



BTO Research Report No. 335

**Low-Tide Distributions of Waterbirds on
the Severn Estuary SPA:
Results of the 2002/03
WeBS Low Tide Counts and
a Historical Analysis**

**Adroddiad Ymchwil Rhif 335 yr Ymddiriedolaeth Adareg
Brydeinig**

**Dosbarthiad Adar Dŵr pan fo hi'n ddistyll
ar Aber yr Afon Hafren AGA :
Canlyniadau AAyG 2002/03 o'r Cyfrifon Distyll
Ynghyd â Dadansoddiad Hanesyddol**

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British Trust for Ornithology

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Executive Summary

1. This report is in two parts. The first summarises the results of the Wetland Bird Survey (WeBS) Low Tide Counts of the Severn Estuary undertaken in the winter of 2002/03. The second part analyses how the numbers and distributions of waterbirds on the estuary have recently changed, using data from past low tide surveys and from WeBS Core Counts.
2. The Severn Estuary is internationally important for waterbirds in the non-breeding seasons and as such is recognised as a Special Protection Area (SPA) and Ramsar site. Partly due to its size, however, recent surveys of the distributions of waterbirds on the estuary at low tide have been incomplete. Most notably, little was known of the populations of birds that might use intertidal areas in the centre of the estuary.
3. The 2002/03 low tide counts have provided the most complete recent survey of the low tide distributions of waterbirds of the Severn Estuary. Of a total of 195 count sections, data were received from 184. Coverage of the intertidal areas was almost complete, with just six sections not surveyed. The New Grounds at WWT Slimbridge were not covered by the survey, though the populations of birds here are well recorded by WeBS Core Counts.
4. A total of 58 waterbird species was recorded during the 2002/03 survey. Most numerous were Dunlin (a peak of 41,120), Lapwing (12,129), Curlew (3,610), Shelduck (3,493) and Wigeon (3,331). The highest bird densities were found between the Rhymney Estuary and the Gwent Levels Wetlands Reserve, on the mudflats adjacent to the New Grounds at Slimbridge, between Avonmouth and Oldbury, at Berrow and the Axe Estuary and at Bridgwater Bay. Few waders or wildfowl were found by surveys by boat on the mobile sediments in the centre of the estuary or on Flatholm or Steepholm, though large numbers of gulls were reported from these sites.
5. One species for which the site was designated a SPA – Whimbrel – was not recorded during the survey, as this species is most common on the Severn while on passage. The 2002/03 low tide counts have provided an accurate record of the distributions of the majority of the other 17 species for which the SPA is important. Bewick's Swan and European White-fronted Goose, however, are almost entirely restricted to Slimbridge, and this site also holds important proportions of the SPA's populations of other wildfowl.
6. The results of the 2002/03 survey were compared to those provided by the WeBS Low Tide Counts of 1998/99 and previous BTO surveys undertaken between 1987/88 and 1991/92 and put into context using data from WeBS Core Counts and other studies.
7. The numbers of many species had changed since the 1987/88-1991/92 surveys, though often in line with national trends. The increases in Wigeon, Gadwall, Teal and Shoveler numbers seen on parts of the Severn may be explained by the national trends for these species and likewise, declines in the numbers of European White-fronted Goose, Mallard, Ringed Plover, Grey Plover and Dunlin numbers also reflect recent national trends.
8. The most obvious local factors that have affected numbers and distributions have been the barraging and consequent loss of the intertidal mudflats of Cardiff Bay and the creation (as compensation for this) of the Gwent Levels Wetlands Reserve between Uskmouth and Goldcliff. The former has resulted in the displacement of considerable numbers of waders and wildfowl, notably Shelduck, Dunlin, Curlew and Redshank, though only for the latter species has there been a subsequent observed increase in numbers on neighbouring sections. The Gwent Levels Wetlands Reserve has been highly successful in attracting large numbers of wildfowl, including Wigeon, Gadwall, Teal, Mallard, Pintail, Shoveler and Tufted Duck.

9. Waterbirds might also have been affected by changes in their food resources associated with the recent improvements to waste water treatment on the estuary. Between Rhymney and Peterstone, for example, Pochard and Tufted Duck numbers have fallen sharply recently following the transferred of discharges to a new offshore pipe in 2001 and improved treatment in 2002. A decline in Shelduck numbers on the Axe Estuary has also been linked to improvements to waste water treatment there. However, it should be noted that in the majority of cases the changes to waste water treatment have been too recent for any changes in waterbird numbers to be apparent in the data presented. Changes are most likely to be detected in the future for those species, such as ducks and gulls, that feed directly on matter discharged from outfalls.
10. Other local factors which might have affected waterbird distributions and numbers within the estuary include the construction of the Second Severn Crossing, the loss of saltmarsh, drainage of adjacent farmland, sediment erosion and disturbance.
11. Three areas are considered worthy of further research. Firstly, it is important to know whether the creation of the Gwent Levels Wetlands Reserve leads (over perhaps the next five or 10 years) to an overall increase in the numbers of birds using the estuary or whether the reserve merely attracts birds away from other parts of the SPA. Secondly, it would also be extremely informative to undertake a wider survey of habitats suitable for waterbirds that border the SPA, e.g. riverine stretches of the Rhymney, Usk and Avon that may be used by Redshank and Teal and of farmland that may be used by Curlew and Lapwing. Lastly, further research is clearly needed to determine the impacts of the changes to waste water treatment currently being made around the estuary.
12. The following constraints of the study should be noted:

Firstly, it should be noted that in each winter only a maximum of four counts were made of each count section, one a month from November to February. Coverage also varied between the surveys – most notably there was little data from Bridgwater Bay or the Gloucestershire Severn during the 1998/99 survey.

Observation of the central areas of the estuary is also very difficult. In the earlier surveys all observations were from land, whereas in 2002/03 low tide counts of these central mud- and sand-flats were undertaken from a boat. In both cases, it is possible that the numbers of birds using these areas were underestimated.

Gulls were only recorded in the 2002/03 survey. However, even in that survey, coverage of these species was patchy.

The Severn is a highly dynamic estuary and thus the location and extent of many of the intertidal areas may have changed since the Ordnance Survey maps used for this project were created. The movements of sediments may potentially also cause marked differences in the distributions of invertebrates and thus waterbirds between years.

It should also be noted that the numbers of birds recorded on the Severn Estuary may vary annually due to weather conditions. In cold winters, the west coast of Britain may act as a refuge for many waterbirds that in milder winters would occur on the east coast or on the Continent. In cold winters, therefore, waterbirds may be more widely distributed across the estuary than they would in milder winters.

Lastly, in assessing the importance of different intertidal mudflats, it is also important to note that some species may use different areas during the night to those where they are recorded in the day.

1. Mae'r adroddiad yma mewn dwy ran. Mae'r rhan gyntaf yn crynhoi canlyniadau Arolwg Adar y Gwlyptir (AAyG) o Gyfrifon Distyll Aber yr Afon Hafren a wnaethpwyd yn ystod gaeaf 2002/03. Mae'r ail ran yn dadansoddi sut y mae niferoedd a dosbarthiad adar dŵr ar yr aber wedi newid yn ddiweddar. Gwneir hyn trwy ddefnyddio data o arolygon distyll y gorffennol ac o Gyfrifon Craidd AAyG.
2. Mae aber yr Afon Hafren o bwysigrwydd rhyngwladol i adar dŵr yn ystod y tymhorau lle na cheir bridio ac ar sail hynny caiff ei gydnabod yn Ardal Gwarchodaeth Arbennig (AGA) ac yn safle Ramsar. Yn rhannol oherwydd maint yr aber, fodd bynnag, ni chafodd arolygon a gafodd eu gwneud yn ddiweddar o ddosbarthiad adar dŵr ar yr aber pan fo hi'n ddistyll eu cwblhau. Yn anad dim, ychydig iawn a wyddid am y poblogaethau o adar fyddai'n debygol o ddefnyddio'r ardaloedd yng nghanol yr aber.
3. Cyfrifon distyll 2002/03 sydd wedi rhoi'r arolwg llawnaf yn ddiweddar o ddosbarthiad adar dŵr Aber yr Afon Hafren pan fo hi'n ddistyll. O gyfanswm o 195 o adrannau cyfrif, cafwyd data o 184 ohonynt. Gwnaethpwyd cyfrif llawn bron o'r ardaloedd rhynglanwol gyda chwe adran yn unig heb ei harolygu. Ni chafodd New Grounds yn YAYG yn Slimbridge eu cynnwys yn yr arolwg er bod y poblogaethau o adar yma wedi cael eu cofnodi yn dda gan Gyfrifon Craidd AAyG.
4. Cafodd gyfanswm o 58 o rywogaethau o adar dŵr eu cofnodi yn ystod arolwg 2002/03. Y rhai mwyaf niferus oedd pibydd y mawn (uchafswm o 41,120) , y gornchwiglen (12,129), y gylfinir (3,610), hwyaden yr eithin (3,493) a'r chwiwell (3,331). Roedd y dwysedd uchaf o adar rhwng Aber y Rhymni a Gwarchodfa Gwlyptiroedd Gwastadeddau Gwent, ar y gwastadeddau mwd y drws nasaf i New Grounds yn Slimbridge, rhwng Avonmouth ac Oldbury, yn Berrow ac Aber yr afon Axe ac ym Mae Bridgewater. Ychydig iawn o adar hirgoes neu adar dŵr a welwyd trwy wneud arolwg o gwch ar y gwaddodion symudol yng nghanol yr aber neu ar Flatholm neu Steepholm, er cafwyd adroddiad fod nifer fawr o wylanod ar y safleoedd hyn.
5. Yn ystod yr arolwg, ni chofnodwyd un rhywogaeth, sef y coegylfinir, ar sail yr hwn yr oedd y safle wedi'i dynodi'n AGA, a hynny am mai'r rhywogaeth yma yw'r fwyaf cyffredin ar yr Hafren tra'i bod yn hedfan heibio. Mae cyfrifon distyll 2002/03 wedi rhoi cofnod manwl gywir o ddosbarthiad y rhan fwyaf o'r 17 rhywogaeth arall y mae'r AGA yn bwysig o'u herwydd. Mae alarch Bewick a'r wydd dalcen wen Ewropeaidd wedi'u cyfyngu bron yn gyfangwbl, fodd bynnag, i Slimbridge a cheir ar y safle yma hefyd ganrannau pwysig o boblogaethau'r AGA o adar dŵr eraill.
6. Cafodd canlyniadau arolwg 2002/03 eu cymharu gyda'r rhai ddarparwyd gan AAyG o Gyfrifon Distyll 1998/99 ac arolygon yr YAB a wnaethpwyd rhwng 1987/88 ac 1991/92 a'u rhoi mewn cyd-destun gan ddefnyddio data o Gyfrifon Craidd AAyG ac astudiaethau eraill.
7. Roedd niferoedd amryw o rywogaethau wedi newid er arolygon 1987/88 –1991/92 er eu bod yn aml yn unol â thueddiadau cenedlaethol. Gellir o bosibl egluro'r cynnydd yn niferoedd y chwiwell, yr hwyaden lwyd, y cornhwyaden a'r hwyaden lydanbig y gellir eu gweld ar rannau o'r Hafren ar sail tueddiadau cenedlaethol ar gyfer y rhywogaethau hyn. Yn yr un modd y mae'r lleihad yn niferoedd yr wydd dalcen wen Ewropeaidd, yr hwyaden wyllt, y cwtiad torchog, y cwtiad llwyd a phibydd y mawn hefyd yn adlewyrchu tueddiadau cenedlaethol yn ddiweddar.
8. Y ffactorau lleol mwyaf amlwg sydd wedi effeithio niferoedd a dosbarthiad yw'r argae a godwyd ac o ganlyniad i gollu gwastadeddau mwd rhynglanwol Bae Caerdydd a chreu (fel iawn am hyn) Warchodfa Gwlyptiroedd Gwastadeddau Gwent rhwng Uskmouth a Goldcliff. Mae'r cyntaf wedi arwain at gael gwared â nifer sylweddol o adar dŵr ac adar hirgoes, yn arbennig hwyaden yr eithin, pibydd y mawn, y gylfinir a'r pibydd coesgoch er mai dim ond gyda'r rhywogaeth olaf y cafwyd cynnydd gweladwy yn y niferoedd ar adrannau cyfagos. Mae Gwarchodfa Gwlyptiroedd Gwastadeddau Gwent wedi bod yn arbennig o lwyddiannus yn denu niferoedd uchel o adar dŵr gan gynnwys y chwiwell, yr hwyaden lwyd, y corhwyaden, yr hwyaden wyllt, yr hwyaden lostfain, yr hwyaden lydanbig a'r hwyaden gopog.

9. Gallai adar dŵr fod wedi'u heffeithio hefyd gan newidiadau yn eu hadnoddau bwyd yn gysylltiedig â'r gwelliannau diweddar i'r driniaeth dŵr gwastraff ar yr aber. Mae niferoedd yr hwyaden bengoch a'r hwyaden gopog wedi syrthio'n arw er enghraifft rhwng Rhymni a Peterstone yn dilyn trosglwyddo arllwysiadau i bibell newydd o'r môr yn 2001 a gwell triniaeth yn 2002. Mae lleihad yn niferoedd hwyaden yr eithin ar Aber yr Afon Axe hefyd wedi cael ei gysylltu â gwelliannau i driniaeth dŵr gwastraff yno. Dylid nodi, fodd bynnag, fod y newidiadau i driniaeth dŵr gwastraff yn y mwyafrif o achosion wedi bod yn rhy ddiweddar i unrhyw newidiadau yn y niferoedd o adar dŵr fod yn amlwg yn y data a gyflwynir. Mae newidiadau'n fwyaf tebygol o gael eu canfod yn y dyfodol yn achos y rhywogaethau rheini, megis hwyaid a gwylanod, sy'n bwydo'n uniongyrchol ar fater sy'n cael ei ollwng o arllwysfeydd.
10. Ymhlith y ffactorau eraill allai fod wedi effeithio dosbarthiad a niferoedd yr adar dŵr o fewn yr aber mae adeiladu Ail Bont Hafren, colli'r morfa, draenio tir fferm cyfochrog, erydiad gwaddod ac aflonyddiad.
11. Ystyrir fod tair ardal yn werth eu hymchwilio ymhellach. Yn gyntaf, mae'n bwysig gwybod a yw creu Gwarchodfa Gwlyptiroedd Gwastadeddau Gwent yn arwain (dros efallai'r ddeng mlynedd nesaf) at gynnydd cyffredinol yn niferoedd yr adar sy'n defnyddio'r aber neu a yw'r warchodfa ond yn denu adar o rannau eraill o'r AGA. Yn ail, byddai hefyd o werth mawr o ran casglu gwybodaeth i ymgymryd ag arolwg ehangach o gynefinoedd addas ar gyfer adar dwr sy'n ffinio'r AGA, e.e. afondiroedd Y Rhymni, y Wysg a'r Avon y gall y pibydd coesgoch a'r gorhwyaden eu defnyddio a thir fferm y gall y gylfinir a'r gornchwigen ei ddefnyddio. Yn olaf, mae'n amlwg fod angen mwy o ymchwil i weld beth yw effeithiau'r newidiadau sydd ar y gweill ar hyn o bryd i'r driniaeth o ddŵr gwastraff o amgylch yr aber.
12. Dylid nodi cyfyngiadau canlynol yr astudiaeth :

Yn gyntaf, dylid nodi mai uchafswm o bedwar cyfrif yn unig a wnaethpwyd bob gaeaf o bob adran gyfrif, un bob mis rhwng Tachwedd a Chwefror. Roedd faint o sylw a roddid i wahanol leoedd hefyd yn amrywio o un arolwg i'r llall – ychydig o ddata a gafwyd yn arbennig o Fae Bridgewater neu o'r Hafren yn Swydd Gaerloyw yn ystod arolwg 1998/99.

Mae cadw gwylidwriaeth ar rannau canol yr aber hefyd yn anodd iawn. Roedd yr holl wylidwriaethau yn yr arolygon cynharach wedi cael eu gwneud o'r tir tra oedd cyfrifon penllanw 2002/03 o'r gwastadeddau mwd a thywod hyn wedi cael eu gwneud o gwch. Mae'n bosibl yn y ddau achos fod y niferoedd o adar yn defnyddio'r ardaloedd yma wedi cael eu hamcangyfrif yn rhy isel.

Dim ond yn arolwg 2002/03 y cafodd gwylanod eu cofnodi. Hyd yn oed yn yr arolwg hwnnw, fodd bynnag, roedd y wylidwriaeth o'r rhywogaethau yma yn ddarniog.

Mae'r Hafren yn aber ddeinamig iawn ac o ganlyniad gallai lleoliad a helaethrwydd nifer o'r ardaloedd rhynglanwol fod wedi newid er i'r mapiau Ordnans a ddefnyddiwyd ar gyfer y prosiect yma gael eu creu. Gallai symudiadau gwaddod o bosibl achosi gwahaniaethau sylweddol hefyd yn nosbarthiad yr infertebrat ac yn yr un modd yn nosbarthiad adar dwr o un flwyddyn i'r llall.

Dylid nodi hefyd y gallai'r niferoedd o adar gofnodwyd ar Aber yr Afon Hafren amrywio'n flynyddol yn dibynnu ar y tywydd. Pan fo'r gaeafau'n oer, gallai arfordir gorllewinol Prydain weithredu fel noddfa i nifer o adar dŵr fyddai yn ystod gaeafau mwy tyner i'w gweld ar yr arfordir dwyreiniol neu ar y Cyfandir. Yn ystod gaeafau oer, felly, gallai adar dŵr fod wedi'u dosbarthu'n ehangach ar draws yr aber nag y byddent yn ystod gaeafau mwy tyner.

Yn olaf, wrth asesu pwysigrwydd y gwahanol wastadeddau mwd rhynglanwol, mae'n bwysig hefyd nodi y gallai rhai rhywogaethau ddefnyddio ardaloedd gwahanol yn ystod y nos i'r rhai y cant eu cofnodi arnynt yn ystod y dydd.

PART 1 THE 2002/03 WEBS LOW TIDE COUNT SURVEY

1. INTRODUCTION

This report is in two parts. This first part summarises the results of the Wetland Bird Survey (WeBS) Low Tide Counts of the Severn Estuary undertaken in the winter of 2002/03. The second analyses how the numbers and distributions of waterbirds on the Severn Estuary have recently changed using data from past low tide surveys and from WeBS Core Counts and makes suggestions as to why some of these changes might have occurred.

The Severn Estuary is internationally important for the populations of waterbirds it supports in winter and on passage and as such is recognised as a Special Protection Area (SPA) (Stroud *et al.* 2001) and as a 'Ramsar' site, under the Convention on Wetlands of International Importance.

The Severn Estuary qualifies as a SPA for the following features:

- Under Article 4.1 of the EC Birds Directive by regularly supporting an internationally important wintering population of Bewick's Swans *Cygnus columbianus bewickii*, an Annex 1 species.
- Under Article 4.2 by regularly supporting, in winter, internationally important numbers of the following five species of migratory waterfowl: European White-fronted Goose *Anser albifrons albifrons*, Shelduck *Tadorna tadorna*, Gadwall *Anas strepera*, Dunlin *Calidris alpina* and Redshank *Tringa totanus* and, on passage, internationally important numbers of Ringed Plover *Charadrius hiaticula*.
- Under Article 4.2 as a wetland of international importance by regularly supporting in winter over 20,000 waterbirds.

Included in the latter assemblage, in addition to the species already listed as important in winter, are Wigeon *Anas penelope*, Teal *Anas crecca*, Mallard *Anas platyrhynchos*, Pintail *Anas acuta*, Shoveler *Anas clypeata*, Pochard *Aythya ferina*, Tufted Duck *Aythya fuligula*, Lapwing *Vanellus vanellus*, Grey Plover *Pluvialis squatarola*, Whimbrel *Numenius phaeopus* and Curlew *Numenius arquata*.

The Severn Estuary qualifies as a Ramsar site for the following criteria relating to birds:

- Under Criterion 2c as it is particularly important for migratory birds during passage periods in spring and autumn.
- Under Criterion 3a by regularly supporting in winter over 20,000 waterfowl.
- Under Criterion 3c by regularly supporting in winter internationally important populations of five species of waterfowl: European White-fronted Goose, Shelduck, Gadwall, Dunlin and Redshank.

The Severn Estuary is also a Site of Special Scientific Interest (SSSI) and Possible Special Area of Conservation (pSAC).

The Severn Estuary is over 15 km wide in the outer estuary, making it difficult to see intertidal banks in this area from the shore. As a result it has in the past been difficult to collect data showing the distributions of waterbirds at low tide and thus to record their feeding distributions. Several previous 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) (e.g. Burton *et al.* in press).

The Severn Estuary was surveyed as part of the Wetland Bird Survey Low Tide Counts scheme in 1998/99, though coverage then was incomplete, with little data from Bridgwater Bay, the Gloucestershire Severn or from the central mud- and sand-flats, for example, the English Stones, Bedwin Sands, Welsh Grounds and Denny Island, Middle Grounds and Langford Grounds. The estuary was also previously surveyed by the BTO between 1987/88 and 1991/92.

Due to the incompleteness of recent data on the distributions of waterbirds on the intertidal habitat of this important SPA and Ramsar site, English Nature and the Countryside Council for Wales commissioned the BTO to organise, as part of the series of WeBS Low Tide Counts, a complete low tide survey of the estuary during the winter of 2002/03. The first part of the report summarises the results of these counts.

