury Marshes) as well as Higham Creek, Hadleigh Ray, Southend Flats and on the south shore from Egypt Bay eastwards. High densities were also recorded on the inner Thames, although much smaller numbers of birds were involved due to the narrower shores here. Many of the individual species were widespread but showed concentrations in one or more areas. Such species included Shelduck (not the Southend area), Lapwing (few Southend), Dunlin (especially East Tilbury and Higham Bight), Curlew (few inner estuary) and Redshank (few Blythe Sands). Other species were mostly found on the outer parts of the site, notably Brent Goose, Oystercatcher, Grey Plover (including East Tilbury), Knot, Sanderling, Bar-tailed Godwit and Turnstone. Wigeon were most numerous on Blythe Sands with a small inner concentration at Aveley Bay. Gadwall, Pintail and Shoveler were all relatively scarce. Avocets were highly concentrated on the East Tilbury shoreline, with most of the Black-tailed Godwits also here and along the North Kent shore. Ringed Plovers were in their highest densities at Thamesmead, West Thurrock to Coalhouse and Hadleigh Ray. Golden Plovers were mostly found at Hadleigh Ray and Higham Bight. Hadleigh Ray was also a key area for Teal. Cormorants were widespread but particularly numerous on the inner Thames around Coldharbour.

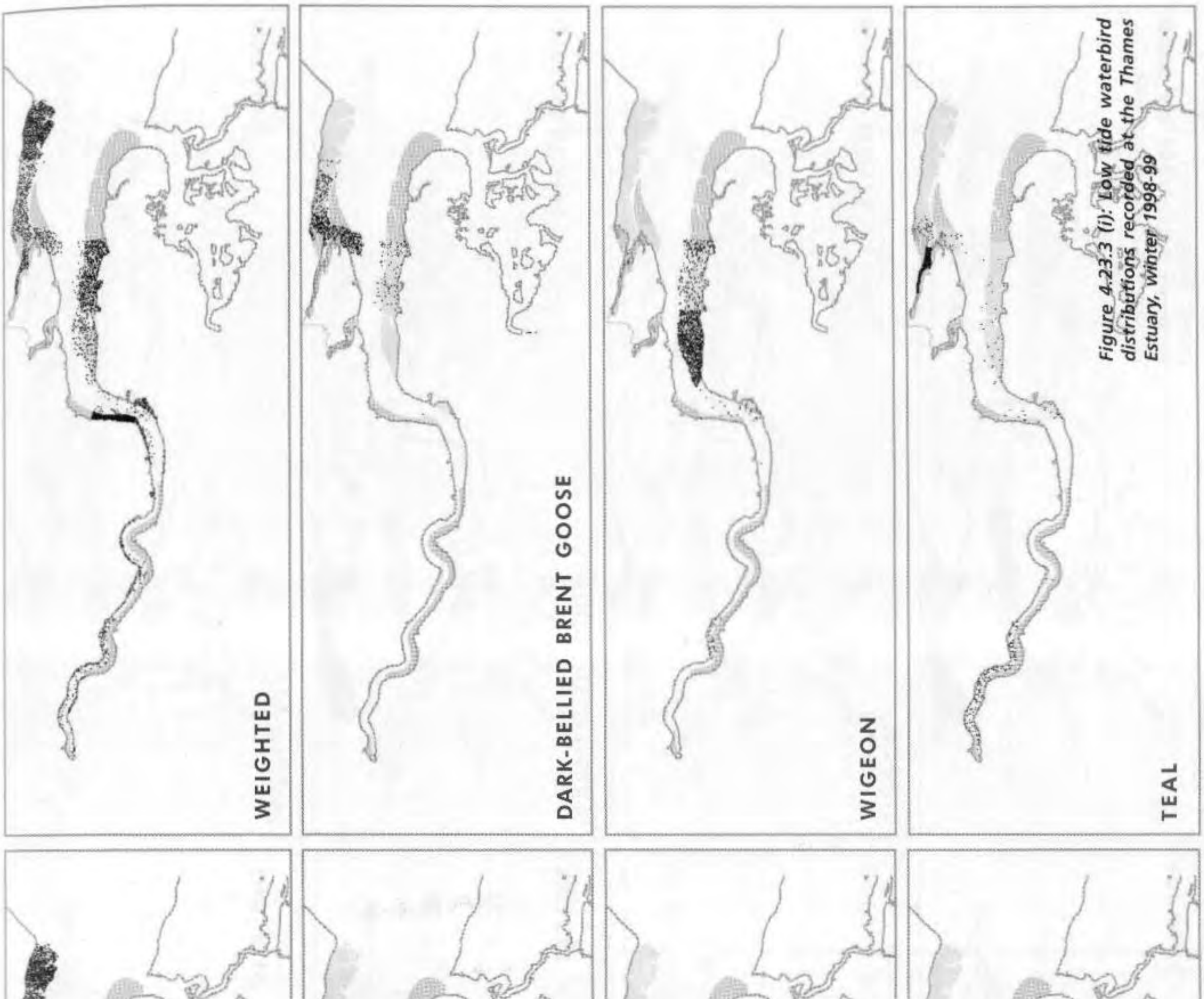


Figure 4.23.3 (i): Low tide waterbird distributions recorded at the Thames Estuary, winter 1998-99

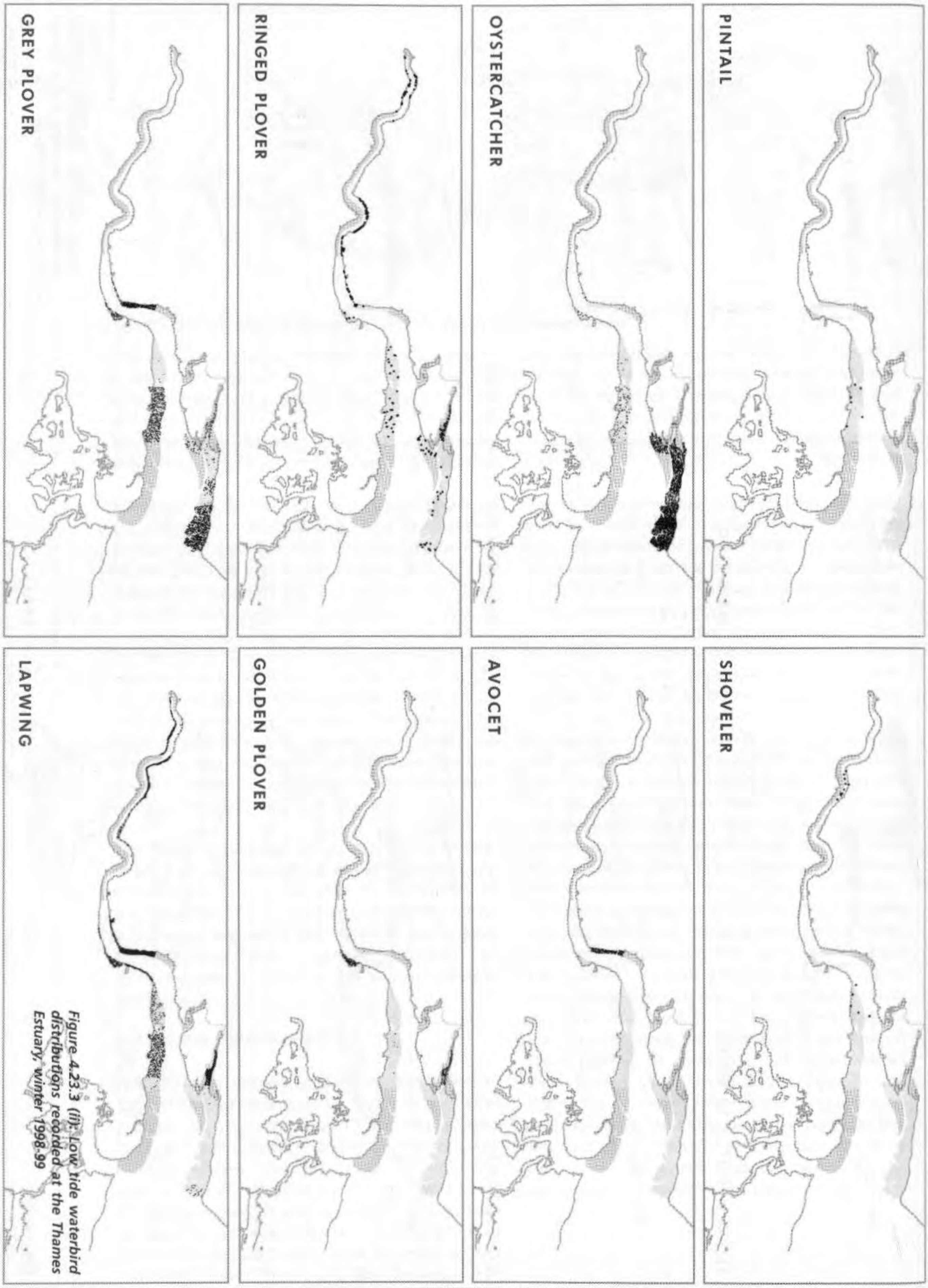


Figure 4.23.3 (ii): Low tide waterbird distributions recorded at the Thames Estuary, winter 1998-99

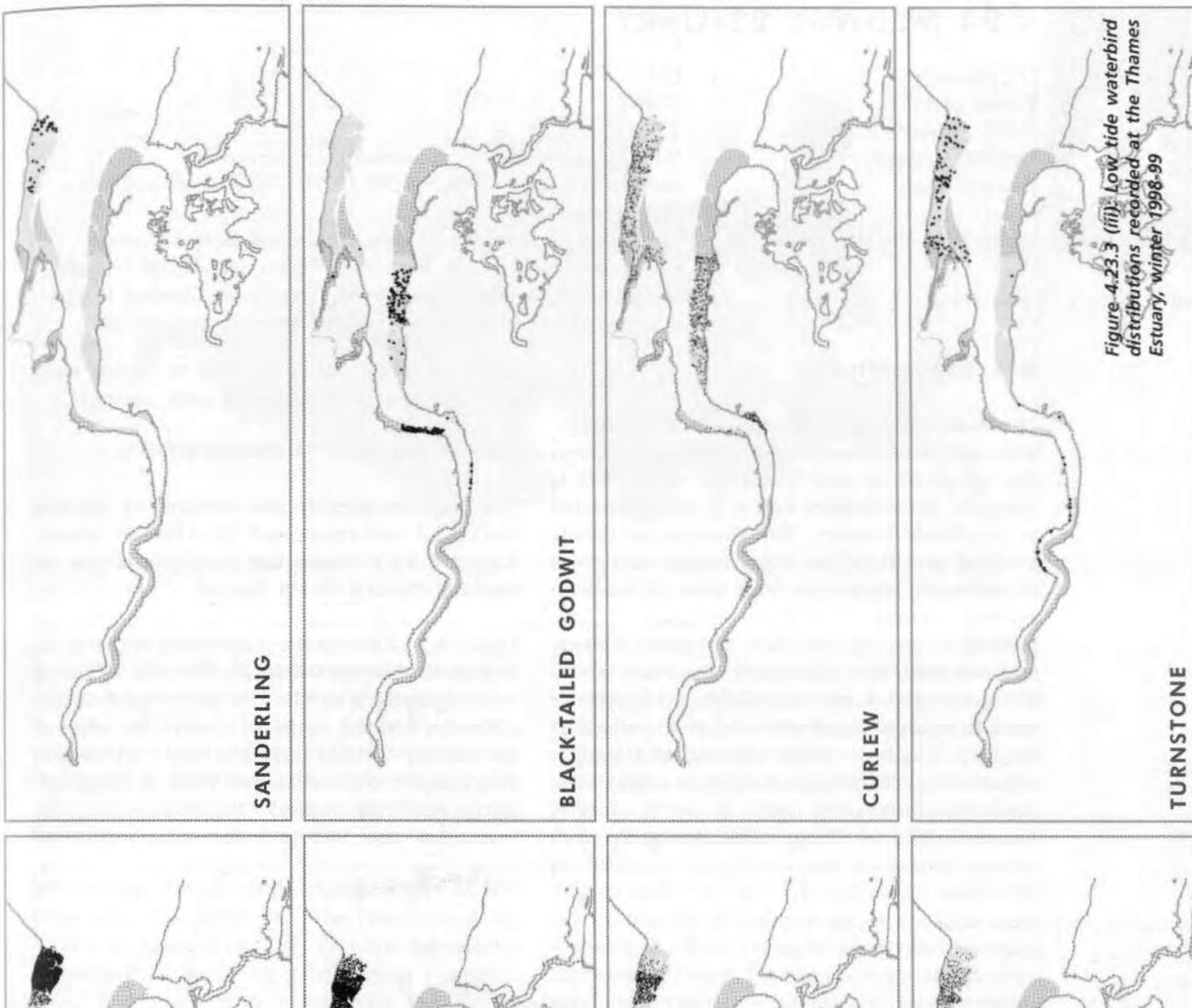


Figure 4.23.3 (iii): Low tide waterbird distributions recorded at the Thames Estuary, winter 1998-99

4.24 MEDWAY ESTUARY

LTC site code:	CM
Centre grid:	TQ8471
JNCC estuarine review site:	119
Habitat zonation:	3064 ha intertidal, 1951 ha subtidal, 737 ha nontidal
Statutory status:	Medway Estuary and Marshes SPA (UK9012031), Medway Estuary and Marshes Ramsar (7UK068)
Winter waterbird interest:	Little Grebe, Great Crested Grebe, Cormorant, Bewick's Swan, Dark-bellied Brent Goose, Shelduck, Wigeon, Teal, Pintail, Shoveler, Oystercatcher, Avocet, Ringed Plover, Grey Plover, Lapwing, Dunlin, Black-tailed Godwit, Curlew, Redshank, Waterbird assemblage

SITE DESCRIPTION

The Medway is a large estuarine site which merges with the Thames Estuary at its outlet between the Isle of Grain and Sheerness on the Isle of Sheppey. At its eastern end it is also connected to the Swale Estuary. The shoreline is deeply indented and there are many islands and areas of saltmarsh, along with large areas of brackish grazing marshes. There are major dockyards around the estuary, as well as two power stations and two defunct oil refineries. The main issues of conservation concern are port developments (such as at Lappel Bank, where an area of intertidal mudflats was lost), illegal shooting and fishing, pollution and disturbance from boats and jet skis. Most importantly, the predicted rise in sea-level induced by climate change will lead to habitat loss as much of the site is hemmed in by sea walls and development (A. Johnson pers. comm.).

COVERAGE AND INTERPRETATION

The Medway Estuary was counted at low tide during all four months of the 1996–97 winter. Figure 4.24.1 shows the positions of the 33 sections counted for the survey.

Figure 4.24.2 shows the relationship between the SPA and LTC boundaries at the Medway. The main areas designated as SPA but not counted for the LTCs are nontidal marshes around the edges of the estuary, notably including much of the area either side of the Ladies Hole Point to Kingsferry Bridge stretch of channel. This channel itself was counted for the 1992–93 Swale Estuary LTCs but

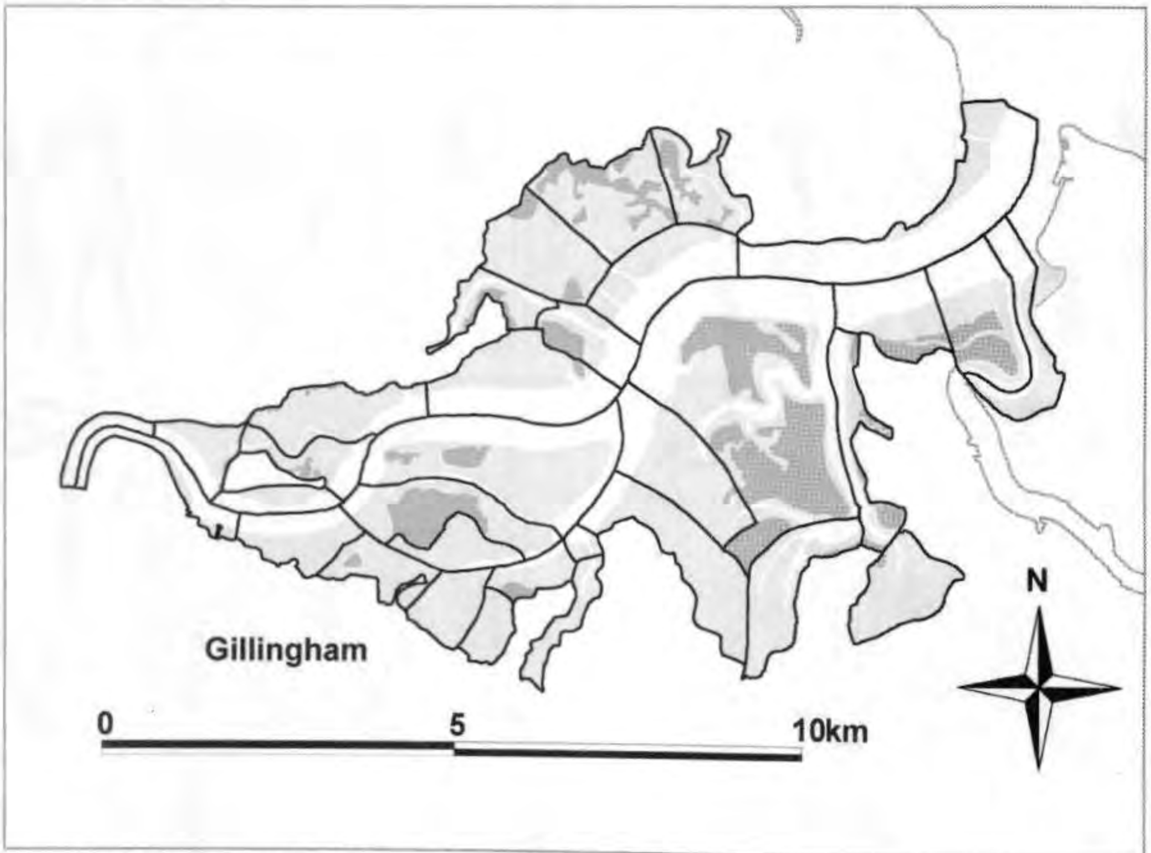


Figure 4.24.1: LTC sections at the Medway Estuary, winter 1996–97

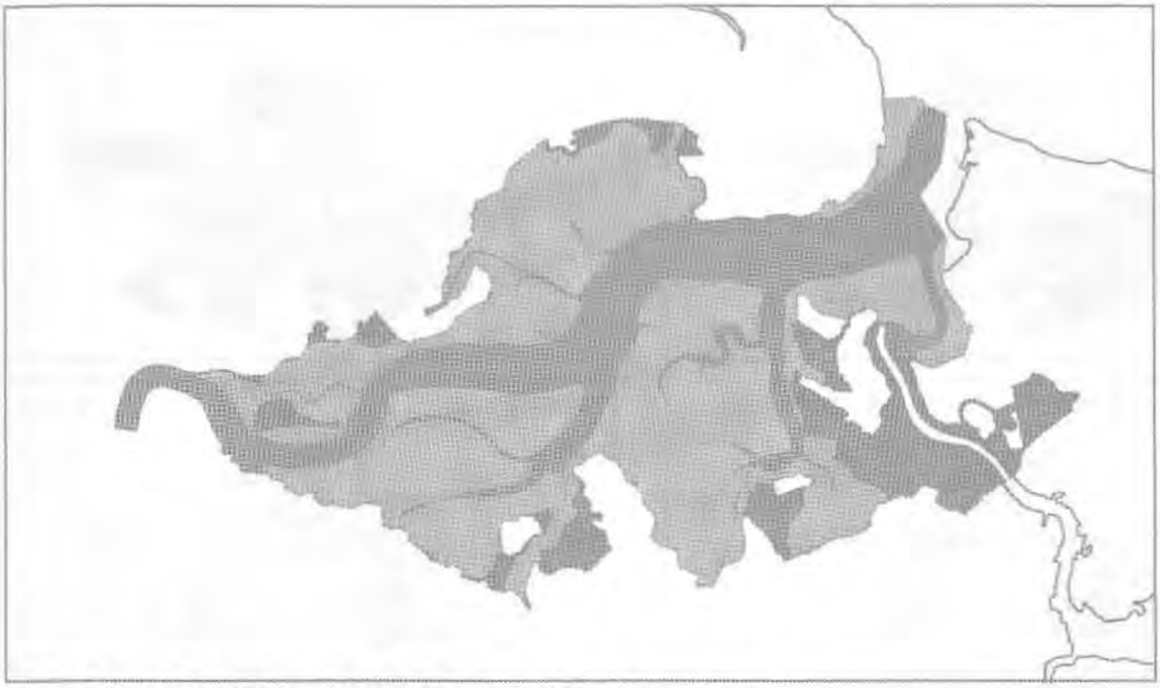


Figure 4.24.2: LTC and SPA boundaries, with overlap, at the Medway Estuary

in light of the SPA boundary should, in future, ideally be transferred to the Medway for the purposes of LTCs. In the west, the SPA boundary did not reach as far upstream as the area covered by the LTCs. The boundaries of the Ramsar site are almost entirely coincident with those of the SPA.

The Medway Estuary is in close proximity to two other major estuarine sites, the Thames and the Swale. Movements of birds between these sites seems likely to occur on a daily basis, especially along the main channel between the Isle of Sheppey and the mainland. Movements of birds between the estuarine and non-estuarine components of the area should also be considered carefully when attempting to describe bird usage of the SPA.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1996–97 are presented for 18 of the 19 species of principal interest listed above. For clarity, smaller dots are used to display the distribution of Dunlin. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.24.3). The remaining species, Little Grebe, was recorded in very small numbers during the survey and the majority presumably make more use of adjacent nontidal habitats.

The totals map reveals a complex picture, but with the highest concentrations of birds at Stoke Ooze, the north side of Deadmans Island, from Copperhouse Marshes to Otterham Creek and at Bedlams Bottom. These high bird densities were strongly driven by Dunlin, the dominant species over most of the site. Bedlams Bottom is given emphasis by the weighted totals map, due largely to the concentrations here of Pintail and Avocet. Both of these species, along with Shoveler, occurred relatively sparsely elsewhere in the south of the site. Of the other very numerous species, Wigeon and Teal were concentrated towards the east of the site but Shelducks were a little more widespread, despite a higher concentration along the southern edge. Lapwing and Redshank were similarly present throughout but most strongly along the south edge of the site. Brent Geese were found throughout with high concentrations at Otterham Creek, Halstow Creek and Colemouth Creek, whereas Oystercatchers showed a preference for Ham Ooze. Grey Plovers and Ringed Plovers were widespread, Grey Plovers being especially common at Stoke Ooze. Curlews were evenly spread throughout but Black-tailed Godwits were patchily distributed in four relatively restricted zones of the estuary. Small numbers of Bewick's Swans were found at Bedlams Bottom. Great Crested Grebes and Cormorants were both widespread throughout the estuary.

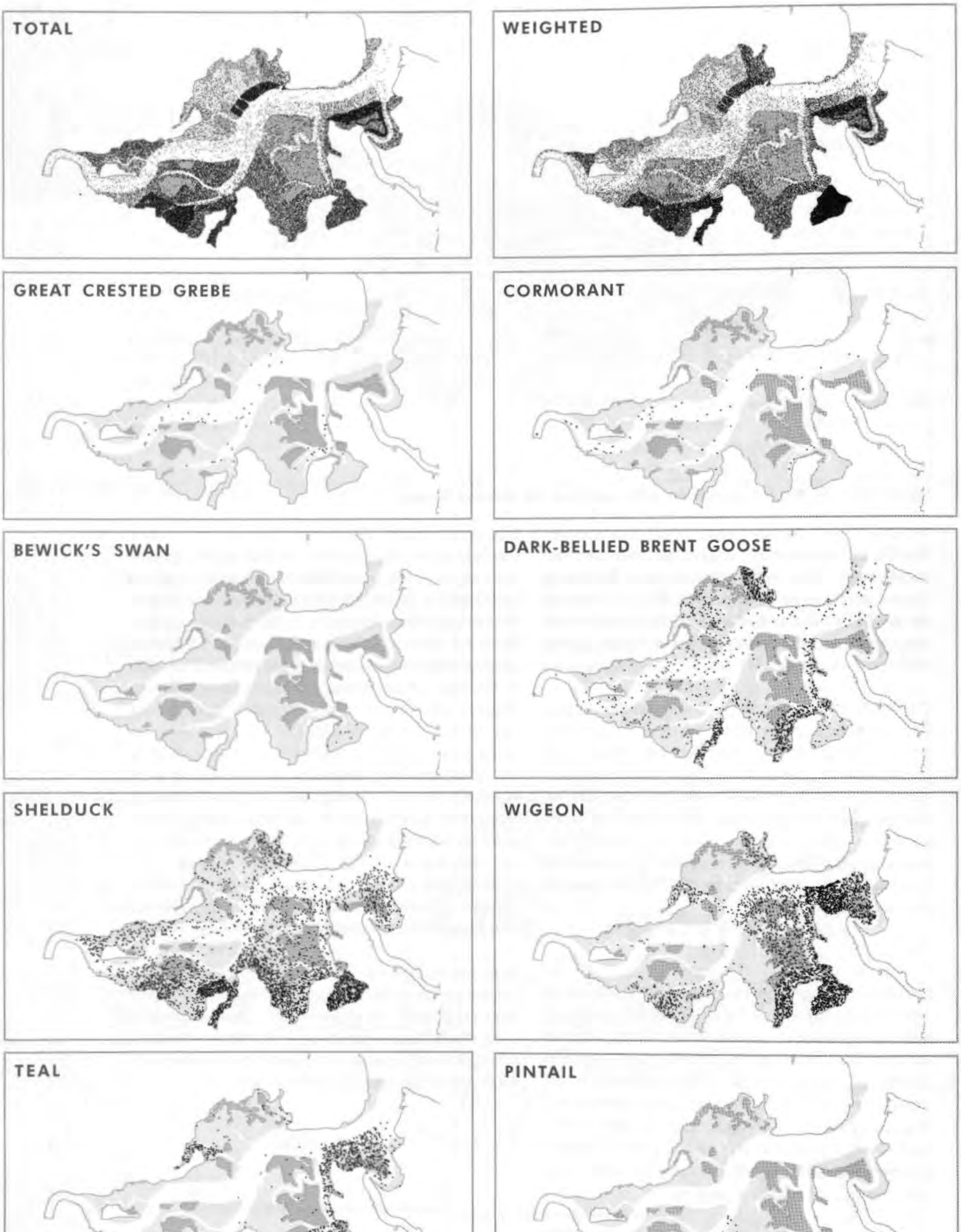


Figure 4.24.3 (i): Low tide waterbird distributions recorded at the Medway Estuary, winter 1996-97

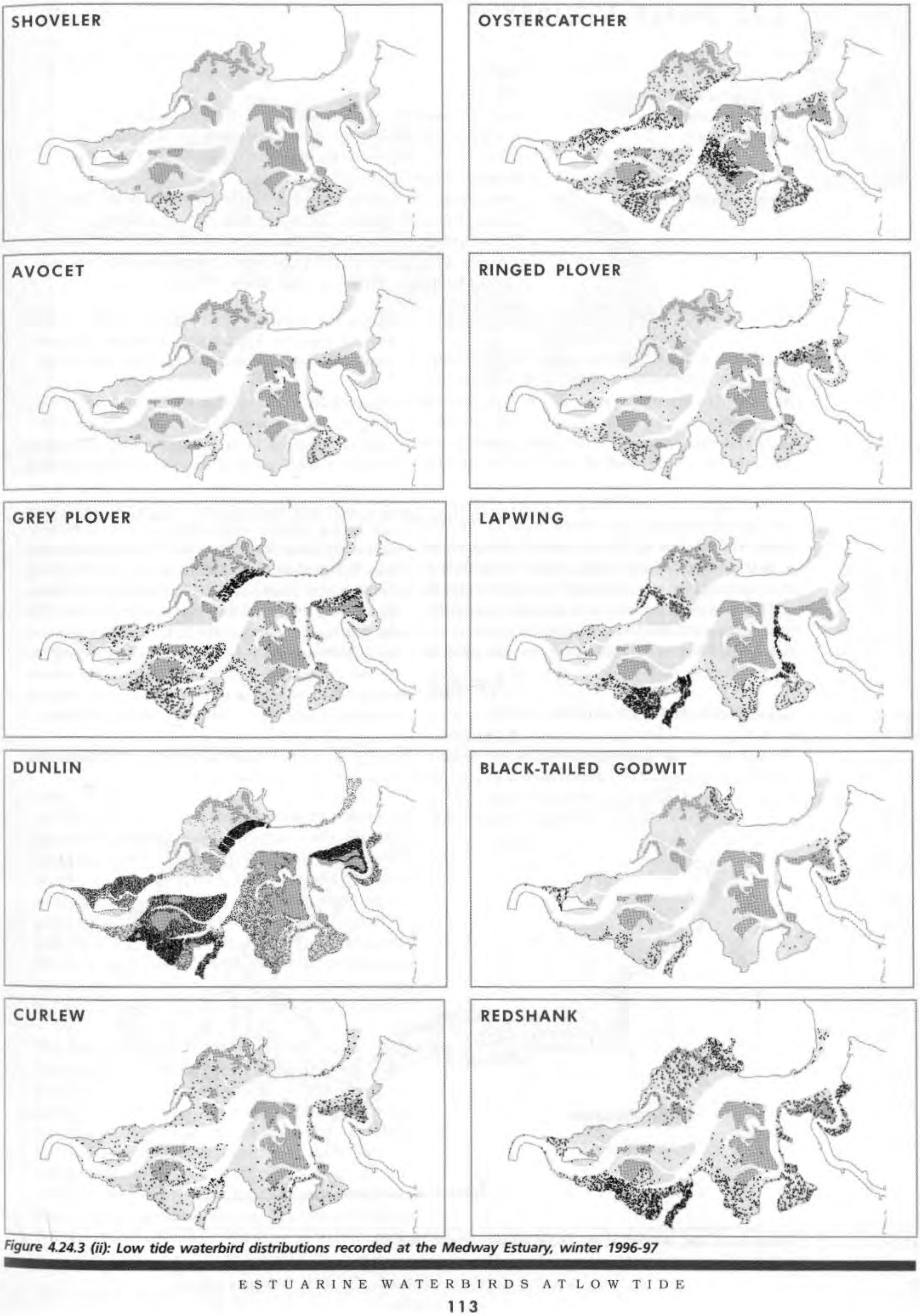


Figure 4.24.3 (ii): Low tide waterbird distributions recorded at the Medway Estuary, winter 1996-97

4.25 SWALE ESTUARY

LTC site code: DS
Centre grid: TR0066
JNCC estuarine review site: 120
Habitat zonation: 2431 ha intertidal, 1420 ha subtidal, 340 ha nontidal
Statutory status: The Swale SPA (UK9012011), Medway Estuary and Marshes SPA (UK9012031), The Swale Ramsar(7UK021), Medway Estuary and Marshes Ramsar (7UK068)
Winter waterbird interest: Little Grebe, Cormorant, White-fronted Goose, Dark-bellied Brent Goose, Shelduck, Wigeon, Gadwall, Teal, Pintail, Shoveler, Oystercatcher, Avocet, Ringed Plover, Golden Plover, Grey Plover, Lapwing, Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Waterbird assemblage

SITE DESCRIPTION

The Swale Estuary separates the Isle of Sheppey from the mainland of Kent and adjoins the Medway Estuary to the west. At low tide, there is a relatively narrow water channel and extensive intertidal flats, muddy in the inner parts of the site and becoming sandier towards the mouth, with an associated area of intertidal shore stretching north-west along the north shore of the Isle of Sheppey from Shell Ness to Warden Point. Much of the site is surrounded by saltmarsh and then by extensive areas of grazing marshes. The estuary is used for leisure activities such as sailing and other watersports, but there is only a limited amount of industrial activity in the area. A large proportion of the estuary is shot over by wildfowlers.

COVERAGE AND INTERPRETATION

The Swale Estuary was counted for the scheme during the 1992–93 winter, with counts made in all four months. Figure 4.25.1 shows the positions of the 60 sections counted for the survey.

Figure 4.25.2 shows that there are large differences in the extents of the LTC site and the SPAs. This is mostly due to the incorporation within the SPA of large areas of nontidal grazing marshes aroundthe estuary, notably at Elmley, Capel Fleet and Graveney Marshes, and between Faversham and Milton Creeks. Additionally, the westernmost part of the area counted as the Swale for the LTCs was subsequently included within the Medway Estuary and Marshes SPA, but most of the latter was covered by the Medway Estuary LTCs. The main area counted for the LTCs but not covered by SPA designation is the north shore of Sheppey between Leysdown and Warden Point. The Ramsar site boundaries around the Swale are entirely coincident with those of their respective SPAs.

Given that the Swale is contiguous with the

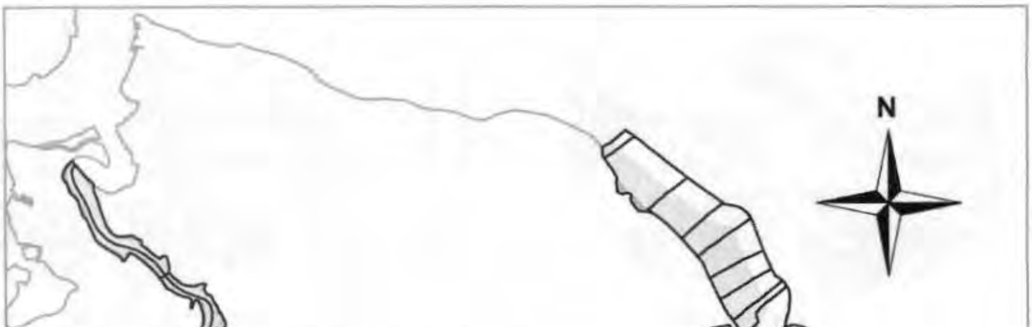


Figure 4.25.1: LTC sections at the Swale Estuary, winter 1992–93

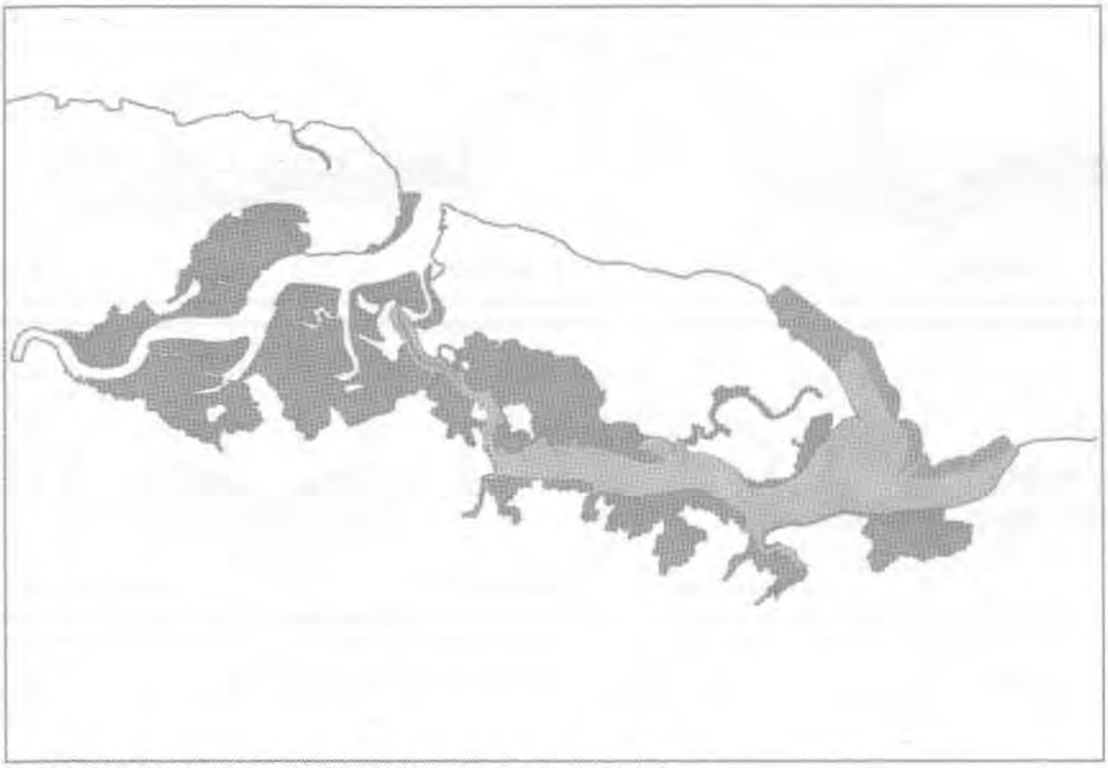


Figure 4.25.2: LTC and SPA boundaries, with overlap, at the Swale Estuary

Medway Estuary, a certain amount of interchange is inevitable although the degree to which this occurs is not known. Some dispersal east to the Thanet Coast is also feasible, as well as to the non-estuarine shore on the north side of the Isle of Sheppey, west of Warden Point. However, the major movements of birds on the estuary will be to the adjacent nontidal wetland habitats contained within the SPA.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1992–93 are presented for 19 of the 22 species of principal interest listed above. For clarity, smaller dots are used to display the distributions of Shelduck, Oystercatcher, Lapwing and Dunlin. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.25.3). The remaining three species (White-fronted Goose, Gadwall and Shoveler) were all recorded but in only very small numbers, the birds mostly using the adjacent nontidal habitats.

The total birds map shows the highest overall bird densities occurring on the inner estuary, with the weighted total map highlighting the flats south of Elmley Hills and from the mouth of Conyer Creek westwards. The inner estuary was the key area for Teal, Pintail, Avocet and Black-tailed Godwit. Additionally, a number of other more widespread species occurred in this part of the estuary in their highest densities, namely Shelduck, Ringed Plover, Grey Plover, Dunlin, Curlew and Redshank. Knot and Lapwings were also common in this area, with further concentrations of Knot north of Graveney Marshes and of Lapwings from Windmill Creek east around the Isle of Harty. The latter area was also the principal area for both Golden Plovers and Brent Geese. Wigeon were few in number, mostly along the north side of the main channel; most occur on nearby nontidal habitats. Two species which, whilst widespread, were in higher densities on the outer parts of the site were Oystercatcher and Bar-tailed Godwit. Cormorants were widespread throughout the site but the small numbers of Little Grebes were mostly restricted to the inner estuary.

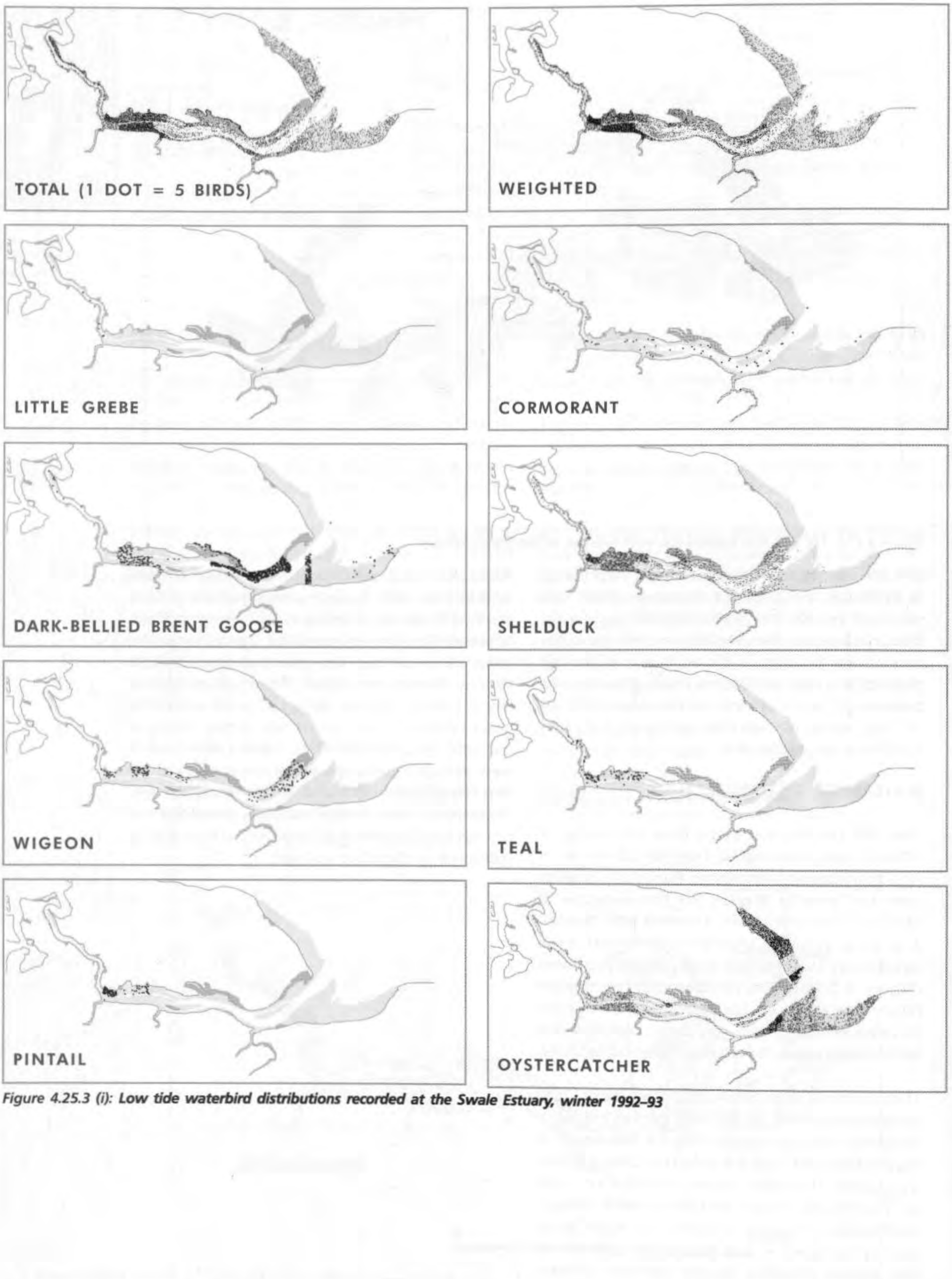


Figure 4.25.3 (i): Low tide waterbird distributions recorded at the Swale Estuary, winter 1992–93

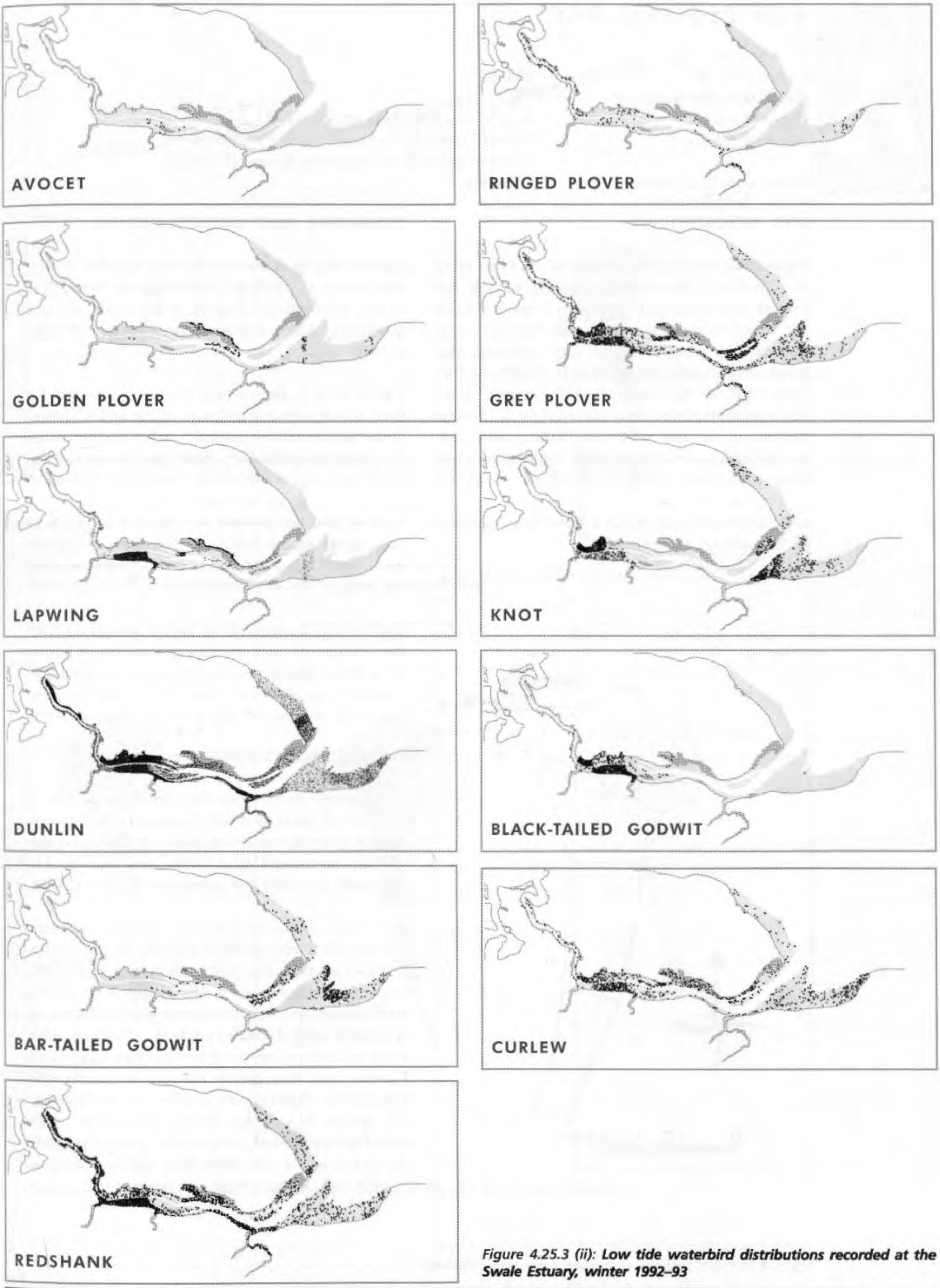


Figure 4.25.3 (ii): ***Low tide waterbird distributions recorded at the Swale Estuary, winter 1992–93***

4.26 PEGWELL BAY

LTC site code:	BG
Centre grid:	TR3563
JNCC estuarine review site:	121
Habitat zonation:	562 ha intertidal, 380 ha subtidal, 0 ha nontidal
Statutory status:	Thanet Coast and Sandwich Bay SPA (UK9012071), Thanet Coast and Sandwich Bay Ramsar (7UK078)
Winter waterbird interest:	Turnstone

SITE DESCRIPTION

Pegwell Bay is the small estuary of the River Stour in east Kent. The inner estuary is muddy and fringed with saltmarsh, although most of that on the western bank has been lost to land-claim. The estuary then broadens into sandflats that reach south along the shores of Sandwich Bay. West Cliff, in the north-east of the site, is the last extension of the rocky outcrops found around the rest of the Isle of Thanet. Sailing and other watersports, as well as beach recreation, occur around the site and wildfowling occurs on the grazing marshes. There is also a power station and pharmaceutical works a short way upstream and a harbour at Ramsgate.

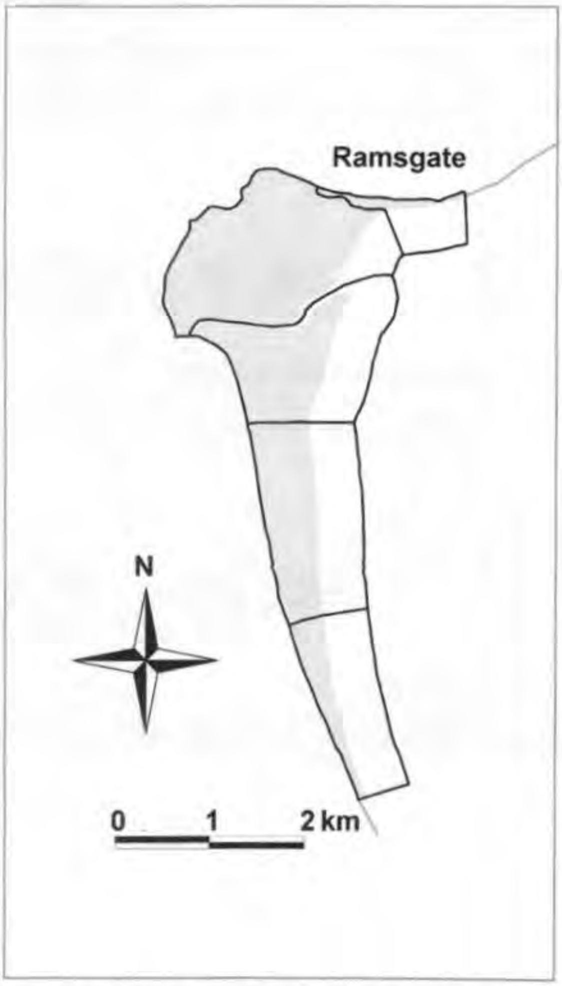


Figure 4.26.1: LTC sections at Pegwell Bay, winter 1994–95

COVERAGE AND INTERPRETATION

Pegwell Bay was covered for the scheme during the winter of 1994–95, although no November count was made. Figure 4.26.1 shows the positions of the five sections counted for the survey.

Figure 4.26.2. shows how the area counted for the LTCs is only a small part of the wider Thanet Coast and Sandwich Bay SPA, which also includes the inner Stour Estuary, rocky shores around the north and east of the Isle of Thanet and grassland habitats to the south on Hacklinge Marshes. The Ramsar site boundaries surround a larger area than those of the SPA, the difference being the inclusion of larger areas of non-tidal marshes than the former.

The site is isolated from other estuaries and interchange of most species is unlikely to occur on a daily basis. However, dispersal from the estuary to adjacent non-estuarine coasts, especially around the Isle of Thanet, seems likely.

WATERBIRD DISTRIBUTION

The low tide distribution map from the winter of 1994–95 is presented for Turnstone, the species of principal interest listed above. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.26.3).

The maps show that within the site covered, Turnstones were confined entirely to the northernmost section, the rocky outcrop of West Cliff. Amongst other species, Ringed Plovers, Sanderlings and Oystercatchers also occurred in relatively high densities at West Cliff but were more widespread on the intertidal flats also. Grey Plovers were very evenly spread across the site but Golden Plovers were confined to the area by the outflow of the river Stour. The overall totals map shows increasing overall bird density towards the north of the site, with West Cliff particularly highlighted by the weighted total map.

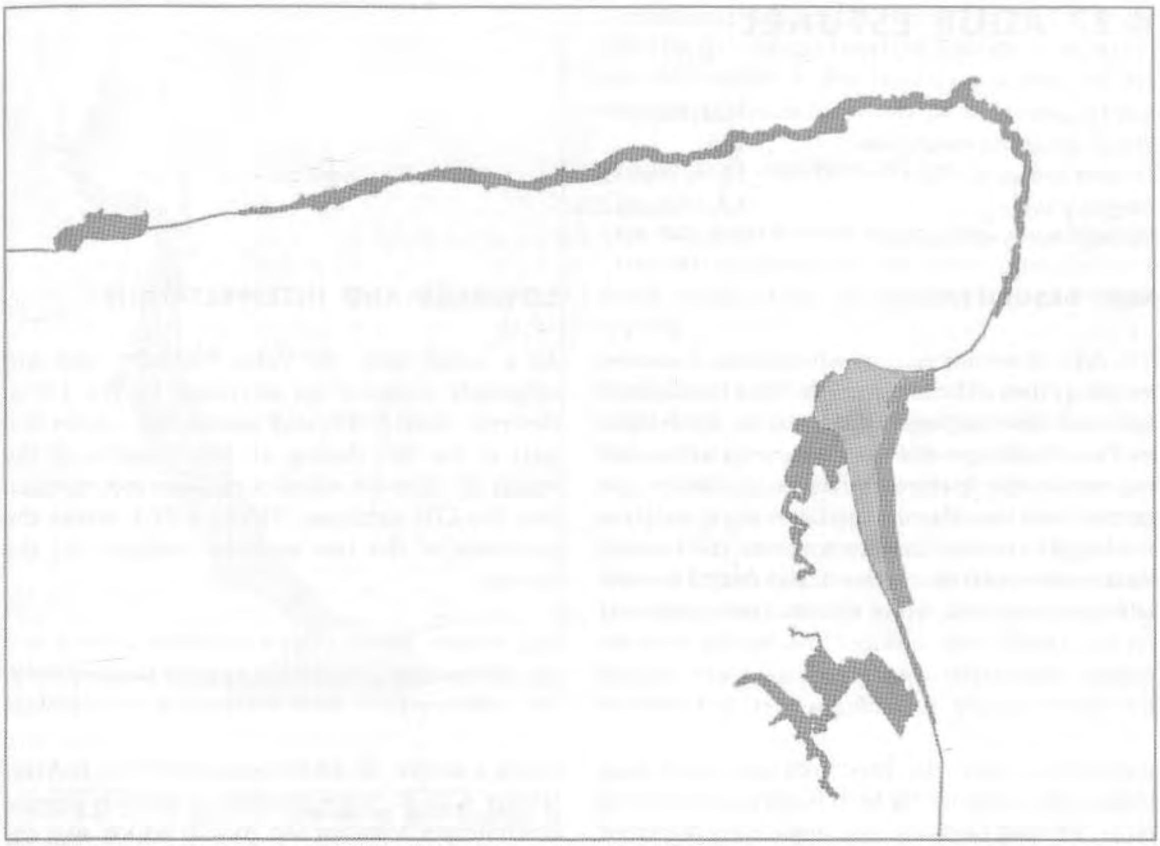


Figure 4.26.2: LTC and SPA boundaries, with overlap, at Pegwell Bay

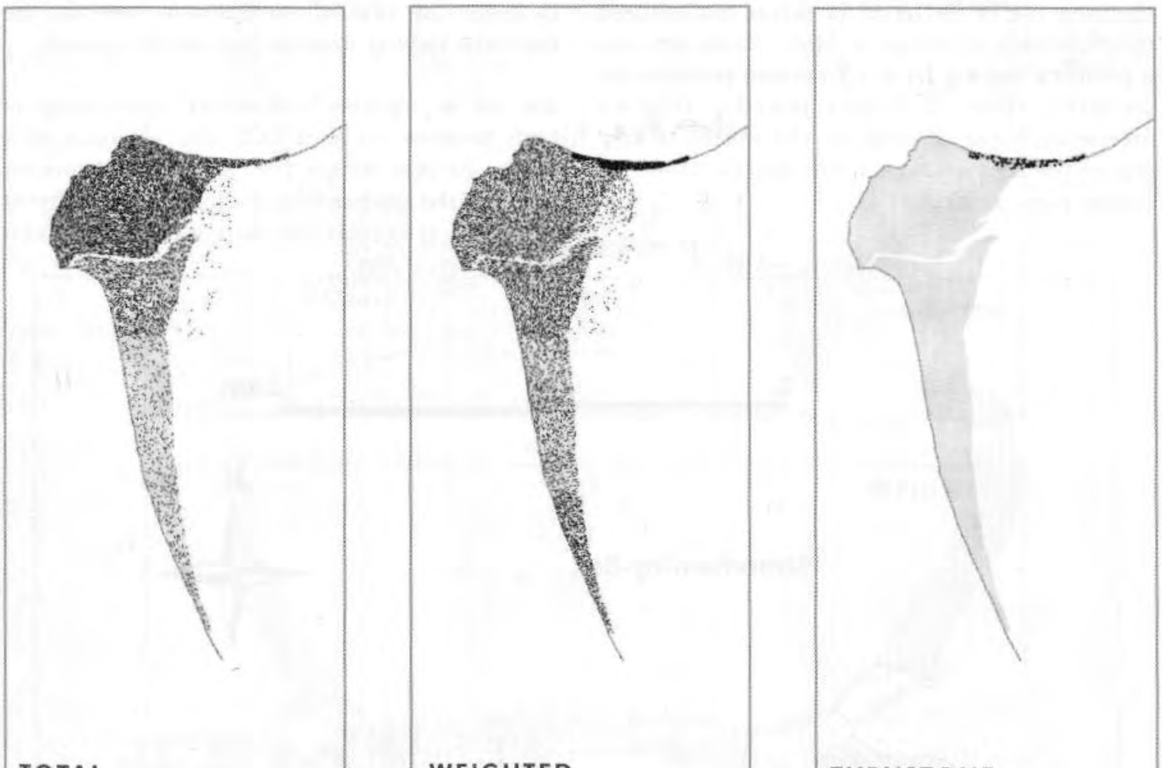


Figure 4.26.3: Low tide waterbird distributions recorded at Pegwell Bay, winter 1994–95

4.27 ADUR ESTUARY

LTC site code:	EA
Centre grid:	TQ2105
JNCC estuarine review site:	125
Habitat zonation:	16 ha intertidal, 3 ha subtidal, 3 ha nontidal
Statutory status:	Adur Estuary SSSI
Winter waterbird interest:	N/A

SITE DESCRIPTION

The Adur is a small estuary which forms a narrow, winding channel before being diverted by a shingle spit and discharging into the sea at Shoreham-by-Sea. The shape of the site is heavily influenced by man-made features such as sea-walls and barrier beaches. Narrow mudflats along much of its length become sandier towards the mouth. Small areas of saltmarsh are found along the edges of the estuary, with recent colonisation by *Spartina* having significantly reduced the feeding area for waders. Industrial activity is prominent around the lower estuary, including a port and onshore oil-holding tanks. Recreational activities are intensive around the lower reaches, with high levels of disturbance for both feeding and roosting birds. Feeding birds are also apparently displaced by bait diggers; although they used to move onto the short grassland of the adjacent airfield, more intensive use of the latter for flights has reduced its availability to estuarine birds. Boats are also a problem, driving birds off muflats prematurely on rising tides. It is also possible that an increasing roost of gulls on the mudflats may reduce the area available for feeding (J. Glover, J. Badley pers. comm.).

COVERAGE AND INTERPRETATION

As a small site, the Adur Estuary was not originally targeted for coverage by the LTCs. However, local RSPB staff carried out counts of a part of the site during all four months of the winter of 1998–99, which were then incorporated into the LTC database. Figure 4.27.1 shows the positions of the two sections counted for the survey.

The estuary has not been classified an SPA but the surveyed area is part of the Adur Estuary SSSI. The latter covers a more extensive area upstream of the LTC sections, but includes only a relatively small amount of additional intertidal habitat (Figure 4.27.2). Some intertidal habitat is present downstream towards the mouth which was included in neither the SSSI nor the area surveyed by the LTCs. Further LTCs of the Adur should aim to cover the rest of the SSSI as well as the intertidal habitat towards the estuary mouth.

The site is relatively isolated and interchange of birds between the Adur and other estuaries on a regular basis is unlikely on a daily basis. However, many of the waders that feed on the estuary at low tide (particularly Ringed Plovers and

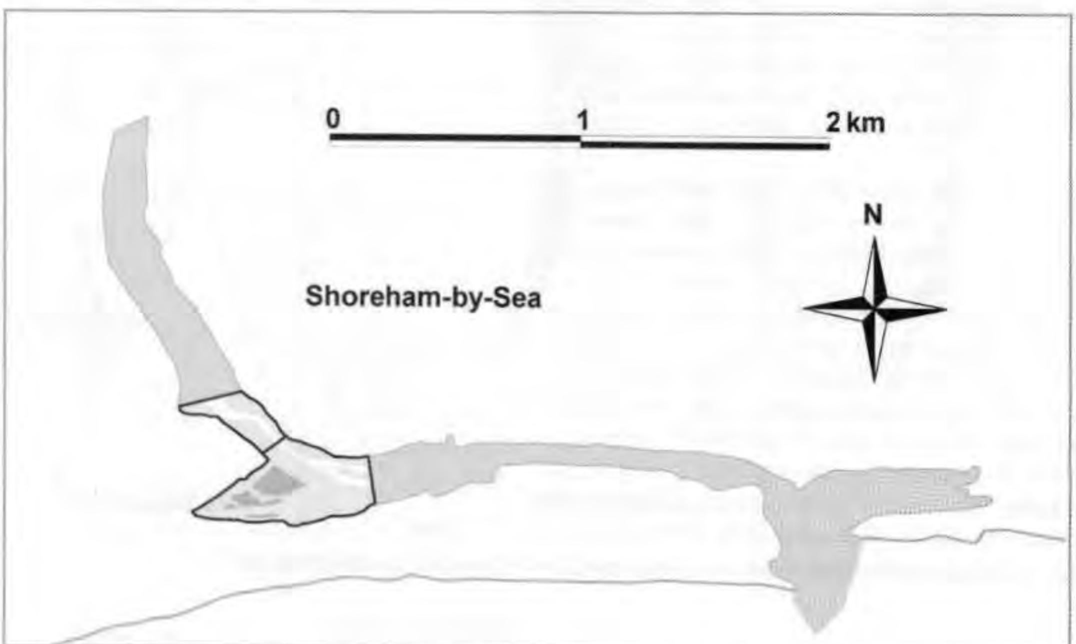


Figure 4.27.1: LTC sections at the Adur Estuary, winter 1998–99

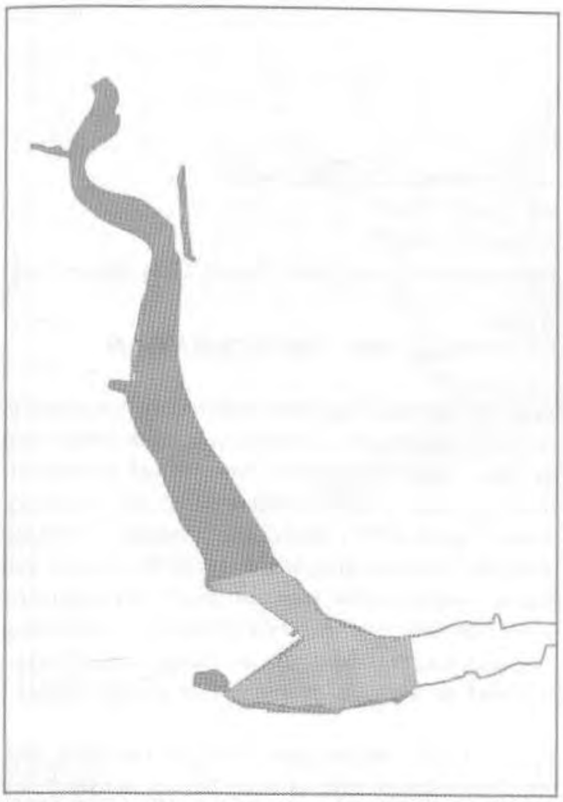


Figure 4.27.2: LTC and SSSI boundaries, with overlap, at the Adur Estuary

Turnstones) also feed and/or roost on the larger tides on the shingle beach at Shoreham seafront, usually within a few hundred metres of the harbour entrance (J. Glover pers. comm.).

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1998–99 are presented for total birds and total birds weighted by 1% threshold value (Figure 4.27.3).

Since the counts took place within only a limited area of the estuary, care must be taken with the interpretation of count results from the site. From the results obtained, the easternmost of the two sections supported higher densities of feeding birds. This pattern was also observed for most of the individual species, although Turnstones were the exception, being more numerous in the western section.

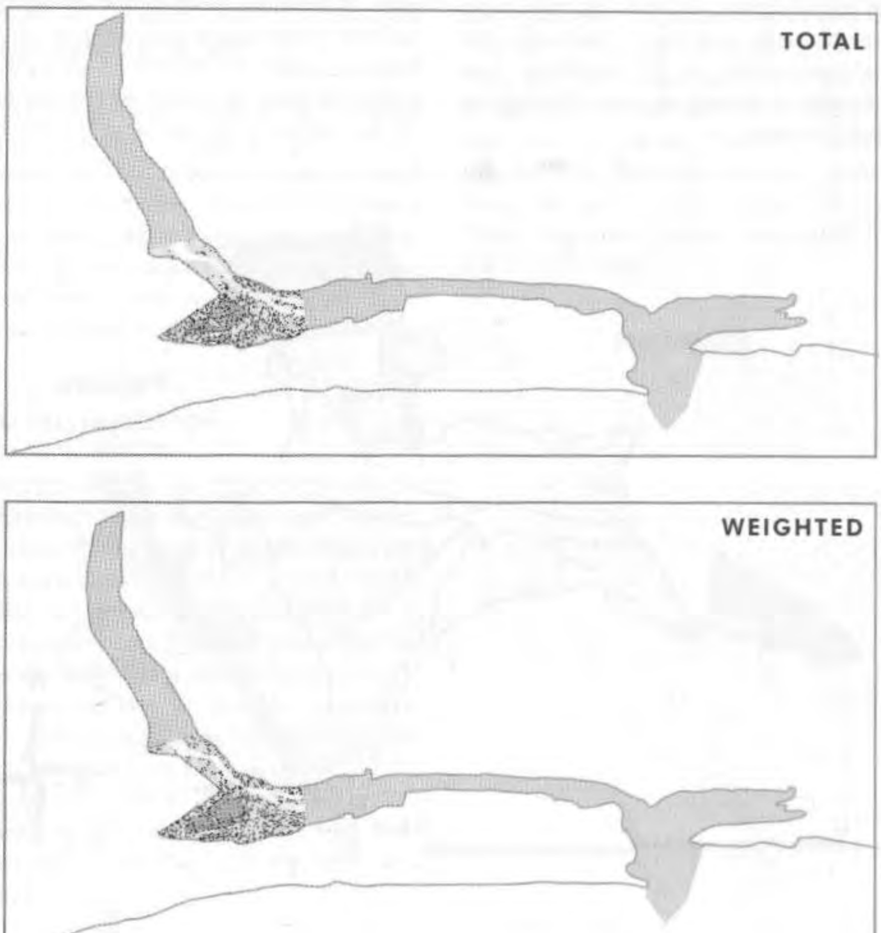


Figure 4.27.3: Low tide waterbird distributions recorded at the Adur Estuary, winter 1998–99

4.28 PAGHAM HARBOUR

LTC site code:	BP
Centre grid:	SZ8796
JNCC estuarine review site:	127
Habitat zonation:	294 ha intertidal, 41 ha subtidal, 102 ha nontidal
Statutory status:	Pagham Harbour SPA (UK9012041), Pagham Harbour Ramsar (7UK035)
Winter waterbird interest:	Cormorant, Dark-bellied Brent Goose, Teal, Pintail, Grey Plover, Ruff, Black-tailed Godwit

SITE DESCRIPTION

Pagham Harbour is a relatively small estuary located just east of Selsey Bill in Sussex. A central area of mudflats and saltmarsh is flanked by brackish marsh, reedbed and damp pastures. The sedimentation processes within the harbour are resulting in a net gain in saltmarsh cover, with further plans to encourage saltmarsh expansion through managed retreat over grazing land to the north-west of the site. The outlet to the sea is a narrow channel flowing through a shingle beach. There are brackish lagoons at Pagham and Sidlesham. The area was once claimed as agricultural land but was flooded again early in the 20th century. Only a very limited amount of sailing takes place in the harbour, and fishing and bait-digging are strictly regulated. Other conservation concerns include the influence of nutrients on the harbour and changes in coastal defences around the harbour (R. Carver pers. comm.).

COVERAGE AND INTERPRETATION

Pagham Harbour has been covered for the scheme each winter between 1995–96 and 1998–99 (as well as subsequently); counts were made during all months apart from November 1995 and January 1996. Figure 4.28.1 shows the positions of the 23 sections counted during the 1998–99 winter; the same overall area was counted throughout, although the two eastern sections containing Pagham Lagoon and the adjacent beach were counted as a single section prior to this winter.

Figure 4.28.2 shows how Pagham Harbour SPA includes almost the entire site as counted for the LTCs (apart from a small area of the fields north of Pagham Wall) but additionally a sizeable area of nontidal fields north along Bremere Rife, smaller areas south of Sidlesham and at Church Norton, and extensions along the coastal intertidal strip to north and south of the mouth of the estuary. An assessment at the SPA level

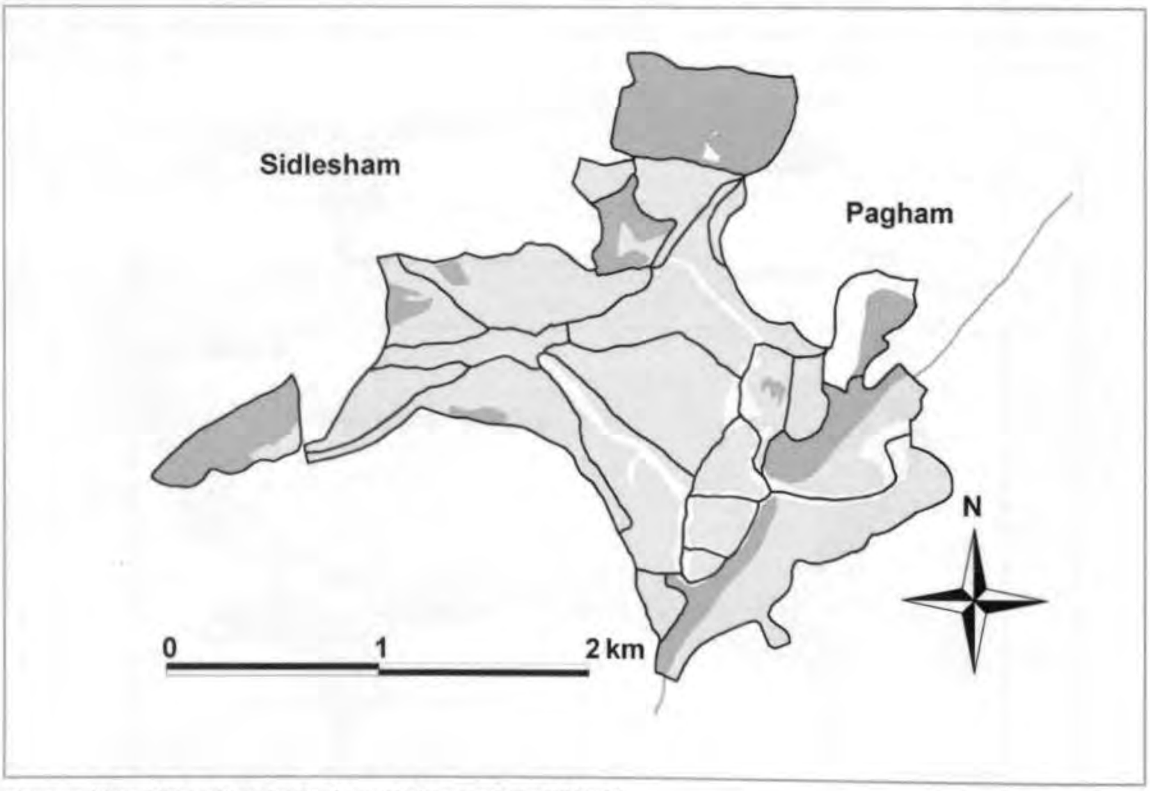


Figure 4.28.1: LTC sections at Pagham Harbour, winter 1998–99

Figure 4.28.2: LTC and SPA boundaries, with overlap, at Pagham Harbour

must take into account these differences. The boundaries of the Ramsar site are entirely coincident with those of the SPA.

Although birds may move between the harbour and adjacent nontidal habitats, there is not thought to be appreciable daily movement between Pagham and other estuaries, notably Chichester Harbour to the north-west. Estuarine birds may, however, move in and out of the harbour onto adjacent non-estuarine coastal habitats at different states of the tide (R. Carver, A. de Potier pers. comm.).

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1998–99 are presented for five of the seven species of principal interest listed above. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.28.3). Of the other species, very few Ruff were recorded by the scheme during any winter under review, this species making use of nontidal grassland areas nearby. Cormorants were very scarce at low tide (but not according to Core Counts) during the 1998–99 winter. However, they were numerous (up to 97 per month) during the previous three winters when most were found in the outer half of the harbour.

The totals map, coupled with the weighted totals map, picks out the higher overall bird density along the main creeks and on the fields north of Pagham Wall. The latter area was clearly the principal area for Brent Geese and Black-tailed Godwits and was also used by Teal and Wigeon. However, the latter two species along with Pintail clearly occurred along the main creeks through the harbour. Grey Plovers occurred widely throughout the intertidal parts of the site.

Figure 4.28.3: Low tide waterbird distributions recorded at Pagham Harbour, winter 1998–99

4.29 CHICHESTER HARBOUR

LTC site code:	BC
Centre grid:	SU7600
JNCC estuarine review site:	128
Habitat zonation:	2601 ha intertidal, 635 ha subtidal, 142 ha nontidal
Statutory status:	Chichester and Langstone Harbours SPA (UK9011011), Chichester and Langstone Harbours Ramsar (7UK032)
Winter waterbird interest:	Little Grebe, Cormorant, Little Egret, Dark-bellied Brent Goose, Shelduck, Wigeon, Teal, Pintail, Shoveler, Red-breasted Merganser, Oystercatcher, Ringed Plover, Grey Plover, Lapwing, Knot, Sanderling, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Waterbird assemblage

SITE DESCRIPTION

Chichester Harbour is situated between Chichester and Havant and is linked to Langstone Harbour to the west by a channel along the north side of Hayling Island. There are four major arms of the estuary, originally formed by land sinking along four small river valleys. These run into a wider area near the mouth of the estuary and there is a fairly wide opening to the eastern Solent. The former river channels are muddy whereas the intertidal areas south of Thorney Island are much sandier, and also support extensive areas of eelgrass and algae.

There is public access by footpath around almost the entire site and so disturbance to birds by walkers and dogs can be an issue. The estuary is also extremely popular with watersports enthusiasts, and whilst this is more of an issue in the summer months, new technology has more recently enabled an increase in winter watersports. Wildfowling also occurs, as does commercial dredging for oysters, hand-gathering of cockles and winkles and bait digging. In the longer term, more serious issues of habitat loss are likely to be those concerned with climate change such as storm-related erosion, sea-level rise and demand for sea defences. Other concerns relate to land use planning, which will have an impact on existing problems such as eutrophication and disturbance (A. de Potier pers. comm.).

COVERAGE AND INTERPRETATION

Chichester Harbour was one of the most frequently covered sites for the scheme during the period under review. Counts were made in the winters 1992–93 (no December or January counts), 1993–94 (no December count), 1996–97, 1997–98 and 1998–99. Figure 4.29.1 depicts the 61 count sections used during the 1998–99 winter. There have been a few changes in section boundaries over the course of this period. If further detail is required, the National Organiser should be consulted.

Figure 4.29.2 shows the LTC and SPA boundaries

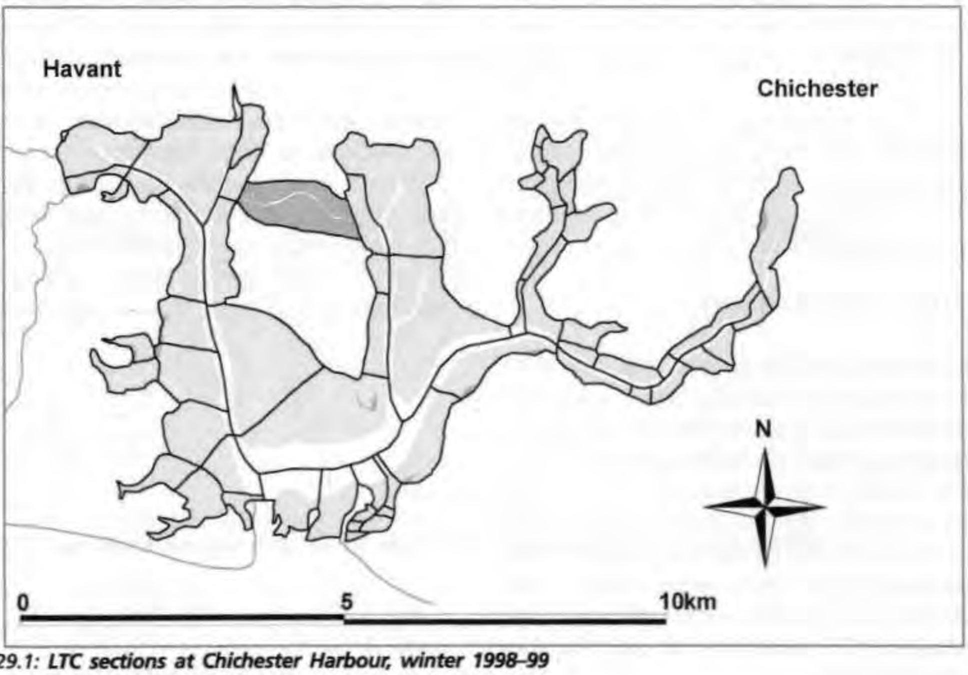


Figure 4.29.1: LTC sections at Chichester Harbour, winter 1998–99

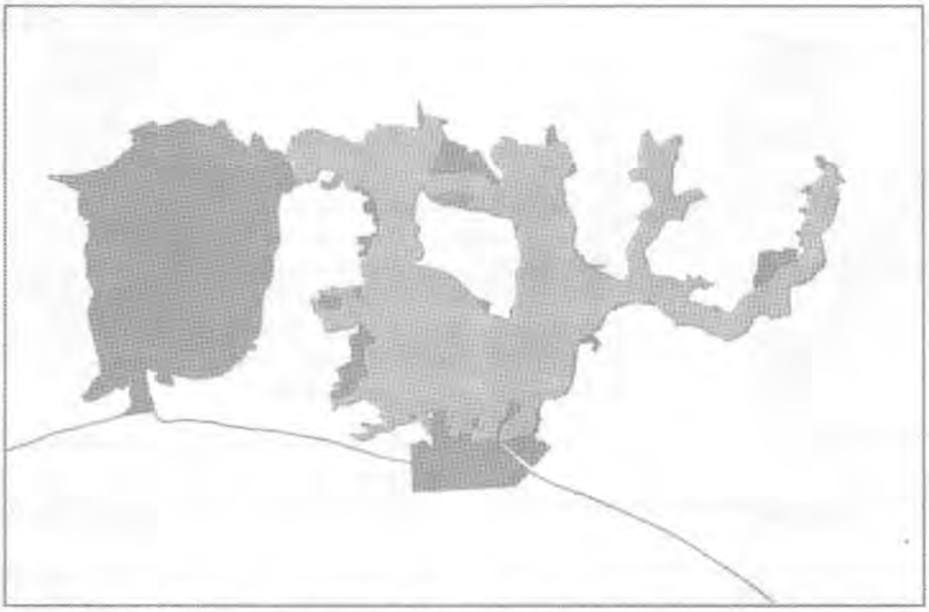


Figure 4.29.2: LTC and SPA boundaries, with overlap, at Chichester Harbour

at the site. The main difference is clearly that the SPA also includes Langstone Harbour to the west, which has been treated as a separate site by WeBS; other differences are fairly marginal. A few non-estuarine areas around the harbour have been included within the SPA but the LTCs concentrated on tidal areas. The boundaries of the Ramsar site are entirely coincident with those of the SPA.

Movements of birds clearly occur on a tide-to-tide basis between Chichester and Langstone Harbours, although this is not as yet fully understood. Birds apparently move in both directions as the tide rises and falls and further work is planned to investigate movements in the area more closely. It is also thought that some interchange with Portsmouth Harbour takes place. East of Chichester, Pagham Harbour is only a short distance away and some regular movements may take place, although these are not confirmed as yet. Some species, notably Brent Geese, Lapwings and Golden Plovers, make use of both the harbour and surrounding nontidal habitats (A. de Potier pers. comm.).

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1998–99 are presented for 20 of the 21 species of principal interest listed above. For clarity, smaller dots are used to display the distribution of Dunlin. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.29.3). Of the remaining species, only small numbers of Shovelers were noted on the site at low tide, this species occurring on nontidal areas within the SPA, notably Farlington Marshes in Langstone Harbour.

The totals and weighted totals maps illustrate that whilst overall bird density varies around the harbour, most parts held substantial numbers of birds; some key areas appear to be at Snow Hill Creek, the north end of Bosham Channel, much of Chichester Channel and the flats east of Langstone Bridge. The overall picture was strongly influenced by Dunlin and Brent Geese, both of which were widespread in large numbers around the site. Wigeon, Teal and Pintail were all found in higher densities along the inner parts of the channels, with Wigeon particularly concentrated at the tops of Bosham and Chichester channels. Ringed Plovers were scarce in the north-west of the harbour but widespread elsewhere. Lapwings occurred widely but major concentrations were highly localised. Sanderlings were almost entirely confined to the sandflats south of Thorney Island and Knot preferred the more open areas, shunning the narrower sections of channels. Black-tailed Godwits and Bar-tailed Godwits were clearly differentiated in their habitat preferences, with the former at the inner end of channels and the latter towards the mouth of the site. Little Grebes were most numerous in Chichester and Bosham Channels. Other species were more widespread although often with local concentrations.

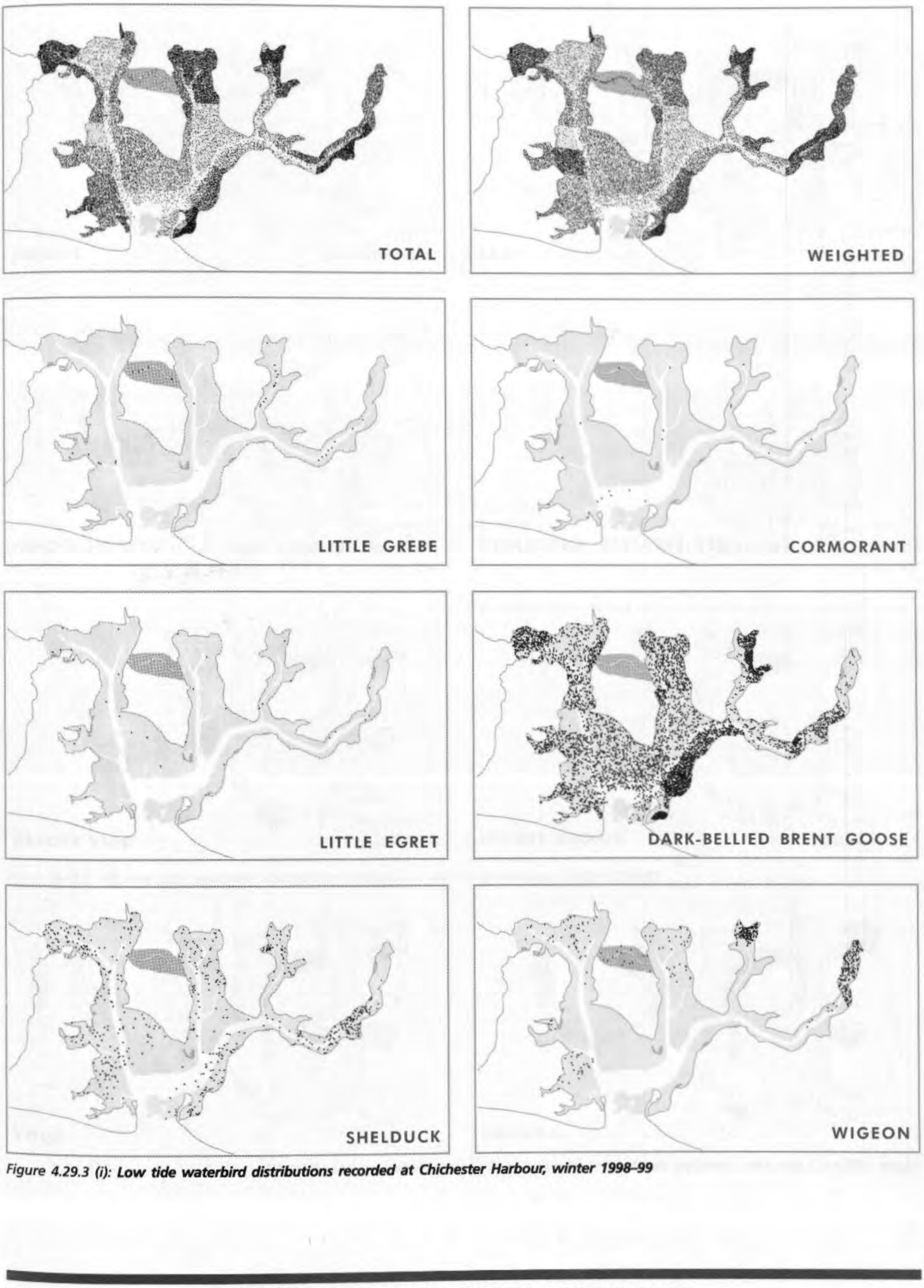


Figure 4.29.3 (i): ***Low tide waterbird distributions recorded at Chichester Harbour, winter 1998–99***

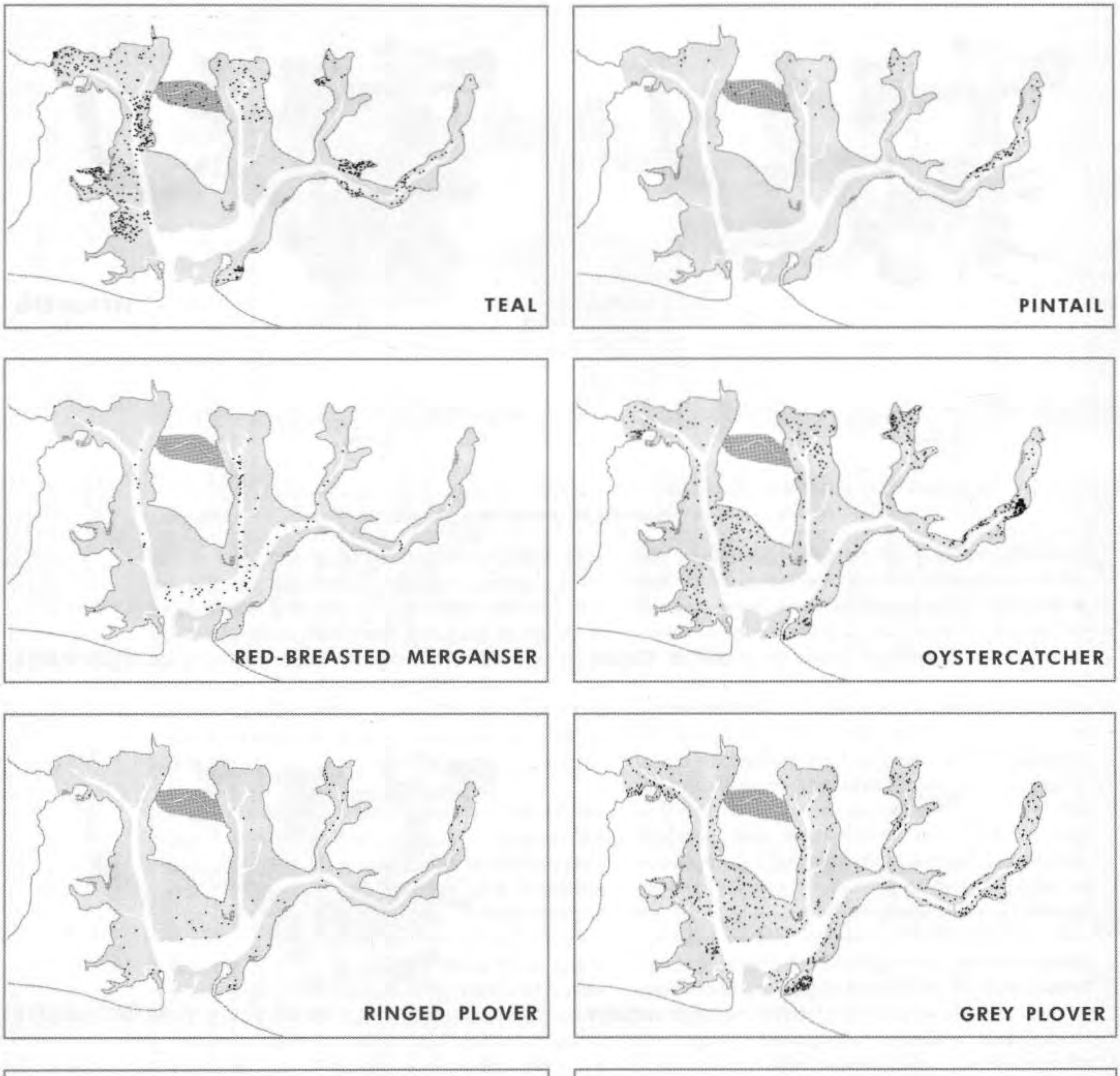


Figure 4.29.3 (ii): Low tide waterbird distributions recorded at Chichester Harbour, winter 1998–99

*Figure 4.29.3 (iii): **Low tide waterbird distributions recorded at Chichester Harbour, winter 1998–99***

4.30 LANGSTONE HARBOUR

LTC site code:	BL
Centre grid:	SU7002
JNCC estuarine review site:	129
Habitat zonation:	1521 ha intertidal, 348 ha subtidal, 66 ha nontidal
Statutory status:	Chichester and Langstone Harbours SPA (UK9011011), Chichester and Langstone Harbours Ramsar (7UK032)
Winter waterbird interest:	Little Grebe, Cormorant, Little Egret, Dark-bellied Brent Goose, Shelduck, Wigeon, Teal, Pintail, Shoveler, Red-breasted Merganser, Oystercatcher, Ringed Plover, Grey Plover, Lapwing, Knot, Sanderling, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Waterbird assemblage

SITE DESCRIPTION

Langstone Harbour is surrounded by urban development, although most of the land immediately adjacent to the shore is relatively open. The site is joined to both Chichester Harbour to the east and Portsmouth Harbour to the west (although only by a narrow creek in the latter case). The sediments exposed at low tide are mainly fine silts and organic matter, with a small area of sand near the harbour mouth. The main conservation issues around the site are developments of land near the shore and disturbance by recreational activities such as boating. Bait digging and shellfish gathering also occur. In the longer term, the decommissioning of the sewage effluent outfall from Budd's farm sewage works into the north-east of the harbour may lead to a reduction in the intertidal invertebrate population and hence to a reduction in the waterbird carrying capacity of the site. Also in the long term, predicted sea-level rise and climate change is likely to become a key issue, due initially to the expected loss of the low saltmarsh/shingle islands in the harbour which act as important undisturbed roost sites (C. Cockburn pers. comm.).