2. METHODS

2.1 Count Sections and Survey Methodology

The 2002/03 WeBS Low Tide Counts of the Severn Estuary attempted to cover all the area within the SPA, including habitat both above and below the mean high water mark. This area was divided into a number of intertidal and non-tidal count sections, the boundaries of these being defined by the mean low tide and mean high tide marks taken from the most recent Ordnance Survey Pathfinder maps (see Musgrove *et al.* 2003 for details).

To allow comparison with the 1998/99 WeBS Low Tide Counts of the estuary, the same count sections were used for the current survey wherever possible. However, changes to a few existing sections were considered necessary, for example, off the coast at Undy, where in 1998/99 an artificial grid of small recording sections had been used. For the current survey, the sections used in this area more closely matched those used in the earlier BTO surveys. Some sections were also added and modified within the upper reaches of the Severn. In addition, the 2002/03 survey also included areas of the SPA that were above the high water mark and thus which may not have been previously counted – for example, fields adjoining the River Parrett. In total, the estuary was divided into 195 recording sections.

The majority of the data were collected under the auspices of the existing WeBS Low Tide Counts scheme, *i.e.* volunteer counters, managed locally by their WeBS Local Organisers, collected data in a standard fashion (see Pollitt *et al.* 2003). However, in some areas, there was a recognised shortage of volunteers. Therefore, to achieve the aims of this specific contract, these gaps in coverage were filled using a combination of BTO staff and other paid professional fieldworkers. Prior to the start of the survey, relevant landowners and occupiers were contacted to ensure that they would allow counters to have access to the land.

As with previous WeBS Low Tide Counts, data were collected between November and February. At this time of year, waterbird numbers on estuaries are at their highest and, for most species, most stable. Four preferred monthly count dates (17 November & 15 December 2002 and 19 January & 16 February 2003) were chosen. On each of these low tide occurred around the middle of the day. These dates were also chosen so as not to clash with the ongoing WeBS Core Counts on the estuary. The volunteers were asked to try to carry out their counts on the designated day, but if this was not possible, as close to this day as possible. In practise, the few counts that were not taken on the preferred date were mostly undertaken within one week of those dates. All counts were undertaken during the two hours either side of low tide. Data were recorded on standard WeBS Low Tide Count forms.

A major addition to the standard WeBS Low Tide Counts was the use of a boat to investigate the mudflats in the middle of the estuary and the outer parts of some of the wider peripheral sections. Counts were undertaken from the boat during January and February 2003. The original aim was to organise boat counts during December 2002 and January 2003, but a combination of poor weather and the limited availability of the boat meant that no counts were made in December. After discussion, it was agreed that the boat counts would be made in January and February instead. It was not considered that collecting these data during the second half of the winter would have made any difference to their validity.

The first boat trips were made on 31 January and 1 February (a long run of unsuitable weather rendered much of January unsuitable), with a second pair on 17 and 18 February. Not all of the areas could be visited on each occasion due to time constraints and access problems in very shallow water. Also, some sections could not be viewed completely due to the height of the flats in relation to the boat. This was overcome in part by landing the observer on some of the sand banks during the second visit.

A GPS was used to record the location of the boat when counting birds on the sand- and mud-flats. The maps in Figure 2.1.1 show the routes taken during each survey, with the grey shading highlighting the areas requiring coverage from the boat. It should be noted that the location and extent of many of the intertidal areas have changed significantly since the Ordnance Survey maps were created.

2.2 Coverage

A summary of the coverage by section and by month is presented in Table 2.2.1.

In order to “flag” likely problem areas on a monthly basis, each counter was contacted shortly before and after each count to confirm that they were intending to count/had counted their allocated sections. This allowed us to plug any gaps in coverage using BTO staff and/or other paid staff at short notice. However, on some occasions, it proved very difficult to get in touch with some of the counters in time to co-ordinate such counts.

The areas that were covered from the boat surveys were (see Figure 2.1.1):

(i) Lower Severn: Flatholm (section BV699), Steepholm (698), outer parts of the southern end of Berrow Flats (667), Gore Sand (669), Bridgwater Bar (670, 690) and parts of Steart Flats around Chisel Rocks (689);

(ii) Mid-Severn: English Stones (section BV793), Bedwin Sands, Welsh Grounds and Denny Island (755, 759, 760, 764, 765, 768, 769, 772, 775, 776, 777, 780, 781, 784), Middle Grounds (749, 750, 751, 752) and Langford Grounds (646, 647).

Overall, the coverage was very good, but inevitably, some areas proved problematical. One such area was Avonmouth and Portbury Docks (sections BV627 – BV630 in Table 2.2.1), where it was not possible for BTO staff to gain access for counts. Latterly however, this access problem was resolved, and an ecological consultancy firm already working within the complex carried out the required counts for us from December onwards. At the timing of writing report, data for three sections – Black Nore, Pigeon House Bay and Ladye Bay, north-east of Clevedon – had still not been received, although it is known that counts were undertaken there. The narrow shore here holds few waterbirds, however, and the results for these sections are unlikely to affect overall interpretation.

Counts were not obtained from eight other sections: six in the middle of the estuary – offshore from Uskmouth (BV747 & BV748), Sudbrook Flats (BV764, BV768 and BV780) and Chapel and Dod Rocks (BV792) – the small area of saltmarsh at the mouth of the River Rhymney (BV728) and from Slimbridge (BV602). This latter important area is regularly covered by WeBS Core Counts. However, at high tide (when the Core Counts are undertaken), numbers of many species at Slimbridge would be inflated by the presence of birds that would usually be found on neighbouring mudflats at low tide.

2.3 Data Presentation

Accounts are provided for every waterbird species recorded during the low tide counts in 2002/03. Except for those species recorded in very low numbers and/or from just one or two locations, summary ‘dot-density’ maps are also provided. On these maps, a number of dots equivalent to the mean number of birds recorded through the winter is plotted randomly within each count section. The impression of density created by these maps is thus related to the average number of birds counted and the area of the count section. Following previous WeBS Low Tide Count methodology (see Pollitt *et al.* 2003; Musgrove *et al.* 2003) count sections are divided into intertidal, subtidal and non-tidal habitats and the number of dots to be plotted on each section divided accordingly, dependent on species.

In addition to the species accounts, a further section describes the overall importance of different areas for waterbirds. Two maps are presented, the first showing the average number of all waterbird species

(excluding gulls – for which counting is optional in WeBS – and naturalised species) on each count section. The second map 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) (see also Musgrove *et al.* 2003).

3. RESULTS OF THE 2002/03 WEBS LOW TIDE COUNTS OF THE SEVERN ESTUARY

Monthly totals from the 2002/03 survey for the whole Severn Estuary SPA are provided for each species in Table 3.1. The following species' accounts discuss results in more detail.

3.1 Little Grebe *Tachybaptus ruficollis*

Figure 3.1.1

This is a widespread nesting species in Britain, mainly on small pools and secluded waterways. Many move to larger lakes or to certain sheltered coasts and estuaries in winter and are joined by winter visitors from the Baltic region and the near Continent.

Little Grebes were recorded from only three areas where non-tidal fresh or brackish water was available: these were Cardiff Bay, the Gwent Levels Wetlands Reserve, and Steart Point. It is likely that none were found on tidal sections of the estuary. At Cardiff Bay, birds were seen only in February, and in that month none were counted at Steart. Eleven were at the Gwent Levels Wetlands Reserve in November but only up to four in subsequent months. This would be an easy species for counters to overlook, however, and it is likely that the changes in number and distribution between months reflect the difficulty in counting rather than indicating any movement during the winter.

3.2 Great Crested Grebe *Podiceps cristatus*

Figure 3.2.1

This grebe is a widespread nesting species in Britain, mainly on larger lakes and pools. Many move to large inland waters or to coasts and estuaries in winter and are joined by winter visitors from the Baltic region and the near Continent.

The tidal waters of the Severn appear to provide a hostile environment for divers and grebes and even this, the most abundant of the grebes on British coasts, was irregular in its occurrence. Single birds were seen in the Peterstone area in November and February, at Severnside in December, opposite Sharpness in January, and by the Gwent Levels Wetlands Reserve in February. Four were counted at Cardiff Bay in November and December but none on subsequent counts.

3.3 Cormorant *Phalacrocorax carbo*

Figure 3.3.1

This was formerly a predominantly coastal nesting species in Britain, but now has an increasing number of inland colonies. It nests within the Severn Estuary on Steep Holm. Much interchange occurs in winter between sites in Britain, Ireland and the Continent.

The highest counts (17 and 30) were those made at Steep Holm in January and February and may have been related to the breeding colony at this site. Elsewhere, Cormorants were found most regularly at Cardiff Bay, near Denny Island, and on the Waveridge Sand area near Sharpness. Smaller numbers were seen in other parts of the upper estuary above Severnside, near the mouths of the Avon, Axe and Parrett, and at the Gwent Levels Wetlands Reserve. The species tends to form loafing groups but feeds individually and less conspicuously. The map therefore is likely to represent the distribution of loafing birds rather than those fishing, which would have occurred in the deeper channels.

3.4 Bittern *Botaurus stellaris*

This heron is a rare and very local breeding bird in Britain, and of great conservation concern. More widely distributed in winter, when it can occur in small as well as large reed beds. The population is swelled most winters by an influx from northwest Continental Europe, especially in December and January.

One was observed along the edge of the non-tidal pools by the Yeo Estuary in January 2003. Given the movements of this species across Europe in response to cold weather, it cannot be certainly

attributed either to the British or Continental European population. Occurrence at any estuarine site is very unusual, except where fresh or brackish reed beds are present.

3.5 Little Egret *Egretta garzetta*

Figure 3.5.1

Until 1989, this was a relatively scarce, mainly spring migrant to Britain, but it has since become a resident with an increasing and spreading breeding population. Numbers are swelled from the south by Continental visitors, especially in autumn. Occurs mostly on sheltered coasts and estuaries throughout the year.

Double-figure counts were made at Steart (15 in December) and at the Gwent Levels Wetlands Reserve (17, totalled across two count sectors, in February), at both of which sites suitable non-tidal habitat was available for feeding or loafing. Smaller counts were widely but thinly distributed around the Severn, most regularly through the winter at the Noose (adjacent to WWT Slimbridge), the Clevedon–Yeo area, and Weston Bay.

3.6 Grey Heron *Ardea cinerea*

Figure 3.6.1

This is the common and widespread nesting heron in Britain, with several breeding colonies close to the Severn Estuary. Many move to sheltered coasts and estuaries in winter and are joined by winter visitors from Scandinavia.

Grey Herons were widely distributed around the inner Severn upstream from the mouth of the Usk and Severnside, and there were further concentrations on the Avon near Bristol and in the southern part of Bridgwater Bay. The highest local concentrations were 12 at Sheperdine Sands in November and December and on the Avon below Clifton where there were 11 in December and 10 in February. Distribution changed relatively little through the winter, despite this species' early nesting season, which begins at some colonies in January. There is no indication, therefore, that any of the birds seen were directly associated with the local heronries.

3.7 Mute Swan *Cygnus olor*

Figure 3.7.1

The common and widespread British swan, nesting and wintering almost throughout Britain. Birds disperse in winter, and some Continental visitors may arrive.

Mute Swans were concentrated into non-tidal parts of the estuary, especially by the Parrett, at the Gwent Levels Wetlands Reserve, and at Cardiff Bay. These were areas where herds could graze grassland, or where swans could feed on sheltered waters. The highest counts were at the Gwent Levels Wetlands Reserve, with 23 in January and 33 in February, across three count sectors, and Pawlett Hams, where there were 15 in December and 30 in January. Counts of two birds in January–February at Northwick Oaze, the fields south of Brue Pill and Wall Common may have indicated pre-breeding pairs separating from the winter herds.

3.8 Bewick's Swan *Cygnus columbianus*

Figure 3.8.1

The race bewickii nests in Arctic Russia, west to the Kanin Peninsula. Its western population, of some 29,000 birds, winters mostly in the Netherlands, Britain and Ireland. At least 4% of the British wintering population winters on the Severn. This is the only Annex I species for which the Severn numbers are of European importance.

Bewick's Swans were recorded only in sectors adjacent to WWT Slimbridge. At the Noose there were 12 in December and 24 in January, and at Frampton Sand 2 in January and 71 in February. These counts under-represent the total population on the Severn, which normally numbers between 200 and 400 birds, but gives a good indication of the full distribution within the area covered. The majority of the birds occur within the adjacent WWT enclosures, which were not included in this low-tide study.

In addition, a small flock was recorded at Bridgwater Bay but not included in the totals as the birds were seen in flight only.

3.9 Whooper Swan *Cygnus cygnus*

Figure 3.9.1

Almost exclusively a winter visitor to Britain, most abundantly in the north although the Ouse Washes in East Anglia has held the highest numbers in recent winters. Britain and Ireland are the main wintering grounds of Icelandic breeders and also receive some visitors from the Fennoscandian/Russian population.

Only two sites held Whooper Swans during the survey. These were the east side of the Parrett, off Steart, where four were present in December, and the Gwent Levels Wetlands Reserve (on the Uskmouth Reedbed Lagoons sector), where a single bird was seen in December, January and February. The Severn is not currently a key area for this species.

3.10 European White-fronted Goose *Anser albifrons albifrons*

Figure 3.10.1

This race of White-fronted Goose nests widely across Russia, with those birds nesting in western and central Siberia wintering in northwest, northeast and central Europe. In Britain, small numbers occur at a few traditional sites in southern England, and formerly Wales. The New Grounds at Slimbridge is the main British site and holds numbers of considerable national importance.

White-fronted Geese were recorded only at the Noose, adjacent to WWT Slimbridge, where there were 990 in January. It is likely that there were other birds nearby on the New Grounds, which were not included in this low-tide study. The first arrivals at Slimbridge are normally in October, and the counts peak in February, typically above 2,000 birds.

3.11 Greylag Goose *Anser anser*

The Greylag Geese that occur on the Severn are likely to belong exclusively to the re-established population that is distributed widely in Britain and currently increasing very strongly in numbers and range. There is also a resident native Scottish population, and a large winter influx of Icelandic birds to Scotland.

There were nine at Frampton Sand in February, and at the Gwent Levels Wetlands Reserve, five in December and two in February. The occurrence of these birds is of no conservation significance, unless these few are the forerunners of the establishment in future years of a large resident population.

3.12 Canada Goose *Branta canadensis*

Figure 3.12.1

Canada Geese that occur on the Severn are likely to belong exclusively to the introduced population that is widely naturalised in Britain and increasing strongly in numbers and range. Tiny numbers of truly wild birds also occur in Britain.

Canada Geese were recorded at the Gwent Levels Wetlands Reserve in all four months, with a maximum of 146 in December. The only other sites were Waveridge Sand (one in January), the Congresbury Yeo, (six in February), and Brue Pill (one in February).

3.13 (Dark-bellied) Brent Goose *Branta bernicla bernicla*

This race of Brent Goose nests in Arctic Russia, predominantly on the Taimyr Peninsula, and winters coastally in northwest Europe, between France and Denmark, including important numbers in Britain where most are found on southeastern English coasts between the Humber and Exe Estuaries.

The Severn Estuary lies somewhat beyond the current regular distribution of this goose. A group of 11 was found near Hinkley Point in November. Elsewhere, a single bird was seen in the Littleton Pill area in December and again in January, and another on the Goldcliff–Sudbrook Flats in December.

3.14 Shelduck *Tadorna tadorna*

Figure 3.14.1

Shelduck breed widely in Britain and around the Severn, and are on their breeding grounds mainly between February and July. Adults visit traditional moulting areas from July onwards, many not returning until January. The main moulting ground for western European birds is in the Helgoland Bight in Germany, but some birds moult at Bridgwater Bay and other sites in Britain. Wintering numbers on the Severn are of European importance, as mentioned specifically in the SPA designation.

Shelduck were widely distributed around the Severn where tidal flats were present relatively close to the shore. They were absent from the flats off Penarth and from the extensive flats in the mid Severn, and appeared also to prefer nearby inshore sectors to the central flats opposite Oldbury. The species was most abundant in the southern part of Bridgwater Bay where, given that this has been identified as one of the few British sites where Shelduck moult, many birds in early winter may have been completing their annual moult. Other highly favoured sites included Berrow Flats, Weston Bay, Sand Bay, the Clevedon–Yeo area, Portishead/Avonmouth, the Magor–Sudbrook flats, and the Peterstone–Rhymney area. The highest count in any one sector was of 450 in the Parrett off Steart in November.

3.15 Wigeon *Anas penelope*

Figure 3.15.1

Wigeon breed widely in northern Eurasia, from Iceland and Scotland eastwards. The British breeding population is tiny but very large numbers of visitors arrive from Iceland, Fennoscandia and Russia, spending the winter at inland as well as coastal wetlands.

Wigeon were most abundant at the smaller estuaries of the contributing rivers where tidal flats or adjacent grassland provided extensive feeding opportunities. There were such concentrations around the mouths of the Parrett, Brue, Axe, Yeo and Usk, but not the Avon, Wye or Rhymney. There were also large numbers at the Gwent Levels Wetlands Reserve, and in the sectors adjacent to the New Grounds at Slimbridge, and lesser concentrations at Hinkley Point and on many sections of the inner Severn between Goldcliff and Severnside. The highest count in any one sector was of 813 at the Noose in November. A substantial proportion of the Severn population, present on non-tidal land at WWT Slimbridge, will have been unrecorded by this survey.

3.16 Chiloe Wigeon *Anas sibilatrix*

This is a non-migratory South American relative of the Eurasian Wigeon that is very common in British wildfowl collections and frequently observed as a non-breeding escapee.

One was observed on the Gwent Levels Wetlands Reserve near Goldcliff in February 2003. Its occurrence is of no conservation significance.

3.17 Gadwall *Anas strepera*

Figure 3.17.1

Historically a winter visitor from central Europe, Fennoscandia and Russia but naturalised as a breeding bird in Britain since the mid 19th century. Both the resident and winter-visiting populations have increased strongly in recent decades, occurring mainly on fresh waters. The British breeding range is expanding, but still centred on eastern and southern England, and includes several sites on or near the Severn.

Gadwall is not normally an estuarine duck and was very restricted in its occurrence, being recorded in only 11 count sectors, mostly where suitable non-tidal habitat was available. The most regular area for them was between the Usk mouth and Goldcliff, especially the Gwent Levels Wetlands Reserve. A

maximum count of 61 was made in four count sectors in this area in February. Double-figure counts elsewhere were made only in the Avonmouth–Chittening Warth area, where 17 were present across three count sectors in December, January and February. Smaller counts were made at the Noose, Northwick Oaze, the Clevedon–Yeo fields, and the Parrett south of Steart, whilst many more are likely to have remained unrecorded at the New Grounds at WWT Slimbridge.

3.18 Teal *Anas crecca*

Figure 3.18.1

Breeding birds are distributed widely across Britain but are especially scarce in southwest England and in Wales. Very large numbers of visitors arrive from Iceland, Fennoscandia and Russia, spending the winter at inland as well as coastal wetlands.

The low-tide distribution of Teal on the Severn was very similar to that found for Wigeon, with most birds in the upper sections of the Severn (above the Second Severn Crossing), at the Gwent Levels Wetlands Reserve, and at certain river mouths in the outer estuary. The main differences were the more restricted distributions of Teal than Wigeon in the estuaries of the Parrett and Yeo, the absence of regular Teal flocks at Hinkley Point and along the Goldcliff–Sudbrook Flats, and the abundance of Teal but not Wigeon in the Cardiff Bay, Peterstone and Chittening Warth areas. The only counts above 200 were 400 at Goldcliff Flats in November, and 250 north of Oldbury Power Station, also in November. As with other most of the other ducks, many will have been unrecorded on non-tidal habitats at WWT Slimbridge.

3.19 Mallard *Anas platyrhynchos*

Figure 3.19.1

Resident Mallard in Britain include domesticated forms living feral in very large and increasing numbers, and birds captive-reared for shooting, as well as truly wild birds. There is also a winter influx from the Continent, although this element of the population is apparently in decline.

Mallard were widely distributed in the Severn Estuary and were absent only from the most exposed sites such as the Penarth area and the extensive flats of the mid Severn. Large concentrations, as were present for Shelduck, Wigeon and Teal were not found for this duck, for which the highest count in any one sector was 234 at St. Brides lower shore in November. The map indicates that Mallard were most abundant in the Steart and Brean Down areas, the River Avon, the upper Severn above Avonmouth and Magor, the Welsh coast between Goldcliff and Rhymney, and at Cardiff Bay. At Cardiff Bay, it was the commonest duck.

3.20 Pintail *Anas acuta*

Figure 3.20.1

The Pintail is very rare as a nesting bird in Britain but many birds from Iceland, Fennoscandia and Russia winter on British wetlands, both coastally and inland. Wintering numbers on the Severn are of European importance, as mentioned specifically in the SPA designation.

A clear concentration of wintering Pintail exists on the Welsh shore between the Rhymney area and the Gwent Levels Wetlands Reserve. A maximum of 475 was counted across these count sectors in December. Lesser concentrations were noted at Hinkley Point and at the Noose, adjacent to the Slimbridge New Grounds. There were only scattered sightings elsewhere. Up to 750 Pintail have been counted on the Severn in recent winters. It is likely that more birds were present on the New Grounds at Slimbridge, which were not included in these low-tide counts.