COVERAGE AND INTERPRETATION

Langstone Harbour was covered for the scheme during the two winters 1993–94 and 1998–99, no monthly counts being missed. The site was also counted in January 1997 as part of a co-ordinated 'Greater Solent' count, although this is not considered part of the WeBS dataset. Figure 4.30.1 shows the positions of the 35 sections counted for the survey during the 1998–99 winter. There were a few minor differences during the 1993–94 winter; three sections were not counted and a further two were lumped together; details can be obtained from the National Organiser if required.

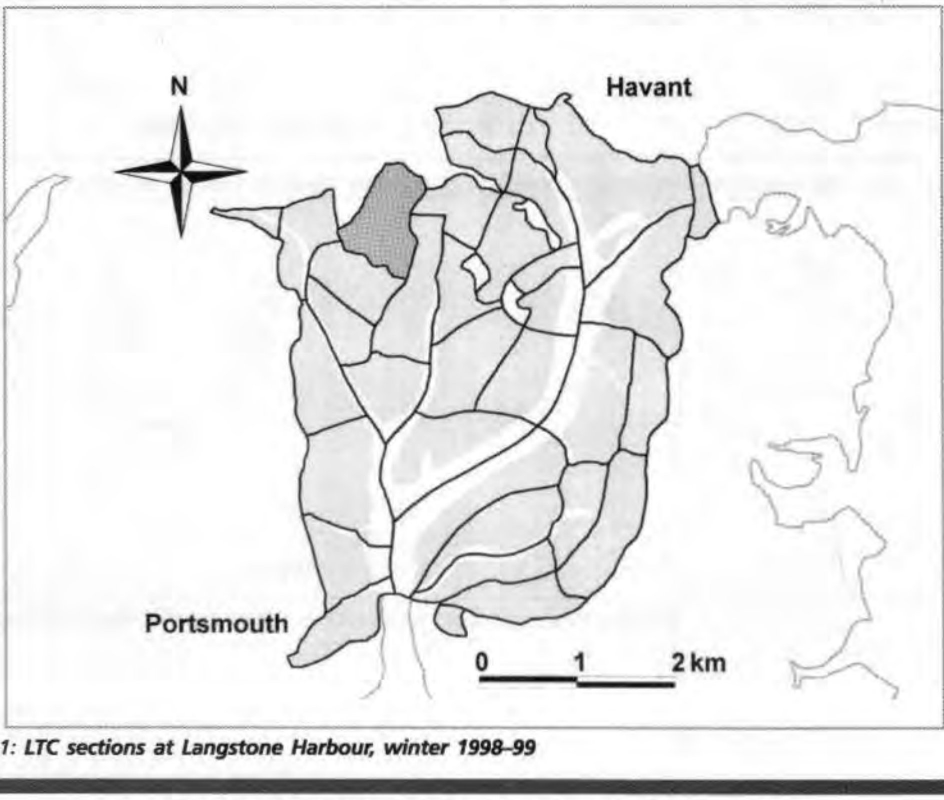


*Figure 4.30.1: **LTC sections at Langstone Harbour, winter 1998–99***

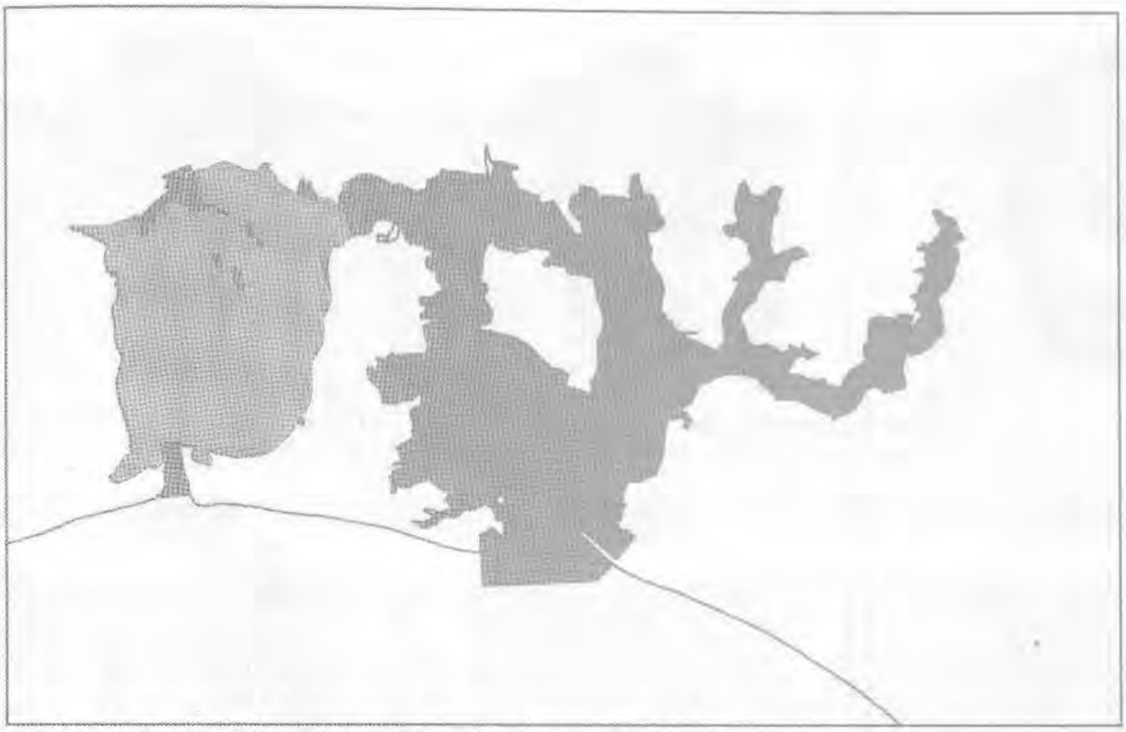


Figure 4.30.2: LTC and SPA boundaries, with overlap, at Langstone Harbour

Figure 4.30.2 shows the overlap between the LTC and SPA boundaries. Clearly, Chichester Harbour is the main difference, being part of the same SPA as Langstone. Around Langstone, the SPA covers additional areas at the mouth of the harbour and on the north side of the site north of Farlington Marshes and behind Budd's Wall. The boundaries of the Ramsar site are entirely coincident with those of the SPA.

A well-defined tidal movement occurs with many birds (including at least Grey Plovers, Knot, Dunlin, Black-tailed Godwits and Curlews) feeding in Portsmouth Harbour but roosting in Langstone Harbour. Tidal movements also occur between Langstone and Chichester Harbours but are less clearly defined, involving birds moving in both directions (C. Cockburn, A. de Potier pers. comm.). Other birds may disperse from the harbour onto the Solent shore of Hayling Island and the Southsea shore. Additionally, Brent Geese feed widely around the area on nontidal habitats.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1998-99 are presented for all of the 21 species of principal interest listed above. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.30.3). The totals map shows that high bird densities occurred throughout, but with the highest concentrations at Chalkdock Lake, Farlington Marshes, the west shore and the Kench; the weighted totals map further emphasises Farlington Marshes, due mostly to the Brent Geese here. Despite the very high concentration at Farlington, Brent Geese were common across the whole site. Other species at Farlington in high densities were Wigeon, Teal, Pintail and Shoveler, with these species largely restricted otherwise to the northern end of the site; Chalkdock Lake held the highest Wigeon density and was also a key area for Black-tailed Godwit. Little Grebes occurred only at the northern end but the small numbers of Black-necked Grebes were along Langstone Channel. Shelducks, Red-breasted Mergansers, Cormorants and Little Egrets were more widespread. Chalkdock Lake held the highest density of Oystercatchers. Lapwings were found at the northern end, Ringed Plovers were absent from the centre and Sanderlings occurred towards the mouth. Most other waders were very widespread, Knot occurring in higher densities in the south-east and Dunlin common everywhere but particularly abundant off Budd's Wall, along the western shore, and at the Kench.

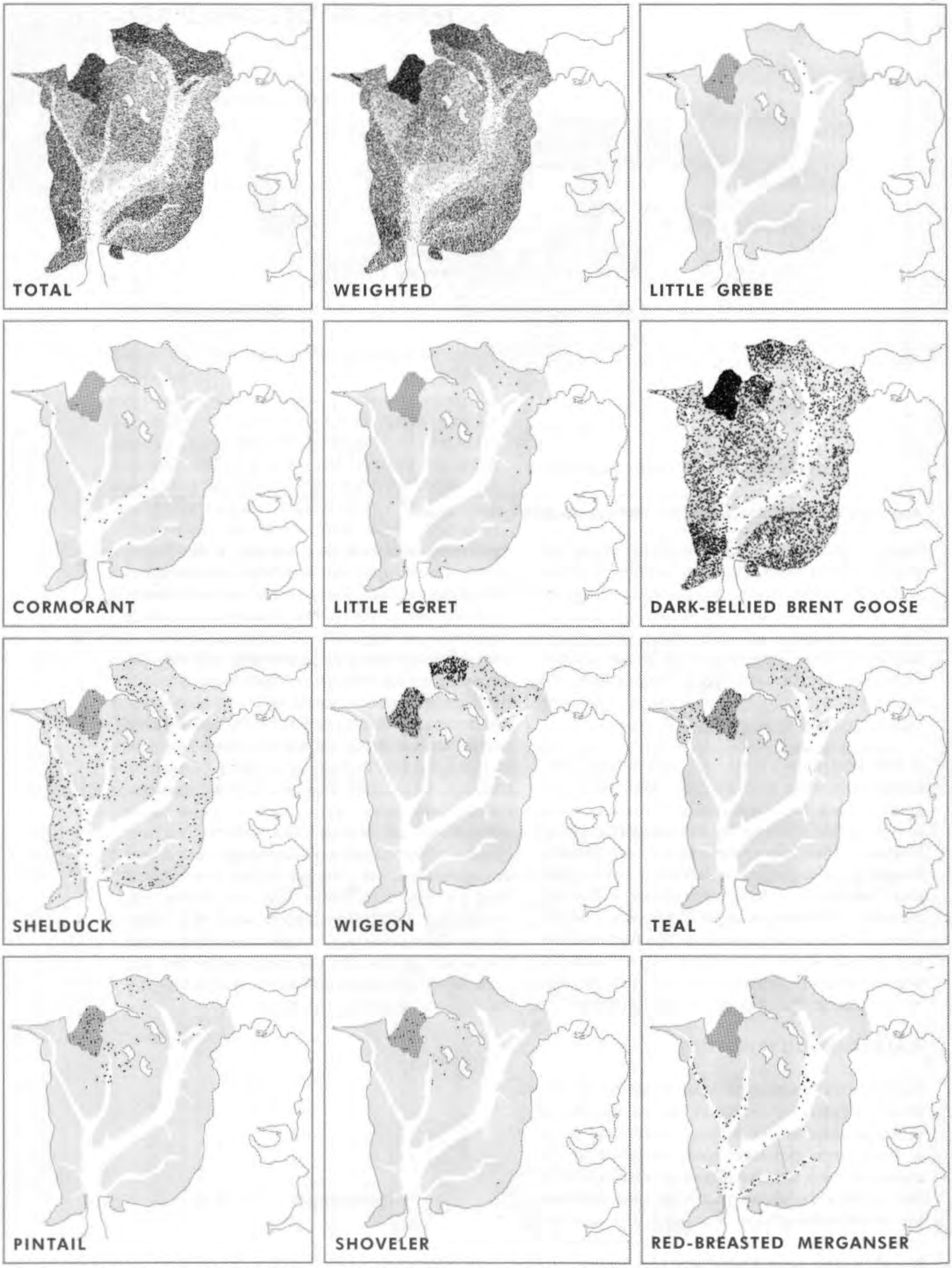


*Figure 4.30.3 (i): **Low tide waterbird distributions recorded at Langstone Harbour, winter 1998–99***

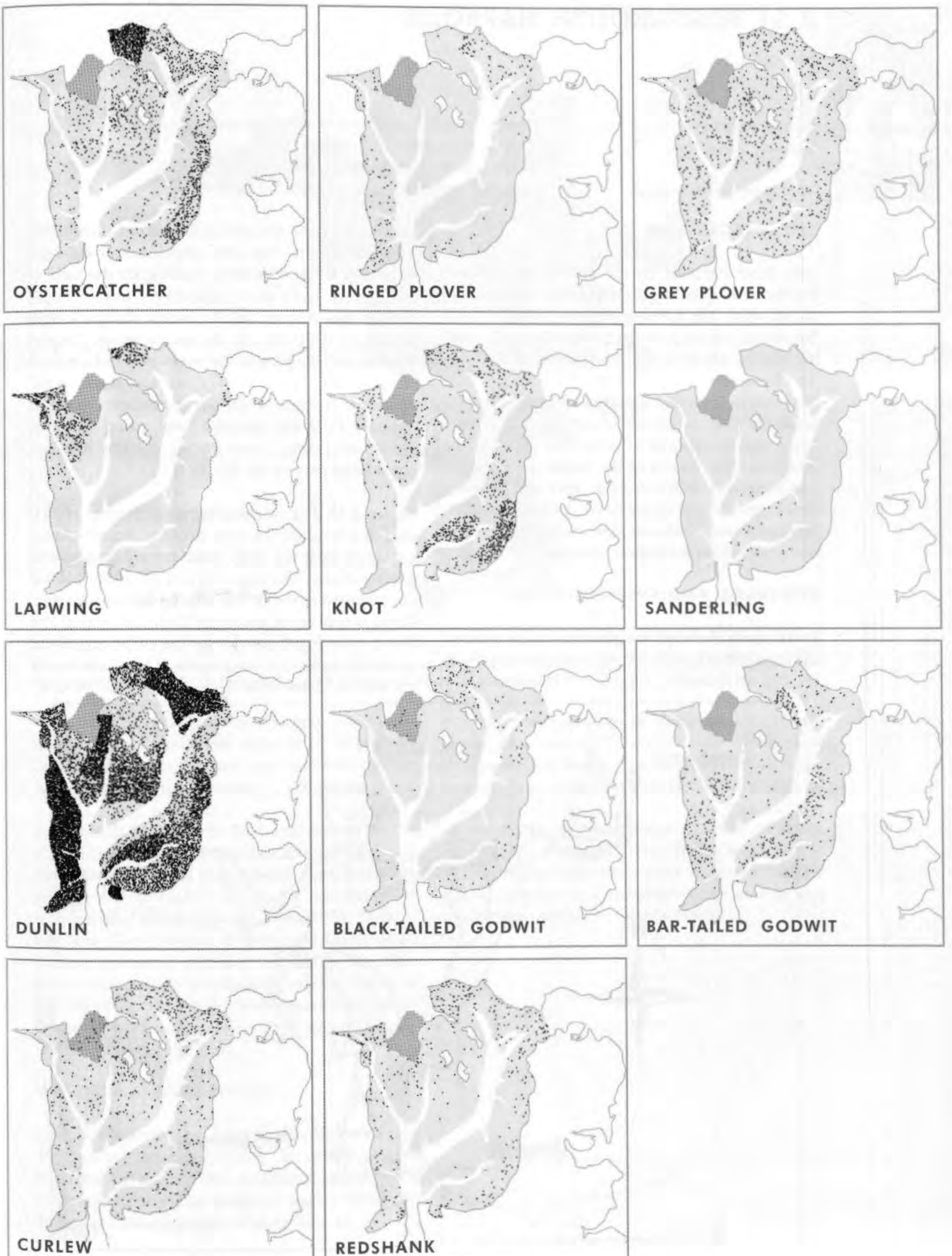


Figure 4.30.3 (ii): ***Low tide waterbird distributions recorded at Langstone Harbour, winter 1998–99***

4.31 PORTSMOUTH HARBOUR

LTC site code:	CP
Centre grid:	SU6203
JNCC estuarine review site:	130
Habitat zonation:	963 ha intertidal, 612 ha subtidal, 4 ha nontidal
Statutory status:	Portsmouth Harbour SPA (UK9011051), Portsmouth Harbour Ramsar (7UK074)
Winter waterbird interest:	Dark-bellied Brent Goose, Black-tailed Godwit

SITE DESCRIPTION

This large harbour on the Solent lies between Portsmouth to the east and Gosport and Fareham to the west. The harbour receives relatively little freshwater input, principally from the fairly small Wallington River in the north-west of the site. The connection to the sea, via the Solent, is only 200 metres wide at its narrowest point. There is relatively little in the way of saltmarsh but there are extensive areas of eelgrass and algae on the mudflats. The shores of the harbour are highly industrialised with extensive port and housing developments and major naval docks and installations. There have also been issues concerned with land-claim for refuse disposal.

COVERAGE AND INTERPRETATION

Portsmouth Harbour was covered for the scheme during 1992–93 and 1997–98, counts being made during all months. Figure 4.31.1 shows the positions of the 24 sections counted during the 1997–98 counts. The only differences in 1992–93 were that the two sections making up the west of Paulsgrove Lake were lumped as one; a small section was counted at Stamshaw that no longer existed by 1997–98; and the area between Gosport Marina and the jetty to the north was not counted in the earlier survey. The harbour was also counted as part of the non-WeBS Greater Solent counts in January 1997 and January 1999, using the same count sections; these latter counts are not considered part of the LTCs.

Figure 4.31.2 shows the degree of overlap of LTC and SPA boundaries. The two are almost identical, apart from the open water towards the mouth of the estuary. The main area of intertidal habitat not included in the SPA is around Gosport Marina. A few small creek ends are included within the SPA but were not covered for the LTCs, mostly for access reasons. The boundaries of the Ramsar site are entirely coincident with those of the SPA.

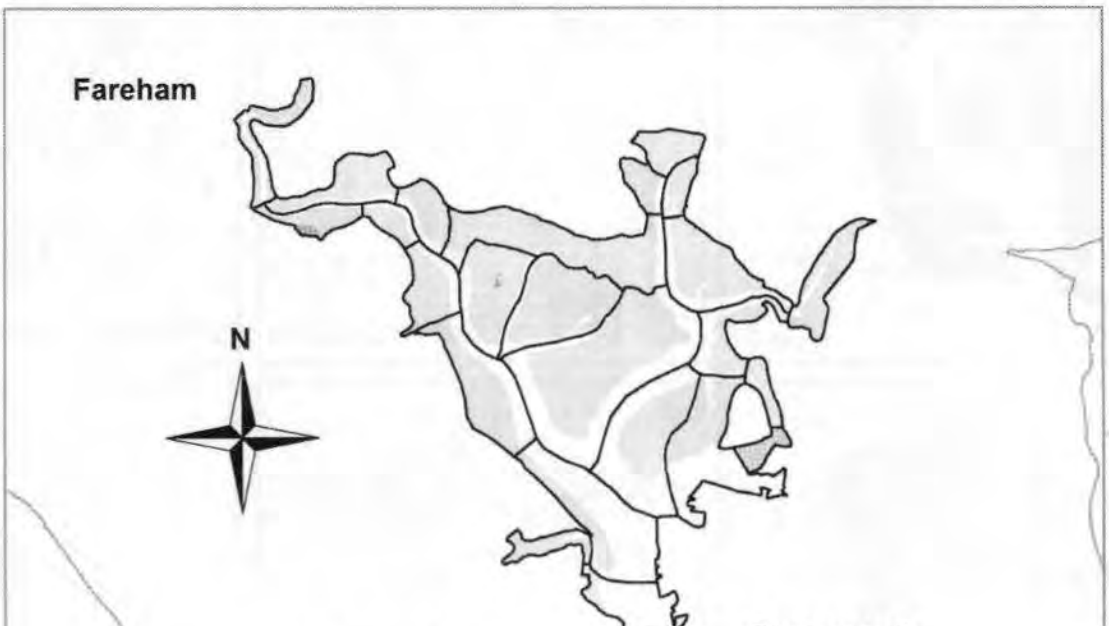


*Figure 4.31.1: **LTC sections at Portsmouth Harbour, winter 1997–98***

Figure 4.31.2: LTC and SPA boundaries, with overlap, at Portsmouth Harbour

Waterbirds using Portsmouth Harbour make daily movements to and from other sites, especially Langstone Harbour to the east but also further east to Chichester Harbour (C. Cockburn pers. comm.). It is a relatively short distance west from Portsmouth Harbour to Titchfield Haven at the south-eastern end of Southampton Water and movements are thus also possible here, although not yet well-defined. It is thought that inter-site movements, which particularly involve Oystercatchers, Grey Plovers, Dunlin and Black-tailed Godwit, increased following the loss of the main wader roost site to development at Port Solent in the late 1980s (Unsworth 1994). Additionally, Brent Geese in particular make much use of nearby nontidal habitats to feed.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1997–98 are presented for the two species of principal interest listed above. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.31.3).

The totals map reveals a pattern of fairly uniform bird density over much of the site, except for an extreme concentration of birds west of Whale Island. This was due mostly to large numbers of Dunlin feeding there. The weighted totals map, however, also picks out Paulsgrove Lake and, to a lesser extent, Fareham Lake as a result of the concentration of Black-tailed Godwits in these parts of the harbour. Brent Geese were clearly very widespread with just slightly higher concentrations at Paulsgrove Lake and in the small creek south of Priddy's Hard.

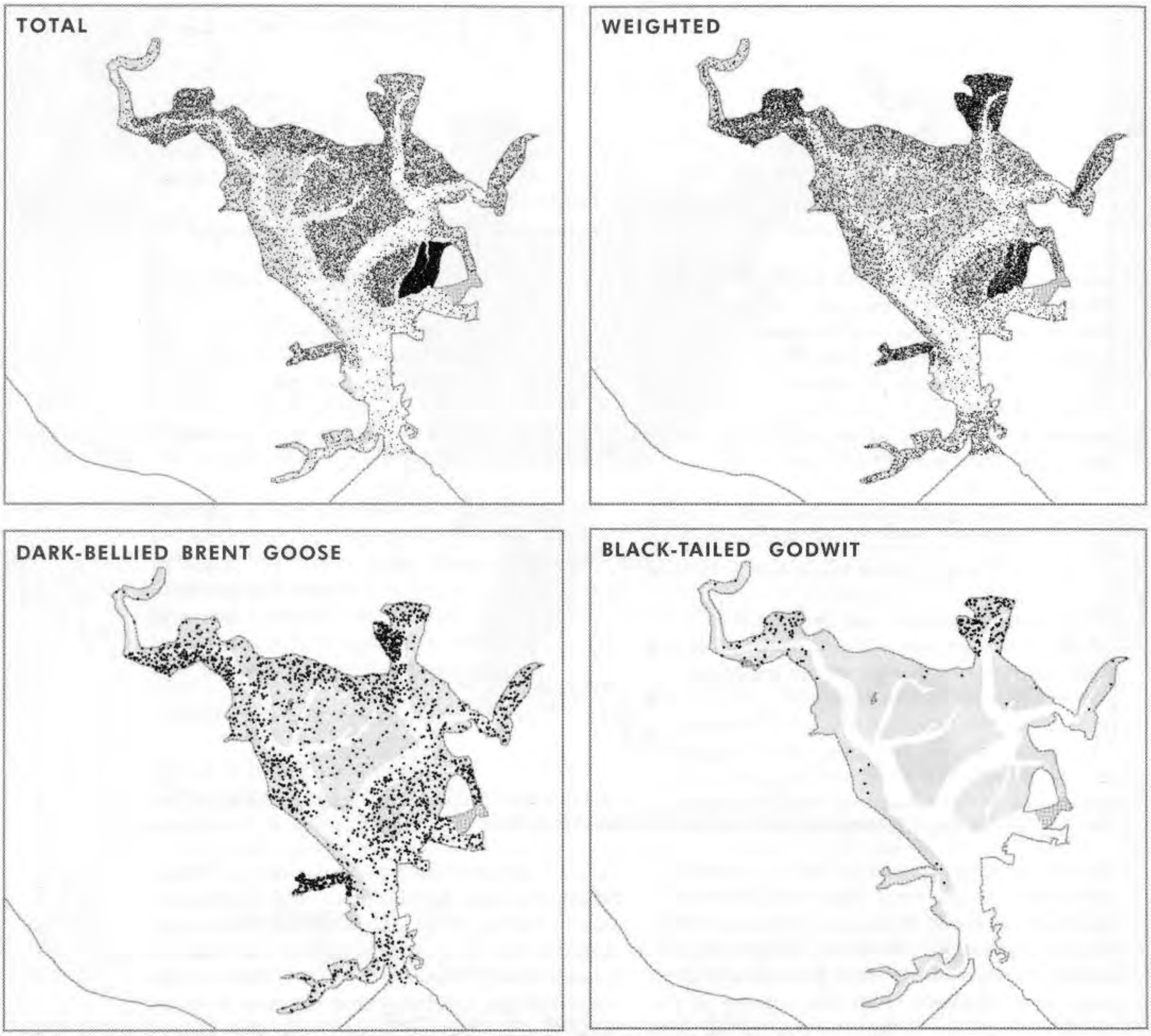


Figure 4.31.3: ***Low tide waterbird distributions recorded at Portsmouth Harbour, winter 1997–98***

4.32 SOUTHAMPTON WATER

LTC site code:	CS
Centre grid:	SU4506
JNCC estuarine review site:	131
Habitat zonation:	1001 ha intertidal, 1523 ha subtidal, 285 ha nontidal
Statutory status:	Solent and Southampton Water SPA (UK9011061), Solent and Southampton Water Ramsar (7UK125)
Winter waterbird interest:	Little Grebe, Great Crested Grebe, Cormorant, Dark-bellied Brent Goose, Shelduck, Wigeon, Gadwall, Teal, Pintail, Shoveler, Red-breasted Merganser, Ringed Plover, Grey Plover, Lapwing, Dunlin, Black-tailed Godwit, Curlew, Redshank, Waterbird assemblage

SITE DESCRIPTION

Southampton Water is part of the Solent complex and lies between the city of Southampton and the New Forest. The three principal rivers entering Southampton Water are the Test, Itchen and Hamble. There are extensive areas of mud on both shores of the estuary, with a large area of *Spartina* saltmarsh along the western shore. Southampton Water is one of the most heavily developed estuaries in Britain and, as well as being adjacent to a large city, also has important docks, an oil refinery and a power station along its shores. The area is also extremely heavily used by sailing enthusiasts and for other recreational uses. One of the most significant current development issues has been at Dibden Bay. Development plans would result in the loss of an extensive area of coastal wet grassland and a considerable area of the remaining intertidal mud. At the time of writing, the outcome of a public enquiry regarding this issue is awaited.

COVERAGE AND INTERPRETATION

One of the most intensively surveyed LTC sites, Southampton Water has been covered by the scheme during the winters 1994–95 to 1998–99 (and beyond). Data were returned for all months during this period. Figure 4.32.1 shows the positions of the 35 sections counted for the survey during 1998–99. A few minor changes in count sections took place between winters, details of which can be obtained from the National Organiser. One point of note is that the western shore from Calshot Spit to Cadland Creek has been counted both from the land and from a boat, with the resulting counts treated by taking the highest species count from either.

Comparing the LTC and SPA boundaries, Figure 4.32.2 shows that the major difference is that the SPA also covers a number of other areas traditionally considered as sites in their own right by WeBS, *i.e.* Beaulieu Estuary, North-west Solent and the Isle of Wight estuaries. Of more relevance to Southampton Water itself, however, are two key areas within the SPA which have not been included in the LTCs to date, namely Titchfield Haven and the Lower Test Marshes. Further slight differences between boundaries exist along the Itchen and Hamble rivers, at Hook Park and at Cracknore Hard. A consideration of bird usage of the estuary should take these differences into account. Similarly, it would be ideal if surveys in

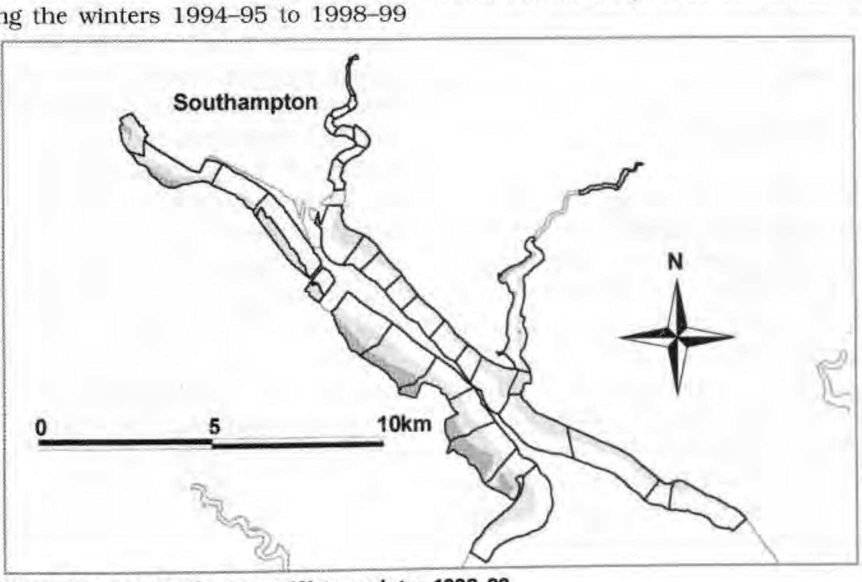


Figure 4.32.1: LTC sections at Southampton Water, winter 1998–99

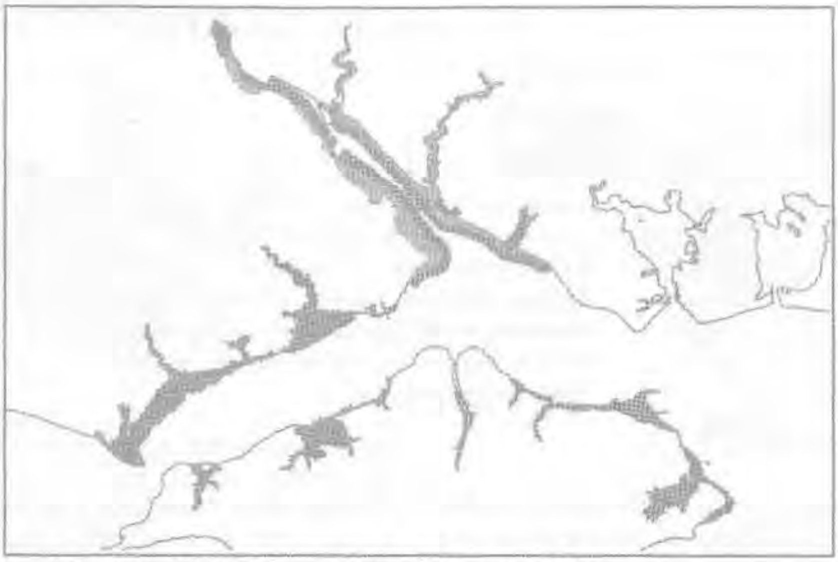


Figure 4.32.2: LTC and SPA boundaries, with overlap, at Southampton Water

the future could attempt some coverage of Titchfield and Lower Test, at least. The boundaries of the Ramsar site are very similar to those of the SPA, the only difference around Southampton Water itself being a small area of nontidal habitat at Hook Lake within the Ramsar site but not the SPA.

There is an increasing appreciation of the level of waterbird movements between Southampton Water and adjacent wetland sites. In particular, many waders are thought to roost at Needs Ore Point, at the mouth of the Beaulieu Estuary, but to feed on Southampton Water (J. Pain, D. Unsworth pers. comm.). The omission of Titchfield Haven from the LTCs to date means that recorded numbers of Black-tailed Godwits in particular were much lower at low tide than on Core Counts. Other species, especially ducks, will have been similarly affected by the lack of LTCs from the Lower Test Marshes. The extent of regular movements between Southampton and Portsmouth to the east, if any, is not yet quantified.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1998–99 are presented for 17 of the 18 species of principal interest listed above. For clarity, smaller dots are used to display the distributions of Wigeon, Teal, Lapwing and Dunlin. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.32.3). The remaining species, Shoveler, was noted in only low numbers by the scheme. Shovelers mostly frequent nontidal habitats around both Southampton Water and the other estuaries included within the SPA boundary.

The totals and weighted totals maps suggest that highest density areas were at Cadland Creek, Hythe/Dibden, Bury/Eling, and the Hamble river. Cadland Creek held the highest concentrations of Pintail, Teal and Gadwall as well as being one of the principal areas for Wigeon. The latter species was a little more widespread, with the densest flocks at Bury and Eling Marshes. Recent observations have shown, however, that many of the Wigeon spending the day at Eling and Bury actually feed on grassland adjacent to Dibden Bay at night (J. Pain pers. comm.). Shelducks were mostly found along the outer south shore plus Eling Marsh, whilst Brent Geese were found more widely throughout the site but with the densest concentrations towards the mouth. Most Little Grebes were along the Itchen and at Fawley but Great Crested Grebes and Cormorants were more widespread. Red-breasted Mergansers were mostly found from the Itchen to the Hamble inclusive. Most of the waders were widespread, although with higher densities in places. Grey Plovers were found in their highest densities at Dibden Bay and Weston Shore, with Dibden also clearly the key feeding area for Curlews at the site. Redshanks reached higher densities in the Cadland to Fawley area. Dunlin density was at its highest at Cadland Creek and on some small sections of the Itchen. Black-tailed Godwits were mostly at Bury/Eling with smaller numbers downstream (although as mentioned, most will have been at Titchfield Haven). Lapwings were typically clumped, with flocks roosting at Eling, Hamble and Hythe. Ringed Plovers were widespread, mostly in the outer estuary but also at Dibden.

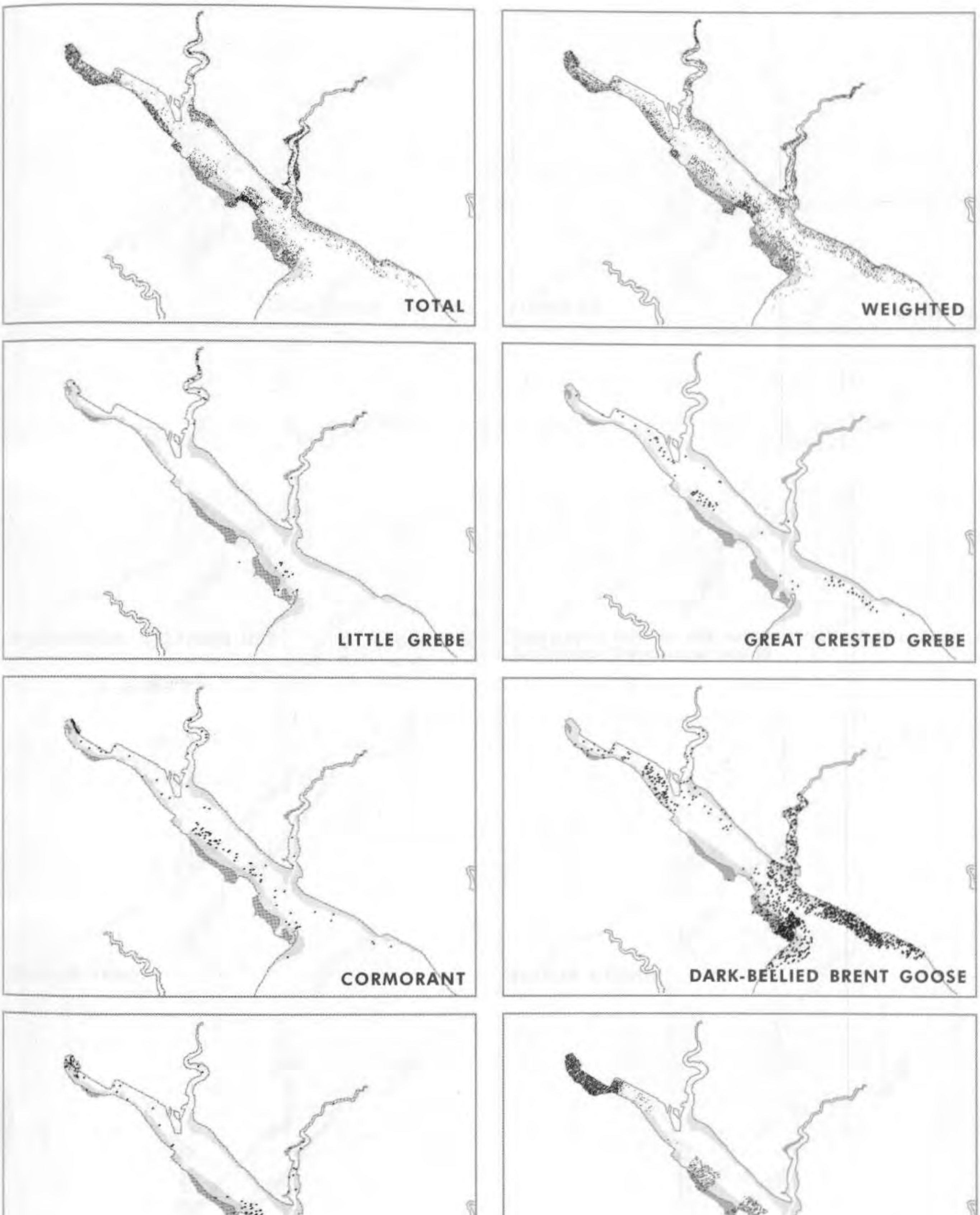


*Figure 4.32.3 (i): **Low tide waterbird distributions recorded at Southampton Water, winter 1998–99***

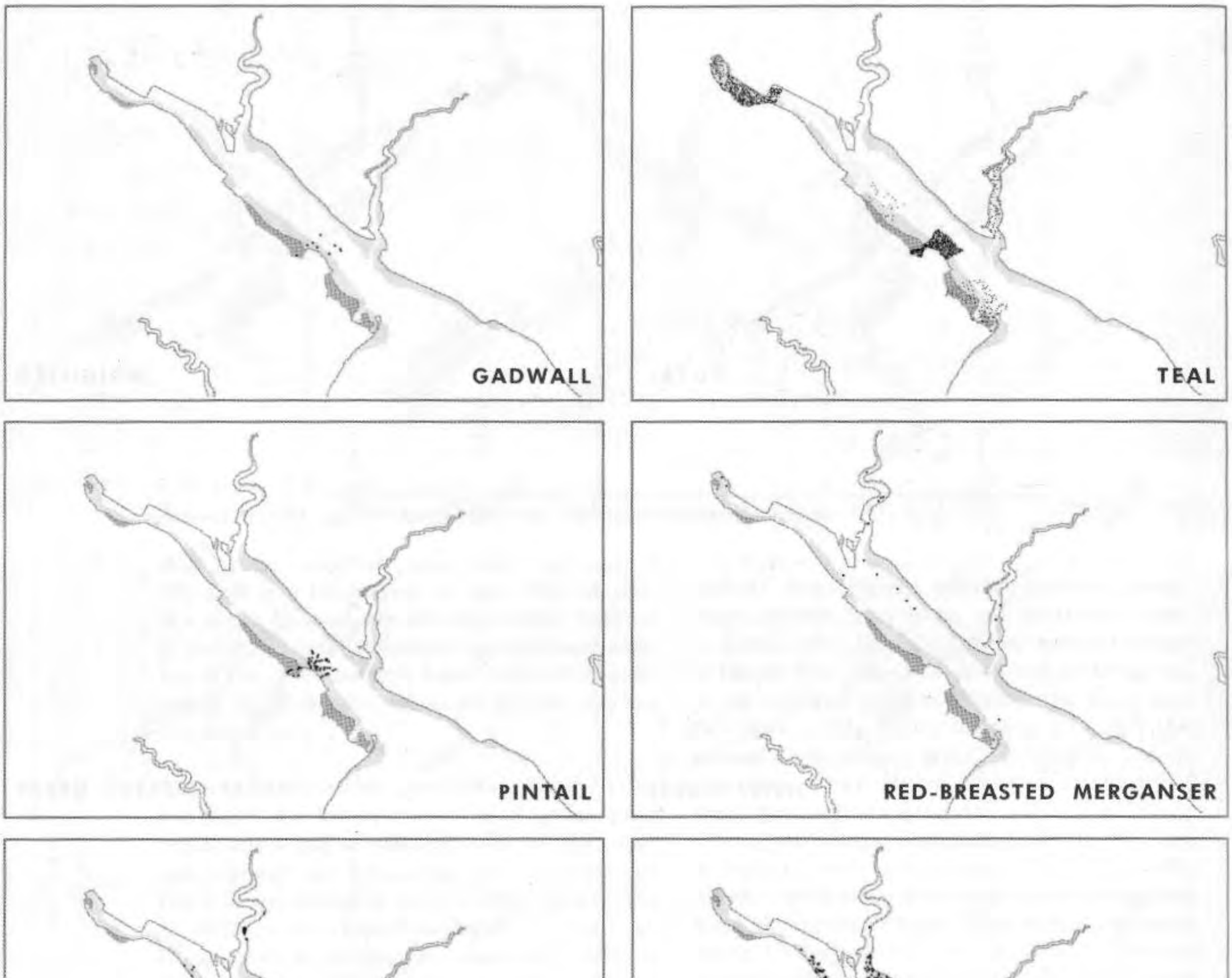
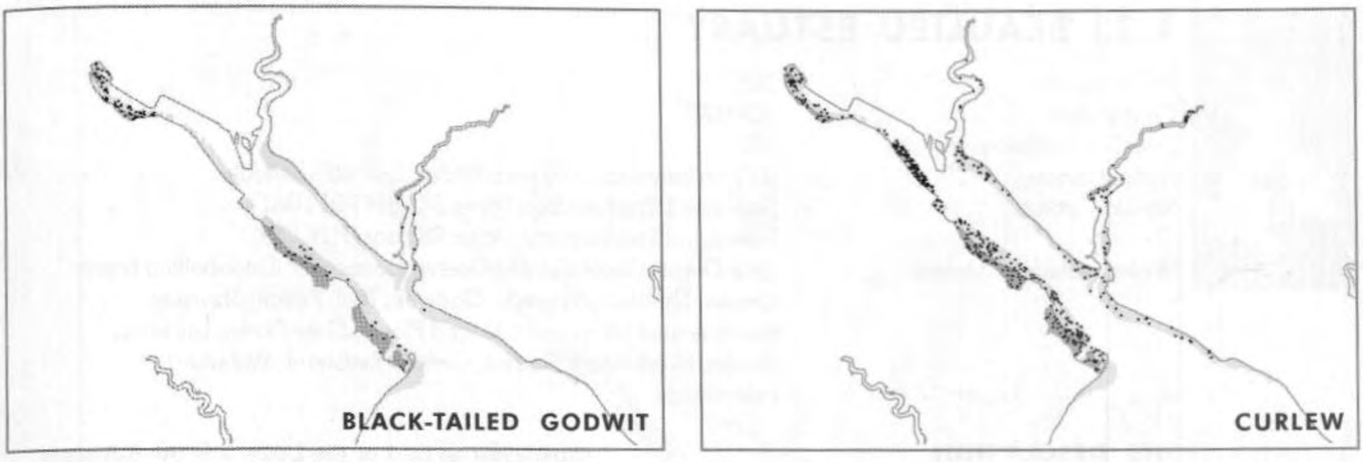


Figure 4.32.3 (ii): Low tide waterbird distributions recorded at Southampton Water, winter 1998–99



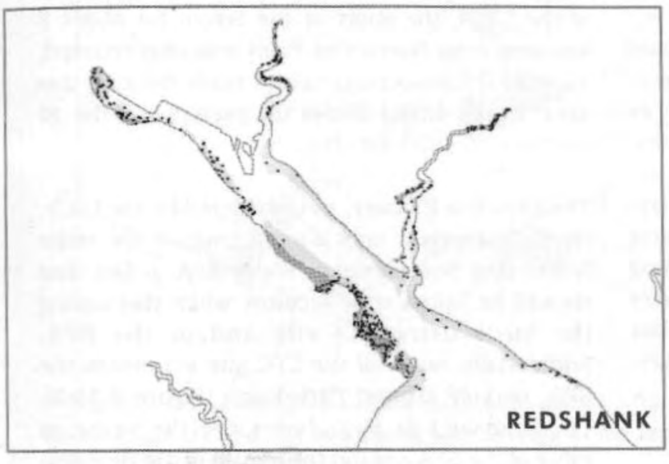


Figure 4.32.3 (iii): Low tide waterbird distributions recorded at Southampton Water, winter 1998–99

4.33 BEAULIEU ESTUARY

LTC site code:	BU
Centre grid:	SU4100
JNCC estuarine review site:	132
Habitat zonation:	212 ha intertidal, 350 ha subtidal, 367 ha nontidal
Statutory status:	Solent and Southampton Water SPA (UK9011061), Solent and Southampton Water Ramsar (7UK125)
Winter waterbird interest:	Little Grebe, Great Crested Grebe, Cormorant, Dark-bellied Brent Goose, Shelduck, Wigeon, Gadwall, Teal, Pintail, Shoveler, Red-breasted Merganser, Ringed Plover, Grey Plover, Lapwing, Dunlin, Black-tailed Godwit, Curlew, Redshank, Waterbird assemblage

SITE DESCRIPTION

The Beaulieu River rises in the New Forest and enters the western Solent at Needs Ore Point. From the village of Beaulieu down as far as Bucklers Hard the river has narrow muddy banks. Further down, saltmarsh begins to develop and becomes extensive at the mouth of the estuary. There is relatively little recreational disturbance to birds using the Beaulieu Estuary, with boating occurring but not intensively. There is also very little industrial activity. Wildfowling occurs but is confined to the ponds adjacent to the estuary.

COVERAGE AND INTERPRETATION

The Beaulieu Estuary was counted for the scheme in 1996–97, although counts were only made in November and January. The same count sections were also counted for the Greater Solent count in January 1999, although these counts are not considered as part of the LTCs. For the purposes of the LTCs, the shore of the Solent for about 3 km west from Needs Ore Point was also counted, as were the associated inland fields backing this area. Figure 4.33.1 shows the positions of the 12 sections counted for the survey.

The Beaulieu Estuary, as considered by the LTCs, clearly comprises only a small part of the wider Solent and Southampton Water SPA, a fact that should be taken into account when discussing the birds using the site and/or the SPA. Additionally, some of the LTC site is outwith the SPA, notably around Park Farm (Figure 4.33.2). The Ramsar site boundaries are the same as those of the SPA around the mouth of the Beaulieu but along the upper reaches of the estuary there are a few areas within the Ramsar boundaries that lie outwith the SPA (and the LTC site).

There is thought to be daily interchange by some

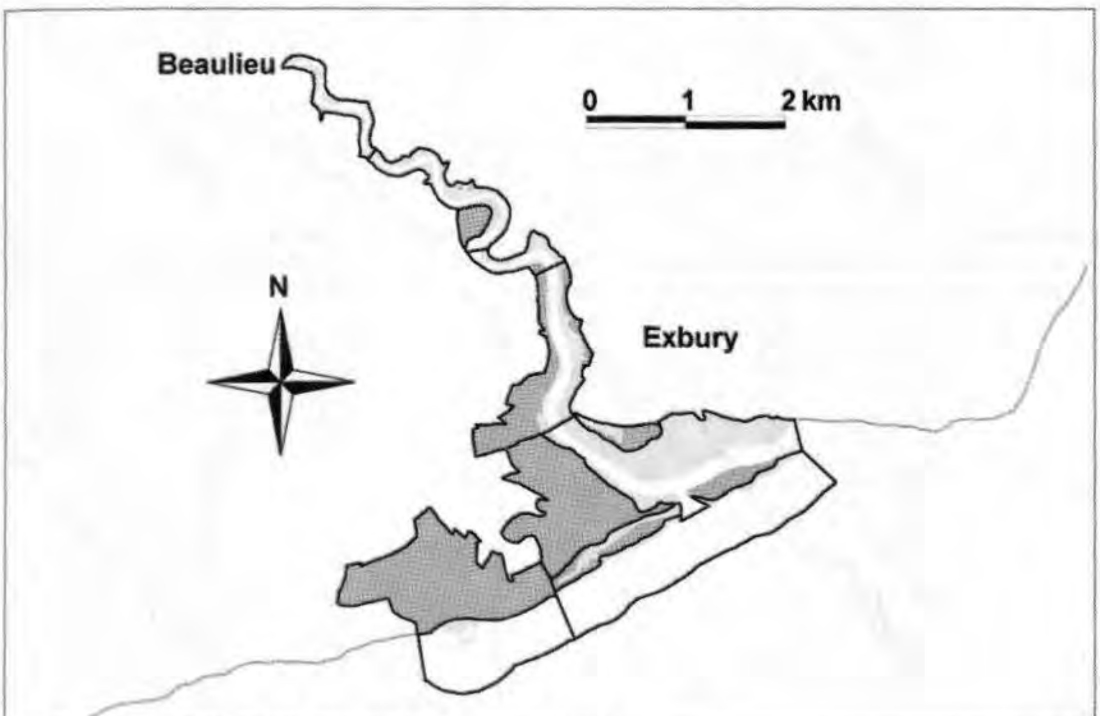


*Figure 4.33.1: **LTC sections at the Beaulieu Estuary, winter 1996–97***

Figure 4.33.2: LTC and SPA boundaries, with overlap, at the Beaulieu Estuary

waterbirds between the Beaulieu Estuary and other areas, especially Southampton Water. Higher numbers of some species (such as Dunlin) at Southampton Water at low tide compared to high tide are thought to be due to some birds roosting at Needs Ore Point. Additionally, other species may move regularly between the Beaulieu and the almost adjacent North-west Solent (D. Unsworth pers. comm.).

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1996–97 are presented for 14 of the 18 species of principal interest listed above. For clarity, smaller dots are used to display the distribution of Wigeon. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.33.3). The remaining four species (Great Crested Grebe, Red-breasted Merganser, Ringed Plover and Black-tailed Godwit) were all recorded during the counts but only in small numbers, with more present at other sites elsewhere within the SPA boundary.

The totals map, supported by the weighted totals map, shows the highest overall bird density on the most upstream section of the estuary near Beaulieu village, with most of the birds present here being Wigeon. Downstream, Keeping Marsh was also a notable section, with Teal the dominant species here. Little Grebes were widespread along the riverine stretches of the site in small numbers but Cormorants were scarce. The intertidal zone on the north shore of the mouth of the estuary was the principal area for Shelducks, Grey Plovers, Dunlin and Redshanks. The counts also covered the nontidal fields adjacent to the west of the estuary, which were clearly the principal area for Brent Geese at low tide, as well as holding large numbers of Wigeon, Teal and Curlew and the majority of the Gadwall, Pintail and Shoveler. The Park Shore area along the edge of the Solent was also frequented by Brent Geese. Lapwings were widespread but there was a particular concentration in the Bucklers Hard/Gilbury Hard area.

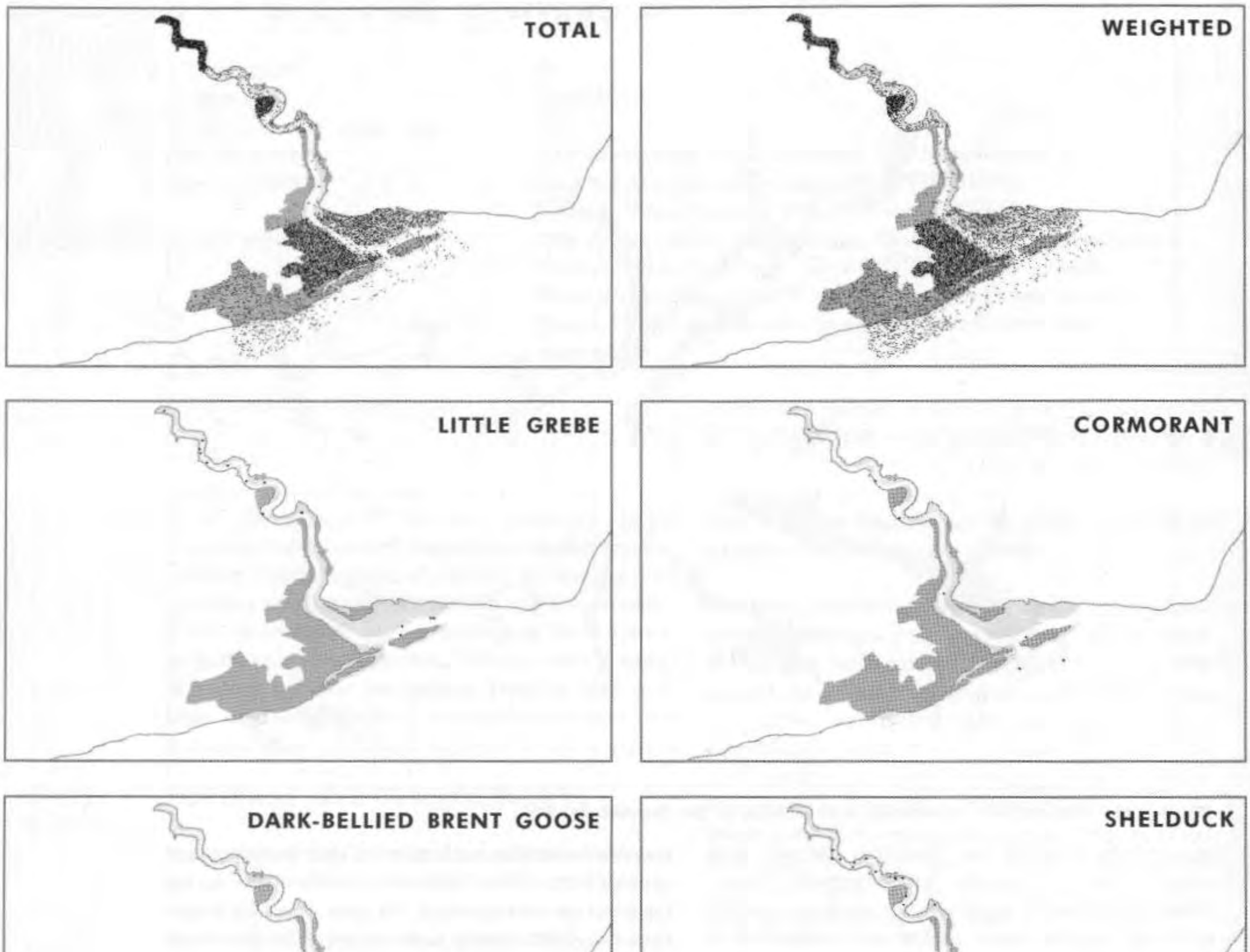


*Figure 4.33.3 (i): **Low tide waterbird distributions recorded at the Beaulieu Estuary, winter 1996–97***

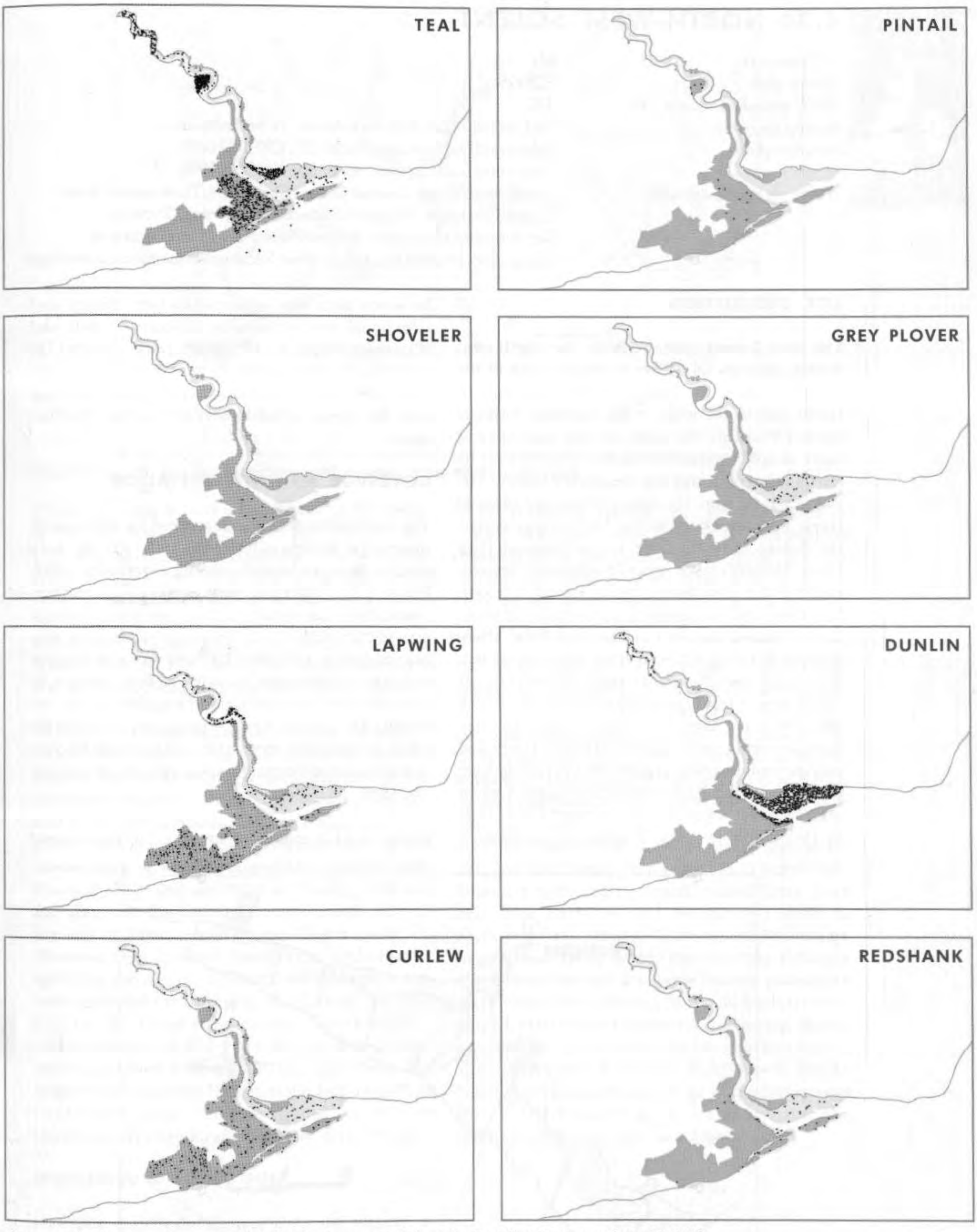


*Figure 4.33.3 (ii): **Low tide waterbird distributions recorded at the Beaulieu Estuary, winter 1996–97***

4.34 NORTH-WEST SOLENT

LTC site code:	BN
Centre grid:	SZ3395
JNCC estuarine review site:	133
Habitat zonation:	734 ha intertidal, 510 ha subtidal, 19 ha nontidal
Statutory status:	Solent and Southampton Water SPA (UK9011061), Solent and Southampton Water Ramsar (7UK125)
Winter waterbird interest:	Little Grebe, Great Crested Grebe, Cormorant, Dark-bellied Brent Goose, Shelduck, Wigeon, Gadwall, Teal, Pintail, Shoveler, Red-breasted Merganser, Ringed Plover, Grey Plover, Lapwing, Dunlin, Black-tailed Godwit, Curlew, Redshank, Waterbird assemblage

SITE DESCRIPTION

The area known collectively as the North-west Solent includes all of the intertidal parts of the north shore of the Solent from the shingle of Hurst Spit in the west to the shoreline south of Sowley Pond in the east. To the east of here there is only a relatively narrow beach as far as Needs Ore Point and the Beaulieu Estuary. The site is not far from the Isle of Wight; the birds at Hurst Spit are closer to the Yar Estuary across the Solent than they are to the birds at Pitts Deep. Although large areas of saltmarsh remain, much of the introduced *Spartina anglica* growth has now died back which, followed by erosion, has increased the area of intertidal flats. There are also areas of *Enteromorpha* algae which is a favoured food of the Brent Geese. The main threat to the area is from predicted sea-level rise which will continue a loss of intertidal habitat that has been occurring over the last 150 years. The Solent has an unusual tidal regime with a 'double high water' occurring. This results in occasions when prime feeding areas may be exposed for as little as two hours per day, leading to movements between here and other sites (see below) and occasional severe mortality incidents (Tubbs and Wiseman 1992, E. Wiseman pers. comm.). In additional, there is also recreational disturbance from such factors as sailing, shooting and walking, and the threat of land-claim for marina development.

COVERAGE AND INTERPRETATION

The North-west Solent was covered for the scheme during the winters of 1992–93 and 1997–98, with counts from all months except November 1997. Figure 4.34.1 shows the positions of the 18 sections counted for the survey in both seasons (although one section adjacent to Pennington Marshes was not counted in 1997–98). The area was also counted for the co-ordinated Greater Solent counts in January 1997 and 1999, not considered part of the WeBS LTC dataset. For the purposes of the WeBS LTCs, no data were received for the brackish lagoons and marshes at Pennington Marshes and Keyhaven Marshes

Figure 4.34.2 makes clear how the North-west

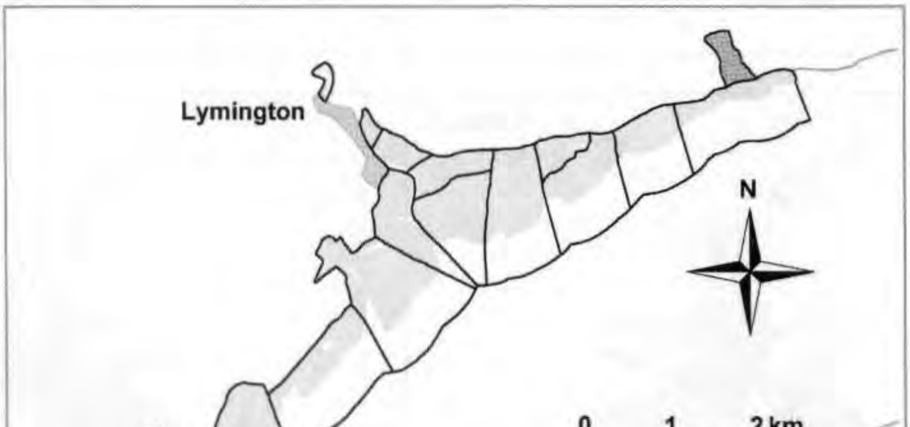


Figure 4.34.1: LTC sections at the North-west Solent, winters 1992–93 and 1997–98

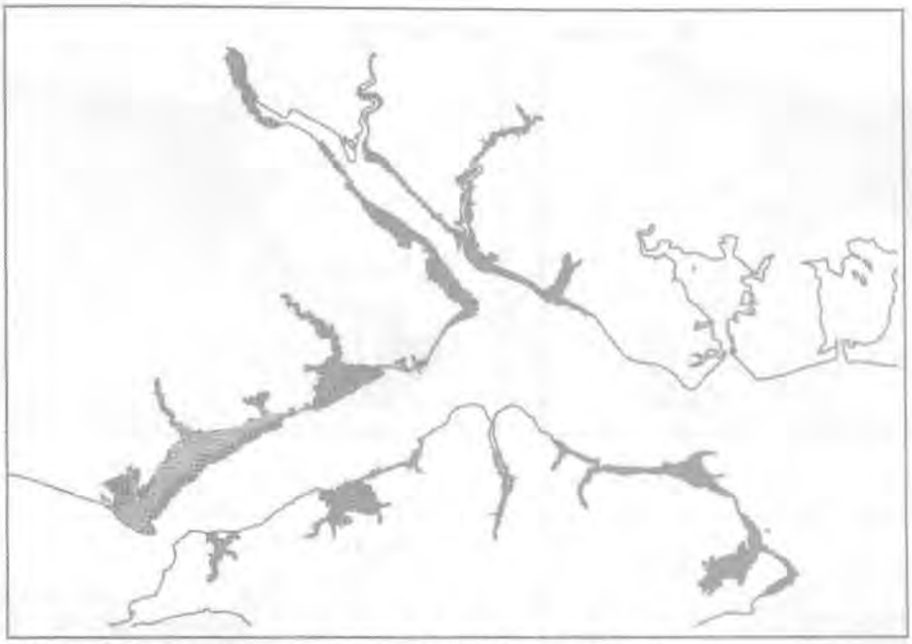


Figure 4.34.2: LTC and SPA boundaries, with overlap, at the North-west Solent

Solent LTC site is only a small part of the wider Solent and Southampton Water SPA. Around the LTC site, agreement is generally close with the exceptions that the SPA includes areas of nontidal coastal marshes, an extension upstream along the Lymington River and Sowley Pond. The SPA and Ramsar site boundaries are mostly coincident around the LTC site, except for slight differences around the Lymington River and Thorns Marsh.

As a part of a larger estuarine complex, the North-west Solent shares its waterbirds to varying degrees with other nearby wetland habitats. Some movement between here and the Beaulieu Estuary and even Southampton Water is thought to take place. Additionally, local observers have noted movements of waders (especially Curlew) and ducks (mostly Teal and Wigeon) moving between the area and the estuaries on the north side of the Isle of Wight (Aspinall and Tasker 1992, E. Wiseman pers. comm.). Some of the Little Egrets spending the day on the North-west Solent shore roost overnight on the Isle of Wight at the Yar Estuary (K. Lover pers. comm.). Furthermore, small numbers of waders have been noted flying westwards from Keyhaven/Hurst Spit along the Milford coast towards Dorset; some feed on clifftop fields but some may be going as far as Christchurch Harbour (E. Wiseman pers. comm.).

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1992–93 are presented for 15 of the 18 species of principal interest listed above. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.34.3).

Of the remaining species, only small numbers of Little Grebes and Great Crested Grebes and no Gadwall were recorded. These three species utilise adjacent nontidal habitats such as Pennington Marshes, as well as other sites within the wider SPA boundary.

The totals map shows the highest overall bird densities at Keyhaven, Hurst Spit and around the mouth of the Lymington River, although the weighted totals map places less emphasis on the latter area. The overall bird density pattern was mirrored by that of Dark-bellied Brent Goose which occurred across the whole site. Shelducks were also widespread but Wigeon were almost absent from the western half, an unusual pattern given that Teal and Pintail both occurred at Hurst Spit. Shovelers were mostly found around Oxey Lake and most Red-breasted Mergansers were at Keyhaven. Grey Plovers, Curlews and Redshanks were spread quite evenly but Dunlin, although ubiquitous, followed the same density pattern as Brent Geese (thus leading to the all-bird pattern). Ringed Plovers were localised, preferring Hurst, whilst Lapwings were mostly found at the mouth of the Lymington River and at Keyhaven. Black-tailed Godwits were almost all at Keyhaven and Hurst. Cormorants were found around the Lymington River in only small numbers.

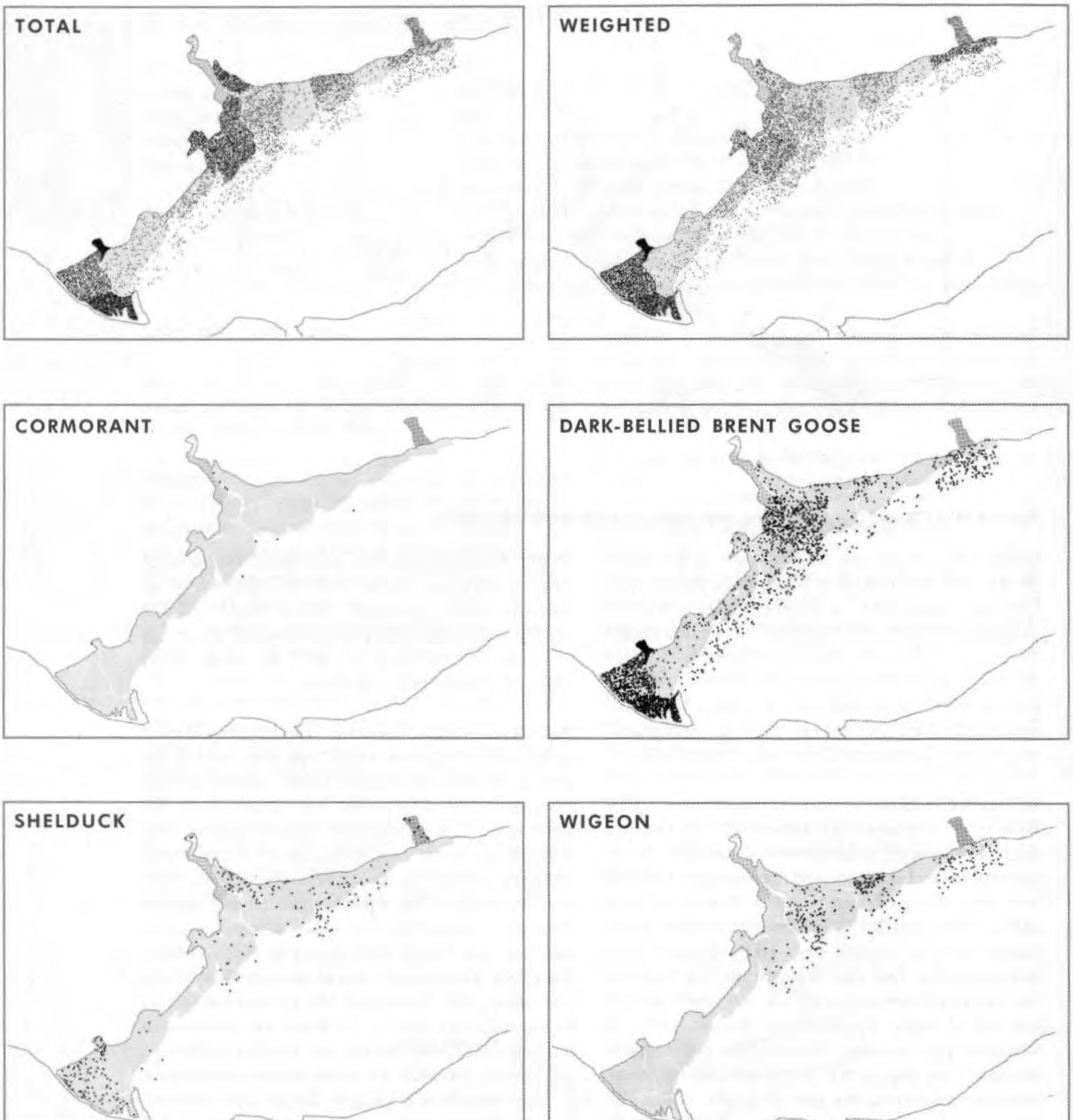


Figure 4.34.3 (i): Low tide waterbird distributions recorded at the North-west Solent, winter 1992–93

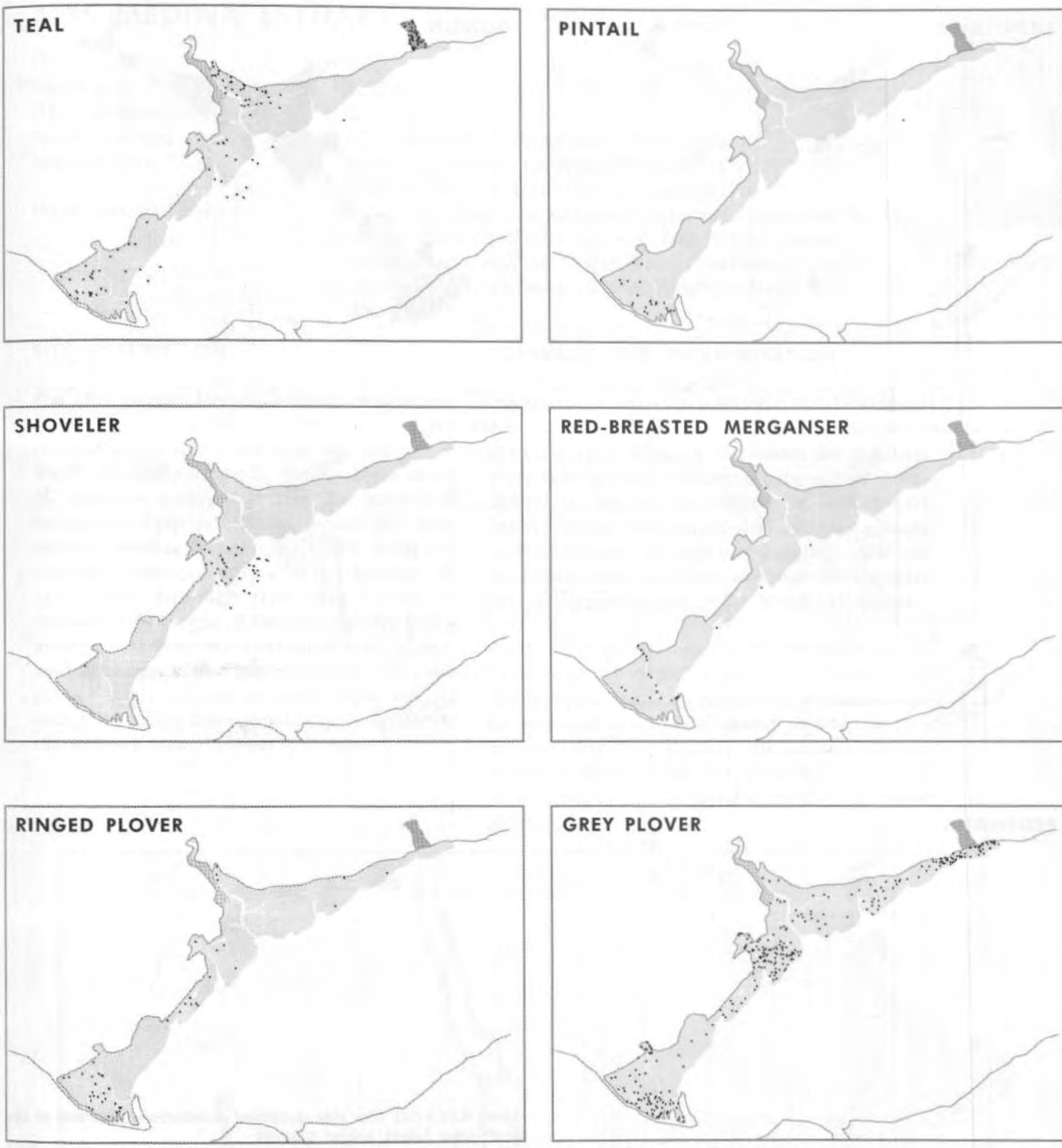
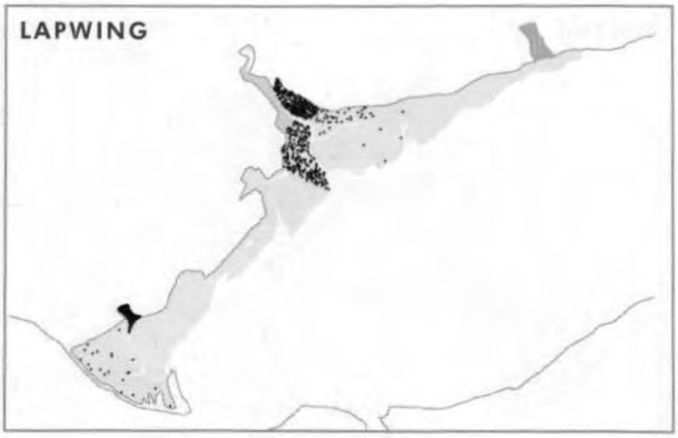
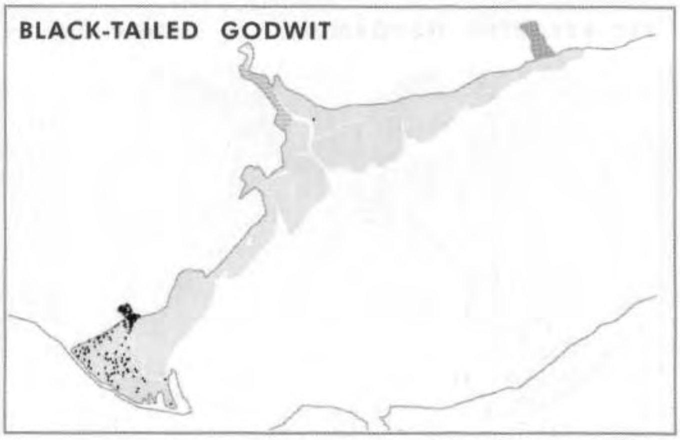


*Figure 4.34.3 (ii): **Low tide waterbird distributions recorded at the North-west Solent, winter 1992–93***





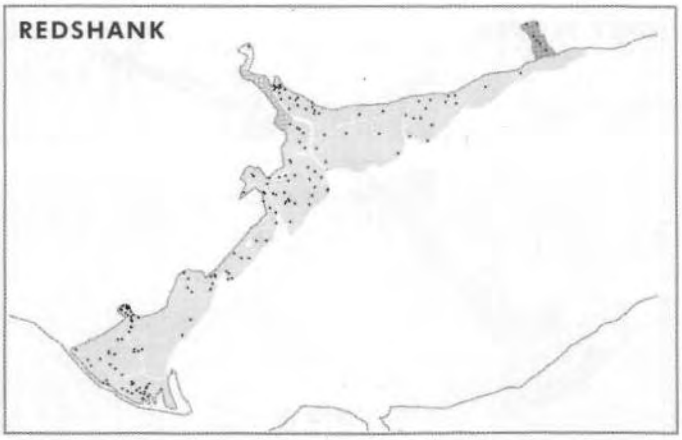


Figure 4.34.3 (iii): Low tide waterbird distributions recorded at the North-west Solent, winter 1992–93

4.35 MEDINA ESTUARY

LTC site code: DE
Centre grid: SZ5093
JNCC estuarine review site: 136
Habitat zonation: 83 ha intertidal, 56 ha subtidal, 0 ha nontidal
Statutory status: Solent and Southampton Water SPA (UK9011061), Solent and Southampton Water Ramsar (7UK125)
Winter waterbird interest: Little Grebe, Great Crested Grebe, Cormorant, Dark-bellied Brent Goose, Shelduck, Wigeon, Gadwall, Teal, Pintail, Shoveler, Red-breasted Merganser, Ringed Plover, Grey Plover, Lapwing, Dunlin, Black-tailed Godwit, Curlew, Redshank, Waterbird assemblage

SITE DESCRIPTION

The long, narrow Medina Estuary runs almost due south from Cowes to Newport, cutting a channel about five miles long into the Isle of Wight. Despite its length, the mudflats along its banks are relatively narrow. The amount of freshwater input is relatively small and thus salinity remains high far upstream along the estuary. There is only a small amount of saltmarsh, although that near Werrar is considered to be one of the best examples of a mature, mixed marsh on the south coast of England. Leisure activities are numerous, with most power boating towards the mouth of the site but sailing occurring throughout, especially during the summer racing season at Cowes.

COVERAGE AND INTERPRETATION

The Medina Estuary was counted for the scheme during the 1995–96 winter, data being returned for all four months. Figure 4.35.1 shows the positions of the three sections counted for the survey. Additionally, the site was counted for the co-ordinated Greater Solent counts in January 1997 (as a single combined count section) and January 1999 (as these three count sections), although these counts are not considered part of the WeBS LTC dataset.

Figure 4.35.2 clearly shows that the Medina Estuary forms only a very small part of the Solent and Southampton Water SPA and any assessment of the bird importance of the estuary should take this into account. The Ramsar site boundaries are similar to those of the SPA with the addition of some nontidal habitat along a creek on the west shore.

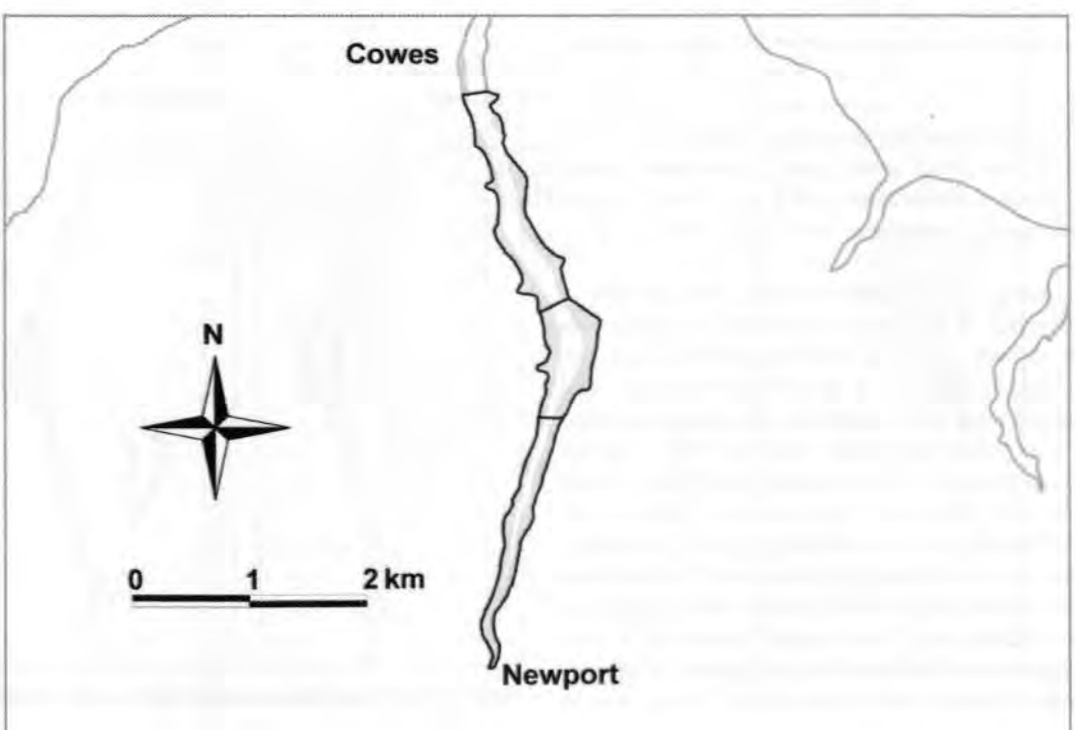


Figure 4.35.1: LTC sections at the Medina Estuary, winter 1995–96

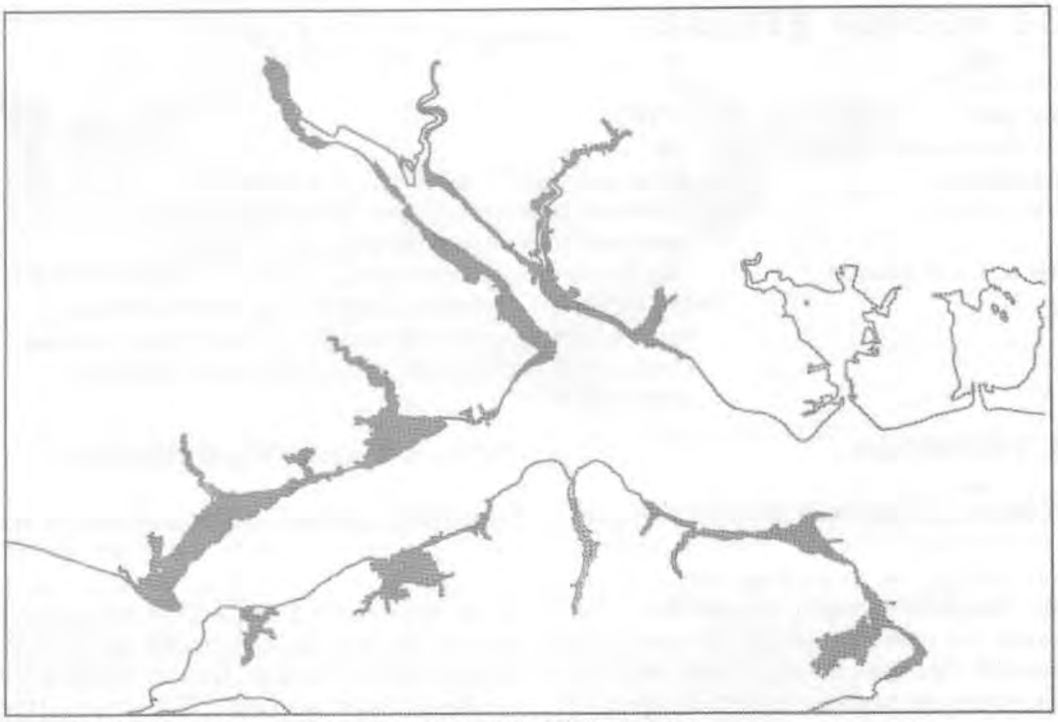


Figure 4.35.2: LTC and SPA boundaries, with overlap, at the Medina Estuary

Although the Medina Estuary is relatively close to other estuarine sites within the SPA, there is not as yet any clear indication of daily movements in and out of the site.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1995–96 are presented for 14 of the 18 species of principal interest listed above. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.35.3). Of the remaining species, Great Crested Grebes and Gadwall were recorded in small numbers and Pintail and Shoveler were both absent. The Medina forms only a small part of the wider Solent and Southampton Water SPA and these species occur mostly elsewhere within the SPA.