3.21 Shoveler *Anas clypeata*

Figure 3.21.1

The Shoveler has a small breeding population in Britain, mainly in the south and east. Peak numbers occur in Britain in October as birds arrive from the Baltic area and Russia. Many immigrants and British-bred birds move south towards the Mediterranean later in the winter.

Like Pintail, Shoveler were concentrated on the Welsh shore. For Shoveler, the main range spanned Peterstone to the Gwent Levels Wetlands Reserve, with most birds on the Gwent Levels Wetlands Reserve itself, whereas the Rhymney area, frequented by Pintail, was not used. Also like Pintail, Shoveler showed a further concentration of birds in areas adjacent to the Slimbridge New Grounds (and some birds were doubtless present on the uncounted non-tidal habitat here). There were no Shoveler recorded at Hinkley Point, but Shoveler occurred at Clevedon–Yeo and at Oldbury Power Station, where Pintail were not found. The peak count was 173 at Peterstone Gout lower shore in November, with numbers decreasing there during the winter but growing at Goldcliff Flats to 139 in February.

3.22 Pochard *Aythya ferina*

Figure 3.22.1

The Pochard is a rare British breeding bird but Britain is an important winter destination for birds breeding across western Eurasia, even to the east of the Urals. Most occur on larger lakes and reservoirs. Many adults arrive before the autumn moult and other birds in early or mid winter.

Pochard were reported only from Cardiff Bay, where there were 25 in November and two in January–February, the Gwent Levels Wetlands Reserve, with three in November, 11 in January, and five in February, and the Rhymney area, with three in January and 11 in February. Numbers on the Welsh coast have declined recently (see section 7.10). However, the majority of the Pochard on the Severn occur on the uncounted non-tidal habitat at WWT Slimbridge.

3.23 Tufted Duck *Aythya fuligula*

Figure 3.23.1

This is a common British breeding bird that also has a large wintering population including many birds from Iceland and across northern Europe. Most occur on larger lakes and reservoirs. Many adults arrive before the autumn moult and other birds in early or mid winter.

A single bird was recorded at Cardiff Bay in January. The only other site at which Tufted Duck were recorded was the Gwent Levels Wetlands Reserve, where a regular flock was observed. Totalled across the three main count sectors of the reserve, there were 17 in November, 10 in December, 32 in January, and 71 in February. The high February count may have represented an influx due to freezing weather, or possibly disturbance, elsewhere. The great majority of Tufted Duck on the Severn, however, frequent the uncounted non-tidal land at WWT Slimbridge.

3.24 Scaup *Aythya marila*

The Scaup is a very rare British breeding bird but Britain is an important winter destination for birds breeding in Iceland. Birds from northern Fennoscandia and western Russia also occur on the British east coast. Although related to Tufted Duck and Pochard, this is primarily a saltwater species, occurring mostly in sheltered bays and estuaries.

Four birds were found off the Goldcliff Flats in February.

3.25 Common Scoter *Melanitta nigra*

Figure 3.25.1

There is a tiny British breeding population of Common Scoter. The more numerous wintering population found on some of Britain's open coastal and offshore waters, originates mostly from Iceland, Fennoscandia and northwest Russia.

Common Scoter were regular only to the west of Hinkley Point Power Station, where 14 were counted in November, 10 in December, and one in February. Elsewhere, singles were observed at Cardiff Bay in November, and at Goldcliff Flats in February.

3.26 Goldeneye *Bucephala clangula*

Figure 3.26.1

Goldeneye nest, mainly in tree-holes, in forested zones across northern Eurasia, from Scotland eastwards. The British breeding population is tiny but many Goldeneye arrive in late autumn, mostly from Fennoscandia; these winter in sheltered bays and estuaries, as well as at inland lakes and reservoirs.

Small numbers were regularly observed in the western sector of the Gwent Levels Wetlands Reserve, where seven were seen in November, three in January, and a single bird in February. The only other observation was of three birds at Cardiff Bay in November, although the species also occurs on the uncounted non-tidal pools at WWT Slimbridge.

3.27 Goosander *Mergus merganser*

The Goosander was historically purely a winter visitor to Britain from Fennoscandia and northwest Russia but since 1871 has established a substantial breeding population in western and northern Britain. Most winter at lowland fresh waters but a few are seen in sheltered bays and estuaries.

The species was observed only at Cardiff Bay, where two were seen in November, three in January, and two again in February.

3.28 Water Rail *Rallus aquaticus*

Water Rails inhabit reed beds and other lush waterside vegetation year-round, and are hard to locate except by their calls. The species is scarce and localised as a breeder in Britain, but more widespread outside the breeding season, when British breeders are supplemented with winter visitors from central Europe and the Baltic.

By the Congresbury Yeo there were two in November and four, totalled across two sectors, in February. Another was recorded on the Blind Yeo at Clevedon in February. Given the secretive nature of this species, yet its widespread winter distribution in suitable habitat, its apparent absence from other parts of the Severn Estuary should not be taken as fact. It is likely that all areas of suitable habitat around the estuary support birds in the winter and the species is certainly present at WWT Slimbridge.

3.29 Moorhen *Gallinula chloropus*

Figure 3.29.1

Moorhens breed abundantly in Britain by all kinds of still or slow-flowing waters. Many winter visitors arrive from the near Continent and perhaps further afield.

The Moorhen is an abundant wetland and farmland bird that is generally under-recorded by counters because it so frequently occurs among dense vegetation where it cannot be seen. It is likely to have occurred in all sectors that include non-tidal habitat, but was recorded in only five. Up to four Moorhens were recorded at Steart Point, up to 12 at the Gwent Levels Wetlands Reserve, and up to two at the River Avon below Clifton. These numbers are small in comparison to those recorded by WeBS Core Counts; the discrepancy being mainly due to the absence of counts from the non-tidal land at WWT Slimbridge, where large numbers are present within the wildfowl collection.

3.30 Coot *Fulica atra*

Figure 3.30.1

Coot breed abundantly in Britain by still or slow-flowing waters. Many winter visitors arrive from northern Europe, but the complexities of movements are not understood.

Coot were regularly common at Cardiff Bay, where counts of 76, 92, 103 and 81 birds were made in the four months respectively. Elsewhere, the only counts came from the Gwent Levels Wetlands

Reserve where, totalled across three count sectors, there were two in November, 13 in January, and 92 in February. The high February count at the Gwent Levels Wetlands Reserve may have represented an influx due to freezing weather, or possibly disturbance, elsewhere. Coot are also common at the uncounted non-tidal land at WWT Slimbridge.

3.31 Oystercatcher *Haematopus ostralegus*

Figure 3.31.1

The nominate race ostralegus breeds mainly coastally in western Europe, from parts of the Mediterranean to northwest Russia, and winters from Iceland and Britain south to West Africa. Inland nesting is common in northern and central Britain, with territories occupied mainly February–July. Winter visitors arrive in Britain mostly from Iceland, the Faeroes, Norway and the Netherlands.

Oystercatcher were strikingly absent from the upper sections of the Severn, above the first Severn Bridge and between the two Severn crossings on the Welsh side, perhaps demonstrating a preference for more exposed sites. Elsewhere they were widely but patchily distributed in all areas of the estuary where counts were made. As was observed for Turnstone, there was a notable concentration on the gravel banks off Severnside, on the adjacent English Stones and northward along the English shore to the first Severn Bridge. There were further concentrations on the Somerset shore at Hinkley Point, at Burnham-on-Sea, on the Berrow Flats, in Weston Bay, in Sand Bay, and on the Clevedon–Yeo section, whereas relatively few were seen at Steart Point and in adjacent sectors of Bridgwater Bay. On the Welsh side, birds were fairly evenly distributed from Lavernock Point to Sudbrook, with the exception of Cardiff Bay, where none were seen, the Gwent Levels Wetlands Reserve, where numbers were relatively few, and the Magor Pill area, where again birds were few. The highest counts in any one sector were made at Orchard Ledges (north), with 127 in January and 141 in February, and at Rhymney, where 140 were counted in one of the sectors in December.

3.32 Avocet *Recurvirostra avosetta*

Figure 3.32.1

Breeds, mainly coastally, in eastern and recently north-western England and at similar latitudes on the near Continent. Winter birds include both British and Continental breeders. A pair on the westernmost lagoon at the Gwent Levels Wetlands Reserve hatched four chicks in 2003, in the first recorded nesting for Wales.

Apart from a December individual at New Grounds, Avocet were found exclusively in the lower sections of the Parrett estuary, where there were 15 in November, 11 in December, 13 in January, and 14 in February. This species, with its upturned bill and characteristic feeding behaviour that requires shallow water and a soft substrate, has traditionally occupied widely scattered wintering sites within the UK, presumably at sites where its prey is abundant and the substrate suitable for efficient feeding. The number of wintering sites has increased during recent decades, alongside an expansion of the British breeding population. The mouth of the Parrett was also one of the few areas of the Severn that were favoured by Black-tailed and Bar-tailed Godwits.

3.33 Ringed Plover *Charadrius hiaticula*

Figure 3.33.1

The nominate race hiaticula nests in northeast Canada and eastwards to western Europe, and is a scarce nesting bird on the Severn. About 80% of the whole population winters in Britain & Ireland, and most of the rest passes through to or from wintering grounds further south in Atlantic Europe or West Africa. Passage numbers on the Severn are of European importance, as mentioned specifically in the SPA designation.

Ringed Plover were not abundant on the Severn in winter and showed three marked concentrations: at the Brue estuary, in inner Weston Bay, and at the mouth of the Avon at Portbury Docks. The count of 16 at Portbury Docks in February was the highest on this sector for any wader during the survey. The highest counts were 33 at Brue Pill in February, and 30 at inner Weston Bay in January. By contrast, almost no birds were seen on the Welsh shore. Single birds or single-figure groups were located on

the south shore of Bridgwater Bay, on the gravel banks off Severnside and northward along the English shore to the first Severn Bridge, near Oldbury Power Station, and on the Portland Grounds near Whitson. A small number of Ringed Plover usually also winter in the Clevedon area (H. Rose pers. comm.), though none were noted here during the 2002/03 survey.

3.34 Golden Plover *Pluvialis apricaria*

Figure 3.34.1

Golden Plover breed widely in upland Britain and winter mainly on lowland farmland. Many winter visitors arrive from Iceland, and many others from the Fennoscandian/Russian population winter in Britain or pass through to and from France and Iberia.

The distribution of Golden Plover showed marked concentrations that reflected the species' normal habit of feeding largely at non-tidal sites in large flocks. The largest count, of 1210, was made at the Noose, adjacent to the Slimbridge New Grounds, in November. There were 250 at Pawlett Hams in January and a maximum of 300, in December, on adjacent sections of the Parrett. Birds probably from this same flock were seen nearby at Wall Common and Steart Flats. The only site away from these two broad areas where a concentration of Golden Plovers was evident was Peterstone Great Wharf, where a flock of 42 was present in December. The species may also have been present on the uncounted non-tidal land at WWT Slimbridge.

3.35 Grey Plover *Pluvialis squatarola*

Figure 3.35.1

This plover has an Arctic distribution in Russia, Alaska and Canada and winters almost worldwide on temperate and tropical coasts. Birds wintering in Britain originate in western Siberia and are at the northernmost limit of the species' winter range.

Like Knot, which have a similar distribution within the Severn, Grey Plover favoured the Steart Flats and Parrett sections of southern Bridgwater Bay, and the Peterstone area, eastwards to the Gwent Levels Wetlands Reserve. Smaller numbers were also recorded on the Goldcliff–Sudbrook Flats (mainly around Magor), off Caldicot Level, in the Clevedon–Yeo area, and at Sand Point. The species was not recorded west of Peterstone or east of Sudbrook on the north shore, or above Clevedon on the south shore, except for a single bird at the Noose (near the Slimbridge New Grounds) in December. The south and southwest sectors of the Steart Flats, taken together, provided the highest counts: 100 in December and February, and 200 in January. The only other three-figure count was 110 in the southeast Steart Flats sector in January.

3.36 Lapwing *Vanellus vanellus*

Figure 3.36.1

Lapwing was once a familiar breeding bird throughout Britain but is decreasing and withdrawing from the west of its former range. Britain and Ireland remain major destinations for winter visitors from a large area of western Eurasia, even apparently east of the Urals. Most winter on farmland, with intertidal zones more frequently used in freezing weather.

The estuarine distribution of Lapwing is bound to be strongly influenced by their habit of feeding largely on farmland and of using intertidal zones mainly as loafing grounds and for feeding when their favoured non-tidal feeding sites are frozen or otherwise inaccessible. In these respects its habits match those of Golden Plover, and the distributions of these two species within the Severn Estuary are clearly similar. The two areas most favoured by Golden Plover, the Noose (adjacent to the Slimbridge New Grounds), and Pawlett Hams, were both densely occupied by Lapwing also. Lapwing were relatively more abundant than Golden Plover in the Steart Point area, but were few in the Peterstone area where Golden Plovers were seen in December. There were many additional parts of the estuary where Lapwing were present in some numbers, but from which Golden Plover were absent. These included the Axe Estuary, the Clevedon–Yeo sectors, Portishead, the River Avon below Clifton, Severnside, Northwick Oaze, the inner Severn between Oldbury Power Station and Sharpness, the Wye, the Magor area, and the Gwent Levels Wetlands Reserve. The December count included a remarkable 9,080 on

Pawlett Hams, adjacent sectors of the Parrett and Steart Point. Other large counts were 1,520 at the Noose in November, and 1,200 at Northwick Oaze in December. The species was almost certainly also present on the uncounted non-tidal land at WWT Slimbridge.

3.37 Knot *Calidris canutus*

Figure 3.37.1

The only regular race in Britain is islandica, which nests in northeast Canada and Greenland. These migrate via Iceland to moult in Britain or the Wadden Sea. By midwinter, 70% of the whole population is in Britain & Ireland. Spring return is mostly via the Wash or Wadden Sea, and Iceland or northern Norway.

Although Knot, like Dunlins, occur in spectacular numbers at certain British estuaries, their distribution in Britain is much more limited than that species and there are many estuaries, and sites within estuaries, at which Knot rarely occur. Within the Severn, there were two areas that were clearly favoured by Knot: the Steart Flats and Parrett sections of southern Bridgwater Bay, and the Peterstone area, eastwards to the Usk. The largest counts were in the west and southwest sectors of Steart Flats, where there were 300 in November, 600 in December, 1,000 in January, and 1,200 in February. Knot were generally greatly outnumbered by Dunlins in these areas, although on the southwest sector in December it was Knot that was the most abundant wader. In the Peterstone Great Wharf area, the highest count was 499 in January. Aside from these two broad areas, 10 were seen near Magor Pill in December, and there were single-figure counts at Hills Flats, Oldbury Power Station, Clevedon–Yeo, inner Weston Bay, Goldcliff Flats, and Woodspring Bay. Knot used more or less the same areas of the estuary as Grey Plover.

3.38 Sanderling *Calidris alba*

Figure 3.38.1

Sanderling are among the most northerly of all breeding birds, but as non-breeders occur on temperate and tropical sandy beaches almost worldwide. British winterers may originate either in Greenland or in central Siberia and are at the northernmost limit of the species' winter range. Birds from both these areas pass through Britain to and from more southerly wintering grounds.

Open sandy beaches are the most frequent winter habitat for Sanderling and, where they occur in estuaries, it is generally near to the estuary mouth where the substrate is wave-washed ocean sand rather than silt deposited by the contributing rivers. Within the entire Severn Estuary, the only area that was occupied by Sanderling was the northern sector of Berrow Flats, encompassing three count sectors. None were counted in this area in November, when only two of the three relevant count sectors were visited. Totalled across these three adjacent sectors, the counts were 109 in December, 126 in January, and 127 in February.

3.39 Purple Sandpiper *Calidris maritima*

The majority of Purple Sandpiper that winter on British coasts originate from breeding populations in southern Scandinavia and Canada. The species is a specialist of rocky shores and most are found in northern and eastern Scotland and north-east England. Comparatively few winter in south-west England or Wales and most that do so are found on the coast of north Wales.

Four Purple Sandpipers were recorded during the low tide survey in December 2002 and a further two in January, all on the rocky shore at Battery Head, Portishead.

3.40 Dunlin *Calidris alpina*

Figure 3.40.1

Dunlin are by far the most abundant wader on British coasts on passage and in winter. Small numbers nest in northwest Britain (race schinzii), but the main populations are schinzii from Iceland and southeast Greenland (also Norway and the Baltic), arctica from northeast Greenland, and nominate alpina from northern Fennoscandia and western Siberia. It is alpina that forms the bulk of

the British winter population, but some schinzii also occur and have been found on the Severn. Wintering numbers on the Severn are of European importance, as mentioned specifically in the SPA designation.

Dunlin was by far the most abundant species counted on the Severn in winter, and was almost universally distributed, occurring even on the River Avon below Clifton, where few other waders were found. The only notable absences were from the outer estuary from Lavernock Point to the Rhymney, including Cardiff Bay, and the islands of Steep Holm and Flat Holm, where no suitable feeding habitat exists. Dunlin were also relatively scarce along the narrow shore between Portishead and Clevedon. Low densities were observed on the north shore of the estuary between Sudbrook and Pillhouse Rocks, though none were noted on the outermost sandbanks, e.g. Bedwin Sands and the Middle Grounds. The main concentrations of Dunlin at low tide were in the Steart Flats sectors of Bridgwater Bay, with more than 17,000 counted in this area in February; these numbers alone would qualify the site as internationally important for the species.

3.41 Jack Snipe *Lymnocyptes minimus*

Jack Snipe are inconspicuous migrants and winter visitors, from northern Fennoscandia and northwest Russia, mostly occurring singly in certain undisturbed wetlands that provide suitable food and cover. Most winter sightings are at traditional sites.

Jack Snipe were recorded from five count sectors during the winter. Counts of two birds were made near Oldbury Power Station in December and by the River Axe in January, and single birds were seen at Berkeley Power Station in January and by the Blind Yeo, on the Clevedon–Yeo fields, and on Steart Point, in February. Given the secretive nature of this species, it is difficult to interpret the apparent absence from other parts of the Severn Estuary, but this is normally a very localised species that is absent from most places frequented by Common Snipe.

3.42 Common Snipe *Gallinago gallinago*

Figure 3.42.1

Common Snipe are common in winter in almost any kind of marshland, including damp grassland. They nest widely in Britain but at very low density in lowland England. Many winter birds are immigrants from northern Europe.

Snipe were recorded from 18 count sectors during the survey, mostly in non-tidal habitat. The main localities were Steart Point and the Parrett, Sand Point, the Gwent Levels Wetlands Reserve, and the areas of Oldbury and Berkeley Power Stations. There were 50 on the Gwent Levels Wetlands Reserve in November. At the Sand Bay north-western salt marsh, there were 22 in November and 20 during December–February. The highest count elsewhere was 21 on non-tidal areas at Steart Point in December. The uncounted non-tidal grassland at WWT Slimbridge also doubtless supported the species. Overall, it is very likely that many more birds were present on the SPA than actually recorded.

3.43 Black-tailed Godwit *Limosa limosa*

Figure 3.43.1

The wintering race in Britain is islandica, which nests in Iceland with a few also in Norway and Shetland. Britain & Ireland may host almost all islandica at some stage of the annual cycle. Nominate limosa nests in central Europe, west to southeast England, and is a passage migrant in small numbers.

Black-tailed Godwit were very restricted in their distribution on the Severn and were found on only three count sectors. The main site was Northwick Oaze, on the English shore between the two Severn crossings, where numbers built up from a single bird in November and two in December to 26 in January and 42 in February. There were 32 in the Parrett south of Steart in November, but these birds were not observed on the three later counts in this sector. It is possible, but perhaps unlikely given the

intervening distance, that the Parrett individuals contributed to the later build-up of numbers at Northwick Oaze. The third locality was the West Pill area of the Goldcliff–Sudbrook Flats, where two birds were seen in December.

3.44 Bar-tailed Godwit *Limosa lapponica*

Figure 3.44.1

The nominate race lapponica nests on Arctic tundra between northern Norway and the Taimyr Peninsula and uses the East Atlantic flyway to reach wintering grounds between the Wadden Sea and South Africa. British winterers are at the northernmost limit of the species' winter range.

There are striking similarities between the distributions on the Severn of the two godwit species. The same three count sectors that held Black-tailed were used also by Bar-tailed Godwit. Four additional sectors, occupied only by the Bar-tailed species, were mostly nearby. Bar-tailed Godwit showed no consistency, however, in the way these sites were occupied through the winter. The highest count was of 58 in the Parrett south of Steart in November but, like the Black-tailed Godwit observed on the same count, they were not present there in subsequent months. Also in November, a single was at Rhymney Great Wharf. In December, 12 birds were seen in total on two adjacent sectors of the Goldcliff–Sudbrook Flats, five at Rhymney Great Wharf, and a single bird off Caldicot Level. Only one bird was located on January counts, near Oldbury Power Station, and in February 12 birds, all at Northwick Oaze.

3.45 Curlew *Numenius arquata*

Figure 3.45.1

Curlew nest in Britain, most commonly in upland areas, and occupy breeding grounds during February–July. Non-breeding Curlew mostly occupy coastal sites and include winter visitors from breeding grounds in northern Europe, especially Fennoscandia. There appears to be a difference between the east and west coasts of Britain, with most birds wintering on the former being of Scandinavian and Continental origin compared to mostly British breeders on the latter. Wintering numbers on the Severn are of European importance, as mentioned specifically in the SPA designation.