With only three count sections, the amount of information to be gleaned is limited, but the totals map shows that the middle section held the highest overall bird density. However, the weighted total map increases the emphasis given to the inner section, due to the higher concentration of Little Grebes and Black-tailed Godwits on the latter. The numerical prominence of the middle section was largely due to Dunlin, although Brent Geese, Wigeon and Curlews also showed some increase in density here and most of the Shelducks, Teal, Ringed Plovers and Grey Plovers were to be found on this section. Lapwings and Redshanks were distributed fairly evenly throughout but no species was found at its highest site density on the northern-most section.

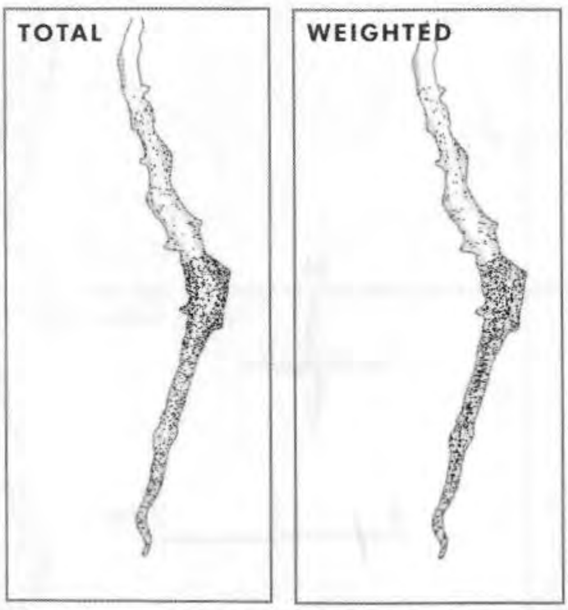


Figure 4.35.3 (i): Low tide waterbird distributions recorded at the Medina Estuary, winter 1995–96

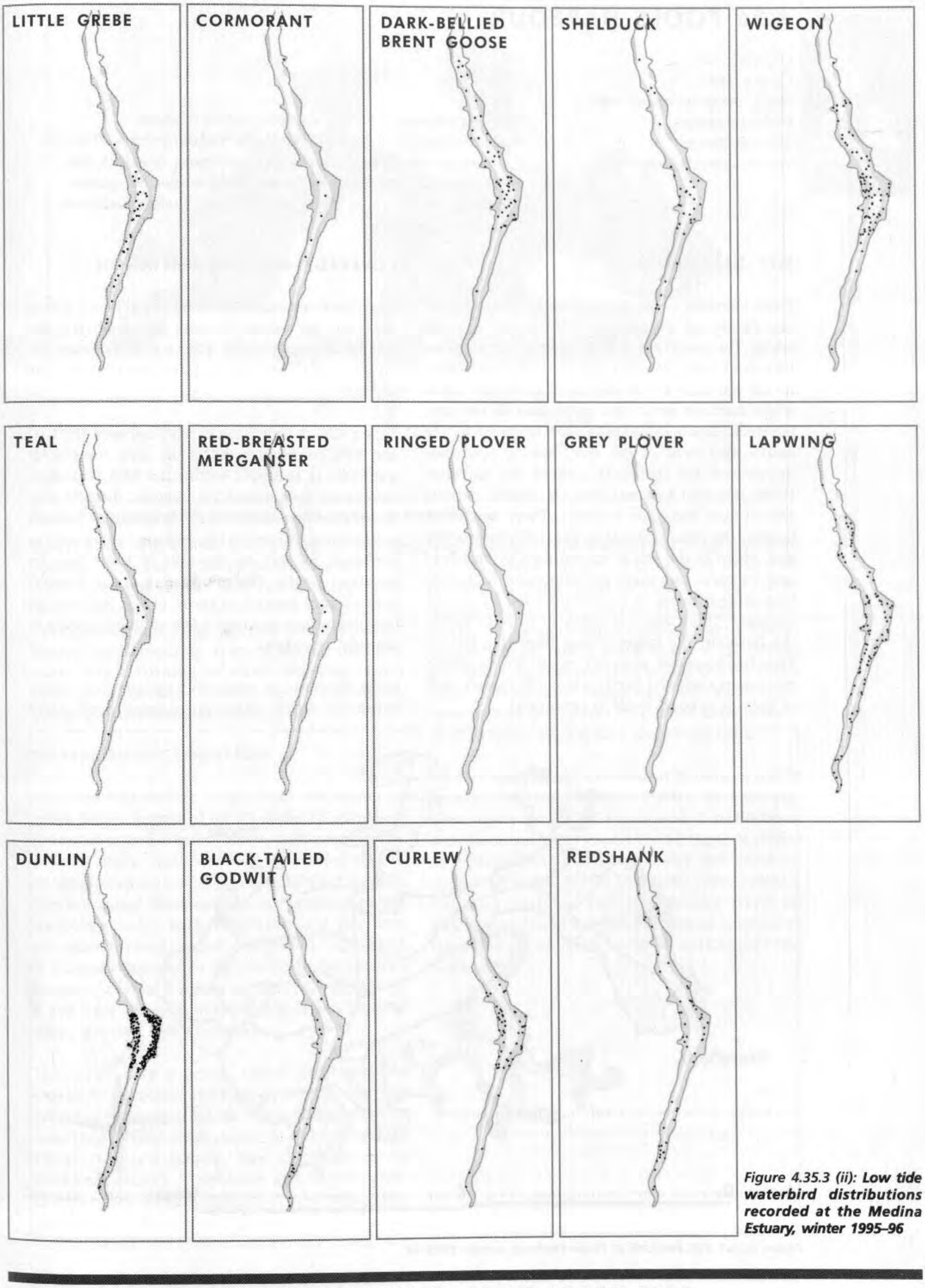


Figure 4.35.3 (ii): Low tide waterbird distributions recorded at the Medina Estuary, winter 1995–96

4.36 POOLE HARBOUR

LTC site code:	DP
Centre grid:	SZ0189
JNCC estuarine review site:	140
Habitat zonation:	1383 ha intertidal, 1839 ha subtidal, 438 ha nontidal
Statutory status:	Poole Harbour SPA (UK9010111), Poole Harbour Ramsar (7UK138)
Winter waterbird interest:	Cormorant, Little Egret, Dark-bellied Brent Goose, Shelduck, Teal, Pintail, Shoveler, Pochard, Goldeneye, Red-breasted Merganser, Avocet, Lapwing, Dunlin, Black-tailed Godwit, Curlew, Redshank, Waterbird assemblage

SITE DESCRIPTION

Poole Harbour is the estuary of the rivers Frome and Piddle but the amount of freshwater input is small. The mouth of the harbour is restricted by two sand spits. Most of the intertidal sediments in the harbour are of soft mud. Extensive areas of the harbour remain as open water at low tide, however. Small saltmarshes are frequent in the south and west of the site, mostly *Spartina*-dominated. On the north side of the harbour, Holes Bay and Lytchett Bay are almost entirely cut off from the main harbour. There is a small lagoon (the Blue Lagoon) in the north-east of the site. Much of the site is surrounded by farmland and forestry, but there are important (although fragmented) areas of heathland adjacent to the harbour. There are a number of islands within the harbour, the largest being Brownsea Island. The harbour is popular with watersports enthusiasts and the north and north-eastern side of the site around Poole is urbanised.

COVERAGE AND INTERPRETATION

Poole Harbour was covered for the scheme during the 1993–94 winter, counts being carried out during all four months. Figure 4.36.1 shows the positions of the 32 sections counted for the survey.

Figure 4.36.2 shows the overlap between the LTC and SPA boundaries. All of the area covered for the LTCs is included within the SPA boundary (except for open water). In addition, the SPA also includes substantial areas of nontidal habitat around the fringes of the estuary, especially in the west, as well as the lake of Little Sea on Studland Heath. The boundaries of the Ramsar site are very similar to those of the SPA except that the former includes a few additional areas of nontidal marshes.

Poole Harbour is relatively isolated from other estuarine sites, although a small amount of

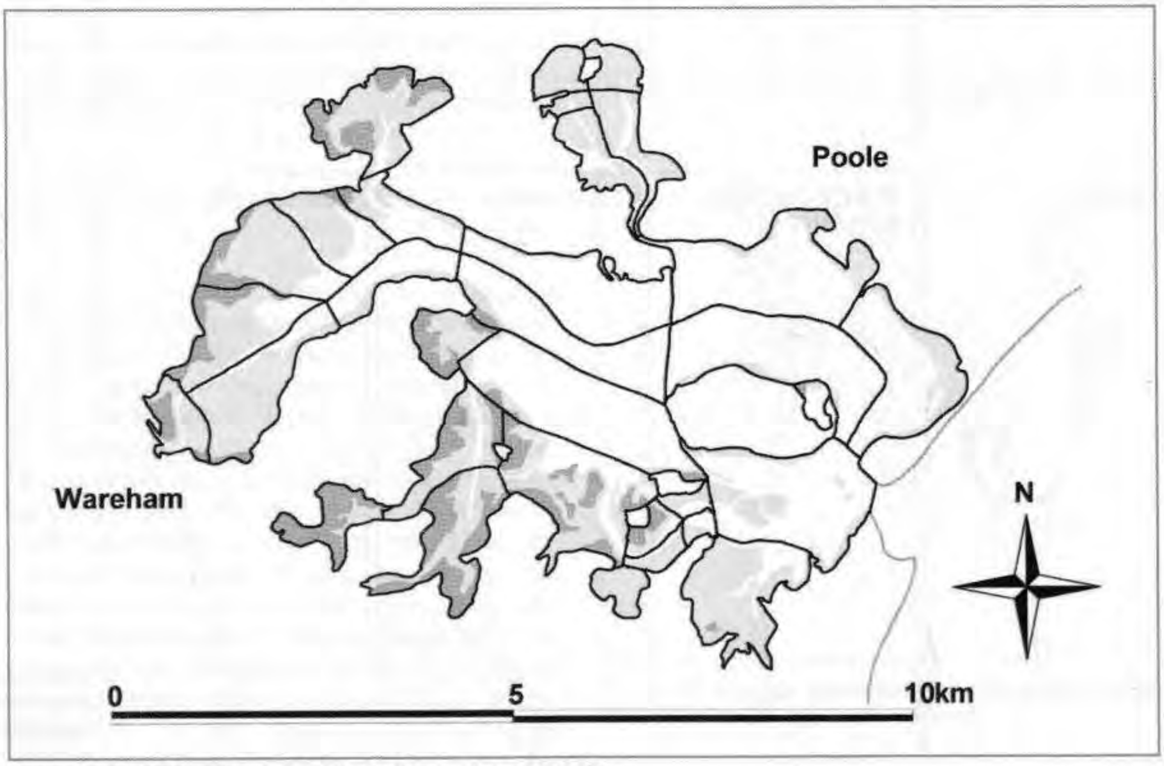


Figure 4.36.1: LTC sections at Poole Harbour, winter 1993–94

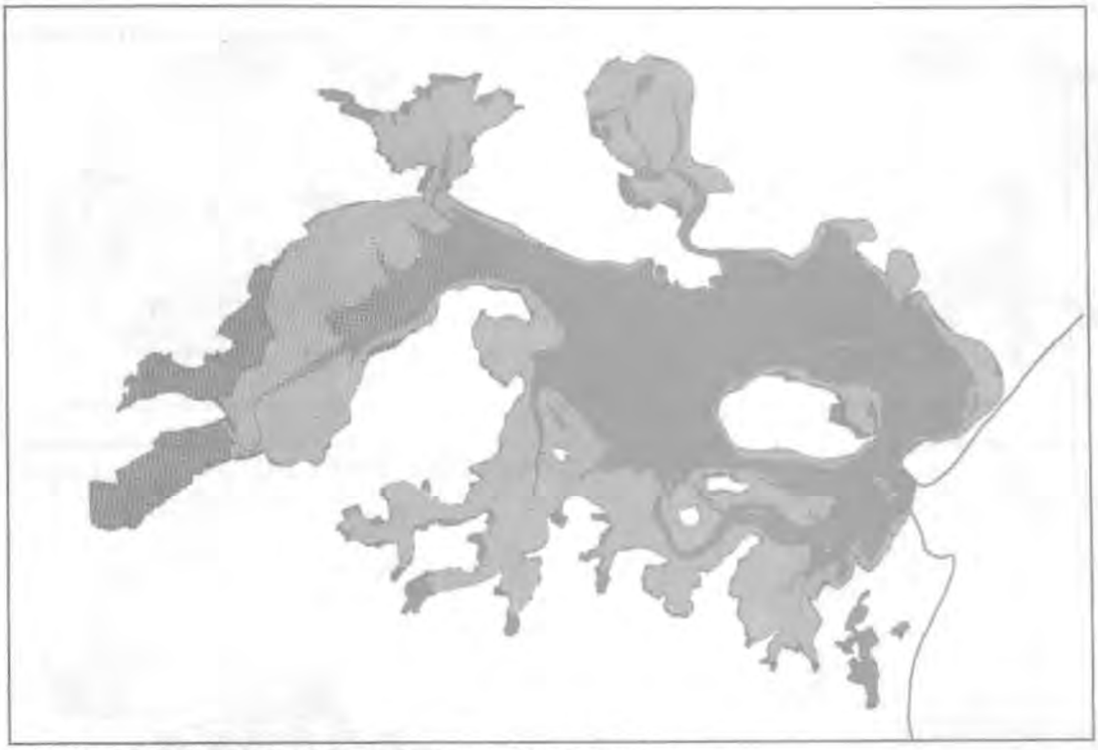


Figure 4.36.2: LTC and SPA boundaries, with overlap, at Poole Harbour

interchange with Christchurch Harbour seems possible. Dispersal to inland habitats is likely by some species along the river valleys. Large-scale daily movements of Red-breasted Mergansers, Cormorants and other species used to occur, leaving the harbour at dawn to feed on the open coast and returning at dusk. However, such movements became much reduced during the 1990s (S. Morrison pers. comm.).

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1993–94 are presented for 13 of the 16 species of principal interest listed above. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.36.3). The remaining three species were present in low numbers only, with Shoveler and Pochard presumably mostly found at Little Sea. Little Egret is a recent colonist in Britain and whilst it was present at Poole Harbour in the 1993–94 winter, it was then far less numerous than it was by 1999 when the SPA was classified.

The totals map suggests higher bird densities overall in the south and west of the site, with the weighted totals map similar but differing in subtle ways; highlighted areas appear to be at Swineham Point/Gigger's Island, the north shore of Brownsea Island, Wych Lake and Newton Bay. Cormorants were widespread but especially numerous at Brownsea Lagoon where they roost. Brent Geese were most numerous along the southern edge of the harbour but Shelducks were very widespread with a small area of Holes Bay holding a high concentration. Teal were widespread but less common in the western part of the harbour, whereas Pintail were rather localised, being mostly found in the south-central part of the site between Long Island and Goathorn Point. Red-breasted Mergansers were more widespread than Goldeneyes, the latter found mostly at Wareham Channel and Ramshorn Lake.

Avocets were highly localised at Brownsea Island (mostly at the lagoon) and at Wych Lake. Lapwings were mostly around the south-west of the harbour, with birds recorded especially at Gigger's Island and Slepe Moor (although most use adjacent terrestrial habitats, S. Morrison pers. comm.). Dunlin, Curlews and Redshanks were all widespread but Black-tailed Godwits were more concentrated, especially at Wareham Channel and Newton Bay.

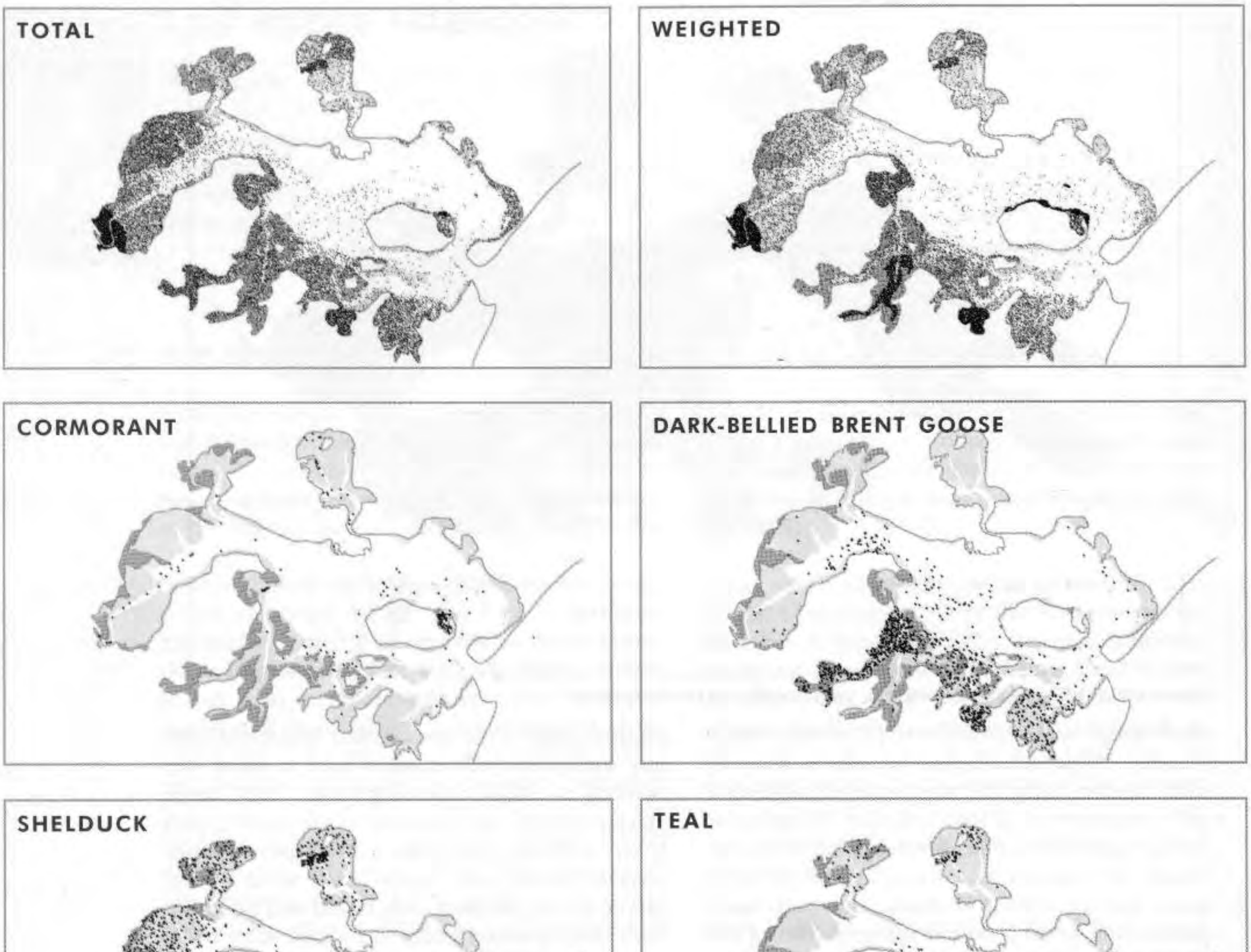


Figure 4.36.3 (i): ***Low tide waterbird distributions recorded at Poole Harbour, winter 1993–94***

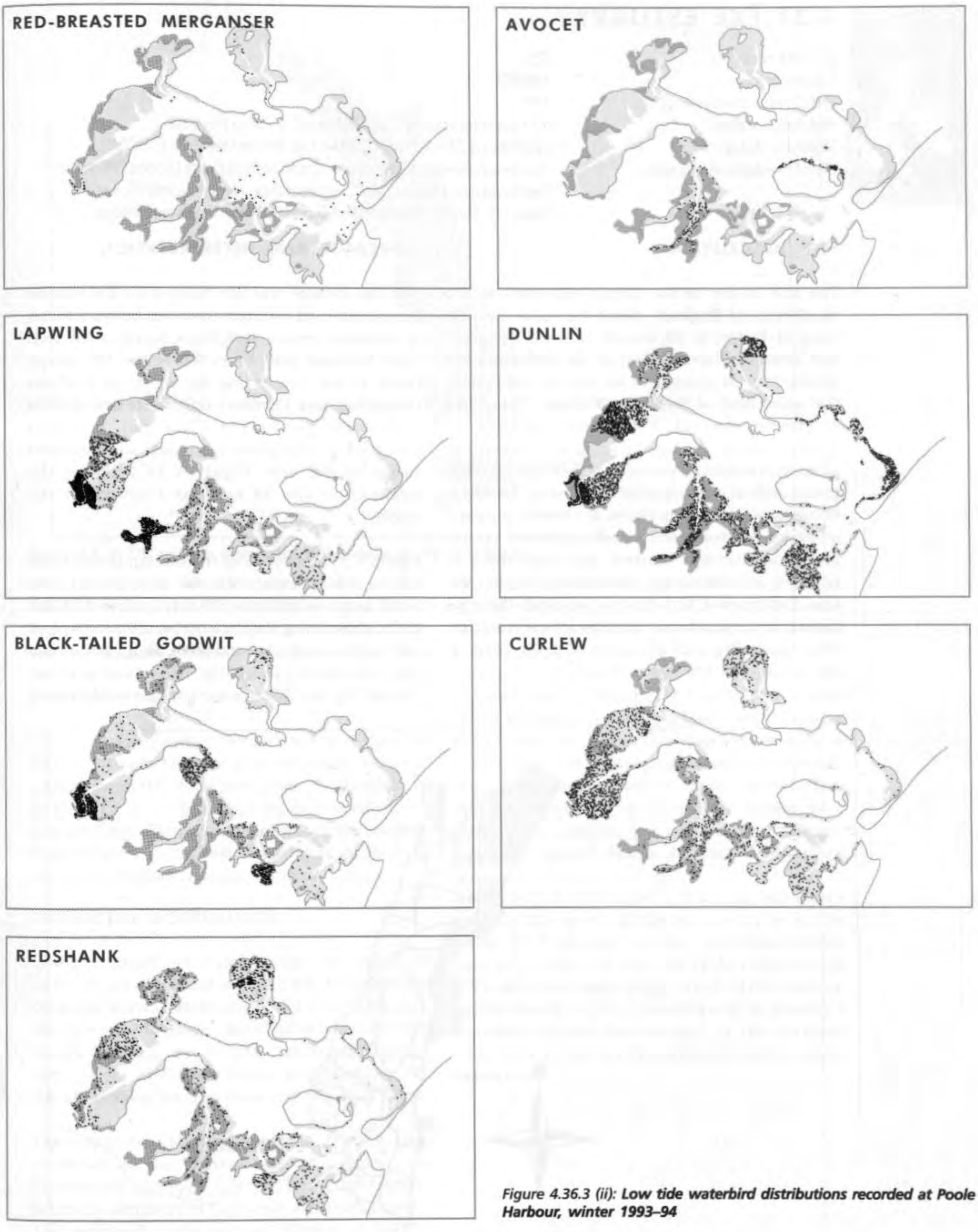


Figure 4.36.3 (ii): Low tide waterbird distributions recorded at Poole Harbour, winter 1993–94

4.37 EXE ESTUARY

LTC site code:	CE
Centre grid:	SX9883
JNCC estuarine review site:	144
Habitat zonation:	971 ha intertidal, 402 ha subtidal, 415 ha nontidal
Statutory status:	Exe Estuary SPA (UK9010081), Exe Estuary Ramsar (7UK051)
Winter waterbird interest:	Slavonian Grebe, Cormorant, Dark-bellied Brent Goose, Wigeon, Red-breasted Merganser, Oystercatcher, Avocet, Grey Plover, Lapwing, Dunlin, Black-tailed Godwit, Waterbird assemblage

SITE DESCRIPTION

The Exe is one of the largest estuaries in the south-west of England, about ten miles from its head at Exeter to its mouth between Exmouth and Dawlish Warren. Most of the sediments are muddy but are sandier in the mouth and behind the sand spit of Dawlish Warren. There are extensive mussel beds and patches of *Enteromorpha* and *Zostera*. The amount of saltmarsh is relatively small but there are nontidal grasslands at the adjacent Exminster Marshes. Water-based leisure pursuits are widely pursued around the estuary and beach recreation occurs mostly at Dawlish Warren, although there is relatively little industrial development around the site. Exploitation of fisheries and shell-fisheries (mostly at the southern end of the estuary) occurs, with wildfowling also practised in many parts of the estuary (D. Price pers. comm.).

COVERAGE AND INTERPRETATION

The Exe Estuary was not counted for the scheme *per se*, but local counters have carried out a series of estuarine counts at different hours of the tidal cycle for some time. From this series, the counts made at low tide during the winter of 1993–94 (November and February only) were suitable for incorporation into the LTCs and provide a preliminary description of the low tide waterbird usage of the site. Figure 4.37.1 shows the positions of the 34 sections counted for the survey.

Figure 4.37.2 shows that the overlap between the LTC and SPA boundaries was close overall. Two small areas outwith the SPA were counted for the LTCs, those being the area between Starcross and Cockwood (partially intertidal) and Powderham Park (nontidal). Parts of the SPA which were not covered by the LTCs were the seaward side of

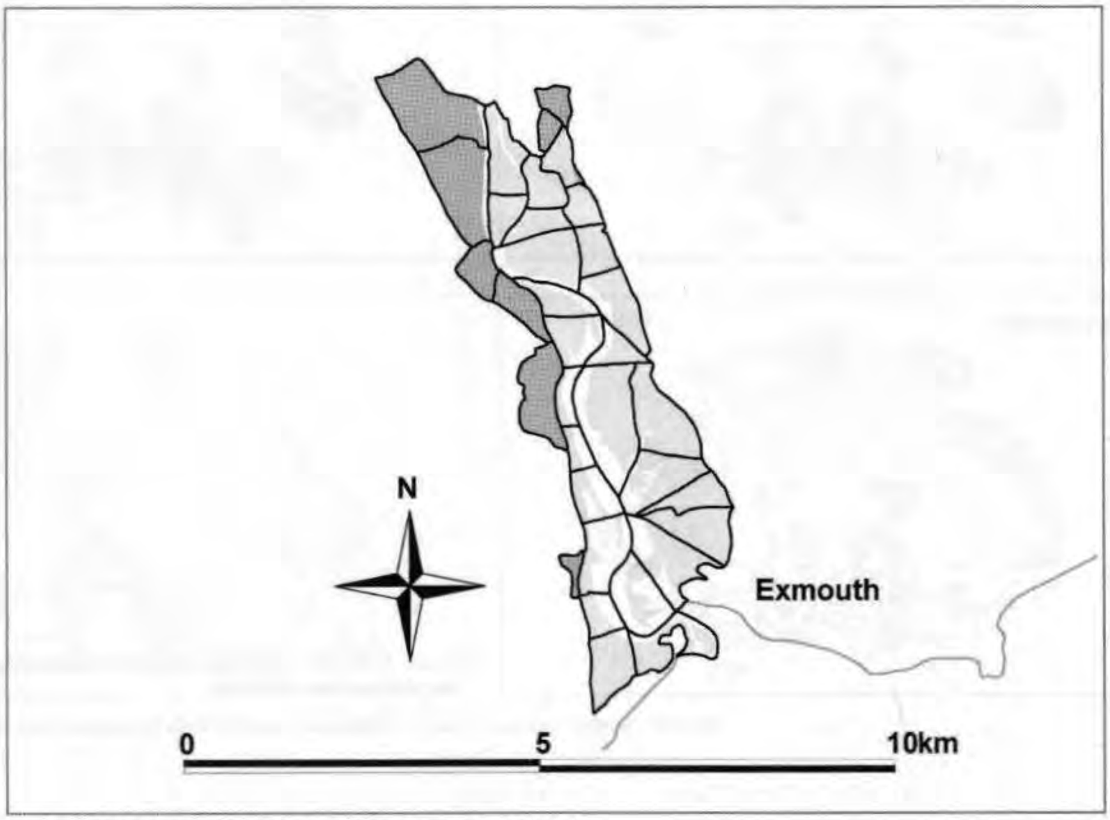


Figure 4.37.1: LTC sections at the Exe Estuary, winter 1993–94

Figure 4.37.2: LTC and SPA boundaries, with overlap, at the Exe Estuary

Dawlish Warren, the outer sandflats, the sea off Dawlish Warren and Exmouth and, at the other end of the estuary, an extension northwards along the river Exe and adjoining nontidal marshes. The boundaries of the Ramsar site are entirely coincident with those of the SPA.

The Exe is a relatively isolated site and there is little movement between here and other sites on a daily basis (D. Price pers. comm.), although it is possible that some may occur between here and the Teign Estuary to the south or the smaller Otter Estuary to the east. Some birds do feed on adjacent nontidal habitats at times, however.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1993–94 are presented for all of the 11 species of principal interest listed above. For clarity, smaller dots are used to display the distributions of Brent Goose, Lapwing and Dunlin. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.37.3).

The totals map shows the highest overall bird densities on the northern mudflat known as Greenland, although this pattern was strongly driven by numbers of Lapwings and Dunlin here. The weighted totals map is different in subtle ways, being more strongly influenced by the distributions of Avocet and Black-tailed Godwit. Most Avocets were present in the north on the muddier sediments. In contrast, Oystercatchers occurred throughout but were found more densely at the southern end of the site where the main mussel beds are situated. The northern end supported higher densities of Grey Plovers, Black-tailed Godwits and Lapwings, with Dunlin widespread but also at their highest densities in northern sections. Although fairly widespread, Brent Geese were found in three main clusters at the northern end of the site and Wigeon were clumped in a similar, but not identical, manner. These two species tend to frequent the southern end of the estuary early in the winter to feed on *Zostera* but after exhausting this food source they move to the north of the estuary later in the winter (D. Price pers. comm.). Slavonian Grebes were not numerous, but the birds noted on the LTCs occurred towards the mouth of the estuary, as did many of the Cormorants, although a secondary cluster was present at the northern end. Red-breasted Mergansers were more widespread.

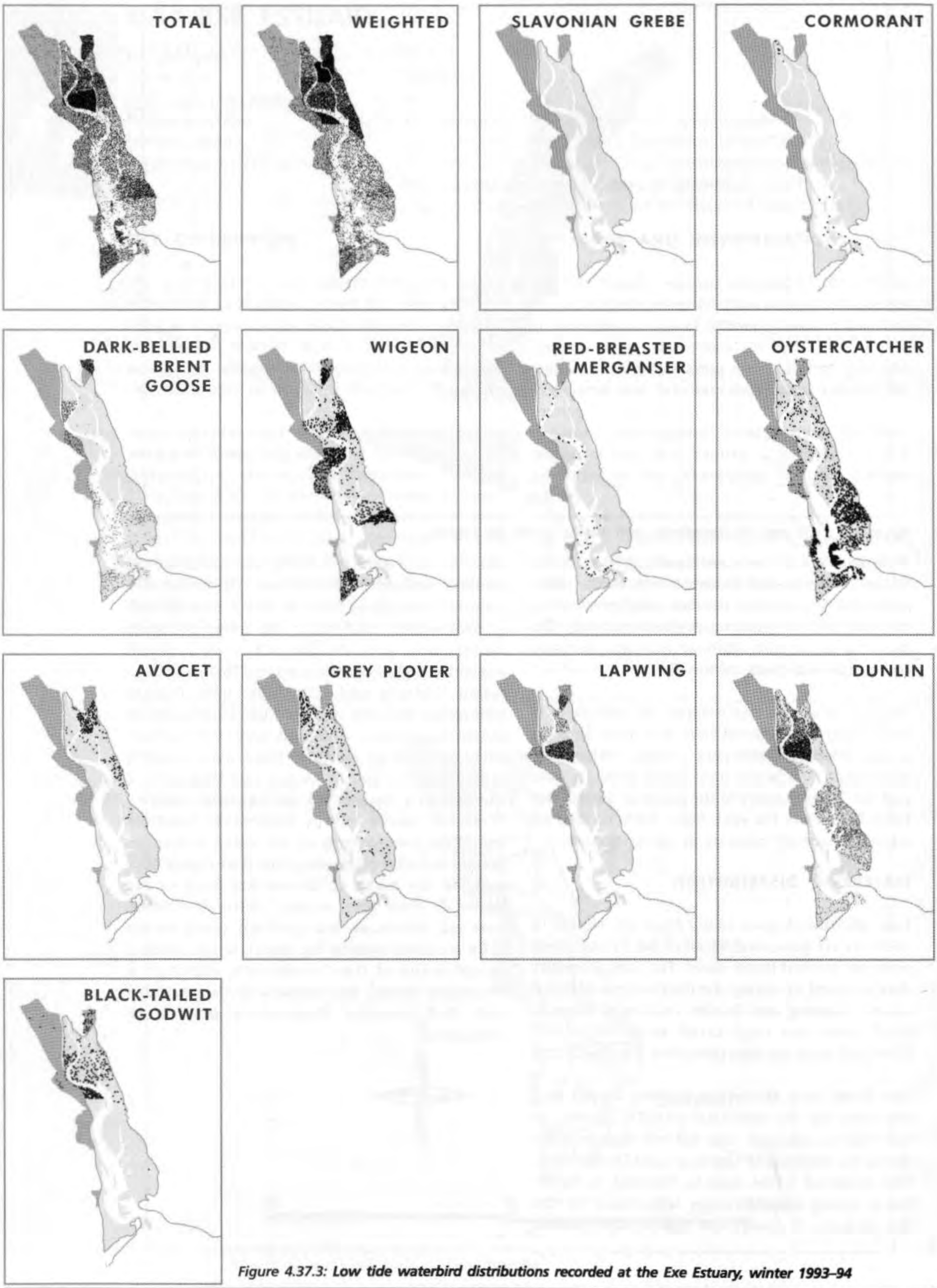


Figure 4.37.3: Low tide waterbird distributions recorded at the Exe Estuary, winter 1993–94

4.38 KINGSBRIDGE ESTUARY

LTC site code: BK
Centre grid: SX7441
JNCC estuarine review site: 147
Habitat zonation: 440 ha intertidal, 173 ha subtidal, 10 ha nontidal
Statutory status: Salcombe to Kingsbridge Estuary SSSI
Winter waterbird interest: N/A

SITE DESCRIPTION

The Kingsbridge Estuary, situated on the south Devon coast between Kingsbridge and Salcombe and emerging to the sea between Bolt Head and Prawle Point, is thought most likely to be a marine inlet worn away along lines of geological weakness. The upper reaches are largely mudflats at low tide but the lower reaches are rocky with sandy beaches. The site receives relatively little freshwater input and is therefore almost marine in nature. Only a very small amount of saltmarsh has been able to form, given the steep-sided valley edges. West Charleton Marsh, separated from the estuary by a sea-wall, is used by waterbirds at high tide. The estuary is predominately rural in character with little in the way of industry. The main conservation issues are concerned with disturbance from increased winter watersports, bait-digging and mass fishing events (G. Waterhouse pers. comm.).

COVERAGE AND INTERPRETATION

The Kingsbridge Estuary was counted for the scheme during the 1993–94 winter, all four months being covered. Figure 4.38.1 shows the positions of the 22 sections counted for the survey.

The Kingsbridge Estuary is not designated an SPA but the area covered for the LTCs overlaps almost perfectly with the Salcombe to Kingsbridge Estuary SSSI (Figure 4.38.2).

The site is relatively isolated from the Avon Estuary to the west and the Dart to the east by intervening rocky shorelines, to which some birds

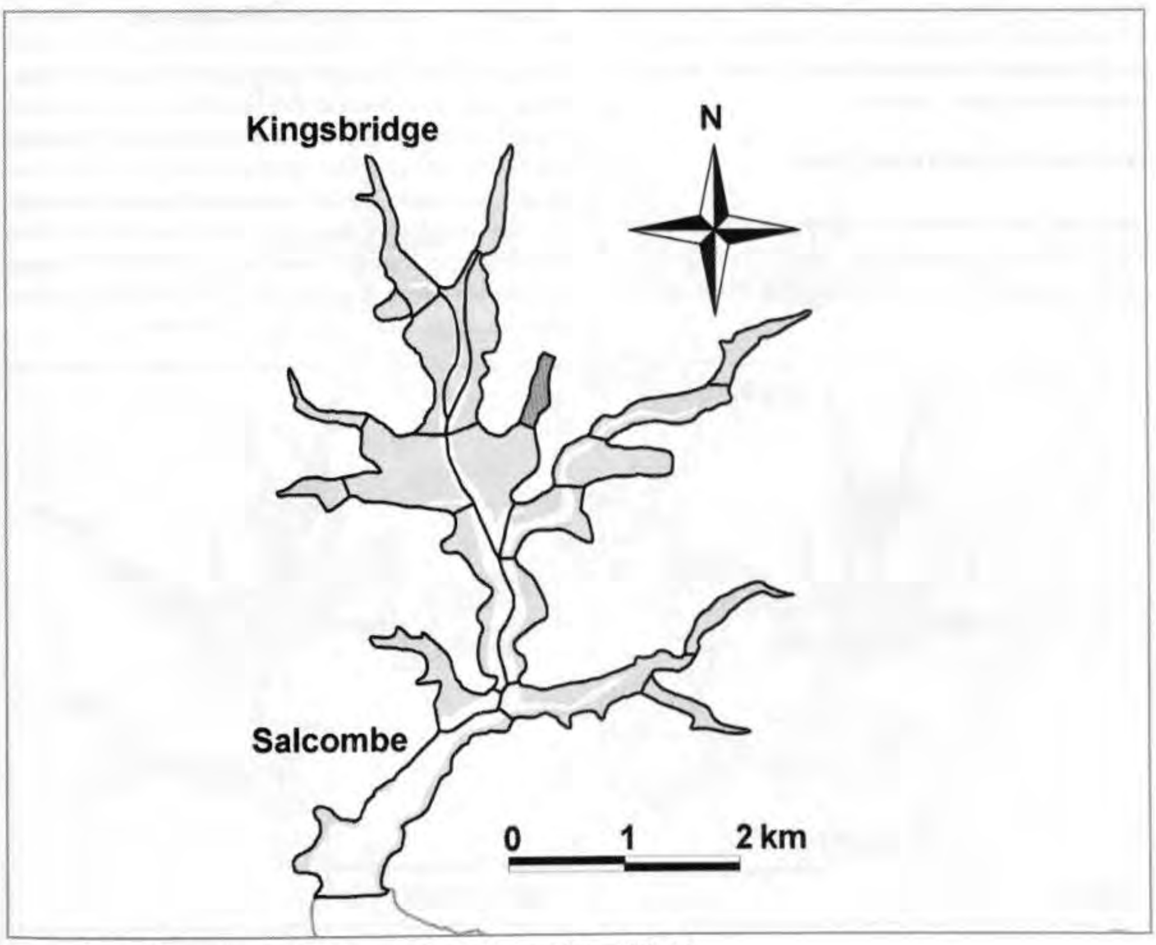


Figure 4.38.1: LTC sections at the Kingsbridge Estuary, winter 1993–94

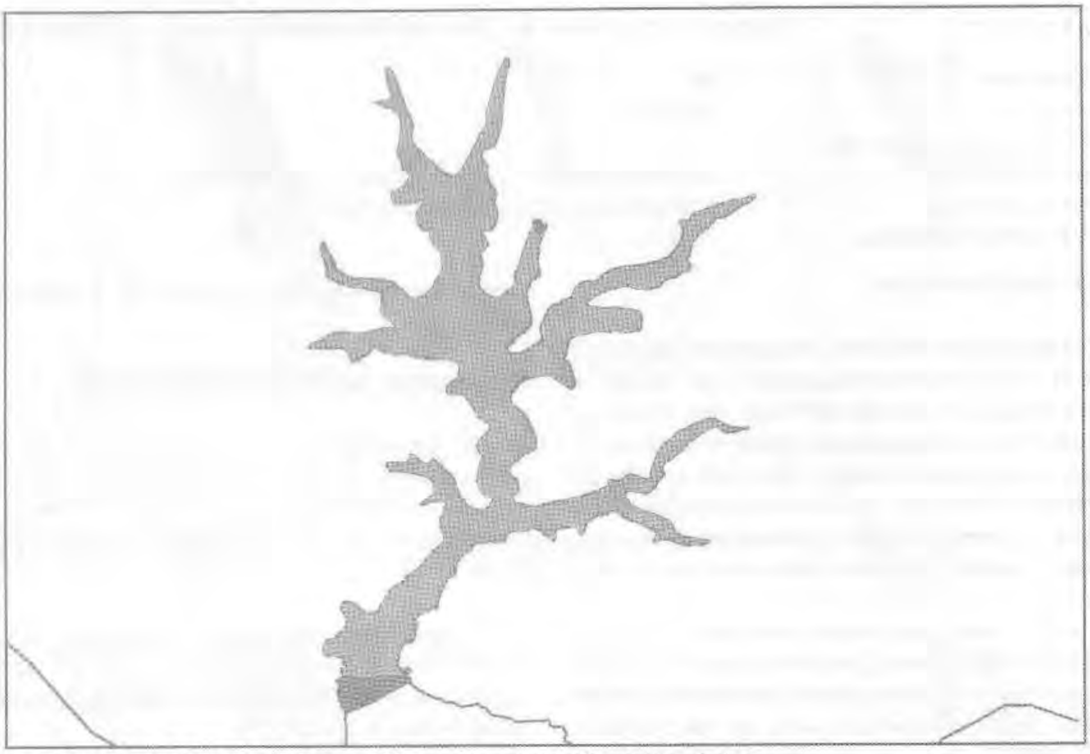


Figure 4.38.2: ***LTC and SSSI boundaries, with overlap, at the Kingsbridge Estuary***

may disperse from the estuary itself. On high spring tides, Dunlin and Grey Plovers fly east via Frogmore Creek to roost on the shingle ridge at Slapton Ley. Wigeon and Teal often move across to the South Huish and South Milton Marshes in rough weather or when there is disturbance (G. Waterhouse pers. comm.).

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1993–94 are presented for total birds and total birds weighted by 1% threshold value (Figure 4.38.3).

The total birds map shows a relatively even overall bird density over much of the site, with higher densities at Blanksmill Creek and Park Bay. The weighted totals map is not strikingly different, but does place a subtly greater emphasis on some areas such as Collapit Creek and Frogmore Creek. Amongst the individual species, Curlews and Redshanks were the most evenly spread, followed by Shelducks of which few occurred on the narrow outer sections. Brent Geese were most common in the middle of the site, with this region also holding the highest densities of Dunlin. Wigeon densities were highest at the heads of three creeks, especially Blanksmill in the west.

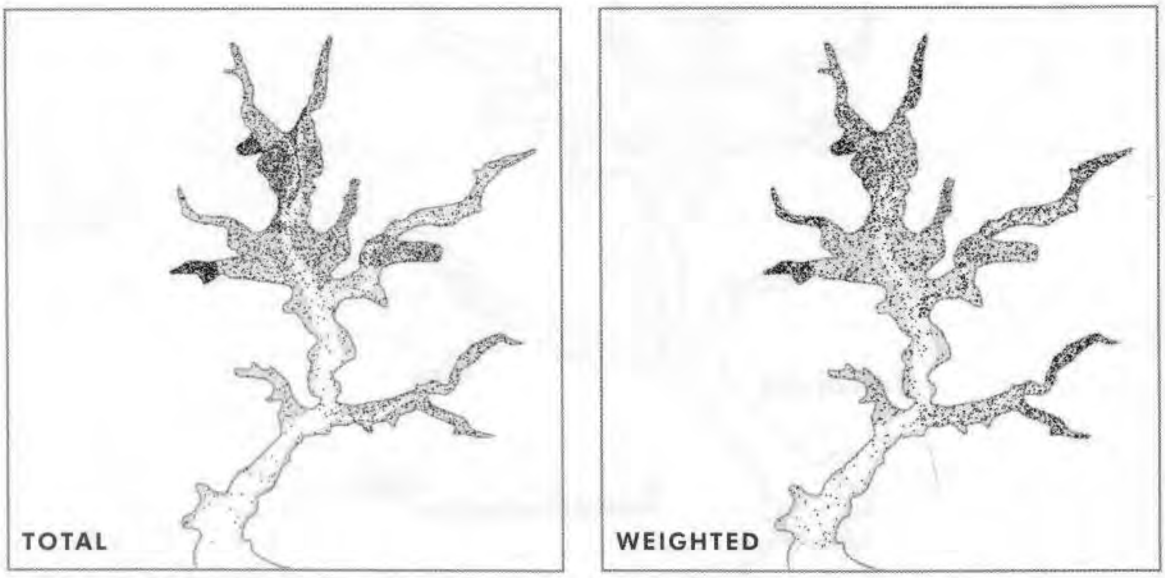


Figure 4.38.3: ***Low tide waterbird distributions recorded at the Kingsbridge Estuary, winter 1993–94***

4.39 TAMAR COMPLEX

LTC site code:	CK
Centre grid:	SX4356
JNCC estuarine review site:	151
Habitat zonation:	439 ha intertidal, 476 ha subtidal, 115 ha nontidal
Statutory status:	Tamar Estuaries Complex SPA (UK9010141)
Winter waterbird interest:	Little Egret, Avocet, Black-tailed Godwit

SITE DESCRIPTION

The Tamar Complex is the name given to the group of river estuaries (with the exception of the Plym) which reach the sea through Plymouth Sound. The estuaries are the drowned river valleys of the Tamar, Lynher and Tavy, which collectively drain a large area of Devon and Cornwall. The wide area of intertidal flats to the south of Torpoint known as St. John's Lake is also included in the site. The east shore of the lower parts of the complex is adjacent to the city of Plymouth, which has extensive dockyards and naval bases. Apart from the towns of Torpoint and Saltash, most of the west side of the estuary, as well as the upper estuary, is rural in nature. Areas of saltmarsh occur throughout even to the upstream reaches, and stretches of rocky shore also occur unusually far inland. Apart from the Plymouth area, most potential pressures on estuarine waterfowl are concerned with recreational disturbance and there are several proposals for new marinas. Additionally, run-off from farmland around the site may be a concern, as may any future expansion of the naval base (G. Grant pers. comm.).

COVERAGE AND INTERPRETATION

Counts were made for the LTCs on the Tamar Complex during the four months of the 1997–98 winter. Only partial coverage was achieved, although many of the Core Counts at this site are actually also carried out at low tide. Figure 4.39.1 shows the positions of the 15 sections counted for the survey.

Figure 4.39.2 shows that a large proportion of the SPA remains to be covered by the LTCs to date, including St John's/Millbrook Lakes, much of the Lynher Estuary, Kingsmill Lake and the upper Tamar Estuary. Conversely, the western shore between Saltash and Torpoint, including the

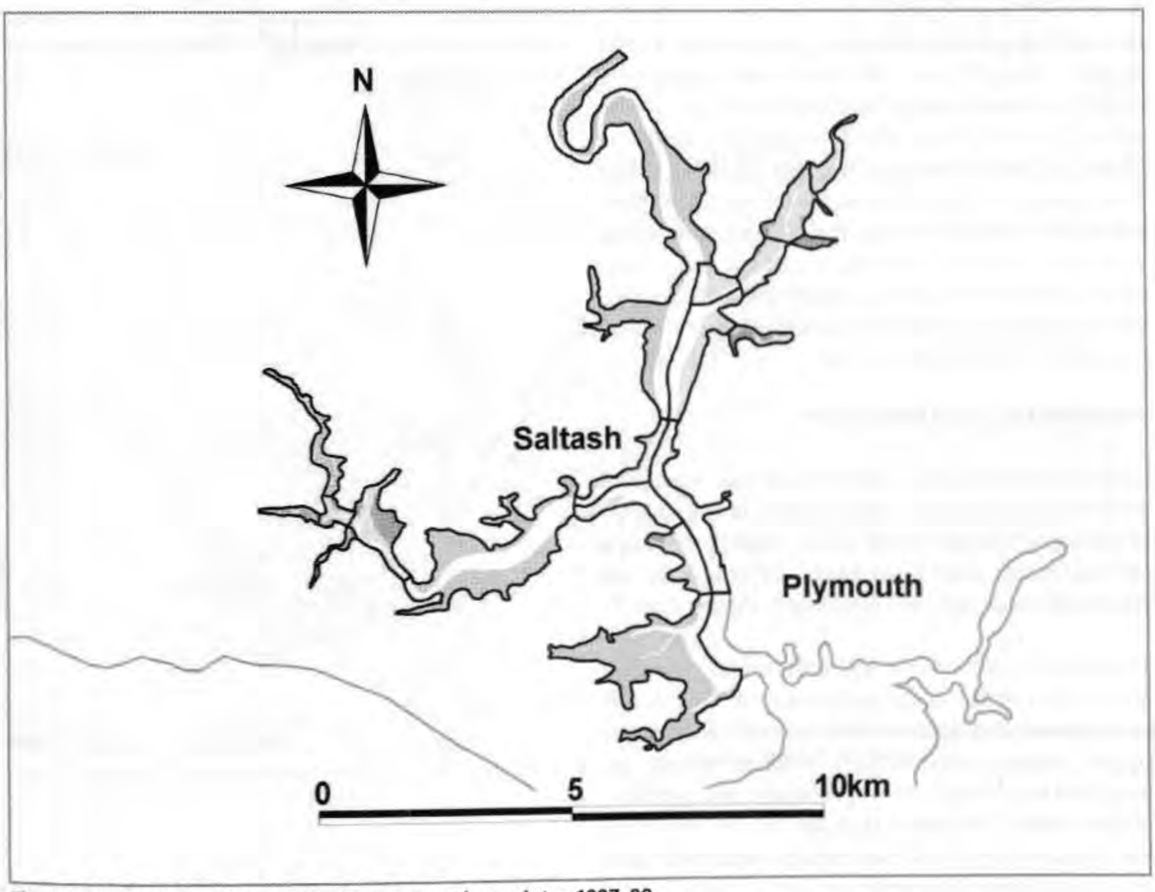


***Figure 4.39.1:** LTC sections at the Tamar Complex, winter 1997–98*

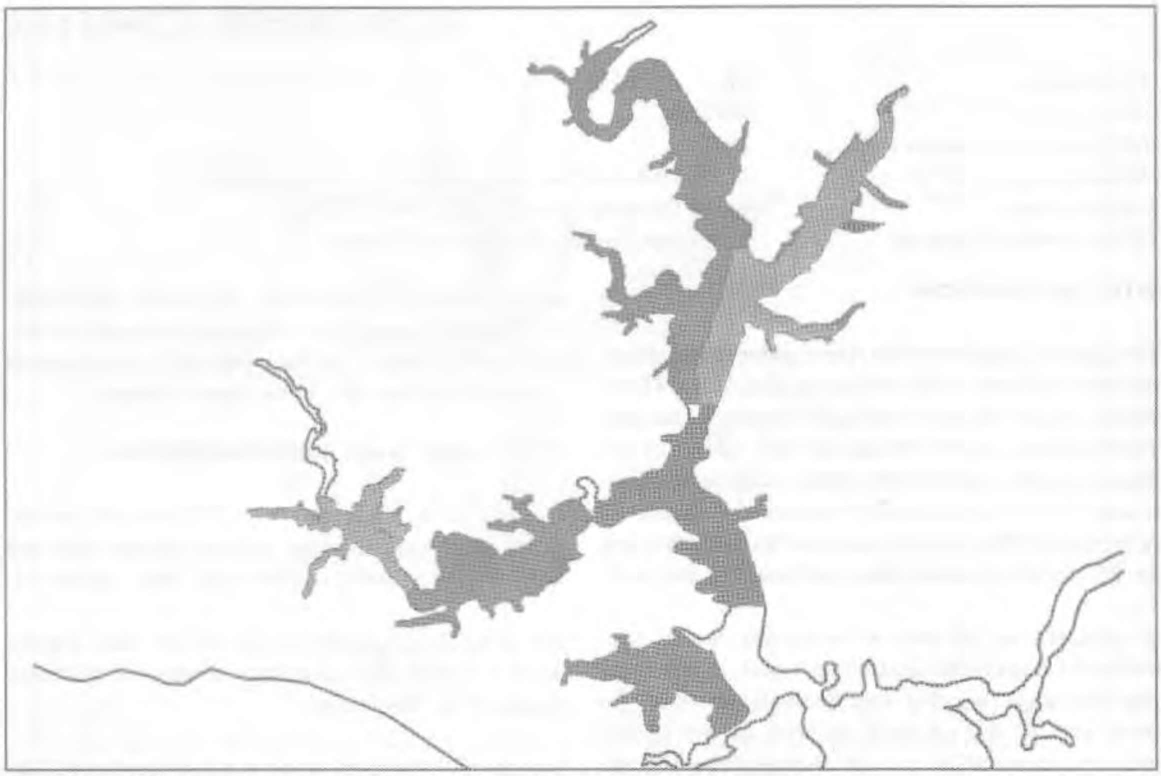


Figure 4.39.2: LTC and SPA boundaries, with overlap, at the Tamar Complex.

mouth of the Lynher, were counted but do not form part of the SPA. These discrepancies should be taken into account when considering bird usage of the SPA.

Although the wintering bird populations of the Tamar Complex are relatively self-contained, frequent interchange is likely with the small estuary of the Plym, which shares the outlet of Plymouth Sound into the English Channel. Some interchange of birds is also likely with the non-estuarine habitat within the Sound and along adjacent stretches of rocky shore (perhaps even to the Yealm Estuary). Lapwings and Golden Plovers will make use of surrounding terrestrial habitat as well as the estuary.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1997–98 are presented for all three of the species of principal interest listed above. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.39.3).

The distribution maps are difficult to interpret given the partial coverage obtained. The totals map draws attention to Tamerton Lake and the upper Lynher around Erth Island, whilst the weighted total map also emphasises the east shore of the Tamar. The latter area, as can be seen from the species maps, held the highest sectional densities (of those covered) for both Avocets and Black-tailed Godwits. Little Egrets were widespread in small numbers. Amongst other species, Golden Plovers were highly concentrated at St Germans on the Lynher. Curlews and Redshanks were both widespread, with the latter species most concentrated at Tamerton Lake and on the Lynher.

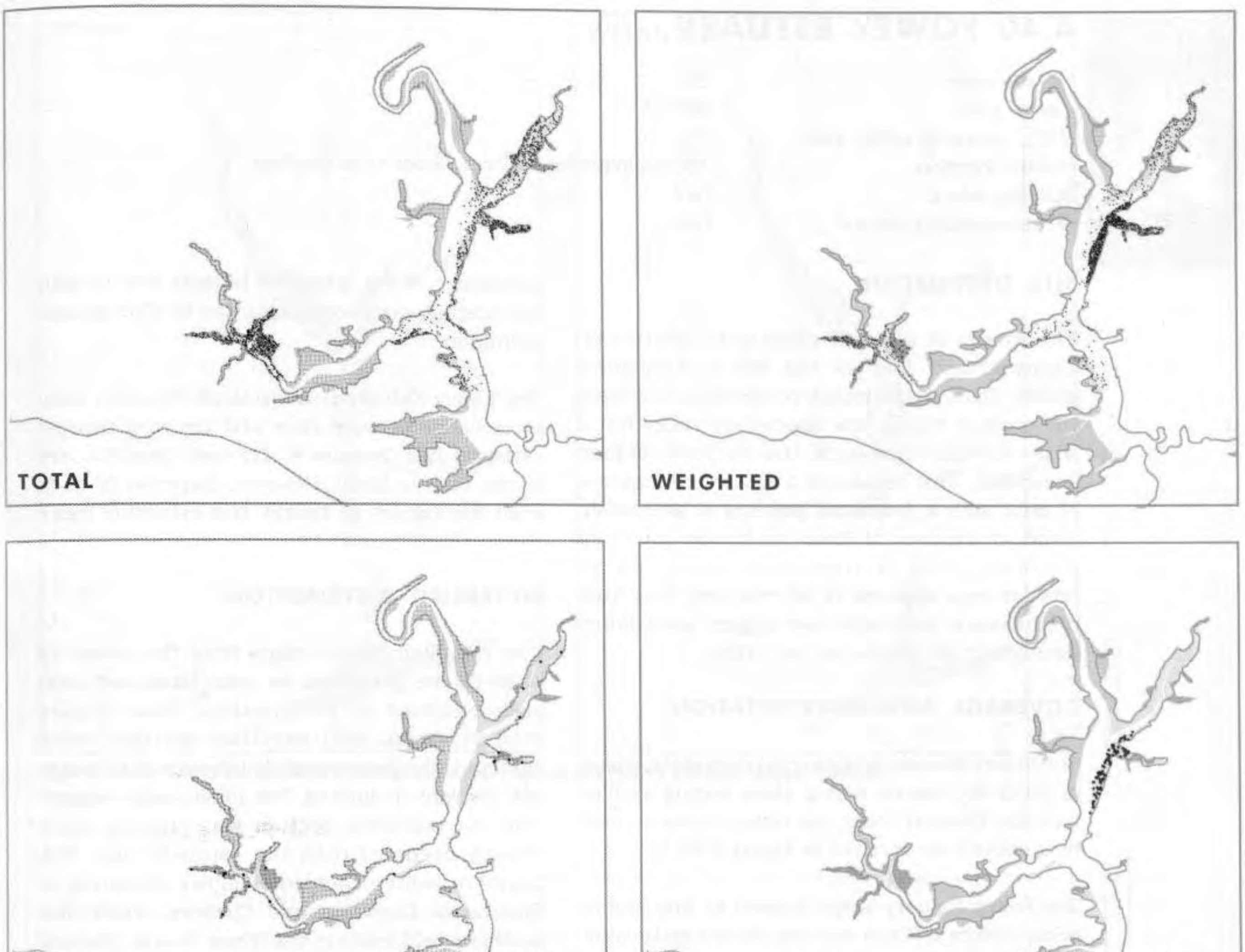


Figure 4.39.3: Low tide waterbird distributions recorded at the Tamar Complex, winter 1997–98

4.40 FOWEY ESTUARY

LTC site code: DF
Centre grid: SX1255
JNCC estuarine review site: 153
Habitat zonation: 103 ha intertidal, 44 ha subtidal, 0 ha nontidal
Statutory status: N/A
Winter waterbird interest: N/A

SITE DESCRIPTION

The Fowey is a small estuary in south-east Cornwall and, like the Fal, has a steep-sided profile. Towards the mouth of the estuary, around the town of Fowey, the shores are rocky but a little further upstream the estuary widens somewhat. This results in a reasonable expanse of mud with a few small patches of saltmarsh. Although the town of Fowey itself is an important port and popular for recreational boating, the intertidal area appears to be relatively free from disturbance, although bait-diggers were noted throughout the course of the LTCs.

COVERAGE AND INTERPRETATION

The Fowey Estuary was covered during the winter of 1995–96, counts taking place during all four months. However, only two count sections could be surveyed, as depicted in Figure 4.40.1.

The Fowey Estuary is not covered by any SPA or SSSI. Future LTCs of the site should endeavour, if possible, to extend the coverage to the remainder of the intertidal habitat and to split the existing count sections further to allow greater definition.

The Fowey Estuary is an isolated site, with daily interchange between here and the next nearest estuaries (Fal Complex to the west, Looe Estuary to the east) unlikely. However, dispersal of birds from the estuary to nearby non-estuarine rocky shores may occur.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1995–96 are presented for total birds and total birds weighted by 1% threshold value (Figure 4.40.2). Given that only two sections were surveyed, the amount of distributional information available is limited. The totals maps suggest that the northern section was slightly more densely occupied than the southern one. The northern section held the higher densities of Shelducks, Lapwings and Curlews, whilst the southern held most of the Mute Swans. Mallard and Redshank were evenly distributed.

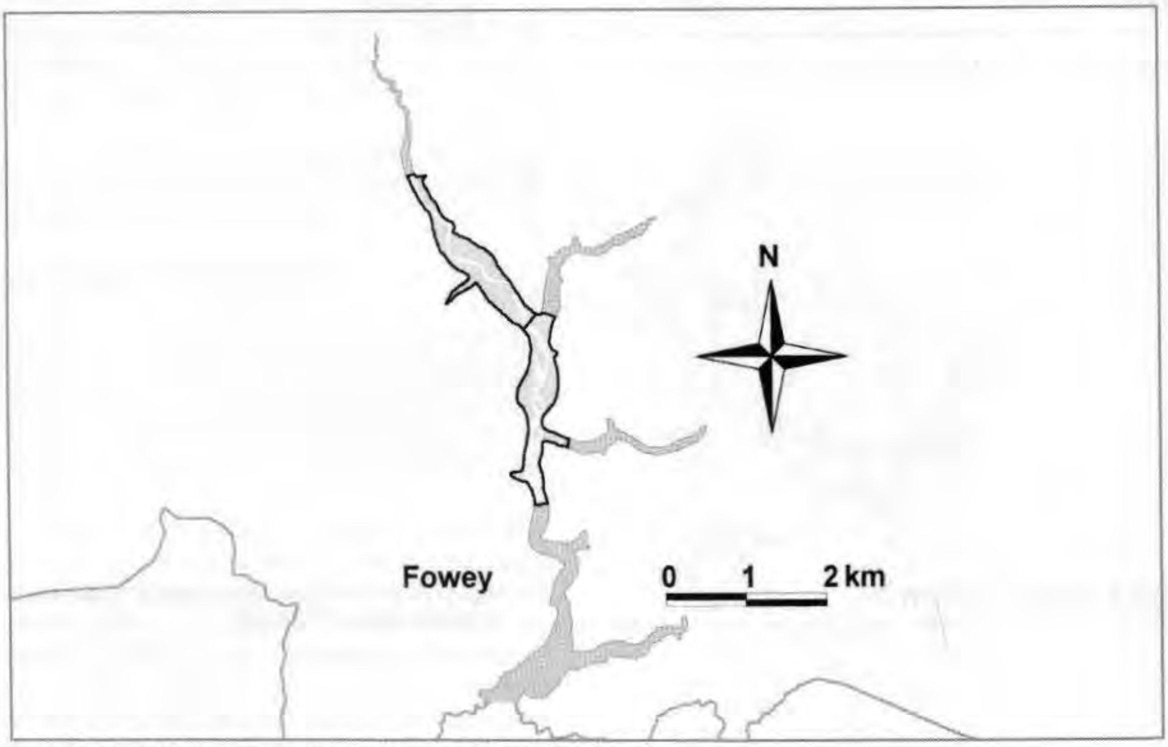


Figure 4.40.1: LTC sections at the Fowey Estuary, winter 1995–96

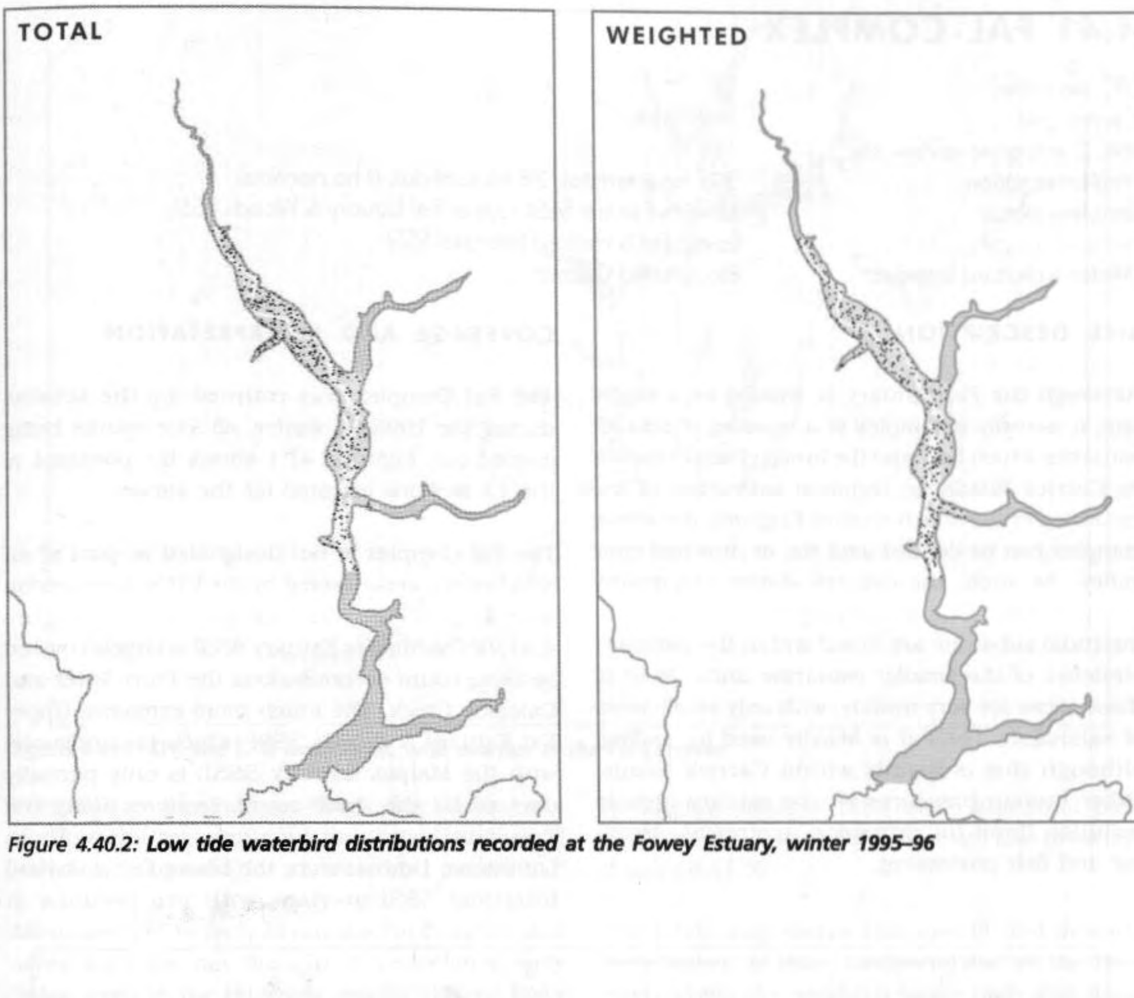


Figure 4.40.2: Low tide waterbird distributions recorded at the Fowey Estuary, winter 1995–96

4.41 FAL COMPLEX

LTC site code:	CF
Centre grid:	SW8334
JNCC estuarine review site:	154
Habitat zonation:	347 ha intertidal, 28 ha subtidal, 0 ha nontidal
Statutory status:	Malpas Estuary SSSI, Upper Fal Estuary & Woods SSSI, Lower Fal & Helford Intertidal SSSI
Winter waterbird interest:	Black-tailed Godwit

SITE DESCRIPTION

Although the Fal Estuary is treated as a single site, it is really a complex of a number of smaller estuaries which flow into the broad channel known as Carrick Roads. In common with most of the estuaries in the south-west of England, the whole complex can be defined as a ria, or drowned river valley. As such, the estuary shores are mostly steep-sided. The relatively small areas of intertidal substrate are found within the narrower stretches of the smaller estuarine units. Most of these areas are very muddy, with only small areas of saltmarsh. The Fal is heavily used for sailing, although this is mainly within Carrick Roads. Other human pressures on the estuary include pollution (from tin extraction upstream), dredging and fish processing.

COVERAGE AND INTERPRETATION

The Fal Complex was counted for the scheme during the 1995–96 winter, all four counts being carried out. Figure 4.41.1 shows the positions of the 13 sections counted for the survey.

The Fal Complex is not designated as part of an SPA but the area covered by the LTCs does overlap with three SSSIs, although not precisely (Figure 4.41.2). The Malpas Estuary SSSI is largely covered by three count sections along the Truro River and Calenick Creek. The much more extensive Upper Fal Estuary & Woods SSSI (which is contiguous with the Malpas Estuary SSSI) is only partially covered by the three count sections along the Tresillian River and the single section at Ruan Lanihorne. Downstream, the Lower Fal & Helford Intertidal SSSI overlaps with two sections at

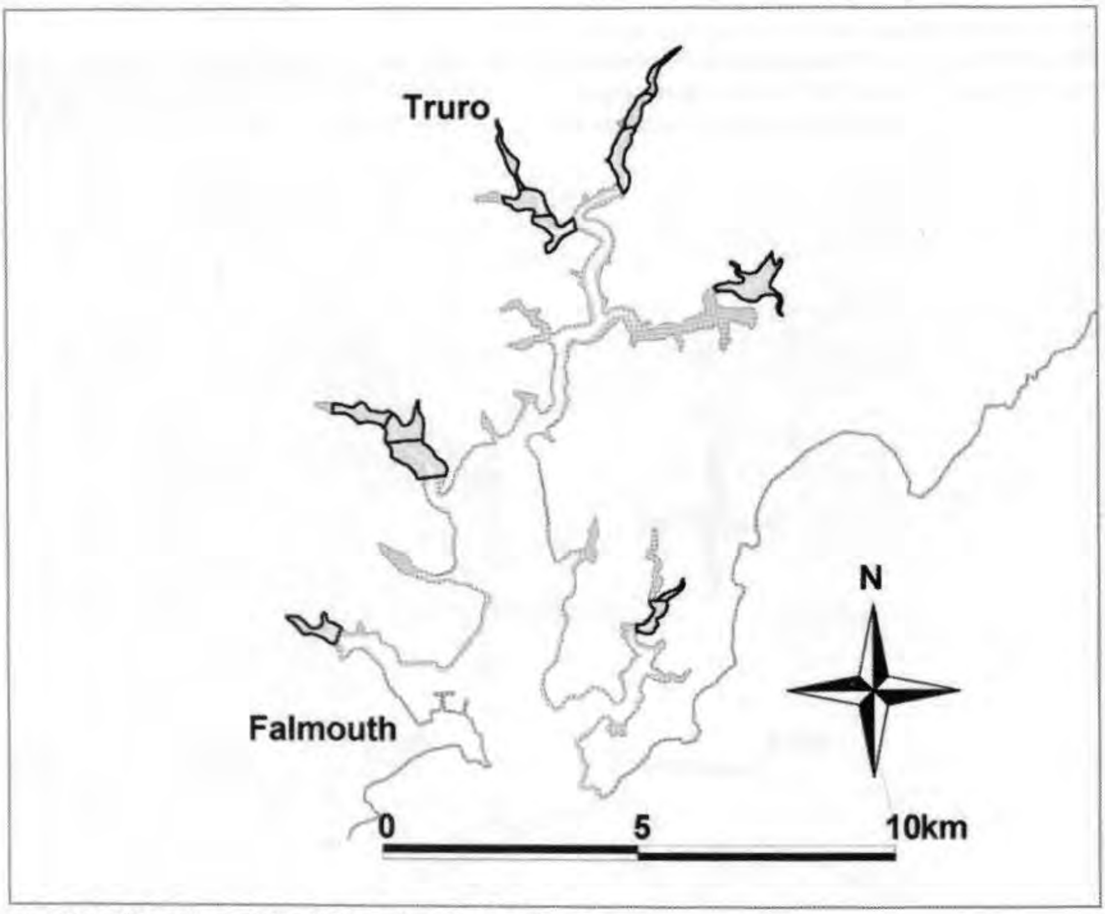


Figure 4.41.1: LTC sections at the Fal Complex, winter 1995–96

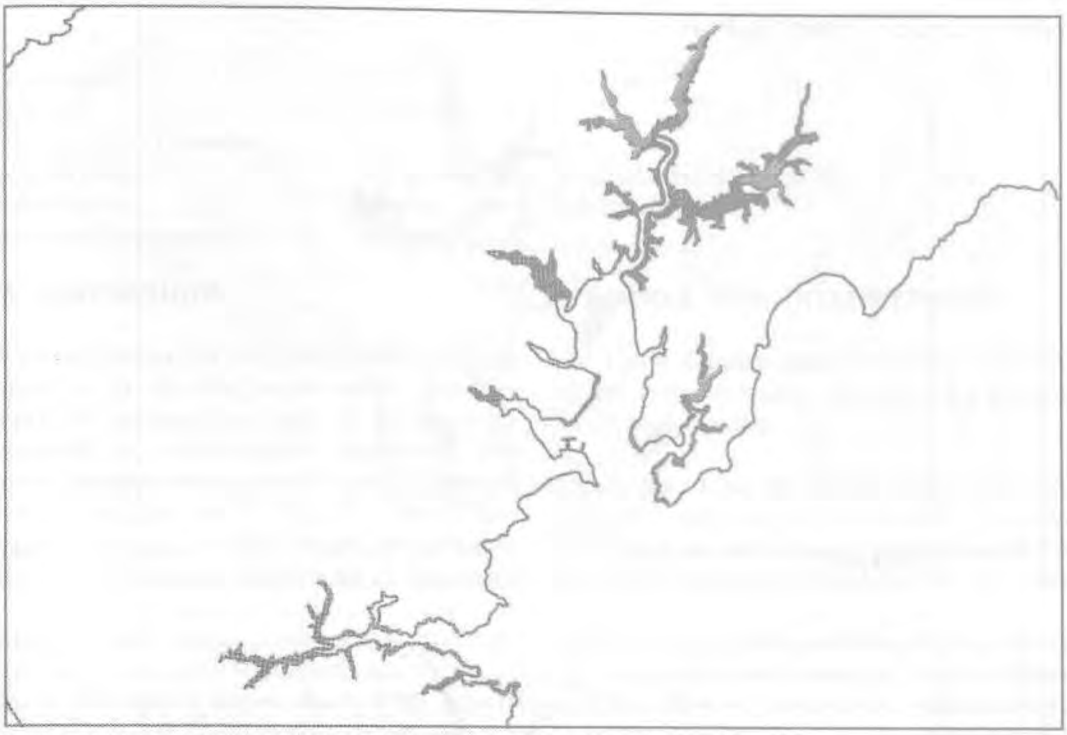


Figure 4.41.2: LTC and SSSI boundaries, with overlap, at the Fal Complex

Percuil River and Polingey Creek, but the majority of this SSSI was not surveyed (indeed this SSSI was not designated for its waterbird interest).

Movements of birds between the Fal Complex and other sites are not thought to occur on a daily basis, even to the relatively nearby Helford River (G. Conway pers. comm.). Some species may, however, disperse from the estuary to feed on nearby non-estuarine rocky shores.

WATERBIRD DISTRIBUTION

The low tide distribution map from the winter of 1995–96 is presented for Black-tailed Godwit, the species of principal interest listed above. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.41.3).

The totals map shows that overall bird densities were highest at Ruan Lanihorne and on the Truro river, whilst the weighted totals map also draws attention to the Tresillian river. The Truro river was the key area for Black-tailed Godwit with few elsewhere. Amongst the other species recorded, Shelduck were mostly found on the Truro and Tresillian rivers. Golden Plover were confined to the Ruan Lanihorne area. Curlew and Redshank were found throughout all parts of the complex but few Dunlin occurred at Tresillian river and Percuil.

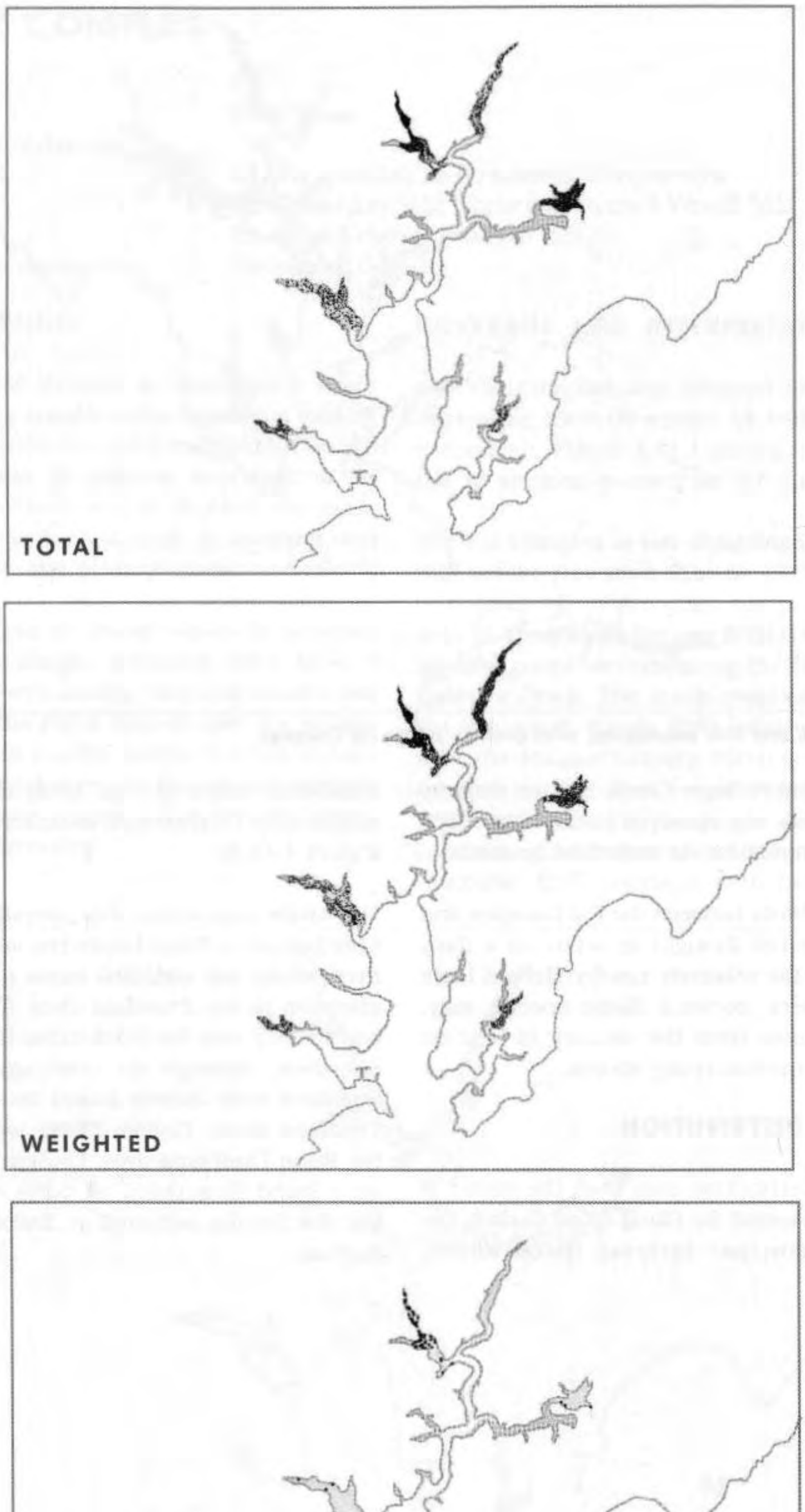


Figure 4.41.3: Low tide waterbird distributions recorded at the Fal Complex, winter 1995–96

4.42 HAYLE ESTUARY

LTC site code:	DH
Centre grid:	SW5538
JNCC estuarine review site:	1
Habitat zonation:	99 ha intertidal, 19 ha subtidal, 6 ha nontidal
Statutory status:	Hayle Estuary & Carrack Gladden SSSI
Winter waterbird interest:	N/A

SITE DESCRIPTION

The Hayle Estuary is the most south-westerly estuary in the UK and, whilst small, provides important habitat in a part of the country dominated by non-estuarine coastlines. The relatively narrow mouth of the estuary opens into the wide expanse of St Ives Bay which has extensive stretches of wide, sandy beaches (not covered by this survey) backed by an important system of dunes or 'towans'. The estuary itself is muddier, with some areas of saltmarsh, particularly at the head of Copperhouse Creek and in the south-western corner. Much of the estuary is adjacent to the small town of Hayle and the villages of Phillack, Copperhouse and Lelant. The area is popular with tourists in the summer months, although winter is much quieter. Redevelopment of the existing harbour and quays to regenerate commercial port operations and tourism facilities has recently been proposed, which could increase disturbance to parts of the estuary. A new area of marsh (Ryan's Field) has been created by the RSPB at the southern end of the estuary. Another interesting habitat is provided by the enclosed Carnsew Pool (J. Wright pers. comm.).

COVERAGE AND INTERPRETATION

The Hayle Estuary was counted for the scheme in the 1998–99 winter, counts being submitted for all four months.

Figure 4.42.1 shows the positions of the eight sections counted for the survey. The Hayle Estuary is not part of any SPA but the LTC area does overlap the Hayle Estuary & Carrack Gladden SSSI. Figure 4.42.2 shows that the SSSI covers a greater area, extending out into the main part of the outer sands along St Ives Bay (although not the whole of these sands, which extend for miles between St Ives and Godrevy Point). The SSSI also covers Ryan's Field and the saltmarsh near Lelant station. Conversely, the LTCs covered an area of the main channel between the Hayle and Copperhouse Creek which was excluded from the SPA.

The Hayle constitutes the only estuarine habitat in this part of Cornwall and daily movements between here and other sites seem highly unlikely. However, it is feasible that birds may disperse into St Ives Bay. Additionally, Curlews and Golden Plovers also feed locally in surrounding fields (J. Wright pers. comm.).

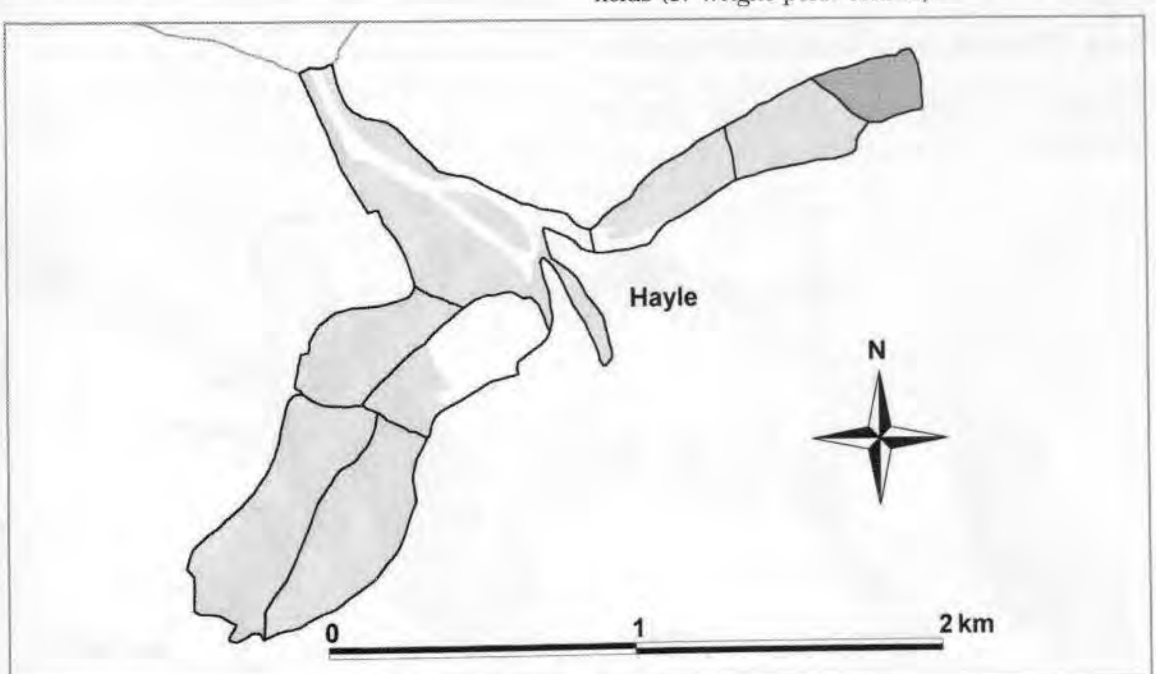


Figure 4.42.1: LTC sections at the Hayle Estuary, winter 1998–99

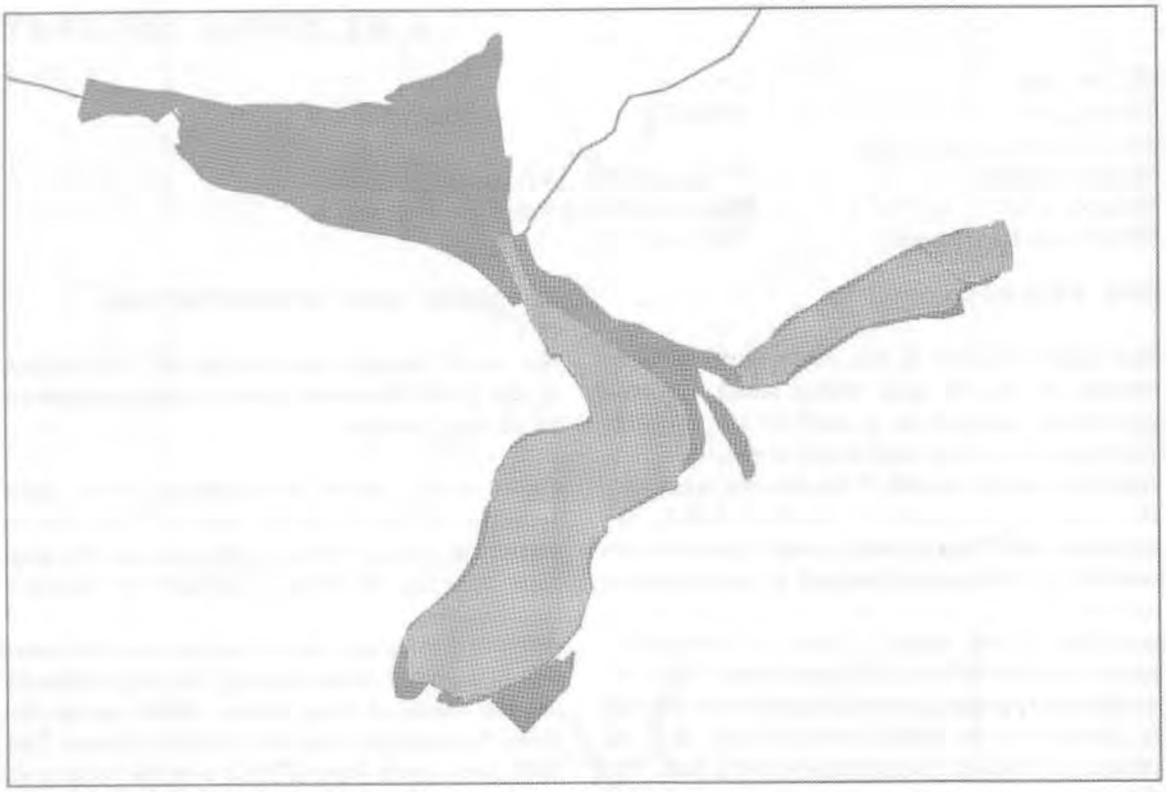


Figure 4.42.2: LTC and SSSI boundaries, with overlap, at the Hayle Estuary

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1998–99 are presented for total birds and total birds weighted by 1% threshold value (Figure 4.42.3).