Curlew were more concentrated within the Severn than the other common wader species, with, in each of the four monthly counts, most of the winter population occurring in the inner sections of Bridgwater Bay, on the inner Severn, on the flats between Magor and Sudbrook, or on the section between Peterstone and the Gwent Levels Wetlands Reserve. They were also somewhat more frequent than other waders on the extensive flats of the mid Severn, however, suggesting that they were able at times to exploit feeding opportunities in all parts of the intertidal area. The largest count made in any one count sector was of 830 at Sheperdine Sands/Beacon Sands in February. There were 740 at Plython Lake (part of Oldbury Sands) in November, and 550 at the adjacent Slimeroad Sand (off Beachley) in November and at Steart Flats (southeast) in January, but no other counts above 500. The species may also have been present on the uncounted non-tidal land at WWT Slimbridge.

3.46 Spotted Redshank *Tringa erythropus*

Spotted Redshank nest across Arctic Eurasia, from Norway eastwards, and winter mostly in the northern tropics, with some on Mediterranean shores and a few in Atlantic Europe north to southern Britain, Ireland, and the Netherlands.

Spotted Redshank were noted in four count sectors during the winter. At Steart, there were two on the Parrett in November, and five in non-tidal habitat on Steart Point in February. Elsewhere, there were single birds at the Noose in November and at the Congresbury Yeo in November, December and February.

3.47 Redshank *Tringa totanus*

Figure 3.47.1

Redshank of the nominate race totanus nest widely in Britain, but at very low density in lowland England, and across much of the European continent. Race robusta nests in Iceland and outnumbers native totanus on British coasts in winter; a few Continental totanus also winter. Wintering numbers on the Severn are of European importance, as mentioned specifically in the SPA designation.

Redshank are abundant and widespread on the Severn in winter but favour river mouths and other sites where there are freshwater inputs into the estuary. In Bridgwater Bay, birds were distributed throughout the southern part and along the Parrett, but strikingly absent from Berrow Flats. Redshank were also absent from count sectors around Cardiff Bay and Lavernock Point and, given their presence on the upper sections of the Parrett and Avon, were surprisingly scarce on the inner Severn above Sharpness. Particular concentrations of Redshank were found in the Steart area, in Weston and Sand Bays, and near the mouth of the Rhymney. The highest count in any one sector was of 350 on the Parrett south of Steart in November.

3.48 Greenshank *Tringa nebularia*

Greenshank nest in a band across Eurasia from Scotland to Kamchatka and winter mostly in the tropics and subtropics of Africa, Asia and Australasia. Many pass through Britain in spring and autumn. Those wintering in Britain and Ireland are at the northernmost limit of the species' winter range.

A single bird was observed on the Goldcliff–Sudbrook Flats near Magor Pill in December 2002.

3.49 Green Sandpiper *Tringa ochropus*

This species nests in wet boreal forest across Eurasia from Germany and Norway eastwards and winters mostly in the tropics and northern subtropics of Africa and Asia; some also winter in Europe with Britain as a northern outpost. The species is common as a passage migrant in Britain, mainly by fresh waters.

A single bird was observed on a non-tidal area at Aylburton Warth in January 2003.

3.50 Common Sandpiper *Actitis hypoleucos*

Common Sandpipers nest in much of Europe and eastwards across Eurasia to Kamchatka, and winter mostly in the tropics and subtropics of Africa, Asia and Australasia. Small numbers winter in Atlantic Europe north to Britain.

Single birds were counted near Pillhouse Rocks in November and January, at Portbury Docks in December, and at Avonmouth in February, when there were also three at Portbury Docks.

3.51 Turnstone *Arenaria interpres*

Figure 3.51.1

This wader has a circumpolar Arctic coastal distribution, including Sweden and the east Baltic but not Iceland, and winters almost worldwide, mainly on temperate and tropical coasts. Birds winter in Atlantic Europe as far north as the Faeroes. Winter birds in Britain originate mainly in Canada or northeast Greenland, while birds from the Fennoscandian and central Siberian populations pass through in spring and autumn.

Although it has been recorded feeding in a wide variety of unusual situations, the Turnstone is essentially a wader of rocky shores that tends to avoid soft substrates. On the Severn, Turnstone were apparently concentrated on the most suitable feeding areas and were recorded in only 22 count sectors during the winter. The map shows a notable concentration on the gravel banks off Severnside, on the

adjacent English Stones and northward along the English shore to the first Severn Bridge. Other favoured sites were the Hills Flats, the Portland Grounds east of Goldcliff, Peterstone, and the Clevedon–Yeo section. The highest count was 119 at Chittening Warth (Severnside) in November. On the English Stones, and at two count sectors off Goldcliff, Turnstone was the most numerous wader, although the English Stones are particularly difficult to survey and it is quite possible that birds were undercounted here.

3.52 Mediterranean Gull *Larus melanocephalus*

The breeding range spread north-westwards across Europe from the east Mediterranean and Black Seas to reach southern England in 1968. It remains a rare British breeder but is increasing as a non-breeding visitor, mostly at coastal sites.

The only report during this survey was of two birds in the Sheperdine Sands area, opposite Oldbury Power Station, in January 2003.

3.53 Black-headed Gull *Larus ridibundus*

Figure 3.53.1

By far the most abundant British-wintering gull, occurring widely inland as well as coastally, roosting nightly on inland waters (including Chew Valley Lake) or at the coast. Nests widely in Britain, at scattered inland and coastal sites, but not in the Severn area. Winter visitors to Britain originate from a large area of northern Europe.

This was the most widespread of the gulls recorded on the Severn, occurring in large numbers in almost all count sectors. The highest count in any one sector was 1,044 at Portbury Docks in February. The only absences were from the central flats and islands, where, conversely, the large gulls were most frequent. Particular concentrations were found throughout the winter in Cardiff Bay, near the mouths of the Rhymney, Usk, Avon, Yeo, Axe, Brue and Parrett rivers, on the Berrow Flats, and in the upper Severn above the first Severn Bridge. Large counts were also made at Peterstone in November and January. At the upper Severn adjacent to Slimbridge New Grounds, the species was counted only in January and this area may therefore be under-represented on the map.

Many of these sites may have offered relatively sheltered feeding areas but it is not clear that all the birds counted were feeding within the Severn area boundaries. Any counts made late in the afternoon are likely to have included birds that had been feeding inland and were arriving on the Severn to roost.

3.54 Common Gull *Larus canus*

Figure 3.54.1

Despite its name, the Common Gull is only the fifth-commonest breeding gull in Britain, with a mainly northerly distribution. In winter, however, it is abundant throughout, second only to Black-headed Gull in numbers, occurring widely inland as well as coastally, and roosting nightly on inland waters (including Chew Valley Lake) or at the coast. Many winter visitors originate in Fennoscandia or western Russia.

Like Black-headed Gull, this species was abundant and widely distributed on the upper section of the estuary, above the first Severn Bridge. It differed markedly from that species in its occurrence in the outer estuary, however, being much scarcer in the Peterstone area, Cardiff Bay, Berrow Flats, Weston Bay, Clevedon–Yeo and Avonmouth areas. The Steart and River Brue sectors were the only ones on the outer estuary where Common Gulls were common. The largest count was of 416 at Waveridge Sand in November: there were no other counts above 150. As with Black-headed and Lesser Black-backed Gulls, it is possible that many of the birds observed were using mainly inland areas for feeding.

3.55 Lesser Black-backed Gull *Larus fuscus*

Figure 3.55.1

*This gull breeds only around the northeast Atlantic and is mainly migratory. It breeds on all British coasts and at inland sites, including rooftops in Bristol, Gloucester and Cardiff. Its winter range has spread northwards from Morocco and Iberia in recent decades to include Britain, and now over 60,000 winter. Winter and passage birds include western *graellsii*, *intermedius* from southwest Scandinavia, and intermediates between these races.*

The main concentrations of Lesser Black-backed Gulls were on the upper section of the estuary above the first Severn Bridge (especially above Sharpness and adjacent to the Slimbridge New Grounds), on Flat Holm, at Cardiff Bay, and at the mudflats off Penarth that lay between these last two sites. By far the largest count was a combined total of 1,610 birds on the Noose and Frampton Sand in January. This site forms the largest roost for the species in the UK, with an estimated 15,000 birds present in January 1993 (Burton *et al.* 2003). It is possible that these were birds whose feeding grounds lay mainly in the surrounding farmland. Elsewhere, the only counts above 100 were 234 off Penarth in December, and 200 there in January. Away from these main areas, Lesser Black-backed Gulls were frequent on the extensive flats of the mid Severn and were also widely distributed on both English and Welsh coasts.

3.56 Herring Gull *Larus argentatus*

Figure 3.56.1

*Two races are common, but see also under Yellow-legged Gull. The race *argenteus* is an abundant breeding bird around British coasts, nesting on urban rooftops in some localities. These mostly remain fairly sedentary in coastal habitats. Herring Gulls inland in winter include many nominate *argentatus* from northern Europe, especially in eastern Britain.*

In contrast to Lesser Black-backed Gull, its close relative, the distribution of Herring Gulls was weighted towards the outer rather than the inner estuary. Herring Gulls were abundant in several areas where Lesser Black-backed Gulls were scarce or absent, most notably Steep Holm, the Lavernock Point area, the mid north shore between the Gwent Levels Wetlands Reserve and Magor, the English Stones area beneath the Second Severn Crossing, Avonmouth, and Brean Down. Some of these sectors may have been more attractive to Herring Gulls because they provided intertidal feeding opportunities that were better suited to this species. The December count at Rhymney, which totalled 1,623 across four count sectors, was by far the largest concentration. Elsewhere, the highest single count was 879 at Steep Holm in January.

3.57 Yellow-legged Gull *Larus argentatus michahellis*

*The southern races of Herring Gull behave as a separate species in western Europe, and the form breeding in France, Iberia and around the western Mediterranean is therefore treated separately here. Concurrent with northward breeding expansion, *michahellis* has become a much more frequent visitor to southern England in recent decades. Peak numbers are in late summer but small numbers also occur in winter, often inland, and typically in company with Lesser Black-backed Gulls. Because of identification problems, some *michahellis* may be overlooked as Herring Gulls.*

Yellow-legged Gulls were identified only at Lydney Sand (near Aylburton Warth), where two were seen in December and three in January, and Sheperdine Sands, where a single bird was found in January.

3.58 Great Black-backed Gull *Larus marinus*

Figure 3.58.1

This, the largest North Atlantic gull, nests coastally mainly in northern and western Britain, with small numbers in the Severn Estuary. More northerly breeders, from Iceland, the Faeroes, Norway and the White Sea join British birds in winter and some, especially in eastern Britain, occur inland.

Like each of the gulls, this species had a distinctive distribution within the Severn. Although a highly maritime species, it was almost absent from the Welsh shore between Lavernock Point and the Gwent Levels Wetlands Reserve, and from Steep Holm and the flats off Penarth. Elsewhere, there were minor concentrations between the Severn crossings, at sectors adjacent to the Slimbridge New Grounds, in Bridgwater Bay, on Flat Holm, and on the extensive flats of the mid Severn. The highest counts were 55 at Frampton Sand in November, with 38 there in January, and 40 in the Black Rock/Charston Sand sector (between the two Severn crossings) in November.

3.59 The Overall Importance of Different Areas for Waterbirds

Figure 3.59.1a shows the average number of all waterbird species (excluding gulls) on each count section in the 2002/03 survey and Figure 3.59.1b the sum weighting numbers of each species by its national population size. The former figure shows Bridgwater Bay and Pawlett Hams to be, numerically, the most important parts of the Severn. Other important concentrations of waterbirds are found at Berrow and the mouth of the River Axe, between Rhymney and the Gwent Levels Wetlands Reserve and on the intertidal mudflats adjacent to Slimbridge. Smaller, but equally dense concentrations were recorded between Avonmouth and Oldbury.

The latter figure indicates that the mudflats adjacent to Slimbridge were the most important if numbers were weighted according to national population sizes – this was largely due to the presence there of Bewick's Swans and European White-fronted Geese. Using this weighting the value of the area between Rhymney and the Gwent Levels Wetlands Reserve is also emphasized. In contrast, the importance of Bridgwater Bay and Pawlett Hams (although still high) is lessened with this weighting, as the large numbers of Dunlin and Lapwing that winter here are of less significance in a national context.

4. DISCUSSION

The low tide counts of the Severn Estuary carried out under the auspices of WeBS in 2002/03 have provided the most complete recent survey of the low tide distributions of waterbirds on the site. Coverage in the last attempted survey in 1998/99 was highly incomplete outside of the Welsh shore, with major gaps in coverage on the Gloucestershire Severn and at Bridgwater Bay. In addition, little attempt was made to cover the more distant sand- and mud-flats in the centre of the estuary. Previous BTO surveys between 1987/88 and 1991/92 attempted to cover these areas from land, though, undoubtedly, this would have led to undercounting.

As in previous surveys, the highest bird densities were found between the Rhymney Estuary and Uskmouth, on the mudflats adjacent to the New Grounds at Slimbridge, between Avonmouth and Oldbury, at Berrow and the Axe Estuary and at Bridgwater Bay. High densities of birds were additionally found on the Gwent Levels Wetlands Reserve and at Pawlett Hams. Also, as predicted by the previous surveys, few waders or wildfowl were found by the boat-surveys of the mobile sediments in the centre of the estuary, for example, on the English Stones, Bedwin Sands, Welsh Grounds and Denny Island, Middle Grounds, Langford Grounds and the outer areas of Bridgwater Bay. However, these areas did support large numbers of gulls, notably Lesser Black-backed, Herring and Great Black-backed Gulls. Unlike the 1998/99 and previous BTO surveys, the 2002/03 survey also covered Flatholm and Steepholm at low tide. Again few waterbirds were recorded here aside from Lesser Black-backed and Herring Gulls.

Notable changes in distributions, such as those caused by the barraging and inundation of Cardiff Bay and the creation of the Gwent Levels Wetlands Reserve between Goldcliff and Uskmouth, are discussed in Part 2 of this report.

The five most numerous wader and wildfowl species recorded during the 2002/03 low tide counts were: Dunlin (a peak of 41,120 in February), Lapwing (12,129 in December), Curlew (3,610 in November), Shelduck (3,493 in February) and Wigeon (3,331 in December) (Table 3.1). In comparison, the WeBS Core Counts for 2000/01 recorded 17,417 Dunlin, 9,817 Lapwing, 1,485 Curlew, 2,912 Shelduck and 5,789 Wigeon on the Severn (Pollitt *et al.* 2003). These figures were lower than the recent averages. The five year mean peak values from WeBS Core Counts for 1996/97 to 2000/01 were 28,003 Dunlin, 12,426 Lapwing, 2,052 Curlew, 3,082 Shelduck and 6,042 Wigeon (Pollitt *et al.* 2003).

One species for which the site was designated a SPA – Whimbrel – was not recorded during the survey. Although included in the ‘waterbird assemblage’, Whimbrel are most numerous on the Severn (and the UK as a whole) while on passage. The 2002/03 low tide counts have provided an accurate record of the distributions of the majority of the other 17 species for which the SPA is important. Bewick’s Swan and European White-fronted Goose, however, are almost entirely restricted on the Severn to the New Grounds at Slimbridge, and this site also holds important proportions of the SPA’s populations of other wildfowl including Wigeon, Gadwall, Teal, Mallard, Shoveler, Pochard and Tufted Duck.

PART 2 ANALYSIS OF HISTORICAL DATASETS

5. INTRODUCTION

This part of the report analyses the data collected in 2002/03 in relation to historic low tide count data, WeBS Core Count data – which indicate those areas of the estuary which are important at high tide – and other surveys. Analyses focus on those species for which the Severn Estuary has been designated a SPA (Stroud *et al.* 2001). Any declines apparent from these data are discussed in relation to recent changes on the estuary.

Over recent years, there have been a number of changes to the Severn Estuary that may have affected the numbers and distributions of waterbirds.

Foremost among these have been the construction of the Second Severn Crossing and the Cardiff Bay Barrage. The former has provided a new motorway crossing between Caldicot and New Passage and was opened in 1996. The construction of the Cardiff Bay Barrage resulted in the impounding and inundation of the bay in November 1999. The impacts of this have been the subject of a long-term study undertaken by the BTO (see Burton *et al.* 2002a for the most recent summary). The low tide count data collected for this project are also included in the WeBS Low Tide Count dataset and thus are not presented separately.

The Gwent Levels Wetlands Reserve was created to compensate for the loss of the intertidal habitats in Cardiff Bay. Construction began in 1998 and was substantially completed in 2000. The reserve, now owned and managed by CCW, is situated behind the seawall between Uskmouth and Goldcliff, and includes grassland, lagoon and reedbed habitats.

The recent changes to waste water outputs resulting from the implementation of the EC's Urban Waste Water Treatment Directive (UWWTD) and Bathing Water Directive (BWD), may have also affected waterbirds (Burton *et al.* 2002b). Outfalls may provide food for birds either as directly edible matter or by organic-enriching sediments and thus increasing the invertebrate (and algal) biomass. The loss of such inputs through the implementation of the directives may thus have reduced the food available to waterbirds on the estuary.

There are a number of waste water discharges to the Severn Estuary, the largest being in the Cardiff area and at Gloucester (which lies upstream of the SPA) and Avonmouth. Other significant discharges occur at Magor Pill, Aust and Thornbury, Portishead, Clevedon, Weston-super-Mare, Burnham-on-Sea and Bridgwater. Since 2000, improvements to waste water discharges have been made at a number of these sites and are in the process of being completed at the remainder. At Cardiff, waste water was formerly discharged from a number of short outfalls (between Cardiff Heliport and Rhymney Great Wharf) directly onto mudflats or at the low tide mark. Following the construction of a new waste water treatment works at Tremorfa, these discharges were transferred from the old outfalls to a new pipe discharging 4.5 km offshore in April 2001. Improved treatment began in March 2002.

In addition to these changes, the impacts of other habitat change and disturbance are also discussed. A summary of past and future changes to the estuary is provided in Table 5.1.

6. DATA COLLECTION AND PRESENTATION

Data were collected for the 17 species which are listed on the SPA citation for the Severn Estuary and which use the site during winter. These were: Bewick's Swan, European White-fronted Goose, Shelduck, Wigeon, Gadwall, Teal, Mallard, Pintail, Shoveler, Pochard, Tufted Duck, Ringed Plover, Grey Plover, Lapwing, Dunlin, Curlew and Redshank. This part of the report does not include data for Whimbrel *Numenius phaeopus*, which only occurs in important numbers on the Severn Estuary during the passage periods. Ringed Plover is also included in the SPA designation because large numbers occur on passage, but, unlike Whimbrel, this species is also present on the Severn Estuary in winter.

The low tide distributions of waterbirds on the Severn Estuary were previously recorded by the WeBS Low Tide Count Scheme in the winter of 1998/99. The coverage that winter was incomplete, with little data from Bridgwater Bay or the Gloucestershire Severn. Some extra counts were undertaken in 1999/2000 and 2000/01 in these areas, though these were still patchy and are not considered further.

Further low tide count data were available for the Severn Estuary from BTO projects which recorded the distributions of waterbirds during the winters of 1987/88 to 1991/92 (see Clark 1988, 1990, Warbrick *et al.* 1991). In contrast to the WeBS Low Tide Counts in 1998/99 and 2002/03, the surveys between 1987/88 and 1991/92 were entirely restricted to intertidal habitats.

Maps are presented from both these periods, following the methods described in Part 1 of this report. For the counts undertaken between 1987/88 and 1991/92, numbers of birds on each count section were averaged firstly by month and then across the five winters. As in Part 1, maps are also presented showing the average number of all waterbirds (excluding gulls) on a count section and the sum weighting numbers of each species by its national population size.

WeBS Core Count data were obtained for the five winters from 1996/97 to 2000/01 (i.e. the most recent for which data were available). For each species, the numbers of birds recorded on each count section were again averaged for each month of the winter (November to March) and then across the five winters. These figures were then plotted on maps as scaled dots. For the Welsh coast of the Severn Estuary, comparison is made between the figures recorded by WeBS Core Counts and counts undertaken by Ward *et al.* (2003) in the winter of 2002/03.

In addition, long-term WeBS Core Count data were also obtained for the five WeBS sub-sites of the Severn Estuary – 'Severn Bridgwater' (i.e. Bridgwater Bay to Brean Beach) 'Severn Avon' (Axe Estuary to Littleton), 'Severn Gloucestershire' (from Berkeley and Wibdon Warth to Longney Sands), 'Gwent Severn' (Mathern to the Rhymney Estuary) and the 'Taff/Ely Estuary', i.e. Cardiff Bay. These data were used to provide plots of the average numbers of waterbirds on each of the sub-sites and thus to highlight in broad terms those parts of the estuary where there have been significant declines or increases.

As the counts from these sub-sites were incomplete in some years, it was necessary to model the count data. Two methods were used to initially produce indices from which the plots of numbers over time were produced. The Underhill method (Underhill & Prys-Jones 1994) uses a Generalised Linear Model (GLM) with a Poisson error distribution and log link function, to fit a model with site, year and months factors. As waterbird numbers may fluctuate naturally from year to year, for example, due to variation in winter weather conditions, we also fitted smoothed curves to the count data using General Additive Models (GAMs). Data were smoothed by reducing the number of degrees of freedom available to the GAMs. As the number of degrees of freedom is decreased from (n-1) the trend become increasingly smooth until ultimately with one degree of freedom the smoothed curve becomes a linear fit. Following previous analysis of WeBS data (Austin *et al.* 2003), we adopted a standard (n/3) degrees of freedom.

For each species certain standard months are used to index the population. These are chosen to be the months in which the population of that species is most stable. For waders these are December through

to February but the months used vary for different species of wildfowl (see Leech *et al.* 2002). Plots are only provided for those sub-sites where the species commonly occur.

Trends in numbers are discussed in relation to national and regional trends (see Austin *et al.* 2003, Pollitt *et al.* 2003). Recent work using WeBS Core Count data has highlighted that a number of the species for which the Severn Estuary SPA is designated are in decline (Austin *et al.* 2003). There is most concern for Mallard, Dunlin and Curlew, as these species have undergone declines of over 50% over either 5-, 10- or 25-year periods (there is thus a 'High Alert' for these species). Bewick's Swan, European White-fronted Goose and Grey Plover have also undergone declines of over 25% on the estuary over one or more of these periods (thus triggering 'Medium Alerts').

7. RESULTS

7.1 Bewick's Swan *Cygnus columbianus*

Low Tide Count data

The main concentration of Bewick's Swans on the Severn Estuary is found on the New Grounds at WWT Slimbridge and the small numbers of birds that have been recorded by low tide counts have been on adjacent mudflats. There appear to have been some changes in the use of these mudflats over time. In comparison to the 2002/03 winter (Figure 3.8.1), less than half the number was recorded on average between 1987/88 and 1991/92 (Figure 7.1.1). The mudflats on this stretch of the estuary were not covered in the WeBS Low Tide Counts of 1998/99.

WeBS Core Count data

The distribution shown by WeBS Core Counts highlights the importance of the New Grounds at Slimbridge for this species (Figure 7.1.2). Aside from this site, Bewick's Swans were only recorded from three other areas of the estuary – the lagoons at the Gwent Levels Wetlands Reserve, Severn Beach and Oldbury. Bewick's Swans also occur on the Somerset Levels.

Ward *et al.* (2003) only recorded a total of 12 Bewick's Swans (in December at the Gwent Levels Wetlands Reserve) during high tide counts of the Welsh coast of the Severn Estuary SPA in winter 2002/03.

Trends in numbers

Figure 7.1.3 shows that numbers of Bewick's Swans on the Severn Gloucestershire sub-site rose during the 1970s, but have since shown a slight decreasing (though fluctuating) trend to a recent average of around 200 birds. This is the main area used by the species on the estuary and consequently there has also been a downward trend in numbers on the SPA as a whole – resulting in a 'Medium Alert' for the species over a 10-year period (see Austin *et al.* 2003 and Section 6 above). Given that the main site used by this species on the estuary is protected and managed for its waterbird interest, it is unlikely that this slight decline is the result of factors operating on the estuary. Nationally, numbers have also fluctuated over the last 20 years (Pollitt *et al.* 2003).

7.2 European White-fronted Goose *Anser albifrons albifrons*

Low Tide Count data

As with Bewick's Swan, the main concentration for this species is found on the New Grounds at WWT Slimbridge. The only White-fronted Geese recorded on the Severn Estuary during the 2002/03 survey were recorded on adjacent mudflats (Figure 3.10.1). The mudflats on this stretch of the estuary were not covered in the WeBS Low Tide Counts of 1998/99. No White-fronted Geese were recorded on intertidal areas of the estuary during the winters of 1987/88 to 1991/92.

WeBS Core Count data

WeBS Core Counts highlight the importance of the New Grounds at Slimbridge for this species (Figure 7.2.1). Outwith this site, White-fronted Geese were only recorded from Severn Beach and the Clevedon-Yeo area. White-fronted Geese are uncommon visitors to the Somerset Levels.

Ward *et al.* (2003) recorded no White-fronted Geese in their high tide surveys of the Welsh coast of the Severn Estuary SPA in winter 2002/03.

Trends in numbers

As White-fronted Geese were rarely recorded away from Slimbridge, it was only appropriate to plot the changes in their numbers over time for the Severn Gloucestershire sub-site. Numbers of White-fronted Geese rose in this area between the 1970s and late 1980s, but have fallen steadily since to less than 1000 in 2000/01 (Figure 7.2.2). The consequent downward trend in numbers on the SPA has resulted in a 'Medium Alert' for the species over a 10-year period (see Austin *et al.* 2003 and Section 6 above). Given that the main site used by this species on the estuary is protected and managed for its waterbird interest, it is likely that this decline is not the result of factors operating on the estuary, but instead reflects the national trend for the species (Austin *et al.* 2003; Pollitt *et al.* 2003).

7.3 Shelduck *Tadorna tadorna*

Low Tide Count data

Low tide distribution maps for Shelduck on the Severn Estuary in 1987/88-1991/92 and 1998/99 are shown in Figures 7.3.1 and 7.3.2 respectively. Comparison of these maps with that for 2002/03 (Figure 3.14.1) indicates that there have been relatively few changes in the species' distribution on the estuary over the last 15 years. The species remains most abundant on the lower stretches of the estuary, with relatively small numbers recorded on the Severn Gloucestershire WeBS sub-site. Numbers along the Severn Avon sub-site peaked during the 1998/99 survey, but have since declined between Severnside and Oldbury. However, higher numbers have remained around Portbury. On the Welsh shore, there now appear to be fewer Shelduck at low tide along the Nash section to the east of Uskmouth. Shelduck have also been displaced by the loss of Cardiff Bay in 1999 and few now use the bay at low tide.

WeBS Core Count data

The WeBS Core Count data for Shelduck (Figure 7.3.3) reflect the low tide distributions. Large numbers of Shelduck were recorded by these high tide surveys along the Welsh shore between Cardiff Bay and Undy and from the Axe Estuary to Bridgwater Bay. These data also indicate a concentration at Slimbridge that was less apparent from the low tide counts of the intertidal parts of the estuary.

On the Welsh coast of the SPA, Ward *et al.* (2003) also reported that Shelduck were most numerous at high tide between Rhymney and Undy. A peak count of 1,184 Shelduck was recorded in December 2002.

Trends in numbers

Figure 7.3.4 shows how numbers of Shelduck have changed on each of the WeBS sub-sites of the Severn Estuary since the 1970s.

Numbers on the Severn Bridgwater sub-site rose to an exceptional peak in 1996/97, but have since fallen back to around 400 birds.

On the Severn Avon sub-site, numbers rose from around 200 birds in the 1980s to 800 birds in the 1990s, but have since fallen to around 400. This pattern is reflected in the numbers recorded by the low tide counts in the three different periods. At the Axe Estuary, a decline was noted in the late 1990s by Martin (2000) who suggested that the lower numbers might have been the result of reduced food resources consequent of the cessation of untreated sewage discharges in the area. More detailed study of the waterbirds at Severnside (Lawrence & Higgins 2002) indicated no significant change in the numbers of Shelduck recorded between 1972/73-1982/83 and 2001/02. Waterbird numbers in this area potentially could have been affected by the new Second Severn Crossing, by disturbance from adjacent industry or changes to the effluents discharged by these works.

On the Severn Gloucestershire sub-site, numbers have risen steadily since the mid-1980s to over 200 in recent years.

On the Gwent Severn, numbers have fluctuated at around 1,000 birds. An average of 200 or more Shelduck also wintered in Cardiff Bay prior to its loss in 1999, but numbers have dropped sharply since then. The bay is now primarily used by the species as a high tide roost site. Preliminary analyses by the BTO have indicated that Shelduck numbers increased slightly on the neighbouring mudflats at Orchard Ledges in the two winters following barrage-closure, but that they have since decreased. At Rhymney, numbers appeared to have decreased since barrage-closure (Burton *et al.* 2002a). It is likely, therefore, that the Shelduck that were displaced from the bay have either been forced to disperse to more distant areas or that there has been increased mortality in the local population.

Nationally, Shelduck numbers have shown no clear trend over the last 20 years (Austin *et al.* 2003; Pollitt *et al.* 2003).

7.4 Wigeon *Anas penelope*

Low Tide Count data

Low tide distribution maps for Wigeon on the Severn Estuary in 1987/88-1991/92 and 1998/99 are shown in Figures 7.4.1 and 7.4.2 respectively. Wigeon were widely distributed on the estuary during both survey periods, being most abundant near the mouths of the Rivers Parrett and Brue (i.e. Bridgwater Bay), Axe, Yeo and Usk and adjacent to the New Grounds at Slimbridge. The 1998/99 survey also indicated large numbers at Mathern and, on the opposite shore, between Severn Beach and Oldbury. Comparison with the 2002/03 survey (Figure 3.15.1) suggests that there have been more recent increases, notably on the Severn Gloucestershire sub-site, the Yeo Estuary, Bridgwater Bay and around the new Gwent Levels Wetlands Reserve.

WeBS Core Count data

The WeBS Core Count data for Wigeon (Figure 7.4.3) also indicate that the species is widely distributed on the estuary, with the only gaps at Cardiff Bay and the Rhymney Estuary. The largest numbers recorded at high tide were at the New Grounds at Slimbridge, Bridgwater Bay and by the Gwent Levels Wetlands Reserve.

On the Welsh coast of the SPA, Ward *et al.* (2003) recorded the majority of Wigeon at Undy and on the Nash foreshore and the Gwent Levels Wetlands Reserve during their high tide counts in winter 2002/03. Other smaller concentrations were recorded at St. Brides, Redwick and Mathern. A peak count of 1,677 Wigeon was recorded in October 2002.

Trends in numbers

Figure 7.4.4 shows how numbers of Wigeon have changed on each of the WeBS sub-sites of the Severn Estuary since the 1970s. (No graph is shown for Cardiff Bay, as Wigeon were seldom recorded there).

As with Shelduck, numbers on the Severn Bridgwater sub-site rose to a peak in 1996/97, but by 2000/01 had fallen back to their previous level of around 500 birds. On the Severn Avon sub-site, numbers peaked in the mid-1980s and, aside also from a brief peak in 1996/97, have since averaged around 300 birds. The peaks seen in both areas in 1996/97 were largely due to birds moving to the coast from the Somerset Levels during freezing conditions that February (Martin 2000).

On the Severn Gloucestershire sub-site numbers also peaked in the mid-1980s, but since a decline at the end of that decade have risen to around 4,000 birds. On the Gwent Severn, numbers showed no

clear trend during the 1990s, but rose to a peak of 800 birds in 2000/01, presumably as a result of the development of the Gwent Levels Wetlands Reserve.

Nationally, Wigeon numbers have increased over the last 20 years (Austin *et al.* 2003; Pollitt *et al.* 2003).

7.5 Gadwall *Anas strepera*

Low Tide Count data

No Gadwall were recorded on the intertidal habitats of the Severn Estuary during the low tide surveys in the winters of 1987/88 to 1991/92. In 1998/99, occasional birds were recorded on the Axe Estuary (Figure 7.5.1). In contrast, in the winter of 2002/03, Gadwall were recorded on intertidal habitats at Severn Beach, on the River Parrett and adjacent to the New Grounds at Slimbridge (Figure 3.17.1). The highest concentration was noted at the new Gwent Levels Wetlands Reserve.

WeBS Core Count data

WeBS Core Count data for 1996/97 to 2000/01 also show the importance for this species of the freshwater habitats at Slimbridge and the Gwent Levels Wetlands Reserve (Figure 7.5.2). Elsewhere on the Severn Estuary, Gadwall were recorded in small numbers at high tide at Bridgwater Bay, the Axe Estuary, Portbury, Severn Beach and Oldbury.

On the Welsh coast of the SPA, Ward *et al.* (2003) also reported that Gadwall were most numerous at high tide on the Gwent Levels Wetlands Reserve. A peak count of 71 Gadwall was recorded in December 2002.

Trends in numbers

Changes in the numbers of Gadwall, as shown by WeBS Core Counts are shown in Figure 7.5.3 for the Severn Gloucestershire and Gwent Severn sub-sites. (No graphs are shown for the Severn Bridgwater, Severn Avon and Cardiff Bay sub-sites, as Gadwall were seldom recorded there).

Numbers on all sites have risen sharply since the 1970s. On the Severn Gloucestershire sub-site, numbers peaked at over 250 birds in the 1980s, but have shown a slight decline to around 180 birds in 2000/01. On the Gwent Severn, the species was rare before the creation of the Gwent Levels Wetlands Reserve, but rose to over 60 birds in 2000/01.

Given that the main site used on the Severn Gloucestershire sub-site – Slimbridge – is protected and managed for its waterbird interest, it is unlikely that the slight decline seen there is the result of factors operating on the estuary. Nationally, numbers have risen steadily since the 1970s (Austin *et al.* 2003; Pollitt *et al.* 2003).

7.6 Teal *Anas crecca*

Low Tide Count data

Low tide distribution maps for Teal on the Severn Estuary in 1987/88-1991/92 and 1998/99 are shown in Figures 7.6.1 and 7.6.2 respectively. In common with Redshank, Teal were found in particularly high concentrations where rivers and other freshwater inputs entered the estuary. Comparison with the results for 2002/03 (Figure 3.18.1) suggests that numbers of this widespread species have increased on the estuary, notably on the Bridgwater Severn sub-site at Bridgwater Bay and the Axe and Yeo Estuaries, on the entire Severn Avon sub-site between the Avonmouth and Oldbury. There have, though, been declines at Rhymney and Cardiff Bay. It should be noted, though, that as this species is usually found in highest densities along river channels, it may be that birds at Rhymney were missed

in the latter two surveys as only the lower estuarine stretches of the river were surveyed (though the areas surveyed match the boundary of the SPA).

WeBS Core Count data

The WeBS Core Count data for Teal (Figure 7.6.3) also show the species' wide distribution on the Severn Estuary. As indicated by the low tide counts, the major concentrations are found at the mouths of the rivers Parrett, Axe, Avon and Usk and on the upper Severn, notably at Slimbridge. In contrast to the low tide counts, these high tide counts also emphasize the continuing importance of the Rhymney Estuary for Teal.

On the Welsh coast of the SPA, Ward *et al.* (2003) recorded the majority of Teal at Rhymney, St. Brides and the Gwent Levels Wetlands Reserve during their high tide counts in winter 2002/03. A peak count of 741 Teal was recorded in December 2002.

Trends in numbers

Changes in the numbers of Teal, as shown by WeBS Core Counts, are shown in Figure 7.6.4 for the Severn Bridgwater, Severn Avon, Severn Gloucestershire and Gwent Severn sub-sites.

As suggested by the low tide count maps, numbers of Teal have recently increased across the whole Severn. On the Severn Bridgwater sub-site numbers increased sharply in 1999/2000 to around 800 birds. On the Severn Avon, numbers have risen since 1996/97 and in 2000/01 reached 900 birds. Martin (2000) indicated that increases on the Axe Estuary after the winter of 1996/97 were probably the result of a cessation of wildfowling on the estuary.

On the Severn Gloucestershire sub-site numbers have increased steadily since the mid-1980s and had reached over 2,500 by 2000/01. On the Gwent Severn, numbers have shown greater fluctuations, but rose in 2000/01 to around 800 birds – perhaps due to the creation of the Gwent Levels Wetlands Reserve.

Although no WeBS Core Count data were available to look at trends in the numbers of Teal at Cardiff Bay, the BTO studies there do help to show how numbers have changed over the last 15 years. Numbers of Teal declined in the bay prior to the completion of the barrage – perhaps due to disturbance associated with the building work (Burton *et al.* 2002c) – and have fallen sharply since. BTO counts recorded a peak of 42 Teal in the bay during the winter of 2001/02, in comparison to a peak of 121 in the winter of 1998/99 prior to closure (Burton *et al.* 2002a).

The rise in numbers on the Severn Estuary reflects the national trend for the species (Austin *et al.* 2003; Pollitt *et al.* 2003).

7.7 Mallard *Anas platyrhynchos*

Low Tide Count data

Low tide distribution maps for Mallard on the Severn Estuary in 1987/88-1991/92 and 1998/99 are shown in Figures 7.7.1 and 7.7.2 respectively. Comparison with the results for 2002/03 (Figure 3.19.1) suggests that there has been little overall change in the distribution of Mallard on the Severn Estuary over the last 15 years. Numbers appear to have fallen around the mouth of the Rivers Parrett and Axe, though appear more numerous between Avonmouth and Berkeley and at Redwick and Undy on the Gwent Severn.

WeBS Core Count data

Mallard were recorded on every count section of the Severn covered by WeBS Core Counts (Figure 7.7.3). Large concentrations occurred on these high tide counts at the Axe Estuary, Severn Beach and along the Gwent Severn as well as on the freshwater habitats at the Gwent Levels Wetlands Reserve and the New Grounds at Slimbridge.

On the Welsh coast of the SPA, Ward *et al.* (2003) recorded the majority of Mallard at Rhymney, St. Brides, the Nash foreshore and Undy during their high tide counts in winter 2002/03, though, as with the WeBS Core Counts, smaller numbers were also recorded elsewhere. A peak count of 1,509 Mallard was recorded in January 2003.

Trends in numbers

Changes in the numbers of Mallard, as shown by WeBS Core Counts, are shown in Figure 7.7.4 for the Severn Bridgwater, Severn Avon, Severn Gloucestershire and Gwent Severn sub-sites.

On the Severn Bridgwater sub-site, Mallard numbers fell sharply between the 1970s and 1980s. A continuing steady decline since then has reduced numbers to less than 100 birds. This decline also seems to be apparent in the lower numbers recorded by the low tide counts in 2002/03. On the Severn Avon sub-site, numbers also peaked in 1991/92, but since a decline over the following three years, have risen again to around 400 birds. On the Severn Gloucestershire sub-site, numbers recorded by WeBS Core Counts have fallen since a peak in the mid-1980s to around 1,300 birds in 2000/01. This decline was not apparent from the low tide counts of the estuary and may reflect a decline at the freshwater habitats of Slimbridge. On the Gwent Severn, as with Teal, numbers have shown greater fluctuations, but rose in 2000/01 to around 1,200 birds – again perhaps due to the creation of the Gwent Levels Wetlands Reserve.

As with Teal, it was also not possible to look at trends in the numbers of Teal at Cardiff Bay using WeBS Core Count data. BTO data indicate that, despite the change to freshwater conditions, the numbers of Mallard using the bay have fallen since barrage-closure, from a winter peak of 127 in 1998/99 to 24 in 2001/02 (Burton *et al.* 2002a).

Over the SPA as a whole, there has been a decline in Mallard numbers and this has resulted in 'High Alerts' for the species over 10- and 25-year periods (see Austin *et al.* 2003 and Section 6 above). Nationally, Mallard numbers have also shown a gradual fall since the mid-1980s (Austin *et al.* 2003; Pollitt *et al.* 2003) and this may explain the decline seen on the Severn Gloucestershire sub-site.

7.8 Pintail *Anas acuta*

Low Tide Count data

The main concentrations of Pintail on the Severn Estuary are found on the intertidal habitats of the Gwent Severn and the freshwater habitats of the New Grounds at Slimbridge. The low tide distribution maps for 1987/88-1991/92, 1998/99 and 2002/03 (Figures 7.8.1, 7.8.2 & 3.20.1 respectively) indicate that along the Gwent Severn the species was formerly restricted largely to the Rhymney Estuary, but that by 2002/03, the species was common at Peterstone, St. Brides and at Uskmouth and the Gwent Levels Wetlands Reserve. In 2002/03, Pintail were also recorded on the intertidal mudflats adjacent to Slimbridge and in small numbers in Bridgwater Bay.

WeBS Core Count data

WeBS Core Count data for 1996/97 to 2000/01 also emphasize the importance for this species of the intertidal areas of the Gwent Severn and the freshwater habitats at Slimbridge (Figure 7.8.3).

Elsewhere on the Severn Estuary, Pintail were recorded in small numbers at high tide at Bridgwater Bay, Berrow, the Axe and Yeo Estuaries, Portbury, Severn Beach and Oldbury.

On the Welsh coast of the SPA, Ward *et al.* (2003) reported that the majority of Pintail were found at Rhymney at high tide in the winter of 2002/03, with other concentrations at Peterstone, St. Brides and the Nash foreshore. As with the WeBS Core Counts, relatively few Pintail were recorded on the Gwent Levels Wetlands Reserve at high tide. A peak count of 709 Pintail was recorded in December 2002.

Trends in numbers

Changes in the numbers of Pintail, as shown by WeBS Core Counts, are shown in Figure 7.8.4 for the Severn Bridgwater, Severn Gloucestershire and Gwent Severn sub-sites. (No graphs are shown for the Severn Avon and Cardiff Bay sub-sites, as Pintail were seldom recorded there).

Pintail appear to have increased slightly in number on the Severn Bridgwater sub-site over the last decade, though numbers remain low and subject to high fluctuations between years. On the Severn Gloucestershire sub-site, numbers have remained largely stable over the last 25 years at an average of around 250 birds. On the Gwent Severn, the population has fluctuated between 100 and 200 birds, though rose in 2000/01 to a peak of almost 300 – perhaps due to the creation of the Gwent Levels Wetlands Reserve.

Nationally, the numbers of Pintail have shown a slight, though steady decline over the last 25 years (Austin *et al.* 2003; Pollitt *et al.* 2003).