The totals map shows the highest densities occurring along the east side of the main Hayle Estuary, next to Carnsew Pool and at the eastern end of Copperhouse Creek, the latter area also being emphasised by the weighted totals map. The overall occurrence pattern was driven by different species for each 'hot-spot'. The top of Copperhouse Creek was mostly occupied by Golden Plover. Dunlin occurred at high density by Carnsew Pool and the south-east part of the Hayle held the highest densities of both Wigeon and Teal, the former being more widespread elsewhere than the latter. Amongst the other species recorded, most Ringed Plovers occurred on the outer parts of the site and Curlews were more common on the inner parts of each 'arm' of the estuary.

Figure 4.42.3: Low tide waterbird distributions recorded at the Hayle Estuary, winter 1998–99

4.43 CAMEL ESTUARY

LTC site code:	CC
Centre grid:	SW9375
JNCC estuarine review site:	3
Habitat zonation:	482 ha intertidal, 150 ha subtidal, 42 ha nontidal
Statutory status:	Rock Dunes SSSI, Amble Marshes SSSI
Winter waterbird interest:	N/A

SITE DESCRIPTION

Although a relatively small estuary, the Camel is the largest inlet on the north Cornish coast and is relatively isolated from other estuaries along a long stretch of rocky shore. The site is mostly sandy in character although muddier upstream, with small areas of saltmarsh in the upper reaches also. Human disturbance is most concentrated around the towns of Wadebridge and Padstow, although a popular tourist nature trail runs along the entire south shore of the estuary.

COVERAGE AND INTERPRETATION

The Camel Estuary was covered during the 1992–93 winter, with counts being made in December and February. Figure 4.43.1 shows the positions of the 60 sections (many relatively small) counted for the survey.

Figure 4.43.2 shows the site in relation to two adjacent biological SSSIs; Rock Dunes near the mouth of the estuary and Amble Marshes upstream. The latter is nontidal and overlaps the Walmsley Bird Sanctuary. Rock Dunes includes no birds on its citation. In addition, there is a geological SSSI (Harbour Cove) on the western shore of the estuary near the mouth. The Camel Estuary itself is proposed for SSSI status but has not received such status to date (M. Lawson pers. comm.).

Movements of birds between the Camel and other estuaries are unlikely to occur on a day-to-day basis due to the isolation of the site. However, birds will use some adjacent non-estuarine habitats, notably Amble Marshes. The large flocks of Lapwings and Golden Plovers roosting at the site also disperse inland to feed.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1992–93 are presented for total birds and total birds weighted by 1% threshold value (Figure 4.43.3).

The maps show that by far the highest bird densities occurred in the east of the estuary, although the weighted total map gives somewhat greater emphasis to some of the areas of intertidal habitat downstream. The high overall bird densities are almost entirely driven by Lapwings and Golden Plovers, both of which can occur in very high numbers on this relatively small site; during the December 1992 LTC over 20,000 birds were present on the estuary, of which over 75% was made up of these two key species. Such flocks can be rather transient, however, with far fewer present in February 1993. With the exception of these species, the site was relatively sparsely occupied, with Dunlin and Ringed Plovers at Town Bar and a short stretch of the south shore further upstream. Redshanks reached their highest densities at Little Petherick Creek and other areas

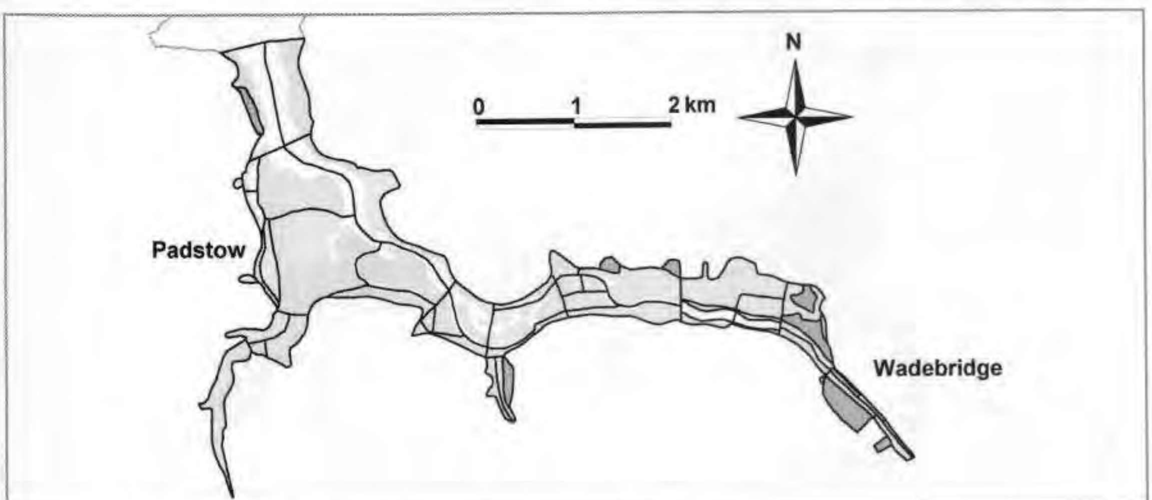


Figure 4.43.1: LTC sections at the Camel Estuary, winter 1992–93

south of the main river channel, but Curlews were typically more widespread. It should be noted that although Amble Marshes SSSI includes White-fronted Goose within its citation, regular wintering by a flock here ceased after 1973 (Cornish Bird Report 1997) with only irregular records since.

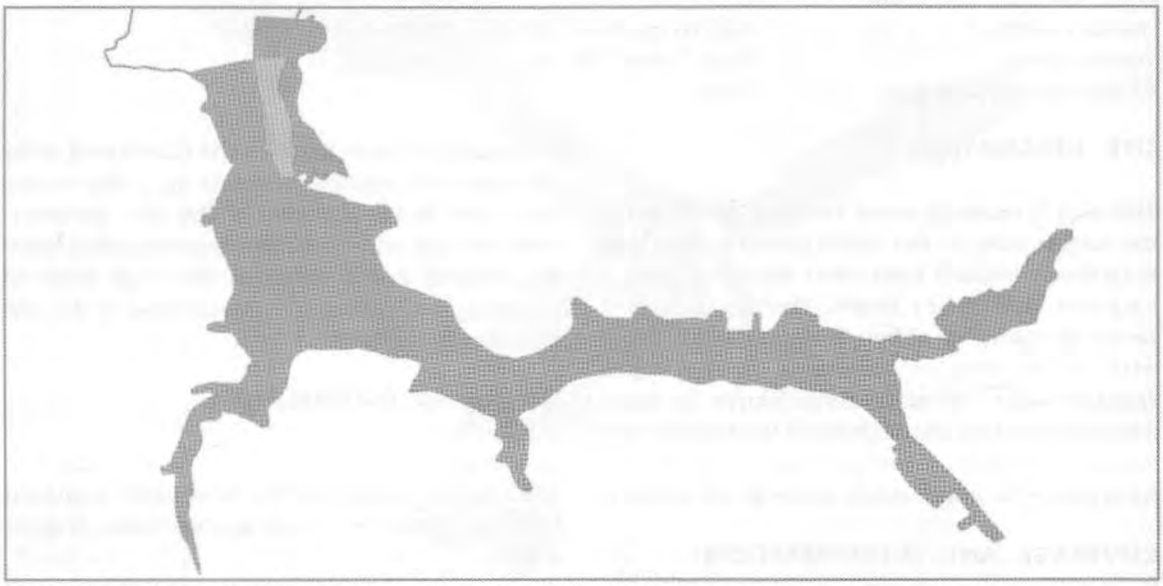


Figure 4.43.2: LTC and SSSI boundaries, with overlap, at the Camel Estuary

Figure 4.43.3: Low tide waterbird distributions recorded at the Camel Estuary, winter 1992–93

4.44 TAW–TORRIDGE ESTUARY

LTC site code:	CT
Centre grid:	SS4631
JNCC estuarine review site:	4
Habitat zonation:	926 ha intertidal, 498 ha subtidal, 208 ha nontidal
Statutory status:	Taw–Torridge SSSI, Northam Burrows SSSI, Braunton Burrows SSSI
Winter waterbird interest:	N/A

SITE DESCRIPTION

The Taw–Torridge Estuary is relatively isolated within a long stretch of non-estuarine coast in north Devon. The two arms of the estuary tend to support softer sediments than the mouth, which is sandy with areas of shingle. The mouth is also backed by important dune systems on the north and south shores, at Braunton Burrows and Northam Burrows respectively. Saltmarsh has developed especially around Yelland and Penhill. Tourism is most pronounced in the summer months but is an important factor all year. Watersports occur mostly around the mouth of the estuary with other leisure pursuits widespread. Wildfowling takes place over limited parts of the site. There is a moderate amount of industrial activity, mostly around the harbours. Military training also occurs at Braunton Burrows and at Instow, including exercises on the estuarine intertidal areas themselves (T. Vickery pers. comm.).

COVERAGE AND INTERPRETATION

The Taw–Torridge Estuary was included in the scheme during the winter of 1994–95, counts being made in all four months. Figure 4.44.1 shows the positions of the 19 sections counted for the survey.

The Taw–Torridge is not designated an SPA but is covered by several SSSI designations. As Figure 4.44.2 shows, the area covered by the LTCs closely approximates the area of the Taw–Torridge Estuary SSSI but near the mouth also overlaps the extent of both the Braunton Burrows SSSI and Northam Burrows SSSI (although the majority of these latter two SSSIs were not covered by the LTCs). The main area covered by the LTCs but not designated as SSSI is the Torridge upstream of Bideford Long Bridge.

Given the relative isolation of the Taw–Torridge Estuary, there is not likely to be any interchange on a estuarine shorelines is possible. As elsewhere, Lapwings and Golden Plovers using the estuary will also be using nearby terrestrial habitats.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1994-95 are presented for total birds and total birds weighted by 1% threshold value (Figure 4.44.3). The totals map shows that the highest

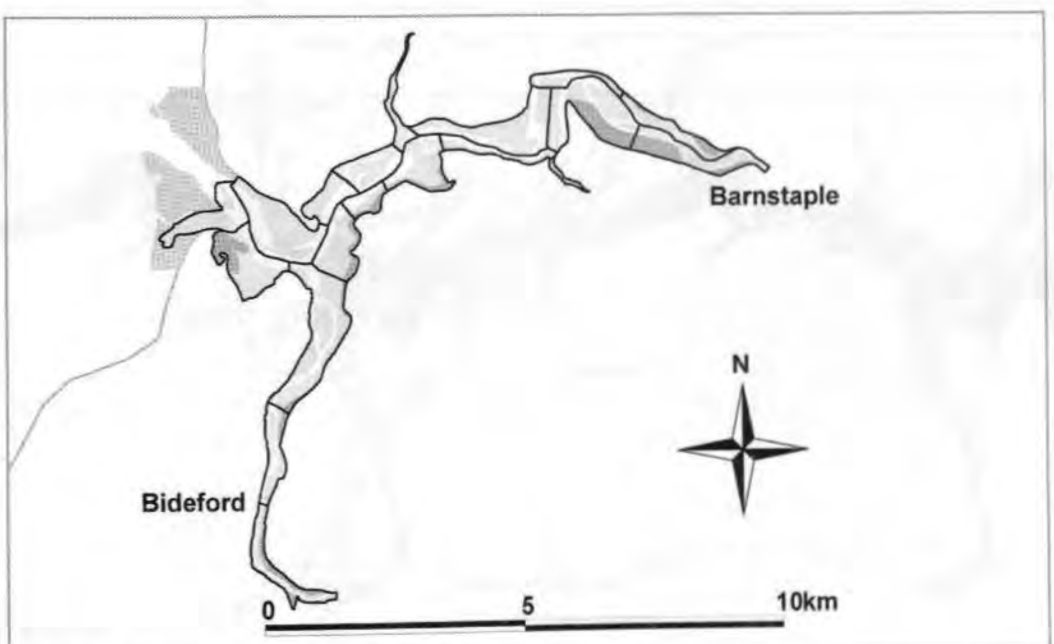


Figure 4.44.1: LTC sections at the Taw–Torridge Estuary, winter 1994-95

overall densities occur along the Taw either side of Penhill Point. The weighted total map draws attention to the northern edge of Northam Burrows and the upper reaches of the Torridge. Amongst the individual species recorded, Cormorants were widespread along the Taw but scarce on the Torridge. Oystercatchers occurred throughout but especially around the combined mouth of the site. Ringed Plovers also preferred the mouth. Most Golden Plovers were found around Penhill Point and around Bideford. Dunlin were widespread on the Taw but virtually ignored the Torridge. Curlews were found evenly throughout.

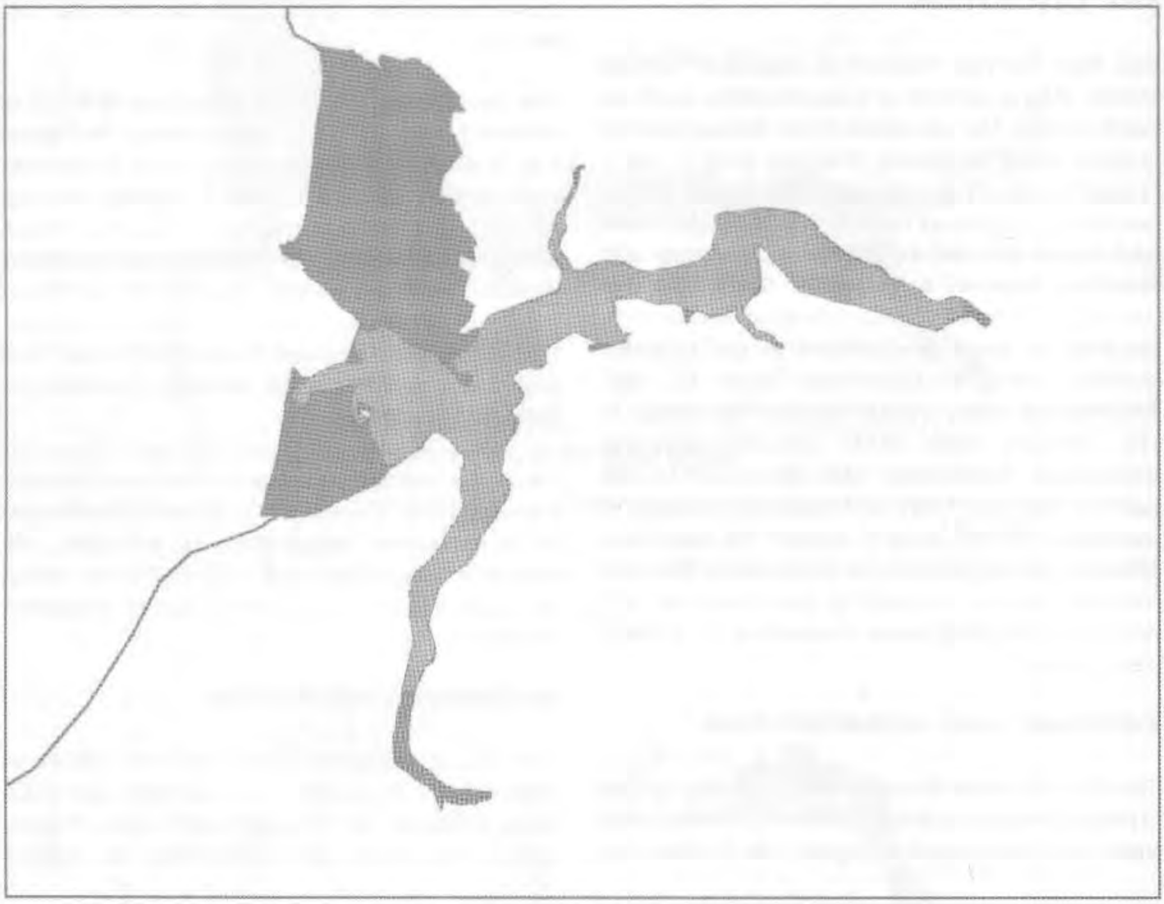


*Figure 4.44.2: **LTC and SSSI boundaries, with overlap, at the Taw–Torridge Estuary***

*Figure 4.44.3: **Low tide waterbird distributions recorded at the Taw–Torridge Estuary, winter 1994–95***

4.45 SEVERN ESTUARY

LTC site code:	BV
Centre grid:	ST4080
JNCC estuarine review sites:	6, 7
Habitat zonation:	9971 ha intertidal, 6275 ha subtidal, 623 ha nontidal
Statutory status:	Severn Estuary SPA (UK9015022), Severn Estuary Ramsar (7UK088)
Winter waterbird interest:	Bewick's Swan, White-fronted Goose, Shelduck, Wigeon, Gadwall, Teal, Mallard, Pintail, Shoveler, Pochard, Tufted Duck, Grey Plover, Lapwing, Dunlin, Black-tailed Godwit, Curlew, Redshank, Waterbird assemblage

SITE DESCRIPTION

The River Severn is the longest in Britain and drains a large area of Wales and the Midlands. The huge tidal range at the estuary (the second largest tidal range in the world) means that much of the intertidal area is composed of mobile sediments. Industrial development is widespread around the Severn and is perhaps most intensive around Avonmouth, where there are major port facilities (particularly for car importation) as well as chemical works. Pollution in the estuary, including discharge of heavy metals, can be a problem. In November 1999 (following the survey described below), the estuarine flats formed by the Taff and Ely, otherwise known as Cardiff Bay, were permanently inundated to create a nontidal lake to act as a focal point for the area's economic regeneration. A further large-scale development in recent years has been the creation of the Second Severn Crossing between Severn Beach and Caldicot. Large parts of the estuary have a rural character, however, particularly the inner stretches within Gloucestershire and along the Gwent Levels.

COVERAGE AND INTERPRETATION

The Severn Estuary was covered for the scheme during the winter of 1998–99, data being returned for all four months. Unfortunately, coverage of much of the Gloucestershire Severn and Bridgwater Bay was not achieved, but most of the remaining area was covered. The sandbars in the centre of the estuary, which could not be reached, were not thought to hold significant numbers of birds. Figure 4.45.1 shows the positions of the 125 sections counted for the survey. Some of these (especially around Cardiff) are too small to display adequately at this scale and for further details the National Organiser should be consulted.

Figure 4.45.2 shows the overlap between LTC and SPA areas. Clearly, the major areas within the SPA but not covered by the LTCs are the inner reaches and Bridgwater Bay; efforts have been

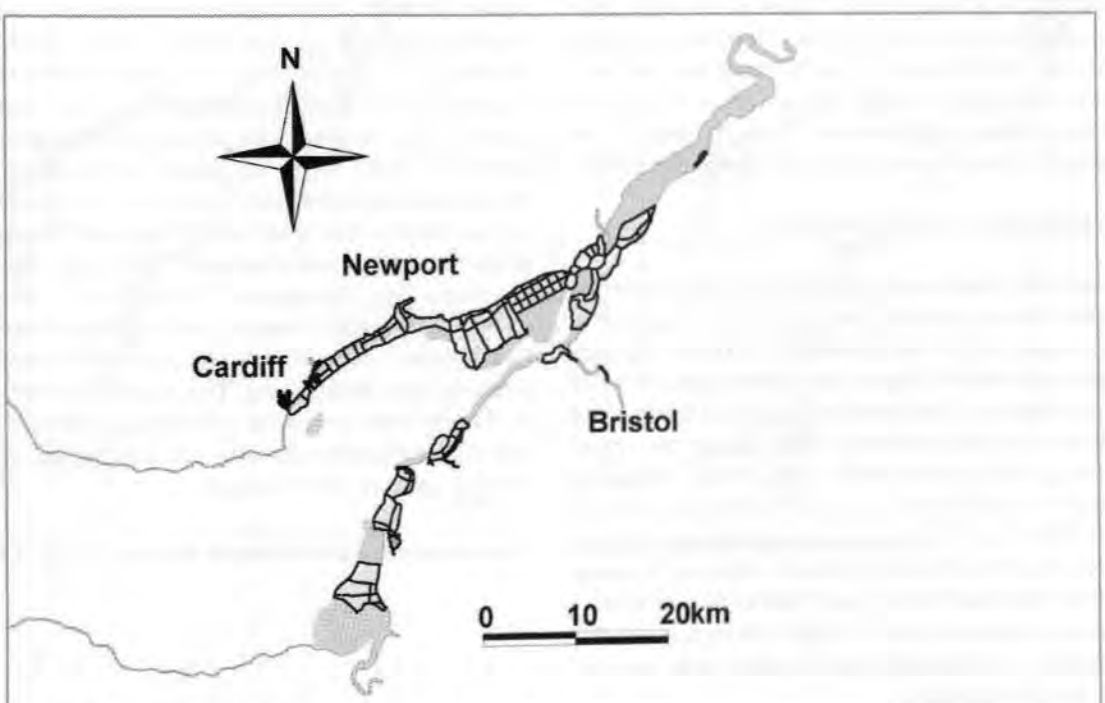


Figure 4.45.1: LTC sections at the Severn Estuary, winter 1998–99

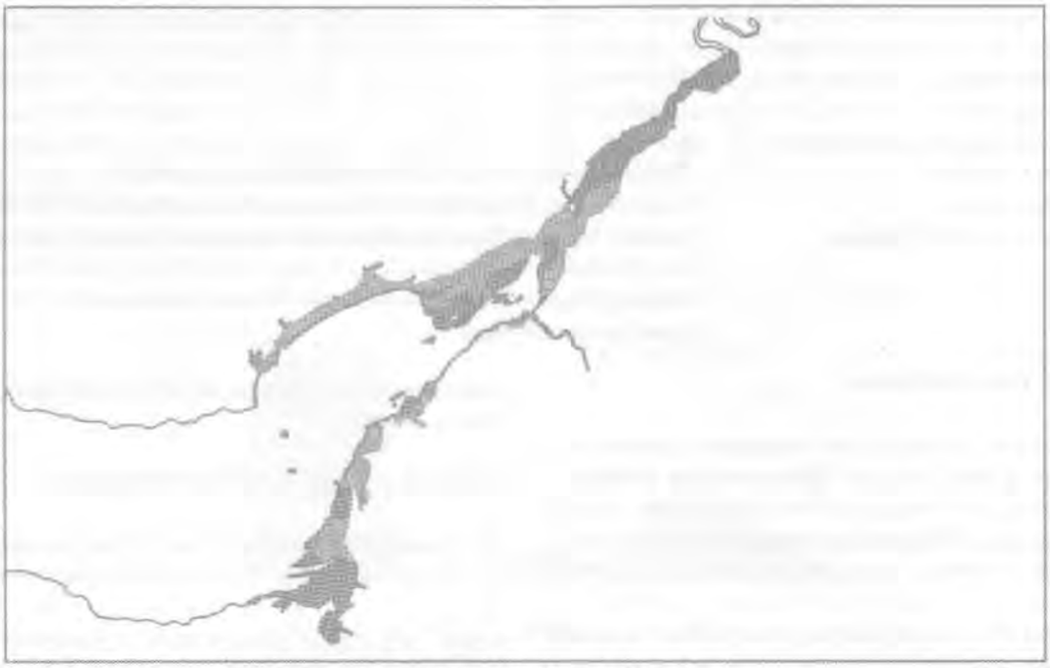


Figure 4.45.2: LTC and SPA boundaries, with overlap, at the Severn Estuary

made in subsequent years to improve coverage of these areas. Within the main area where coverage was achieved, there were gaps south of Brean Down, north of Sand Point, between Clevedon and Portishead (although few birds are likely along this stretch, H. Rose pers. comm.) and south of Cardiff on the Welsh shore. There were also some differences around Avonmouth and the river Avon. The boundaries of the Ramsar site are entirely coincident with those of the SPA.

Owing to the size of the site, most bird movements take place within the estuary and it is unlikely that interchange takes place with other estuaries on a daily basis. However, a small amount of dispersal is likely along the adjacent non-estuarine coasts downstream along the Bristol Channel. Dispersal inland is likely to be more of a feature, notably to the Somerset Levels.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1998–99 are presented for 14 of the 17 species of principal interest listed above. For clarity, smaller dots are used to display the distributions of all of these species. Furthermore, maps for Lapwing and Dunlin are displayed at a scale of one dot representing five and ten birds respectively. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.45.3). The remaining species (Bewick's Swan, White-fronted Goose and Gadwall) are mostly concentrated around the upper Severn and WWT Slimbridge, although a few Gadwall were recorded at the Axe Estuary.

The totals map suggests that, within those areas covered by the counts, the highest bird densities were to be found between the River Usk and Cardiff, especially off Peterstone, and between Chittening and Oldbury. The weighted totals map adds little to the overall picture at a broad scale but gives greater emphasis to the Axe Estuary and the Rhymney area. The individual species maps show that, within the surveyed area, five species were largely confined to the Peterstone to Rhymney shore, these being Pintail, Shoveler, Pochard, Tufted Duck and Grey Plover, although it is likely that if coverage had been more complete, larger numbers of the first four would have been found elsewhere in the SPA, notably around Slimbridge in the upper estuary. Both Wigeon and Lapwings were more concentrated in the upper parts of the surveyed area, north of Severn Beach and the River Wye, although with smaller concentrations elsewhere, such as at the mouths of the Rivers Yeo and Axe. Teal and Mallard showed similar distributions, but with larger numbers at Peterstone. Shelducks were widespread (apart from at the aforementioned Redwick to Goldcliff stretch), as were Dunlin, Curlews and Redshanks. The highest densities of Dunlin also occurred off Peterstone. Black-tailed Godwits were virtually all found at the Axe Estuary and at New Passage.

*Figure 4.45.3 (i): **Low tide waterbird distributions recorded at the Severn Estuary, winter 1998–99***

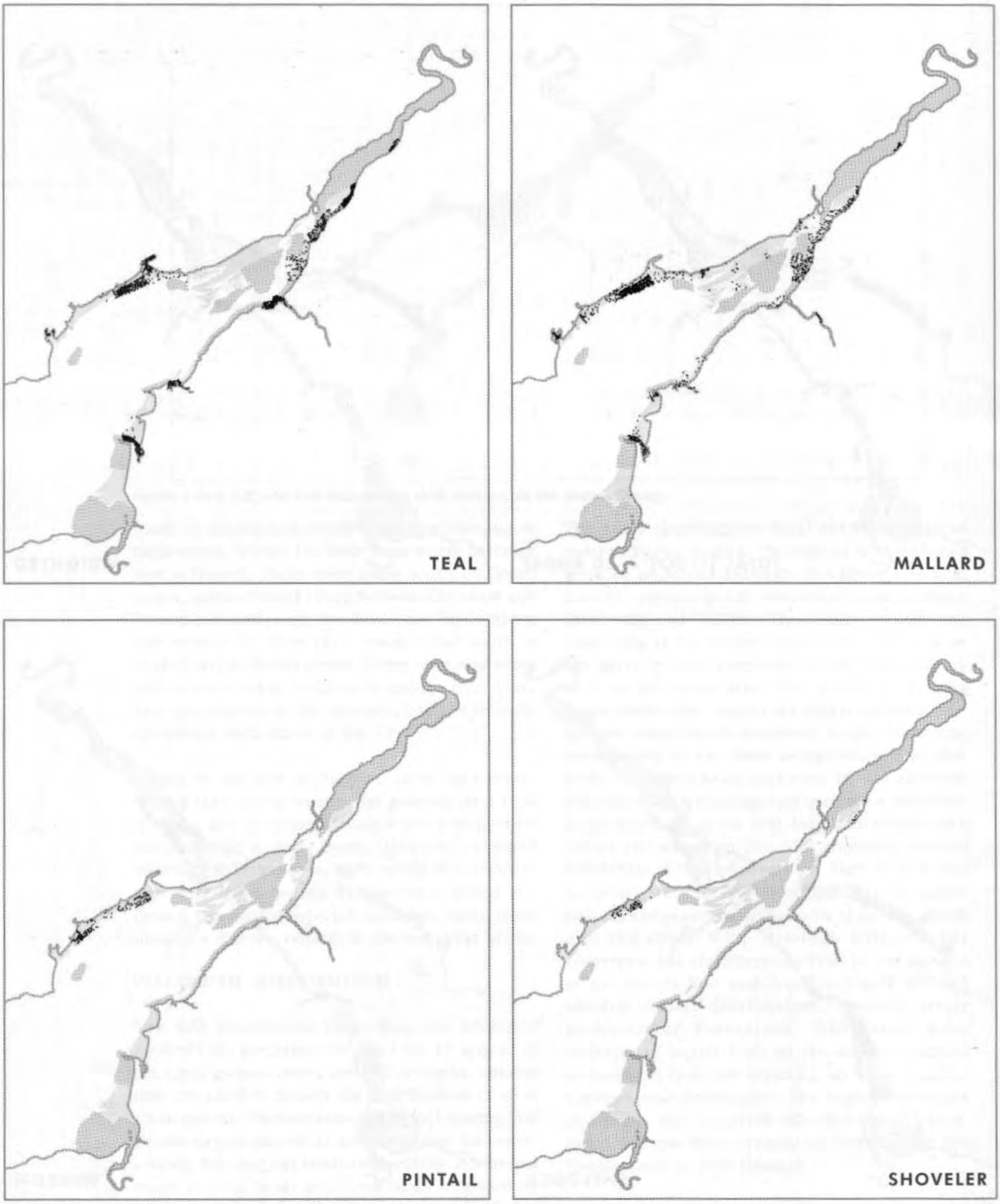


*Figure 4.45.3 (ii): **Low tide waterbird distributions recorded at the Severn Estuary, winter 1998–99***

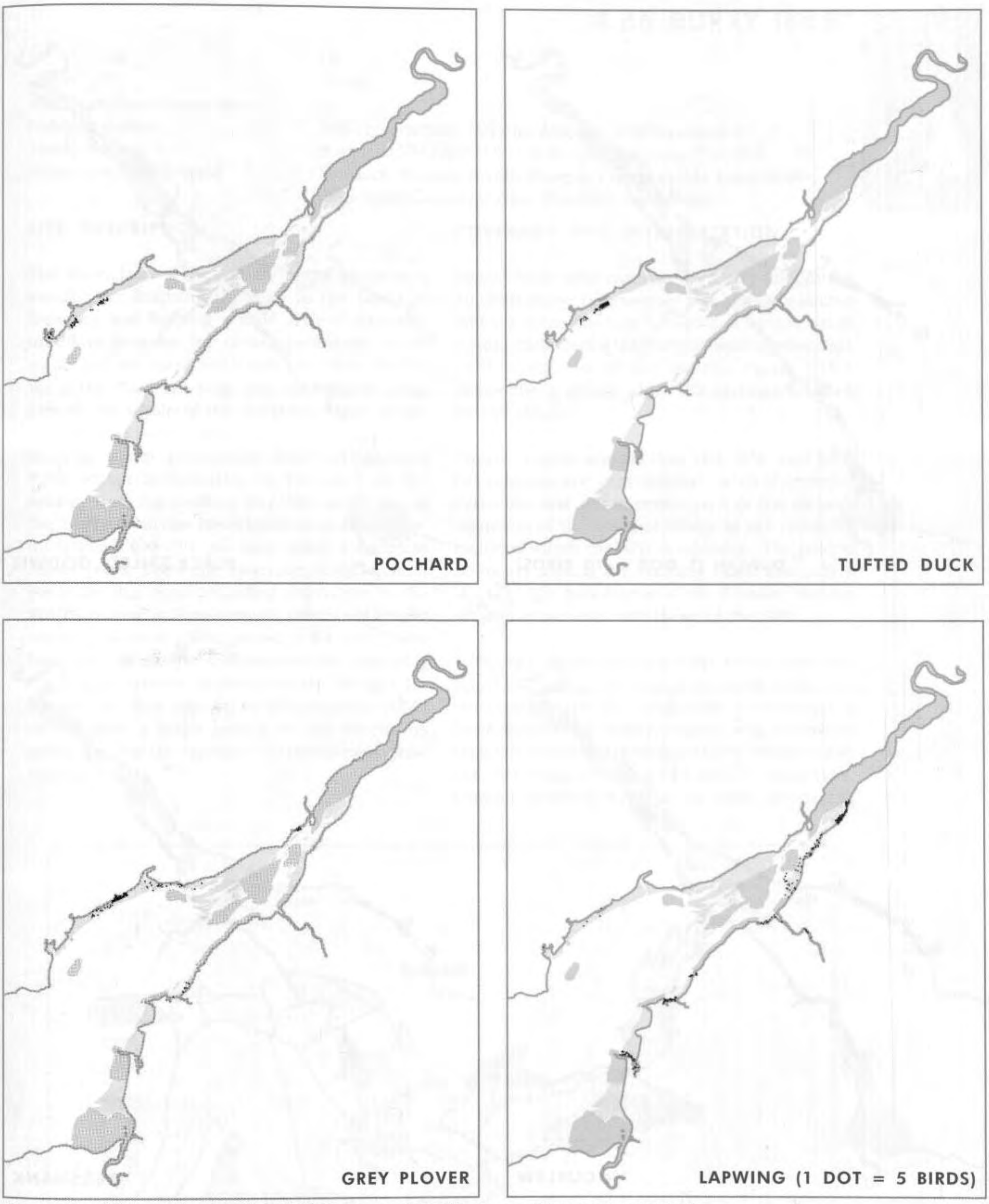


*Figure 4.45.3 (iii): **Low tide waterbird distributions recorded at the Severn Estuary, winter 1998–99***

*Figure 4.45.3 (iv): **Low tide waterbird distributions recorded at the Severn Estuary, winter 1998–99***

4.46 BURRY INLET

LTC site code:	DB
Centre grid:	SS4897
JNCC estuarine review site:	13
Habitat zonation:	3981 ha intertidal, 1092 ha subtidal, 1848 ha nontidal
Statutory status:	Burry Inlet SPA (UK9015011), Burry Inlet Ramsar (7UK054)
Winter waterbird interest:	Shelduck, Wigeon, Pintail, Shoveler, Oystercatcher, Knot, Dunlin, Black-tailed Godwit, Curlew, Waterbird assemblage

SITE DESCRIPTION

The Burry Inlet is the estuary of the Loughor, a small river draining the hills to the north of Swansea and forming a wide area of intertidal mudflats between the Gower peninsula to the south and the towns of Llanelli and Burry Port to the north. There is a large area of saltmarsh along almost the whole of the southern shore of the estuary. The mouth of the estuary is narrowed by flanking dunes, particularly those at Whiteford Point which demarcates the boundary of the estuary from Carmarthen Bay. The north side of the Burry Inlet has historically been heavily industrialised but this has been much reduced in recent years. There are extensive redevelopment plans for this area, including extensions to the WWT's reserve at Penclacwydd, which will almost certainly increase public access to the area. There has been, in the past, a proposal for damming the upper estuary (above Loughor Bridge) for leisure use. Any renewal of this proposal would clearly have a major impact on the waterbirds using the site (B. Howells, M. Humphreys pers. comm.).

COVERAGE AND INTERPRETATION

Some counts were made at the Burry Inlet in the 1993–94 winter but coverage was relatively limited and the dataset is now limited to a further set of counts made during the 1996–97 winter, when data were returned for all four months. Figure 4.46.1 shows the positions of the 27 sections counted for the survey.

Figure 4.46.2 shows that the SPA and LTC boundaries are very similar, with the major exception that the narrower part of the estuary upstream of the Loughor Bridge is not currently included within the SPA designation. The precise boundary around the Pembrey Coast also differs slightly. The boundaries of the Ramsar site are entirely coincident with those of the SPA.

Most birds roosting around the Burry Inlet also use it for feeding, although movements within the site clearly occur on a tidal basis. For example, a large number of Oystercatchers which roost at high tide between Llanrhidian and Wernffrwd move over to feeding grounds off Llanelli (C. Peake pers. comm.). However, some of the birds roosting at

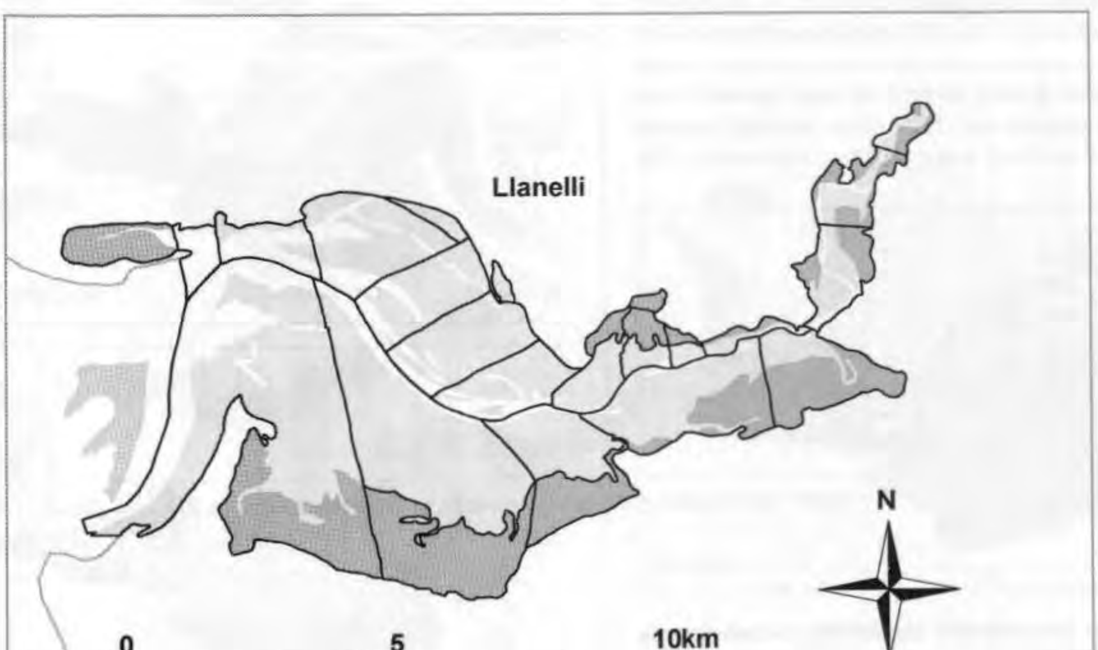


Figure 4.46.1: LTC sections at the Burry Inlet, winter 1996–97

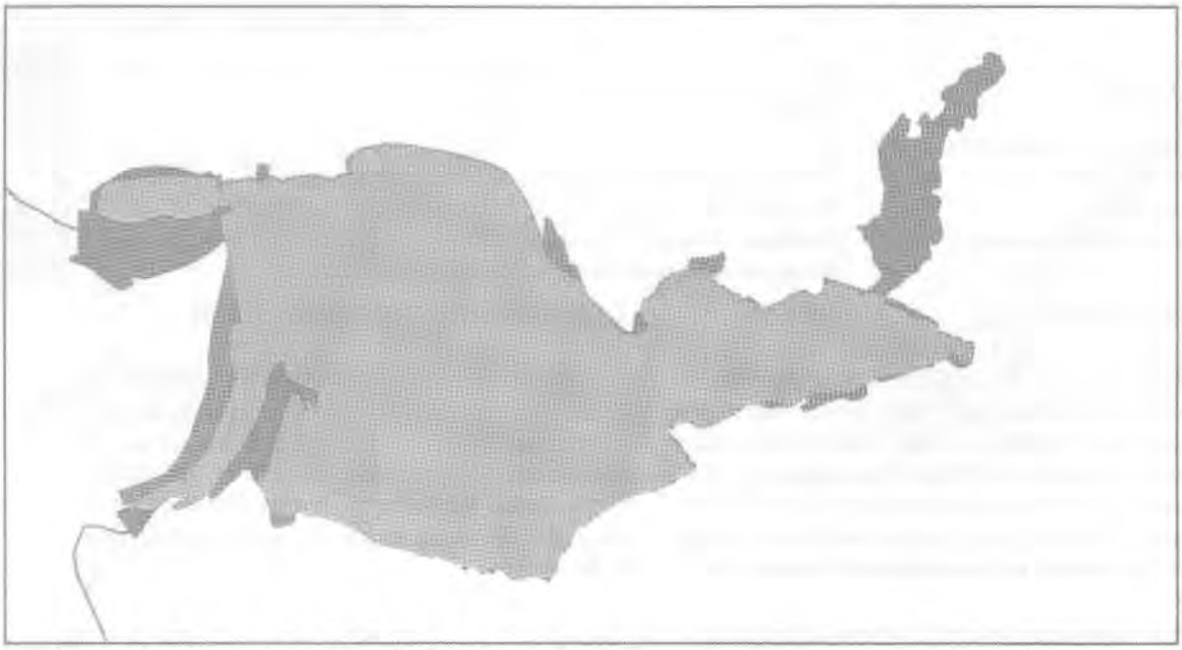


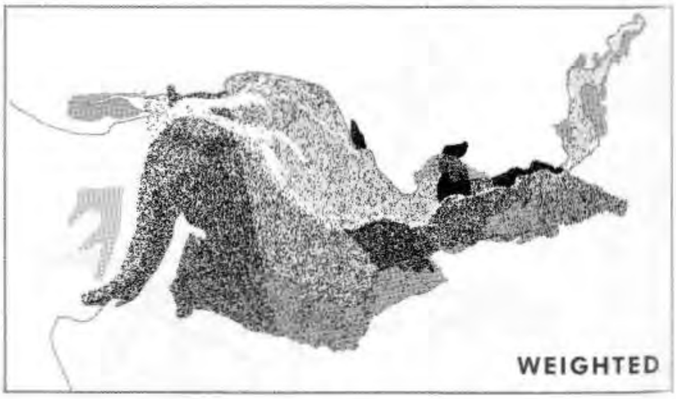
Figure 4.46.2: LTC and SPA boundaries, with overlap, at the Burry Inlet

Whiteford Point could potentially be feeding along the Cefn Sidan Sands shore of Carmarthen Bay. Similarly, Eiders roosting on Whiteford Point probably disperse offshore into Carmarthen Bay.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1996–97 are presented for all of the nine species of principal interest listed above. For clarity, smaller dots are used to display the distributions of Wigeon, Oystercatchers and Dunlin. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.46.3).

The totals map shows that higher densities of birds were found on the inner half of the SPA-designated part of the estuary. However, it should be noted that as the outer south sections were relatively very large it is quite possible that densities of some species may have been as high in parts of these sections as they were further upstream. The weighted totals map also draws attention to the north shore between Llanelli and Loughor Bridge. The mid-south area held the highest densities of Oystercatchers, Knot and Dunlin, although Oystercatchers were particularly widespread around the site. Curlews, Shelducks and Pintail were fairly widespread but all had clear concentrations south of Penclacwydd. Shovelers were also mostly found upstream from Penclacwydd along the north shore and Black-tailed Godwits occurred over much of the inner half of the SPA. Wigeon were widespread and numerous, the highest densities present at Penclacwydd.



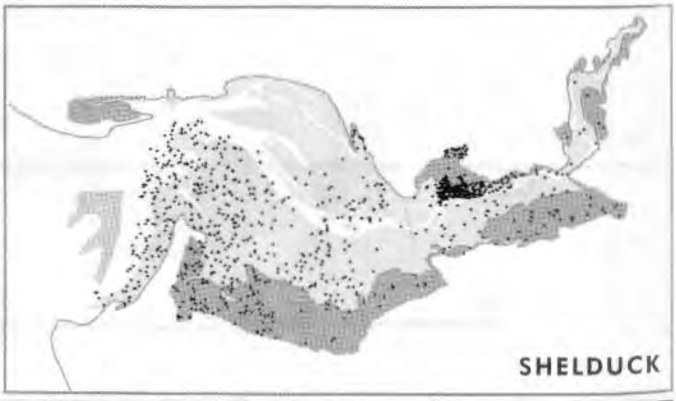


Figure 4.46.3 (i): Low tide waterbird distributions recorded at the Burry Inlet, winter 1996–97

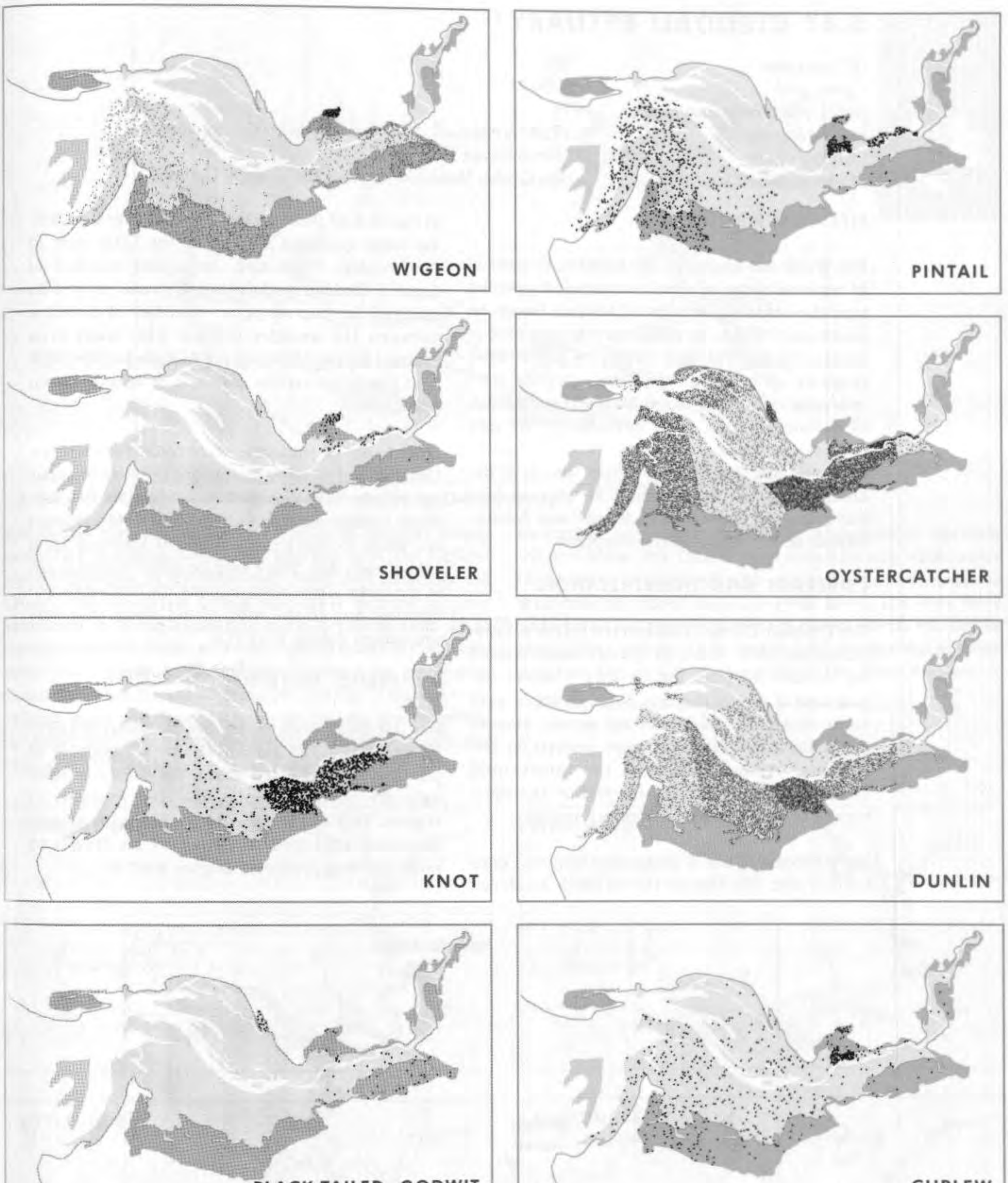


Figure 4.46.3 (ii): Low tide waterbird distributions recorded at the Burry Inlet, winter 1996–97

4.47 CLEDDAU ESTUARY

LTC site code:	DG
Centre grid:	SM9403
JNCC estuarine review site:	15
Habitat zonation:	1208 ha intertidal, 505 ha subtidal, 110 ha nontidal
Statutory status:	Milford Haven SSSI
Winter waterbird interest:	Little Grebe, Shelduck, Wigeon, Teal, Dunlin, Curlew

SITE DESCRIPTION

The WeBS site known as the Cleddau Estuary is in reality a series of small estuaries all opening into the sheltered waters of Milford Haven in south-west Wales. In character, the complex is similar to the Fal and Tamar in south-west England, all of these sites being drowned river valleys (or rias) in which mudflats and some areas of saltmarsh have later developed. The *Sea Empress* oil spillage of early 1996 illustrates extremely well one of the principal threats to the area, which is a major centre for oil transport and refining. However, both leisure and fishery-related activities are also widespread.

COVERAGE AND INTERPRETATION

The Cleddau Estuary was covered by the scheme during the 1997–98 winter, counts being received for all four months. Figure 4.47.1 shows the positions of the 60 sections (some of which were relatively small) counted for the survey. Most of the main intertidal areas were covered for the scheme, although some of the intervening stretches of rocky coast, as well as the open waters of Milford Haven, were not covered.

The Cleddau is not a designated SPA but does overlap with the Milford Haven SSSI, as shown in Figure 4.47.2. Of the areas included in the SSSI, the major ones not covered by the LTCs were at Pwllcrochan Flats and the upper reaches of Eastern Cleddau and Cresswell rivers, as well as much of the 'non-estuarine' stretches of shoreline between the smaller creeks. The main area counted for the LTCs but not included in the SSSI is at Castle Pill on the east side of Milford Haven town.

Movements of estuarine waterbirds between the Cleddau and other estuaries are unlikely to occur on a daily basis, given the isolation of the site. Some species (such as Lapwing and Golden Plover) are likely to use nearby nontidal habitats for a part of each day. There may be some dispersal out to the rocky shore areas outside the Milford Haven complex and to the intervening shore that was uncounted during the LTCs.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1997–98 are presented for all of the six species of principal interest listed above. For clarity, smaller dots are used to display the distributions of Wigeon, Teal and Dunlin. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.47.3).

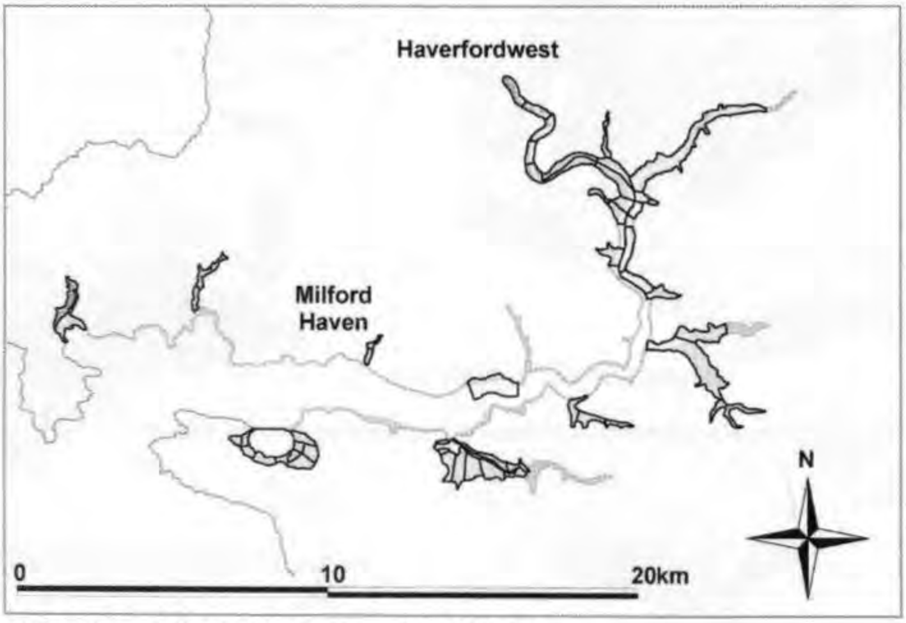


Figure 4.47.1: LTC sections at the Cleddau Estuary, winter 1997–98

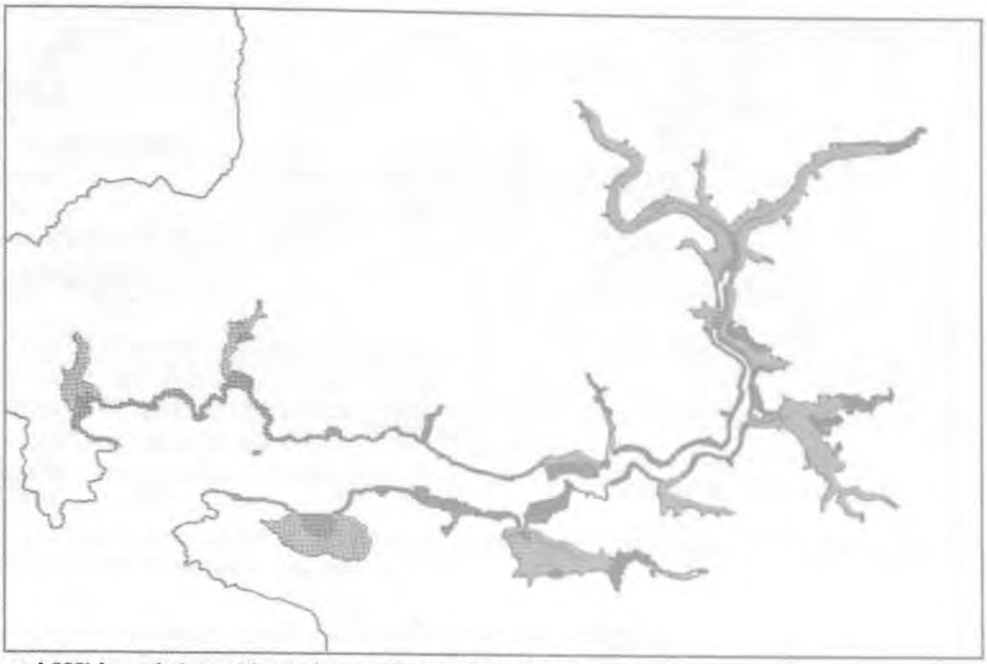


Figure 4.47.2: LTC and SSSI boundaries, with overlap, at the Cleddau Estuary

The totals map shows concentrations of birds at widely scattered locations across the site but with the highest overall densities at the Pembroke River and Landshipping Quay; the weighted totals map gave somewhat less emphasis to these areas but more to others such as at Sandyhaven Pill. Shelducks were mostly found at Pembroke River and Sprinkle Pill but were widespread elsewhere, including Angle Bay, Cosheston Pill and the Cresswell river. Wigeon were found across most of the site but especially at Angle Bay, west Pembroke River, Beggar's Reach and Sprinkle Pill, amongst others. Teal were much more restricted to inner parts of the site, especially at Sprinkle Pill and Millin Pill. Dunlin were found on any wider areas of mudflats throughout with the highest concentrations on Pembroke River and Cresswell River. Curlews were widespread but notably present in Sandy Haven Pill, unlike many other species. Little Grebes were widespread in small numbers but mostly on the pools at the Gann Estuary.

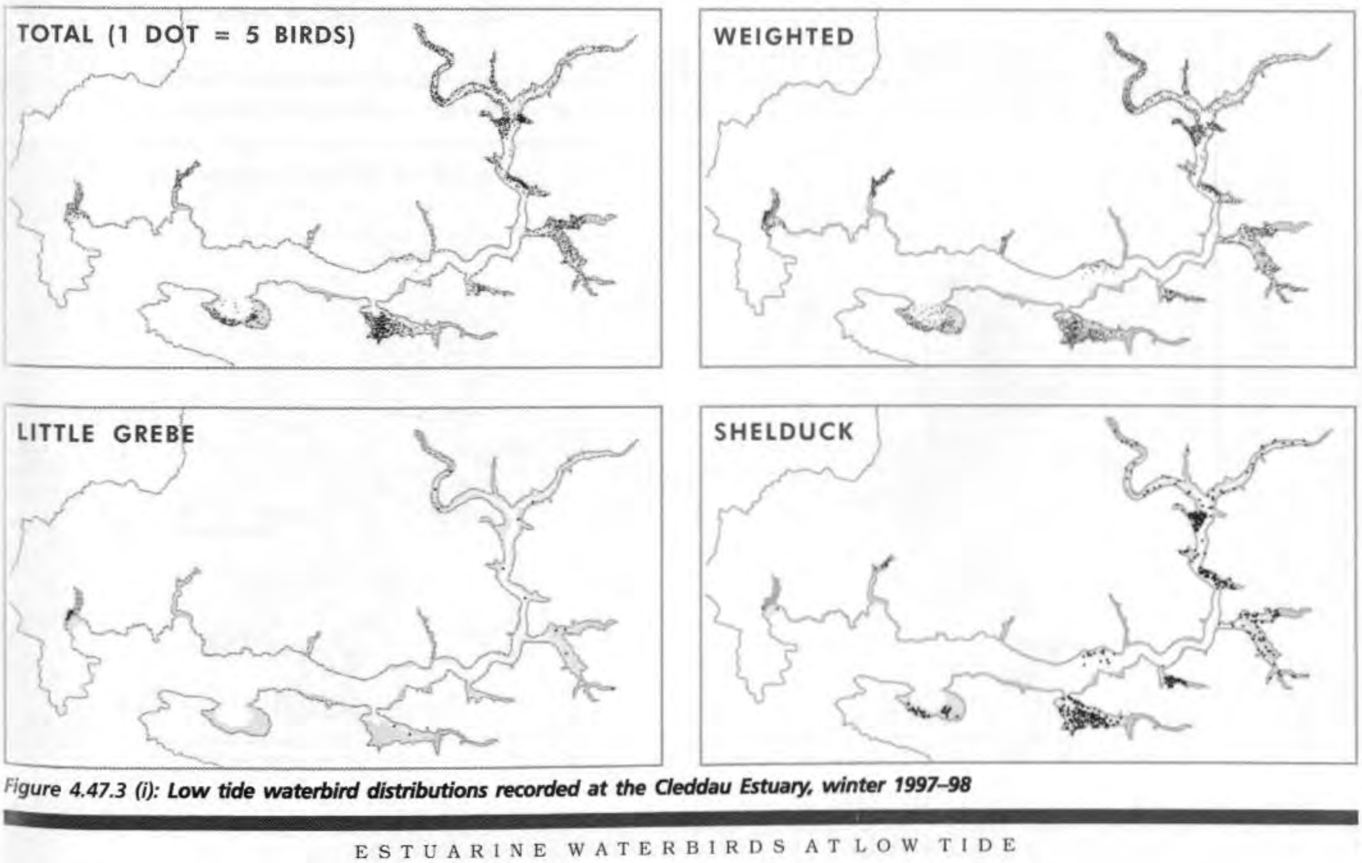


Figure 4.47.3 (i): Low tide waterbird distributions recorded at the Cleddau Estuary, winter 1997–98

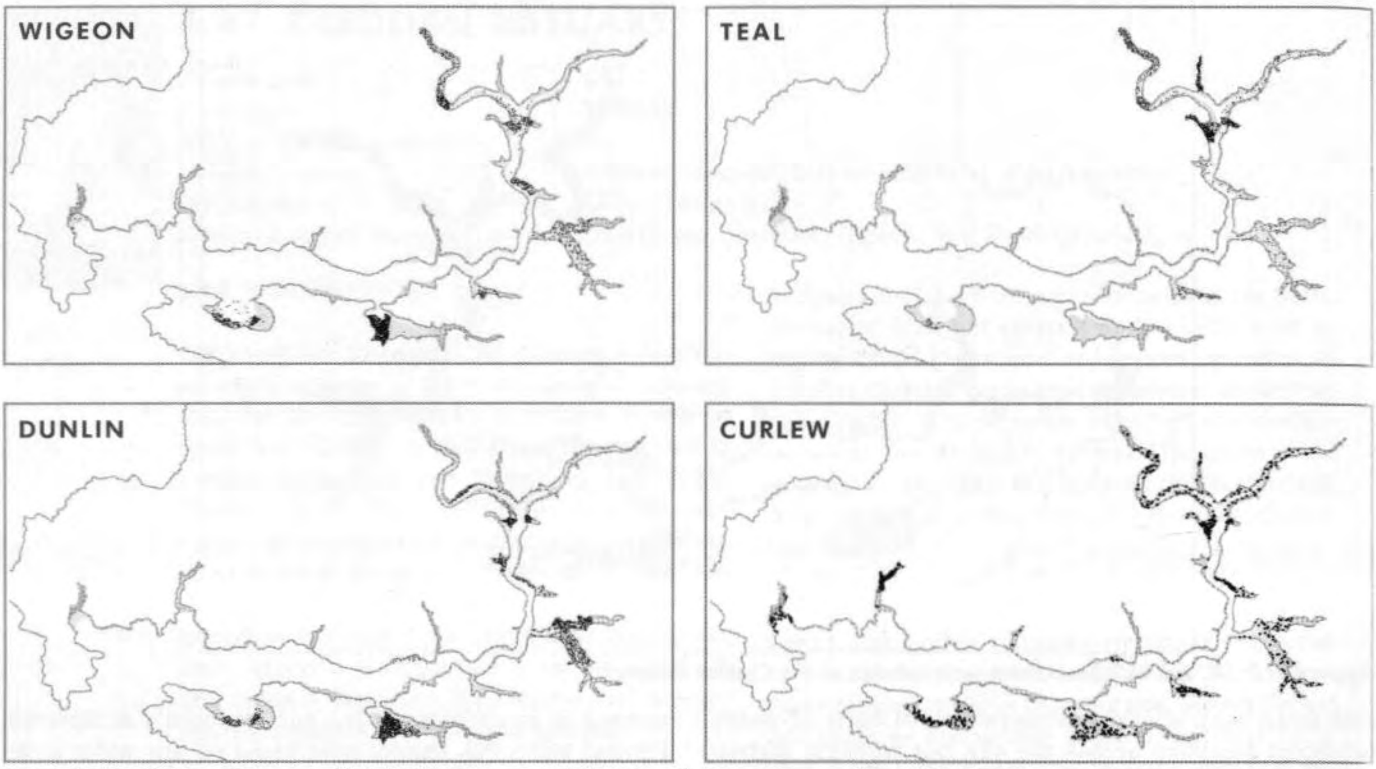


Figure 4.47.3 (ii): Low tide waterbird distributions recorded at the Cleddau Estuary, winter 1997–98

4.48 INLAND SEA

LTC site code:	BI
Centre grid:	SH3081
JNCC estuarine review site:	28
Habitat zonation:	368 ha intertidal, 337 ha subtidal, 20 ha nontidal
Statutory status:	Beddmanarch–Cymyran SSSI
Winter waterbird interest:	N/A

SITE DESCRIPTION

The Inland Sea lies between Anglesey and the smaller Holy Island, and is bordered to south and north by two road bridges, the Four Mile Bridge and the Stanley Embankment respectively, with a second road crossing constructed just south of the Stanley Embankment recently. To the north of the Stanley Embankment is the small estuary of the Afon Alaw which empties into Holyhead Bay past the sands of Traeth y Gribin. For the LTCs, the whole intertidal area from Porth Dryw on the east shore and Gorsedd-y-penrhyn on the west shore south to Four Mile Bridge was counted. The sandy creek running south from Four Mile Bridge to the sea at Cymyran Bay was not included in the survey area. The shore is largely rocky, with a small area of sand dunes at the mouth of the Afon Alaw. Apart from an aluminium smelter to the north-west of the site, there is relatively little industry in the area, although the port of Holyhead is nearby to the west. Recreational activities are widespread, notably canoeing and windsurfing, and the site is also used for training by military and coastguard aircraft (Ivor McLean pers. comm.).

COVERAGE AND INTERPRETATION

The Inland Sea was covered by the scheme during the 1995–96 winter only with counts made in all four months. Figure 4.48.1 shows the positions of the nine sections counted for the survey.

The area covered by the Inland Sea LTCs is not included within any SPA, although it does lie within the Beddmanarch–Cymyran SSSI (Figure 4.48.2). The SSSI, however, also includes the channel between Holy Island and Anglesey which lies to the south of Four Mile Bridge. This latter area would also appear to be suitable waterbird habitat, so any assessment of the birds of the SSSI should take this difference into account.

Although birds may move between the site and adjacent nontidal habitats, or into more terrestrial habitats, the Inland Sea is a very isolated site and there are unlikely to be daily movements between here and other estuaries. Interestingly, as the Inland Sea proper is bounded to north and south by the two road bridges, with narrow openings for the tidal flow, the high and low tides within the Inland Sea are delayed by about two hours compared to those outside the road bridges. As a result, the area provides an extended period when feeding opportunities are available and birds will move around the site to take advantage of this (Ivor McLean pers. comm.).

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1995–96 are presented for total birds and total birds weighted by 1% threshold value (Figure 4.48.3).

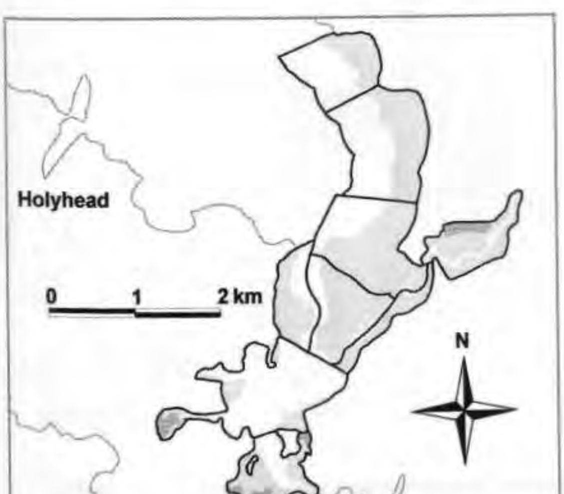


Figure 4.48.1: LTC sections at the Inland Sea, winter 1995–96

Figure 4.48.2: LTC and SSSI boundaries, with overlap, at the Inland Sea

Both the totals map and the weighted totals map suggest a very even spread of birds around the site. Amongst the individual species recorded, Shelducks and Ringed Plovers were found to be distributed very evenly throughout the site. However, the small flock of Light-bellied Brent Goose (at the time the only regular wintering flock in Britain of the Canadian population, most of which winter in Ireland) and Red-breasted Mergansers were more restricted to the Inland Sea itself (*i.e.* between the two road bridges). Dunlin occurred throughout but with clearly higher densities at Beddmanarch Bay and near Four Mile Bridge. Bar-tailed Godwits were restricted to the wider flats north of the Stanley Embankment.

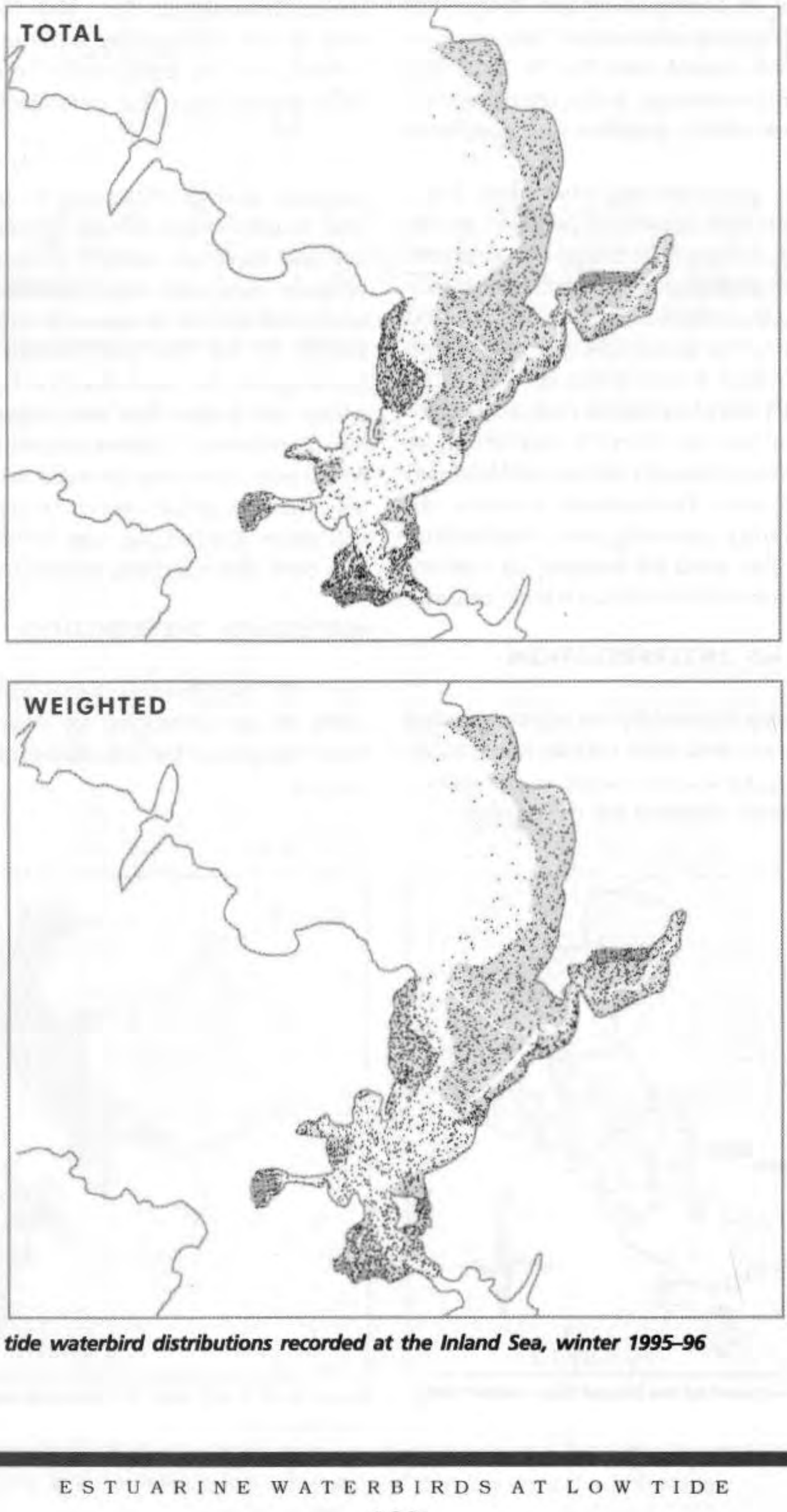


Figure 4.48.3: Low tide waterbird distributions recorded at the Inland Sea, winter 1995–96

4.49 LAVAN SANDS

LTC site code:	CL
Centre grid:	SH6375
JNCC estuarine review site:	31
Habitat zonation:	2713 ha intertidal, 636 ha subtidal, 0 ha nontidal
Statutory status:	Traeth Lafan/Lavan Sands, Conwy Bay SPA (UK9013031)
Winter waterbird interest:	Great Crested Grebe, Goldeneye, Red-breasted Merganser, Oystercatcher

SITE DESCRIPTION

Lavan Sands is an extensive intertidal area on the south side of the Menai Strait whose shoreline stretches from Bangor to Llanfairfechan. The intertidal flats are almost unbroken except for the freshwater streams of the Afon Ogwen in the west and the smaller Afon Aber to the east. The flats comprise muddy sediments close to the shore grading into sandier sediments further out. The area is used for recreational activities, with boating along the main channel and disturbance of high tide roosts by walkers and dogs especially around the main access points along the mainland coastline. A key issue in relation to the management of the site is commercial shellfish exploitation, principally cockling. There has been hydraulic suction dredging carried out in the past along with periodic hand collection depending upon stock levels (M. Howe, L. Kay pers. comm.).

COVERAGE AND INTERPRETATION

Lavan Sands was counted for the scheme during all four months of the 1995–96 winter, jointly as part of a study being carried out by the Countryside Council for Wales looking into the use of the site by birds and the potential impact of cockling activities. Figure 4.49.1 shows the positions of the 20 sections counted for the survey. The northern shore of the Strait, along the coast of Anglesey, was not surveyed, nor was the offshore area known as Dutchman's Bank.

As Figure 4.49.2 shows, there is a high level of agreement between the area covered for the LTCs and covered by the SPA boundary, the only difference being that the LTCs extended slightly further westwards at Bangor Harbour. Neither the Anglesey shore nor the offshore Dutchman's Bank were included in the SPA or the LTCs.

Lavan Sands is not contiguous with any other estuaries but intertidal habitat is to be found east, west and north of the surveyed site. Some dispersal of birds to and from the site therefore seems likely, with colour-marking of Oystercatchers in the 1970s confirming that this species, at least, does move between the site and the Conwy Estuary to the east (M. Howe pers. comm.).

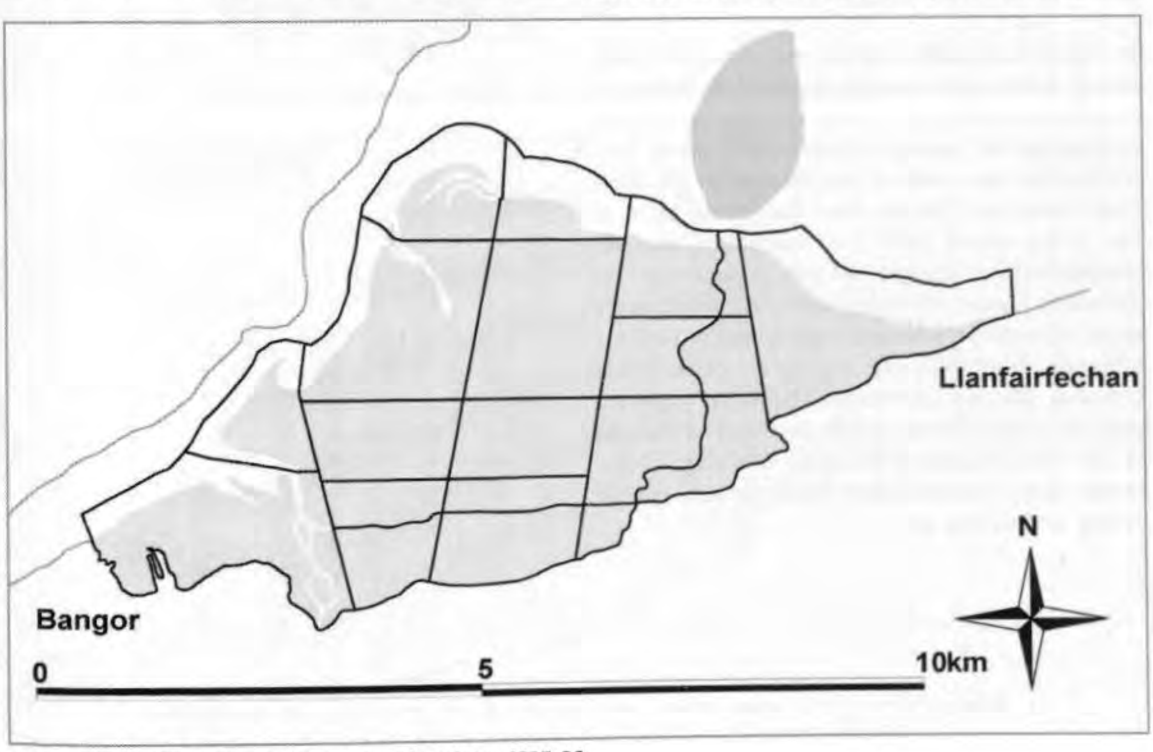


Figure 4.49.1: LTC sections at Lavan Sands, winter 1995–96

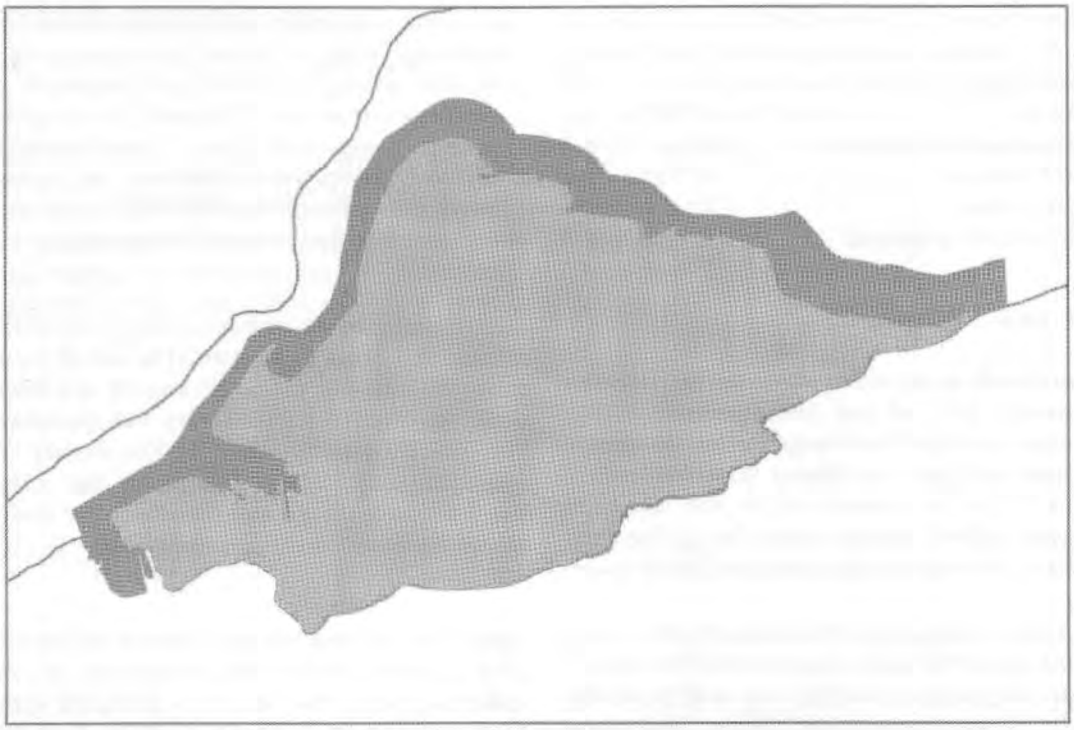


Figure 4.49.2: LTC and SPA boundaries, with overlap, at Lavan Sands

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1995–96 are presented for three of the four species of principal interest listed above. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.49.3). No Great Crested Grebes were recorded; this species was presumably too far offshore at low tide to see from the high water mark.

The totals map and weighted totals map are both clearly influenced strongly by the distribution of Oystercatchers at the site. This species was widespread but present in particularly dense concentrations just east of the channel of the Afon Aber, especially further from the shore. Most of the Goldeneyes and the few Red-breasted Mergansers recorded at low tide were present on the main Menai Strait channel, although more were doubtless present out of sight further offshore along with the aforementioned Great Crested Grebes. Amongst the other species present, Dunlin were mostly at the western end of the site, Wigeon were along the edge of the Menai Strait channel and Curlews were spread evenly across the site.

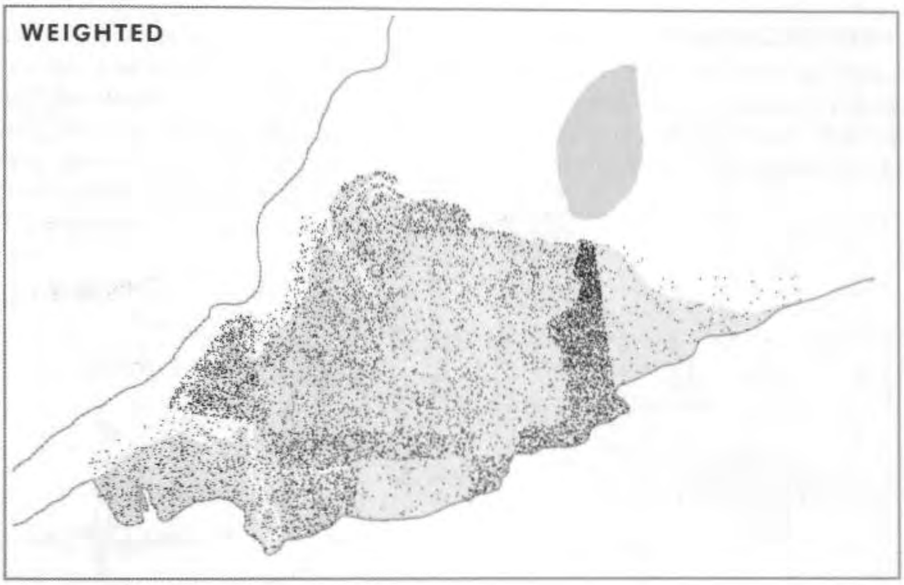


Figure 4.49.3 (i): Low tide waterbird distributions recorded at Lavan Sands, winter 1995-96

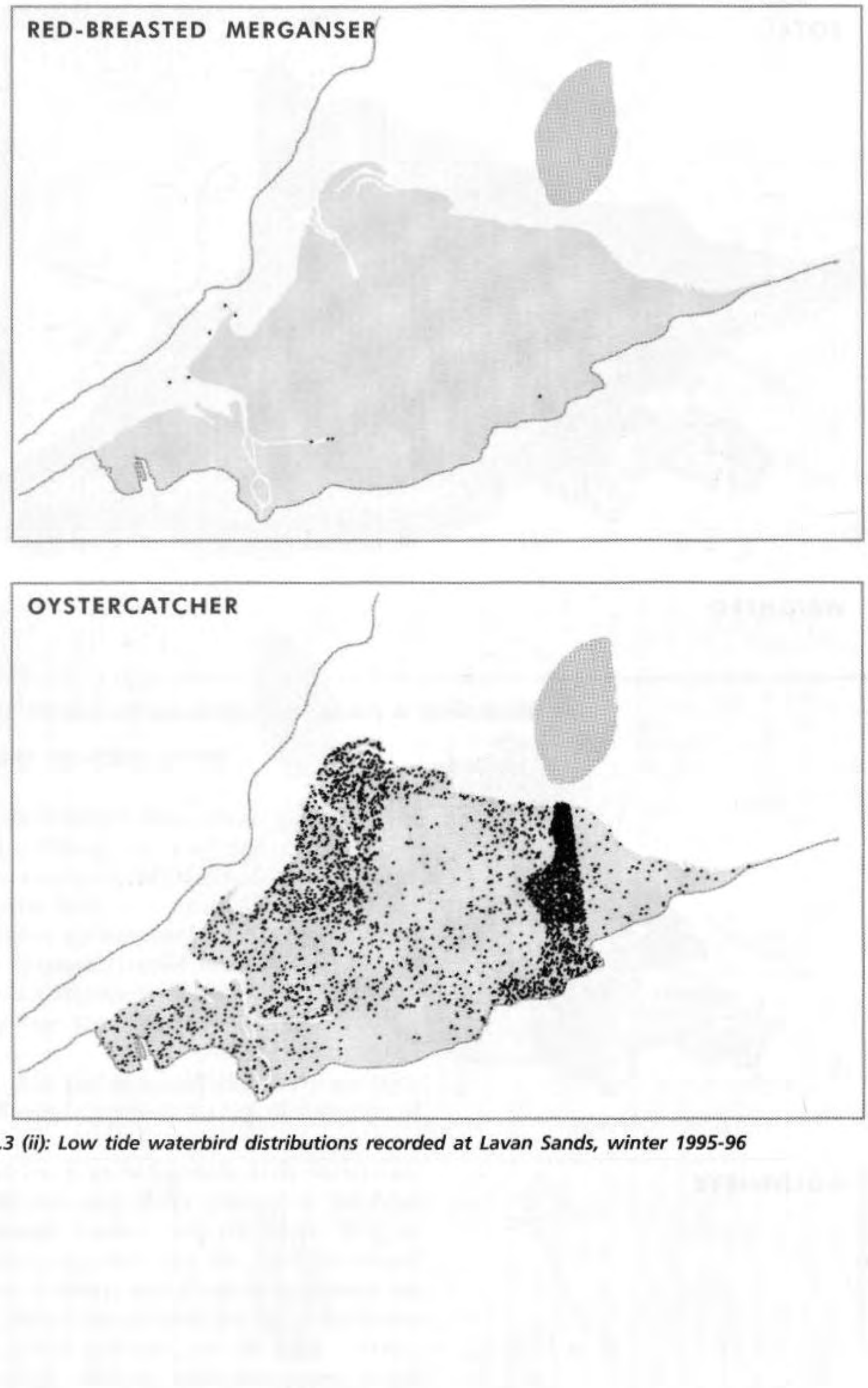


Figure 4.49.3 (ii): Low tide waterbird distributions recorded at Lavan Sands, winter 1995-96

4.50 CONWY ESTUARY

LTC site code: EC
Centre grid: SH7976
JNCC estuarine review site: 32
Habitat zonation: 1009 ha intertidal, 608 ha subtidal, 27 ha nontidal
Statutory status: N/A
Winter waterbird interest: N/A

SITE DESCRIPTION

The River Conwy drains the eastern slopes of Snowdonia National Park, and flows into the eastern end of Conwy Bay. The site counted for the scheme comprises two distinct areas: a relatively narrow inner estuary, counted from the bridge at Tal-y-cafn northwards, and the wide expanse of Conwy Sands which lie between the Great Orme and Conwy Mountain. The RSPB has recently acquired a reserve at Glan Conwy, to the south of Llandudno Junction. The intertidal flats support extensive growths of *Zostera* and mussel beds. Although saltmarsh vegetation fringes much of the estuary, the total area is small. The whole area is heavily used by tourists, although more so during the summer. A tunnel has recently been built under the estuary to relieve traffic congestion in Conwy.

COVERAGE AND INTERPRETATION

The Conwy Estuary was covered during the winter of 1996–97, although no count was made during February. Figure 4.50.1 shows the positions of the 11 sections counted for the survey.

The Conwy Estuary does not overlap with any SPA or SSSI.

Movements of birds occur between the Conwy Estuary and Lavan Sands to the west, which holds far higher numbers of feeding birds. The shore between these two LTC sites is a long stretch of sandy beach, rockier in places, that also supports some feeding birds (I. Higginson pers. comm.).

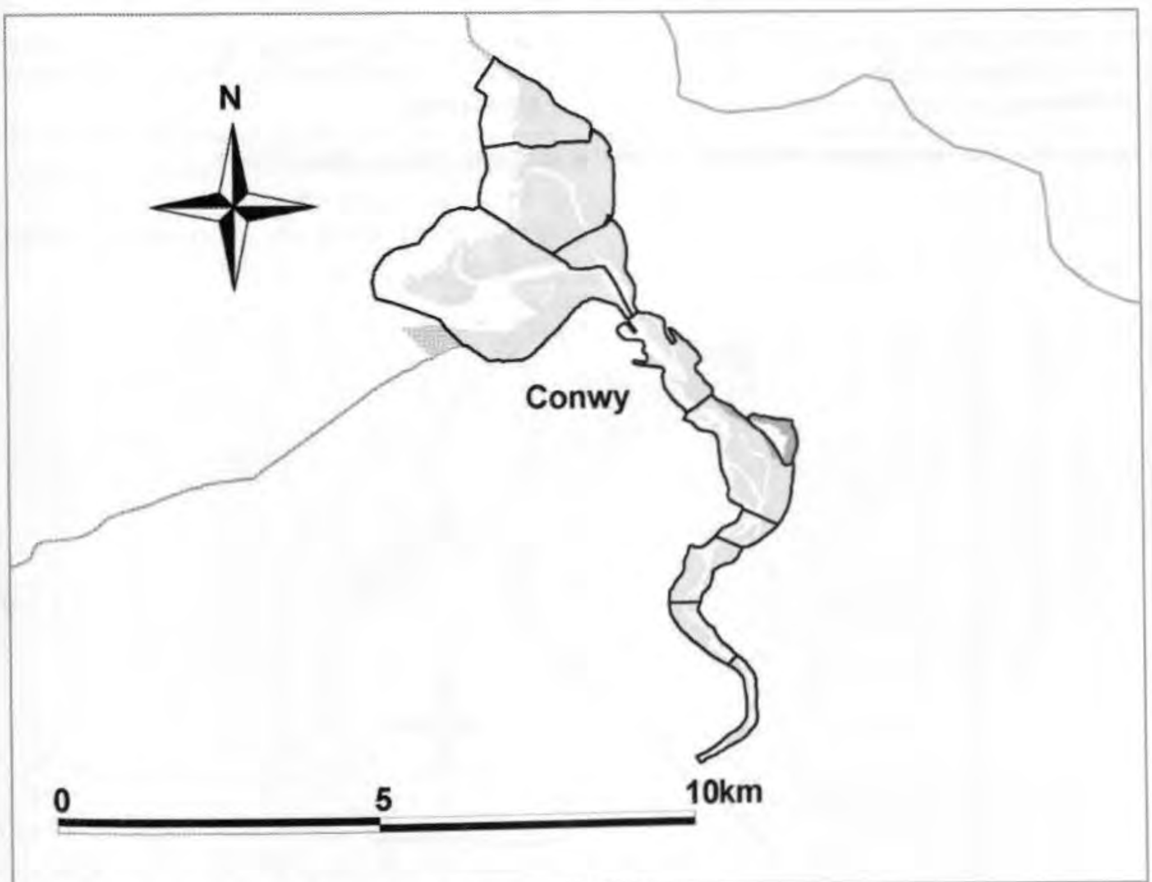


Figure 4.50.1: LTC sections at the Conwy Estuary, winter 1996–97

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1996–97 are presented for total birds and total birds weighted by 1% threshold value (Figure 4.50.2).

The two totals maps show a similar pattern, with a fairly even spread of birds across the site but a concentration at the Glan Conwy reserve, mostly made up of Lapwings and a selection of wildfowl. Amongst the other species recorded, there were clear differences in habitat preferences. The inner estuary supported the majority of the Shelducks and Redshanks whilst Oystercatchers were very much more concentrated on the outer sandflats, with most of the Cormorants also on the outer estuary. Curlews and Red-breasted Mergansers were distributed more evenly.

Figure 4.50.2: ***Low tide waterbird distributions recorded at the Conwy Estuary, winter 1996–97***

4.51 CLWYD ESTUARY

LTC site code: CG
Centre grid: SJ0080
JNCC estuarine review site: 33
Habitat zonation: 174 ha intertidal, 164 ha subtidal, 0 ha nontidal
Statutory status: N/A
Winter waterbird interest: Cormorant, Common Scoter

SITE DESCRIPTION

The Clwyd is a small estuary on the North Wales coast. The river channel is narrow and entirely canalised, with a restricted mouth opening onto a wide sandy beach at Rhyl. The inner estuary is mostly muddy with a limited saltmarsh fringe. The adjacent marine lake at Rhyl is also a suitable feeding ground when drained in the winter. Most disturbance to the site comes from human recreational activities, most intensively during the summer months, but industrial activities are limited.

COVERAGE AND INTERPRETATION

The Clwyd Estuary was counted during 1992–93, during all four months of the winter. Figure 4.51.1 shows the positions of the six sections counted for the survey.

The Clwyd Estuary overlaps with no SPAs or SSSIs, the only protection coming from Local and County Structure Plans (Buck 1993b).

The site is not far from the Dee Estuary, although probably far enough that there is little interchange of birds on a daily basis. The area of outer beach chosen to survey for the LTCs, however, was somewhat arbitrary, and some birds are likely to occur east and west of the mapped sections.

WATERBIRD DISTRIBUTION

The low tide distribution map from the winter of 1992–93 is presented for one of the two species of principal interest listed above, namely Cormorant. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.51.2). The other listed species, Common Scoter, occurs offshore in Liverpool Bay and was not recorded during the survey.

The highest densities of birds were found on the inner estuary, as well as on the marine lake. Cormorants were recorded in only very low numbers at low tide and presumably disperse out into Liverpool Bay to feed. Amongst the other species recorded, the inner estuary supported the majority of the Lapwings and Curlews, Shelducks occurred more evenly along the river channel and Oystercatchers were more common on the outer sandflats along the edge of Liverpool Bay. Redshanks occurred throughout but more densely along the river.

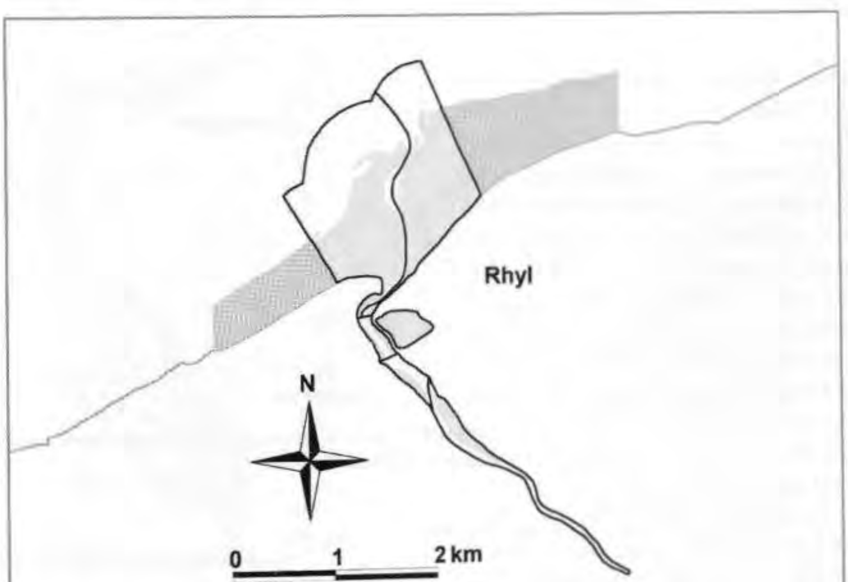


Figure 4.51.1: LTC sections at the Clwyd Estuary, winter 1992–93

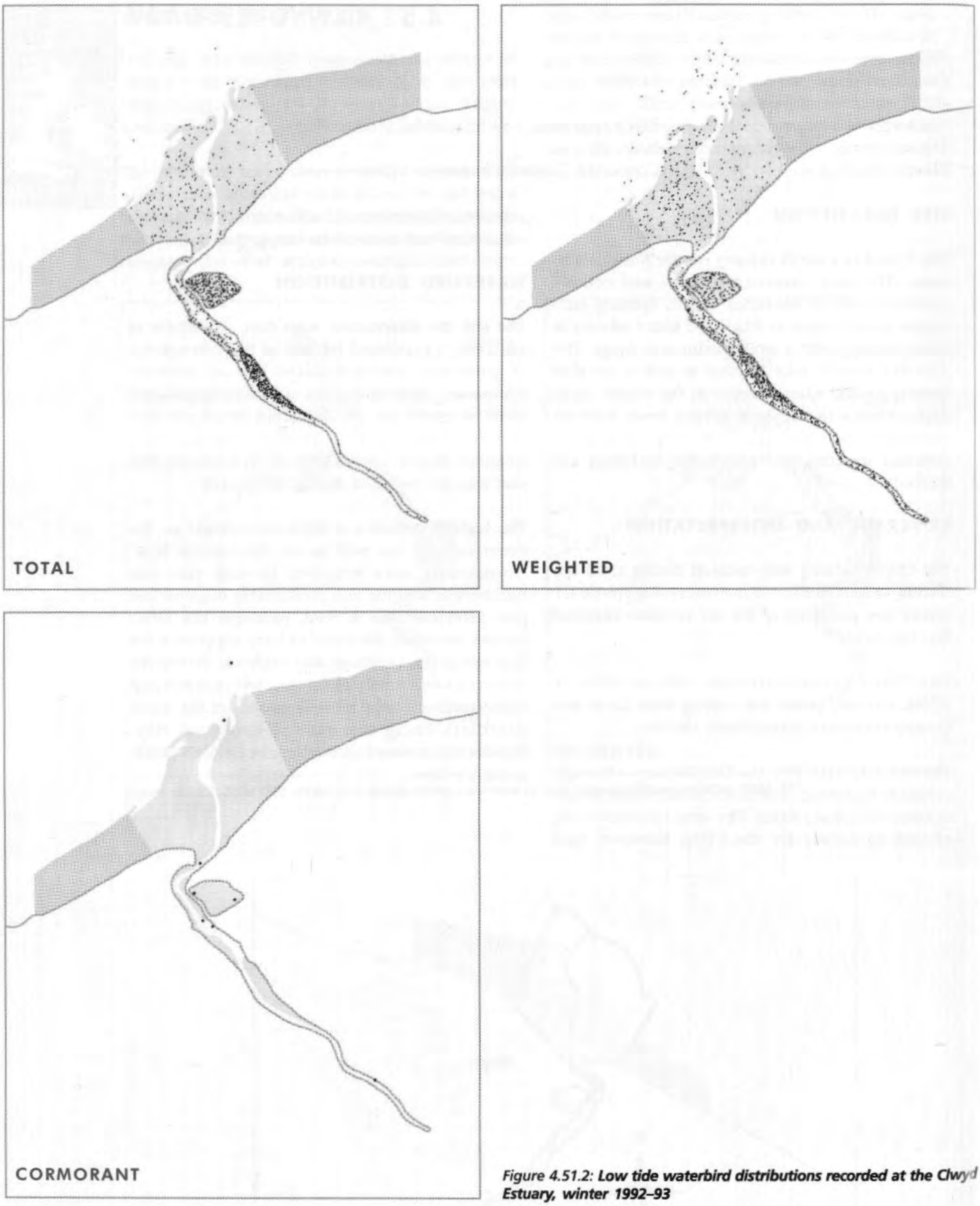


***Figure 4.51.2:** Low tide waterbird distributions recorded at the Clwyd Estuary, winter 1992–93*

4.52 DEE ESTUARY & NORTH WIRRAL SHORE

LTC site code:	DD
Centre grid:	SJ2674
JNCC estuarine review site:	34
Habitat zonation:	9376 ha intertidal, 3039 ha subtidal, 1517 ha nontidal
Statutory status:	The Dee Estuary SPA (UK9013011), The Dee Estuary Ramsar(7UK020) [Also Mersey Narrows and North Wirral Foreshore proposed SPA (UK9013011), Mersey Narrows and North Wirral Foreshore proposed Ramsar (7UK153)]
Winter waterbird interest:	Great Crested Grebe, Cormorant, Shelduck, Wigeon, Teal, Mallard, Pintail, Oystercatcher, Grey Plover, Lapwing, Knot, Sanderling, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Turnstone, Waterbird assemblage

SITE DESCRIPTION

The Dee is a large estuary on the border between Wales and north-west England, comprising very extensive sandflats, mudflats and saltmarsh. The main channel of the Dee runs close to the Welsh shore for most of its length and so the mudflats are less wide on this side. At the northern end of the Dee are a series of rocky islands at Hilbre nearer the eastern shore and there is an area of sand dunes at Point of Ayr on the western shore. The site, as considered by WeBS, also includes the adjacent North Wirral Shore, an area of intertidal sand, mudflats and developing saltmarsh which reaches eastwards to the mouth of the Mersey. The Dee is a heavily industrialised and urbanised area (particularly along the Welsh shore) which suffers from pollution, windsurfing, jet-skiing (and other general disturbance) and commercial cockling. Recently, there have been port developments and associated channel dredging (C. Wells pers. comm.).

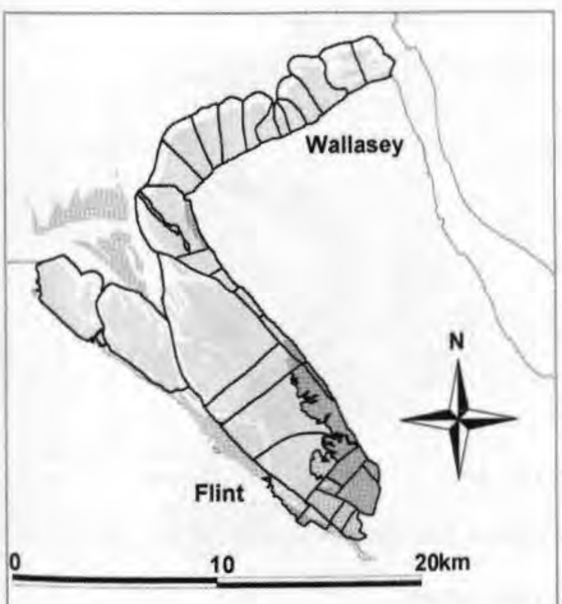


Figure 4.52.1: LTC sections at the Dee Estuary, winter 1996–97

COVERAGE AND INTERPRETATION

The Dee Estuary and North Wirral Shore were counted in entirety (the 41 sections depicted in Figure 4.52.1) during the winter of 1996–97, although no November count was made in that winter. During the following two winters, 1997–98 and 1998–99, repeat counts were carried out of the North Wirral Shore only (a total of 12 sections), counts being returned for all months for these two winters.

Figure 4.52.2 shows that the Dee Estuary SPA has been largely covered by the LTCs, but that there were areas along the Welsh shore for which access was not possible. Additionally, some of the outer sandflats at the mouth of the Dee were uncounted for reasons of distance from the counter. The North Wirral shore LTC area will overlap with the Mersey Narrows and North Wirral Foreshore pSPA, although the latter is not depicted since, at time of writing, the boundary has not been finalised. The boundary of the Ramsar site is entirely coincident with that of the SPA.

Movements by birds between this site and others nearby occur on a daily basis and an understanding of this must be taken into account when discussing the birds of the Dee Estuary and North Wirral shore. The degree to which birds in the main part of the Dee move to and from other sites is not clear, although there is likely to be a small amount of dispersal west along the Welsh coastline from the Point of Ayr high tide roost. At the south end of the site, birds may interchange with areas further upstream and to and from other nearby wetlands. More significant, however, is the situation at the north-eastern end of the site. Interchange of birds is frequent between the North Wirral Shore and the contiguous Mersey Narrows (the latter counted as part of the Mersey to date). Some movement further up the Mersey to Rock Ferry could also occur. Furthermore, birds feeding at both the Mersey Narrows and North Wirral

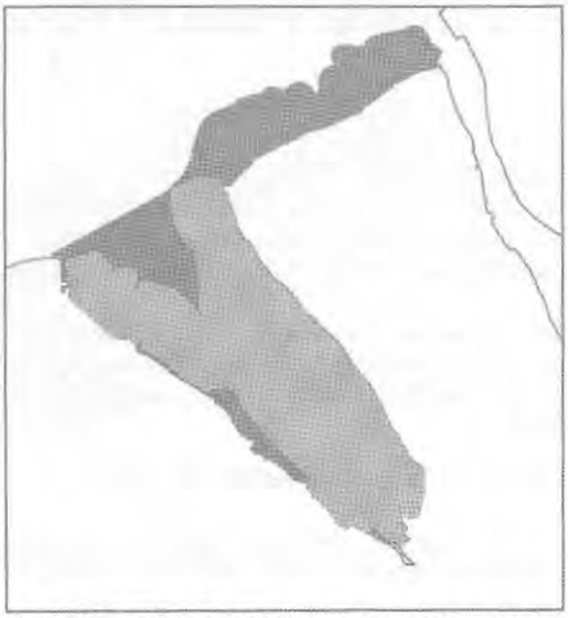


*Figure 4.52.2: **LTC and SPA boundaries, with overlap, at the Dee Estuary***

Shore are known to roost, at least in part, across the water at the Alt Estuary (Mitchell *et al.* 1988).

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1996–97 are presented for 17 of the 18 species of principal interest listed above. For clarity, smaller dots are used to display the distributions of a number of these species. Furthermore, maps for Teal, Oystercatcher, Knot, Dunlin and Bar-tailed Godwit are displayed at a scale of one dot representing five birds. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.52.3). Only a single Great Crested Grebe (not mapped) was recorded at low tide at the Dee during the the 1996–97 winter, compared to over 200 on Core Counts, and the species was presumably far offshore at low tide.

The Dee Estuary supports very large numbers of waterbirds, apparent even when the totals map is displayed at a scale of one dot for every 20 birds. However, by far the highest overall bird density is at Mockbeggar Wharf on the North Wirral Shore. The weighted totals map also picks out this section, but further highlights parts of the main Dee Estuary off Flint and along the east shore between Caldy and Heswall; in both of these cases the weighting is strongly driven by Black-tailed Godwits which occur in their highest densities at these two areas. Other species which showed a clear preference for the main Dee Estuary were Shelduck and the four *Anas* ducks. The largest concentrations of the *Anas* species occurred almost exclusively in the inner half of the main estuary, although some Pintail were found towards the mouth along the Welsh shore. Shelducks were more widespread and a few made it round to the North Wirral Shore. Species occurring mostly or entirely along the North Wirral Shore were Grey Plover, Sanderling, Bar-tailed Godwit and Turnstone, the latter species also concentrated at Hilbre Island (although larger numbers were present adjacent to the Dee Estuary LTC site, at the mouth of the Mersey Estuary). Species widely distributed across the whole area were Oystercatcher, Dunlin, Curlew and Redshank. Knot and Lapwing were clumped across the site. Cormorants were only noted in two discrete areas, the inner Dee and off Mockbeggar Wharf.

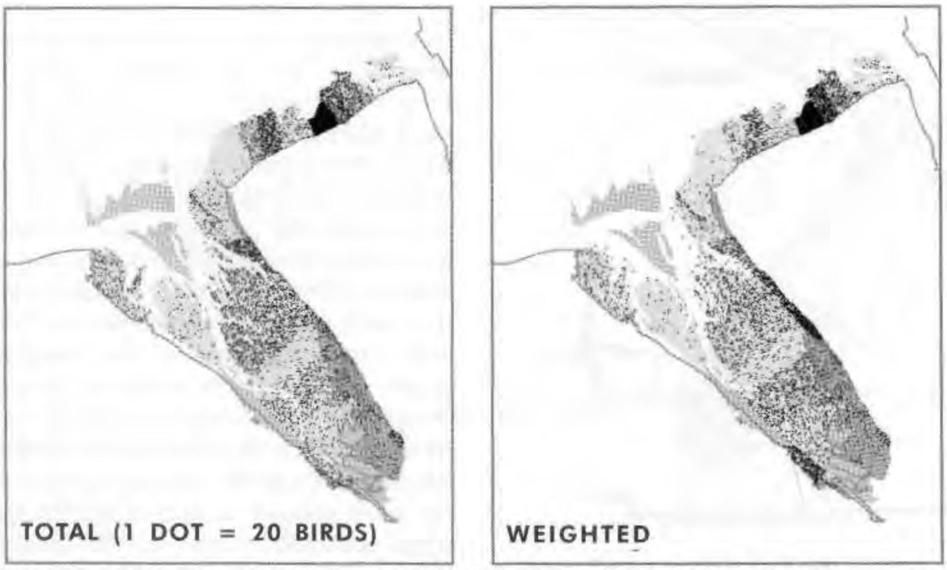


*Figure 4.52.3 (i): **Low tide waterbird distributions recorded at the Dee Estuary, winter 1996–97***

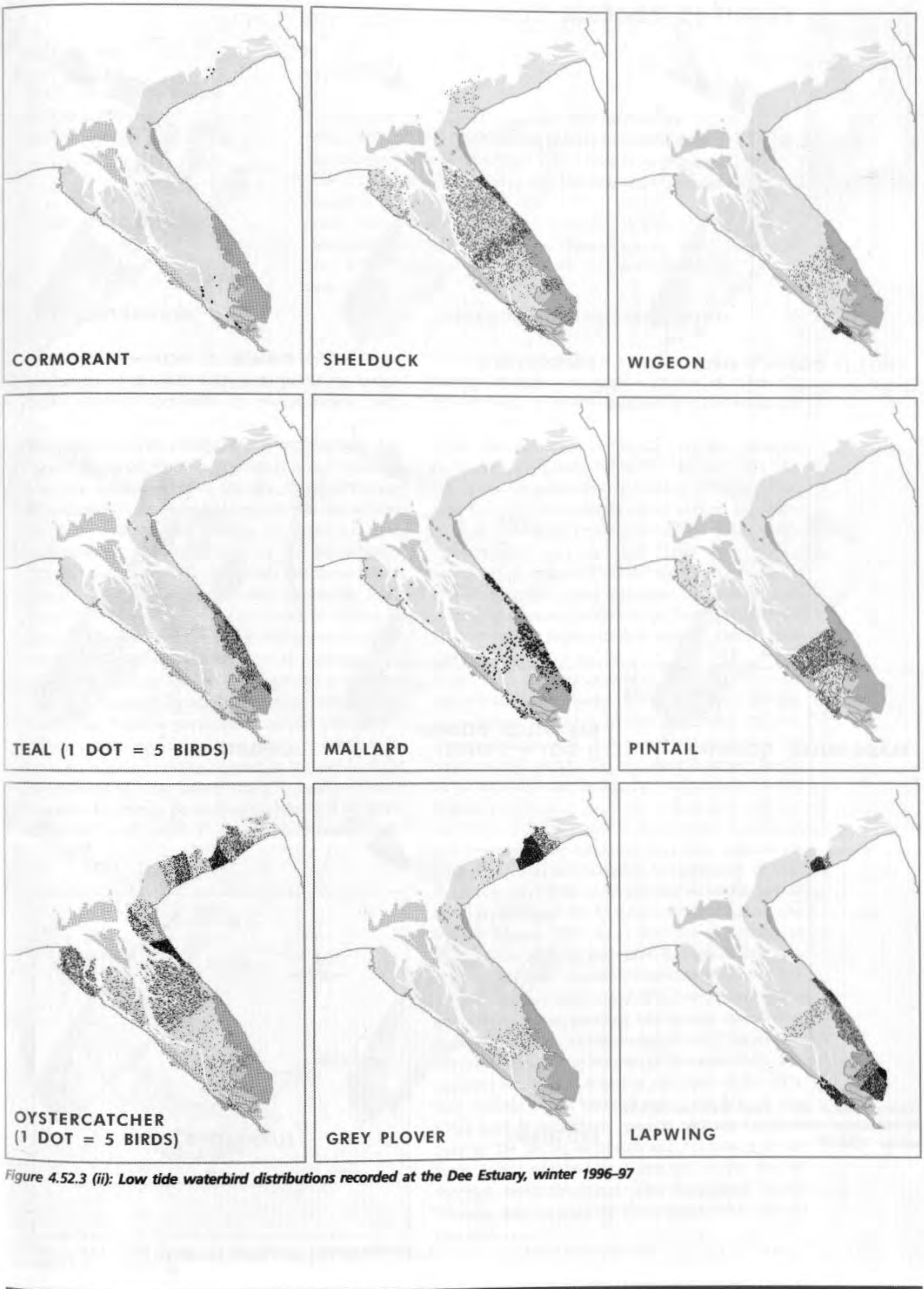


Figure 4.52.3 (ii): Low tide waterbird distributions recorded at the Dee Estuary, winter 1996–97

Figure 4.52.3 (iii): ***Low tide waterbird distributions recorded at the Dee Estuary, winter 1996–97***

4.53 MERSEY ESTUARY

LTC site code:	BM
Centre grid:	SJ4180
JNCC estuarine review site:	35
Habitat zonation:	2520 ha intertidal, 1074 ha subtidal, 882 ha nontidal
Statutory status:	Mersey Estuary SPA (UK9005131), Mersey Estuary Ramsar (7UK096) [Also Mersey Narrows and North Wirral Foreshore proposed SPA (UK9013011), Mersey Narrows and North Wirral Foreshore proposed Ramsar (7UK153)]
Winter waterbird interest:	Great Crested Grebe, Cormorant, Shelduck, Wigeon, Teal, Pintail, Oystercatcher, Golden Plover, Grey Plover, Lapwing, Knot, Dunlin, Black-tailed Godwit, Curlew, Redshank, Turnstone, Waterbird assemblage

SITE DESCRIPTION

The Mersey is one of the most heavily developed estuaries in the UK (although pollution levels have lessened somewhat in recent years), with the outer sections of the estuary in particular infringed upon by Liverpool and Birkenhead. The large towns of Widnes, Runcorn and Ellesmere Port are also adjacent to the site. Extensive areas of saltmarsh on the southern shore, as well as the Ince and Stanlow Banks, are protected from disturbance to some degree by the Manchester Ship Canal. As well as the usual problems which occur on heavily industrialised estuaries, such as pollution and disturbance from a variety of sources, a more specific issue which could be detrimental to wintering waterbirds is a proposal for a second runway for Liverpool Airport to be built on land claimed from the estuary. Additionally, there has been a proposal in recent years for a Mersey barrage to generate power from tidal energy, which could be revived in the event of the economics of tidal power being considered more realistic by energy producers (Rehfisch *et al.* 1991, Holloway *et al.* 1992, T. Parker pers.comm.).

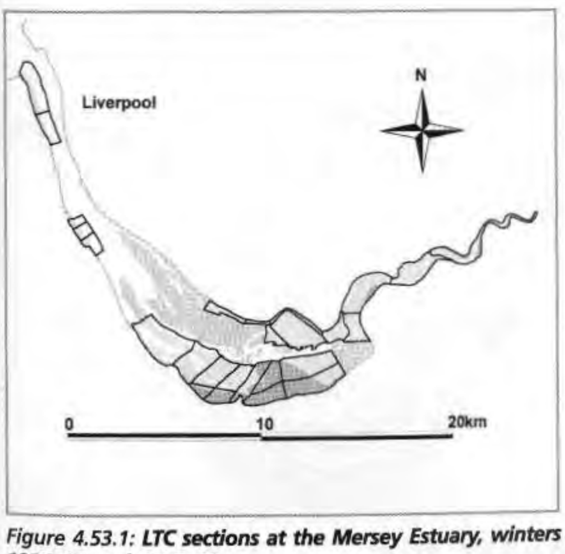


Figure 4.53.1: LTC sections at the Mersey Estuary, winters 1996–97 and 1997–98

COVERAGE AND INTERPRETATION

The Mersey Estuary was counted for the scheme during the three consecutive winters of 1996–97, 1997–98 and 1998–99, data being returned for all months except November 1996. Figure 4.53.1 shows the positions of the 28 sections counted for the survey during 1996–97 and 1997–98. The two count sections downstream of Runcorn Gap were lumped into a single count section in 1998–99. Note that large areas of sandflats in the outer estuary were not counted. This was largely because the counters considered them to be of little interest for birds, but some areas were also difficult to access. Another important point is that the Mersey is a highly mobile estuary and its true shape changes from year to year. The maps depicted are an approximation based on OS maps last revised in the early 1990s and count section boundaries provided by the counters did not always match well. Thus, especially along the middle south part of the site, distributions should be interpreted as being approximate to some degree.

The overlap of the LTC site with SPA boundaries (Figure 4.53.2) is currently complicated in that there are two SPAs involved, one of which is still at the proposed SPA stage. Additionally, the Mersey Estuary SPA is, at the time of writing, in the process of being extended to include the New Ferry SSSI (not shown). Considering only the Mersey Estuary SPA, the LTCs cover most of the important feeding grounds but do not include the outer sandbanks, as discussed above. Conversely, the inner estuary upstream of Runcorn Gap was counted for the LTCs but is not part of the SPA. The mouth of the estuary was counted for the LTCs and is equivalent to the Mersey Narrows part of the pSPA, although the boundary of the latter is not depicted as it has not, at the time of writing, been finalised. The boundary of the Ramsar site is entirely coincident with that of the SPA.

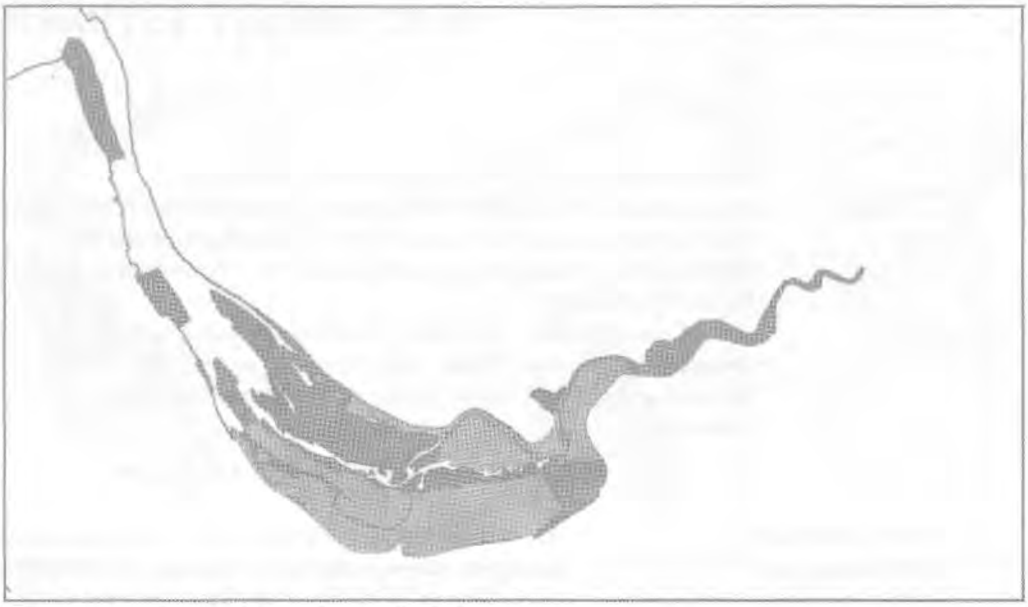


*Figure 4.53.2: **LTC and SPA boundaries, with overlap, at the Mersey Estuary***

Significant inter-site movements do occur on a daily basis, with many of the birds feeding at the mouth of the Mersey roosting on the Alt (including Seaforth NR), although an increasing number of Turnstones, at least, have begun to roost at Egremont itself (C. Clee pers. comm.). Similarly, intertidal habitat at Egremont is contiguous with that on the North Wirral Shore, treated to date by the LTCs as part of the Dee. It is now established that there is also interchange of birds between the main part of the Mersey Estuary and the Dee (T. Parker pers. comm.). Additionally, tidal movements occur between the Mersey and adjacent areas such as Frodsham sludge beds, Fiddlers Ferry power station lagoons and nearby farmland.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1998–99 are presented for all of the 16 species of principal interest listed above. For clarity, smaller dots are used to display the distributions of many of these species. Furthermore, maps for Lapwing, Knot and Dunlin are displayed at a scale of one dot representing five birds. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.53.3).

The totals map shows that overall bird density was at its highest around Stanlow Banks and at New Ferry, with the weighted total map particularly emphasising the latter area as well as the Mersey Narrows. Dunlin were clearly the dominant species over much of the middle estuary with Wigeon and Teal numbers around the southern saltmarshes also very high. Lapwings were also common in the middle estuary but were clearly the dominant species in the inner reaches, along with smaller numbers of Golden Plovers. The middle parts of the site were also important for Shelducks, Knot, Grey Plovers, Black-tailed Godwits, Curlews and Redshanks. Further downstream, the New Ferry shore was of critical importance to Pintail as well as holding high densities of Shelducks, Black-tailed Godwits, Oystercatchers, Knot and Redshank. Finally, the mouth of the estuary was the key area for Turnstones with high densities also of Oystercatchers and Redshanks. Great Crested Grebes and Cormorants were relatively scarce at low tide.

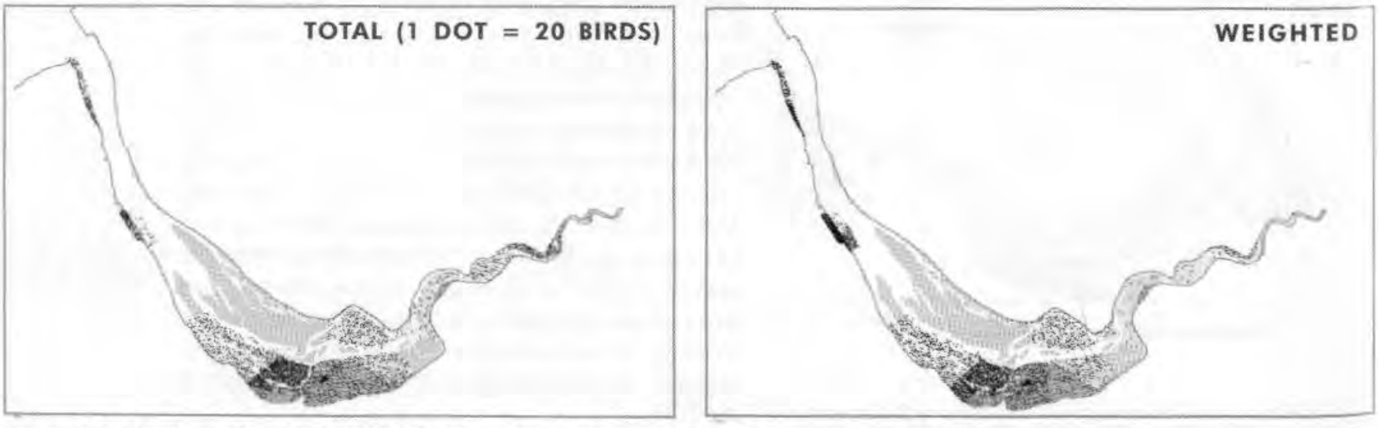


*Figure 4.53.3 (i): **Low tide waterbird distributions recorded at the Mersey Estuary, winter 1998–99***

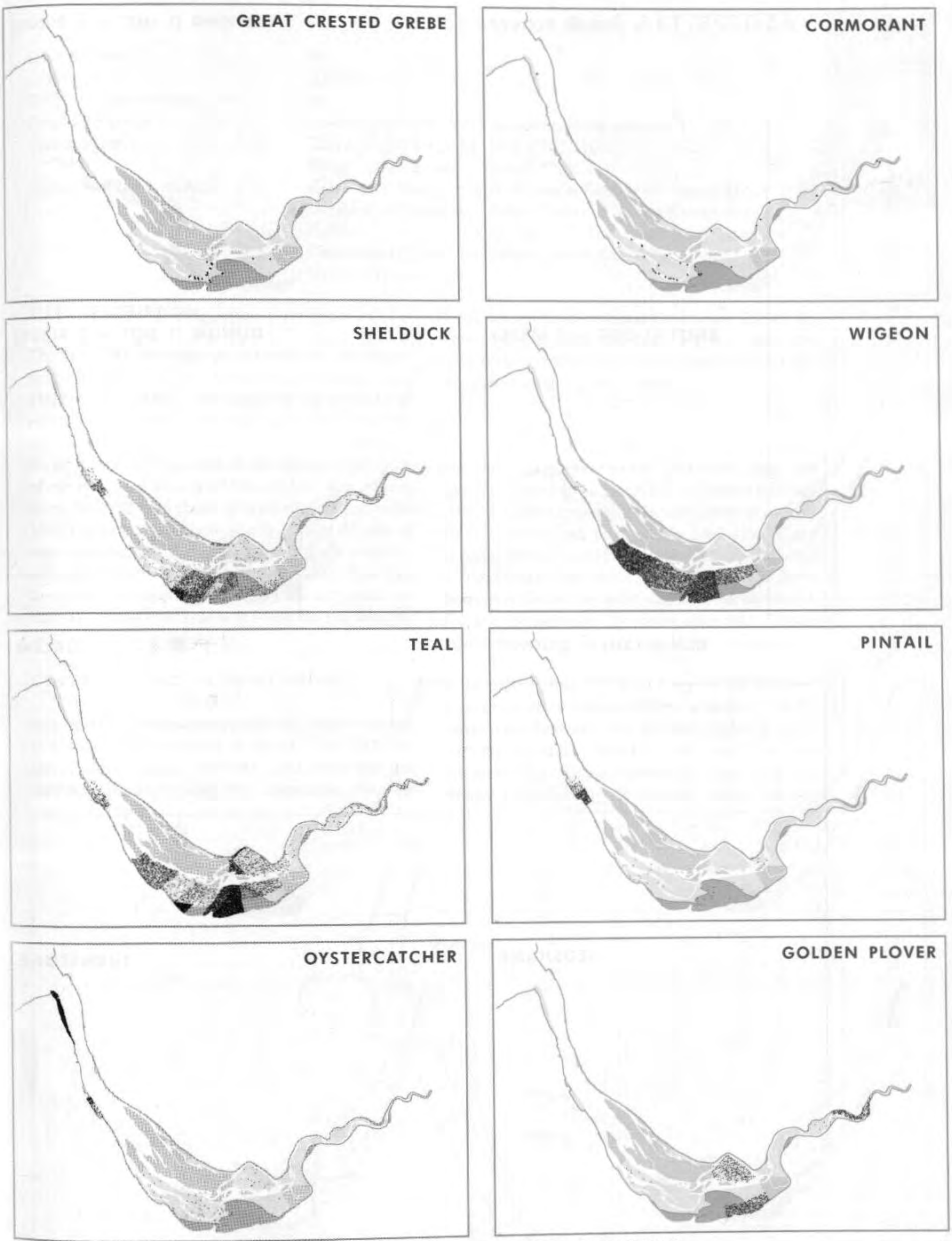


*Figure 4.53.3 (ii): **Low tide waterbird distributions recorded at the Mersey Estuary, winter 1998–99***

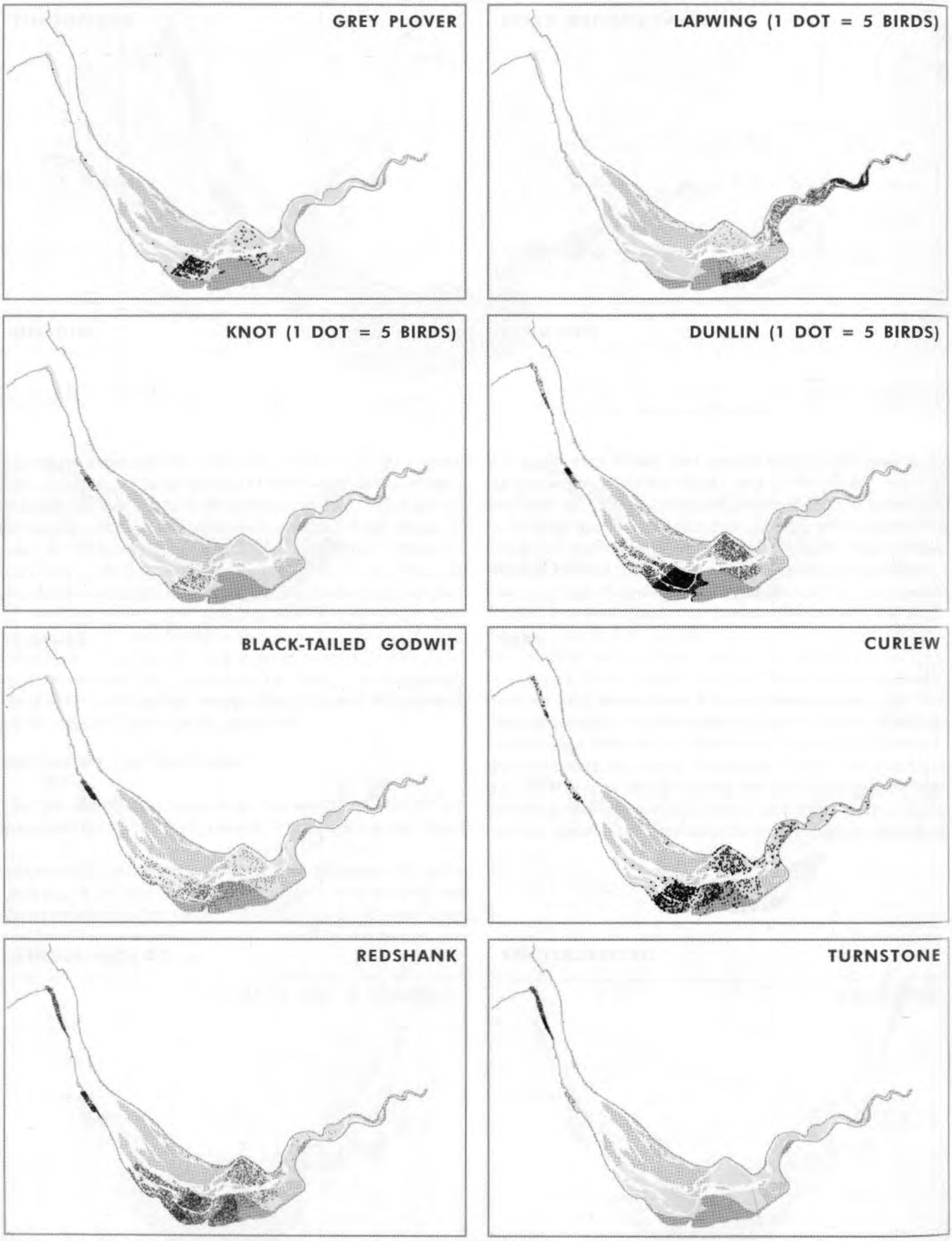


Figure 4.53.3 (iii): Low tide waterbird distributions recorded at the Mersey Estuary, winter 1998–99

4.54 ALT ESTUARY

LTC site code: BA
Centre grid: SD2903
JNCC estuarine review site: 36
Habitat zonation: 1646 ha intertidal, 997 ha subtidal, 0 ha nontidal
Statutory status: Ribble and Alt Estuaries SPA (UK9005103), Ribble and Alt Estuaries Ramsar (7UK083)
Winter waterbird interest: Cormorant, Bewick's Swan, Whooper Swan, Pink-footed Goose, Shelduck, Wigeon, Teal, Pintail, Common Scoter, Oystercatcher, Golden Plover, Grey Plover, Lapwing, Knot, Sanderling, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Waterbird Assemblage

SITE DESCRIPTION

The River Alt emerges as a creek on the shoreline of Liverpool Bay between the Ribble and Mersey Estuaries. The majority of the site is sandy in character, although somewhat muddier around the river mouth where there are also some rocky areas. A large area of saltmarsh used to be present at the mouth of the Alt but has mostly been lost to land-claim, principally in the early 19th century. The whole site is backed by one of the most important dune systems in the country, although much of the southern part of this has been lost to housing and dock development at Crosby. Human activities are few on the estuary and are not intensive.

COVERAGE AND INTERPRETATION

The Alt Estuary was covered by the scheme during the three consecutive winters 1996–97 (no November count), 1997–98 and 1998–99 (no January count). Figure 4.54.1 shows the positions of the 16 sections counted for the survey which were the same during each winter, with the exception that the northernmost section was not counted during the first winter.

Figure 4.54.2 shows how the Alt Estuary is a relatively small part of the Ribble and Alt Estuaries SPA. Any assessment at the SPA level must also take into account the results of the Ribble Estuary LTCs. A further important feature, however, is that the southernmost part of the LTC site is not included within the SPA boundary. The boundaries of the Ramsar site are coincident with those of the SPA so far as the intertidal zone is concerned, but the former also includes an area of dune habitat from the River Alt north to Southport.

When interpreting LTC data from the Alt Estuary, it is crucial to consider the effects of daily movements between the Alt and adjacent sites, not only the Ribble Estuary to the north but also the North Wirral Shore and the mouth of the Mersey Estuary. The numbers of birds roosting

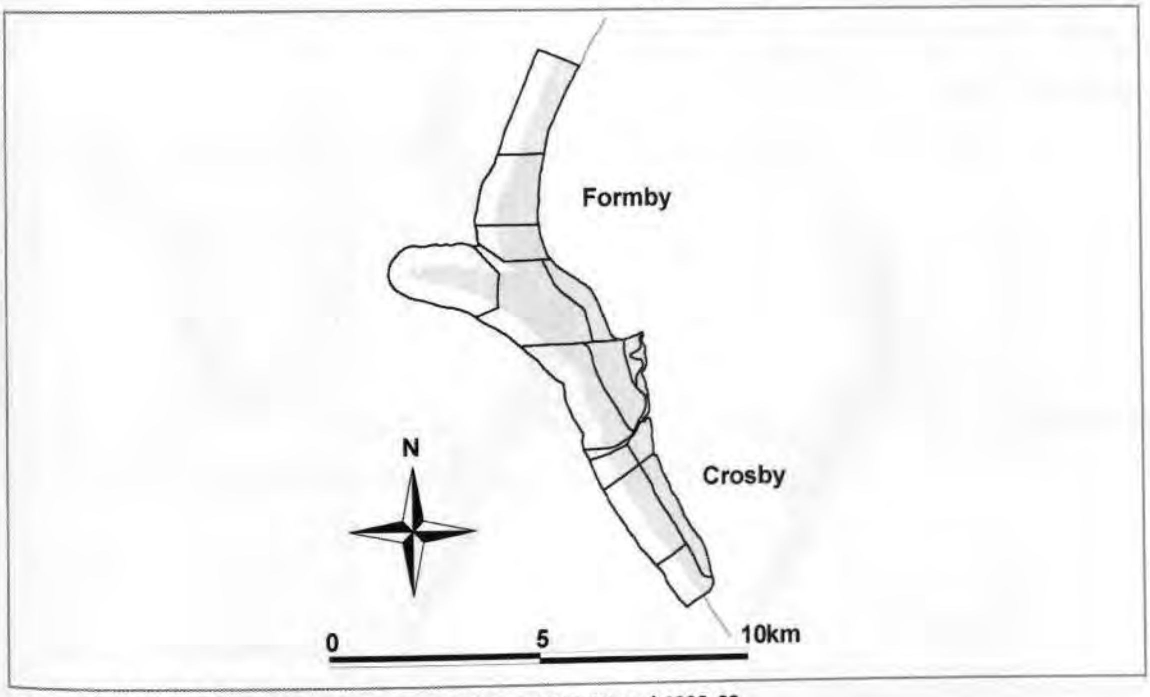


Figure 4.54.1: LTC sections at the Alt Estuary, winters 1997–98 and 1998–99

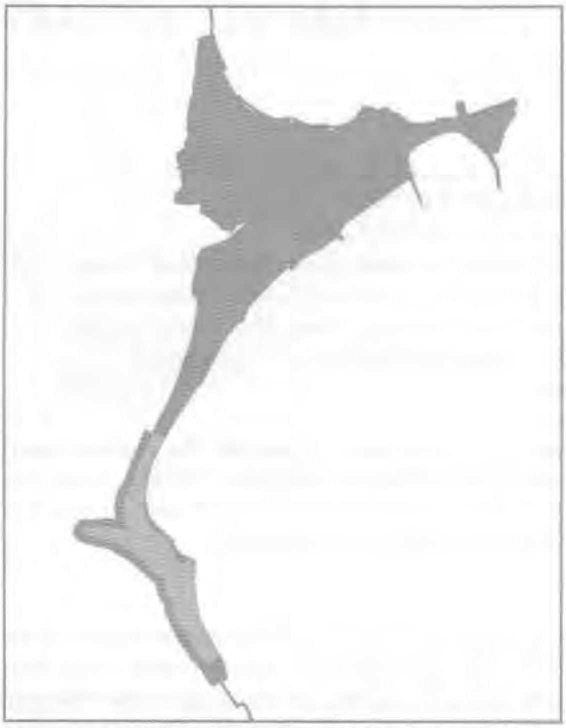


Figure 4.54.2: LTC and SPA boundaries, with overlap, at the Alt Estuary

at the Alt increased greatly following increased disturbance of previous roost sites in the outer parts of the Dee Estuary and North Wirral Shore, but birds still returned to those areas to feed (Mitchell et al. 1988). Movements may also occur between the site and inland (e.g. for Pink-footed Geese) or further offshore (e.g. Common Scoters).

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1997–98 are presented for 13 of the 20 species of principal interest listed above. For clarity, smaller dots are used to display the distribution of Dunlin. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.54.3). Of the remaining species, very small numbers of Pink-footed Geese were recorded at low tide on several occasions but there were no records of Bewick's Swan, Whooper Swan, Wigeon, Teal, Pintail or Black-tailed Godwit; these species occur to the north on the Ribble Estuary part of the SPA.

The totals map suggests that the highest overall bird densities were found along the channel of the River Alt and at its mouth. The weighted totals map revealed little difference. Notably lower densities were recorded on the upshore sections where the beach had been split into upshore and downshore. Additionally, the long spit of Taylor's Bank was occupied mostly by Cormorants (and some of the gulls) with very few waders present, although it is possible that the greater distance involved may have hampered viewing of smaller species. Species occurring in their highest densities along the channel of the Alt and its immediate surroundings were Shelducks, Lapwings and Golden Plovers. Curlews and Redshanks also occurred at higher densities closer to the channel. Other species widespread on the lower shore which nevertheless occurred at high densities near the Alt mouth were Sanderlings, Grey Plovers, Dunlin and Bar-tailed Godwits. Oystercatchers and Knot were less attracted by the river mouth. Common Scoters were noted only offshore from the northern part of the site; numbers noted at low tide were low compared to those known to be present in Liverpool Bay.

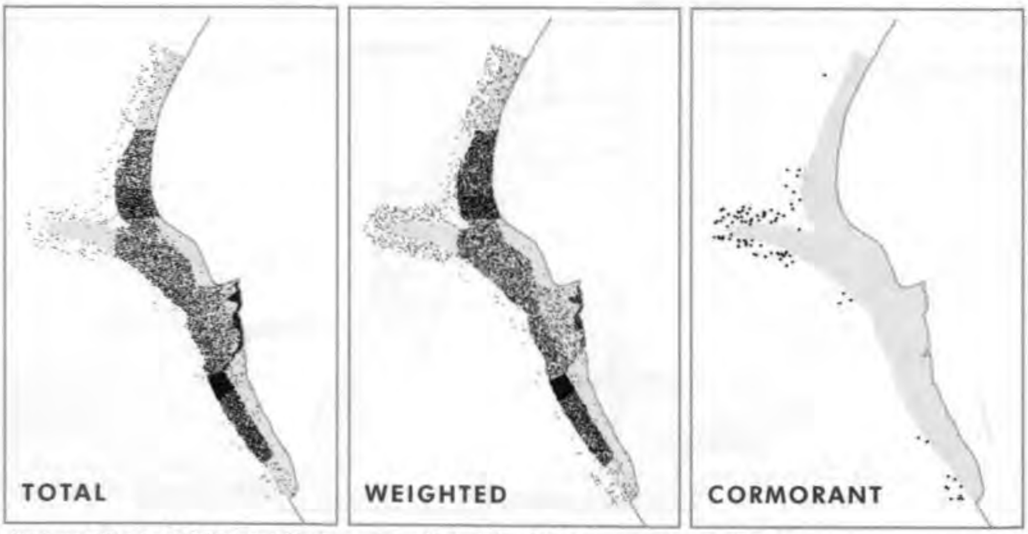


Figure 4.54.3 (i): Low tide waterbird distributions recorded at the Alt Estuary, winter 1997–98

*Figure 4.54.3 (ii): **Low tide waterbird distributions recorded at the Alt Estuary, winter 1997–98***

4.55 RIBBLE ESTUARY

LTC site code:	BR
Centre grid:	SD3424
JNCC estuarine review site:	37
Habitat zonation:	7261 ha intertidal, 1722 ha subtidal, 428 ha nontidal
Statutory status:	Ribble and Alt Estuaries SPA (UK9005103), Ribble and Alt Estuaries Ramsar (7UK083)
Winter waterbird interest:	Cormorant, Bewick's Swan, Whooper Swan, Pink-footed Goose, Shelduck, Wigeon, Teal, Pintail, Common Scoter, Oystercatcher, Golden Plover, Grey Plover, Lapwing, Knot, Sanderling, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Waterbird assemblage

SITE DESCRIPTION

The Ribble Estuary comprises a long, relatively narrow inner estuary, which is flanked by very large areas of saltmarsh, and a huge area of intertidal flats as the outer regions of the estuary. These flats run south as a wide, sandy shore, past Southport and merge into the area treated by the LTCs as the Alt Estuary. On the northern side the area extends to the southern outskirts of Blackpool. Current issues concerning the Ribble include the level of sand winning which is carried out, and the use of vehicles on the flats by fishermen. More general disturbance comes from recreational use, wildfowlers and the presence of the Warton aerodrome on the north shore. However, disturbance levels are generally low and development pressures are currently light, much of the area being a National Nature Reserve (M. Gee, R. Lambert pers. comm.).

COVERAGE AND INTERPRETATION

The Ribble Estuary was covered for the scheme during the 1997–98 winter, with data returned for all four months. Figure 4.55.1 shows the positions of the ten sections counted for the survey. As one of the largest sites covered by the LTCs, with vast expanses of intertidal habitat, there was a very real issue of safety and a finer-level subdivision of the estuary was unfortunately not possible at this time.

Figure 4.55.2 shows the LTC and SPA boundaries. The major difference is clearly that the SPA also includes the Alt Estuary. Further areas of SPA not counted were extensive areas of saltmarshes at Warton Bank, Hutton Marsh and around Banks Marsh, difficult to access safely by counters. All of the Ribble counted for the LTCs was included within the SPA. The boundaries of the Ramsar site are mostly coincident with those of the SPA around the Ribble Estuary, although there are some additional areas of dune habitat south of Southport also included within the Ramsar site.

The amount of daily interchange of birds between the Ribble and other estuaries to the south is unknown but clearly must occur to some degree at the boundary with the Alt. Some dispersal north along Blackpool beach also doubtless occurs. More

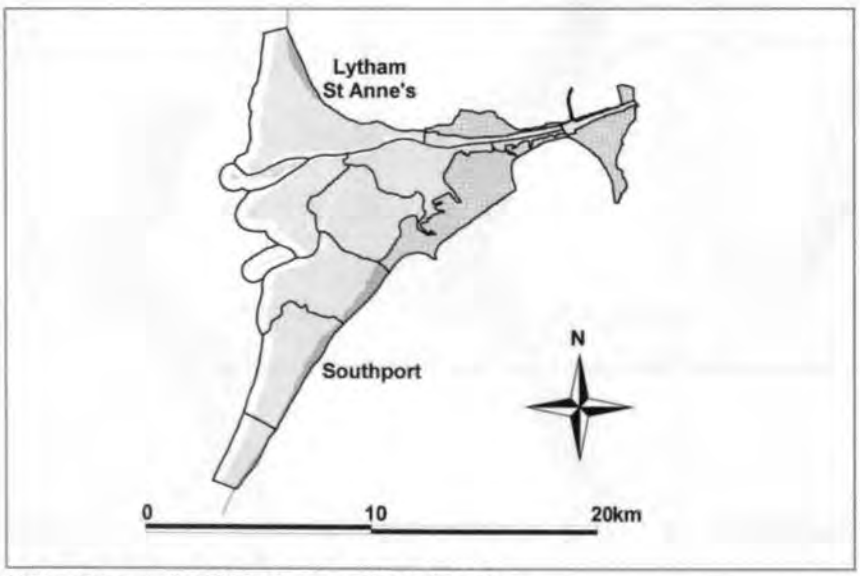


*Figure 4.55.1: **LTC sections at the Ribble Estuary, winter 1997–98***

Figure 4.55.2: LTC and SPA boundaries, with overlap, at the Ribble Estuary

notably, anecdotal evidence suggests that there may even be regular interchange of birds between the Ribble and Morecambe Bay. However, since even within the site the regular tidal movements of birds can involve long flight distances, it is difficult to be certain how far some birds are moving. In addition, Pink-footed Geese and the winter swans make use of a wide variety of sites in south-west Lancashire, notably Martin Mere. Other wildfowl species also make use of surrounding areas, but mostly at night, making the extent of the movements difficult to determine.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1997–98 are presented for 19 of the 20 species of principal interest listed above. For clarity, smaller dots are used to display the distributions of many of these species. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.55.3). Common Scoter, the only species of interest not mapped, occurs offshore in Liverpool Bay, mostly off the Alt Estuary.

The totals map (and similar weighted totals map) suggests that the highest overall bird densities were found on Foulnaze, Southport Sands and the inner estuary. However, even more than at other sites, the mapped distributions at the Ribble are extremely approximate given the very large size of most of the sections. Feeding flocks were clumped within these sections, often (but not always) along channels or the lower shore, hence discussion can be at the broadest scale only. Therefore, the apparent importance of Foulnaze compared to Marshside Sands, say, may hide a more complex pattern of high and low density usage areas at a finer scale. With this in mind, it may be safest to restrict comments to the following. The inner estuary (where narrow and flanked by saltmarshes) was the principal area for Bewick's and Whooper Swans, Pink-footed Geese, Shelducks, Teal, Golden Plovers and Lapwings. In addition, the two very widespread species Redshank and Curlew appeared to occur on the inner river in higher densities. Wigeon were widespread but the highest concentrations appeared to be at Banks Sands, with Pintail mostly found on Salter's Bank; these two species roost on the estuary during the daylight hours and feed inland at night. Sanderlings also occurred in locally high densities at Salter's Bank as well as Ainsdale/Birkdale Sands. Black-tailed Godwits were mostly at Ainsdale Sands and on the inner estuary. A number of waders (Oystercatcher, Grey Plover, Knot, Dunlin, Bar-tailed Godwit) were found in their highest densities on the outer parts of the estuary, mostly showing a higher apparent density at Foulnaze, but Grey Plovers more so on Southport Sands.

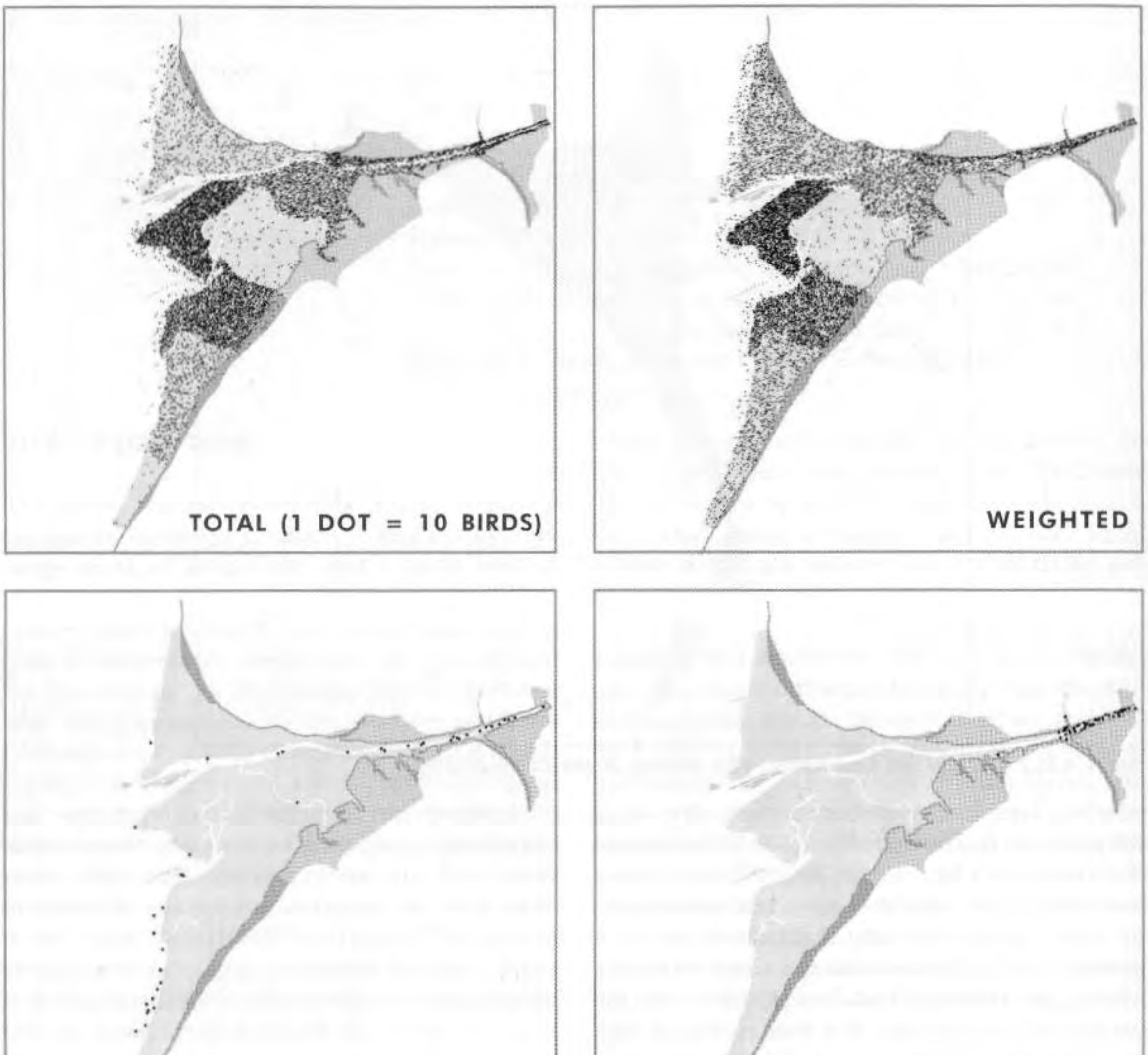


Figure 4.55.3 (i): Low tide waterbird distributions recorded at the Ribble Estuary, winter 1997–98

Figure 4.55.3 (ii): ***Low tide waterbird distributions recorded at the Ribble Estuary, winter 1997–98***

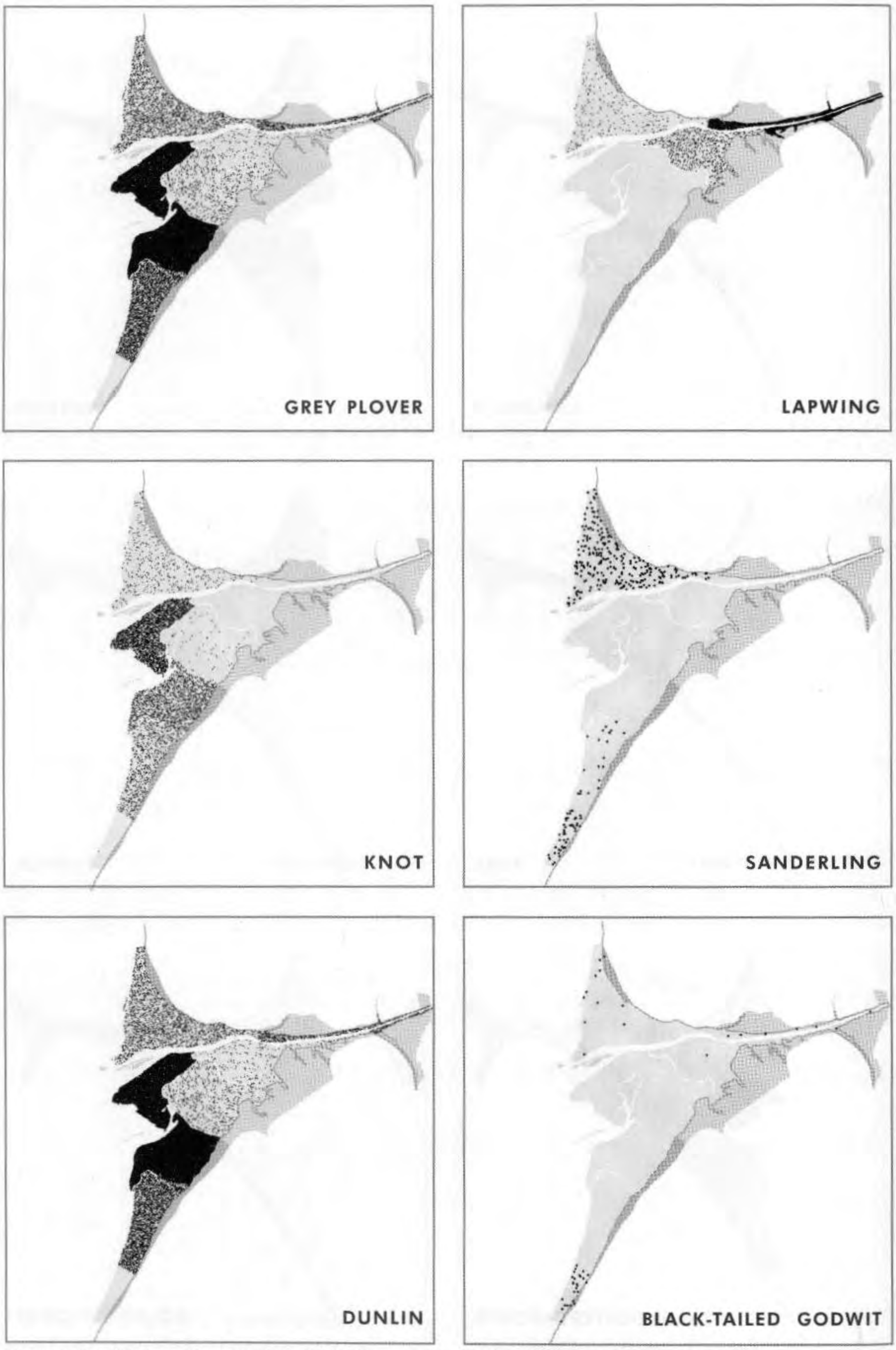


Figure 4.55.3 (iii): ***Low tide waterbird distributions recorded at the Ribble Estuary, winter 1997–98***

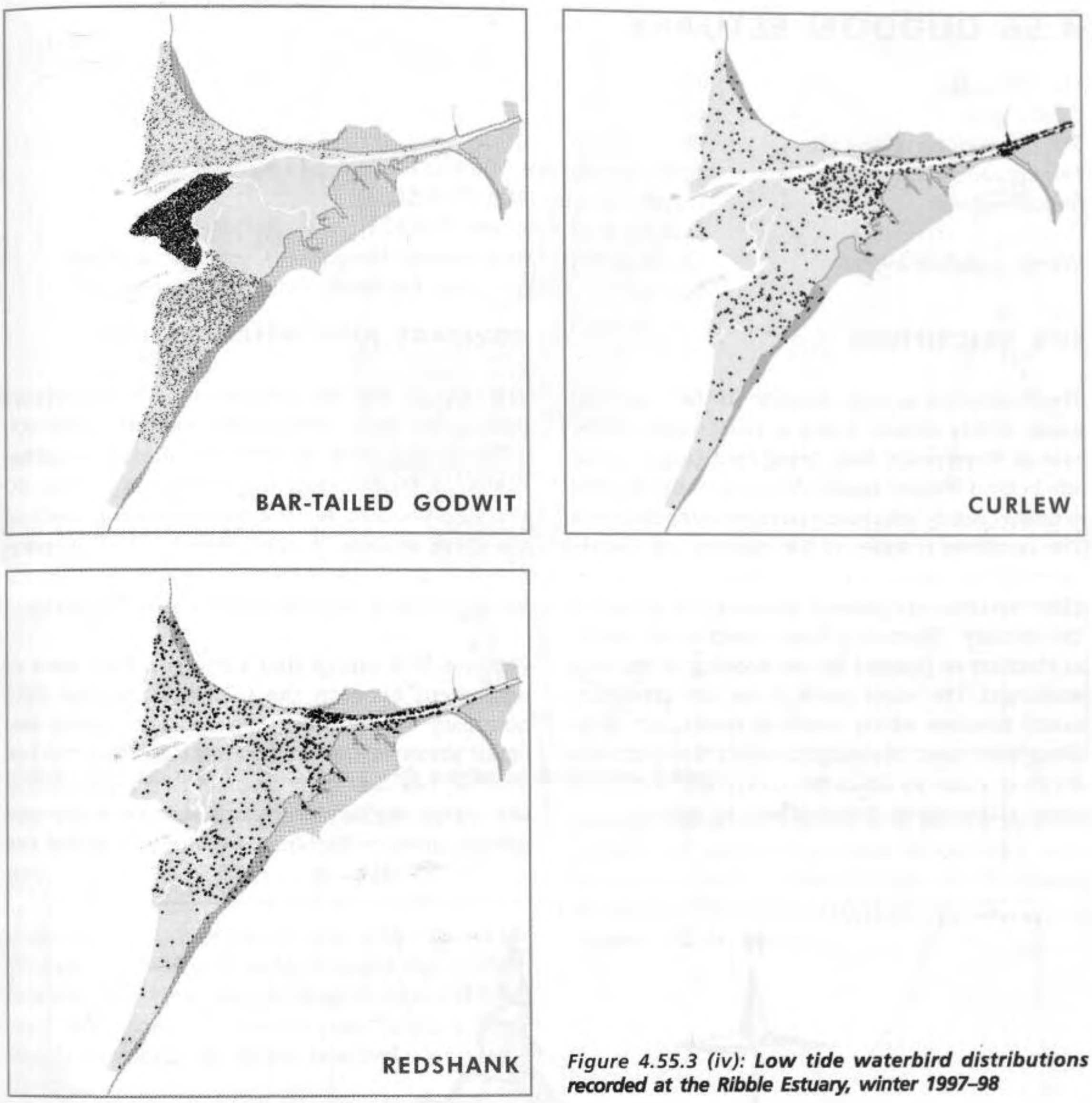


Figure 4.55.3 (iv): Low tide waterbird distributions recorded at the Ribble Estuary, winter 1997–98

4.56 DUDDON ESTUARY

LTC site code:	BD
Centre grid:	SD1977
JNCC estuarine review site:	39
Habitat zonation:	3589 ha intertidal, 1024 ha subtidal, 541 ha nontidal
Statutory status:	Duddon Estuary SPA (UK9005031), Duddon Estuary Ramsar (7UK121)
Winter waterbird interest:	Shelduck, Pintail, Red-breasted Merganser, Oystercatcher, Knot, Sanderling, Dunlin, Curlew, Redshank, Waterbird assemblage

SITE DESCRIPTION

The Duddon is a large estuary on the Cumbrian coast which almost forms a northwards extension of Morecambe Bay, being contiguous to that site behind Walney Island. At low tide, the Duddon is mostly sandy with many narrow water channels. The northern reaches of the estuary are flanked by extensive areas of saltmarsh whilst important dune systems are present towards the mouth of the estuary. There is a large, man-made lagoon at Hodbarrow (formed by the flooding of old mine workings). The outer parts of the site grade into sandy beaches which continue north and south along the coast. Although most of the estuarine shore is rural in character, there are industrial areas at Barrow-in-Furness and at Millom.

COVERAGE AND INTERPRETATION

The Duddon Estuary was counted for the scheme during the three consecutive winters 1992–93, 1993–94 and 1994–95, with no missing months. Figure 4.56.1 shows the positions of the 40 sections counted for the survey during each of the three winters. A short continuation of non-counted shoreline extending north and south along the coast is illustrated in grey for clarity.

Figure 4.56.2 shows that there is a high level of agreement between the LTC site and the SPA boundary on the inner estuary, with only a few small areas of nontidal habitat omitted by the scheme, but that large areas of SPA surrounding the outer estuary were not surveyed for the counts, notably the outer beach and some of the

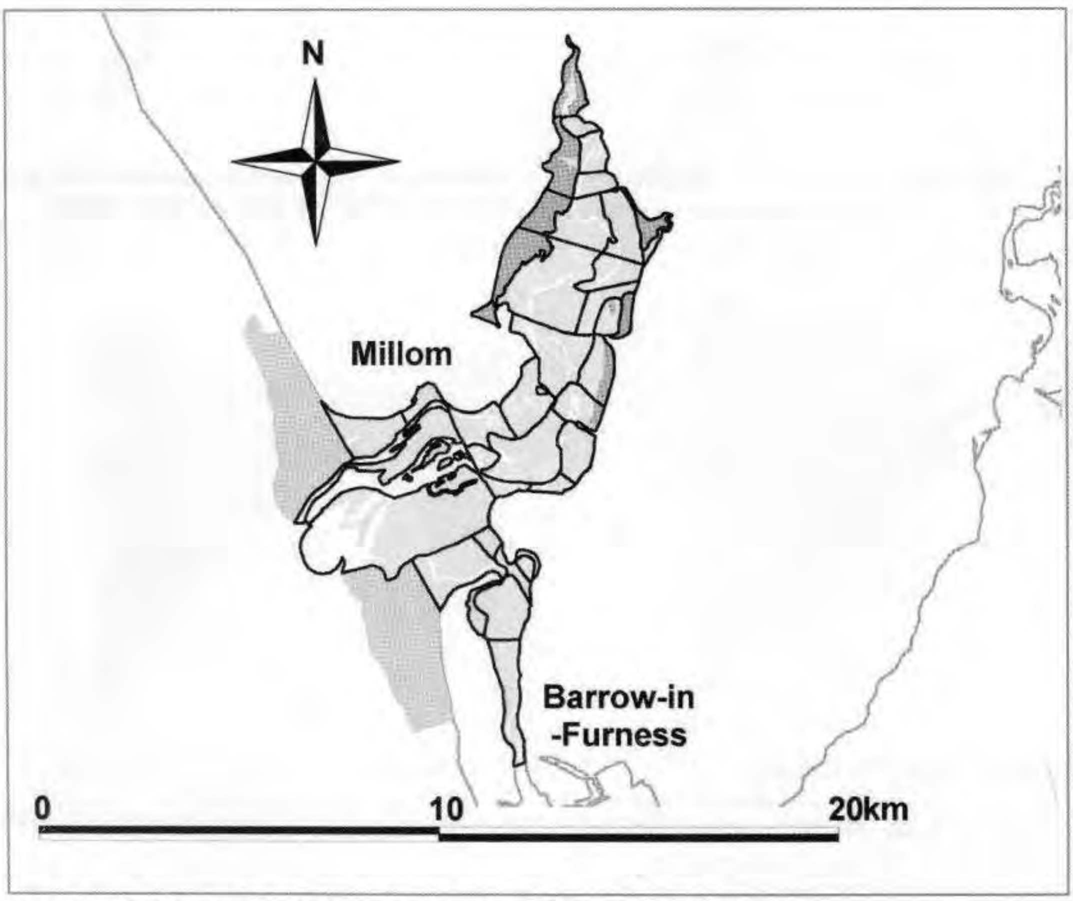


Figure 4.56.1: LTC sections at the Duddon Estuary, winters 1992–93 to 1994–95

Figure 4.56.2: LTC and SPA boundaries, with overlap, at the Duddon Estuary

surrounding dune systems. The Ramsar site boundary is entirely coincident with that of the SPA.

A certain amount of interchange with birds in the Walney Channel area of Morecambe Bay is likely but not thought to involve large numbers of birds on a daily basis (N. Burton pers. comm.). Some dispersal along the outer beaches also seems likely.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1994–95 are presented for all of the nine species of principal interest listed above. For clarity, smaller dots are used to display the distributions of a number of these species. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.56.3).

The totals maps clearly show higher densities of waterbirds on the eastern side of the Duddon and in the channel between the mainland and the north of Walney Island. The weighted totals map accentuates an area off Soutergate occupied by most of the Pintail on the site. Most of the individual species occurred in higher densities on the east side of the site. Pintail, Knot and Sanderling were particularly localised, although it seems likely that many Sanderlings using the SPA were not recorded by the LTCs given the lack of counts of the outer shore areas. Shelducks, Oystercatchers and Dunlin were somewhat more widespread and Curlews and Redshanks were even more widely distributed. Red-breasted Mergansers also occurred widely along the channels of the estuary.

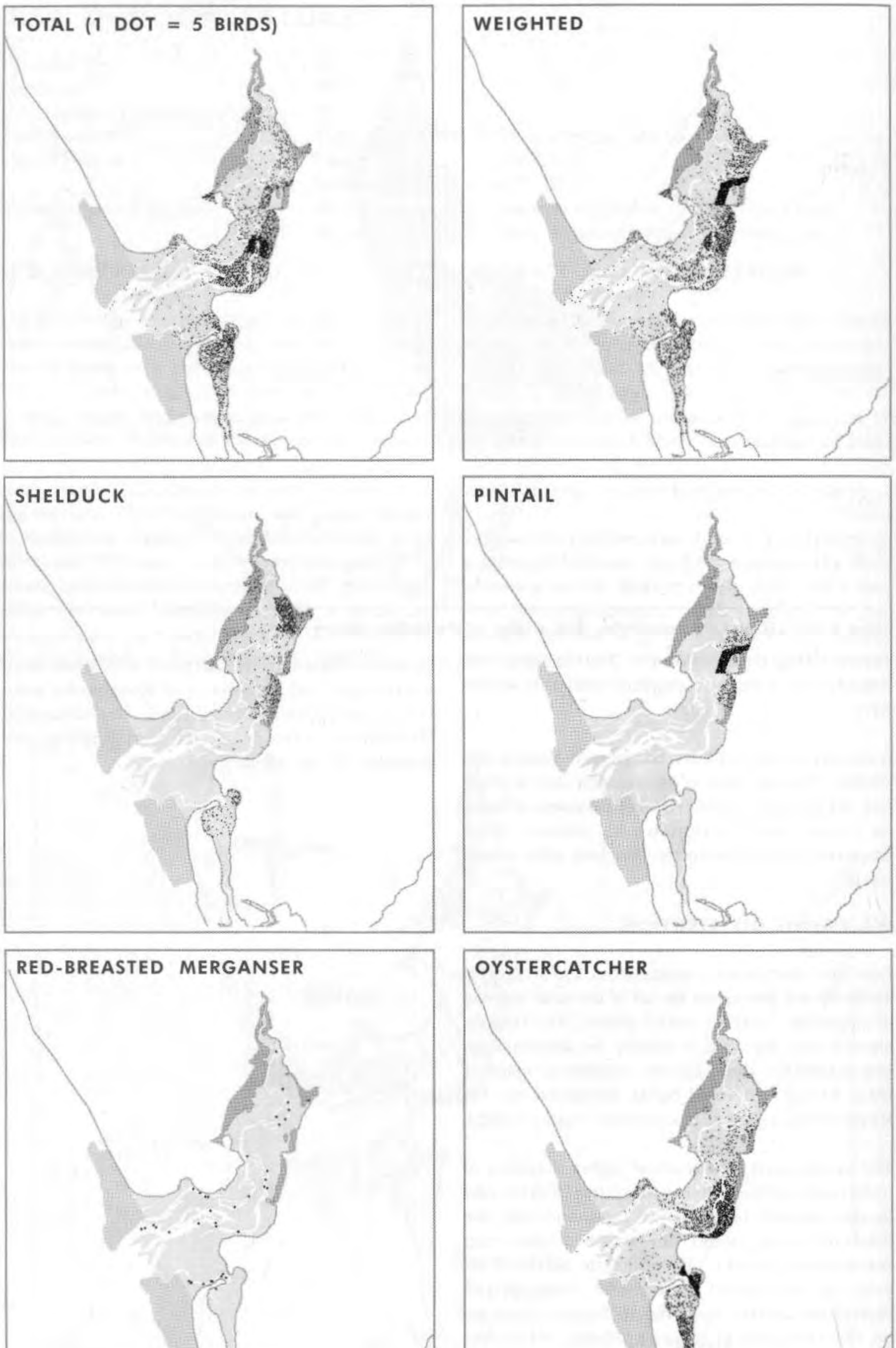


Figure 4.56.3 (i): ***Low tide waterbird distributions recorded at the Duddon Estuary, winter 1994–95***

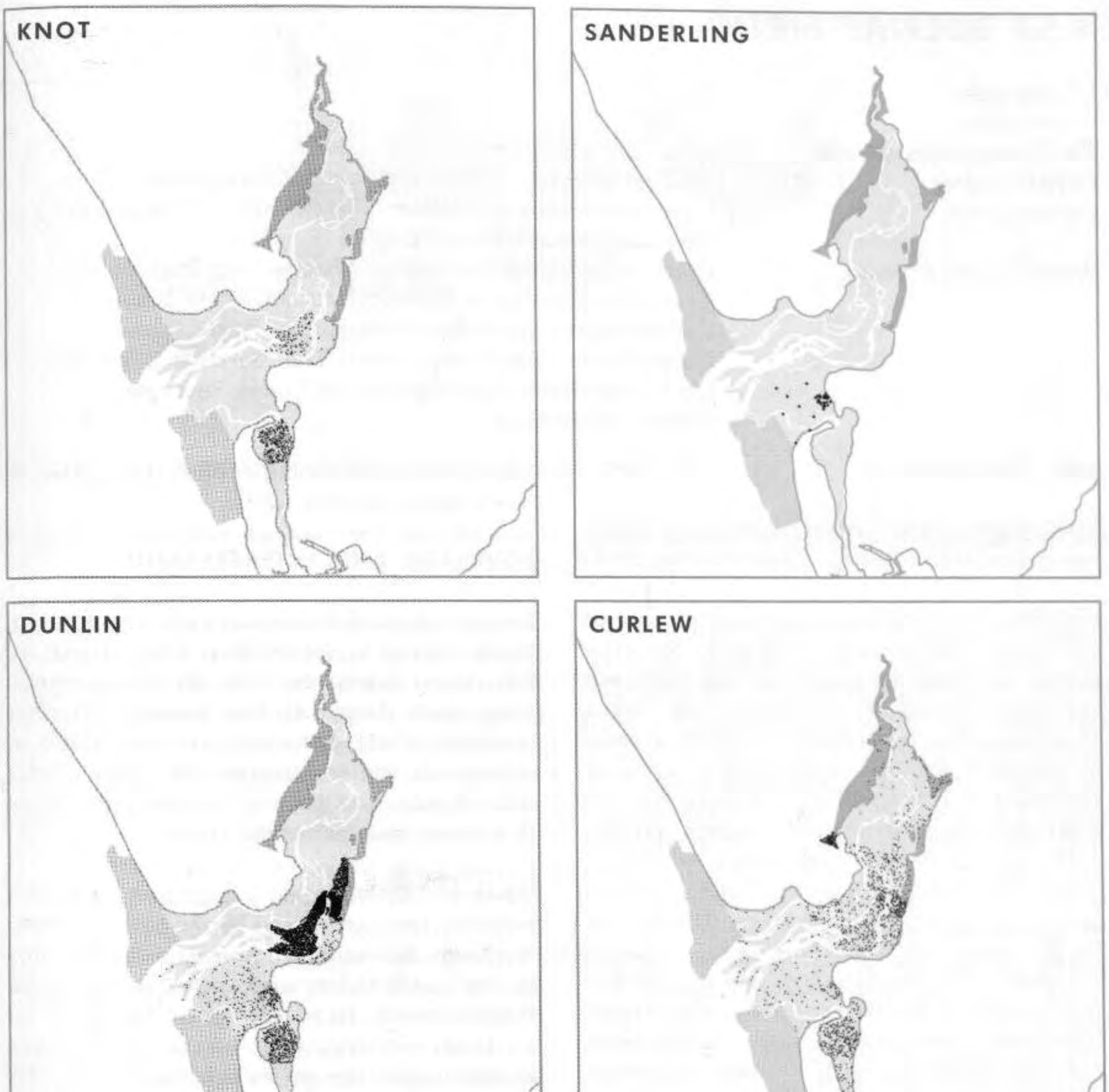


Figure 4.56.3 (ii): Low tide waterbird distributions recorded at the Duddon Estuary, winter 1994–95

4.57 SOLWAY FIRTH

LTC site code:	CV
Centre grid:	NY2762
JNCC estuarine review site:	41
Habitat zonation:	6065 ha intertidal, 1293 ha subtidal, 1155 ha nontidal
Statutory status:	Upper Solway Flats and Marshes SPA (UK9005012), Upper Solway Flats and Marshes Ramsar (7UK058)
Winter waterbird interest:	Great Crested Grebe, Cormorant, Whooper Swan, Pink-footed Goose, Barnacle Goose, Shelduck, Mallard, Pintail, Scaup, Common Scoter, Goldeneye, Oystercatcher, Ringed Plover, Golden Plover, Grey Plover, Lapwing, Knot, Sanderling, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Waterbird assemblage

SITE DESCRIPTION

The Solway Firth, as considered by WeBS, comprises the coastline between Mersehead Sands on the Scottish coast to Workington in Cumbria, but only the inner estuary is considered here. The principal inputs to the inner estuary are from the rivers Esk and Eden, with the rivers Wampool and Waver entering at Moricambe Bay. The majority of the site is sandy in character with several isolated rocky scars, principally at the mouth of Moricambe Bay. The intertidal sediments are highly mobile, particularly in the lower reaches of the estuary. Large areas of saltmarsh are found along the south side of Moricambe Bay, between Glasson and Burgh, and at Rockcliffe. Most of the estuary is surrounded by low-lying farmland and there is little industry in the area. The main issues concerning waterbird conservation on the Solway concern exploitation of natural resources, especially commercial shellfish exploitation. In addition, the issue of wind-powered turbines for electricity generation is one which will need careful consideration in the future (M. Carrier, C. Hartley pers. comm.).

COVERAGE AND INTERPRETATION

The inner parts of the Solway Firth, roughly from Annan around to Skinburness, were covered for the scheme during the 1998–99 winter, counts being made during all four months. (Further coverage of the outer estuary was made in subsequent winters, outside the scope of this atlas.) Figure 4.57.1 shows the positions of the 40 sections counted for the survey.

Figure 4.57.2 shows that a large part of the SPA boundary was not covered by the LTCs in 1998–99, mostly the outer firth from Annan westwards on the north shore and the coast south of Skinburness on the south shore. Additionally, on the inner estuary, some of the saltmarshes adjacent to the site are included within the SPA but were not covered for the counts, notably Rockcliffe Marsh and Burgh Marsh. The boundaries of the Ramsar site are entirely coincident with those of the SPA.