7.9 Shoveler *Anas clypeata*

Low Tide Count data

As with Pintail, the main concentrations of Shoveler on the Severn Estuary are found on the intertidal habitats of the Gwent Severn and the freshwater habitats of the New Grounds at Slimbridge. Away from these sites, Shoveler were only recorded at low tide from the River Parrett (in 1987/88-1991/92), Oldbury (in 1998/99 and 2002/03) and the River Yeo (in 2002/03) (see Figures 7.9.1, 7.9.2 & 3.21.1). Comparison with the results for 2002/03 indicates that Shoveler have expanded in number along the Gwent Severn. Having formerly only been recorded at St. Brides and Peterstone, Shoveler are now common between this area and Goldcliff and were also recorded at the new Gwent Levels Wetlands Reserve. Shoveler were also only recorded on the mudflats adjacent to Slimbridge in the 2002/03 survey.

WeBS Core Count data

WeBS Core Count data for 1996/97 to 2000/01 also show the importance for this species of the freshwater habitats at Slimbridge and the Gwent Severn (Figure 7.9.3). Shoveler were also recorded in low numbers at high tide from Cardiff Bay, Oldbury, Severn Beach and the Yeo, Axe and Parrett Estuaries.

On the Welsh Coast of the SPA, Ward *et al.* (2003) reported that the majority of Shoveler recorded by their high tide counts in 2002/03 were found at St. Brides or the Nash foreshore. A peak count of 203 Shoveler was recorded in both November and December 2002.

Trends in numbers

Changes in the numbers of Shoveler, as shown by WeBS Core Counts, are shown in Figure 7.9.4 for the Severn Avon, Severn Gloucestershire and Gwent Severn sub-sites. (No graphs are shown for the Severn Bridgwater and Cardiff Bay sub-sites, as Shoveler were seldom recorded there).

Numbers on the Severn Avon have increased over the last 10 years, though only to around 13 birds in 2000/01. On the Severn Gloucestershire sub-site, numbers have also increased over the same period, to around 100 birds in the most recent winters. On the Gwent Severn, the numbers recorded by WeBS Core Counts have generally been lower than those recorded by the low tide surveys – a peak count of 173 was recorded on the Peterstone Gout section during the 2002/03 WeBS Low Tide Counts. In 2000/01, however, the numbers recorded by the Core Counts increased – though only to just over 40 – presumably due to the creation of Gwent Levels Wetlands Reserve.

The rise in numbers on the Severn Estuary reflects the national trend for the species (Austin *et al.* 2003; Pollitt *et al.* 2003).

7.10 Pochard *Aythya ferina*

Low Tide Count data

Large numbers of Pochard winter on the freshwater habitats of the New Grounds at Slimbridge. On the intertidal habitats of the estuary, however, the species' main concentration lies along the Welsh shore, between Cardiff Bay and Goldcliff (see Figures 7.10.1, 7.10.2 & 3.22.1). Away from here, Pochard were only recorded at Portishead (in the 1987/88-1991/92 survey). Comparison of the maps for the three survey periods shows that Pochard declined sharply in numbers between 1998/99 and 2002/03. The former concentrations at Cardiff Bay, Rhymney and Peterstone are now much reduced and there is no evidence that these birds have moved elsewhere on the estuary.

WeBS Core Count data

WeBS Core Count data for 1996/97 to 2000/01 show the former importance of the Welsh shore for this species for this species, as well as the large concentration of birds at Slimbridge (Figure 7.10.3). Pochard were also recorded in low numbers at high tide from Oldbury, Severn Beach, Avonmouth and the Yeo, Axe and Parrett Estuaries.

During their high tide surveys of the Welsh coast of the SPA in winter 2002/03, Ward *et al.* (2003) recorded a peak of just 34 Pochard in February. As with the WeBS Core Counts, the majority of birds were seen at Rhymney, with others at the Gwent Levels Wetlands Reserve and occasionally at St. Brides and on the Nash foreshore.

Trends in numbers

Changes in the numbers of Pochard, as shown by WeBS Core Counts, are shown in Figure 7.10.4 for the Severn Avon, Severn Gloucestershire, Gwent Severn and Cardiff Bay sub-sites. (No graph is shown for the Severn Bridgwater sub-site, as Pochard were seldom recorded there).

On the Severn Avon, numbers increased sharply from very low levels to over 50 in 1999/2000. This may have partly been the result of the use of lagoons at the new waste water treatment works on the Axe Estuary, where the species was formerly uncommon (Martin 2000).

On the Severn Gloucestershire sub-site, numbers rose from low levels in the 1970s to over 800 by the late 1980s – presumably due to the increase in the open-water habitats at Slimbridge – but since the mid-1990s have shown a slight decline.

Numbers on the Gwent Severn have been falling since a peak of around 400 birds in the early 1980s. At Cardiff Bay, a short-lived peak in the late 1980s was followed by another increase at the end of the 1990s. The graphs for these two sub-sites do not fully describe the recent changes experienced by this species, however. BTO surveys indicate that the peak numbers at the Rhymney Estuary and Cardiff Bay had risen to 350 and 240 respectively in the 2001/02 winter (Burton *et al.* 2002a). In 2002/03, however, peaks of just 19 and 25 birds were recorded at the two sites (BTO unpubl. data). This sharp

fall in numbers, which as the low tide survey for 2002/03 suggests does not seem to have been compensated for by an increase elsewhere, may be linked to improvements to waste water treatment. The Pochard that occurred on the Rhymney Estuary were most often found around the outfall of the Cardiff eastern sewer. Waste water from this and other discharges was transferred to a new pipe discharging offshore in 2001 and received improved treatment in 2002.

Nationally, Pochard numbers have been stable in the long-term (Austin *et al.* 2003; Pollitt *et al.* 2003).

7.11 Tufted Duck *Aythya fuligula*

Low Tide Count data

As with Pochard, large numbers of Tufted Duck occur on the freshwater habitats at Slimbridge in winter, while on the intertidal habitats of the estuary, the species' main concentration lies on the Gwent Severn (see Figures 7.11.1, 7.11.2 & 3.23.1). Comparison of the results for the three surveys indicates a recent change in the distribution of Tufted Duck in the latter area. Whereas in 1987/88-1991/92 and 1998/99, the species was primarily found between St. Brides and Rhymney, in 2002/03, Tufted Duck were only found at the Gwent Levels Wetlands Reserve. Aside from a single bird at Cardiff Bay in 2002/03, no Tufted Duck were recorded elsewhere on the estuary in any of the three surveys. Tufted Duck are also found on Newport's Docks in winter, though this area was not covered by any of the three surveys.

WeBS Core Count data

WeBS Core Count data for 1996/97 to 2000/01 show the importance of Gwent Severn and Gwent Levels Wetlands Reserve for this species, as well as the large concentration of birds at Slimbridge (Figure 7.11.3). Tufted Duck were also recorded in low numbers at high tide from Oldbury, Severn Beach, Avonmouth and the Yeo, Axe and Parrett Estuaries.

Ward *et al.* (2003) recorded Tufted Duck most regularly on the Gwent Levels Wetland Reserve during their high tide counts of the Welsh coast of the SPA in winter 2002/03. Flocks were also reported from Cardiff Bay and the Nash foreshore. A peak of 64 Tufted Duck was recorded in October 2002.

Trends in numbers

Changes in the numbers of Tufted Duck, as shown by WeBS Core Counts, are shown in Figure 7.11.4 for the Severn Avon, Severn Gloucestershire and Gwent Severn sub-sites. (No graphs are shown for the Severn Bridgwater and Cardiff Bay sub-sites, as Tufted Duck were seldom recorded there).

On the Severn Avon sub-site, numbers rose from low levels to over 25 birds in 2000/01. As with Pochard, this may have partly been the result of the use of lagoons at the new waste water treatment works on the Axe Estuary, where the species was formerly uncommon (Martin 2000).

On the Severn Gloucestershire sub-site, numbers have risen greatly since the 1970s to a current level of around 350 birds. Again, as with Pochard, this increase has probably been largely driven by the increase in the open-water habitats available at Slimbridge.

On the Gwent Severn, Tufted Duck have also followed a similar pattern to Pochard, declining from a peak in the early 1980s to a current level of around 100 birds. As with Pochard, the decline in Tufted Duck numbers on the intertidal habitats between Rhymney and St. Brides may be linked to improvements in waste water treatment (notably, for this species, the transfer of the discharge from the outfalls at Peterstone). Unlike Pochard, however, Tufted Duck seem to have benefited from the new Gwent Levels Wetlands Reserve and thus there has been little recent change in their numbers on the Gwent Severn.

Nationally, Tufted Duck numbers have shown a slow but steady increase over the last two decades (Austin *et al.* 2003; Pollitt *et al.* 2003).

7.12 Ringed Plover *Charadrius hiaticula*

Low Tide Count data

Ringed Plovers are not abundant on the Severn in winter and are most important on the SPA for their passage populations. Comparison of the low tide distribution maps for 1987/88-1991/92, 1998/99 and 2002/03 (Figures 7.12.1, 7.12.2 & 3.33.1 respectively) indicates that the species has become much more localised over the last 15 years. In 2002/03, the species appeared to be largely absent from Cardiff Bay, the Gwent Severn and the Severn Gloucestershire sub-sites. Ringed Plover were also not seen at Berrow in the 2002/03 survey, but were recorded at Weston Bay.

WeBS Core Count data

WeBS Core Count data show that Ringed Plover were still widely distributed on the Severn Estuary between 1996/97 and 2000/01 (7.12.3). On the Welsh shore, Ringed Plover were recorded at high tide at Cardiff Bay, Peterstone, St. Brides, Redwick and Mathern. On the English shore, Ringed Plovers were recorded on every section between Bridgwater Bay and Oldbury, with the exception of the River Avon.

Ward *et al.* (2003) recorded a high tide peak of 88 Ringed Plover in November during their counts of the Welsh coast of the SPA in winter 2002/03. Birds were predominantly recorded at Rhymney, St. Brides, Redwick and Mathern.

Trends in numbers

Figure 7.12.4 shows how numbers of Ringed Plover have changed on each of the WeBS sub-sites of the Severn Estuary since the 1970s.

On the Severn Bridgwater, Severn Gloucestershire and Cardiff Bay sub-sites, Ringed Plover numbers have shown large fluctuations from year to year, but have been largely absent since the mid-1990s. On the Severn Avon sub-site, numbers fell from 150-200 in the early 1970s to under 50 in the most recent winters. On the Gwent Severn, numbers rose from around 50 in the 1970s to peaks of over 100 in the late 1980s, but have declined sharply since. Only occasional small groups of Ringed Plovers were recorded on the Gwent Severn by WeBS Core Counts in 1999/2000 and 2000/2001.

Ringed Plovers have also declined nationally over the last 25 years (Austin *et al.* 2003; Pollitt *et al.* 2003), though on the east coast, numbers have increased (Austin *et al.* 2000). The apparent redistribution from the west coast to the east coast has been linked to an increase in mild winters (Rehfishch & Austin 1999).

7.13 Grey Plover *Pluvialis squatarola*

Low Tide Count data

Low tide distribution maps for Grey Plover on the Severn Estuary in 1987/88-1991/92 and 1998/99 are shown in Figures 7.13.1 and 7.13.2 respectively. Comparison of these maps with that for 2002/03 (Figure 3.35.1) indicates that there have been relatively few changes in the species' overall distribution on the estuary over the last 15 years, though that there have been some declines.

Grey Plovers remain most abundant on the lower stretches of the estuary. On the Welsh shore, however, the species was absent from Cardiff Bay and the Rhymney Estuary in 2002/03 and had become less numerous at Redwick and Undy. There were also fewer Grey Plover at Weston Bay in

2002/03 and, at Bridgwater Bay, the species had become more concentrated towards the mouth of the River Parrett. None were recorded on the Severn Gloucestershire WeBS sub-site in the 2002/03 survey.

WeBS Core Count data

The WeBS Core Count data for Grey Plover for 1996/97 to 2000/01 show a similar distribution to the 1998/99 and 2002/03 low tide count surveys. The majority of birds were recorded at Bridgwater Bay, with another concentration along the Gwent Severn (Figure 7.13.3). In contrast to the 2002/03 low tide counts, WeBS Core Counts also recorded low numbers of Grey Plover at Severn Beach, Oldbury and Slimbridge.

During their high tide surveys of the Welsh coast of the SPA in winter 2002/03, Ward *et al.* (2003) recorded most Grey Plover at St. Brides, the Nash foreshore, Undy and Mathern. A peak of 159 Grey Plover was recorded in January 2003.

Trends in numbers

Changes in the numbers of Grey Plover, as shown by WeBS Core Counts, are shown in Figure 7.13.4 for the Severn Bridgwater, Severn Avon, Gwent Severn and Cardiff Bay sub-sites. (No graph is shown for the Severn Gloucestershire sub-site, as Grey Plover were uncommon there).

On the Severn Bridgwater and Severn Avon sub-sites, numbers peaked in the early 1990s, but have since fallen – to around 125 and 20 birds respectively. On the Gwent Severn, numbers have shown a longer-term decline and currently average less than 50 birds. A similar decline led to the abandonment of Cardiff Bay as a wintering site prior to its loss in 1999.

Over the SPA as a whole, there has thus been a decline in Grey Plover numbers and this has resulted in a 'Medium Alert' for the species over the most recent 10-year period (see Austin *et al.* 2003 and Section 6 above). Nationally, numbers also increased up until the mid-1990s (Austin *et al.* 2003; Pollitt *et al.* 2003), perhaps due to a northward shift in the species' overall wintering distribution (Wetlands International 1999), but have also declined slightly since. The trends in numbers on the Severn Bridgwater and Severn Avon sub-sites thus mirror the national situation for the species. The declines on the Welsh shore appear to have begun earlier, however, and are of more concern.

7.14 Lapwing *Vanellus vanellus*

Low Tide Count data

Low tide distribution maps for Lapwing on the Severn Estuary in 1987/88-1991/92 and 1998/99 are shown in Figures 7.14.1 and 7.14.2 respectively. Comparison with the results for 2002/03 (Figure 3.36.1) indicates that, although the species is still widely distributed across the estuary, there have been some changes. Most notably, the numbers of Lapwings counted on the Gwent Severn and at Cardiff Bay have declined. Very few Lapwing were recorded on the intertidal mudflats along the Welsh coast in either 1998/99 or 2002/03, though a small concentration was found at the Gwent Levels Wetlands Reserve in 2002/03. On the English coast, there has been an increase around the Yeo Estuary and Clevedon since the surveys of 1987/88 to 1991/92. The main intertidal concentrations of Lapwing in each of the surveys were found adjacent to the New Grounds at Slimbridge and at the mouth of the River Parrett. The 2002/03 survey also recorded large numbers using fields (within the SPA) adjacent to the River Parrett, which were not surveyed in 1998/99 or 1987/88 to 1991/92.

WeBS Core Count data

WeBS Core Count data showed that Lapwing were still widely distributed on the Severn Estuary between 1996/97 and 2000/01 (7.14.3). Lapwing were recorded from every count section with the

exception of the 'Uskmouth Reedbed Lagoons' of the Gwent Levels Wetlands Reserve, Undy, Sand Bay and Flatholm. The main concentrations recorded were at the New Grounds at Slimbridge and Bridgwater Bay. The species was also still recorded from the majority of the Welsh shore, albeit in small numbers.

During their high tide counts of the Welsh coast of the SPA in 2002/03, Ward *et al.* (2003) recorded Lapwing on almost every sector covered, with the largest concentrations at St. Brides and the Gwent Levels Wetlands Reserve. A peak of 746 Lapwing was recorded in December 2002.

Trends in numbers

Long-term WeBS data were not available to plot trends in the numbers of Lapwings at the different sub-sites of the Severn Estuary. As the low tide count maps show, however, there has been a decline in the numbers of Lapwing wintering on the Welsh shore of the estuary since 1987/88 to 1991/92. Numbers appear less affected on the estuary's English shores, though numbers here may fluctuate greatly from year to year due to cold weather movements between the estuary and the neighbouring Somerset Levels (Martin 2000).

Nationally numbers may also vary markedly between years in response to the severity of winter weather on the Continent (Pollitt *et al.* 2003). Both in the Great Britain and the rest of north-west Europe, however, breeding populations have been falling (Wilson *et al.* 2000; van Strien *et al.* 2001) and this may in part explain the declines seen in numbers wintering on the Welsh shore of the estuary.

7.15 Dunlin *Calidris alpina*

Low Tide Count data

Dunlin was the most abundant species counted on the Severn Estuary during each of the low tide surveys (see Figures 7.15.1, 7.15.2 and 3.40.1 for 1987/88-1991/92, 1998/99 and 2002/03 respectively). Densities have declined in a number of areas since the 1987/88-1991/92, however. Most notably, Dunlin are now less numerous on the Gwent Severn and from Clevedon to Berrow. Dunlin also appeared to make less use of the outer sandflats of Bridgwater Bay, e.g. Gore Sands, than in the past and have been absent at low tide from Cardiff Bay since its inundation in 1999.

Dunlin formerly occurred in the highest concentrations on the Gwent shore between Rhymney and Goldcliff, between Clevedon and the Yeo Estuary and between Weston Bay and Bridgwater Bay. In 2002/03, the highest densities were recorded on the Steart Flats sectors of Bridgwater Bay.

WeBS Core Count data

Dunlin were reported from every section surveyed during WeBS Core Counts between 1996/97 and 2000/01 (Figure 7.15.3). As shown by the low tide surveys, the main concentrations of this species were found along the Gwent Severn and between Clevedon and Bridgwater Bay. Large numbers were also reported from Severn Beach, Oldbury and Slimbridge.

Ward *et al.* (2003) recorded a peak of 8,887 Dunlin (in February) during their high tide counts of the Welsh coast of the SPA in winter 2002/03. The main high tide roosts used were at Redwick, Undy, the Nash Foreshore, St. Brides and Undy.

Trends in numbers

Figure 7.15.4 shows how numbers of Dunlin have changed on each of the WeBS sub-sites of the Severn Estuary since the 1970s.

On the Severn Bridgwater sub-site, Dunlin numbers peaked in the late 1970s and again in the early 1990s, but have since declined to around 5,000 birds. On the Severn Avon sub-site, numbers declined between the early 1970s and early 1990s, but have since stabilised at around 5,000 birds. Lawrence & Higgins (2002) reported that Dunlin numbers at Severn Beach had fallen from maxima of 4-5,000 in the 1970s to a maximum of just 1,200 in 2001/02 and suggested that this may have been due to a loss of suitable roost sites in the saltmarsh or increased disturbance. On the Severn Gloucestershire sub-site, in contrast to the rest of the estuary, numbers rose during the 1990s to around 3,000 birds in 2000/01.

Dunlin numbers have shown the steepest decline on the Gwent Severn, falling from an average of around 15,000 birds in the 1980s to 2,000 in the winter of 2000/01. At Cardiff Bay, numbers started to decline in the early 1980s, falling from around 6,000 birds to 2,000 in the winter of 1998/99 just prior to the closure of the barrage. Cardiff Bay was primarily used as a roost site by Dunlin prior to its loss and numbers during the intertidal period were usually lower. Since barrage-closure, however, no Dunlin have been recorded in the bay and only occasional small flocks use the bay to roost (Burton *et al.* 2000a). Numbers of Dunlin at the neighbouring Rhymney Estuary fell further in the winter of 1999/2000 following the bay's loss. It is probable, therefore, that the Dunlin that were displaced from the bay have either been forced to disperse to more distant areas or that there has been increased mortality in the local population.

Over the SPA as a whole, there has thus been a decline in Dunlin numbers and this has resulted in a 'High Alert' for the species over a 25-year period (see Austin *et al.* 2003 and Section 6 above). Nationally, Dunlin numbers have fluctuated over the long-term (Austin *et al.* 2003; Pollitt *et al.* 2003). A fall in numbers since the mid-1990s may in part explain the recent declines seen on the Severn Estuary – though those on the Severn Avon, Gwent Severn and at Cardiff Bay began earlier than this. It is unclear what other local factors may have been involved in these declines, though in some areas erosion may be a factor. At Clevedon, declines in Dunlin have been linked to a loss of soft sediments through erosion (Warbrick *et al.* 1991, Chown 2000). Dunlin are most associated with soft sediments where the densities of their invertebrate prey are greatest and least associated with sandy sediments, such as those found furthest offshore in Bridgwater Bay and at Bedwin Sands and the Middle Grounds (McCulloch & Clark 1992).

7.16 Curlew *Numenius arquata*

Low Tide Count data

Curlew are found throughout the Severn, though are found in the highest concentrations at low tide on the inner sections of Bridgwater Bay, the Severn Gloucestershire sub-site and at Undy and between Rhymney and St. Brides on the Gwent Severn (see Figures 7.16.1, 7.16.2 and 3.45.1 for 1987/88-1991/92, 1998/99 and 2002/03 respectively). Comparison of the maps suggests that there have been declines at Rhymney and Peterstone on the Gwent Severn and on the Severn Bridgwater sub-site. Numbers also declined at Cardiff Bay between 1987/88-1991/92 and 1998/99, prior to the loss of its intertidal mudflats.