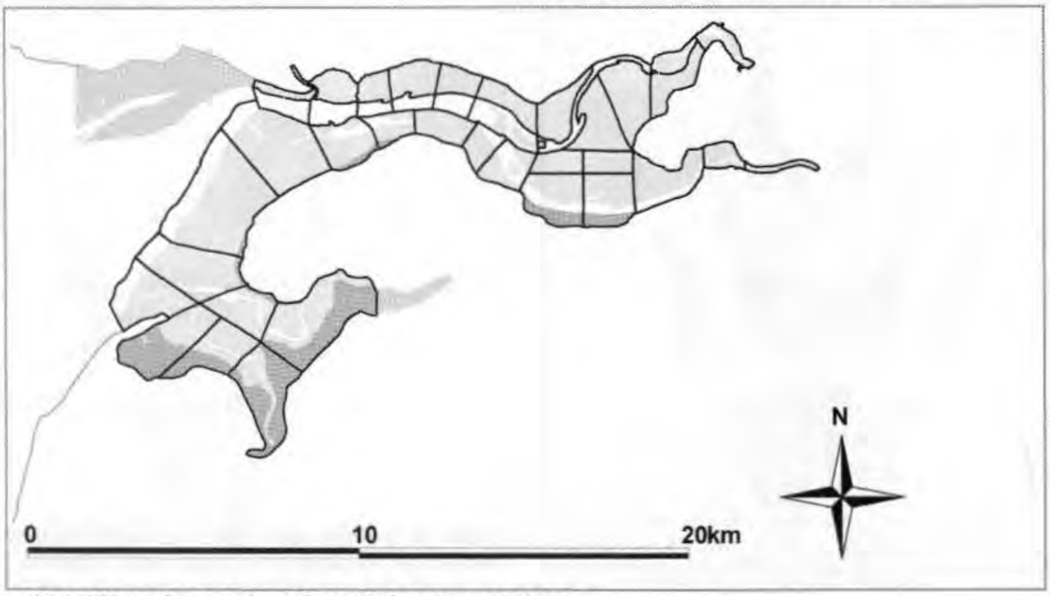


Figure 4.57.1: LTC sections at the Solway Firth, winter 1998–99

*Figure 4.57.2: **LTC** and **SPA** boundaries, with overlap, at the Solway Firth*

The Solway Firth is relatively isolated from other estuaries and thus its waterbirds are fairly self-contained on a day-to-day basis, although large within-site movements can occur. The site grades into non-estuarine shore suitable for wintering waterbirds and some dispersal and interchange does occur. For example, Bar-tailed Godwits roosting within Moricambe Bay are increasingly to be found feeding at low tide on the sandflats to the south of Silloth, outside the surveyed area (although within the SPA). Additionally, some species will make use of nearby non-coastal habitats at times, especially the geese (Barnacle Geese notably using Rockcliffe Marsh and the Caerlaverock area) and the grassland plovers. Finally, tidal movements occur involving some of the offshore species such as Red-throated Divers, Great Crested Grebes, Scaup and Common Scoters. Thus, the numbers of these species within the 'Solway' depends upon the site defintition used and upon the state of the tide, points that should be borne in mind when assessing the site (M. Carrier, C. Hartley pers. comm.).

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1998–99 are presented for 21 of the 23 species of principal interest listed above. For clarity, smaller dots are used to display the distributions of several of these species. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.57.3). The two remaining species, Great Crested Grebe and Black-tailed Godwit, were noted in small numbers only. Most Great Crested Grebes at the Solway occur offshore in the outer parts of the estuary not covered by the scheme during 1998–99. Numbers of Black-tailed Godwits are generally low on the Solway but the five-year average was boosted by a particularly large count in December 1996.

The totals map suggests that the highest overall bird density is on the shore at Newbiebarns, with the middle stretches off Bowness also higher than average. The weighted totals map emphasises the inner Esk and Eden, the Newbiebarns foreshore and the middle parts of Moricambe Bay. Cormorants were widespread but most common off Cardurnock. The Barnacle Geese were noted at parts of Moricambe Bay and along the northern boundary of Rockcliffe Marsh, with a lower density on Cardurnock Flatts. A flock of Pink-footed Geese was also recorded on the south side of Moricambe Bay during February 1999. Shelducks and Mallards were both widespread, but the former were found in their highest densities at Moricambe Bay whereas the latter reached their highest densities off Bowness. Pintail were mostly found at Moricambe Bay and south of Rockcliffe Marsh. Only small numbers of Scaup and Common Scoters were recorded, off Moricambe Bay; much larger flocks of both species frequent the outer firth. Goldeneyes were widespread in the main Solway channels but few were found in Moricambe Bay. Small numbers of Whooper Swans were found along the River Eden only. Oystercatchers and Dunlin were widespread through most of the surveyed site but shunned the innermost areas. Lapwings were widespread but Golden Plovers were found in two main concentrations, on the north shore between Seafield and Torduff Point and in the north-east of Moricambe Bay. Grey Plovers, Knot and Bar-tailed Godwits all preferred the outer parts of the site, generally downstream of a line between Annan and Bowness. Curlews and Redshanks were both fairly widespread, with Curlews found somewhat more densely in Moricambe Bay and Redshanks showing an unusual (for this species) relative absence from the innermost parts of the site. Only small numbers of Ringed Plovers and Sanderlings were recorded on the inner firth.

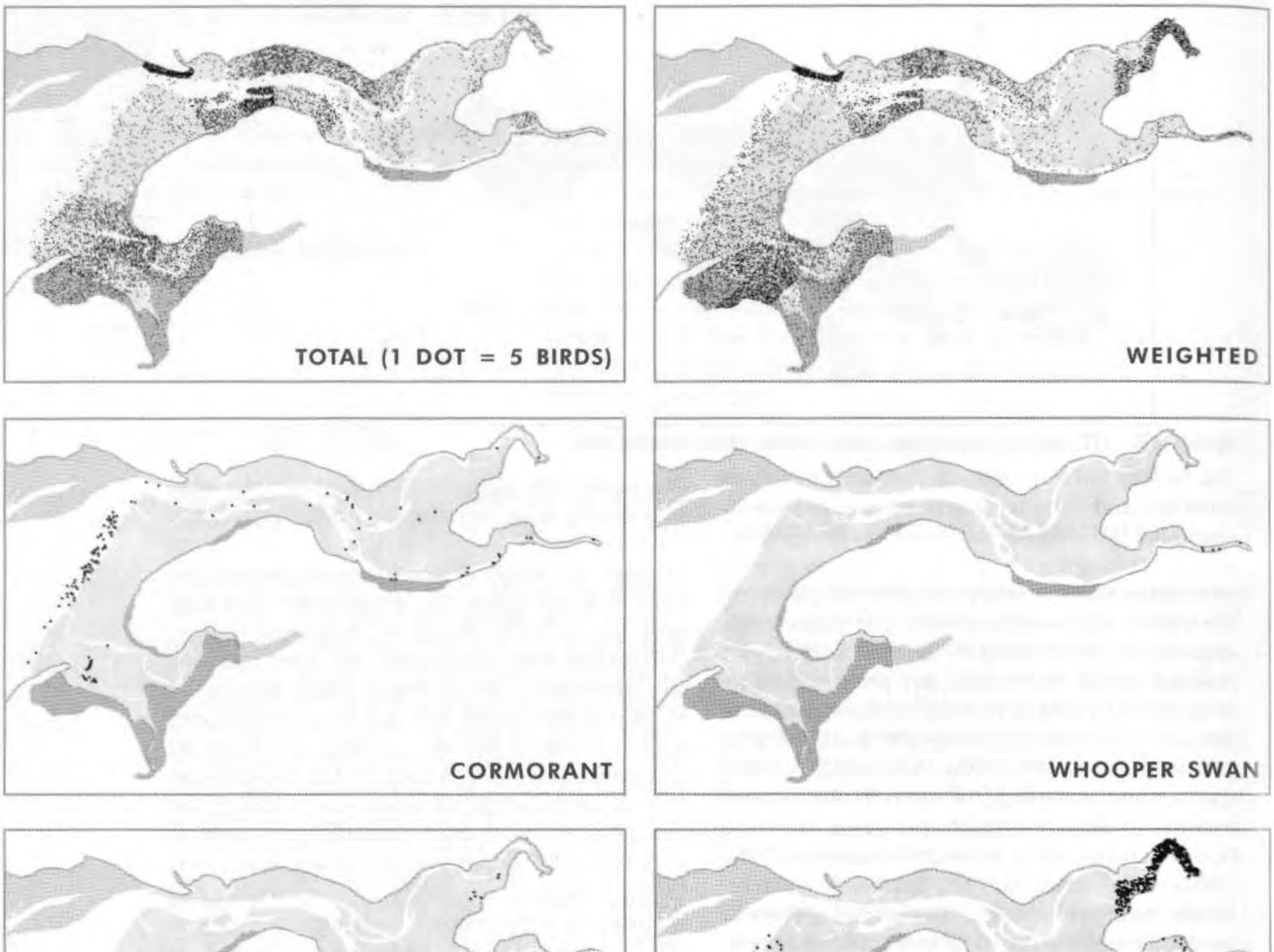


Figure 4.57.3 (i) Low tide waterbird distribution recorded at the Solway Firth, winter 1998-99

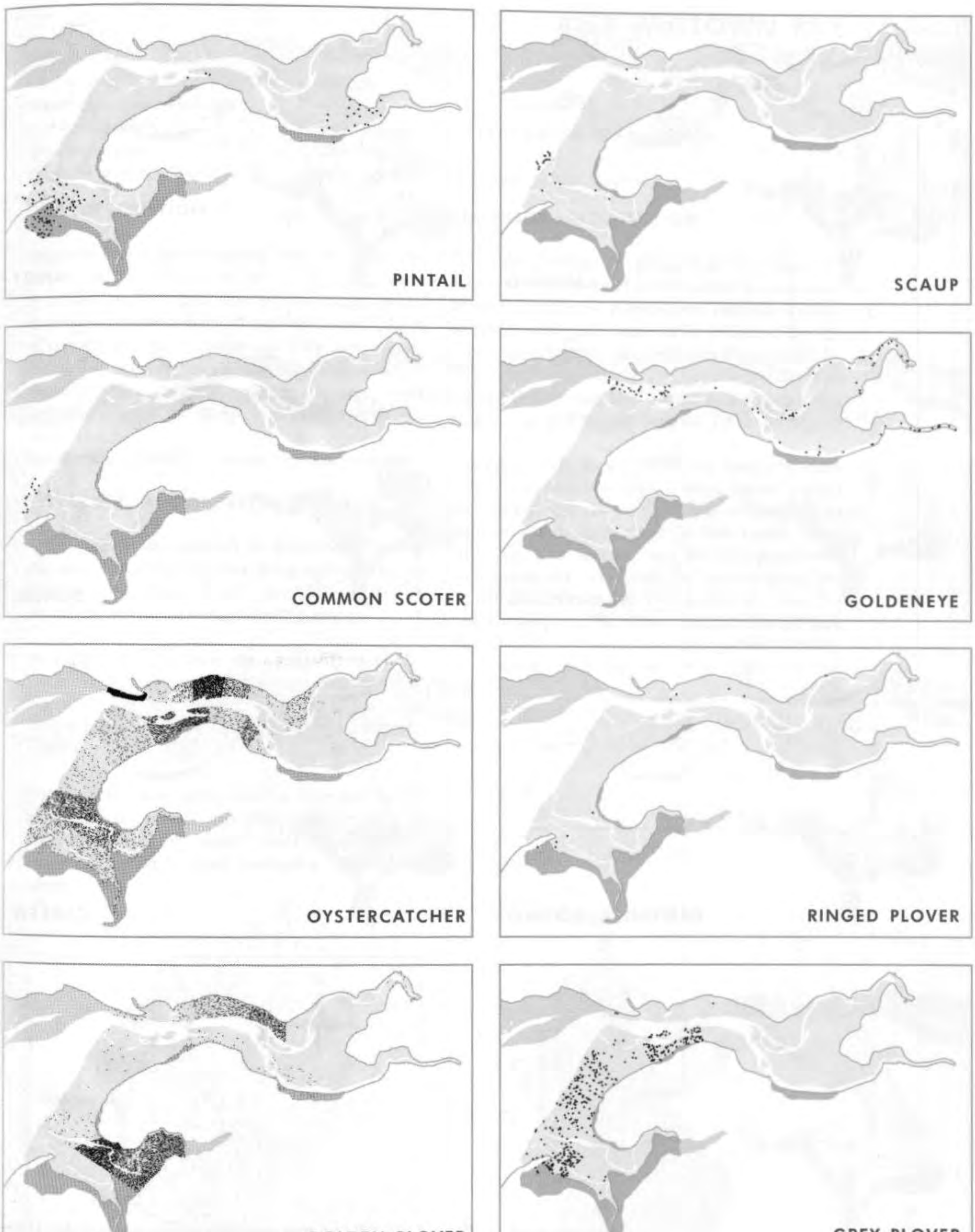
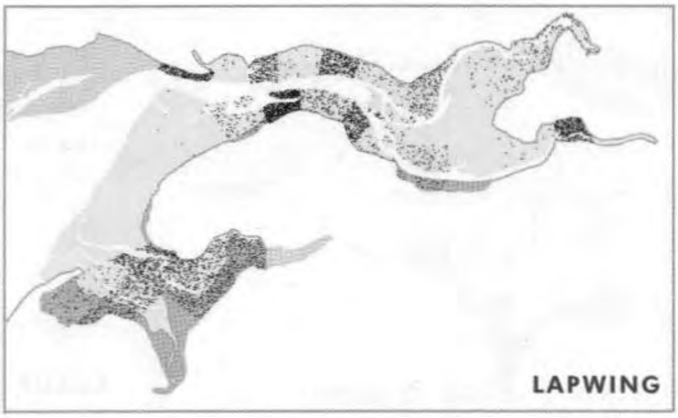
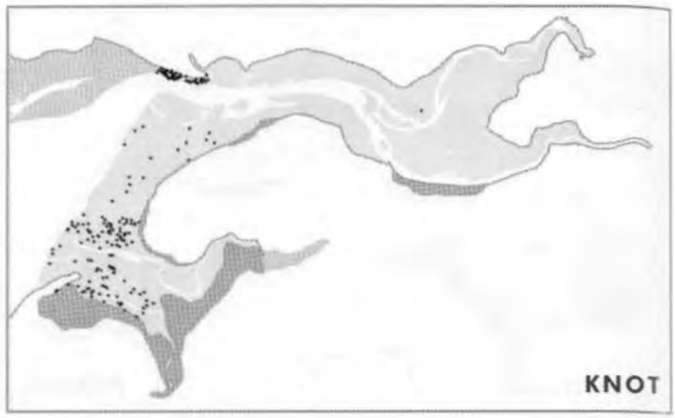
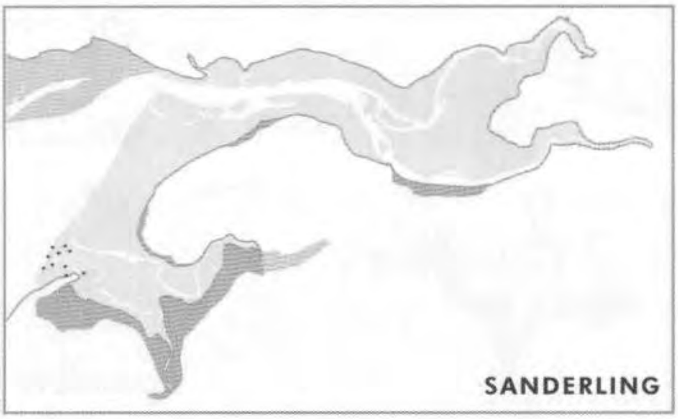
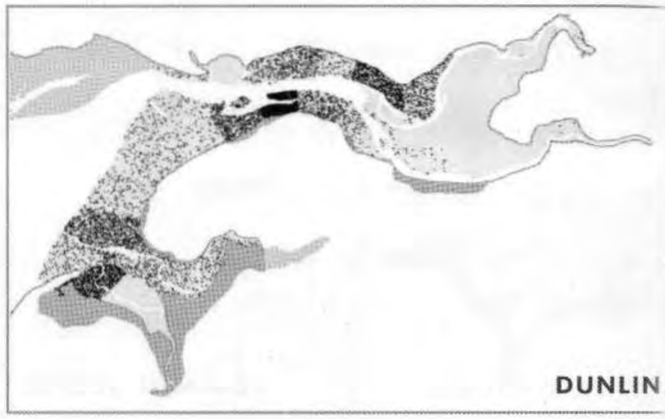


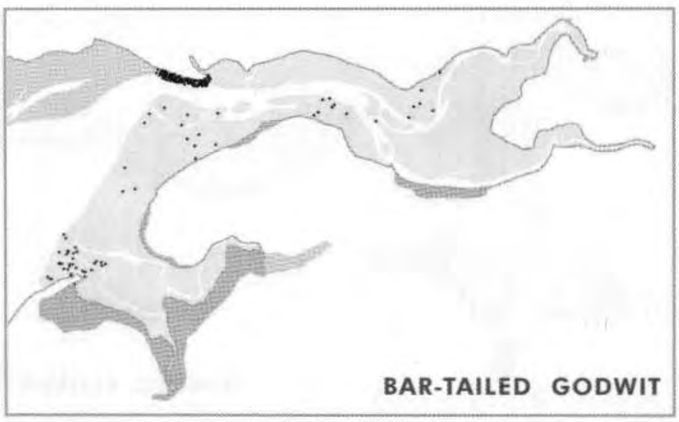
Figure 4.57.3 (ii) Low tide waterbird distribution recorded at the Solway Firth, winter 1998-99











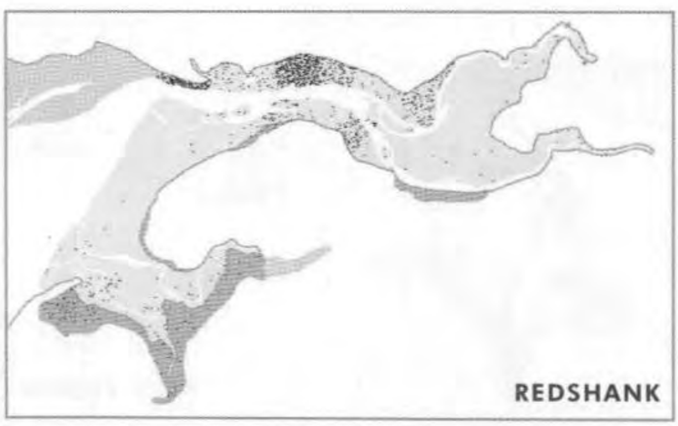


Figure 4.57.3 (iii) Low tide waterbird distribution recorded at the Solway Firth, winter 1998-99

4.58 WIGTOWN BAY

LTC site code:	BW
Centre grid:	NX4655
JNCC estuarine review site:	45
Habitat zonation:	2494 ha intertidal, 514 ha subtidal, 419 ha nontidal
Statutory status:	Cree Estuary SSSI
Winter waterbird interest:	Whooper Swan, Pink-footed Goose, Curlew

SITE DESCRIPTION

Wigtown Bay is the estuary of the river Cree and is one of the largest estuaries in south-west Scotland. At low tide, the site is composed of extensive intertidal flats of mud and sand. Much of the western shore, particularly the north-west, is backed by saltmarsh. On the eastern shore there is a long ridge of sand and shingle. Most activities around the site involve natural resource exploitation, such as fishing, bait-digging and wildfowling. Leisure activities are not intensive.

COVERAGE AND INTERPRETATION

Wigtown Bay was counted for the scheme during the winter of 1992–93, data being returned for all four months. Figure 4.58.1 shows the positions of the 24 sections counted for the survey.

As Figure 4.58.2 shows, the area covered by the LTCs overlaps closely with the Cree Estuary SSSI boundary, the main difference being at the head of the estuary where the SSSI extends further upstream.

Wigtown Bay is relatively close to Fleet Bay to the east and some interchange of birds between these two sites would seem moderately likely. Interchange with other estuaries seems less likely.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1992–93 are presented for two of the three species of principal interest listed above. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.58.3). The remaining species, Whooper Swan, was unrecorded during the counts and presumably makes use of adjacent nontidal habitats.

The totals map, supported by the weighted totals map, picks out two areas holding higher overall bird densities, the first at the south end of Baldoon Sands as a result of Pink-footed Geese (although this species uses the site principally as a nocturnal roost) and the second along the channel of the river Bladnoch, due to concentrations of wildfowl, notably Pintail and Shoveler. Curlews were widespread and evenly distributed across the site, as is typical for this species.

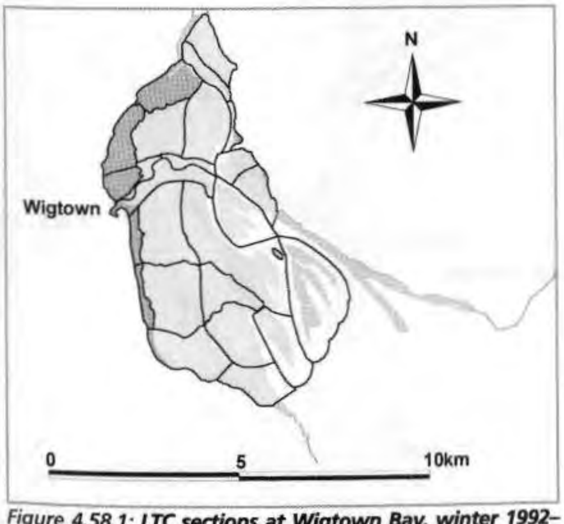


Figure 4.58.1: LTC sections at Wigtown Bay, winter 1992–93

Figure 4.58.2: LTC and SSSI boundaries, with overlap, at Wigtown Bay

Figure 4.58.3: ***Low tide waterbird distributions recorded at Wigtown Bay, winter 1992–93***

4.59 IRVINE–GARNOCK ESTUARY

LTC site code: CI
Centre grid: NS3039
JNCC estuarine review site: 47
Habitat zonation: 134 ha intertidal, 47 ha subtidal, 30 ha nontidal
Statutory status: Bogside Flats SSSI
Winter waterbird interest: Eider, Red-breasted Merganser

SITE DESCRIPTION

This fairly small site is the estuary of the Irvine and Garnock Rivers and is situated about 25 miles south-west of Glasgow. Although small, it is the most significant intertidal area between the Clyde and the Solway and is thus locally important. As well as the mudflats, there is a relatively large area of saltmarsh. The outlet from the estuary into Irvine Bay is through a narrow channel. There is disturbance from bait-diggers, walkers and aircraft and there are industrial sites on the eastern shores of the estuary. Consent has recently been granted for a refuse dump at Bogside, adjoining the estuary. The water of the estuary, formerly highly polluted, has seen recent improvements in quality.

COVERAGE AND INTERPRETATION

The combined estuaries of the Irvine and Garnock were counted for the scheme during the 1998–99 winter, counts being made during all four months. Figure 4.59.1 shows the positions of the nine sections counted for the survey.

The Irvine–Garnock Estuary is not designated an SPA but overlaps closely with the Bogside Flats SSSI. Figure 4.59.2 shows how the two boundaries overlap. Those areas within the SSSI but not counted for the LTCs are nontidal. Areas counted but outside the SSSI were a small extension north along the Garnock, the estuary mouth and some downstream areas of mudflats along both arms of the estuary.

The site is very isolated from other estuaries. Movements of birds are possible between the estuary and nearby non-estuarine coasts and inland areas.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1998–99 are presented for both of the two species of principal interest listed above. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.59.3).

The totals map suggests that overall bird density is fairly even across the site, although the weighted total map gives a slight emphasis to the river channel of the Garnock, as a result of the two key interest species. Red-breasted

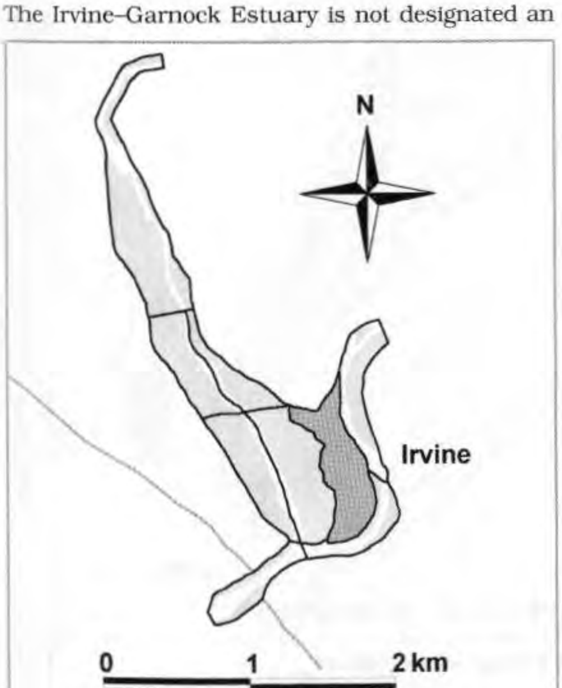


Figure 4.59.1: LTC sections at the Irvine–Garnock Estuary, winter 1998–99

Figure 4.59.2: LTC and SSSI boundaries, with overlap, at the Irvine–Garnock Estuary

Mergansers occurred along the whole length of the rivers but Eiders frequented mostly the lower reaches and the mouth of the combined estuary. Fewer of either species occurred along the channel of the Irvine, presumably due to the narrower and more industrialised nature of the estuary here. Amongst other species, the small numbers of Goldeneyes were present in roughly equal densities on both channels. Teal, Curlew and Redshank were distributed quite evenly across the site.

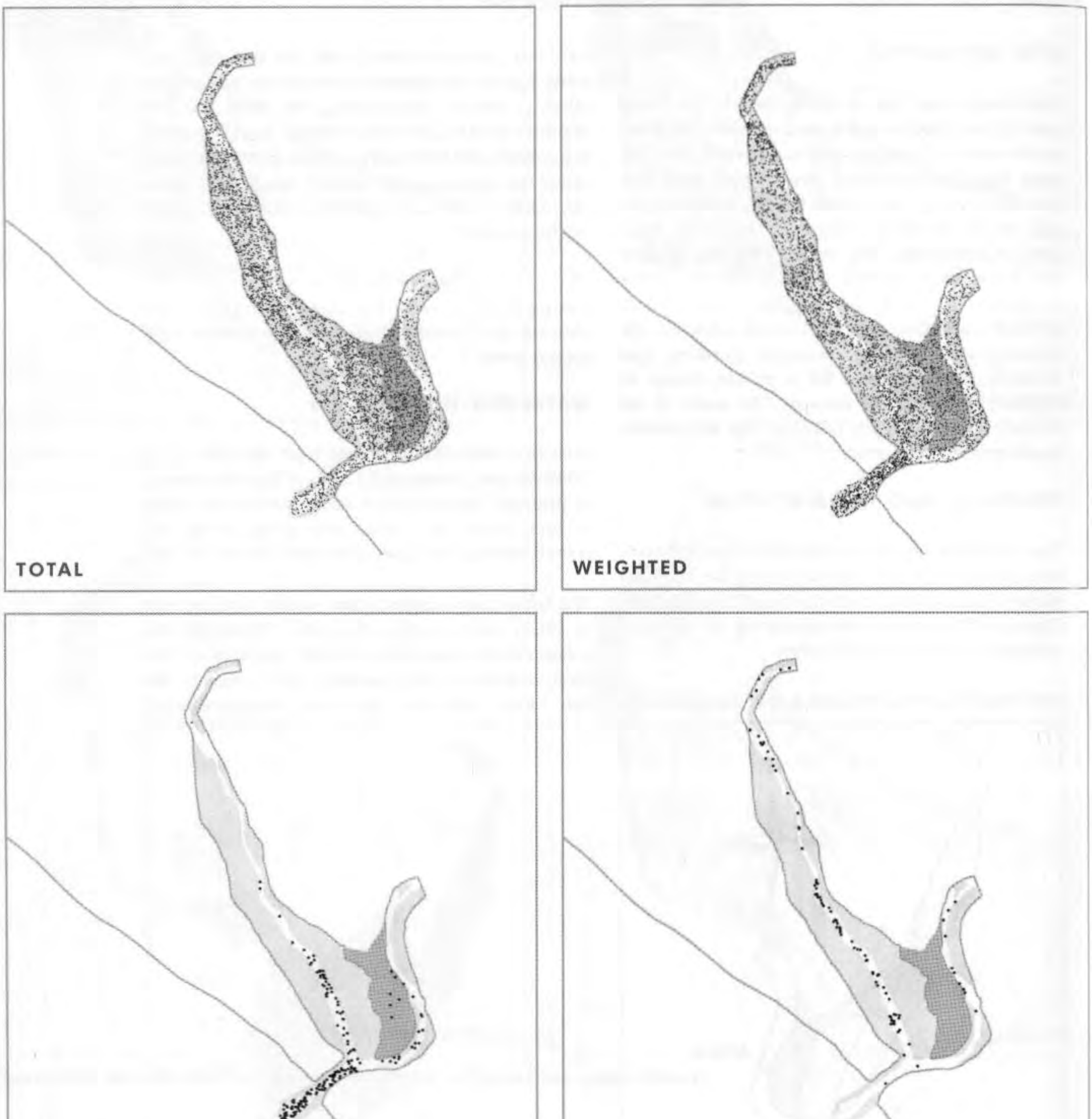


Figure 4.59.3: Low tide waterbird distributions recorded at the Irvine–Garnock Estuary, winter 1998–99

4.60 BELFAST LOUGH

LTC site code:	BB
Centre grid:	J3982
JNCC estuarine review site:	159
Habitat zonation:	447 ha intertidal, 1704 ha subtidal, 0 ha nontidal
Statutory status:	Belfast Lough SPA (UK9020101), Belfast Lough Ramsar (7UK123) [Also Outer Ards proposed SPA (UK9020271), Outer Ards Peninsula proposed Ramsar]
Winter waterbird interest:	Great Crested Grebe, Cormorant, Light-bellied Brent Goose, Shelduck, Mallard, Scaup, Eider, Goldeneye, Red-breasted Merganser, Oystercatcher, Ringed Plover, Golden Plover, Lapwing, Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Turnstone, Waterbird assemblage

SITE DESCRIPTION

Belfast Lough is a large sea lough in the north-east of Ireland, with the city of Belfast at its head. The area surveyed comprises the coast from Carrickfergus on the north shore around to the eastern end of Bangor on the south shore. The outer parts of the lough's shore are generally rocky with some sandy bays, but more extensive areas of intertidal mud are located toward Belfast. Industrial land-claim has, however, reduced the area of the mudflats over the last 150 years, and Belfast has become the main port in Northern Ireland for heavy cargo. More recently, some of the area, including the RSPB Belfast Harbour reserve, has been given a degree of protection, but there is a continuing threat to the remaining intertidal mudflats from potential future harbour expansion. The wash from the shipping activities, including high-speed passenger ferries, may also cause increased erosion of intertidal habitats. Additionally, a proposed new water-taxi service which would operate outside the main shipping lanes could cause increased disturbance. There has been a loss of disturbance-free high-tide roosts within the inner lough, along with problems of refuse disposal and pollution, as would be expected at a highly urbanised and industrialised site. Recreational activities only occur over relatively small, localised parts of the lough. However, extensive areas of Belfast Lough are licensed for shellfish aquaculture, the impact of which is currently unclear (I. Enlander pers. comm.).

COVERAGE AND INTERPRETATION

Belfast Lough is one of the more frequently surveyed sites at low tide, with counts being returned each winter from 1994–95 to 1998–99 (and subsequently). Local circumstances, however,

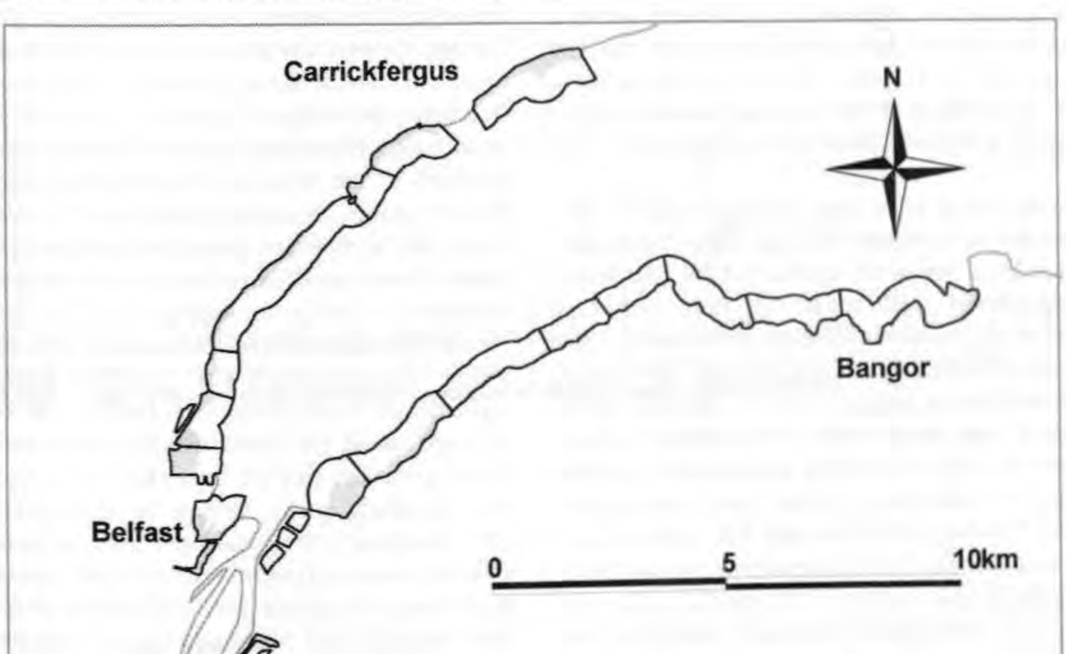


*Figure 4.60.1: **LTC sections at Belfast Lough, winters 1995–96 to 1998–99***

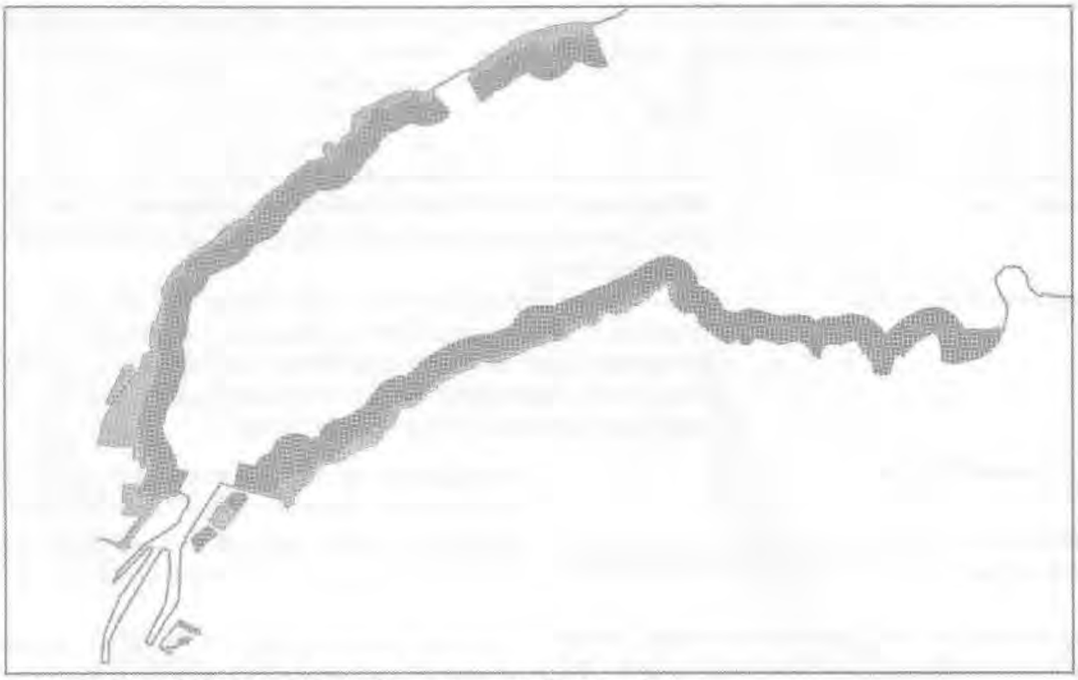


Figure 4.60.2: ***LTC and SPA boundaries, with overlap, at Belfast Lough***

have unfortunately not made it possible for four counts per winter to be carried out; instead, counts have been restricted to two or three months per winter. Figure 4.60.1 shows the positions of the 23 sections counted for the survey. The same count sections have been used throughout, although the survey was confined to the inner lough during the winter of 1994–95.

The Belfast Lough SPA covers much the same area as the LTC site on the north shore, but on the south only extends a short way past Grey Point (Figure 4.60.2). However, the outer part of the south shore is proposed for inclusion within a proposed Outer Ards SPA. Two of the harbour pools, plus Victoria Park, are also outside the SPA. The boundaries of the existing Ramsar site are entirely coincident with those of the SPA.

Movements of birds from Belfast Lough to other sites are not known to occur on a daily basis, although at the outer extremes of the site similar rocky habitat continues on both north and south shores and local movements seem likely. Great Crested Grebes are known to move between the site and Lough Neagh, but on a seasonal rather than a daily basis. Many of the offshore species, however, will be variably detectable depending upon the conditions. At high tide, some species move inland (often several kilometres) onto agricultural land and recreational playing fields, mostly Oystercatchers, Curlews and, more recently, Black-tailed Godwits (I. Enlander pers. comm.).

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1996–97 are presented for all of the 20 species of principal interest listed above. For clarity, smaller dots are used to display the distributions of many of these species. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.60.3).

The totals maps show that for many species, the inner parts of the lough (especially the western shore) support the highest overall bird densities, including the largest concentrations of Great Crested Grebes, Shelducks, Scaup, Goldeneyes, Oystercatchers, Knot, Dunlin, Black-tailed Godwits, Bar-tailed Godwits, Curlews and Redshanks. Some species were almost entirely confined to this area (*e.g.* Black-tailed Godwit), whilst others occurred elsewhere at lower densities. A different group of species (Eider, Ringed Plover and Turnstone) occurred in higher densities on the outer parts of the site. Red-breasted Mergansers and Cormorants were found widely throughout the site. Small numbers of Light-bellied Brent Geese occurred to the north of Green Island. The RSPB Belfast Harbour reserve is an important area for Lapwings, Mallards and other dabbling ducks. Despite being outside the SPA boundary, Victoria Park also supported notable concentrations of several species, including estuarine birds such as Dunlin, Oystercatcher and Redshank, small numbers of Golden Plovers and more typical parkland species like Mallard.

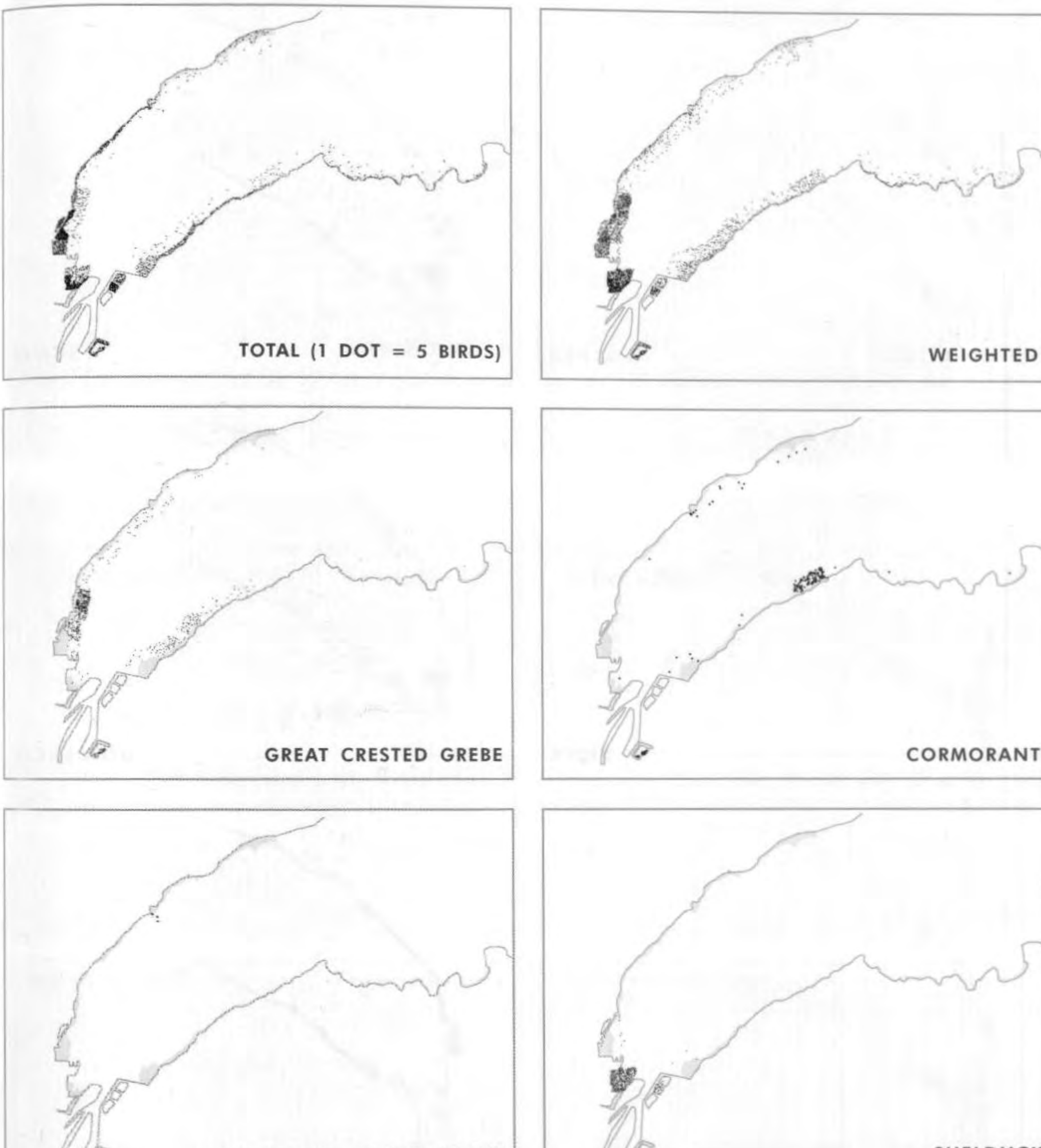


Figure 4.60.3 (i): Low tide waterbird distributions recorded at Belfast Lough, winter 1996–97

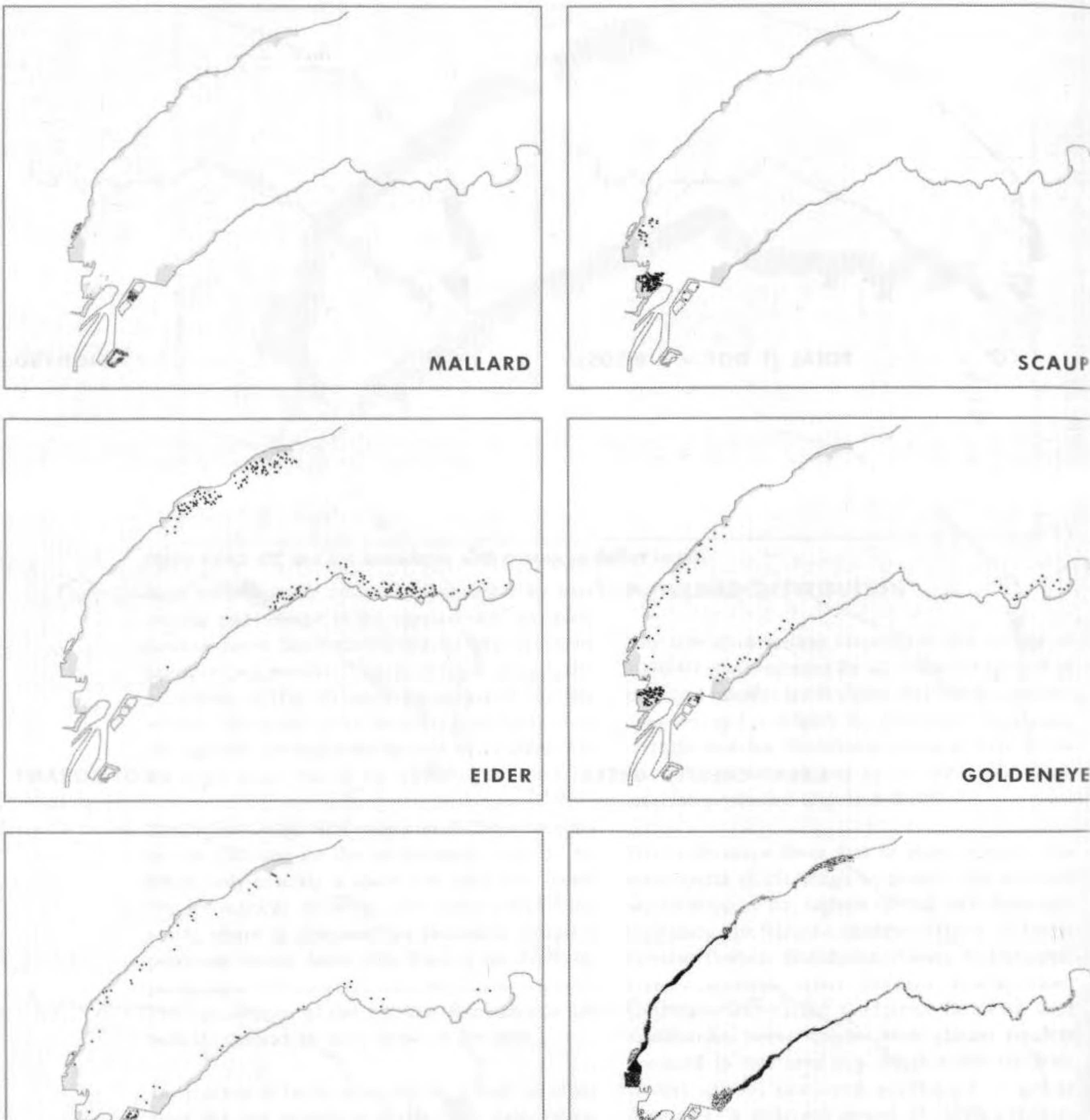


Figure 4.60.3 (ii): Low tide waterbird distributions recorded at Belfast Lough, winter 1996–97

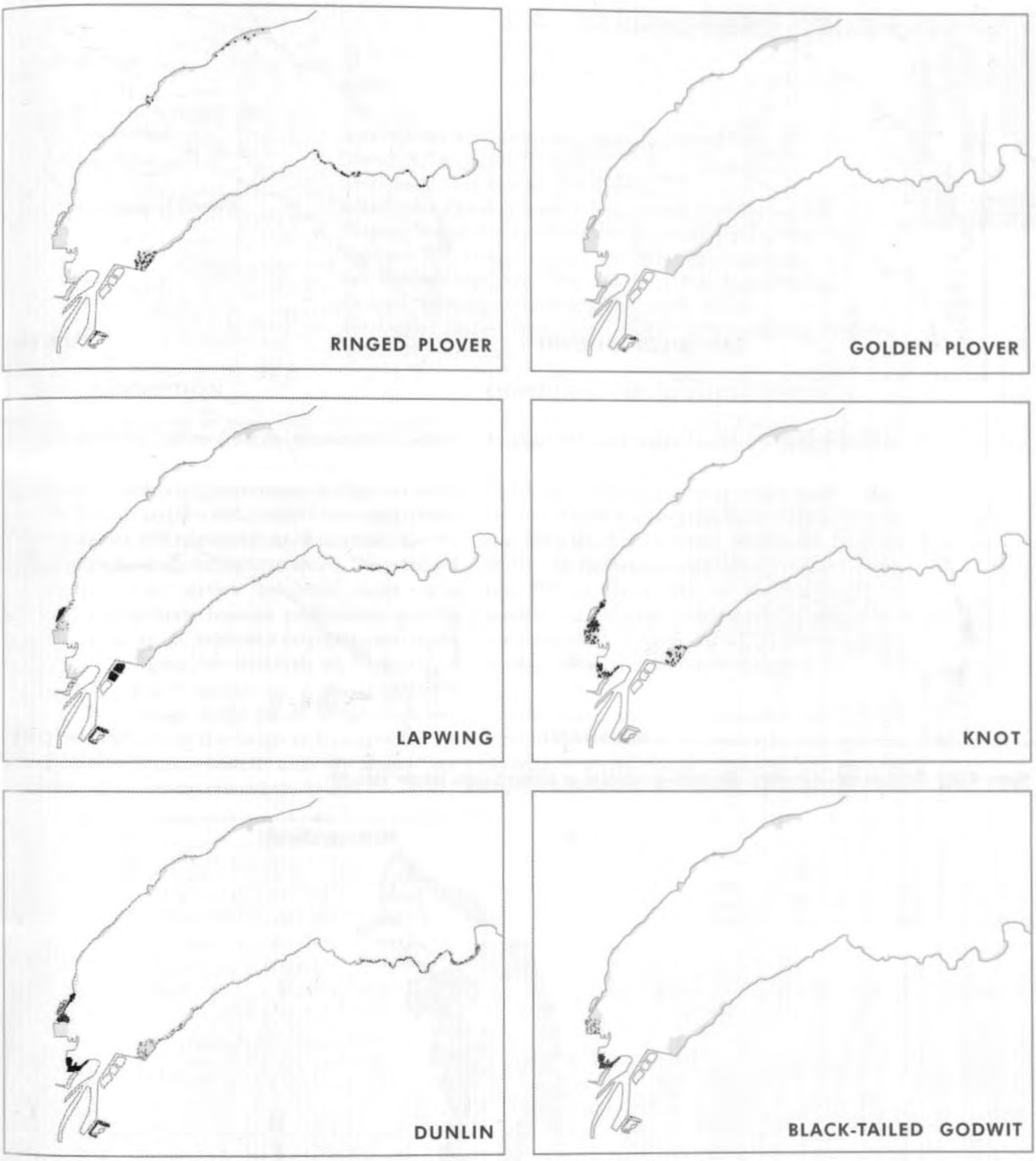


Figure 4.60.3 (iii): Low tide waterbird distributions recorded at Belfast Lough, winter 1996–97

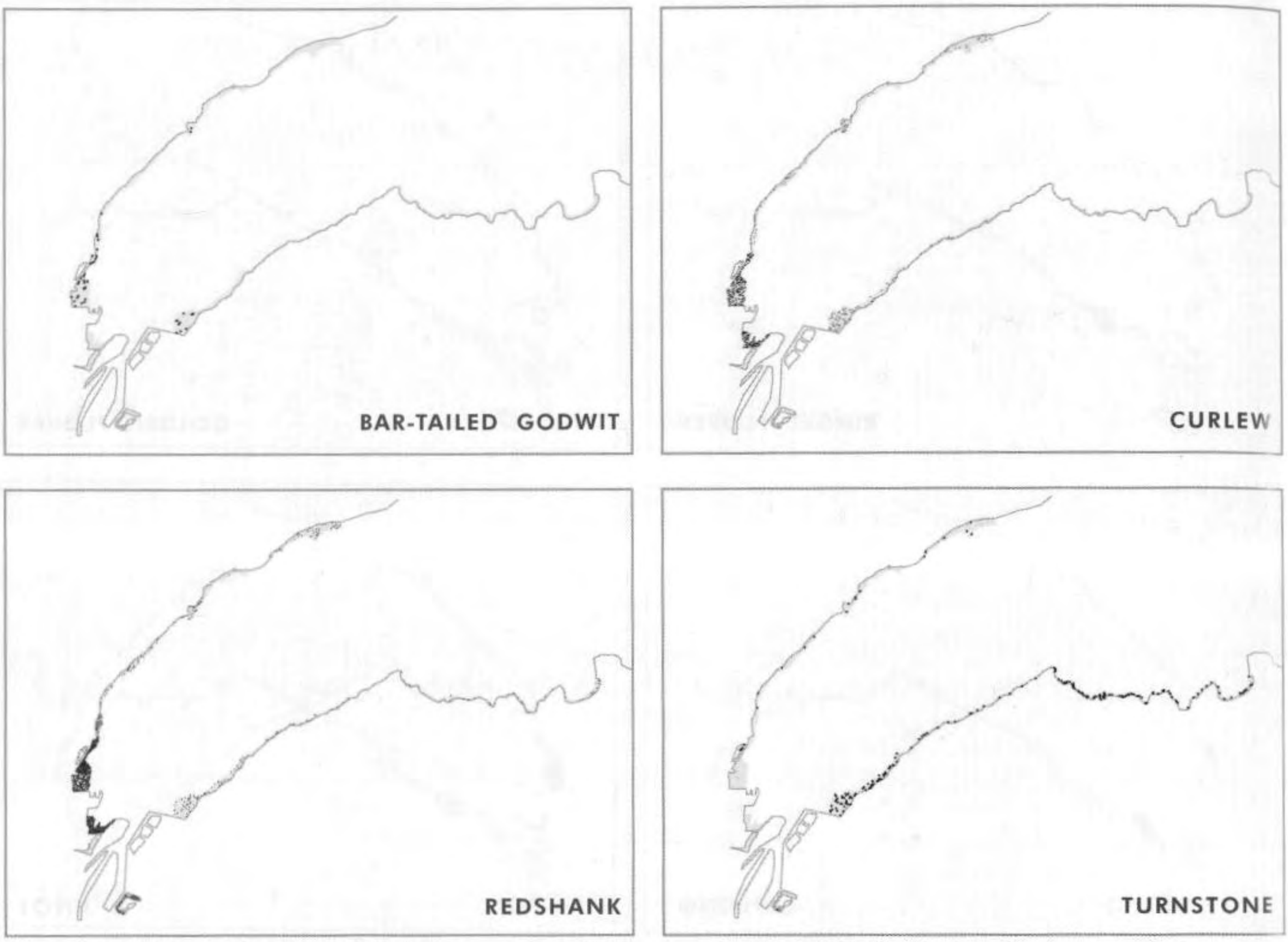


Figure 4.60.3 (iv): Low tide waterbird distributions recorded at Belfast Lough, winter 1996–97

4.61 STRANGFORD LOUGH

LTC site code: BS
Centre grid: J5660
JNCC estuarine review site: 160
Habitat zonation: 4030 ha intertidal, 5080 ha subtidal, 0 ha nontidal
Statutory status: Strangford Lough SPA (UK9020111), Strangford Lough Ramsar (7UK120)
Winter waterbird interest: Little Grebe, Great Crested Grebe, Cormorant, Mute Swan, Greylag Goose, Light-bellied Brent Goose, Shelduck, Wigeon, Gadwall, Teal, Mallard, Pintail, Shoveler, Eider, Goldeneye, Red-breasted Merganser, Coot, Oystercatcher, Ringed Plover, Golden Plover, Grey Plover, Lapwing, Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Turnstone, Waterbird assemblage

SITE DESCRIPTION

Strangford Lough is a large, almost land-locked sea lough situated to the south-east of Belfast in Northern Ireland. It encompasses extensive tidal flats at the northern end, smaller bays and creeks throughout and numerous small drumlin islands, particularly along the western shore. The principal conservation issues concern large-scale recreational use, human population growth around the lough, increased eutrophication of the water, dredging for shellfish and increased intensification of agriculture. A recent proposal for a tidal barrage at the mouth of the lough was rejected. Much of the lough is managed by the National Trust, which also manages the wildfowling activity around the lough.

COVERAGE AND INTERPRETATION

Strangford Lough has been counted for the scheme during every month of every winter since its inception in 1992–93, although data for the 1998–99 winter were not available for incorporation into this account. Figure 4.61.1 shows the positions of the 118 sections counted for the survey during the 1997–98 survey. Over the years, a number of modifications have been made to the count sections used, further details of which can be obtained from the National Organiser.

Figure 4.61.2 shows the overlap between the SPA boundary and the area counted for the LTCs. Strangford Lough SPA is unusual in that the area below mean low water is included within the SPA

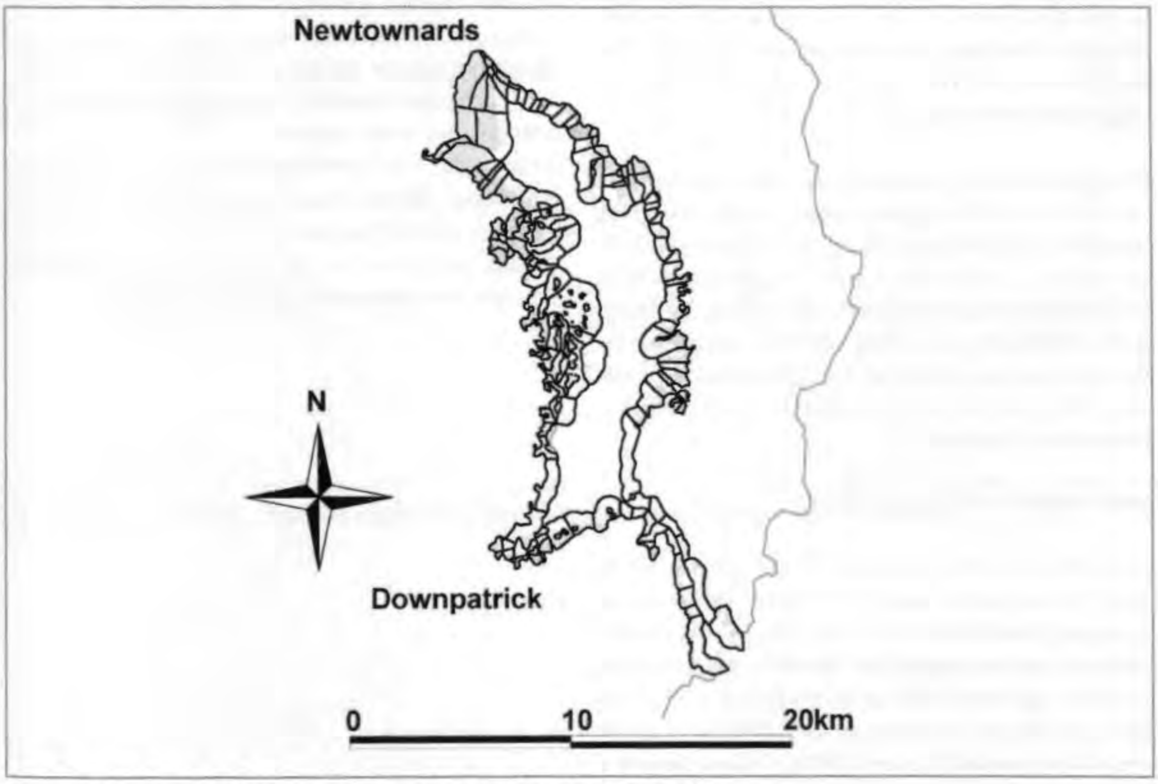


Figure 4.61.1: WeBS LTC sections at Strangford Lough, winter 1997–98

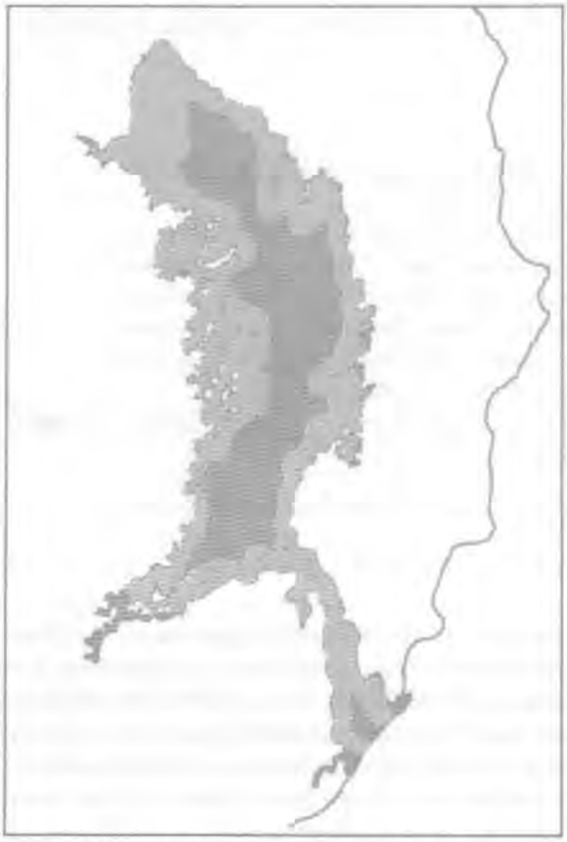


Figure 4.61.2: ***LTC and SPA boundaries, with overlap, at Strangford Lough***

boundary. Thus, much of the inner lough is within the SPA but not surveyed by the LTCs. Otherwise, some small areas, particularly around the mouth of the lough and around Quoile and Ringmore Hill in the south-west of the site, are within the SPA boundary but were not surveyed for the LTCs. The boundaries of the Ramsar site are entirely coincident with those of the SPA.

Strangford Lough is a large and relatively isolated site and it is likely that most of the wintering waterbird populations using the lough are self-contained. However, some interchange with nearby non-estuarine coasts, including the Outer Ards WeBS site, at the mouth of the site is likely. Certain species, such as the grassland plovers, will also make use of nearby terrestrial or freshwater habitats.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1997–98 are presented for 27 of the 29 species of principal interest listed above. For clarity, smaller dots are used to display the distributions of several of these species. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.61.3). Of the remaining species, Coots have not been recorded during LTCs at the site and presumably occur on nearby non-tidal wetlands. No Greylag Geese were recorded by the scheme during the 1997–98 winter, although the species was noted in each of the five previous winters.

The totals map shows that most of the high density areas are at the northern end of the site, with birds distributed more patchily elsewhere. The weighted totals map also emphasises the northern lough, from Mahee Island around to Greyabbey Bay. The northern flats were key areas for many of the waders, notably Oystercatchers, Golden Plovers, Grey Plovers, Knot and the two godwits (although finer-scale differences in distribution were apparent for these two species), as well as Shelduck and Pintail. Light-bellied Brent Geese were also found in their highest density in the north of the lough, although they disperse southwards as the winter progresses, both within the lough and within Ireland as a whole. Ringed Plovers were mostly found at Greyabbey and in the outer channel connecting the lough to the sea; the latter area was also a key area for Cormorants and Turnstones, as well as many of the Teal. Teal and Wigeon were found in localised areas around much of the lough, especially the islands along the middle of the west shore. The mid-west shore held most of the Mallards also, with Shovelers mostly at Mahee Island and Gadwall at Castleward Bay. Redshanks and Curlews were rather evenly distributed around the whole site, whereas Lapwings and Dunlin, although widespread, were more clumped and displayed gaps in their distributions. Little Grebes, Great Crested Grebes, Eiders and Red-breasted Mergansers were widespread in small numbers, with Goldeneyes somewhat more localised around Ardmillan/Mahee Island on the west shore and near Ardkeen on the east shore. Most Mute Swans were found in the north of the lough, with notable concentrations off Mount Stewart.

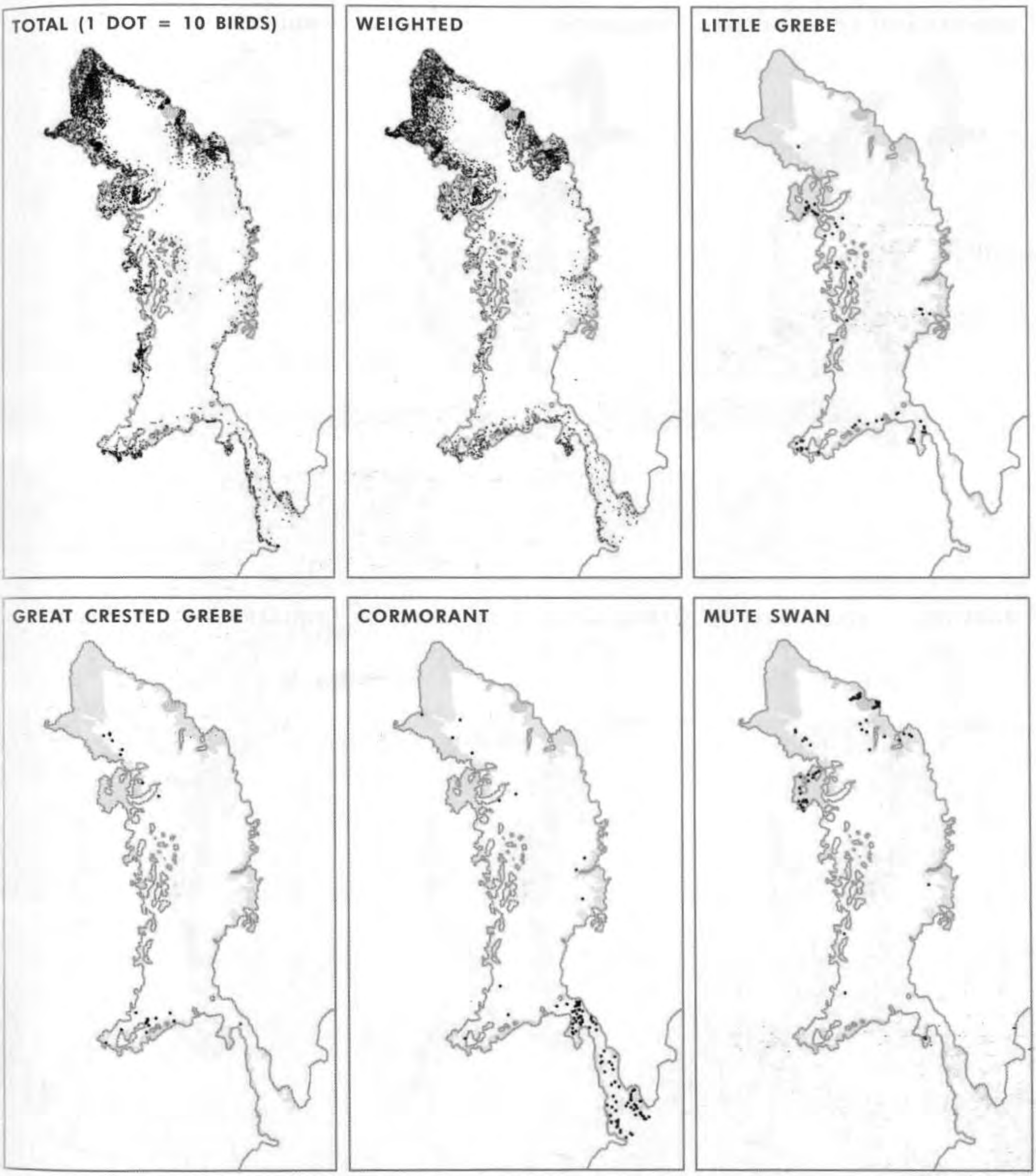


Figure 4.61.3 (i): Low tide waterbird distributions recorded at Strangford Lough, winter 1997–98

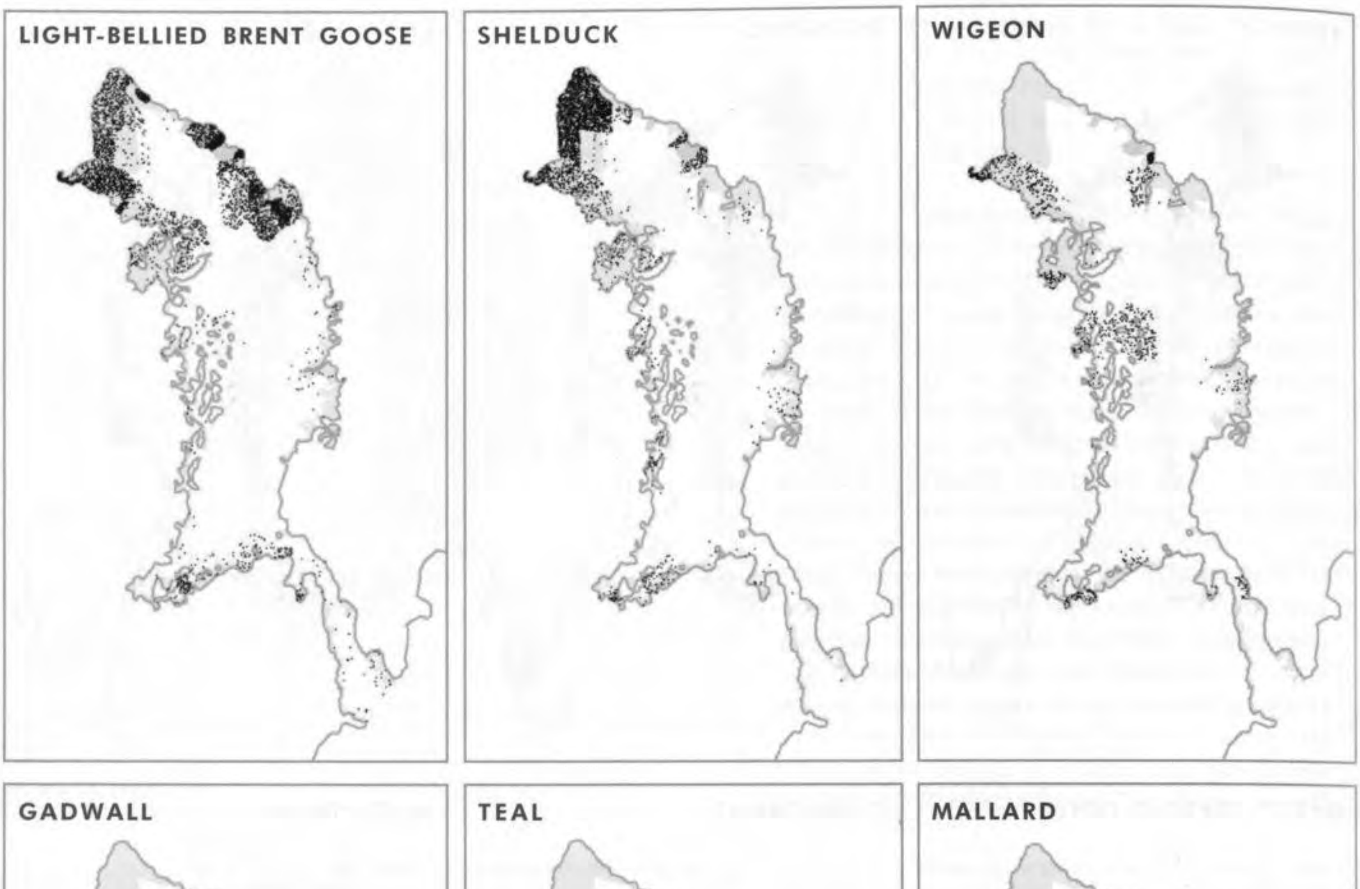


*Figure 4.61.3 (ii): **Low tide waterbird distributions recorded at Strangford Lough, winter 1997–98***

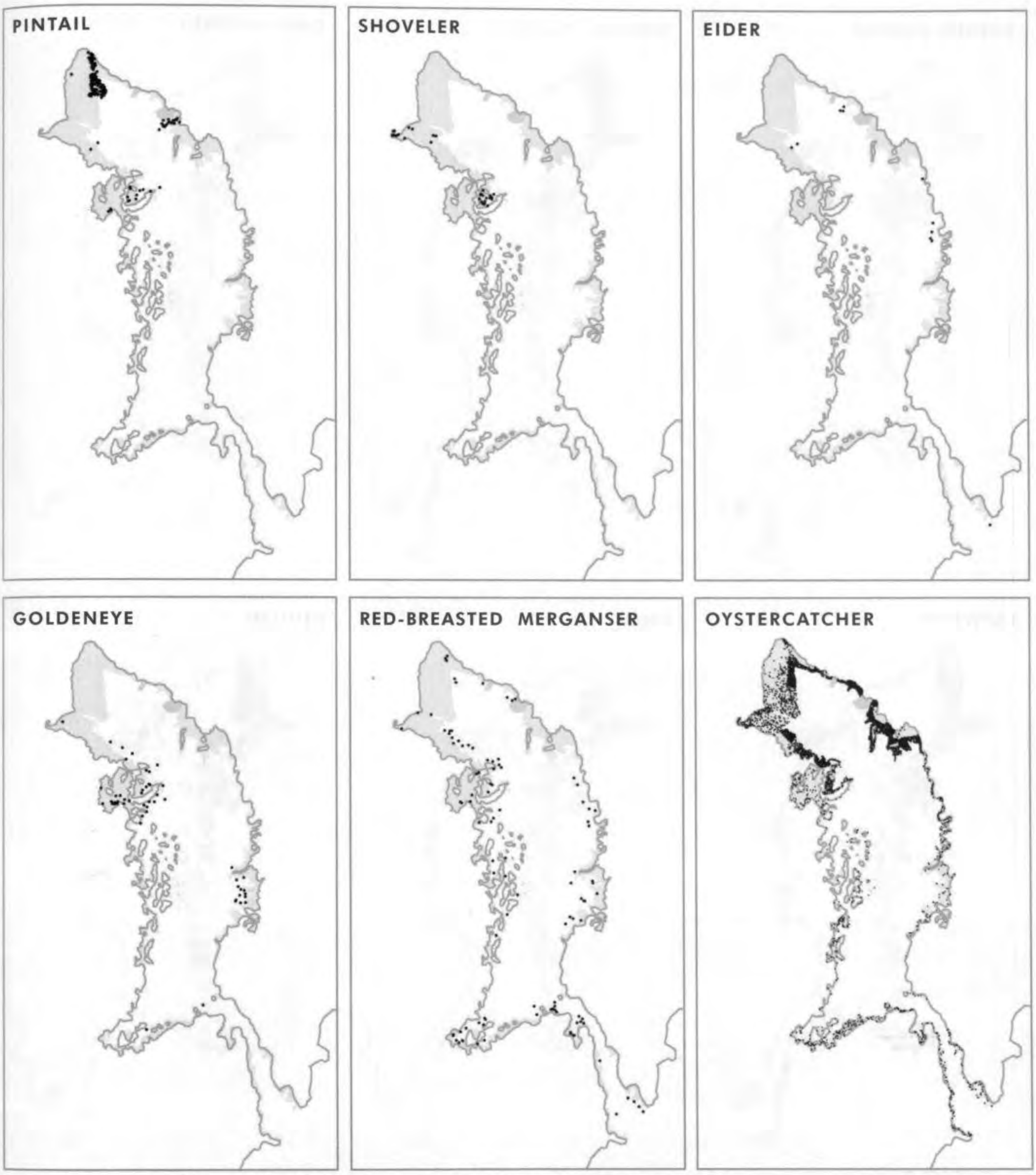


Figure 4.61.3 (iii): ***Low tide waterbird distributions recorded at Strangford Lough, winter 1997–98***

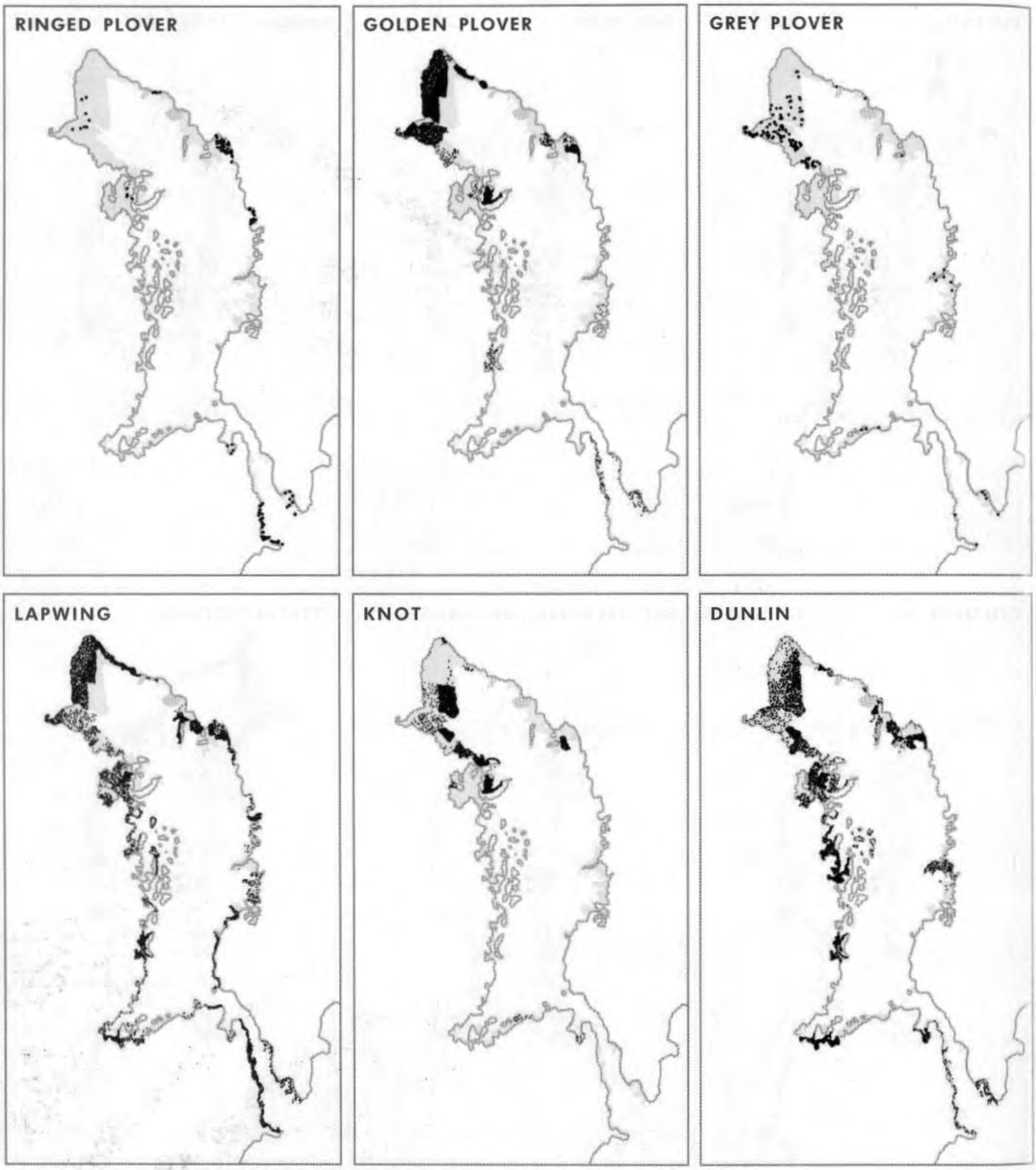


Figure 4.61.3 (iv): ***Low tide waterbird distributions recorded at Strangford Lough, winter 1997–98***

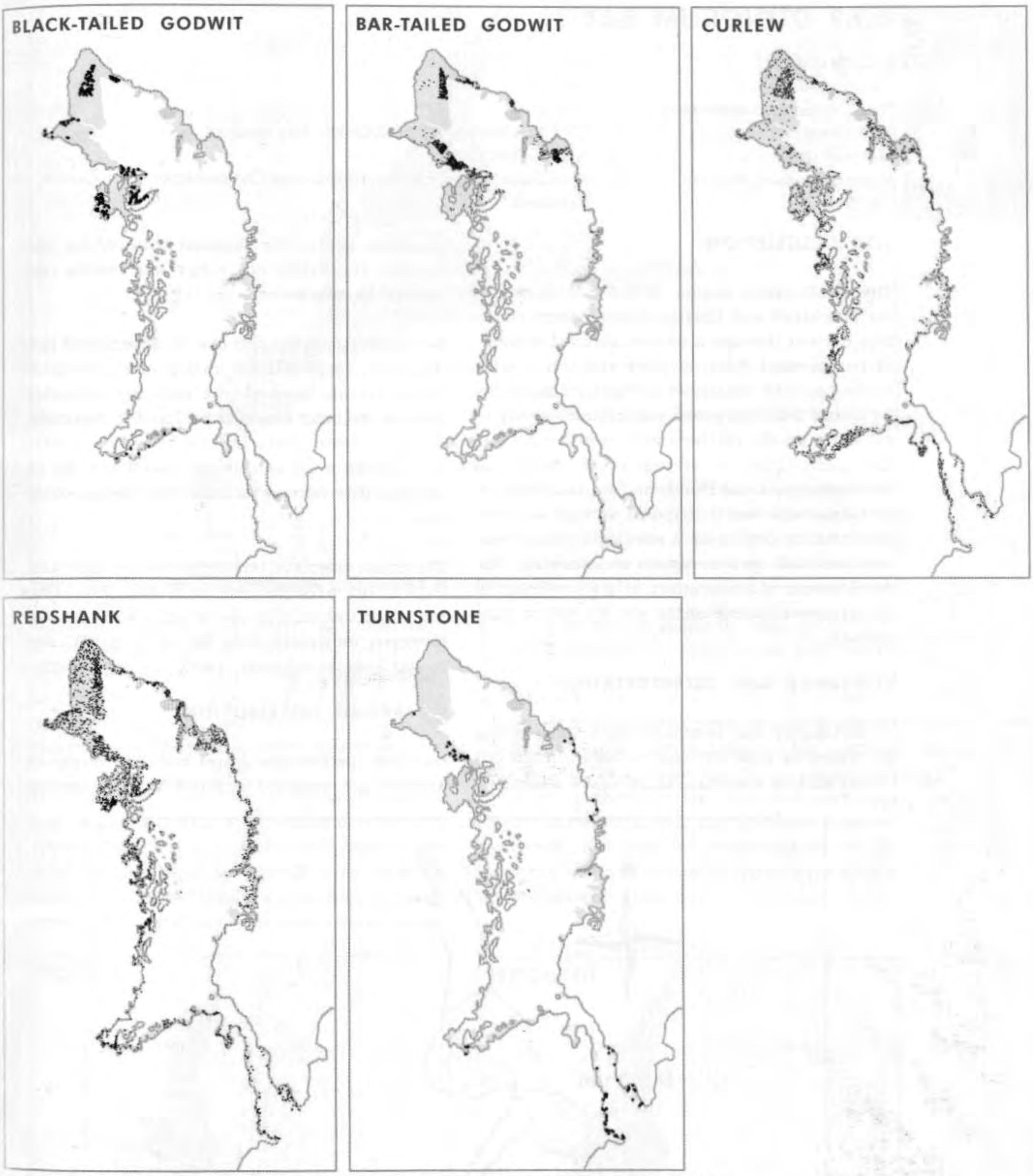


Figure 4.61.3 (v): Low tide waterbird distributions recorded at Strangford Lough, winter 1997–98

4.62 DUNDRUM BAY

LTC site code:	DU
Centre grid:	J4137
JNCC estuarine review site:	162
Habitat zonation:	393 ha intertidal, 68 ha subtidal, 3 ha nontidal
Statutory status:	Murlough ASSI
Winter waterbird interest:	Mute Swan, Shelduck, Common Scoter, Oystercatcher, Knot, Dunlin, Redshank

SITE DESCRIPTION

This small muddy estuary is at the confluence of the Blackstaff and Carrigs Rivers, which empty into the sea through a narrow channel between extensive sand dune systems and into a wide sandy bay. The estuary is surrounded largely by farmland but there are some small areas of saltmarsh at the northern and southern ends of the site. There is virtually no industrial development around Dundrum Bay, but there are problems with waste disposal around the site. Disturbance occurs as a result of recreational activities such as watersports and shooting. The development of aquaculture is also an issue of conservation concern at the site (C. Mellon pers. comm.).

COVERAGE AND INTERPRETATION

Dundrum Bay was covered for the scheme during the winter of 1996–97, counts being carried out during all four months. Figure 4.62.1 shows the positions of the five sections counted for the survey. The sandy outer bay was mostly not covered for this survey.

Dundrum Bay is not part of a designated SPA but does form a part of the Murlough ASSI. As Figure 4.62.2 shows, however, the ASSI also includes more of the outer beach as well as the important dune systems. Care should be taken in the interpretation of counts for Dundrum, as to whether they refer to the inner bay and/or outer bay.

Dundrum Bay is a relatively isolated site and movements between here and other estuarine sites are unlikely to occur on a daily basis. However, movement from the counted LTC site to and from the adjacent open coast seems likely.

WATERBIRD DISTRIBUTION

Low tide distribution maps from the winter of 1996–97 are presented for five of the seven species

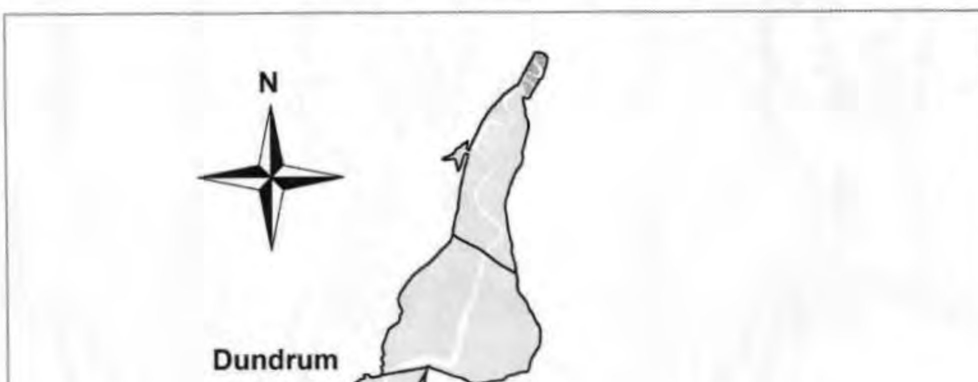


Figure 4.62.1: LTC sections at Dundrum Bay, winter 1996–97

Figure 4.62.2: LTC and ASSI boundaries, with overlap, at Dundrum Bay.

of principal interest listed above. Additional maps of total birds and total birds weighted by 1% threshold value are also presented (Figure 4.62.3). Of the remaining species, only a single Knot and no Common Scoter were recorded; these two species make greater use of the outer bay.

The totals map, supported by the weighted totals map, suggests a fairly even density of waterbirds around the site, but with the south-west corner holding the highest overall bird density. Oystercatchers and Dunlin were numerous on the widest part of the bay, east of Dundrum village, with Dunlin also in relatively high densities in the south-west corner. Mute Swans were mostly found at the south-west of the site, in contrast to Shelducks which were mostly at the north-eastern end. Redshanks were evenly distributed around the inner bay. Amongst other species, Light-bellied Brent Geese were most common in the central parts of the bay but Curlews were at a lower density here than at the north-east or south-west ends. Although the outlet channel to the outer bay was counted, only Oystercatchers were at all numerous along it.

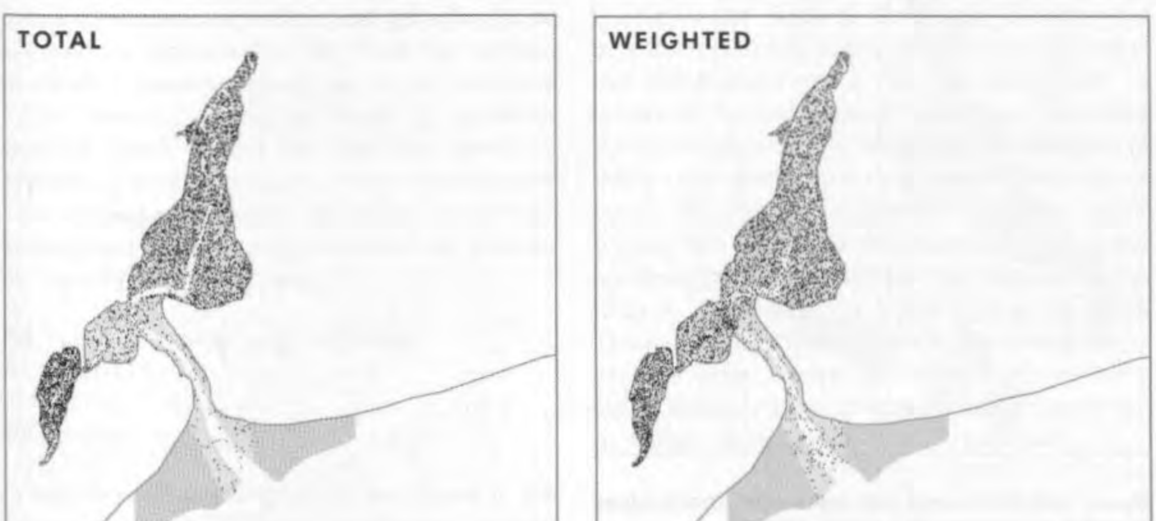


Figure 4.62.3 (i): Low tide waterbird distributions recorded at Dundrum Bay, winter 1996–97

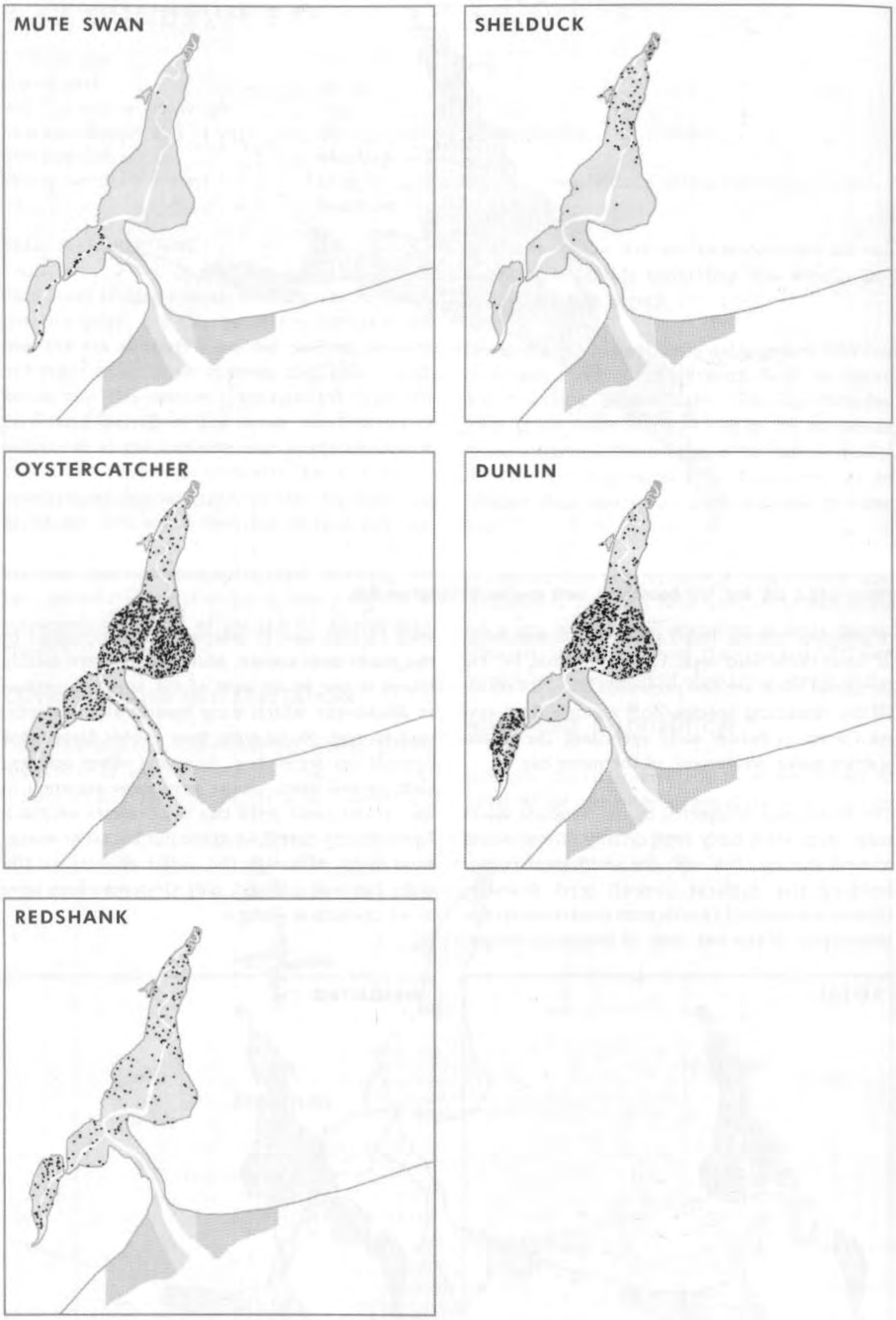


Figure 4.62.3 (ii): ***Low tide waterbird distributions recorded at Dundrum Bay, winter 1996–97***

5 Species Accounts

Andy Musgrove

INTRODUCTION

The following section provides a species-by-species summary of the information collected by the WeBS Low Tide Counts. The amount of information presented for each species varies. Full-page accounts are presented for 29 of the most common estuarine waterbird species. A further 32 species, generally less common or less dependent upon estuaries, are treated in reduced accounts. Amongst these reduced accounts are those for the gulls; although a very important component of estuarine waterbird assemblages, monitoring of gulls has been optional to date for WeBS volunteers (as discussed in Methods). A further 47 species (mostly rare species and escapes from captivity) are summarised in Table 5.1. It should be noted that the division of the recorded species into these three groups is based on a subjective assessment and has no wider relevance outside this publication.

Raptors and passerines are omitted from the species accounts. The presence or absence of raptors was recorded by counters in an analogous fashion to human activities and therefore these species are discussed in the Coverage section. In general, passerines were not recorded by the LTCs. However, during the counts of the North Norfolk Coast during the 1997–98 winter, a systematic study was made of the occurrence of selected passerines across the whole site; a brief summary of the results is given in the site account for the North Norfolk Coast.

OUTLINE OF THE FULL SPECIES ACCOUNTS

UK Status

A brief description is given of the status of the species within the UK, its distribution, habitat preferences, movements and food.

LTC Status

The proportions of sites, sections and visits on which each species was recorded is set out and any inherent patterns are discussed, along with the proportion of birds noted as feeding or roosting. The distribution maps for each site are considered and any underlying patterns in distribution are discussed in the light of known biological factors.

A map is presented depicting the mean site densities recorded at each site. The mean site density is defined as 'the sum of the mean counts for each section divided by the total area of suitable habitat surveyed'. The suitable habitat is determined in the same way as for the plotting of distribution maps, *i.e.* Dunlin on intertidal habitats, Goldeneye on water, etc. (as discussed in Methods). The mean site densities at each site are depicted using a series of four red dots of increasing diameter, the larger dots representing the higher densities. For further details on the actual values of the mean site densities, the National Organiser should be consulted. Additional blue dots (of a single size) are also placed on the maps to show any estuaries not covered by the LTCs during the period under review but which supported a five-year peak mean in excess of the 1% national importance threshold during the period 1994–95 to 1998–99 (as listed in Pollitt *et al.* 2000). This is to ensure that readers recall that further important sites may exist, notably the Wash and Morecambe Bay for many species. The between-site pattern depicted by the map is discussed. In some cases, the term 'Greater Thames' is used whilst discussing large-scale patterns; within the context of this book this is taken to mean all estuaries from the Deben in Suffolk to the Swale in Kent inclusive.

Any notably high site densities and site totals are mentioned. It should always be noted, however, that the methodology of the LTCs does not require counts to be made synchronously across a site and so the potential for double-counting is greater than for the Core Counts, where a greater effort is made to achieve a level of synchronicity. The distribution of section densities is also given in broad terms, by presenting the 95th and 99th percentile values of section density as a broad example of what might be considered to be a high sectional density.

SPA network

The coverage of the UK SPA network achieved by the LTCs for the selected species is given. Additional sites for which recorded site totals of a species at low tide were in excess of the national 1% threshold value are highlighted. However, additional data would be required for most sites to assess whether numbers at a site regularly exceed national or international 1% thresholds and therefore merit further consideration of suitability for designation as an SPA. Furthermore, in most cases the LTC data in isolation are not suitable for assessing sites for designation. This is largely because the degree of synchronicity in site counting is less for some sites than is the case with Core Counts (see Methods).

REDUCED SPECIES ACCOUNTS

These cover many of the same aspects as listed above for the full accounts, but no map is presented and discussion of distribution is limited by the smaller dataset for each species.

TABULATED SPECIES

For each additional species, the number of sites and the number of visits for which the species was recorded is listed in Table 5.1, along with a very brief synopsis of its status.

Table 5.1: Summary information for additional species recorded by the WeBS Low Tide Counts: 1992–93 to 1998–99

Species	No of records	No of sites	Notes
Black-throated Diver *Gavia arctica*	6	3	Localised open-coast species
Red-necked Grebe *Podiceps grisegena*	9	7	Scarce in winter, notably at Firth of Forth
Black-necked Grebe *Podiceps nigricollis*	6	5	Scarce in winter, notably at several south coast estuaries
Fulmar *Fulmarus glacialis*	2	2	Numerous coastal breeder but winters out to sea
Bittern *Botaurus stellaris*	1	1	Scarce and elusive non-estuarine species
Great White Egret *Ardea alba*	3	1	Vagrant
Spoonbill *Platalea leucordia*	7	4	Several individuals winter on traditional southern estuaries
Greater Flamingo *Phoenicopterus ruber*	2	2	Presumed escape
Black Swan *Cygnus atratus*	1	1	Escape
Bean Goose *Anser fabalis*	2	2	Localised non-estuarine species
White-fronted Goose *Anser albifrons*	17	8	Non-estuarine species, although several key areas adjacent to estuaries, especially Severn and Swale
Bar-headed Goose *Anser indicus*	1	1	Escape
Snow Goose *Anser caerulescens*	3	2	Escape
Ross's Goose *Anser rossii*	3	1	Escape
Emperor Goose *Anser canagicus*	4	2	Escape
Barnacle Goose *Branta leucopsis*	15	7	Svalbard population winters on Solway but other records mostly attributable to naturalised populations
Black Brant *Branta bernicla nigricans*	3	2	Vagrant
Egyptian Goose *Alopochen aegyptiacus*	2	2	Naturalised in East Anglia, others may be more recent escapes
Ruddy Shelduck *Tadorna ferruginea*	4	4	Escape
Muscovy Duck *Cairina moschata*	1	1	Escape
Mandarin *Aix galericulata*	4	2	Naturalised in several areas but also frequent escape from captivity
American Wigeon *Anas americana*	2	2	Vagrant
Yellow-billed Duck *Anas undulata*	1	1	Escape
Red-crested Pochard *Netta rufina*	1	1	Escape, naturalised or wild immigrant from continent
Pochard x Tufted Duck *Aythya hybrid*	1	1	*Aythya* hybrids are not infrequent
Surf Scoter *Melanitta perspicillata*	4	1	Vagrant
Smew *Mergellus albellus*	23	12	Localised non-estuarine species
Ruddy Duck *Oxyura jamaicensis*	6	3	Naturalised non-estuarine species
Water Rail *Rallus aquaticus*	32	10	Widespread but elusive species, mostly non-estuarine
Black-winged Stilt *Himantopus himantopus*	2	1	Long-staying individual of debated origin
Little Stint *Calidris minuta*	13	9	Widespread in autumn with few remaining to overwinter
Curlew Sandpiper *Calidris ferruginea*	3	3	Widespread in autumn but very few overwinter
Jack Snipe *Lymnocryptes minimus*	27	12	Widespread but elusive species, mostly non-estuarine
Woodcock *Scolopax rusticola*	5	5	Common but principally terrestrial
Green Sandpiper *Tringa ochropus*	15	11	Widespread but mostly non-estuarine
Mediterranean Gull *Larus melanocephalus*	28	10	Widespread in small numbers
Little Gull *Larus minutus*	2	2	Scarce in winter except at a few traditional sites
Ring-billed Gull *Larus delawarensis*	6	2	Scarce in winter, mostly in the west
Yellow-legged Gull *Larus michahellis*	12	2	Widespread in small numbers, not exclusively coastal. Of debated taxonomic position
Iceland Gull *Larus glaucoides*	4	3	Scarce in winter, mostly in the north
Glaucous Gull *Larus hyperboreus*	7	3	Scarce in winter, mostly in the north
Kittiwake *Rissa tridactyla*	11	5	Winters out to sea
Sandwich Tern *Sterna sandvicensis*	3	2	Long-distance migrant, scarce in winter
Common Tern *Sterna hirundo*	1	1	Long-distance migrant, very scarce in winter
Guillemot *Uria aalge*	28	3	Winters out to sea
Razorbill *Alca torda*	9	4	Winters out to sea
Black Guillemot *Cepphus grylle*	21	1	Widespread open coast species in the north-west
Kingfisher *Alcedo atthis*	37	12	Widespread in small numbers, not confined to coast

LITTLE GREBE
TACHYBAPTUS RUFICOLLIS

The Little Grebe is a fairly common and widespread species that occurs in wetland habitats across much of the UK during the winter, although the species is scarce in upland areas and along the open coast (Lack 1986). Most birds are thought to be resident or locally dispersive, but some interchange with the continent does occur (Wernham *et al.* 2002). Little Grebes feed mostly by diving from the surface to catch insect larvae, molluscs, crustaceans, amphibian and small fish (Snow and Perrins 1998).

Little Grebes were recorded at 46 of the 62 sites under review. The species was localised within each site, however, being noted on only 14% of count sections and on only 8% of visits. The proportion of Little Grebes recorded as feeding at low tide was 99%, a similarly high figure to other grebes, divers and sea-ducks. An examination of the LTC distribution maps for Little Grebe shows that, in general, the species was mostly found in the more sheltered, inner parts of estuaries, either along the higher reaches of a main river channel or along narrow side channels, in small bays or on adjacent nontidal pools. Some of the sites from which Little Grebes were unrecorded at low tide, notably the Thames Estuary, are known to support the species (from WeBS Core Counts); the discrepancies are explained largely by differing site definitions (*i.e.* the birds occurring on nontidal habitat adjacent to the estuary which was counted for Core Counts but not for the LTCs).

Figure 5.1: Mean site densities of Little Grebe

Figure 5.1 shows the relative site densities at the review sites around the UK, suggesting that densities tended to be higher in southern England, notably around the Solent and in Cornwall. The sites supporting the highest densities were all relatively small. At a sectional level, 5% of all sections surveyed supported densities in excess of 0.10 birds per hectare, with 1% of sections supporting densities in excess of 0.63 birds per hectare. At most sites during the period under review, monthly site totals of fewer than 30 Little Grebes were recorded.

A total of ten SPAs in the UK are designated for their value to wintering Little Grebes, of which seven overlap with the LTC sites within this review (the others being the Wash and two inland sites) (Stroud *et al.* 2001). Additional to the sites overlapping SPAs, site totals exceeding the 1% national threshold value were recorded at the Deben Estuary and North Norfolk Coast.

GREAT CRESTED GREBE
PODICEPS CRISTATUS

***Figure 5.2:* Mean site densities of Great Crested Grebe**

Great Crested Grebes are widespread in lowland wetland habitats across the UK throughout the year, with inland still waters favoured in the summer but a degree of dispersal outside the breeding season, partly to form congregations on larger inland waterbodies but also to coastal habitats (Gibbons *et al.* 1993, Lack 1986). Some interchange with the continent has been demonstrated by ring-recoveries but data are sparse and the extent of this is unclear (Wernham *et al* 2002). Additionally, it appears that much migration occurs at night, hence most movement goes unobserved. Great Crested Grebes feed mainly on fish, although other foods such as aquatic invertebrates will be taken. Prey is taken following a surface dive followed by underwater pursuit (Snow and Perrins 1998).

Great Crested Grebes were recorded at 41 of the 62 sites under review. The species was relatively localised within each site, however, being noted on 17% of count sections and on only 8% of visits. The proportion of Great Crested Grebes recorded as feeding at low tide was 95%, a similarly high figure to other grebes, divers and sea-ducks. An examination of the LTC distribution maps for Great Crested Grebe shows little in the way of general distributional patterns. At most sites, the species was scarce and scattered. At sites where birds were more numerous, they were often quite widespread (such as on the Stour Estuary), but often certain areas held locally higher densities, such as the inner half of the west shore of Belfast Lough, or the inner parts of the Firth of Forth. Some of the sites where Great Crested Grebes were not recorded at low tide were of note, either given their size (*e.g.* Severn Estuary, Ribble Estuary) or given that they would have been expected to do so from an examination of WeBS Core Counts (*e.g.* Lavan Sands, Pegwell Bay). In some cases at least, the discrepancies may be explained largely by counters concentrating on intertidal habitats and not attempting (or being unable) to count distant offshore birds.

Figure 5.2 shows the relative site densities at the review sites around the UK. Belfast Lough is highlighted, with most other higher densities occurring in the south, especially around the Solent and Greater Thames. At a sectional level, 5% of all sections surveyed supported densities in excess of 0.07 birds per hectare, with 1% of sections supporting densities in excess of 0.37 birds per hectare. The highest counts by far were made at Belfast Lough, where the peak was a synchronous count of 1,662 in November 1997. Few other site counts in excess of 100 birds were recorded.

A total of 17 SPAs in the UK are designated for their value to wintering Great Crested Grebes, of which 11 overlap with the LTC sites within this review (the others being Morecambe Bay, Lough Foyle and four inland sites) (Stroud *et al.* 2001). At no additional sites did low tide site totals exceed the 1% national threshold value.

CORMORANT
PHALACROCORAX CARBO

Outside the breeding season, Cormorants are widespread in coastal and inland lowland wetlands throughout the UK, although the distribution is much more localised around breeding colonies in the summer (Lack 1986, Gibbons *et al.* 1993). The Cormorants wintering in the UK are a mixture of dispersing resident breeders (the first-years dispersing further than the adults) and immigrant birds from the near-continent, the latter largely of the race *sinensis* (Wernham *et al.* 2002). Cormorants feed almost exclusively on fish, caught following a surface dive and underwater pursuit; the prey is usually brought to the surface before being consumed (Snow and Perrins 1998).

The LTCs confirmed that Cormorants are very widespread on estuaries in winter, the species being recorded at 60 of the 62 sites under review. Also, the species was relatively widespread within each site, being noted on 49% of count sections and on 23% of visits. The proportion of visits on which the species was recorded changed significantly (χ^2_3=26.55, P<0.001) over the course of the winter, declining from 25% in November and December to 21% by February. The proportion of Cormorants recorded as feeding at low tide was 44%, a relatively low figure compared to superficially similar species such as Great Crested Grebe or Red-breasted Merganser, for example. This may be due to differences in feeding biology but could equally be due to the very obvious appearance of a roosting Cormorant, which is unlikely to be overlooked or recorded as feeding. Examination of the LTC distribution maps for Cormorant shows that the species was widespread and fairly evenly scattered at most sites. At a few sites, birds were more localised, sometimes around the mouth (*e.g.* Strangford Lough, Conwy Estuary) or sometimes in more inner parts of a site (*e.g.* Moray Firth). The only two sites where Cormorants were not recorded during the period under review were the Adur Estuary and Lindisfarne; both of these sites were only partially covered by the scheme and it is likely that the species did indeed occur on all sites.

Figure 5.3: Mean site densities of Cormorant

Figure 5.3 shows the relative site densities at the review sites around the UK. Several of the sites supporting the highest densities were in the north, whilst there was a cluster of low densities around the Irish Sea and along the Bristol Channel. At a sectional level, 5% of all sections surveyed supported densities in excess of 0.27 birds per hectare, with 1% of sections supporting densities in excess of 1.38 birds per hectare.

A total of 32 SPAs in the UK are designated for their value to wintering Cormorants, of which 23 overlap with the LTC sites within this review (the others being Morecambe Bay, Lough Foyle, the Wash and six inland sites) (Stroud *et al.* 2001). Additional to the sites overlapping SPAs, site totals exceeding the 1% national threshold value were recorded at the Thames Estuary and Conwy Estuary.

LITTLE EGRET
EGRETTA GARZETTA

Figure 5.4: Mean site densities of Little Egret

The Little Egret is now a relatively common sight on estuaries in southern England and Wales. Numbers tend to peak in late summer and decline through the winter, and are at their lowest ebb in late spring and early summer. Only a very small proportion of the population occurs away from estuaries. The species is a recent colonist in the UK, following a range expansion northwards along the French Atlantic coast (Dubois *et al.* 2000). An influx of about 50 birds in autumn 1989 has been followed by ever increasing autumn influxes, with at least 1,650 present in autumn 1999. Winter numbers have also increased dramatically, from practically nil during the 1980s to about 900 in January 2000 (Musgrove 2002). Although numbers are also increasing rapidly in the Republic of Ireland, records from Northern Ireland are still sparse (Smiddy and O'Sullivan 1998, *Wildfowl & Wader Counts*). Most UK Little Egrets are derived by post-breeding dispersal from north-west France but locally bred birds are contributing an increasing proportion of the total (Combridge and Parr 1992, Lock and Cook 1998). Little Egrets feed mostly on small fish but also take a wide variety of other prey items such as amphibians and insects (Snow and Perrins 1998).

Wintering Little Egrets were recorded at 23 of the 62 sites under review, with the species being noted on 12% of count sections and on 5% of visits, the latter figure declining throughout the winter in line with the seasonal pattern described above (χ^2_3=11.51, P<0.01). The proportion of Little Egrets recorded as feeding at low tide was 95%, compared to only 68% for Grey Heron. This difference could have been due to a greater propensity of Grey Heron towards nocturnal foraging (Voisin 1991). Examination of the LTC distribution maps for Little Egret reveals no particular preference for inner or outer parts of sites. Most of the sites at which Little Egrets were not recorded during the period under review were outside its core southern range. However, a few estuaries within this range also lacked records, notably the Camel Estuary and Swale Estuary. Due to the massive range expansion during the course of the review period, occurrence and numbers depended greatly on which winter a site was covered by the scheme; these two sites were both covered in 1992–93 only.

Figure 5.4 shows the south-westerly distribution during the period under review, the highest densities being found around the Solent and in southern Devon and Cornwall. At a sectional level, 5% of all sections surveyed supported densities in excess of 0.02 birds per hectare, with 1% of sections supporting densities in excess of 0.09 birds per hectare. Counts of 30 or more birds were made at Langstone Harbour, Chichester Harbour and the Fowey Estuary.

Only three SPAs in the UK have been designated for their value to wintering Little Egrets: Chichester and Langstone Harbours, Poole Harbour and Tamar Estuaries Complex (Stroud *et al.* 2001). At no additional sites did site totals exceed the 1% national threshold value.

GREY HERON
ARDEA CINEREA

Figure 5.5: Mean site densities of Grey Heron

Grey Herons are common and widespread in winter in wetland habitats throughout the UK, both inland and on the coast, although seldom numerous at any one site (Lack 1986). Most UK Grey Herons are resident but there is some dispersal from upland areas in the summer to the lowlands and the coast in winter. Prolonged cold periods can make feeding difficult and can trigger further movements. The resident breeding population is also supplemented in the winter by an unknown number of immigrants from northern Europe, especially Norway, Sweden, Denmark and the Netherlands (Wernham *et al.* 2002). Grey Herons feed mostly on fish, but will also take other prey such as amphibians, reptiles and small mammals (Snow and Perrins 1998).

Grey Herons were recorded at 61 of the 62 sites under review (only missed from Lavan Sands), with the species being noted on 38% of count sections and on 16% of visits. The proportion of visits on which Grey Herons were recorded dropped markedly and steadily over the course of the winter: the species was recorded on 20% of November visits, but this declined to just 10% of February visits (χ^2_3=154.56, P<0.001). This may be partly explained by winter mortality and partly by dispersal back to breeding colonies, as the species breeds early in the year. The proportion of Grey Herons recorded as feeding at low tide was 68%. This is a relatively low figure, especially in relation to Little Egret, and may be partly explained by the fact that Grey Herons feed at night more often (Voisin 1991). Examination of the LTC distribution maps for Grey Heron shows that the species was usually quite dispersed within an estuary. The widest intertidal flats were less frequently occupied, however, with narrower estuarine areas and saltmarshes occupied in preference.

Figure 5.5 shows the very widespread distribution of the species, with little suggestion of broad-scale geographical differences in estuarine densities. The highest recorded mean site densities were from the Wear and Irvine–Garnock Estuaries, both small sites. At a sectional level, 5% of all sections surveyed supported densities in excess of 0.06 birds per hectare, with 1% of sections supporting densities in excess of 0.25 birds per hectare. The majority of site counts of over 50 Grey Herons during the scheme were made at the large site of Strangford Lough.

No SPAs in the UK have been designated for their value to wintering Grey Herons, given that the species is mostly non-migratory in the UK (Stroud *et al.* 2001). The population is very dispersed across the country, mostly inland, and numbers are never particularly high on any one site. No 1% threshold level has been set to date, due to the uncertainty in the winter population estimate, but in any case, no LTC sites reached the value of 300 that would be inferred from the rough Winter Atlas estimate. However, a (non-synchronous) count of 108 Grey Herons from Strangford Lough just exceeds 1% of the all-Ireland estimate.

MUTE SWAN
CYGNUS OLOR

Figure 5.6: Mean site densities of Mute Swan

Mute Swans are a familiar sight on wetlands throughout the UK in the winter, mostly on lowland freshwater habitats although birds do also occur on estuaries (Lack 1986, Gibbons *et al.* 1993). Mute Swans in the UK are largely resident, making mostly local movements except during summer moult migrations to traditional sites. However, longer-distance movements can occur in severe winters, with some UK-bred birds moving to the south coast and across to France and other birds arriving from the near continent. Elsewhere in Europe, Mute Swans exhibit more clearly defined migratory behaviour (Wernham *et al.* 2002). Mute Swans feed mainly on aquatic vegetation, often taken by up-ending in water up to a metre deep, although the species will also graze on land (Snow and Perrins 1998).

Mute Swans were recorded at 55 of the 62 sites under review, with the species being noted on 23% of count sections and on 10% of visits. The proportion of Mute Swans recorded as feeding at low tide was 73%. Examination of the LTC distribution maps for Mute Swan shows that the species was usually fairly localised within an estuary, with the major concentrations occurring around towns (*e.g.* Bideford, Southampton, Ipswich, etc.) or on adjacent freshwater habitats (such as the Emsworth and Langstone Mill Ponds by Chichester Harbour). Other concentrations were recorded in the vicinity of grain-unloading docks, as on the Humber Estuary, where there is an abundance of food. In more natural locations, fewer birds were found on the wider intertidal flats and most birds occurred on the inner estuaries.

Figure 5.6 shows the widespread distribution of the species, with little suggestion of broad-scale geographical differences in estuarine densities. The highest site density was recorded at Montrose Basin. At a sectional level, 5% of all sections surveyed supported densities in excess of 0.29 birds per hectare, with 1% of sections supporting densities in excess of 2.75 birds per hectare. The highest site counts were made at the Humber Estuary, with a synchronous count of 311 in December 1998.

No SPAs in the UK have been designated for their value to wintering Mute Swans, given that the species is essentially non-migratory (Stroud *et al.* 2001). However, site totals exceeding the 1% national threshold values were recorded at Belfast Lough, Strangford Lough, Dundrum Bay and the Humber Estuary.

DARK-BELLIED BRENT GOOSE
BRANTA BERNICLA BERNICLA

Figure 5.7: Mean site densities of Dark-bellied Brent Goose

Dark-bellied Brent Geese are the most numerous of the three subspecies of Brent Goose occurring in the UK (Kershaw and Cranswick 2003). Most birds arrive in October and remain until May when they depart to breeding grounds in the Russian Arctic. In the UK, the geese are almost entirely confined to estuaries and surrounding grassland habitats to the south-east of a line from the Humber Estuary to the Burry Inlet (Lack 1986, *Wildfowl & Wader Counts*). In the spring and autumn, many use the Wadden Sea as a staging ground, but in mid-winter most of the population is found in Britain and on the Atlantic coast of France (Ebbinge *et al.* 1999). Dark-bellied Brent Geese traditionally feed on intertidal habitats and saltmarshes by grazing, pulling up underwater plants and by eating drifting eel-grass and green algae (Snow & Perrins 1998). However, they have increasingly been making use of coastal grasslands (including amenity grassland such as playing fields) and arable crops (Vickery *et al.* 1995).

Dark-bellied Brent Geese were recorded at 33 of the 62 sites under review. However, the geese were noted from 27% of count sections and on 19% of visits and were thus rather widespread in those areas where they occurred. The proportion of birds recorded as feeding at low tide was 79%. Examination of the LTC distribution maps for Dark-bellied Brent Geese shows that within the core range of the species (*i.e.* from the Solent to the Wash) the geese were very widespread within almost all sites, although local concentrations did occur, especially on nontidal grassland (such as at Farlington Marshes in Langstone Harbour, at Pagham Harbour and the Beaulieu Estuary). On the North Norfolk Coast, most geese occurred on saltmarsh with relatively few on intertidal habitats. Towards the periphery of the range, the birds became more localised within each site (*e.g.* at the Humber Estuary, Burry Inlet and Exe Estuary). Of the sites from which Dark-bellied Brent Geese were not recorded, most were outwith the core south-eastern range. Within the core range, the only major site from which the species was not recorded was Breydon Water.

Figure 5.7 shows the distribution of the birds clearly, with the major concentrations around the Solent and the Greater Thames. At a sectional level, 5% of all sections surveyed supported densities in excess of 2.15 birds per hectare, with 1% of sections supporting densities in excess of 6.49 birds per hectare. Counts exceeding the current 1% threshold value were recorded at 20 sites, although most of the counts in excess of the international 1% threshold value of 3,000 were from just four sites: Blackwater Estuary, Chichester Harbour, Langstone Harbour and North Norfolk Coast.

A total of 19 SPAs have been designated for their value to wintering Dark-bellied Brent Geese (Stroud *et al.* 2001). All of these SPAs overlap with the LTC sites with the exception of the Wash and Chesil Beach & the Fleet. In addition to the sites overlapping SPAs, site totals exceeding the 1% national threshold value were recorded at Pagham Harbour.

LIGHT-BELLIED BRENT GOOSE

BRANTA BERNICLA HROTA

Figure 5.8: **Mean site densities of Light-bellied Brent Goose**

Light-bellied Brent Geese occur in the UK in two separate populations. The more numerous of these breeds in the eastern Canadian Arctic and winters almost exclusively in Ireland (Merne *et al.* 1999), whereas another population breeds on Svalbard and winters around the North Sea (Clausen *et al.* 1999). Within the UK, the latter population only occurs with regularity at Lindisfarne. Light-bellied Brent Geese at other east coast sites also derive from this population. The following discussion mostly refers to the Canadian/Irish population. Light-bellied Brent Geese arrive in Northern Ireland in September and October, with most birds making first for Lough Foyle or Strangford Lough. The latter site regularly supports over 75% of the entire flyway population of about 20,000 birds. Numbers peak in the province in October and November and then decline over the winter as the population redistributes, mostly into the Republic of Ireland with small numbers making it to western Britain and France (O'Briain and Healy 1991, *Wildfowl & Wader Counts*). Most birds leave in March. Many birds stage in spring and autumn in Iceland on route to and from the breeding grounds (Gardarsson and Gudmundsson 1997). On arrival at Strangford Lough, the geese feed initially on *Zostera*, but as the winter progresses other foodsources are increasingly utilised, including agricultural land (Andrews *et al.* 1996).

Light-bellied Brent Geese were recorded at 11 of the 62 sites under review, with records from 8% of count sections and on 10% of visits. The proportion of visits on which the geese were recorded rose significantly (χ^2_3=19.45, P<0.001) over the course of the winter, averaging 8% in November compared to 11% in February, as birds disperse within Strangford Lough as the winter progresses. The proportion of birds recorded as feeding at low tide was 94%, perhaps suggesting a higher reliance on intertidal habitats than Dark-bellied Brent Geese. Five of the sites apparently involved the Canadian flyway (Inland Sea, Dee Estuary and three in Northern Ireland) and the other six involved small numbers of birds (up to three birds per site) of the Svalbard population, along the east coast from the Moray Firth to the Crouch-Roach Estuary. Of the sites not recording Light-bellied Brent Geese, the key absence was the lack of records from Lindisfarne. This site was only partially covered by the LTCs in 1992–93, when the geese obviously made use of the uncounted main part of the site but were unrecorded at the adjacent surveyed Budle Bay. Examination of the LTC distribution maps for Light-bellied Brent Geese reveals little in underlying principles given the concentration at Strangford Lough. At those sites where birds occurred, they tended to be widespread.

The Republic of Ireland should be remembered when considering Figure 5.8; key sites in the Republic are distributed around the whole coast, with Dublin Bay the most important single site. At a sectional level, 5% of all sections surveyed supported densities in excess of 0.09 birds per hectare, with 1% of sections supporting densities in excess of 1.29 birds per hectare. Strangford Lough totals tended to be highest in November, although the numbers by then were much lower than typical peak counts earlier in the autumn when birds first arrive.

Seven SPAs have been designated for their value to wintering Light-bellied Brent Geese, six in Northern Ireland plus Lindisfarne (Stroud *et al.* 2001). Although it is not designated an SPA, site totals exceeding the 1% national threshold value were recorded at Dundrum Bay.

SHELDUCK
TADORNA TADORNA

Figure 5.9: Mean site densities of Shelduck

Shelducks are familiar estuarine birds throughout the UK. The vast majority of the population winters on intertidal habitats, with only small numbers at inland sites (Lack 1986). Movements of Shelducks are complex. Most adults make a post-breeding moult migration to Helgoland Bight in northwest Germany, although some moult in smaller flocks on certain UK estuaries such as at Bridgwater Bay on the Severn Estuary. Juveniles stay around their natal areas until the autumn when they disperse, mostly moving south. At the same time, the birds moulting in Germany start to return, although the movement is staggered and many birds continue to move into the UK, especially the south-east, over the course of the winter (Wernham *et al.* 2002). Shelducks feed mostly on intertidal molluscs and crustaceans, obtained by wading in shallow water or on wet mud (Snow and Perrins 1998).

Shelducks were recorded at 60 of the 62 sites under review, with the species being noted on 66% of count sections and on 44% of visits, making Shelduck the most widespread wildfowl species in UK intertidal habitats. The movement of Shelducks back from the continent into the UK over the course of the winter was apparent from the proportion of visits on which the species was recorded each month, increasing steadily from 35% in November to 52% in February (χ^2_3=216.08, P<0.001). The proportion of Shelducks recorded as feeding at low tide was 85%, much higher than the dabbling ducks and more in line with the estuarine waders. Examination of the LTC distribution maps for Shelduck shows that at many sites the species was widespread and fairly evenly distributed (*e.g.* Chichester Harbour, Langstone Harbour, Blackwater Estuary, Colne Estuary, Deben Estuary, etc.). However, at other sites, the birds were more localised, numbers being concentrated on inner parts of sites with fewer in the outer estuary. This was presumably linked to the occurrence of sand and mud, with extensive sandflats (such as found at the Alt Estuary, Ribble Estuary, Duddon Estuary, Conwy Estuary, Swale Estuary, *etc.*) unsuitable. Only at two sites, the relatively small and incompletely surveyed Adur and Tyne Estuaries, was the species not recorded.

Figure 5.9 shows that Shelducks were clearly widespread but that site densities were higher on the east coast than in the west. This is due to the generally muddier nature of east coast estuaries and to the closer proximity to the moulting site on the near continent. At a sectional level, 5% of all sections surveyed supported densities in excess of 1.48 birds per hectare, with 1% of sections supporting densities in excess of 3.71 birds per hectare. Despite high densities in the east, many of the highest site totals of Shelducks were recorded in the west, notably the Dee, Mersey and Severn Estuaries and Strangford Lough.

A total of 32 SPAs in the UK have been designated for their value to wintering Shelducks (Stroud *et al.* 2001). Of these, five were not surveyed by the LTCs during the period under review: Alde-Ore Estuary, Lough Foyle, Lough Neagh & Lough Beg, Morecambe Bay and the Wash. Additional to the sites overlapping SPAs, site totals exceeding the 1% national threshold value were recorded at the Deben Estuary, Blyth Estuary (Suffolk), Crouch-Roach Estuary and Dundrum Bay.

WIGEON
ANAS PENELOPE

Figure 5.10: **Mean site densities of Wigeon**

Although scarce as a breeding species, the Wigeon is now thought to be the most numerous species of wildfowl found in the UK in winter, following an increase in its numbers coupled with a concurrent decline in the Mallard population (Kershaw and Cranswick 2003). Although many of the largest flocks occur on estuaries, Wigeon are also found widely inland, with some sites also holding large flocks (Lack 1986, *Wildfowl & Wader Counts*). Wigeon wintering in the UK originate from Fennoscandia, Russia and, to a lesser extent, Iceland (Wernham *et al.* 2002). Most birds arrive in the UK in October and November and leave again from late March to early April. However, there is also known to be a high degree of turnover and some redistribution throughout the winter. Wigeon feed mostly on vegetable matter, obtained both from the surface of the water and by grazing on land (Snow and Perrins 1998).

Wigeon were recorded at 58 of the 62 sites under review, with the species being noted on 42% of count sections and on 22% of visits. The four sites at which Wigeon were unrecorded included the three small (and partially covered) estuaries of the Adur, Wear and Tyne, and the larger Alt Estuary. The lack of any Wigeon at the Alt was linked to the open, sandy habitat present but was notable given the huge numbers on the adjacent sites of the Ribble, Dee and Mersey Estuaries. There was no appreciable difference between months in the proportion of visits on which the species was recorded. The proportion of Wigeon recorded as feeding at low tide was 42%, much lower than the majority of estuarine waders but very similar to Teal and Pintail. Wigeon feed on vegetable material either by grazing (including at night) or by picking at floating vegetation as the tide rises and falls and hence there can be less of a reliance on the low tide period for feeding. Examination of the LTC distribution maps for Wigeon fails to reveal any clear patterns. At some sites, birds were widespread and evenly distributed (*e.g.* Stour Estuary), whereas at others, birds were more localised, although potentially still as abundant (*e.g.* Humber Estuary). Distribution therefore appears to have been influenced by highly local factors.

Figure 5.10 shows the widespread distribution of the species on UK estuaries, with little geographical difference in site densities apparent. At a sectional level, 5% of all sections surveyed supported densities in excess of 2.96 birds per hectare, with 1% of sections supporting densities in excess of 9.20 birds per hectare. The only counts made at low tide that were in excess of the current international 1% threshold value of 12,500 were from the Ribble Estuary.

A total of 38 SPAs in the UK have been designated for their value to wintering Wigeon (Stroud *et al.* 2001). Of these, 16 were not surveyed by the LTCs during the period under review, including six estuaries: Alde-Ore Estuary, Cromarty Firth, Dornoch Firth and Loch Fleet, Lough Foyle, Morecambe Bay and the Wash. Additional to the sites overlapping SPAs, site totals exceeding the 1% national threshold value were recorded at the Burry Inlet and Cleddau Estuary.

TEAL
ANAS CRECCA

Several thousand pairs of Teal breed in the UK but, whilst these are thought to mostly remain during the winter, they are heavily outnumbered by immigrants from further north (Gibbons *et al.* 1993, Kershaw and Cranswick 2003). Although many coastal sites are of great importance, this is also a widespread species inland during the winter, both in large flocks and scattered more widely at low density (Lack 1986). Most of the Teal wintering in the UK breed from Iceland across to northwest Siberia. Both the autumn arrival and spring departure tend to be quite protracted. Teal are known to be highly responsive to local conditions, and cold weather in particular can cause rapid redistribution of birds, especially south into France and Iberia (Wernham *et al.* 2002). Teal are omnivorous, but feed mostly on seeds during the winter, filtering through mud with their bills; most feeding takes place at night (Snow and Perrins 1998).

Teal were recorded at 58 of the 62 sites under review, with the species being noted on 35% of count sections and on 18% of visits. The four sites at which the species was unrecorded were the Alt Estuary, Camel Estuary, Pegwell Bay and Ythan Estuary. There was no difference between months in the proportion of visits on which the species was recorded. The proportion of Teal recorded as feeding at low tide was 39%, much lower than the majority of estuarine waders but very similar to Wigeon and Pintail. Examining the LTC distribution maps for Teal shows a general preference for sheltered creeks and channels, including along larger river channels such as the Ribble Estuary, with fewer on open sandy coastlines. Saltmarshes (notably on the Dee Estuary and the North Norfolk Coast) and adjacent freshwater wetlands (such as Trimley Marshes on the Orwell Estuary) were also occupied by higher densities of the species.

Figure 5.11: Mean site densities of Teal

Figure 5.11 shows the widespread distribution of the species on UK estuaries, with little geographical difference in site densities apparent. At a sectional level, 5% of all sections surveyed supported densities in excess of 1.55 birds per hectare, with 1% of sections supporting densities in excess of 5.88 birds per hectare. The highest site totals were consistently recorded at the Mersey Estuary, although counts in excess of the current international 1% threshold value of 4,000 were also recorded at the Dee Estuary.

A total of 30 SPAs in the UK have been designated for their value to wintering Teal (Stroud *et al.* 2001). Of these, 16 were not surveyed by the LTCs during the period under review, including four estuaries: Alde-Ore Estuary, Dornoch Firth and Loch Fleet, Lough Foyle and Morecambe Bay. Additional to the sites overlapping SPAs, site totals exceeding the 1% national threshold value were recorded at Pagham Harbour.

MALLARD
ANAS PLATYRHYNCHOS

*Figure 5.12: **Mean site densities of Mallard***

The Mallard is the most widespread and familiar species of wildfowl in the UK, occurring in almost every conceivable wetland habitat. The wintering population is derived from both resident birds, which tend to be largely sedentary or locally dispersive, and immigrants from northern Europe (from Iceland to Russia) (Wernham *et al.* 2002). The picture is complicated by deliberate releases of large numbers of reared stock for shooting (Harradine 1985). Mallards are omnivorous and highly opportunistic feeders, both in the water and on land (Snow and Perrins 1998).

Mallards were recorded at 61 of the 62 sites under review, with the species being noted on 55% of count sections and on 29% of visits. The only site at which the species was unrecorded was the Hayle Estuary. There was no difference between months in the proportion of visits on which the species was recorded. The proportion of Mallards recorded as feeding at low tide was 56%, notably higher than the other dabbling ducks and perhaps influenced by the reliance of the species on feeding by man. Examining the LTC distribution maps for Mallard shows the species to be widespread at some sites but more localised at others. Many were found along river channels, as with the other dabbling ducks, but particularly high concentrations occurred around towns, car-parks and the like, where local birds gather to be fed.

Figure 5.12 shows the widespread distribution of the species on UK estuaries, with little geographical difference in site densities apparent, although lower densities were found at most sites around the Irish Sea and along the east coast from Norfolk north to the Tyne Estuary. At a sectional level, 5% of all sections surveyed supported densities in excess of 0.96 birds per hectare, with 1% of sections supporting densities in excess of 3.14 birds per hectare.

A total of 14 SPAs in the UK have been designated for their value to wintering Mallards (Stroud *et al.* 2001). Of these, seven were not surveyed by the LTCs during the period under review, including three estuaries: Lough Foyle, Morecambe Bay and the Wash. At no additional sites did site totals exceed the 1% national threshold value.

PINTAIL
ANAS ACUTA

The Pintail is fairly widespread but local in the UK in winter, with the majority of birds found on a small number of key sites, mostly estuaries (Lack 1986). Most UK wintering birds originate from Russia, as well as from the Baltic States, Fennoscandia and Iceland (Wernham *et al.* 2002). Pintail feed on a wide variety of both plant and animal material, mostly obtained from underwater mud by up-ending, although the species will also feed on land (Snow and Perrins 1998).

Pintail were recorded by the LTCs from 40 of the 62 sites under review, although the degree of localisation within each site was striking, with records from only 16% of count sections and only 7% of visits. There was little difference between months in the proportion of visits on which the species was recorded, although the proportion was slightly lower in November (χ^2_3=8.35, P<0.05). The proportion of Pintail recorded as feeding at low tide was 40%, a relatively low value but very similar to that for Wigeon and Teal. These species find more suitable feeding conditions on a rising or falling tide and/or at night. An examination of the LTC distribution maps for Pintail reinforces the fact that this was usually either a scarce species or, when more numerous, highly localised within a site. Pintail generally preferred inner, more sheltered parts of estuaries, often where there are saltmarshes or adjacent grazing marshes. Birds often loaf at low tide along main river channels, such as in the inner Dee Estuary, at Pagham Harbour and at Wigtown Bay.

Figure 5.13: ***Mean site densities of Pintail***

Figure 5.13 shows the relative site densities at the review sites around the UK, showing a wide scatter of higher density sites, although higher densities were present at several East Anglian sites. The low densities of birds in Northern Ireland were notable, given the prominence of some other sites on the eastern side of the Irish Sea. At a sectional level, 5% of all sections surveyed supported densities in excess of 0.20 birds per hectare, with 1% of sections supporting densities in excess of 1.00 birds per hectare. Counts in excess of the 1% international threshold of 600 birds were recorded at eight sites, the highest totals being recorded at the Dee Estuary, Duddon Estuary and Burry Inlet.

A total of 25 SPAs in the UK are designated for wintering Pintail, of which 17 overlap to some extent with the LTC sites within this review (Stroud *et al.* 2001). Of the remaining eight sites, three are estuarine (the Wash, Morecambe Bay and Cromarty Firth) and five are inland. At no additional sites did site totals exceed the 1% national threshold value.

EIDER

SOMATERIA MOLLISSIMA

*Figure 5.14: **Mean site densities of Eider***

The Eider is the most numerous sea-duck in UK waters and is often found close inshore. Like most sea-ducks, it has a predominantly northern distribution in the UK with Scotland accounting for the majority of the birds. Except for Northumberland, Northern Ireland and Walney Island in Cumbria, birds are found widely but relatively sparsely around the rest of the coast. Eiders frequent both estuaries and more open coast, although they seldom stray inland (Lack 1986). The majority of our wintering birds also breed here. Some are sedentary, whilst others move to favoured sites in the winter, notably at the mouth of the Firth of Tay. Only relatively small numbers are thought to arrive from the larger Fennoscandian and Russian population that winters mostly in the Baltic Sea and northern Wadden Sea (Wernham *et al.* 2002). Eiders feed mostly upon molluscs, as well as crustaceans and echinoderms, generally obtained by surface-diving (Snow and Perrins 1998).

Eiders were recorded at 32 of the 62 sites under review, with the species being noted on 11% of count sections and on 4% of visits. There was no difference between months in the proportion of visits on which the species was recorded. The proportion of Eiders recorded as feeding at low tide was 42%, a value more similar to the dabbling ducks than to most sea-ducks and seemingly contrary to the statement in Lack (1986) that 'In estuaries Eiders feed at low tide and roost over the high tide period.' However, the feeding *vs* roosting figures were heavily biased by the single flock at the mouth of the Firth of Tay that made up a large proportion of the total birds recorded by the scheme. Of the sites where Eiders were not recorded by the scheme, most were in the south, but the list also included more northerly sites such as the Solway Firth (inner estuary only), Wigtown Bay and Eden Estuary. Examining the LTC distribution maps for Eider, there was clearly a preference for outer parts of estuaries. At the Ythan Estuary, Irvine–Garnock Estuary and Montrose Basin, each of which has a constricted exit to the sea, Eiders were found on lower stretches of the main river channels, whilst at Belfast Lough and the Firth of Tay, with wide mouths, birds congregated around the outer reaches of both shores. Birds were more generally distributed around the Firth of Forth, which is rather non-estuarine in character for much of its length. In the south, the smaller numbers of birds tended to be found mostly around the mouths of sites also.

Figure 5.14 shows the northerly distribution of this species, with a scattering of lower densities elsewhere around the coast; the highest mean site densities were recorded at Montrose Basin and the Ythan Estuary. At a sectional level, 5% of all sections surveyed supported densities in excess of 0.13 birds per hectare, with 1% of sections supporting densities in excess of 3.83 birds per hectare. The highest actual counts made at low tide were from the Firth of Tay.

A total of eight SPAs in the UK have been designated for their value to wintering Eiders (Stroud *et al.* 2001). Of these, neither Morecambe Bay nor Lough Foyle was surveyed by the LTCs during the period under review. At no additional sites did site totals exceed the 1% national threshold value.

GOLDENEYE
BUCEPHALA CLANGULA

The Goldeneye is a scarce breeding species in the UK but is much more widespread during the winter across much of the UK, both on the coast and inland (Gibbons et al. 1993, Lack 1986). Most of our wintering birds breed in Fennoscandia and Russia, although the small number of British breeders is also thought to remain throughout the winter. Birds make a post-breeding movement to parts of the Baltic Sea and then later travel to their wintering grounds, mostly from November onwards. Return migration occurs from February onwards, although birds often remain relatively late into the spring (Wernham *et al.* 2002). Goldeneyes feed on molluscs, crustaceans and insect larvae, obtained by surface-diving in water of depths of up to four metres (Snow and Perrins 1998).

Goldeneyes were recorded at 47 of the 62 sites under review, with the species being noted on 28% of count sections and on 12% of visits. There was a relatively late arrival, with the species recorded on only 8% of visits in November compared to 13–14% during the rest of the winter (χ^2_3=65.05, P<0.001). The proportion of Goldeneyes recorded as feeding at low tide was 95%, which is comparable to most other diving ducks and similar species. There was no clear pattern to the 15 sites where Goldeneyes were not recorded. Examining the LTC distribution maps for Goldeneye, a variety of patterns were observed. At many sites, Goldeneyes were few in number but where they were more numerous, the species was generally distributed quite widely around a site. At some sites, most were found along the upper reaches of channels (*e.g.* Stour and Orwell Estuaries) whilst the lower reaches were more densely occupied elsewhere. In a few cases, large concentrations occurred in very restricted areas, notably on the Humber Estuary and Moray Firth. Such concentrations were related to the habit of the species to gather at sewers and food processing plants, where the birds often feed on waste grain. Such concentrations were transitionary, depending upon the provision of the food source; concentrations which used to be observed around Edinburgh on the Firth of Forth no longer occur following improved sewage treatment systems.

Figure 5.15: Mean site densities of Goldeneye

Figure 5.15 shows the widespread distribution of this species on UK estuaries, with a tendency for the highest densities to be in the north and low densities in Wales and the south-west. At a sectional level, 5% of all sections surveyed supported densities in excess of 0.29 birds per hectare, with 1% of sections supporting densities in excess of 1.22 birds per hectare. Actual counts made at low tide that exceeded the current 1% British or Irish national threshold values were recorded at seven sites, the highest site total being recorded at the Moray Firth.

A total of 15 SPAs in the UK have been designated for their value to wintering Goldeneyes (Stroud *et al.* 2001). Of these, five are not covered at all by the LTCs, those being Morecambe Bay and four inland sites. Additional to the sites overlapping SPAs, site totals exceeding the 1% national threshold value were recorded at the North Norfolk Coast.

RED-BREASTED MERGANSER

MERGUS SERRATOR

Figure 5.16: **Mean site densities of Red-breasted Merganser**

Red-breasted Mergansers breed locally in much of north-western Britain, especially in coastal areas (Gibbons *et al.* 1993). The winter distribution is much wider, with birds found around all coasts (both estuarine and open) but seldom inland (Lack 1986). The wintering population is made up of UK breeders, which are largely sedentary and disperse to coasts near to their breeding locations, plus immigrants which appear to be mostly Icelandic in the north but may be more from north-east and central Europe along the south and east coasts of England. Some UK birds congregate at moulting sites in August but immigrants are not thought to appear until October and peak in December (Wernham *et al.* 2002). Red-breasted Mergansers feed on fish, obtained by foraging from the surface with head submerged and subsequent diving (Snow and Perrins 1998).

Red-breasted Mergansers were recorded at 46 of the 62 sites under review, with the species being noted on 33% of count sections and on 14% of visits; the latter figure did not vary significantly during the course of the winter. The proportion of Red-breasted Mergansers recorded as feeding at low tide was 91%, which was similar to most other diving ducks. There was no clear pattern to the sites not recording Red-breasted Mergansers, although the species was notable by its absence from a number of the largest sites (Severn, Thames, Humber, Ribble and Mersey Estuaries). From looking at the LTC distribution maps for Red-breasted Merganser it can be seen that the species occurred in a highly dispersed and evenly distributed pattern on most sites. However, at a few sites the species showed a preference for the mouth of the estuary. Concentrations of Red-breasted Mergansers were unusual, however, with sectional counts in excess of 100 birds noted only on the Moray Firth and Firth of Forth.

Figure 5.16 shows that the species was widespread on UK estuaries, but only in low densities along much of the English east coast, around the Bristol Channel and around most of the Irish Sea. The Solent and south-west England, along with several Scottish sites, held higher densities. At a sectional level, 5% of all sections surveyed supported densities in excess of 0.27 birds per hectare, with 1% of sections supporting densities in excess of 1.48 birds per hectare. Actual counts made at low tide that exceeded the current 1% British or Irish national threshold values were recorded at ten sites, the highest site total being from the Firth of Forth.

A total of 15 SPAs in the UK have been designated for their value to wintering Red-breasted Mergansers (Stroud *et al.* 2001). Of these, three have not been covered at all by the LTCs during the period under review, those being Cromarty Firth, Morecambe Bay and Lough Foyle. Additional to the sites overlapping SPAs, site totals exceeding the 1% national threshold value were recorded at the North Norfolk Coast and Irvine–Garnock Estuary.

OYSTERCATCHER
HAEMATOPUS OSTRALEGUS

The Oystercatcher is one of the most familiar waders frequenting UK shores, as well as one of the most common and widespread. Virtually all UK Oystercatchers winter on the coast, with about 78% found on estuaries (Rehfisch *et al.* 2003). The species breeds widely in coastal regions of the UK, as well as inland in the north (Gibbons *et al.* 1993). These birds tend to remain in the country in the winter and are joined by birds from as far as Iceland and Russia, different regions of the UK receiving immigrants from broadly different breeding areas (Wernham *et al.* 2002). On estuaries, Oystercatchers feed mostly on bivalve molluscs, especially cockles, mussels and Baltic tellin, whilst inland earthworms are favoured (Snow and Perrins 1998).

Oystercatchers were recorded at 61 of the 62 sites under review (the exception being the small, partially-covered Wear Estuary), with the species being noted on 80% of count sections and on 66% of visits. This level of ubiquity at the section and visit level was exceeded only by Curlew and Redshank. There was no appreciable difference between months in the proportion of visits on which the species was recorded. The proportion recorded as feeding at low tide was 90%, a little lower than some other intertidal feeders. Oystercatchers were found to be widespread on most sites. At many sites, higher densities were clearly present towards the mouth of the estuary, such as at the Humber Estuary. At other sites, such as the Medway Estuary, a more even distribution was noted. At a few sites inner estuary densities were the highest, probably due to local conditions leading to more extensive areas of intertidal habitat here (*e.g.* Strangford Lough, Orwell Estuary). The most striking concentration of Oystercatchers, however, occurred in Belfast Lough where the relatively narrow flats, especially on the west shore south of Green Island, supported extremely high densities of birds.

Figure 5.17: Mean site densities of Oystercatcher

Figure 5.17 well depicts the widespread distribution of the species, with little broad-scale difference in site densities apparent, although the relative importance of the Northern Ireland estuaries and the relatively low densities along much of the English east coast can be seen. The highest mean site density by far was recorded at Belfast Lough. At a sectional level, 5% of all sections surveyed supported densities in excess of 5.34 birds per hectare, with 1% of sections supporting densities in excess of 14.80 birds per hectare.

A total of 30 SPAs in the UK have been designated for their value to wintering Oystercatchers (Stroud *et al.* 2001). Of these, six were not surveyed by the LTCs during the period under review, all of which were estuarine in character: Cromarty Firth, Dornoch Firth and Loch Fleet, Lough Foyle, Morecambe Bay, the Wash and Gibraltar Point (although it is likely that the latter two SPAs involve, in part, the same birds). Additional to the sites overlapping SPAs, site totals exceeding the 1% national threshold value were recorded at Dundrum Bay.

AVOCET
RECURVIROSTRA AVOSETTA

Figure 5.18: **Mean site densities of Avocet**

Avocets first started to winter regularly in the UK in 1947, the same year as the resumption of breeding in Suffolk. Wintering birds were initially found mostly on the Tamar Complex and Exe Estuary in the south-west but the range has increased in recent years, with the largest numbers now in the south-east (*Wildfowl & Wader Counts*). To date, no regular wintering occurs in Ireland. Birds form post-breeding moulting flocks on favoured sites, with British breeders joining flocks both at home and across the North Sea. From late October, Avocets move to their wintering sites. Most birds wintering in Britain (all of which are on estuaries) are thought to be British breeders, although some of the latter have been found to move as far south as Morocco (Wernham *et al.* 2002). Avocets feed mostly on invertebrates, such as small crustaceans, worms and insects, obtained by sweeping the head and bill from side to side through the water column and soft substrates (Snow and Perrins 1998).

Avocets were recorded at 18 of the 62 sites under review, with the species being noted on 4% of count sections and on 1% of visits. Birds were found throughout the south-east of the country, from the Humber Estuary to the Tamar Complex. Within this range, notable gaps in LTC occurrence were at the Stour and Orwell Estuaries, the Blackwater Estuary, several sites in the Solent (which remains sparsely occupied at the current time, although Pagham Harbour appears to be becoming a regular site) and the Kingsbridge Estuary. There was no appreciable difference between months in the proportion of visits recording the species. The proportion of Avocets recorded as feeding at low tide was 91%. Examining site-based distribution maps for Avocets shows how restricted the species was at many sites. At a number of sites within the broader range, numbers were very low, but even where more numerous, the range was highly localised. For example, the Avocets on the Thames Estuary were almost all found off East Tilbury. Only at the Medway Estuary and the Blyth Estuary (Suffolk) – the latter a small site – were birds more widespread.

Figure 5.18 shows the south-easterly winter distribution of the species during the late 1990s, with a set of closely neighbouring sites between Suffolk and North Kent and then more scattered sites along the south coast. At a sectional level, the top 1% of sections surveyed supported densities in excess of 0.43 birds per hectare.

A total of 16 SPAs in the UK have been designated for their value to wintering Avocets (Stroud *et al.* 2001). Of these, two were not surveyed by the LTCs during the period under review: the Alde–Ore Estuary and the Wash. At no additional sites did site totals exceed the 1% national threshold value.

RINGED PLOVER
CHARADRIUS HIATICULA

The Ringed Plover is a widespread although seldom numerous species which breeds and winters around much of the UK coastline, with very few inland (Lack 1986). Only about 27% winter on estuaries, most birds preferring rocky and sandy coastlines (Rehfisch *et al.* 2003). Birds wintering around the UK coastline comprise a mixture of UK breeders and immigrants from the Baltic Sea and Wadden Sea. More northerly breeding birds, from Canada to Fennoscandia, pass through the UK to and from wintering grounds in Spain and West Africa (Wernham *et al.* 2002). Ringed Plovers feed mostly upon polychaete worms, crustaceans and molluscs, taken from or near to the surface (Snow and Perrins 1998).

Ringed Plovers were recorded at 59 of the 62 sites under review, with the species being noted on 37% of count sections and on 17% of visits. The three sites from which Ringed Plovers were unrecorded were the small estuaries of the Fowey and the Clwyd and the partially covered Tamar Complex; further fieldwork at all of these sites would doubtless reveal it to be present. There was no appreciable difference between months in the proportion of visits on which the species was recorded. The proportion of Ringed Plovers recorded as feeding at low tide was 92%, predictably high for this intertidal specialist. Ringed Plovers displayed a variety of within-site distributional patterns. At many sites, birds were widely distributed with no strong preferences for any parts of the site, such as at the Blackwater Estuary or Inland Sea. At other locations, however, birds were more localised. These localised patterns more frequently involved concentrations towards the mouth of the estuary (*e.g.* most birds on the Dee and Mersey Estuaries were found along the North Wirral Shore and the Mersey Narrows) but occasionally the inner estuary was the preferred feeding area, as at the Deben Estuary and Swale Estuary.

Figure 5.19 shows the species to be widespread. There was a slight tendency towards higher densities in the south, whilst most of the sites around the Irish Sea supported only low densities, as did those on the east coast north of Norfolk. At a sectional level, 5% of all sections surveyed supported densities in excess of 0.38 birds per hectare, with 1% of sections supporting densities in excess of 1.00 birds per hectare.

A total of 22 SPAs in the UK have been designated for their value to wintering Ringed Plovers (Stroud *et al.* 2001). Of these, six were not surveyed by the LTCs during the period under review, including the two estuaries of Morecambe Bay and the Wash, the other four being non-estuarine coastal SPAs. At no additional sites did site totals exceed the 1% national threshold value.

Figure 5.19: Mean site densities of Ringed Plover

GOLDEN PLOVER
PLUVIALIS APRICARIA

*Figure 5.20: **Mean site densities of Golden Plover***

Golden Plovers are widespread in the UK in winter when large flocks congregate on farmland throughout much of the lowlands. Birds also commonly use estuarine habitats outside the breeding season (Lack 1986). The origins of the birds wintering in Britain and Ireland are complex. Icelandic breeders winter in Ireland and western Britain. British breeders winter both in Britain and further south. Birds from Scandinavia and further east also winter in Britain but some pass through to and from wintering grounds further south (Wernham *et al.* 2002). Golden Plovers feed mostly inland upon invertebrates, especially beetles and earthworms, although some plant material is eaten at certain times of the year. Additionally, intertidal molluscs are eaten on estuaries (Snow and Perrins 1998).

Golden Plovers were recorded at 53 of the 62 sites under review, with the species being noted on 22% of count sections and on 8% of visits. Many of the sites at which the species was unrecorded were relatively small. In North Wales, none were noted at the two adjoining sites of Lavan Sands and the Conwy Estuary, an area also devoid of this species during fieldwork for the Winter Atlas. There was no significant difference between months in the proportion of visits on which the species was recorded. The proportion of Golden Plovers recorded as feeding at low tide was 25%, a relatively low figure and assumed to be related to the fact that most Golden Plovers use estuaries as a safe roost site but feed on adjoining farmland. However, there have been recent suggestions that intertidal areas may become more important for foraging as the amount of suitable farmland becomes less (Mason and MacDonald 1999). Although often numerous, the species tended to be highly concentrated at a site. At many of the sites, most of the birds present were found in one or two discrete flocks. However, roughly half of these concentrations were found in the outer half of estuaries and half in the inner half, suggesting that substrate was not an important factor in roost position.

Figure 5.20 reveals somewhat higher densities at estuaries along the east coast and also along the south-west peninsula, with lower densities around the Solent and the Irish Sea in particular. At a sectional level, 5% of all sections surveyed supported densities in excess of 2.90 birds per hectare, with 1% of sections supporting densities in excess of 16.55 birds per hectare. By far the highest numbers were counted at the Humber Estuary.

A total of 22 SPAs in the UK have been designated for their value to wintering Golden Plovers (Stroud *et al.* 2001). Of these, eight were not surveyed by the LTCs during the period under review; including three estuaries (Lough Foyle, Morecambe Bay and the Wash) in addition to the non-estuarine coastal Outer Ards and four inland sites. Additional to the sites overlapping SPAs, site totals exceeding the 1% national threshold value were recorded at the Camel Estuary, Taw–Torridge Estuary and Blyth Estuary (Suffolk).

GREY PLOVER
PLUVIALIS SQUATAROLA

Grey Plovers are found around much of the UK coast in the winter, although seldom inland, but about 95% of the birds frequent estuaries (Lack 1986, Rehfisch *et al.* 2003). All of these birds breed in northern Russia, with more passing through the UK to and from wintering grounds further south (Wernham *et al.* 2002). The British population has increased approximately fourfold since the 1970s (Atkinson *et al.* 2000). Grey Plovers feed on a variety of intertidal polychaete worms, molluscs and crustaceans (Snow and Perrins 1998).

Grey Plovers were recorded at 56 of the 62 sites under review, with the species being noted on 49% of count sections and on 33% of visits. The six sites at which the species was unrecorded by the scheme were mostly quite small. There was no appreciable difference between months in the proportion of visits upon which the species was recorded. The proportion of Grey Plovers recorded as feeding at low tide was 93%, a high figure but very similar to the majority of other intertidal specialist waders. The LTC site maps for Grey Plover reveal a variety of different distribution patterns. Most of the estuaries in the south-east of the UK supported Grey Plovers fairly evenly across much of their intertidal habitats. Elsewhere, the species was more localised, but not consistently so. On most of the sites in the north-east and on the Duddon, Ribble and Dee Estuaries, the outer estuary tended to support higher densities. In the south-west and at Strangford Lough, however, the species was mostly found in inner estuary situations.

Figure 5.21 shows the relative site densities at the review sites around the UK and highlights the key areas of the Greater Thames, Solent and, to a lesser extent, Liverpool Bay. At a sectional level, 5% of all sections surveyed supported densities in excess of 0.92 birds per hectare, with 1% of sections supporting densities in excess of 2.91 birds per hectare. Many of the highest absolute counts were recorded at the four adjacent Liverpool Bay estuaries (Ribble, Alt, Mersey and Dee), despite the overall density here being lower than in the south-east.

A total of 28 SPAs in the UK are designated for wintering Grey Plovers, of which 25 overlap to some extent with the LTC sites within this review (the others being Morecambe Bay, the Wash and Gibraltar Point, the last two involving the same birds to a great extent) (Stroud *et al.* 2001). Additional to the sites overlapping SPAs, site totals exceeding the 1% national threshold value were recorded at Pagham Harbour and Pegwell Bay.

Figure 5.21: Mean site densities of Grey Plover

LAPWING
VANELLUS VANELLUS

Figure 5.22: Mean site densities of Lapwing

The Lapwing is one of the most familiar waders in the UK and is the most numerous. The species breeds widely, although in declining numbers in recent years in the lowlands, and winters almost everywhere except for the highest land (Lack 1986). The species breeds across the whole of Eurasia. Some British breeders winter locally whilst others migrate south to France and Iberia, especially those from SE England. Some of the more northerly British breeders winter in Ireland. Additionally, continental birds move into the UK in large numbers in the winters, with cold weather prompting often highly visible migration to the west and south (Wernham *et al.* 2002). Lapwings feed, both by day and night, on a wide variety of ground-living invertebrates (Snow and Perrins 1998).

Lapwings were recorded at all of the sites under review, with the sole exception of the Kingsbridge Estuary (a site at which Golden Plover also went unrecorded). The species was noted on 48% of count sections and on 28% of visits. There was a significant decline (χ^2_3=44.14, P<0.001) over the course of the winter in the proportion of visits on which the species was recorded, with 30% of visits in November and December declining to 23% by February, perhaps reflecting the relatively early breeding season of this species. The proportion of Lapwings recorded as feeding at low tide was 30%, similarly low to Golden Plover and again reflecting the principal use of estuarine habitats as a safe roost with birds feeding inland. As for Golden Plover, however, it is possible that intertidal habitats may become increasingly important as foraging areas with a reduction in suitable farmland for foraging (Mason and MacDonald 1999). Within estuaries at low tide, Lapwings tended to have a rather clumped distribution, although there were sometimes many 'clumps', leading to an appearance of a more continuous distribution depending on the scale of representation. About half of the sites had more defined concentrations of birds. For all sites, broad-scale distributions showed either preferences for the inner estuary or showed no preferences; in no cases did the outer estuary support the highest densities.

Figure 5.22 shows the widespread distribution of the species on UK estuaries, with little suggestion of broad-scale geographical differences in estuarine densities. At a sectional level, 5% of all sections surveyed supported densities in excess of 9.30 birds per hectare, with 1% of sections supporting densities in excess of 35.08 birds per hectare. The only counts in excess of 20,000 Lapwings were made on the Humber Estuary.

A total of 38 SPAs in the UK have been designated for their value to wintering Lapwings (Stroud *et al.* 2001). Of these, 11 were not surveyed by the LTCs during the period under review, including four estuaries (Alde–Ore Estuary, Lough Foyle, Morecambe Bay and the Wash) and seven inland sites. At no additional sites did site totals exceed the 1% national threshold value.

KNOT
CALIDRIS CANUTUS

The Knot is an abundant, although relatively localised, wintering wader and one for which the UK has a particular international responsibility. The species is entirely coastal during the winter and about 97% of UK birds occur on estuaries (Rehfisch *et al.* 2003). The vast majority of wintering birds are of the race *islandica*, which breeds in northern Greenland and on the north-east Canadian islands. Some birds of the nominate race also occur, but mostly only on passage. Large numbers of both of these races moult in the autumn on the Wadden Sea, with *islandica* dispersing westwards to Britain and Ireland from October onwards, some of these birds returning to the Wadden Sea in the spring before migrating north to the breeding grounds (Wernham *et al.* 2002). Knot feed on a fairly restricted range of intertidal invertebrates, mostly molluscs (Snow and Perrins 1998).

Knot were recorded at 49 of the 62 sites under review, with the species being noted on 26% of count sections and on 11% of visits. Most of those sites not recording the species were relatively small and often narrow, with Lavan Sands perhaps being the most notable omission. The proportion of visits on which the species was recorded increased significantly (χ^2_3=27.05, P<0.001) over the course of the winter, from 9% in November to 12% in January/February, presumably reflecting the post-moulting arrival of birds from the Wadden Sea. The proportion of Knot recorded as feeding at low tide was 85%, a relatively low percentage compared to the other specialist intertidal waders. On about a third of sites where recorded, Knot were rather scarce. Elsewhere, although the species was sometimes quite widespread and fairly evenly distributed (such as at Dengie Flats or the Eden Estuary), it more frequently exhibited a much more concentrated pattern. In most (but not all) of the latter cases, an outer estuary preference was apparent.

Figure 5.23: Mean site densities of Knot

Figure 5.23 shows that Knot occurred in only low densities in south-west Britain, between North Wales and Kent. Higher densities occurred along the east coast and in the north-west. At a sectional level, 5% of all sections surveyed supported densities in excess of 2.58 birds per hectare, with 1% of sections supporting densities in excess of 10.10 birds per hectare. The highest absolute counts at low tide were made on the largest sites, notably at the Dee and Humber Estuaries and Strangford Lough.

A total of 25 SPAs in the UK have been designated for their value to wintering Knot (Stroud *et al.* 2001). Of these, five were not surveyed by the LTCs during the period under review, all estuarine: Cromarty Firth, Lough Foyle, Morecambe Bay, the Wash and Gibraltar Point (the last two involving the same birds to some extent). Additional to the sites overlapping SPAs, site totals exceeding the 1% national threshold value were recorded at the Blackwater Estuary and Medway Estuary.

SANDERLING
CALIDRIS ALBA

Figure 5.24: Mean site densities of Sanderling

The Sanderling is a high arctic breeder that occurs in the UK both as a wintering species and also in higher numbers on passage. Only about 34% of the British total is found on estuaries, most birds preferring open coast habitats, especially sandy beaches along the tideline of which Sanderlings feed on small invertebrates (Rehfisch *et al.* 2003, Snow and Perrins 1998). The Sanderlings wintering in Britain breed in Siberia, Greenland and possibly Canada. It was initially thought that most of the Greenland birds passed through to wintering grounds further south, whereas Siberian birds wintered here. Recent ringing recoveries, however, suggest that the distinction is not so clearcut (Wernham *et al.* 2002). Peak numbers occur at passage periods though, with moulting birds present in the autumn (*Wildfowl & Wader Counts*).

Sanderlings were recorded at 36 of the 62 sites under review, with the species being noted on 9% of count sections and on 4% of visits. Some of the larger sites from which Sanderlings were unrecorded included Belfast Lough, Stour Estuary and Swale Estuary. It is possible that, given the preference of this species for the water's edge, on some of the sites with the widest intertidal flats birds may have been present but not visible from the high water mark. There was no appreciable difference between months in the proportion of visits on which the species was recorded. The proportion of Sanderlings recorded as feeding at low tide was 98%, confirming that this species feeds actively at this state of the tide. Examination of the distributional maps of Sanderling at each site reveals that there was clearly a strong preference for the outer parts of estuaries. Given that this is more prevalently a non-estuarine species, habitually found along sandy beaches, this preference for the sandier parts of estuaries is as expected. Indeed, at some sites, the part of the 'estuary' most densely occupied was in reality an adjacent area of beach (*e.g.* at the Tees Estuary). Only at the Alt Estuary, North Norfolk Coast and Pegwell Bay, all of which are rather 'open-coast' in nature, could Sanderling have been described as widespread.

Figure 5.24 shows the relative site densities at the review sites around the UK. With the exception of the Alt Estuary, site densities were mostly low on the west coast (especially in the south-west) and higher in the east. At a sectional level, 5% of all sections surveyed supported densities in excess of 0.03 birds per hectare, with 1% of sections supporting densities in excess of 0.36 birds per hectare. The highest counts by far were recorded at the Alt Estuary.

A total of 11 SPAs in the UK have been designated for their value to wintering Sanderlings (Stroud *et al.* 2001). Of these, three were not surveyed by the LTCs during the period under review, those being the estuaries of the Wash and Morecambe Bay and the non-estuarine shoreline at South Uist Machair and Lochs. Additional to the sites overlapping SPAs, site totals exceeding the 1% national threshold value were recorded at Strangford Lough.

DUNLIN

CALIDRIS ALPINA

Figure 5.25: Mean site densities of Dunlin

The Dunlin is generally the most abundant wader on UK estuaries. Although small numbers occur at inland sites, over 99% occur on the coast, with about 95% of the total on estuaries (Rehfisch *et al.* 2003). Dunlin have a very wide breeding range in low arctic and boreal regions, with most wintering north of the equator. Three races occur in the UK. The westernmost component of the nominate race *alpina* breeds from northern Fennoscandia to Siberia and winters in western Europe, including the UK. The race *arctica* from north-east Greenland passes through the UK on its way to and from West African wintering grounds. Finally, *schinzii* is a breeding species in the UK as well as in Iceland, south-east Greenland and south Norway; most of this race winters in West Africa but some do so in Europe, including the UK (Wernham *et al.* 2002). Dunlin feed on a wide range of intertidal invertebrates, characteristically captured by a rapid series of shallow probes with the bill (Snow and Perrins 1998).

Dunlin were recorded at all of the 62 sites under review, with the species being noted on 68% of count sections and on 46% of visits. There was no significant difference between months in the proportion of visits on which the species was recorded. The proportion of Dunlin recorded as feeding at low tide was 98%, a typically high value as with most specialist intertidal waders. Examination of distributional patterns at the site level revealed little in the way of underlying principles; at some sites, the species was widespread, elsewhere it could be highly localised. It seems likely that the underlying patterns were not clearcut because the species is highly versatile and so can exploit food resources whenever and wherever they become available.

Figure 5.25 reveals a preference for the south-east of England, with high densities of Dunlin found especially around the Greater Thames area and the Solent, although the Mersey Estuary was also prominent. Densities were mostly low in Scotland and in the south-west. At a sectional level, 5% of all sections surveyed supported densities in excess of 16.04 birds per hectare, with 1% of sections supporting densities in excess of 39.67 birds per hectare. Site totals in excess of 30,000 from the Mersey, Ribble and Dee Estuaries show that north-west England, whilst not supporting such high densities as the south-east, nonetheless holds very high numbers.

A total of 38 SPAs in the UK have been designated for their value to wintering Dunlin (Stroud *et al.* 2001). Of these, six were not surveyed by the LTCs during the period under review, all of which were estuaries: Alde–Ore Estuary, Cromarty Firth, Dornoch Firth and Loch Fleet, Lough Foyle, Morecambe Bay and the Wash. Additional to the sites overlapping SPAs, site totals exceeding the 1% national threshold value were recorded at Pagham Harbour, Portsmouth Harbour, Crouch–Roach Estuary, Dundrum Bay and Moray Firth.

BLACK-TAILED GODWIT

LIMOSA LIMOSA

Figure 5.26: Mean site densities of Black-tailed Godwit

The Black-tailed Godwit is an increasingly numerous wintering wader in the UK, with an increase of over 200% since the 1970s, although the increase has been even more dramatic since the 1930s, when less than 100 birds wintered (Atkinson *et al.* 2000). The majority of wintering birds occur on estuaries, although some make use of wet grasslands, particularly later in the winter. Birds wintering in the UK belong to the Icelandic breeding subspecies *islandica* (Wernham *et al.* 2002). Black-tailed Godwits locate their invertebrate food by both sight and touch, most frequently by prolonged and vigorous probing and often with the head immersed in water (Snow and Perrins 1998).

Black-tailed Godwits were recorded at 46 of the 62 sites under review, with the species being noted on 25% of count sections and on 13% of visits. There was no appreciable difference between months in the proportion of visits on which the species was recorded. The proportion of Black-tailed Godwits recorded as feeding at low tide was 75%, a relatively low value for a wader, suggesting that significant numbers of this species feed at different states of the tide, or perhaps move to terrestrial habitats at night, although Zwarts and Wanink (1993) suggested that larger species of wader would need to feed for a lower proportion of the time than smaller ones. Examination of distributional patterns at the site level reveals a strong tendency for Black-tailed Godwits to occur mostly in the inner (muddier) parts of estuaries, with adjacent nontidal fields utilised at some sites.

Figure 5.26 shows the relative site densities at the review sites around the UK. Higher site densities occurred widely between Norfolk and Cornwall, with other high density sites outside this area more isolated at Belfast Lough and the Mersey Estuary. At a sectional level, 5% of all sections surveyed supported densities in excess of 0.52 birds per hectare, with 1% of sections supporting densities in excess of 2.61 birds per hectare. Most of the highest site totals were recorded at the Mersey, Dee and Stour Estuaries.

A total of 27 SPAs in the UK are designated for wintering Black-tailed Godwits, of which 21 overlap to some extent at least with the LTC sites within this review, the others being the Wash, Alde Complex, Morecambe Bay and three inland sites (Stroud *et al.* 2001). Additional to the sites overlapping SPAs, site totals exceeding the 1% national threshold value were recorded at Pagham Harbour, Strangford Lough, Severn Estuary, Deben Estuary, Portsmouth Harbour, Blyth Estuary (Suffolk) and Montrose Basin.

BAR-TAILED GODWIT

LIMOSA LAPPONICA

Bar-tailed Godwits breed in the high arctic from Fennoscandia eastwards across northern Siberia and winter in coastal regions of the Old World. The nominate race, occupying the western half of the breeding range, winters mostly in West Africa and in north-west Europe. In Britain, this is an entirely coastal species and about 94% of birds inhabit estuaries (Rehfisch *et al.* 2003). In the autumn, birds arrive both to moult and winter in the UK and also pass through en route to moult and winter in West Africa. In February and March, British wintering birds leave to feed on the Wadden Sea before migrating northwards. There is then a notable pulse of migration in May, especially along south-east coasts, of birds from the African wintering grounds that are also on the way to the Wadden Sea for refuelling (Wernham *et al.* 2002). Bar-tailed Godwits feed on intertidal molluscs, crustaceans and worms, often probing along or just below the tideline with head immersed (Snow and Perrins 1998).

Figure 5.27: Mean site densities of Bar-tailed Godwit

Bar-tailed Godwits were recorded at 53 of the 62 sites under review, with the species being noted on 36% of count sections and on 17% of visits. Most of the sites from which the species was unrecorded were small estuaries. There was no appreciable difference between months in the proportion of visits on which the species was recorded, suggesting that if dispersal to the Wadden Sea begins in February, the bulk of this must be rather late in the month. The proportion of Bar-tailed Godwits recorded as feeding at low tide was 96%. On many of the sites where Bar-tailed Godwits occurred, numbers were too low for a meaningful examination of distribution. Elsewhere, birds at many sites displayed a preference for the outer parts of the site (Strangford Lough and Belfast Lough being the exceptions), in association with sandy substrates.

Figure 5.27 shows the widespread distribution of the species, with little geographical difference in site densities apparent, although the Liverpool Bay estuaries were prominent. At a sectional level, 5% of all sections surveyed supported densities in excess of 0.72 birds per hectare, with 1% of sections supporting densities in excess of 3.26 birds per hectare. The highest absolute counts made at low tide were recorded at the Ribble and Dee Estuaries.

A total of 23 SPAs in the UK have been designated for their value to wintering Bar-tailed Godwits (Stroud *et al.* 2001). Of these, seven were not surveyed by the LTCs during the period under review, including the non-estuarine East Sanday Coast and six estuarine sites: Cromarty Firth, Dornoch Firth and Loch Fleet, Lough Foyle, Morecambe Bay, the Wash and Gibraltar Point (the last two doubtless involving the same birds to some degree). At no additional sites did site totals exceed the 1% national threshold value.

CURLEW

NUMENIUS ARQUATA

Figure 5.28: ***Mean site densities of Curlew***

The Curlew is a familiar UK bird both in the breeding season and in the winter. In the winter, about 95% of birds occur along the coast, although the true numbers of birds wintering inland are not fully known. Both estuaries and non-estuarine coastlines are frequented, the proportion of the population using estuaries being estimated at about 52% (Rehfisch *et al.* 2003). British and Irish breeding birds tend to winter in western Britain and Ireland, although some of the more southerly breeders winter as far south as Portugal. On the east coast of Britain, however, all of the wintering birds appear to be from the continent, from Norway to Russia and down to central Europe. UK breeding birds depart to their breeding grounds earlier than do the continental ones (Wernham *et al.* 2002). Curlews are omnivorous but feed chiefly on intertidal invertebrates on estuaries, both taking food from or near the surface and probing deep into the sediments with their long bills (Snow and Perrins 1998).

Curlews were recorded at all of the 62 sites under review, with the species being noted on 89% of count sections and on 73% of visits. These proportions were the highest recorded for any species by the scheme (albeit only slightly higher than for Redshank) and confirm the ubiquity of Curlews on the UK's estuaries. There was no appreciable difference between months in the proportion of visits on which the species was recorded. The proportion of Curlews recorded as feeding at low tide was 83%, somewhat lower than for the majority of estuarine waders, perhaps due to the species sometimes feeding on terrestrial habitats such as wet fields, although Zwarts and Wanink (1993) suggested that larger species of wader would need to feed for a lower proportion of the time than smaller ones. An examination of the individual site maps shows that at almost all sites, Curlews were extremely evenly distributed across the intertidal habitat. Not only that, but at sites where adjacent fields or marshes had been counted at low tide along with the mudflats, the density of birds was similar on intertidal and nontidal habitats.

Figure 5.28 shows the widespread distribution of Curlews on UK estuaries, with little geographical difference in site densities apparent; the Ythan and Irvine–Garnock Estuaries supported the highest mean site densities. At a sectional level, 5% of all sections surveyed supported densities in excess of 1.57 birds per hectare, with 1% of sections supporting densities in excess of 3.56 birds per hectare. As would be expected for such an evenly distributed species, the highest absolute counts were recorded on the largest sites, notably the Solway Firth, Dee Estuary and Humber Estuary.

A total of 25 SPAs in the UK have been designated for their value to wintering Curlews (Stroud *et al.* 2001). Of these, five were not surveyed by the LTCs during the period under review, all of which were estuaries: Cromarty Firth, Dornoch Firth and Loch Fleet, Lough Foyle, Morecambe Bay and the Wash. Additional to the sites overlapping SPAs, site totals exceeding the 1% national threshold value were recorded at the North Norfolk Coast and Ythan Estuary.

REDSHANK
TRINGA TOTANUS

The Redshank is a widespread breeding species in the UK, both inland (more so in the north) and on the coast (Gibbons *et al.* 1993). In winter, 99% of the UK's Redshanks are found on the coast, with 71% of the total on estuaries (Rehfisch *et al.* 2003). Many of the birds breeding in the UK also winter, although most leave the northernmost parts of Britain in the winter. Our birds are joined by large numbers of immigrants from Iceland for the winter, with further birds from the continent mostly passing through to wintering grounds further south (Wernham *et al.* 2002). Redshanks feed on a variety of crustaceans, molluscs and polychaete worms, hunting mostly by day on estuaries as they are largely visual foragers (Snow and Perrins 1998).

Redshanks were recorded at all of the 62 sites under review, with the species being noted on 88% of count sections and on 73% of visits; these proportions ranked Redshank the second most widespread estuarine waterbird in the UK, only marginally behind Curlew. There was no appreciable difference between months in the proportion of visits on which the species was recorded. The proportion of Redshanks recorded as feeding at low tide was 96%. An examination of the distribution maps for each site re-emphasise that Redshanks were extremely widely distributed. At many sites, the distribution was rather even. At other sites, a preference was shown for the inner parts of the site, to a greater or lesser extent. However, at no sites did Redshanks exhibit a preference for the outer estuary. Creeks were often densely occupied (*e.g.* Fremington Pill at the Taw–Torridge Estuary) but fields and freshwater marshes supported relatively few Redshanks compared with Curlews.

*Figure 5.29: **Mean site densities of Redshank***

Figure 5.29 clearly reveals a series of higher site densities along the east coast than on the west, presumably due to the muddier nature of most east-coast estuaries. Belfast Lough was the most prominent site in the west. At a sectional level, 5% of all sections surveyed supported densities in excess of 3.22 birds per hectare, with 1% of sections supporting densities in excess of 9.18 birds per hectare. Despite the relatively low densities, many of the highest site totals were counted at west coast sites, notably the Mersey Estuary.

A total of 35 SPAs in the UK have been designated for their value to wintering Redshanks (Stroud *et al.* 2001). Of these, six were not surveyed by the LTCs during the period under review, all of which were estuaries: Alde–Ore Estuary, Cromarty Firth, Inner Clyde Estuary, Lough Foyle, Morecambe Bay and the Wash. Additional to the sites overlapping SPAs, site totals exceeding the 1% national threshold value were recorded at the Deben Estuary, Crouch–Roach Estuary, Dundrum Bay and Breydon Water.

TURNSTONE
ARENARIA INTERPRES

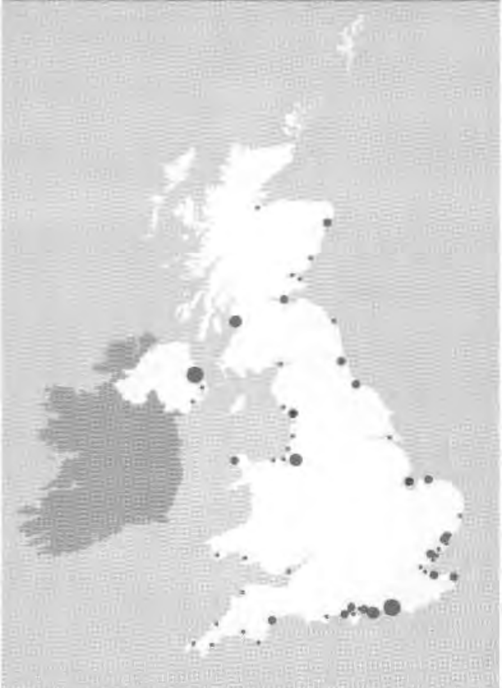


Figure 5.30: ***Mean site densities of Turnstone***

The Turnstone is a familiar species on rocky coasts around the whole of the UK (Lack 1986). Virtually none are encountered inland and only 22% occur on estuaries where they tend to inhabit the rockier areas (Rehfisch *et al.* 2003). Turnstones have a Holarctic northerly breeding distribution but the wintering range is almost worldwide. Most of those wintering in the UK are birds which breed in Canada and Greenland. Fennoscandian birds pass through the UK, where some may winter, but most continue south to North-west and West Africa (Wernham *et al.* 2002). Turnstones eat mostly insects, molluscs and crustaceans found by overturning stones, although the species will scavenge most potential food items on a beach (Snow and Perrins 1998).