WeBS Core Count data

Curlew were reported from every section surveyed during WeBS Core Counts between 1996/97 and 2000/01 (Figure 7.16.3). The counts indicate that high numbers of Curlew were found at high tide all along the Gwent Severn, at Bridgwater Bay, the Axe Estuary and Severn Beach. Surprisingly, given the high numbers found at low tide, the numbers recorded on the Severn Gloucestershire sub-site by the WeBS Core Counts were low, with the exception of the New Grounds at Slimbridge.

During their high tide counts of the Welsh coast of the SPA in winter 2002/03, Ward *et al.* (2003) recorded the majority of Curlew at Peterstone, St. Brides, the Nash foreshore and Undy, though, as

with the WeBS Core Counts, smaller numbers were also recorded elsewhere. A peak count of 852 Curlew was recorded in November 2002.

Trends in numbers

Figure 7.16.4 shows how numbers of Curlew have changed on each of the WeBS sub-sites of the Severn Estuary since the 1970s.

On the Severn Bridgwater sub-site, numbers declined in the late 1970s, before rising again in the early 1990s. Since then, however, numbers have fallen from around 1,200 birds to 400. On the Severn Avon sub-site, numbers rose during the 1980s, but have been relatively stable at 400-500 birds in the 1990s. On the Severn Gloucestershire sub-site, numbers have declined since a peak of around 1,500 birds in the mid-1980s to less than 100 in 2000/01. This trend is not reflected in the low tide counts and it is possible that the Curlew that feed on the mudflats now roost or feed at high tide at sites not covered by the Core Counts.

The numbers of Curlew recorded on the Gwent Severn also peaked in the mid-1980s, but have since fallen from around 1,000 birds to 400 in 2000/01. At Cardiff Bay numbers fell from around 120 in the 1970s to 70 in the winter of 1998/99 just prior to the closure of the barrage. As with Dunlin, Cardiff Bay was primarily used as a roost site by Curlew prior to its loss. Since barrage-closure, Curlew have rarely been recorded in the bay at low tide and the average number of roosting birds has fallen (Burton *et al.* 2000a). Preliminary analyses by the BTO have indicated that, as with Shelduck, Curlew numbers increased on the neighbouring mudflats at Orchard Ledges in the two winters following barrage-closure, but that they have since decreased. At Rhymney, numbers remained stable, however, and it thus appears that the Curlew that were displaced from the bay were either dispersed to more distant areas or that there was increased mortality in the local population.

The declines on the Severn Estuary are contrary to the gradual increase that has been seen nationally (Austin *et al.* 2003; Pollitt *et al.* 2003) and are thus of cause for concern – Austin *et al.* (2003) reported 'Alerts' for the species over the most recent 5-, 10- and 25-year periods. The decline might be linked to changes in the breeding populations. The majority of Curlew that winter on Britain's east coast come from Scandinavia and eastern Europe, whereas birds from the British and Irish breeding populations, which have been in decline (Grant 1998), predominate in the west (Wernham *et al.* 2002).

Aside from the loss of Cardiff Bay, it is unclear what local factors might have driven these declines. On the Welsh shore, the loss of saltmarsh and the gradual draining of farmland behind the sea-walls, which is traditionally used by Curlew to forage on over high tide, may perhaps be a cause. The degradation of these habitats has been linked to declines in breeding waders in this area (Thomas 1998).

7.17 Redshank *Tringa totanus*

Low Tide Count data

Redshank are found throughout the Severn Estuary, though tend to be concentrated at the mouths of rivers or other freshwater inputs into the estuary (see Figures 7.17.1, 7.17.2 and 3.47.1 for 1987/88-1991/92, 1998/99 and 2002/03 respectively). Comparison of the low tide maps show some changes between the surveys. Redshank were absent from Cardiff Bay following the loss of its mudflats in 1999, but showed small increases at Peterstone and between the River Usk and Goldcliff in 2002/03. On the Severn Avon, increases were noted between Severn Beach and Littleton. Likewise, there were more Redshank on the Axe Estuary in 1998/99 and 2002/03 than in 1987/88-1991/92.

WeBS Core Count data

WeBS Core Count data showed that Redshank were present at high tide on every section of the Severn Estuary surveyed between 1996/97 and 2000/01, with the exception of Flatholm, Berrow and the 'Uskmouth Reedbed Lagoons' and 'Saltmarsh Grasslands' on the Gwent Levels Wetlands Reserve (7.17.3). The largest concentrations of Redshank recorded at high tide were found at Bridgwater Bay (around the River Parrett), the Axe Estuary, River Avon, Severn Beach, Rhymney Estuary and before its inundation, Cardiff Bay.

During their high tide surveys of the Welsh coast of the SPA in winter 2002/03, Ward *et al.* (2003) recorded a peak of 1,473 Redshank in November. As with the WeBS Core Counts, the majority of birds were seen at Rhymney, with others between St. Brides and Mathern. No Redshank were recorded at high tide in Cardiff Bay during their study.

Trends in numbers

Figure 7.17.4 shows how numbers of Redshank have changed on each of the WeBS sub-sites of the Severn Estuary since the 1970s.

On the Severn Bridgwater sub-site, the numbers recorded by WeBS Core Counts appeared to fall in the 1970s and have since fluctuated around 200 birds. Roosts of Redshank can be easily overlooked here, particularly along the banks of the River Parrett and thus these counts may underestimate total numbers. Indeed, a count of 350 was recorded at low tide on the Parrett south of Steart in November 2002 (and counts of 850 and 570 were recorded in January 2001 and February 2002 respectively). On the Severn Avon, Redshank numbers have undergone a series of long-term fluctuations and between the early 1990s and 2000/01 rose from under 400 birds to over 600. On the Severn Gloucestershire sub-site, numbers peaked at around 70 birds in the mid-1990s, though the long-term trend has been downward.

On the Gwent Severn, there has been a steady decline since the late 1980s and numbers had fallen to less than 500 birds in 2000/01. At Cardiff Bay, numbers similarly fell from peaks of over 1,000 in the late 1970s / early 1980s to around 250 in the winter of 1998/99, just prior to the closure of the barrage. As with Dunlin and Curlew, Redshank are now rarely recorded in Cardiff Bay at low tide and the average number of roosting birds has also fallen. BTO surveys have shown that the numbers of Redshank wintering on the neighbouring Rhymney Estuary have risen since the closure of the barrage and analyses of the movements of colour-ringed birds suggests that this has been largely due to an influx of birds from the bay. Preliminary analyses also suggest that the survival rates of adult Redshank from Cardiff Bay fell over the two winters following barrage-closure (Burton *et al.* 2002a).

Although the national population trend for Redshank has been stable (Austin *et al.* 2003; Pollitt *et al.* 2003), the declines noted on parts of the Severn do reflect the overall trend for western Britain (Austin *et al.* 2000). Aside from the loss of Cardiff Bay, however, it is unclear what local factors might have driven these declines.

7.18 The Overall Importance of Different Areas for Waterbirds

Figure 7.18.1a indicates the average numbers of all waterbirds using different parts of the Severn Estuary in the Low Tide Counts undertaken between 1987/88 and 1991/92 and Figure 7.18.1b, the sum weighting average numbers of each species by its national population size. Figures 7.18.2a and 7.18.2b show the equivalent maps for the 1998/99 survey.

As in 2002/03, the most important areas numerically were Bridgwater Bay and the area between Rhymney and Uskmouth (adjacent to the future Gwent Levels Wetlands Reserve). High densities of birds were also found at Berrow, the Axe Estuary and Weston Bay and between Avonmouth and

Oldbury, though at least in the earlier surveys, there were fewer birds on the mudflats adjacent to Slimbridge.

The maps showing waterbird totals weighted by national population size indicate the area between Rhymney and Uskmouth to be the most important and also emphasize the former importance of Cardiff Bay. As in 2002/03, the importance of Bridgwater Bay (although still high) is lessened with this weighting, as the large numbers of Dunlin that winter here are of less significance in a national context.

8. DISCUSSION

8.1 Waterbird Distributions in the Past Surveys

The low tide distributions of the majority of species discussed were broadly similar in 2002/03 to those reported in previous surveys. The highest bird densities were found between the Rhymney Estuary and Uskmouth, on the mudflats adjacent to the New Grounds at Slimbridge, between Avonmouth and Oldbury, at Berrow and the Axe Estuary and at Bridgwater Bay, with few waders and wildfowl reported from the outer mud- and sand-flats of the estuary.

In making comparisons between years, however, a number of constraints should be noted. Firstly, in each winter only a maximum of four counts were made of each count section, one a month from November to February. Coverage also varied between the surveys – most notably there was little data from Bridgwater Bay or the Gloucestershire Severn during the 1998/99 survey.

Observation of the central areas of the estuary is also very difficult. In the earlier surveys all observations were from land, whereas in 2002/03 low tide counts of these central mud- and sand-flats were undertaken from a boat. In both cases, it is possible that the numbers of birds using these areas were underestimated.

Additionally, it should be noted that gulls were only recorded in the 2002/03 survey (although even in that survey coverage of these species was patchy).

The Severn is a highly dynamic estuary and thus the location and extent of many of the intertidal areas may have changed since the Ordnance Survey maps used for this project were created. The movements of sediments may potentially also cause marked differences in the distributions of invertebrates and thus waterbirds between years.

It should also be noted that the numbers of birds recorded on the Severn Estuary may vary annually due to weather conditions. In cold winters, the west coast of Britain may act as a refuge for many waterbirds that in milder winters would occur on the east coast or on the Continent. In cold winters, therefore, waterbirds may be more widely distributed across the estuary than they would in milder winters.

Lastly, in assessing the importance of different intertidal mudflats, it is also important to note that some species may use different areas during the night to those where they are recorded in the day (e.g. Redshank – see Burton *et al.* 2002a).

8.2 Changes Reflecting Regional or National Trends

The numbers of many species have changed since the 1987/88-1991/92 survey, though often in line with national trends.

The increases in Wigeon, Gadwall, Teal and Shoveler numbers seen on at least parts of the Severn, for example, may be explained by the national trends for these species. Likewise, the declines in the numbers of European White-fronted Goose, Mallard, Ringed Plover, Grey Plover and Dunlin numbers also reflect recent national declines in these species populations (see Austin *et al.* 2003 for a summary of national trends).

The declines in wader populations on the Severn may be the results of redistributions away from the south-west. There is, for example, some evidence of a northward shift in the wintering distribution of Grey Plover over recent years (Wetlands International 1999). Similarly, although Ringed Plover numbers have declined in the south-west, they have increased on the east coast (Austin *et al.* 2000). This apparent redistribution from west to east has been correlated to an increase in mild winters (Rehfishch & Austin 1999).

8.3 Changes Resulting From Local Factors

The barraging and inundation of Cardiff Bay

The most obvious local factors that have affected numbers and distributions have been the barraging and consequent loss of the intertidal mudflats of Cardiff Bay and the creation of the Gwent Levels Wetlands Reserve between Uskmouth and Goldcliff. The loss of Cardiff Bay in November 1999 led to the displacement of considerable numbers of waders and wildfowl, notably Shelduck, Dunlin, Curlew and Redshank. Respective peaks of 307, 786, 122 and 344 were recorded for these species by BTO counts in year before barrage-closure, but since the numbers of each have fallen sharply and the bay is now rarely used by Dunlin and primarily just as a high tide roost by Shelduck, Curlew and Redshank (Burton *et al.* 2002a). An observed increase in the number of Redshank at the neighbouring Rhymney Estuary over the three winters since barrage-closure would account for the loss of birds from the Bay. Observations of colour-ringed birds have also suggested that the majority of Redshank from the bay moved to this site, though preliminary analyses have indicated an increase in winter mortality amongst these birds. The BTO studies have found no increase sufficiently large enough to account for the losses of Shelduck, Oystercatcher, Dunlin and Curlew from the bay, however. Although numbers of some of these species increased at neighbouring sites immediately following barrage-closure, these increases were not maintained.

The creation of the Gwent Levels Wetlands Reserve

The Gwent Levels Wetlands Reserve was created to compensate for the loss of Cardiff Bay. Its construction has provided new grassland, lagoon and reedbed habitats that have benefited a range of species. The reserve has been most successful in attracting large numbers of wildfowl, including (as recorded in the 2002/03 survey) Wigeon, Gadwall, Teal, Mallard, Pintail, Shoveler and Tufted Duck.

Aside from Lapwing, the reserve attracts few wintering waders while intertidal mudflats are exposed, though does provide safe roost sites over high tide (e.g. for Dunlin, Curlew and Redshank) (see Ward *et al.* 2003). The reserve also attracts breeding waders in spring, including in 2003 the first Avocets known to have bred in Wales.

Some of the increases in waterbird numbers noted at the Gwent Levels Wetlands Reserve have been accompanied by declines at other nearby sites. Most notably, the Tufted Duck that were present in large numbers offshore between St. Brides and Rhymney in the 1987/88-1991/92 and 1998/99 low tide surveys were completely absent there in 2002/03. Thus, for this species there has been little over change in the numbers wintering on this part of the Severn.

Changes in water quality

The decline of Tufted Duck between St. Brides and Rhymney and the decline of Pochard at Rhymney in 2002/03 may be linked to the recent improvements to waste water treatment. Waste water from the discharges in this area was transferred to a new pipe discharging offshore in 2001 and received improved treatment in 2002. Further data are required though to determine whether these declines are maintained over the longer term.

Studies in Scotland have described how flocks of Scaup and Goldeneye, in particular, were previously concentrated near sewage outfalls or outfalls discharging waste from food factories, breweries and distilleries (e.g. Player 1971, Milne & Campbell 1973, Pounder 1976a, 1976b, Campbell & Milne 1977, Campbell 1978, Campbell *et al.* 1986). Following improvements to waste water discharges at Leith and Seafield on the Firth of Forth, numbers of seaduck fell sharply in these areas (Campbell 1984).

Improvements to waste water treatment have also occurred recently at a number of other sites on the Severn Estuary (e.g. at Bridgwater, Burnham-on-Sea, the Axe Estuary, Clevedon and Portishead).

Aside from at Rhymney and St. Brides, however, there is little evidence from the Low Tide Counts that these changes have affected waterbird populations – though on the Axe Estuary, the changes have been tentatively linked to a decline in Shelduck numbers (Martin 2000).

In the majority of cases the changes to waste water treatment have been too recent for any changes in waterbird numbers to be apparent in the data presented. Changes are most likely to be detected in the future for those species, such as ducks and gulls, that feed directly on matter discharged from outfalls. Impacts on other estuarine waders and wildfowl that feed on the invertebrates in the organic-enriched sediments by outfalls may be less clear and may take longer to become apparent.

Construction of the Second Severn Crossing

The largest other recent development on the estuary has been the construction of the Second Severn Crossing. However, there is no clear evidence that any waterbird declines in this area are the result of this. Although, for example, both the Low Tide Counts and a more detailed study by Lawrence & Higgins (2002) have suggested a decline in Shelduck numbers at Severnside, numbers of this species have declined recently on the Severn Avon WeBS sub-site as a whole.

It should be noted, though, that because of the difficulties of surveying the English Stones area beneath the bridge, it is difficult to assess any population changes in this area from the Low Tide Counts alone.

Other habitat loss / change

Another factor which might be linked to declines in the numbers of waterbirds in some areas is the loss of saltmarsh. At Severnside, for example, the loss of saltmarsh has been linked to a decline in the numbers of roosting Dunlin (Lawrence & Higgins 2002). Again, it is difficult to ascertain the true impact of this, given the decline of Dunlin across the estuary as a whole.

On the Gwent Levels, loss of saltmarsh and the drainage of adjacent farmland may have affected Curlew numbers. Erosion of soft sediments has also been linked with the decline in Dunlin numbers at Clevedon (Warbrick *et al.* 1991, Chown 2000), although again the wider decline of Dunlin needs to be taken into account when considering this.

More accurate data on the timing and extent of changes in sediments (and their impacts on invertebrate densities) or saltmarsh would be needed to be able to determine the impacts of these habitat changes.

Disturbance

Increased disturbance may also be an important factor in changes in waterbird numbers at a number of sites, for example at Severnside (Lawrence & Higgins 2002). However, information concerning disturbance is usually only anecdotal and long-term quantitative data are rarely available to demonstrate measurable impacts.

8.4 Recommendations

Three areas are considered worthy of further research.

Firstly, it is important to know whether the creation of the Gwent Levels Wetlands Reserve leads (over perhaps the next five or 10 years) to an overall increase in the numbers of birds using the estuary or whether the site merely attracts birds away from other parts of the SPA. Comparison between the different low tide count surveys certainly suggested that the increase in Tufted Duck using the reserve had been the result of a redistribution of birds from neighbouring intertidal shores. In addition to the ongoing surveys of the reserve, this would require further low tide counts, at least of the Welsh coast of the Severn.

Secondly, it is clear that a number of waterbird species regularly use areas that are outside the SPA. Teal and Redshank, for example, tend to concentrate at the mouths of rivers or other freshwater inputs into the estuary. Many are thus found along the riverine stretches of the rivers Rhymney, Usk and Avon. Curlew and Lapwing likewise frequently forage on farmland adjacent to the estuary – for example, along the Gwent Levels. Curlew typically feed in fields over the high tide period, though also increasingly through the winter. In addition to studies of the waterbirds using the Gwent Levels Reserve, it would thus be extremely informative to undertake a wider survey of habitats suitable for waterbirds that border the SPA (covering at least one winter) and determine linkages and movements between the SPA and these neighbouring areas.

Lastly, further research is clearly needed to determine the impacts of the changes to waste water treatment currently being made around the estuary. Further low tide counts around the outfalls in question would help to show any distributional or numerical changes of foraging birds not so apparent from the coarser scale WeBS Core Counts. However, although changes in some species' numbers may be apparent from the level of monitoring provided by WeBS Low Tide Counts – counts of Pochard at Rhymney, for example, show a clear decline in the first year following changes to waste water treatment there – a higher level of monitoring may be required to detect impacts on species which feed on invertebrates in the organic-enriched sediments by outfalls. To fully investigate the impacts of these changes, however, it would be necessary to mark birds so as to monitor their subsequent movements and survival.

The results of the 2002/03 survey provide a good overview of the current distributions of waterbirds on the Severn Estuary and with the results of the past surveys in 1998/99 and 1987/88-1991/92 provide some insight into the impacts of changes to the estuary. To be able to investigate the impacts of any future changes to the estuary, however, it is important that regular low tide surveys continue.

Acknowledgements

This report uses data from the Wetland Bird Survey (WeBS) Core and Low Tide Count Schemes. WeBS is a partnership between the BTO, The Wildfowl and Wetlands Trust, the Royal Society for the Protection of Birds and the Joint Nature Conservation Committee (the latter on behalf of English Nature, Scottish Natural Heritage, the Countryside Council for Wales and the Environment and Heritage Service in Northern Ireland). Thanks are due to all the counters who helped with WeBS counts on the Severn Estuary. Louise Redgrave of LandMark Environmental Consultants undertook counts at Avonmouth and Portbury for the 2002/03 Low Tide Counts. Thanks are also due to Mike Nicholas of Bay Island Voyages for his help in surveying the outer mudflats of the estuary.

Additional data were also taken from BTO low tide surveys of the Severn for the winters of 1987/88 to 1991/92.