Turnstones were recorded at 56 of the 62 sites under review, with the species being noted on 37% of count sections and on 20% of visits. The six sites at which Turnstone was unrecorded were Wigtown Bay, Lavan Sands, Conwy Estuary, Breydon Water, Fowey Estuary and Wear Estuary. There was no appreciable difference between months in the proportion of visits on which the species was recorded. The proportion of Turnstones recorded as feeding at low tide was 99%. An examination of distribution maps for each site reveals that Turnstones were often widespread but frequently showed a preference for the outer estuary, especially where there were rocky substrates. At many sites, Turnstones were rather localised, often on well-defined rocky outcrops, pebbly beaches and man-made structures such as marinas or breakwaters. However, open flats were used on occasion.

Figure 5.30 shows the widespread distribution of the species, with little geographical difference in site densities apparent, although site densities were generally low in the south-west. At a sectional level, 5% of all sections surveyed supported densities in excess of 0.48 birds per hectare, with 1% of sections supporting densities in excess of 1.73 birds per hectare. By far the highest absolute counts were made at the mouth of the Mersey Estuary, where a peak of 1,727 was recorded.

A total of 13 SPAs in the UK have been designated for their value to wintering Turnstones (Stroud *et al.* 2001). Of these, six were not surveyed by the LTCs during the period under review, those being Morecambe Bay, the Wash and four non-estuarine coastal SPAs. Additional to the sites overlapping SPAs, site totals exceeding the 1% national threshold value were recorded at the Blackwater Estuary, Humber Estuary and North Norfolk Coast.

RED-THROATED DIVER *GAVIA STELLATA*

The Red-throated Diver is a widespread wintering species around the coasts of the UK, being generally the most numerous of the diver species (Lack 1986, Kershaw and Cranswick 2003). These birds breed across the Arctic from at least as far away as Greenland and Finland, and also include birds which nest in Scotland (Wernham *et al.* 2002). The Firth of Forth is the only SPA currently designated for wintering Red-throated Divers (Stroud *et al.* 2001).

Red-throated Divers were recorded at 22 of the sites under review, with the species being recorded on 79 visits. Most of the records were from the Moray Firth and the Firth of Tay. Over 70% of observations were of single birds, with the remainder mainly involving up to six at at time. Larger concentrations were noted on individual count sections at the Moray Firth (12) and at the Alt Estuary (19). Given that thousands winter offshore in UK waters, the LTCs clearly provide little information about this species. The proportion of Red-throated Divers recorded as feeding at low tide was 95%.

GREAT NORTHERN DIVER *GAVIA IMMER*

Although widespread around UK coasts in the winter, numbers of Great Northern Divers are much higher in the west and north than along the east coast (Lack 1986). The precise breeding range of those wintering in UK waters is unknown but is thought to include Iceland, Greenland and possibly Canada (Wernham *et al.* 2002). There are no SPAs currently designated for Great Northern Divers in the UK (Stroud *et al.* 2001).

Great Northern Divers were recorded at eight of the sites under review, with the species being recorded on 26 visits. Seven of the eight sites where the species was recorded (Moray Firth, Belfast Lough, Strangford Lough, Cleddau Estuary, Taw-Torridge Estuary, Southampton Water and Langstone Harbour) corresponded with the generally westerly national distribution, with just a single east coast record of two on the Blackwater Estuary; on no visits were more than two birds recorded. The proportion of Great Northern Divers recorded as feeding at low tide was 97%.

SLAVONIAN GREBE *PODICEPS AURITUS*

The Slavonian Grebe is a scarce wintering species around much of the coasts of Britain and Ireland (Lack 1986). The movements of the species are unclear, but it has been suggested that there are two populations involved. Birds along the east coast of Britain may be of the nominate race *auritus*, which breeds in Sweden, Finland and the Baltic States. However, birds wintering in north-west Scotland and Ireland are thought to be of the race *arcticus*, and probably originate largely from Iceland (Wernham *et al.* 2002). The Exe Estuary and the Firth of Forth are the only two SPAs designated for their value to wintering Slavonian Grebes (Stroud *et al.* 2001).

Slavonian Grebes were recorded at 15 of the sites under review, with the species being recorded on 64 visits. The principal sites appeared to be Pagham Harbour (with a peak of a synchronous count of 26 birds), Strangford Lough (up to 11 birds), Chichester Harbour (up to nine birds) and Exe Estuary (up to nine birds), no other site totals in excess of four birds being recorded. The proportion of Slavonian Grebes recorded as feeding at low tide was 97%.

SHAG *PHALACROCORAX ARISTOTELIS*

The Shag is a common resident around much of the inshore waters of Britain and Ireland, although scarce in the south-east (between Yorkshire and Dorset). Shags disperse from breeding colonies in the winter but do not tend to make long-distance movements and avoid long sea-crossings (Wernham *et al.* 2002). There are currently no UK SPAs designated for their value to wintering Shags (Stroud *et al.* 2001).

Shags were recorded at 16 of the sites under review, with the species being recorded on 161 visits. It is possible that the species may have been seen but left unrecorded by counters at other sites, given the lack of emphasis WeBS has given to this species in the past. The majority of records came from Belfast Lough, Strangford Lough and the Firth of Forth, all sites with strongly non-estuarine character in places. Many counts were in single figures but larger flocks were recorded at the main sites. The peak for the Firth of Forth in 1992–93 was 509, including a flock of 263 on one count section. Counts at Belfast Lough over five winters varied greatly, between two and 237, the latter involving a single section count of 228. Strangford Lough's peak counts were more consistent, varying between 21 and 78 each winter. Other double-figure site totals were from the Firth of Tay, Moray Firth, Dundrum Bay, Conwy Estuary and Kingsbridge Estuary, but the species was scarce in the south-east. The proportion of Shags recorded as feeding at low tide was 60%.

BEWICK'S SWAN *CYGNUS COLUMBIANUS*

Bewick's Swan is a high-arctic breeder in the Russian tundra, the westernmost population of which winters primarily in Britain and the Netherlands (Wernham *et al.* 2002). In the UK, the majority of Bewick's Swans occur on just a handful of sites, with over 50% wintering on the Ouse Washes and Nene Washes (*Wildfowl & Wader Counts*). A number of the other key sites are parts of estuarine complexes, but the swans make use of adjacent nontidal pasture to feed. A total of 15 SPAs (mostly non-estuarine) have been designated for their value to Bewick's Swans, of which three (Breydon Water, Ribble & Alt Estuaries, Severn Estuary) overlap with sites covered by the LTCs during the period under review (Stroud *et al.* 2001). The only other estuarine SPA not covered by the LTCs was Lough Foyle.

Bewick's Swans were recorded at nine of the sites under review, with the species being recorded on 16 visits. These sites were quite widespread: five in the south-east from Poole Harbour around to the Humber Estuary, and four in the north-west around the Irish Sea. The largest counts were from the Ribble, Dee and Medway Estuaries, with counts at no other sites exceeding ten birds. Given that this species tends to frequent habitats which were not specifically targeted by the scheme, the data gathered by the LTCs for this species are of limited utility. The proportion of Bewick's Swans recorded as feeding at low tide was 96%.

WHOOPER SWAN *CYGNUS CYGNUS*

Within Britain and Ireland, the wintering range of the Whooper Swan has a more northerly and westerly pattern than that of Bewick's Swan, with far more birds frequenting Ireland. This is because the majority of our wintering Whooper Swans breed in Iceland, although it has become apparent in recent years that some birds from the population breeding in Fennoscandia and north-west Russia also arrive in the winter (Wernham *et al.* 2002). Notably, however, the most important single site in the UK is also the most south-easterly regular site, the Ouse Washes (*Wildfowl & Wader Counts*). A total of 19 SPAs have been designated for their value to wintering Whooper Swans, of which three (Lindisfarne, Ribble & Alt Estuaries and Upper Solway Flats & Marshes) overlap with sites covered by the LTCs during the period under review (Stroud *et al.* 2001). Three other estuarine SPAs important for Whooper Swans but not covered by the LTCs were Cromarty Firth, Lough Foyle and the Wash.

Whooper Swans were recorded at ten of the sites under review, with the species being recorded on 55 visits. The sites were all in Scotland, Northern Ireland and northern England with the exception of the Burry Inlet. The only counts in excess of 50 birds were made at Strangford Lough and the Firth of Tay. As with Bewick's Swan, the species tends to frequent nontidal habitat adjacent to the estuaries themselves and so the counts do not necessarily fully represent the birds present. The proportion of Whooper Swans recorded as feeding at low tide was 73%.

PINK-FOOTED GOOSE *ANSER BRACHYRHYNCHUS*

The Pink-footed Goose is the most numerous wintering goose in the UK, but is highly restricted in its world range. Most of the population breeds in Iceland and east Greenland and winters in Britain south to Norfolk and Lancashire, although very few are recorded in Ireland (*Wildfowl & Wader Counts*, Colhoun 2001). A total of 24 SPAs have been designated for their value to wintering Pink-footed Geese, of which nine overlap with sites covered by the LTCs during the period under review (Stroud *et al.* 2001). Two estuarine SPAs within the network for Pink-footed Goose were not covered by the LTCs: Morecambe Bay and the Wash.

Pink-footed Geese were recorded at 17 of the sites under review, with the species being recorded on 111 visits. The sites at which the species was recorded by the LTCs fit closely to the known winter range of the species, the most extralimital records being single-figure counts from the Taw–Torridge Estuary, Stour Estuary and Strangford Lough. There were some very large counts elsewhere, the highest being 15,150 at Montrose Basin in November 1997, but four-figure counts were also recorded at Firth of Forth, North Norfolk

Coast, Solway Firth and Wigtown Bay. As a highly gregarious species, this 'all or nothing' pattern is quite typical. Even within sites with high numbers, birds were mostly on a single count section, such as at Scolt Head on the North Norfolk Coast and near Grangemouth on the Firth of Forth. The proportion of Pink-footed Geese recorded as feeding at low tide was 8%; the species feeds almost entirely on inland fields and uses estuaries, as well as inland waterbodies, principally as safe nocturnal roosts. Therefore, the numbers recorded during LTCs do not describe the use of the site by the bird adequately.

GREYLAG GOOSE
ANSER ANSER

The indigenous population of the Greylag Goose is now confined to north-west Scotland, the latest winter estimate being 9,620 birds. Birds from this population were reintroduced to other parts of the UK, so successfully that there are now thought to be a further 28,500 birds in Britain as a result, with a small additional number in Ireland. Finally, the UK (Scotland in particular) is important as the wintering ground for Greylag Geese which nest in Iceland, of which the latest estimates are 81,900 birds in Britain and about 5,000 in Ireland (Kershaw & Cranswick 2003, Colhoun 2001). Small numbers of geese which breed in eastern Europe and winter mostly in the Netherlands also make it into the UK, although these are likely to go mostly undetected amongst naturalised re-established flocks. A total of 22 SPAs have been designated for their value to wintering Icelandic Greylag Geese, of which six overlap with sites covered by the LTCs during the period under review (Stroud *et al.* 2001). Three estuarine SPAs within the network for Greylag Goose were not covered by the LTCs: Cromarty Firth, Dornoch Firth & Loch Fleet and Lough Foyle.

Greylag Geese were recorded at 24 of the sites under review, with the species being recorded on 208 (2%) visits. Sites at which the species was recorded by the scheme were widely distributed around the country. Most birds on Scottish estuaries, plus those at Lindisfarne, were Icelandic immigrants. Most of the sites further south were assumed to hold birds of the naturalised re-established population. Within sites, naturalised re-established birds were often found on freshwater wetland habitat adjacent to estuaries, whereas the Icelandic birds tended to be roosting on the intertidal. The proportion of Greylag Geese recorded as feeding at low tide was 35%, with most birds feeding away from estuaries.

CANADA GOOSE
BRANTA CANADENSIS

Although occasional vagrant wild Canada Geese cross the Atlantic (as evidenced by ringing recoveries), almost all birds in Britain and Ireland are part of a naturalised introduced population. Most Canada Geese in the New World, as well as naturalised introduced populations in Scandinavia, migrate south in the winter. However, British and Irish birds are generally sedentary, although a moult migration of part of the population to the Beauly Firth is well-documented. Birds breeding at more upland sites will also move to the lowlands in the winter (Wernham *et al.* 2002). At all times of year, freshwater habitats are preferred. As a naturalised introduced species, there are no SPAs designated for Canada Geese (Stroud *et al.* 2001).

Canada Geese were recorded at 31 of the sites under review, with the species being recorded on 257 (2%) visits. The species was recorded widely around the UK by the scheme, but numbers were low in Scotland and at most Welsh sites. At most sites, Canada Geese were scarce on intertidal habitats and showed a preference for adjacent freshwater habitats. Nine sites recorded counts into three figures, the largest concentrations being at Burton Marsh at the Dee Estuary, Ince Banks at the Mersey Estuary and Loompit Lake at the Orwell Estuary. The proportion of Canada Geese recorded as feeding at low tide was 67%.

GADWALL
ANAS STREPERA

The Gadwall is one of the most rapidly increasing species of wintering waterbird in the UK, the population having expanded over 100-fold since the mid-1960s (Atkinson *et al.* 2000). The increase is thought to be due to the great enlargement of available habitat provided by the creation of artificial wetlands such as flooded gravel pit complexes. Gadwall have traditionally been most common in south-east England but larger flocks are now becoming more widespread. However, the great majority are found on inland waters. The birds wintering here are derived from a mixture of three sources. An increasing population breeds in the UK, of which some stay the winter and some disperse south to France and beyond, with some of the Scottish birds wintering in Ireland. Some of the other birds wintering in Ireland are from the Icelandic breeding population. Finally, there is also a winter arrival from eastern Europe

(Wernham *et al.* 2002). A total of 18 SPAs in the UK have been designated for their value to wintering Gadwall, 12 of which are inland (Stroud *et al.* 2001). However, on the six estuarine SPAs (all of which overlap with sites covered for the LTCs during the period under review), it is likely that most Gadwall were present on non-estuarine habitat within those SPAs.

Gadwall were recorded at 26 of the sites under review, with the species being recorded on 168 (1%) visits. The species was recorded widely around the UK by the LTCs although, as would be expected, numbers were generally lower in the north. At most sites, Gadwall occurred on marshes and pools adjacent to the main estuary, although some were found in intertidal habitats as well. Double-figure counts were quite widely noted, but the highest site total was of 147 at the Orwell Estuary in November 1996. The proportion of Gadwall recorded as feeding at low tide was 68%.

SHOVELER
ANAS CLYPEATA

The Shoveler is the least common of the principal dabbling duck species wintering in the UK. Shovelers favour areas of shallow freshwater and as these are the most likely to dry out or freeze over, the species has developed a strong dispersive and migratory tendency. Over 1,000 pairs breed in Britain and Ireland but most of these move south to winter from France to North Africa. However, birds from further east arrive in the autumn, some staying to winter here and some passing through, leading to an autumn peak in numbers (Wernham *et al.* 2002). A total of 26 SPAs in the UK have been designated for their value to wintering Shovelers (Stroud *et al.* 2001). Of the 12 SPAs which have an estuarine component, only the Alde–Ore Estuary was not surveyed by the scheme during the period under review.

Shovelers were recorded at 41 of the sites under review, with the species being recorded on 258 (2%) visits. The species was recorded widely around the UK by the LTCs. At some sites, Shovelers occurred on freshwater habitats adjacent to the main estuary, such as Blacktoft Sands at the Humber Estuary, Trimley Marshes on the Orwell Estuary and WWT Penclacwydd at the Burry Inlet. On other sites, however, substantial numbers were present on intertidal habitats, such as at the Medway Estuary (at Bedlams Bottom and Riverside Country Park) and along the Peterstone shoreline of the Severn Estuary. Double-figure counts were widely noted, but three-figure counts were only recorded in the south, at the Medway Estuary, Burry Inlet, North-west Solent and Severn Estuary. The proportion of Shovelers recorded as feeding at low tide was 73%.

POCHARD
AYTHYA FERINA

The Pochard is a common and widespread wintering species across much of the UK, although a relatively scarce breeding bird. Most are found on inland sites, with coastal sites occupied during harsh weather or where feeding opportunities are particularly suitable. Substantial moulting flocks can occur in the late summer, with further arrivals for the winter, mostly originating from the Baltic States, central Europe and Russia; the breeding range of this species is somewhat more southerly than those of many of the other duck species wintering in the UK (Wernham *et al.* 2002). A total of 12 SPAs in the UK have been designated for their value to wintering Pochard, nine of which are inland (Stroud *et al.* 2001). The three estuarine SPAs, the Severn Estuary, Humber Flats, Marshes & Coast and Poole Harbour, were all covered by the LTCs during the period under review.

Pochard were recorded at 25 of the sites under review, with the species being recorded on 172 (1%) visits. The species was recorded widely around the UK by the LTCs, although numbers were generally low in the north. At most sites, Pochard were scarce, but larger numbers occurred in two situations. Firstly, at sites such as the Orwell Estuary (where 772 were counted in February 1996) and the Burry Inlet, most birds were present on nontidal habitat adjacent to the estuary. At a few other sites, however, birds congregated at grain or sewage outfalls on the estuary itself, notably at New Holland on the Humber Estuary and at Peterstone on the Severn Estuary. Large flocks also historically occurred around outfalls on the Firth of Forth before these were cleaned up. The proportion of Pochard recorded as feeding at low tide was 60%.

TUFTED DUCK
AYTHYA FULIGULA

Tufted Ducks are common and widespread throughout the year and across the UK, the breeding population being supplemented by continental immigrants in the winter. The majority occur inland but some make use of coastal sites, including estuaries, at times. Large flocks of the species are uncommon, except at Loughs Neagh and Beg in Northern Ireland. Most British breeders are resident, although many Scottish birds appear to move south-west to Ireland for the winter. Winter immigrants originate from Iceland (mostly wintering in Ireland) and from Fennoscandia and European Russia (Wernham *et al.* 2002). A total of seven SPAs in the UK have been designated for their value to wintering Tufted Ducks, six of which are inland (Stroud *et al.* 2001). The only estuarine SPA, the Severn Estuary, was partly surveyed during the period under review.

Tufted Ducks were recorded at 28 of the sites under review, with the species being recorded on 208 (2%) visits. Sites from which the species was recorded were widely distributed around the UK. At a number of sites, Tufted Ducks were mostly confined to adjacent freshwater habitat (such as at the Burry Inlet, Chichester Harbour and Orwell Estuary). Only on a few sites were larger concentrations of several hundred birds found on the estuary itself, along the Peterstone shore of the Severn Estuary, at New Holland on the Humber Estuary, at Barking on the inner Thames Estuary, at Inverness on the Moray Firth and at Dundee on the Firth of Tay; most of these concentrations were due to site-specific food inputs such as sewage or waste grain outfalls. The proportion of Tufted Ducks recorded as feeding at low tide was 73%.

SCAUP
AYTHYA MARILA

Scaup are the most maritime of the genus *Aythya*, using both estuaries and the open coast, with only small numbers occurring inland apart from the very notable exception of Loughs Neagh and Beg in Northern Ireland, which supports the largest flock in the UK (*Wildfowl & Wader Counts*). Ringing recoveries suggest that many of the Scaup wintering in the UK originate from Iceland, although birds from the Baltic and further east also occur (Wernham *et al.* 2002). A total of six SPAs in the UK have been designated for their value to wintering Scaup, four of which overlap with estuaries covered by the LTCs during the period under review; the other two are the Cromarty Firth and the inland site Loughs Neagh & Beg (Stroud *et al.* 2001).

Scaup were recorded at 16 of the sites under review, with the species being recorded on 73 visits. The sites at which Scaup were recorded were widely distributed around the coast. By far the largest counts were from the Moray Firth and Belfast Lough; at only four sites did peak counts not reach double figures, emphasising how this species usually occurs in flocks. Scaup tended to be very concentrated on a site, flocking at suitable feeding sites, with no particular preference for the inner or outer estuary. Peak numbers were often short-lived. The proportion of Scaup recorded as feeding at low tide was 88%.

LONG-TAILED DUCK
CLANGULA HYEMALIS

Long-tailed Ducks are not uncommon wintering birds in UK waters, but the vast majority are highly localised in the Moray Firth, the Firth of Forth, St Andrew's Bay and the northern isles. Smaller numbers are regular down the east coast but Long-tailed Ducks are scarce inland (Lack 1986). Together, these form only a tiny proportion of the estimated five million wintering in Europe, mostly in the Baltic Sea. The species frequently feeds far offshore in the Moray Firth and thus the birds are most effectively surveyed from the air. There is a lack of ring-recovery data for this species but our birds are thought to originate from Fennoscandia and north-west Russia (Wernham *et al.* 2002). Only three SPAs in the UK have been designated for their value to wintering Long-tailed Ducks: Firth of Forth, Firth of Tay & Eden Estuary and Moray & Nairn Coast, all of which were covered by the LTCs during the period under review (Stroud *et al.* 2001).

Long-tailed Ducks were recorded at eight of the sites under review, with the species being recorded on 103 visits. Four of these sites were in the south and involved up to three birds each. However, larger numbers were recorded at the four main sites further north. The Moray Firth held the highest numbers, although these were well short of the numbers thought to be actually present further offshore here. Up to 109 were counted in the Firth of Forth but the surveying of offshore species during these counts in 1992–93 was patchy and further surveys would probably yield far more. Up to 15 were recorded off Broughty Ferry at the Firth of Tay but the main flock in this area, in St Andrew's Bay off the Eden Estuary, was not covered by the counts. In Northern Ireland, up to 20 were recorded irregularly in Belfast Lough. The proportion of Long-tailed Ducks recorded as feeding at low tide was 94%.

COMMON SCOTER
MELANITTA NIGRA

Common Scoters are one of the more widespread and numerous sea-duck wintering around UK coasts and birds can be seen at almost any time of year, although only very small numbers breed. Although any coastal habitat can be occupied, the largest numbers occur in a few major concentrations in traditional areas. The monitoring of Common Scoters has been improved enormously by the use of aerial survey techniques in some of these areas. Details of movements are hampered by a lack of ringing information but recoveries have been made of birds ringed in Iceland and the Gulf of Finland (Wernham *et al.* 2002). A total of six SPAs in the UK have been designated for their value to wintering Common Scoters, all of which were covered by the LTCs during the period under review (Stroud *et al.* 2001).

Common Scoters were recorded at 17 of the sites under review, with the species being recorded on 46 visits. Common Scoters occurred in the inner parts of estuaries only in low numbers and most of the larger flocks were offshore along parts of sites more non-estuarine in character. The sites were widely distributed around the coast but higher numbers were found in the north, with large flocks noted off the Alt Estuary and off Tentsmuir Point at the mouth of the Firth of Tay; the largest flock was at the Moray Firth, concentrated off Nairn and Culbin Bars. The proportion of Common Scoters recorded as feeding at low tide was 71%.

VELVET SCOTER
MELANITTA FUSCA

Velvet Scoter is a localised wintering species in Britain, with sightings possible around most of the coast. However, the vast majority of birds are present in the Moray Firth complex, St Andrew's Bay, the Firth of Forth and around Orkney (Lack 1986). Velvet Scoters are usually found with Common Scoters and usually in much smaller numbers, although they can be the majority on occasion. The origin of these birds is thought to be Fennoscandia and probably Russia (Wernham et al. 2002). Four UK SPAs are designated for their value to wintering Velvet Scoters: Firth of Forth, Firth of Tay & Eden Estuary, Moray & Nairn Coast and North Norfolk Coast (Stroud *et al.* 2001). The relative or complete lack of records from these sites at low tide is due solely to a general lack of recording effort being directed at sea-duck at these sites, which are difficult to survey at any time but particularly so at low tide when birds may be further offshore and feeding more actively.

Velvet Scoters were recorded at just three of the sites under review, with the species being recorded on nine visits. Most of the records were from the Moray Firth, where site totals of up to 140 per month were recorded off the Nairn and Culbin Bars. Elsewhere, two birds were at the Taw–Torridge Estuary in January 1995 and two were in the Firth of Tay in January 1998. The proportion of Velvet Scoters recorded as feeding at low tide was 94%.

GOOSANDER
MERGUS MERGANSER

In the UK, Goosanders are mostly found inland, both in and out of the breeding season (Lack 1986, Gibbons *et al.* 1993). The traditional exception has been the Moray Firth, where counts of 1,500 have been recorded (although numbers have declined drastically in recent winters) (*Wildfowl & Wader Counts*). Following the breeding season, the majority of male Goosanders undertake a moult migration to the northernmost fjords of Norway whilst females remain to moult in Britain. Males begin to return from Norway in November. Some of the birds wintering south to the Midlands are known to be British breeders. However, few in the far south-east appear to be so and most of these appear to be from the continent, largely from northern Fennoscandia and western Russia (Wernham *et al.* 2002). Only two SPAs in the UK have been designated for their value to wintering Goosanders; the Firth of Tay & Eden Estuary and the Inner Moray Firth, both of which overlap with sites covered by the LTCs during the period under review (Stroud *et al.* 2001).

Goosanders were recorded at 22 of the sites under review, with the species being recorded on 56 visits. Records were geographically very widespread, from the Moray Firth south to the Kingsbridge Estuary. Most sectional counts were of single figures, with the only exceptions from the Moray Firth (mostly within the Beauly Firth at this site) and the Irvine–Garnock Estuary. The proportion of Goosander recorded as feeding at low tide was 88%.

MOORHEN
GALLINULA CHLOROPUS

The Moorhen is one of the most numerous and widespread waterbird species in the UK, being present in every inland wetland habitat down to small ditches and garden ponds, although intertidal habitats are rarely used (Lack 1986). Most British and Irish breeders are mostly sedentary but interchange occurs at least with birds from Denmark, the Netherlands and Germany (Wernham *et al.* 2002). No UK SPAs are designated for Moorhen (Stroud *et al.* 2001).

Moorhens were recorded at 30 of the sites under review, with the species being recorded on 337 (3%) visits. The sites from which the species was recorded were distributed around the whole coastline. The within-site distribution maps for Moorhen reveal a preference for narrower, more riverine parts of inner estuaries (such as along the river Caen at the Taw–Torridge Estuary, the river Itchen at Southampton Water and by Woodbridge at the head of the Deben Estuary), as well as on freshwater marshes and fields. The only three-figure concentration was at WWT Penclacwydd on the Burry Inlet. The proportion of Moorhens recorded as feeding at low tide was 95%.

COOT
FULICA ATRA

Coots are widespread and abundant waterbirds which favour standing freshwater such as natural lakes, gravel pits and reservoirs, with rivers also occupied (Lack 1986). Intertidal habitats, however, tend not to be used. The species breeds commonly across the UK, with these birds largely sedentary while their numbers are augmented by an influx of birds from north-west Europe in the winter. Movements are not fully understood, however, since the species migrates entirely by night and is relatively difficult to catch and ring (Wernham *et al.* 2002). There are six SPAs in the UK which have been designated for wintering Coot: five are inland sites and the other is Strangford Lough (Stroud *et al.* 2001).

Coots were recorded at 23 of the sites under review, with the species being recorded on 249 (2%) visits. The sites at which the species was recorded showed a southern bias. Examination of the distribution maps for Coot at individual sites shows that few occur on intertidal flats but more are found on inner, more riverine parts of the estuary (such as at Ipswich on the Orwell Estuary) as well as adjacent freshwater pools. The only site counts of Coot in excess of 100 birds were recorded at the Orwell Estuary, the Swale Estuary and the Burry Inlet. The proportion of Coots recorded as feeding at low tide was 94%.

PURPLE SANDPIPER
CALIDRIS MARITIMA

The Purple Sandpiper is a characteristic species of rocky shorelines around much of the UK, although local and generally scarce in the south (Lack 1986). Only about 3% of the total occurs on estuaries (Rehfisch *et al.* 2003). Purple Sandpipers breed from Canada to Russia and winter further north than other waders, extending south to Spain and Maryland on either side of the Atlantic respectively. Some populations, including those in Iceland and western Greenland, are resident. About 75% of British wintering birds, found around most of the north and west, are thought to come from Canada with most of the rest, from Aberdeenshire to Yorkshire, breeding in Norway. Some of the birds on the south coast may be from Russia (Wernham *et al.* 2002). Only three SPAs in the UK have been designated for their value to wintering Purple Sandpipers (Stroud *et al.* 2001). All of these are stretches of non-estuarine coast which do not overlap with the sites covered by the LTCs, apart from a small amount of overlap of the Northumbria Coast SPA at the mouth of the Tyne Estuary.

Purple Sandpipers were recorded at 14 of the sites under review, with the species being recorded on 92 visits. They occurred sparsely and locally within estuaries, tending to be found either on discrete rocky outcrops (such as Hilbre Island on the Dee Estuary) or on the outer parts of sites which grade into rocky non-estuarine coast (such as at the Firth of Forth and Belfast Lough). Counts at most sites were in single figures, the highest site count being at the Firth of Forth. The proportion of Purple Sandpipers recorded as feeding at low tide was 98%, as would be expected given that the richest pickings on the rocky shores inhabited by this species are at the lowest end of the tidal range.

RUFF
PHILOMACHUS PUGNAX

The Ruff is a scarce wintering species in the UK and very small numbers also breed. However, larger numbers pass through, especially in the autumn. Although many of the sites recording the highest numbers of Ruff are, at first glance, coastal, closer investigation reveals that the intertidal habitats are used only infrequently and Ruff prefer marshes and flooded fields, sometimes even being found within winter flocks of Lapwing and Golden Plover in areas of extensive farmland (Lack 1986). Wintering birds were unknown in the

UK before 1934. Ruff breed across the Palaearctic from the Atlantic to Pacific, both in northern regions and also in more temperate zones from Britain to Kazakhstan. The majority of birds winter in sub-Saharan Africa (Wernham *et al.* 2002). In the UK, a total of eight SPAs have been designated for their value to wintering Ruff, four on the coast (all of which overlap with sites covered by the scheme during the period under review) and four inland, the latter all involving extensive floodplains (Stroud *et al.* 2001).

Ruff were recorded at 17 of the sites under review, with the species being recorded on 37 visits. Sites were well distributed geographically, although the Firth of Forth was the only Scottish site to record the species. The maps for each site reveal little in the way of underlying distributional patterns since the species was generally scarce or highly localised. Key areas include Blacktoft Sands on the Humber Estuary, Blakeney and Brancaster Harbours on the North Norfolk Coast and the creeks near Old Hall Marshes on the Blackwater Estuary. The proportion of Ruff recorded as feeding at low tide was 63%.

SNIPE
GALLINAGO GALLINAGO

Snipe are widespread in the UK throughout the year, although breeding numbers have declined in recent years, especially in lowland areas. Snipe can be found in almost any wetland habitat, although marshes and flooded fields are the most favoured (Lack 1986). On estuaries, although intertidal flats are seldom occupied, saltmarshes can support large numbers. Most UK breeders are fairly sedentary, but many more arrive in the autumn, especially from Iceland and Fennoscandia (Wernham *et al.* 2002). The only UK SPA designated for wintering Snipe is the inland Somerset Levels and Moors (Stroud *et al.* 2001).
Snipe were recorded at 50 of the sites under review, with the species being recorded on 462 (4%) visits. Most of the sites from which Snipe were unrecorded were those where counts were restricted to intertidal habitats, with the species doubtless present in the general area around all sites. At most sites during the LTCs, small numbers of Snipe were found by chance by flushing birds from the edges of saltmarshes or from nontidal habitats. An examination of the distribution maps for the species suggests that narrower channels were often occupied, but the highest numbers were found at adjacent freshwater habitats, especially at reserves like Blacktoft Sands on the Humber Estuary and WWT Penclacwydd at the Burry Inlet. The highest saltmarsh counts were made when particular effort was made to survey the species, such as along the North Norfolk Coast, where intensive surveys suggested that in excess of 600 Snipe were present. Most other sites recorded peak counts of less than 100 birds, with the exception of the Dee Estuary, Pegwell Bay and the Swale Estuary. Clearly, the numbers counted on a site by the LTCs should not always be treated as a true representation of the numbers actually present. The proportion of Snipe recorded as feeding at low tide was 85%.

WHIMBREL
NUMENIUS PHAEOPUS

Whimbrel are principally passage migrants through most of the UK, with a notable difference between a west coast bias in the spring and an east coast bias in the autumn. The nominate race of the species breeds in northern Scotland, mostly on Shetland, and more commonly further north from Greenland to central Siberia. Very small numbers are recorded each winter in Britain and Ireland, mostly along the south coasts of each, although the main wintering range of the species is sub-Saharan Africa (Wernham *et al.* 2002). Although a total of 11 SPAs in the UK are designated for their value to non-breeding Whimbrels, this is a reflection of their importance during passage periods and not mid-winter (Stroud *et al.* 2001).

Whimbrels were recorded at 13 of the sites under review, with the species being recorded on 32 visits. The majority of records were from the south-west, between Pagham Harbour and the Camel Estuary. Further north, the species was recorded at the Firth of Forth, Strangford Lough, Mersey Estuary and North Norfolk Coast. Most records were of single birds. The proportion of Whimbrels recorded as feeding at low tide was 77%.

SPOTTED REDSHANK
TRINGA ERYTHROPUS

The Spotted Redshank occurs in the UK as a scarce winter visitor and a slightly more numerous passage migrant, more so in the autumn. The species breeds from Fennoscandia eastwards across Siberia, with the wintering range extending from West Africa to China (Wernham *et al.* 2002).

In the UK in the winter, most birds are found on estuaries, although the total number present represents a minute proportion of the flyway population. No SPAs in the UK are designated for Spotted Redshank (Stroud *et al.* 2001).

Spotted Redshanks were recorded at 30 of the sites under review, with the species being recorded on 84 visits. The species was recorded widely around the UK by the LTCs, although as would be expected, numbers were generally lower in the north. Examination of the distribution maps for each site reveals little in the way of habitat preferences, given the small number of birds present at most sites. Where larger numbers were present, preference was shown for areas of saltmarsh or for narrow creeks, notably along the upper reaches of the Torridge and along the Tresillian River at the Fal Complex. The highest counts were recorded at Pagham Harbour, Taw–Torridge Estuary and North Norfolk Coast, but at most sites only single-figure counts were noted. The proportion of Spotted Redshanks recorded as feeding at low tide was 99%, similarly high to that for most other specialist intertidal waders.

GREENSHANK
TRINGA NEBULARIA

Greenshanks breed widely across the taiga and forest zones of the Palaearctic, from Scotland to Kamchatka. Most birds winter in sub-Saharan Africa, southern Asia and Australasia, but smaller numbers over-winter in north-east Europe. Birds occur widely in the UK on passage, including inland, but most wintering birds are found on the coast, both at estuaries and along non-estuarine shores. The wintering population is concentrated in the south-west, with Ireland apparently supporting higher numbers than Britain. The origin of these birds is not certain but a large proportion of the Scottish breeders are thought to winter in Britain and Ireland, based on timing of departures from wintering grounds and arrival in late March on breeding grounds. Spring passage birds en route to breeding grounds further north-east in Europe occur in April and May (Wernham *et al.* 2002). There are no UK SPAs which have been designated for wintering Greenshanks (Stroud *et al.* 2001).

Greenshanks were recorded at 34 of the sites under review, with the species being recorded on 565 (5%) visits. Sites at which the species was recorded were widely distributed but showed a bias to the west. At most sites, too few birds were present to make comments about distributional patterns and preferences within sites, apart from a liking for narrow creeks (which may, in part, be simply due to there being many such creeks in south-west estuaries). Only single-figure counts were recorded at most sites, with the highest counts in the west. Site totals of 20 or more birds were recorded at Strangford Lough, Inland Sea, Kingsbridge Estuary and Taw–Torridge Estuary. The proportion of Greenshanks recorded as feeding at low tide was 95%.

COMMON SANDPIPER
ACTITIS HYPOLEUCOS

The Common Sandpiper is a common breeding species in northern and western Britain and Ireland, mostly frequenting streams and lake-shores in upland areas (Gibbons *et al.* 1993). Birds occur widely on passage elsewhere. Small numbers remain in the winter, with a south-western bias to these records, although most UK breeders are thought to winter in West Africa (Lack 1986, Wernham *et al.* 2002). There are no UK SPAs which have been designated for Common Sandpipers (Stroud *et al.* 2001).

Common Sandpipers were recorded at ten of the sites under review, with the species being recorded on 36 visits. Most of these sites were in the south, from the Crouch–Roach Estuary around to the Severn Estuary. Further north, birds were recorded at Strangford Lough and the Ythan Estuary. Most records involved only one or two birds, although ten were noted at Strangford Lough in February 1994 and up to six were recorded at the Tamar Complex each month during the 1997–98 winter. The proportion of Common Sandpipers recorded as feeding at low tide was 88%.

BLACK-HEADED GULL
LARUS RIDIBUNDUS

The Black-headed Gull is one of the most abundant and familiar wintering waterbirds in the UK, frequenting almost all of the country except for the most upland areas (Lack 1986). A wide variety of habitats are used, including farmland, but on the coast estuaries often support high concentrations of birds. Most gulls in the UK in winter congregate at discrete roosting sites overnight, often on freshwater although some large roosts also occur at estuaries. At the beginning of the 20th century, the species was virtually unknown inland but its spread into terrestrial habitats has allowed a huge increase in the population (Burton *et al.* 2002c, Bowes *et al.* 1984). The wintering population of Black-headed Gulls is derived partly from British and Irish breeders and partly from immigrants, especially from Fennoscandia, the Baltic region and the Netherlands but also from Iceland, Russia and central Europe (Wernham *et al.* 2002). No SPAs in the UK have been designated for their value to wintering Black-headed Gulls (Stroud *et al.* 2001).

Black-headed Gulls were recorded at 54 of the sites under review, with the species being recorded on 38% of visits. However, as recording of gulls was optional for counters and as the remaining eight sites had no gull counts submitted, it is unlikely that the species was entirely absent from any site. Given the optional nature of gull recording for the scheme, it is not possible to discuss in detail the within-site distribution of Black-headed Gulls, although examination of the maps perhaps suggests a preference for upper-estuary count sections such as narrow creeks. Although counting was optional and datasets are incomplete, the (admittedly non-synchronous) site total of almost 20,000 Black-headed Gulls on the Firth of Forth serves as an example of the high numbers of this species present on estuaries. The proportion of Black-headed Gulls recorded as feeding at low tide was 60%.

COMMON GULL *LARUS CANUS*

The Common Gull is a widespread and numerous species throughout most of the UK during the winter, using both terrestrial and wetland habitats; the latter (including estuaries) are often used as nocturnal roost sites (Lack 1986). Wintering birds in the UK are a combination of UK breeders and immigrants from, especially, Fennoscandia, the Baltic States and Western Russia (Wernham *et al.* 2002). No SPAs in the UK have been designated for their value to wintering Common Gulls (Stroud *et al.* 2001).

Common Gulls were recorded at 53 of the sites under review, with the species being recorded on 19% of visits. However, recording of gulls was optional for counters and the remaining nine sites had no or few gull counts submitted; it is unlikely that the species was entirely absent from any site. Given the optional nature of gull recording for the scheme, it is not possible to discuss in detail the within-site distribution of Common Gulls, nor the numbers present on most sites, although the highest site total of over 8,000 (albeit not a synchronous count) on the Firth of Forth highlights the large numbers of this species using estuaries at low tide. The proportion of Common Gulls recorded as feeding at low tide was 52%.

LESSER BLACK-BACKED GULL *LARUS FUSCUS*

Lesser Black-backed Gulls occur widely in the UK outside the breeding season, involving two subspecies, *graellsii* (mostly breeding in Britain and Ireland) and *intermedius* (breeding from the Netherlands to southern Scandinavia), whilst the nominate race (breeding in northern Scandinavia and migrating to East Africa) appears to be genuinely rare in the UK (Wernham *et al.* 2002). Lesser Black-backed Gulls appear to have changed their habits with regard to wintering in the UK: in the first gull roost survey in the UK in January 1953, 165 Lesser Black-backed Gulls were located, but by January 1993 this had risen to about 61,000 (no equivalent estimates are available for Ireland) (Burton *et al.* 2002c). The change in habits has been attributed, in part at least, to the increased availability of food at large landfill sites. Birds also occur on farmland and widely around the coast, including estuaries. Like other gulls, Lesser Black-backed Gulls congregate at nocturnal roost sites, including many estuaries. No SPAs in the UK have been designated for their value to wintering Lesser Black-backed Gulls (Stroud *et al.* 2001).

Lesser Black-backed Gulls were recorded at 48 of the sites under review, with the species being recorded on 7% of visits, although recording of gulls was optional for counters and many of the remaining sites had no or few gull counts submitted. However, zero returns for the Ythan Estuary, Montrose Basin and the Tyne Estuary reflected a generally low density in the north-east in the winter. Given the optional nature of gull recording for the scheme, it is not possible to discuss in detail the within-site distribution of Lesser Black-backed Gulls, nor the numbers of birds present on estuaries at low tide, although the peak site total was 867 at the Alt Estuary in December 1998. The proportion of Lesser Black-backed Gulls recorded as feeding at low tide was 44%.

HERRING GULL
LARUS ARGENTATUS

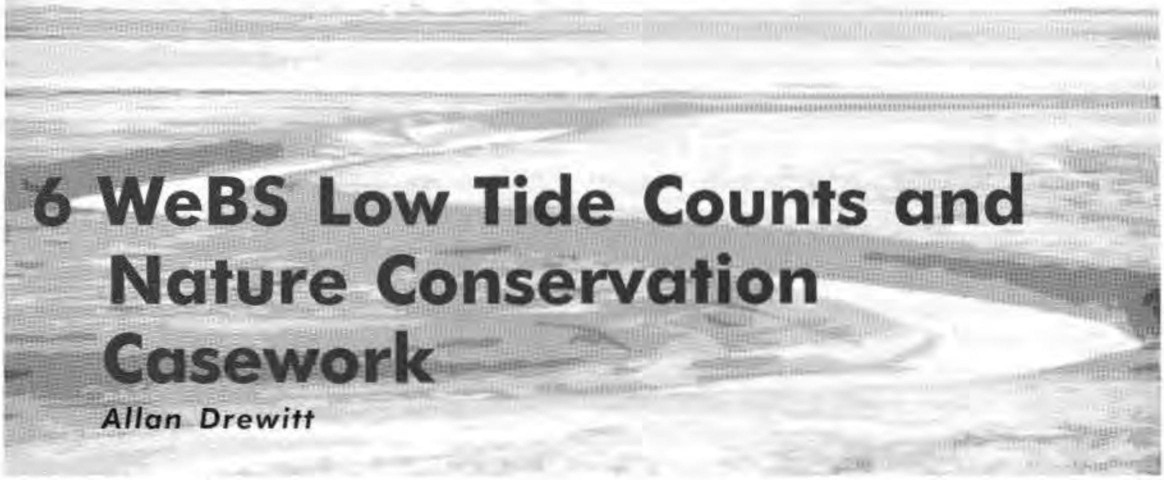
The Herring Gull is a common and widespread species around the coasts of the UK throughout the year. Additionally, large numbers of birds are also found inland in the winter, often attracted by refuse tips (Lack 1986). Breeding birds of the subspecies *argenteus* mostly remain around the UK all year. The nominate race *argentatus* breeds in north-west Europe and many of these birds winter in the UK; many of the Herring Gulls wintering inland appear to be of this race (Wernham *et al.* 2002). No SPAs in the UK have been designated for their value to wintering Herring Gulls (Stroud *et al.* 2001).

Herring Gulls were recorded at 54 of the sites under review, with the species being recorded on 30% of visits. However, recording of gulls was optional for counters and the remaining eight sites had no or few gull counts submitted; it is unlikely that the species was entirely absent from any site. Given the optional nature of gull recording for the scheme, it is not possible to discuss in detail the within-site distribution of Herring Gull, save to mention that higher concentrations were apparent around some harbours and docks, such as at Tynemouth, Hartlepool and Inverness. Similarly, it is not possible to discuss numbers of birds recorded, although particularly high site totals were recorded at the Firth of Forth (with a non-synchronous peak total of almost 25,000 birds), the Alt Estuary and Belfast Lough. The proportion of Herring Gulls recorded as feeding at low tide was 52%.

GREAT BLACK-BACKED GULL
LARUS MARINUS

The Great Black-backed Gull is the largest and the least numerous of the five *Larus* gulls in the UK. In the winter, the whole coast is occupied by the species, which also penetrates inland at this time, although inland birds are most numerous in eastern England and Scotland (Lack 1986). Many UK breeders are only locally dispersive in the winter but numbers are supplemented by an arrival of Norwegian birds along the east coast, with smaller numbers from Iceland and the Faeroes arriving in the north-west (Wernham *et al.* 2002). No SPAs in the UK have been designated for their value to wintering Great Black-backed Gulls (Stroud *et al.* 2001).

Great Black-backed Gulls were recorded at 51 of the sites under review, with the species being recorded on 17% of visits. However, recording of gulls was optional for counters and the remaining sites had no or few gull counts submitted; it is unlikely that the species was entirely absent from any site. Given the optional nature of gull recording for the scheme, it is not possible to discuss in detail the within-site distribution of Great Black-backed Gull, nor the precise numbers present, although the highest site totals (albeit not made as synchronous counts) were consistently recorded at the Firth of Forth, with over 1,000 recorded monthly. Large counts were also recorded at the Tees Estuary and Pegwell Bay. The proportion of Great Black-backed Gulls recorded as feeding at low tide was 38%.



6 WeBS Low Tide Counts and Nature Conservation Casework

Allan Drewitt

INTRODUCTION

The great majority of wetland sites of national importance for non-breeding waterbirds have been designated under the Wildlife and Countryside Act 1981 as Sites of Special Scientific Interest (SSSIs) (in Northern Ireland as Areas of Special Scientific Interest (ASSIs) under the Wildlife (Northern Ireland) Order 1985). Those sites that support nationally important numbers of certain rare or vulnerable waterbirds and/or internationally important numbers of waterbirds may be further protected through designation under the EU Directive on the Conservation of Wild Birds (79/409/EEC) as Special Protection Areas (SPAs). Within SPAs, the UK Government is obliged to take necessary steps to avoid deterioration of natural habitats and disturbance of the species for which sites have been designated. Internationally important sites may also be designated as Ramsar sites under the Convention on Wetlands of International Importance 1971.

The protection afforded by SSSI status has recently been reinforced by the introduction of new legislation in England and Wales in the form of the Countryside and Rights of Way Act 2000 (referred to as the CRoW Act). Under the Wildlife & Countryside Act 1981, owners, occupiers and various other authorities with land management and maintenance duties must consult with the relevant conservation agency (English Nature, Countryside Council for Wales and Scottish Natural Heritage) before undertaking, or permitting to undertake, activities that may harm the special interest of these sites. Under CRoW, the conservation agencies in England and Wales may then withhold consent or, if necessary, secure the appropriate management of an SSSI through a management scheme.

The designation of a wetland site as an SPA confers even stronger protection under The Conservation (Natural Habitats, &c.) Regulations 1994, commonly known as the Habitats Regulations. These regulations have transposed the requirements of the EC Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) (known as the Habitats Directive) into national law. They build on existing national nature conservation legislation for the protection of habitats and species and apply the specific provisions of the Habitats Directive to SPAs.

Under the Regulations, any activity requiring a formal consent or licence, which is not necessary for the management of the site but is likely to have a significant effect upon its international interest, must be subject to an 'appropriate assessment' of its implications for the site. So, for example, if a potential developer puts forward a planning application that would, if granted consent, have a significant effect on non-breeding waterbirds within an SPA, then the planning authority must carry out an appropriate assessment of the implications of the proposed development for the site. In carrying out the appropriate assessment, the planning authority must consult with the relevant statutory nature conservation body and have regard to any representations made by that body.

Importantly, a planning authority can only consent to a proposed development if the appropriate assessment determines that it will not adversely affect the integrity (ecological structure and function) of the SPA. Thus the onus is on the developer to show that its proposals will not damage an SPA, rather than on the conservation agencies and planning authority to argue that damage would be caused. If it cannot be ascertained that a site will not suffer an adverse effect then a development can proceed only if there are 'no alternative solutions' and if it is necessary for 'reasons (social, economic, public health and safety or environmental) of overriding public interest'.

THE ROLE OF LOW TIDE COUNTS IN SITE PROTECTION

Low tide data have been used to manage and safeguard both SSSIs and SPAs. However, as the vast majority of waterbird SSSIs, especially on the coast, are within SPAs, and because the legislation protecting SPAs is more powerful than that protecting SSSIs, the following account will focus on the application of low tide counts for the protection of SPAs.

The determination of whether or not a proposed development is likely to have a significant effect on the waterbirds using an SPA should be based on the best *available* information. Firstly, it is important to establish if the habitats that support the bird populations for which the SPA has been designated are likely to be affected, either directly or indirectly, or if the birds themselves are likely to be affected. Amongst other information it is often important to have details on the distribution of different species within the site, including locations of concentrations of birds that may be particularly sensitive to disturbance (for example, key feeding, roosting or nesting areas) and the time of year when birds are present.

On many SPAs, especially coastal sites, this information is readily available in the form of WeBS data. However, although WeBS core count data are often useful in identifying the presence and numbers of different species, they provide limited information on the way in which birds use habitats within a site. This is because core counts are normally undertaken around high tide when birds are generally roosting and are concentrated into small areas of the upper shore or sometimes even outside the SPA on adjacent farmland. If additional information is needed on the location of birds within the site, especially to assess the importance of intertidal habitats for feeding birds, then the low tide data are of critical importance. Often the two datasets can be used together: the core count data can be used to show the longer-term use of a site by particular species, generally over the most recent five winters (to allow assessment of *regularity* of use), whereas the low tide data, although collected over a shorter period, can give more precise distributional information.

In many cases the establishment of the presence of waterbirds, either feeding or roosting, within the area of an SPA likely to be affected by a proposed development, will be sufficient to require a fuller assessment of the implications of a project under the Habitats Regulations. This is particularly important when the proposal is more likely to result in disturbance to birds, rather than the loss, damage or deterioration of their habitats. Generally, the effects of habitat loss or damage are easier to assess than the less tangible effects of disturbance. Although disturbance is considered to be less serious than habitat loss, mainly because it may have only a temporary impact and does not directly affect the physical condition of a site, it is nevertheless an important consideration and is explicitly identified as an issue for concern in the European Directives.

Once the decision has been reached that an activity is likely to have a significant effect on an SPA, it is then necessary to carry out a more detailed assessment of the implications of a proposal for the site's important waterbird populations. This will include the extent and proportion of the habitats affected and the proportion of the population of individual species that would be affected. If disturbance is likely to be a significant issue, it would be important, as well as seeking information on the intensity, duration and frequency of repetition of the disturbance, to assess the numbers of birds that could be affected. Once again low tide data can help provide this detailed information.

MITIGATION AND COMPENSATION

In the context of site protection, mitigation includes measures which are put in place to reduce the impact of an activity on habitats and bird populations. Compensation is the creation of new habitats (usually outside the designated site) to replace those lost as a result of an activity. Low tide data are not only important when assessing the potential impacts upon a site, they are also valuable when considering the potential effectiveness of any mitigation or compensatory measures that accompany development proposals.

With regard to mitigation measures, information on the distribution and activities (roosting or feeding) of waterbirds on a site can help identify measures which may largely offset the impacts of a proposal. In particular, low tide and core count data may help when considering the following issues:

- *the creation or enhancement of habitats within the affected site, including the reduction of disturbance through the creation of refuges;*
- *adjustments to the timing of activities or operations to avoid particularly sensitive periods, for example the period of high tide if roosts would be affected, or breeding vs non-breeding periods;*

- *the positioning of acoustic and visual screening and shielding of light sources to reduce disturbance effects in key feeding and roosting areas;*
- *the need to control access for works personnel during construction, and members of the public following completion if new roads or floodbanks are created;*
- *the restoration of habitats following completion of works.*

Turning to the creation of replacement habitats, it is essential that any compensatory measures designed to accommodate a displaced population of birds should be on a 'like for like' and *at least* an 'area for area' basis. Any replacement habitat should be as similar as possible to that which has been adversely affected. Thus, in the context of feeding waterbirds, it will be important to consider sediment type, tidal range and exposure times, shelter from adverse weather, levels of disturbance and the proximity of suitable roosting areas. Compensatory habitat should be in place and in a suitable condition before the commencement of the development, so that it is immediately available to birds that are displaced. Another criterion for the success of any compensation scheme is that it supports at least the same number of birds as are found on the area due to be lost to development, and that the species composition of this group of birds is similar. Otherwise, the special interest features for which the SPA was designated will be diminished.

MONITORING

A critical requirement for any development, particularly those that incorporate mitigation or compensation, is appropriate monitoring to determine the effectiveness of mitigation or compensation measures and whether any adverse effects take place. Once again, both low tide and core count data are invaluable. The core count data will allow some assessment of effects at the overall site level. However, more precise data on the use of particular mudflats, on or adjoining the development site, or on the use of an area of compensatory habitat, will be of much greater value. In these cases the existing low tide data can provide a useful baseline. Follow up monitoring can then be undertaken by the developer using the WeBS methodology, with the potential addition of more detailed studies.

As stated above, an important test of the success or otherwise of compensatory habitats is an assessment of subsequent bird usage. Thus, in order to establish the success of such compensation, it would be necessary to carry out long-term monitoring of both habitat quality and bird numbers. Appropriate contingency measures should also be agreed in advance in case the primary compensation project fails to deliver its objectives.

CASE STUDIES

In order to gain a better understanding of how low tide count data can be used for assessing possible land-use changes in designated sites, two case studies are set out below: Dibden Bay in Southampton Water and Rock Ferry in the Mersey Estuary. The former is an example of potential habitat loss within an SPA and the latter an example of potential habitat loss and disturbance affecting an area of intertidal mud adjacent to an SPA.

Dibden Bay, Southampton Water

A planning application to build a container terminal on an area of intertidal foreshore and associated grassland in Southampton Water was made in 2000. The development would result in the almost total loss of Dibden foreshore including 42 hectares within the Solent and Southampton Water SPA/Ramsar site. It was estimated that the loss of Dibden foreshore would reduce the extent of the intertidal mud in Southampton Water by 4.6% and in the SPA/Ramsar site by 2.0%. In addition to the loss of intertidal habitat, there would be a loss of 250 hectares of grassland on an area of reclaimed marsh behind the foreshore, which is an important habitat for feeding wildfowl from Southampton Water. The application included a package of measures intended to offset the damage caused by the development, including the creation of an intertidal creek and adjacent freshwater habitat, and the capping of an existing area of allegedly contaminated mudflat.

English Nature and RSPB objected to the application on the basis that the project would result in a net loss of habitat within and adjacent to the Solent and Southampton Water SPA/Ramsar site and that this was likely to have a harmful effect on the internationally important waterbird populations. An appropriate assessment of the project was undertaken by the local authority and this concluded that, because of various mitigation measures including the creation of a new intertidal habitat, there would be no significant adverse effect on the SPA/Ramsar site. At the time of writing, the case remains unresolved and the outcome of a long-running Public Inquiry is awaited. Low tide count data for Southampton Water have played a vital part in the assessment of the impact of this development and their application in this case is described below.

The Solent and Southampton Water SPA/Ramsar site is designated for internationally important non-breeding populations of Dark-bellied Brent Goose, Teal, Ringed Plover and Black-tailed Godwit, as well as an assemblage of over 50,000 non-breeding waterbirds. The SPA is of additional importance for nationally important breeding populations of five species of gulls and terns (Stroud *et al.* 2001). The 1.5 kilometre stretch of Dibden foreshore supports a wide range of waterbirds, including Brent Goose, Shelduck, Oystercatcher, Ringed Plover, Grey Plover, Dunlin, Curlew and Redshank along with Red-breasted Merganser and Great Crested Grebe using the nearby shallow water.

A consistent set of low tide data has been collected annually in Southampton Water since the winter of 1995–96, around the time when the Dibden Terminal was first proposed. These data, along with the WeBS core counts, have been used to assess the importance of Dibden foreshore in the context of Southampton Water and the wider Solent and Southampton Water SPA/Ramsar site. The technique applied in this case was to take the peak low tide count recorded for each species during each winter (November to February) and to calculate peak means for the six-year period 1995–96 to 2000–01. A five-year period is usually considered to be sufficient to calculate a reliable peak mean. In this case, however, it was sensible to use all the available data. A peak mean derived from a number of years serves to 'smooth' annual fluctuations giving a reasonable representation of the peak numbers that are likely to occur in any given year.

The peak, rather than the average, count in each winter was used to better reflect the totals of birds using the site. This approach makes some allowance for the fact that counts will tend to underestimate the true numbers of birds that use a particular area. This is because counts represent only a 'snapshot' of bird usage during a few hours on a single day each month. The likelihood of such a snapshot occurring on the day when peak numbers of birds are present during a particular month is remote, and thus the real importance of an area in terms of the numbers of birds it supports will be underestimated. Furthermore, a single count takes no account of the turnover of birds present. Turnover is a major factor in autumn and spring migration periods, but continues during the winter, albeit at a lower level. Although using the peak mean does not address the issue of turnover, it does reduce the degree of underestimation of bird numbers in general terms. Thus, it is considered that averaging winter peak counts gives a better indication of bird use over time than averaging the mean winter counts.

Having calculated a peak mean for each species that regularly uses the foreshore, these figures were then expressed as a percentage of the total estimated populations for Southampton Water and the SPA/Ramsar site. The results of this comparison are given in Table 6.1.

This simple analysis shows that Dibden foreshore is more important for certain species than it is for others. For many species, Table 6.1 shows that Dibden foreshore supports a significant proportion of the total SPA population. In particular, for many species the Dibden foreshore supports a higher proportion of the population of Southampton Water or the SPA/Ramsar site than would be expected, given its size. For example, Dibden Bay is considered to represent 2% of the area of the SPA/Ramsar site but it supports more than 2% of the population of 11 of the tabulated species (indeed, ten times this value for Goldeneye and Oystercatcher).

Another approach taken to describe the importance of Dibden foreshore was to compare the densities of birds present at low tide with densities recorded elsewhere within Southampton Water. This provided some information on the quality of the intertidal habitat both in terms of the availability of invertebrate food for feeding birds and as a loafing or roosting area. Once again, the peak mean numbers have been used to calculate densities. The densities present at Dibden foreshore can then be compared with the densities present in Southampton Water overall, as shown in Table 6.2.

It can be seen that, although Dibden foreshore is not particularly densely occupied by wildfowl at low tide in the context of Southampton Water, it is clearly of outstanding importance as a habitat for waders, supporting almost four times the average Southampton Water density at low tide. Within this group, the relative importance of Dibden for Oystercatcher, Grey Plover, Dunlin and Curlew is particularly striking.

Both of the above analyses of low tide count data provide contextual information for evaluating the importance of the Dibden foreshore within the larger SPA/Ramsar site. In this particular case, the judgement on whether the loss of Dibden foreshore, when weighed against the proposed offsetting measures, would amount to an adverse effect on the SPA/Ramsar site will be made by the Public Inquiry.

Table 6.1: ***Peak mean waterbird numbers using Dibden foreshore or adjacent shallow water at low tide during the winters 1995–96 to 2000–01, along with the proportions present of the population of Southampton Water and of the Solent and Southampton Water SPA/Ramsar site. Species in blue bold occur on the SPA/Ramsar site in internationally important numbers. All other species are components of the internationally important waterbird assemblage. It should be noted that totals are derived from the single highest count of all wildfowl, waders and waterbirds respectively, and not the sum of individual species peaks (Dibden Bay data provided by Associated British Ports, Southampton).***

Species	Mean LTC peak	% Southampton Water	% SPA/Ramsar
Great Crested Grebe	16	18.2	11.7
Cormorant	8	5.0	3.8
Dark-bellied Brent Goose	83	4.8	1.2
Shelduck	10	3.9	0.8
Wigeon	12	0.6	0.2
Goldeneye	11	68.8	20.0
Red-breasted Merganser	5	13.5	3.5
Oystercatcher	291	21.8	20.2
Ringed Plover	19	12.5	4.7
Grey Plover	95	26.8	7.6
Lapwing	21	1.4	0.3
Dunlin	880	14.6	7.2
Black-tailed Godwit	1	0.8	0.1
Curlew	121	18.5	6.7
Redshank	30	6.2	2.8
Turnstone	31	12.5	8.9
Total wildfowl	120	2.2	0.5
Total waders	1415	13.8	5.4
Total waterbirds	1514	9.7	3.1

Table 6.2 (right): ***Peak mean densities, in birds per hectare, of selected waterbird species using Dibden foreshore and Southampton Water as a whole at low tide during the winters 1995–96 to 2000–01. Species in blue bold occur on the SPA/Ramsar site in internationally important numbers. All other species are components of the internationally important waterbird assemblage (Dibden Bay data provided by Associated British Ports, Southampton).***

Species	Mean density at Dibden Bay	Mean density in Southampton Water
Dark-bellied Brent Goose	1.56	1.49
Shelduck	0.19	0.22
Wigeon	0.22	1.69
Oystercatcher	5.49	1.16
Ringed Plover	0.35	0.13
Grey Plover	1.79	0.31
Lapwing	0.40	1.27
Dunlin	16.60	5.26
Black-tailed Godwit	0.01	0.12
Curlew	2.28	0.57
Redshank	0.56	0.42
Turnstone	0.58	0.22
Total wildfowl	2.86	4.72
Total waders	33.69	8.95
Total waterbirds	36.05	13.56

Rock Ferry, Mersey Estuary

This case involves an application made during 2000 to create a 'marine lake' in the Mersey Estuary on an area of intertidal mudflat known as Rock Ferry. Although it was not an SSSI at the time, it was considered that the development of this area of intertidal habitat would have a significant effect on the bird populations of the adjacent Mersey Estuary SPA/Ramsar site, and so an appropriate assessment was carried out by the local authority according to the Habitats Regulations. Once again, low tide count data were used to assess the implications of the proposal.

The appropriate assessment presented low tide data for the winters of 1994–95 to 1998–99 in the form of peak means for the Rock Ferry foreshore. These are summarized below in Table 6.3 for the most numerous, regularly occurring species.

These data clearly identified Rock Ferry as an important area of intertidal habitat for feeding waterbirds, especially for Pintail and Black-tailed Godwit for which numbers exceed the national importance thresholds. However, the appropriate assessment undertaken for the local authority concluded that the loss of habitat resulting from the development would be unlikely to reduce the value of this area for feeding birds to the point where it would affect the SPA/Ramsar site. The reasoning behind this conclusion was that the development would largely avoid the preferred areas of the Rock Ferry foreshore, and that the remainder of the area would remain available to feeding birds.

To illustrate this point, further low tide count data were provided for the individual count sectors of Rock Ferry. The Rock Ferry foreshore is divided into three sectors for the purposes of the low tide count and the data for *average* numbers of birds are given for each sector in Table 6.4.

The marina lake would result in the loss of two-thirds of sector 3 and most of the upper shore of sector 4. Sector 5 (the smallest sector) would remain intact. Although Sector 5 is the most important sector for the largest number of species, it can be seen that Sector 3 holds notable

Table 6.3: ***Peak low tide counts at Rock Ferry during the winters 1994–95 to 1998–99. Species in blue bold are those for which the five-year peak mean numbers exceeded their national 1% thresholds values (Young Associates 2000).***

Species	1994-5	1995-6	1996-7	1997-98	1998-9	five-year peak mean	% of national population
Shelduck	130	170	20	278	193	158	0.2
Pintail	100	120	230	464	555	294	1.1
Ringed Plover	270	350	200	48	140	202	0.7
Knot	650	300	1000	595	1020	713	0.2
Dunlin	500	450	1825	120	8910	2361	0.4
Black-tailed Godwit	7	40	150	4	587	158	2.3
Redshank	1500	750	341	607	757	791	0.7
Turnstone	4	70	100	10	250	87	0.1

Species	Sector 3	Sector 4	Sector 5
Shelduck	10	8	68
Wigeon	3	0	12
Teal	11	9	70
Pintail	28	19	169
Oystercatcher	54	20	14
Ringed Plover	3	10	13
Grey Plover	2	1	1
Knot	41	281	129
Dunlin	610	171	226
Black-tailed Godwit	14	50	107
Bar-tailed Godwit	2	1	0
Curlew	8	3	14
Redshank	216	102	196
Turnstone	8	4	1

Table 6.4 (right): ***Average number of birds present in each count sector at Rock Ferry, 1996–97 to 1999–2000 (Young Associates 2000).***

numbers of Oystercatcher, Dunlin and Redshank and Sector 4 holds the highest numbers of Knot.

The appropriate assessment put forward several proposals aimed at preserving the quality of the remaining area as a feeding habitat. These included restrictions to the timing of construction work, so that potentially disturbing activities would be undertaken outside the winter period. It was also recommended that public access to the retaining wall of the marina should be prevented during November to February, again to avoid disturbance to feeding birds.

English Nature and RSPB did not support the conclusions of the appropriate assessment and maintained its objection to the project on the basis of the low tide data. The data indicated that the loss of a substantial proportion of Sectors 3 and 4, although not directly affecting the nationally important numbers of Pintail and Black-tailed Godwit to a significant extent, would result in a considerable displacement of other species. Furthermore, it was felt that the quality of the remaining foreshore would be impaired by the proximity of a high retaining wall (thus reducing visibility for feeding birds) and by an unavoidable increase in disturbance from people using the marina lake. It was considered that because most, if not all, of the birds present on Rock Ferry were likely to be part of the Mersey SPA/Ramsar site population, the displacement of birds from this mudflat would place more pressure on feeding habitat within the SPA/Ramsar site, especially at times of peak numbers. This might have resulted in birds moving away from the Mersey, thus reducing the size of the SPA/Ramsar site population.

Following the objections of English Nature and RSPB, and the proposal to designate Rock Ferry as an SSSI, the developers have withdrawn the application for the project. Rock Ferry is now an SSSI and has been proposed as an extension to the Mersey Estuary SPA/Ramsar site.

CONCLUSIONS

These case studies clearly illustrate the great importance of low tide count data to the work of the nature conservation agencies and non-governmental conservation bodies. In combination with the core counts, these data are invaluable for the identification of accurate and ecologically sensible boundaries for the designation of SSSIs and SPAs. Low tide data are also of enormous importance when making assessments of the potential impact of management changes or habitat loss as a result of proposed developments. Finally, they are also necessary to assist the design, implementation and assessment of effective mitigation measures or compensation for harmful impacts. For these reasons it is essential that low tide data are collected across as wide an area of intertidal habitat as possible, not only within existing SSSIs and SPAs, but also elsewhere in areas that may be of sufficient importance to warrant designation in the future.

7 Discussion

Andy Musgrove and Niall Burton

This book describes a scheme that has been extremely successful in achieving its aims so far. This success is largely due to the dedicated and highly skilled team of 600 volunteer counters and the local organisers who have co-ordinated the counts at a site level. Without them, only a small fraction of the information could have been obtained and the prospects for the conservation of estuarine waterbirds would be greatly reduced.

COVERAGE

During the period covered by this book, the winters 1992–93 to 1998–99, LTCs were carried out at 62 estuarine sites around the UK. These sites were subdivided into almost 2,000 count sections, to which over 10,000 visits were made. Overall, almost nine million bird records were collected. This represents an unprecedented level of information on low tide bird distribution. Moreover, the scheme has continued in years subsequent to those reported upon here, thus adding further value to the dataset.

All of the species most specialised to estuarine habitats were well monitored by the LTCs, as were many more widespread waterbird species also present on estuaries. Intertidal flats were readily surveyed, although saltmarshes proved problematic at times. This is not a problem that can be easily overcome by a volunteer-based survey, due to the difficult and potentially hazardous nature of the terrain. However, there may be occasions when one-off surveys of saltmarshes by professional staff could provide useful information, as was seen on the North Norfolk Coast, for example; a professional fieldworker attempted to walk within 100m of every point within the saltmarshes there, revealing much higher numbers of some species than had been previously observed (M. Rooney pers. comm.). Offshore species which were not too distant were generally well-recorded by the scheme whilst nontidal habitats adjacent to estuaries were included in counts to a varying degree on a site-by-site basis.

The counting of gulls was optional throughout the survey, as it has been with WeBS Core Counts. The interpretation of the resulting gull data therefore requires care. However, Table 2 shows that these are clearly an important component of the estuarine bird assemblage. Whilst recording gulls at some sites can cause difficulties for counters, every encouragement should be given to do so in the future. In situations where counters feel that the recording of gulls would detract from the recording of other waterbirds, some indication of the order of magnitude of the number of gulls present on the section would be very helpful.

INTERPRETATION

The LTCs provide an excellent picture of the distribution of estuarine waterbirds at low tide during the winter. Whilst there are a number of interpretative issues to bear in mind, the consistent methods by which the LTCs are carried out ensure that bird distributions can be well-defined and valid comparisons can be made. It is reasonable to ask, however, to what degree the LTCs can be regarded as representative in a wider sense. For example, LTCs were seen to be most often carried out at weekends; to what extent has this affected the recorded distributions? Similarly, to what extent can LTCs recorded during the day be assumed to be representative of the night-time distribution of birds on intertidal habitats? Clearly, this will vary on a case-by-case basis and will depend upon the underlying reasons influencing bird distribution at a site. In particular, if bird distribution is affected by human recreational disturbance, often there will be a difference in the intensity of the latter between weekends and weekdays (or between night and day). Research into the impacts of man-made landscape features on estuarine waterbirds at low tide showed that the numbers of six species were significantly reduced by the presence of a footpath close to a count section and that whilst this effect was highly significant at weekends, it was much less distinct on weekdays (Burton *et al.* 2002b). Similarly, a study of the Cotswold Water Park looked at the differences between waterbird counts made on weekends and weekdays and concluded that the distribution within the complex did vary between the two (Kershaw 1997). Further investigation of the differences between weekend and weekday distributions would be of value.

How closely do distributions recorded in the winter represent those found at other times of the year? Although relatively few birds are present on estuaries during the summer, many pass through the UK in the autumn and spring. Whilst some characteristics of parts of estuaries remain much the same throughout the year (*e.g.* substrate, tidal regime), others may vary (*e.g.* relative abundance of prey, disturbance, competition and predation). As the LTCs have been confined to the mid-winter period to date, it is difficult to speculate. However, at the Humber Estuary, a series of low tide counts were undertaken throughout a whole year, from September 1998 to August 1999 (Catley 2000). For some species, relative distribution was similar throughout the year, but for others, notable differences occurred. Further work during other periods of the year would be a potentially useful development of the scheme, especially at those sites that are of particular importance for birds on passage.

At most sites, the WeBS LTCs are not undertaken annually but about once every six years. It is reasonable to consider how well distributions recorded in one winter represent those in another. Fortunately, at a number of sites counts have been undertaken more frequently, enabling some level of appreciation of this issue. Experience shows that distributions do change to some extent but that broad-scale distributional patterns are frequently maintained between years. The issue is thus one of the degree of consistency of distributions. However, it is not straightforward to define the manner in which distributions should be compared between years; what is a 'similar' distribution and what is a 'different' one? It may be possible to undertake a broad descriptive overview by a simple visual inspection of mapped distributions, especially for clearly clumped distributions. However, such subjective comparisons may not be suitable in a scientific or legal context and are also less straightforward for assessing more subtle gradations in density across a site. The issue of carrying out such spatial analyses is one which WeBS is keen to tackle in the future.

From a preliminary examination of distributions in different years, it appears that distributions recorded at low tide in a single winter are fairly reliable predictors of longer-term distributions. Particular exceptions are likely, however, where major year-to-year changes occur as a result of highly variable food sources, such as cockles (Atkinson *et al.* in press, Norris *et al.* 1998, Piersma *et al.* 2001). Given the relatively short span of the dataset to date, it would be sensible to revisit this issue in the future when longer runs of data are available for sites. Determining the amount to be gained by collecting additional data will be of great value in ensuring that counter time and effort is utilised as efficiently as possible. Further work should lead to a closer understanding of the factors determining which species are more mobile and at which sites such mobility is greater or lesser.

Finally, the WeBS LTCs are restricted to the period within two hours either side of low tide. However, most estuarine waterbirds also feed at other stages of the tidal cycle. To what extent do the broad distributions recorded at low tide represent the relative importance of parts of a site through the wider tidal cycle? Analogous to this question are the potential similarities and differences in low tide distribution occurring at neap and spring low tides. Clearly, the most complete understanding of the usage of the site by estuarine waterbirds would be achieved by monitoring continuously throughout the tidal cycles. However, as the LTCs are intended as a broad-scale approach to gathering baseline data, it has not been considered reasonable to ask volunteer observers to carry out such intensive monitoring.

The issue has, however, been investigated by Burton *et al.* (in prep.). Waterbird count data from six UK intertidal study sites were analysed to determine whether or not the numbers of birds using these areas changed across the tidal cycle. Additional analyses investigated the required frequency of counts to be undertaken to detect changes in numbers through the tidal cycle and whether low tide counts were representative of the average numbers of birds using a site. Comparison of counts undertaken at low tide and those across the rest of the tidal cycle suggested that low tide counts were representative of the average usage of the study sites in 75% of cases.

There was considerable variation between species and sites and thus it was difficult to produce recommendations about the minimum frequency at which counts would need to be undertaken across the tidal cycle to detect changing usage. However, examination of the variation in species' feeding activity did help to show which were the best tidal states for recording the feeding distributions of different species. While low tide counts were suitable for describing the feeding distributions of many species of wader, it would have been preferable to record the feeding distributions of some species of wildfowl on the ebb or flood tide. Even for these latter species (notably Wigeon), although the proportion feeding dropped at low tide it was not clear that the birds moved away from the feeding area; they may simply have been waiting in the same general area for the tide to rise again. Overall, the work showed that LTCs are a good representation of average site usage through the tidal cycle, although the numbers of study sites and species available for consideration were limited.

Clearly, further information would be gained through additional counts at other states of the tide, but this is largely beyond the scope of a volunteer survey and should be undertaken on a case-by-case basis, as and when the need arises.

USES

The use of low tide count information for applied research topics is of great value for the conservation of estuarine habitats and estuarine birds, whilst more pure research can also provide valuable contextual information.

The value of estuarine waterbird data collected at low tide is clearly demonstrated by the two case studies describing the use of low tide count data in conservation casework. In the case of Rock Ferry, a potentially damaging development was averted. Whilst the results of the public enquiry for Dibden Bay are, at the time of writing, unknown, the LTC data has provided objective information to enable an informed decision to be made. A number of other studies have used counts made at low tide to investigate the effects on estuarine waterbirds of habitat loss, either actual (Evans 1978/79, Evans and Pienkowski 1984, Evans 1997b, Meire 1991, Lambeck 1991) or predicted (Clark and Prys-Jones 1994, Goss-Custard *et al.* 1991, Goss-Custard and Yates 1992, Yates *et al.* 1996, Rehfisch *et al.* 1997, Rehfisch *et al.* 2000, Austin *et al.* 1996), whilst Evans *et al.* (2001) investigated the potential effects of a barrage across the river Tees, where no habitat loss occurred downstream of the development. Further research has been carried out into the potential effects of disturbance on estuarine waterbirds at low tide (Burton *et al.* 2002a, Davidson and Rothwell 1993, Burton *et al.* 2002b, Madsen and Fox 1995, Goss-Custard and Verboven 1993, Owen 1993, Musgrove *et al.* 2001b).

As well as these studies, low tide counts of waterbirds have been used widely for other research purposes. A number of studies have used low tide count data to investigate how waterbird distributions vary according to prey densities and to look at species' habitat use and preferences. Goss-Custard *et al.* (1977, 1988) used low tide counts to describe the distribution of feeding waders on the inner banks of the Wash. In a further study on the Severn Estuary, Goss-Custard *et al.* (1991) used counts undertaken at low tide to relate densities of waders to densities of their favoured prey. Goss-Custard *et al.* (1992) also investigated variation in the densities of Oystercatchers using the Exe Estuary at low tide. Moreira (1993) used low tide counts to investigate species' associations and habitat preferences on the Tagus Estuary in Portugal, whilst on the Mondego Estuary, also in Portugal, Múrias *et al.* (1997) found that species differed in their use of intertidal mudflats and adjacent salinas at low tide. Masero *et al.* (2000) investigated seasonal differences in preferences between intertidal mudflats and salinas in Cádiz Bay in Spain. Weber and Haig (1996) investigated variation in wader densities at low tide between diked, managed wetlands and natural mudflats in South Carolina, whilst Colwell and Landrum (1993) similarly used low tide counts to test whether or not the spatial distribution of waders varied across the Mad River Estuary in California and whether or not wader abundance was related to invertebrate densities. Cresswell (1994) investigated differences in the habitat use of adult and juvenile Redshank at Tyninghame in Lothian partly by using low tide count information. At a much larger scale, Austin *et al.* (1996, in prep.) used low tide count information (obtained by Holloway *et al.* 1996) to look at variation in the densities of waders between British estuaries in relation to factors such as estuary location, sediment type and measures of estuary morphology.

8 The future of the WeBS Low Tide Counts

Andy Musgrove

The WeBS Low Tide Counts have been highly successful in gathering baseline data on intertidal waterbird distribution for many sites. It would be short-sighted to consider there to be little need for the scheme to continue. Long-term monitoring schemes have many advantages over occasional, reactive surveys. Firstly, a continuous, long-term scheme, using a standardised method, yields data of a consistent nature. Surveys carried out on an ad hoc basis, instigated as and when particular needs arise, would probably be organised by a number of different organisations, making comparisons with other low tide surveys difficult. Secondly, maintaining the LTCs as part of the wider Wetland Bird Survey maintains the relationship with the WeBS network of volunteer counters and thus is more cost-effective than piecemeal surveys which would have repeated start-up costs and probably would involve professional fieldworkers. The local volunteer counters have the best knowledge of the waterbirds on a site as they are often those who also carry out WeBS Core Counts there. Additionally, a continuous scheme makes use of standardised infrastructure, such as recording forms and instructions, inputting techniques, validation checks and presentation of results. Comparison between sites and between years is therefore straightforward.

Much use is made of LTC data in assessing developments on estuaries. It is important that if such cases come to public enquiry the data are seen to be impartial, with the same figures available to all. If counts were carried out on a purely reactionary basis then this impartiality could be more open to question. Similarly, when there is a need for data, for whatever reason, it is usually required immediately. Faced with a lack of data, one would have to design a survey, recruit counters, carry out counts and analyse the data, a process of many months at the very least. With a continuous scheme, the data from the latest survey of a site, once collated and processed, are immediately available and can provide added value to any additional data collected specifically as part of an environmental impact assessment, as well as providing a suitable method and count sections for the latter.

Finally, carrying out ad hoc surveys can only address short-term issues. However, some important questions are best addressed using a suite of low tide data collected in a standardised fashion at regular intervals over a longer time period. These include the effects of sea-level rise on estuaries or gradual changes in pollution or disturbance. In many cases, waiting until a problem is identified before carrying out a survey greatly reduces the chance of being able to measure its impact.

Therefore, the LTCs should continue to collect vital information on estuarine waterbirds in much the same format as previously. Clearly, improved coverage of partially covered sites and sites not covered at all to date will be a priority. However, some modifications and developments could also be introduced, in the light of this report, to increase the value of the scheme. Additionally, research should be undertaken to address some of the interpretative issues raised by this volume, as well as to increase our knowledge of the between-site movements of estuarine waterbirds, a subject which could be tackled in conjunction with the various colour-ringing and colour-marking schemes that are in operation.

The WeBS Low Tide Counts have clearly been a great success. They have not only gathered a huge amount of novel information but have also been effective in directing the data into areas where it can make a difference. The success of the scheme and its contribution to conservation, to date and in the future, are due to the dedication of the skilled volunteer counters and the network of local organisers. With the continued support of the volunteer network the WeBS Low Tide Counts should continue to be a vital and influential source of information.

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Glossary

Accuracy
Within the context of the LTCs during the period under review, an accuracy code (1–4) is requested from counters to indicate how accurately they feel each species count reflects the actual number present (see Methods).

Activities
Whilst carrying out LTCs, counters are asked to record any types of human activity present at the site during the count (see Methods).

Density
The number of birds per unit area. Within the context of the LTCs, bird densities are always expressed in birds per hectare. In general, mean densities are used (*i.e.* the mean number of birds per unit area over a given time period, usually a winter (*q.v.*)).

Disturbance
Whilst recording activities (*q.v.*), counters are asked to indicate which of those activities are 'affecting the birds'. Additionally, counters are asked to provide an overall assessment of the level of disturbance on each mudflat (see Methods).

Feeding
Within the context of the LTCs during the period under review, counters are asked to record all birds in the 'number feeding' column except for those birds that are definitely roosting (q.v.).

Great Britain (GB)
Great Britain comprises England, Scotland and Wales, but excludes the Channel Islands and the Isle of Man.

Internationally important
A site is considered internationally important if it regularly holds at least 1% of the individuals in a population of one species or subspecies of waterbird, or if it regularly supports 20,000 or more individual waterbirds (Ramsar Convention Bureau 1988).

Intertidal
Within the context of the LTCs, the area of the intertidal zone is calculated as the area of that part of a count section which lies between mean low water and mean high water.

Nationally important
A site is considered nationally important if it regularly holds 1% or more of the estimated national (British or all-Ireland) population of a species or subspecies of waterbird.

Nontidal
Within the context of the LTCs, the area of the nontidal zone is calculated as the area of that part of a count section which lies above mean high water. It should be noted that, despite the term 'nontidal', some of this area is under tidal influence at times, such as the higher zone of a saltmarsh. The term 'nontidal' has been adopted for use within the scheme only; where the alternative hyphenated phrase 'non-tidal' is used this refers to a habitat not influenced by the tide.

Peak mean
Mostly used within the context of WeBS Core Counts. Calculated by averaging the peak count in each season for a particular species at an individual site. Normally calculated using the most recent five years' data.

Ramsar site
An area designated under the Convention on Wetlands of International Importance (1971).

Raptors
Birds of prey, including owls. Within the context of the LTCs during the period under review, raptors are treated as equivalent to human activities and as potential disturbance, rather than a species to monitor numerically.

Roosting
Within the context of the LTCs during the period under review, counters are asked to record roosting birds, including wildfowl 'loafing' on the

water, in the 'number roosting' column of the recording form.

Saltmarsh
A vegetated area experiencing periodic inundation by tidal water.

Section
Within the context of the LTCs, a section is a discrete subdivision of a site for which a counter provides the finest level of count detail.

Site
An area described as a site within the context of the LTCs does not necessarily have the same geographic boundaries as a site given the same name by any other scheme (including the WeBS Core Counts).

Special Protection Area (SPA)
An area classified under Article 4 of the EU Directive on the Conservation of Wild Birds (79/409/EEC).

SPA network
The total UK network of all classified or proposed SPAs.

Subtidal
Within the context of the LTCs, the subtidal zone is used to describe water-covered areas of a count section. The area of the subtidal zone is calculated as the area of that part of the section below mean low water.

1% Threshold Value
The number of birds that are used as the nominal 1% of the relevant population for the purposes of site selection. The data used within this review span the period 1992–93 to 1998–99 and thus the 1% Threshold Values used are those listed in Musgrove *et al.* (2001a) and based on population reviews by Kirby (1995), Cayford and Waters (1996), Way *et al.* (1993), Smit and Piersma (1989) and Rose and Scott (1997).

United Kingdom (UK)
The United Kingdom comprises England, Scotland, Wales and Northern Ireland (but excludes the Channel Islands, the Isle of Man, the Overseas Territories and Crown Dependencies).

Visit
Within the context of the LTCs, a visit refers to the counts made on a single section on a single date.

Waders
Within the context of the LTCs, used to refer to species of the families Haematopodidae, Recurvirostridae, Charadriidae and Scolopacidae.

Waterbirds
The term 'waterbirds' is a somewhat artificial grouping, comprising a number of distinct avian families linked by habitat preferences as opposed to strict taxonomic relationships (Rose and Scott 1997). Within a UK context, waterbirds include divers (Gaviidae), grebes (Podicipedidae), cormorants (Phalacrocoracidae), herons (Ardeidae), wildfowl (Anatidae), rails (Rallidae), waders (Haematopodidae, Recurvirostridae, Charadriidae, Scolopacidae), gulls (Laridae) and terns (Sternidae), although a few additional species are discussed within this book also. The term 'waterbirds' has superseded 'waterfowl' (which was used in the UK until quite recently), since the latter is used commonly in North America as a label for only the Anatidae.

Wildfowl
Generally used to refer to species belonging to the Family Anatidae, *i.e.* ducks, geese and swans.

Wildfowl and Wader Counts
The annual report of the Wetland Bird Survey (see References).

Winter
Within the context of the LTCs, a winter refers to the four months November to February inclusive. It should be noted that this definition is different to that used for the WeBS Core Counts.

INTERNATIONAL WADER STUDY GROUP

The International Wader Study Group (WSG) is an association of amateurs and professionals from all parts of the world interested in Charadrii (waders or shorebirds). Membership of the WSG is currently over 650 worldwide.

The aims of the International Wader Study Group are:

to maintain contact between both amateurs and professionals studying waders
to help organise co-operative studies; and
to provide a vehicle for exchange of information on waders and their biology.

The main means of achieving these aims are by:

holding an annual conference;
publishing, three times per year, the *Wader Study Group Bulletin*, and on an occasional basis, *International Wader Studies*, each issue of which covers a major topic of wader biology and conservation; and
acting as Wetlands International's Specialist Group on waders.

International Wader Studies (IWS) is a fully refereed occasional journal series published by the International Wader Study Group. *International Wader Studies* publishes proceedings based on conferences, symposia and workshops, many arranged by the Wader Study Group, and major analyses of single topics in wader biology. A full listing of published IWS is available on the WSG website, along with information on how to obtain copies.

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http://web.uct.ac.za/depts/stats/adu/wsg/index.html

WeBS is the monitoring scheme for non-breeding waterbirds in the UK which aims to provide the principal data for the conservation of their populations and wetland habitats. The data collected are used to assess the size of waterbird populations, determine trends in numbers and distribution, and assess the importance of individual sites for waterbirds, in line with the requirements of international conservation Conventions and Directives. A programme of research underpins and enhances these objectives.

WeBS is a partnership between the British Trust for Ornithology, The Wildfowl & Wetlands Trust, Royal Society for the Protection of Birds and the Joint Nature Conservation Committee (the last on behalf of English Nature, Scottish Natural Heritage, the Countryside Council for Wales and the Environment and Heritage Service in Northern Ireland).

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