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Section	Approx name/description of section	Nov-02	Dec-02	Jan-03	Feb-03
BV601	The Moose	Y	Y	Y	Y
BV602	Slimbridge - non-tidal	N	N	N	N
BV603	Frampton Sand	Y	Y	Y	Y
BV604	Waveridge Sand / The Ridge Sand	Y	Y	Y	Y
BV605	Opposite Sharpness	Y	Y	Y	Y
BV606	Sharpness to Berkeley Pill	Y	Y	Y	Y
BV607	Lydney Sand	Y	Y	Y	Y
BV608	Berkeley Power Station	Y	Y	Y	Y
BV609	Hills Flats	Y	Y	Y	Y
BV610	Aylburton Warth -non-tidal	Y	Y	Y	Y
BV611	Guscar Rocks	Y	Y	Y	Y
BV612	Pillhouse Rocks to Grange Pill	Y	Y	Y	Y
BV613	Sheperdine Sands and Beacon Sand	Y	Y	Y	Y
BV614	Off Shepperdine Farm	Y	Y	Y	Y
BV615	Oldbury Power Station North	Y	Y	Y	Y
BV616	Oldbury Power Station to Littleton Pill	Y	Y	Y	Y
BV617	Littleton Pill to Severn Bridge	Y	Y	Y	Y
BV618	Plython Lake	Y	Y	Y	Y
BV619	Oldbury Sands North	Y	Y	Y	Y
BV620	Slimeroad Sand	Y	Y	Y	Y
BV621	Pillhouse Rocks to Grange Pill	Y	Y	Y	Y
BV622	Northwick Oaze	Y	Y	Y	Y
BV623	New Passage-Severn Beach	Y	Y	Y	Y
BV624	Chittening Warth North	Y	Y	Y	Y
BV625	Chittening Warth South	Y	Y	Y	Y
BV626	Avonmouth frontage main	Y	Y	Y	Y
BV796	Avonmouth front west end	N	Y	Y	Y
BV627	Avonmouth river	N	Y	Y	Y
BV628	Avon Bridge - north	N	Y	Y	Y
BV629	Portbury Docks	N	Y	Y	Y
BV630	Portbury Wharf	Y	Y	Y	Y
BV631	Battery Point	Y	Y	Y	Y
BV632	Kilkenny Bay	Y	Y	Y	Y
BV633	Black Nore	?	?	?	?
BV634	Pigeon House Bay	?	?	?	?
BV635	Ladye Bay	?	?	?	?
BV636	Salthouse Bay	Y	Y	Y	Y
BV637	Blackstone Rocks and Blind Yeo	Y	Y	Y	Y
BV638	Clevedon-Yeo Fields North - non-tidal	Y	Y	Y	Y
BV639	Clevedon-Yeo North-east	Y	Y	Y	Y
BV640	Clevedon-Yeo North-west	Y	Y	Y	Y
BV641	Clevedon-Yeo South-east	Y	Y	Y	Y
BV642	Clevedon-Yeo South-west	Y	Y	Y	Y
BV643	Clevedon-Yeo Fields South - non-tidal	Y	Y	Y	Y
BV644	Congresbury Yeo	Y	Y	Y	Y
BV797	Woodspring Bay a	Y	Y	Y	Y
BV798	Woodspring Bay b	Y	Y	Y	Y
BV646	Langford Grounds	Y	Y	N	Y
BV647	Flats further offshore from Langford Grounds	Y	Y	Y	Y
BV648	Sand Point North	Y	Y	Y	Y
BV649	Sand Bay NW	Y	Y	Y	Y
BV650	Sand Bay W	Y	Y	Y	Y
BV651	Sand Bay middle	Y	Y	Y	Y
BV652	Sand Bay saltmarsh in NW	Y	Y	Y	Y
BV653	Sand Bay E	Y	Y	Y	Y
BV654	Sand Bay SE	Y	Y	Y	Y
BV655	Sand Bay SW	Y	Y	Y	Y
BV656	Weston Bay outer	N	Y	Y	Y

Section	Approx name/description of section	Nov-02	Dec-02	Jan-03	Feb-03
BV657	Weston Bay inner	N	Y	Y	Y
BV658	Weston Bay south (Axe channel)	N	Y	Y	Y
BV659	Axe Fields	N	Y	Y	Y
BV660	River Axe	N	Y	Y	Y
BV661	Brean Down	Y	Y	Y	Y
BV662	Brean Down to Brean Farm	Y	Y	Y	Y
BV663	Brean Farm to Brean	Y	Y	Y	Y
BV664	Brean to Holiday Camp	Y	Y	Y	Y
BV665	Berrow Flats	Y	Y	Y	Y
BV666	Off Berrow a	Y	Y	Y	Y
BV667	Off Berrow b	N	N	N	Y
BV668	Off Berrow c	Y	Y	Y	Y
BV669	Gore Sand	N	N	Y	Y
BV670	Parrett Mouth North	N	N	Y	Y
BV671	Parrett N channel off Berrow	Y	Y	Y	Y
BV672	Parrett mid-channel north island	N	N	Y	Y
BV673	Parrett off Burnham N	Y	Y	Y	Y
BV674	Parrett off Burnham S	N	N	Y	Y
BV675	Parrett mid-channel south island	N	N	Y	Y
BV676	Brue Pill	N	N	Y	Y
BV677	Parrett off Stert - east side	Y	Y	Y	Y
BV678	Parrett s of Stert	Y	Y	Y	Y
BV679	Fields S of Brue Pill - non-tidal	N	N	N	Y
BV680	Parrett N of Pawlett Hams	Y	Y	Y	Y
BV681	Pawlett Hams - non-tidal	N	Y	Y	N
BV682	Parrett W of Pawlett Hams	N	Y	Y	Y
BV683	Parrett SW of Pawlett Hams	N	Y	Y	Y
BV684	Parrett SE of Pawlett Hams	Y	Y	Y	N
BV685	Stert Point - non-tidal	Y	Y	Y	Y
BV686	Stert Point N past Stert Islands	N	N	Y	Y
BV799	Stert Point N from offshore	N	N	Y	Y
BV687	Stert Flats SE	Y	Y	Y	Y
BV688	Stert Flats E	Y	Y	N	Y
BV689	Stert Flats NE	N	N	Y	Y
BV690	Parrett Mouth South	Y	Y	N	Y
BV691	Stert Flats NW	Y	Y	Y	Y
BV692	Stert Flats W	Y	Y	Y	Y
BV693	Stert Flats SW	Y	Y	Y	Y
BV694	Wall Common etc - non-tidal	Y	Y	Y	Y
BV695	Wick Moor - non-tidal	Y	Y	Y	Y
BV696	Submarine Forest	Y	Y	Y	Y
BV697	Hinkley Point to west	Y	Y	Y	Y
BV698	Steep Holm	N	N	Y	Y
BV699	Flat Holm	N	N	Y	Y
BV700	Mudflats off Penarth	Y	Y	Y	Y
BV701	Ranny Bay	Y	Y	Y	Y
BV702	Lower Penarth	Y	Y	Y	Y
BV703	Penarth Head	Y	Y	Y	Y
BV704	Cardiff Bay	Y	Y	Y	Y
BV705	Cardiff Barrage - dredge area	Y	Y	Y	N
BV706	Cardiff Barrage - north of Penarth Head	Y	Y	Y	N
BV707	Cardiff Barrage	Y	Y	Y	N
BV708	Orchard Ledges South	Y	Y	Y	Y
BV709	Orchard Ledges North	Y	Y	Y	Y
BV710	Rhymney a	Y	Y	Y	Y
BV711	Rhymney b	Y	Y	Y	Y
BV712	Rhymney c	Y	Y	Y	Y
BV713	Rhymney d	Y	Y	Y	Y
BV714	Rhymney e	Y	Y	Y	Y

Section	Approx name/description of section	Nov-02	Dec-02	Jan-03	Feb-03
BV715	Rhymney f	Y	Y	Y	Y
BV716	Rhymney g	Y	Y	Y	Y
BV717	Rhymney h	Y	Y	Y	Y
BV718	Rhymney I	Y	Y	Y	Y
BV719	Rhymney j	Y	Y	Y	Y
BV720	Rhymney k	Y	Y	Y	Y
BV721	Rhymney l	Y	Y	Y	Y
BV722	Rhymney n	Y	Y	Y	Y
BV723	Rhymney o	Y	Y	Y	Y
BV724	Rhymney p	Y	Y	Y	Y
BV725	Rhymney q	Y	Y	Y	Y
BV726	Rhymney - Orchard Ledges corner	Y	Y	N	Y
BV727	Rhymney – saltmarsh	N	N	N	Y
BV728	Rhymney river channel	N	N	N	N
BV729	Rumney Great Wharf W	Y	Y	Y	Y
BV730	Rumney Great Wharf E	Y	Y	Y	Y
BV731	Peterstone Great Wharf W	Y	Y	Y	Y
BV732	Peterstone Great Wharf E	Y	Y	Y	Y
BV733	Peterstone Gout upper shore	Y	Y	Y	Y
BV734	Peterstone Gout lower shore	Y	Y	Y	Y
BV735	St Brides upper shore	Y	Y	Y	Y
BV736	St Brides lower shore	Y	Y	Y	Y
BV737	Usk Mouth West	Y	Y	Y	Y
BV738	Usk Mouth West - non-tidal	Y	Y	Y	Y
BV739	Mouth of Eddw River	Y	Y	Y	Y
BV740	Usk - Bridge Watermans Reach	Y	Y	Y	Y
BV741	Usk Mouth East	Y	Y	Y	Y
BV742	Goldcliff Flats	Y	Y	Y	Y
BV743	Goldcliff Reserve – Uskmouth	Y	N	Y	Y
BV744	Goldcliff Reserve – Saltmarsh	Y	Y	Y	Y
BV745	Goldcliff Reserve – Goldcliff	Y	Y	Y	Y
BV747	Usk Patch – offshore	N	N	N	N
BV748	Patch – offshore	N	N	N	N
BV749	Middle Grounds combined	N	N	Y	Y
BV753	Goldcliff - Sudbrook Flats a	Y	Y	Y	Y
BV754	Goldcliff - Sudbrook Flats b	Y	Y	Y	Y
BV755	Goldcliff - Sudbrook Flats c	N	N	Y	Y
BV756	Goldcliff - Sudbrook Flats d	Y	Y	Y	Y
BV757	Goldcliff - Sudbrook Flats e	Y	Y	Y	Y
BV758	Goldcliff - Sudbrook Flats f	Y	Y	Y	Y
BV759	Goldcliff - Sudbrook Flats g	N	N	Y	Y
BV760	Goldcliff - Sudbrook Flats h	N	N	N	Y
BV761	Goldcliff - Sudbrook Flats I	Y	Y	Y	Y
BV762	Goldcliff - Sudbrook Flats j	Y	Y	Y	Y
BV763	Goldcliff - Sudbrook Flats k	Y	Y	Y	Y
BV764	Goldcliff - Sudbrook Flats l	N	N	N	N
BV765	Goldcliff - Sudbrook Flats m	N	N	N	Y
BV766	Goldcliff - Sudbrook Flats n	Y	Y	Y	Y
BV767	Goldcliff - Sudbrook Flats o	Y	Y	Y	Y
BV768	Goldcliff - Sudbrook Flats p	N	N	N	N
BV769	Goldcliff - Sudbrook Flats q	N	N	N	Y
BV770	Goldcliff - Sudbrook Flats r	Y	Y	Y	Y
BV771	Goldcliff - Sudbrook Flats s	Y	Y	Y	Y
BV772	Goldcliff - Sudbrook Flats t	N	N	N	Y
BV773	Goldcliff - Sudbrook Flats u	Y	Y	Y	Y
BV774	Goldcliff - Sudbrook Flats v	Y	Y	Y	Y
BV775	Goldcliff - Sudbrook Flats w	N	N	Y	N
BV776	Goldcliff - Sudbrook Flats x	N	N	Y	Y
BV777	Goldcliff - Sudbrook Flats y	N	N	Y	Y

Section	Approx name/description of section	Nov-02	Dec-02	Jan-03	Feb-03
BV778	Goldcliff - Sudbrook Flats z	Y	Y	Y	Y
BV779	Goldcliff - Sudbrook Flats aa	Y	Y	Y	Y
BV780	Goldcliff - Sudbrook Flats ab	N	N	N	N
BV781	Goldcliff - Sudbrook Flats ac	N	N	Y	Y
BV782	Goldcliff - Sudbrook Flats ad	Y	Y	Y	Y
BV783	Goldcliff - Sudbrook Flats ae	Y	Y	Y	Y
BV784	Goldcliff - Sudbrook Flats af	N	N	Y	Y
BV785	Gruggy (offshore rocks)	Y	Y	Y	Y
BV786	Sudbrook to Black Rock including Lady Bench	Y	Y	Y	Y
BV787	Black Rock to Mathern Oaze including Charston Sands	Y	Y	Y	Y
BV788	Central flats	Y	Y	Y	Y
BV789	Mathern Oaze to Mathern Pill	Y	Y	Y	Y
BV790	Off Caldicot Level	Y	Y	Y	Y
BV791	Wye Mouth	Y	Y	Y	Y
BV792	Chapel and Dod Rocks	N	N	N	N
BV793	English Stones (off Severn Beach)	N	Y	Y	Y
BV794	By Cardiff Heliport	N	Y	N	Y
BV795	River Avon B-C	Y	Y	Y	Y

Table 2.2.1 Coverage of count sections during the 2002/03 WeBS Low Tide Counts of the Severn Estuary.

A “Y” indicates that a count was made and “N” that no count was made. Counts from three sections had still to be received at the time of writing the report and are indicated by a “?”.

Species	November	December	January	February	MAX
Little Grebe	18	5	4	3	18
Great Crested Grebe	5	5	1	2	5
Cormorant	27	34	64	61	64
Bittern	0	0	1	0	1
Little Egret	23	21	17	31	31
Grey Heron	103	86	59	60	103
Mute Swan	15	26	59	47	59
Bewick's Swan	0	12	26	71	71
Whooper Swan	1	4	1	1	4
European White-fronted Goose	0	0	990	0	990
Greylag Goose	0	5	0	11	11
Canada Goose	140	146	44	9	146
Dark-bellied Brent Goose	11	2	1	0	11
Shelduck	2924	2187	1988	3493	3493
Wigeon	2851	3331	3134	2995	3331
Chiloe Wigeon	0	0	0	1	1
Gadwall	10	60	45	85	85
Teal	1624	1447	1492	1345	1624
Mallard	1787	1408	1638	1121	1787
Pintail	209	478	211	309	478
Shoveler	368	351	247	207	368
Pochard	28	0	16	18	28
Tufted Duck	17	10	33	71	71
Scaup	0	0	0	4	4
Common Scoter	15	10	0	2	15
Goldeneye	10	0	3	1	10
Goosander	2	0	3	2	3
Water Rail	2	0	0	5	5
Moorhen	6	2	6	14	14
Coot	78	92	116	173	173
Oystercatcher	702	819	727	829	829
Avocet	15	12	13	14	15
Ringed Plover	6	37	33	84	84
Golden Plover	1215	377	349	146	1215
Grey Plover	170	289	555	208	555
Lapwing	3953	12129	6048	4367	12129
Knot	852	1079	1703	1389	1703
Sanderling	0	109	126	127	127
Purple Sandpiper	0	4	2	0	4
Dunlin	25442	23216	31264	41120	41120
Jack Snipe	0	2	3	3	3
Snipe	93	69	46	68	93
Black-tailed Godwit	33	4	26	42	42
Bar-tailed Godwit	59	18	1	12	59
Curlew	3610	2745	3478	3538	3610
Spotted Redshank	4	1	0	6	6
Redshank	1140	1394	1095	2439	2439
Greenshank	0	1	0	0	1
Green Sandpiper	0	0	1	0	1
Common Sandpiper	1	1	1	4	4
Turnstone	178	274	182	196	274
Mediterranean Gull	0	0	2	0	2
Black-headed Gull	5149	4709	8267	9196	9196
Common Gull	744	250	645	465	744
Lesser Black-backed Gull	330	838	2403	551	2403
Herring Gull	948	2116	2974	2314	2974
Yellow-legged Gull	0	2	4	0	4
Great Black-backed Gull	195	88	207	63	207

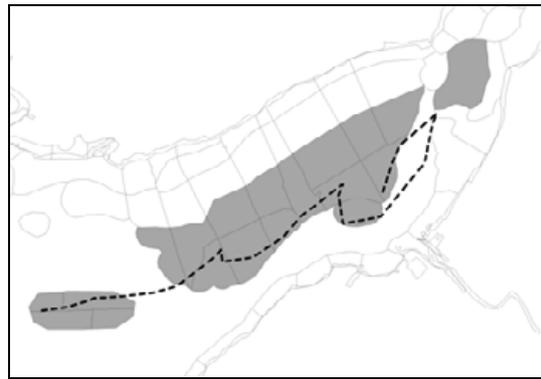
Table 3.1 Monthly totals of waterbirds recorded by WeBS Low Tide Counts of the Severn Estuary in 2002/03.

	Description of change	Date
Past developments		
Penarth	Construction of a new river walk	
Cardiff Bay	Impoundment and inundation of the Bay's intertidal habitat following the completion of the Cardiff Bay Barrage	Completed 1999
Cardiff Bay Barrage	Bi-annual dredging of the channel from the barrage's outer harbour	
Cardiff Heliport	Warehouse developments	2001-2002
Tremorfa	Development of a new Waste Water Treatment Works and a new offshore outfall to replace old discharges	New outfall opened 2001 Improved treatment 2002
Rhymney Great Wharf / Peterstone	Sea defence improvements	
Rhymney Great Wharf / Peterstone	Loss of saltmarsh	
Mouth of River Ebbw	Improved access	
Newport	Work to the jetty at the dock's entrance	
Uskmouth	Work on the Uskmouth Powerstation	
Uskmouth	New pipeline at the Monsanto works (Solutia)	
Uskmouth / Goldcliff	New Gwent Levels Wetlands Reserve created as compensation for the loss of Cardiff Bay	Completed 2000
Caldicot / New Passage	Construction of the Second Severn Crossing for the M4	Opened 1996
Sudbrook	Construction of a new cycle way between Sudbrook and the Second Severn Crossing	
Avonmouth/Severnside	Greenfield development	Ongoing
Woodspring bay	Sea defence improvements	
Axe Estuary	Managed realignment of coastline	Ongoing
Proposed developments		
Orchard Ledges	East Bay link road	
Lydney Docks	Regeneration of docks and possible establishment of 40-80 berth marina	
Oldbury	Decommissioning of Oldbury nuclear power station	
Beachley	Mooring of Severn Princess	
Portishead Ashlands	Proposed housing	
Brue Estuary	Proposed housing & marina	
River Parrett	Sluice	
Bridgwater Bay	Managed realignment	
Hinkley	Decommissioning of Hinkley "A" nuclear power station	
Other factors		
Various sites	Wildfowling	
Brean, Weston-super-Mare & Sand Bay	Beach cleaning	
Sand Bay	Increased saltmarsh development	
Piling & Caldicot	MOD and private firing ranges	

Table 5.1 Changes to the Severn Estuary and other factors that may affect waterbird numbers and distributions. Note that, in addition to Cardiff, improvements to waste water treatment have occurred or are currently being implemented at Gloucester, Avonmouth, Magor Pill, Aust and Thornbury, Portishead, Clevedon, Weston-super-Mare, Burnham-on-Sea and Bridgwater.



Visit 1 (i) Lower-Severn (31/01/03)



Visit 1 (ii) Mid-Severn (01/02/03)



Visit 2 (i) Lower-Severn (17/02/03)



Visit 2 (ii) Mid-Severn (18/02/03)

Figure 2.1.1 Routes taken during boat surveys of the Severn Estuary at low tide during January & February 2003 (as recorded by GPS).

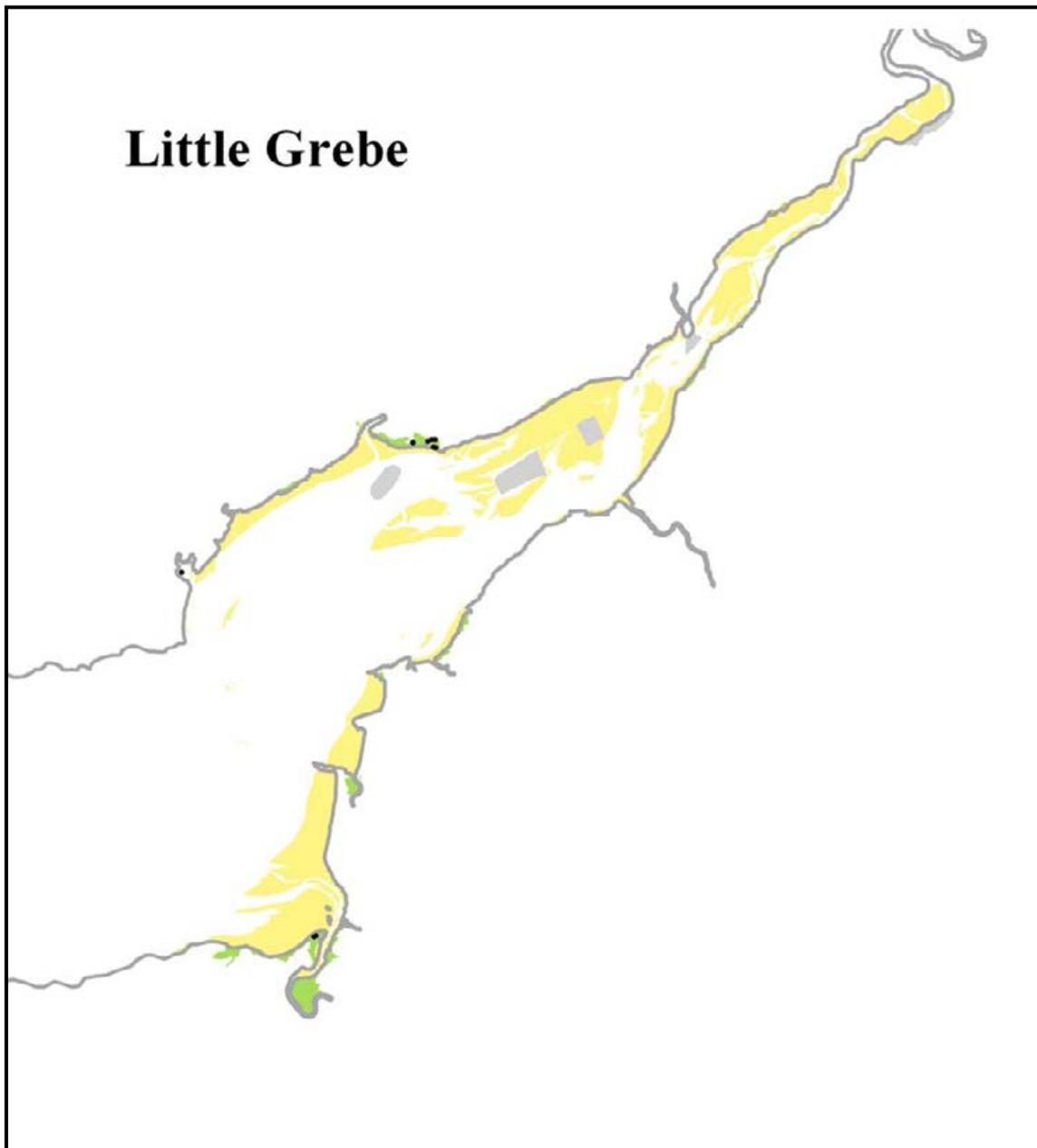


Figure 3.1.1 The mean numbers and distribution of Little Grebe on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

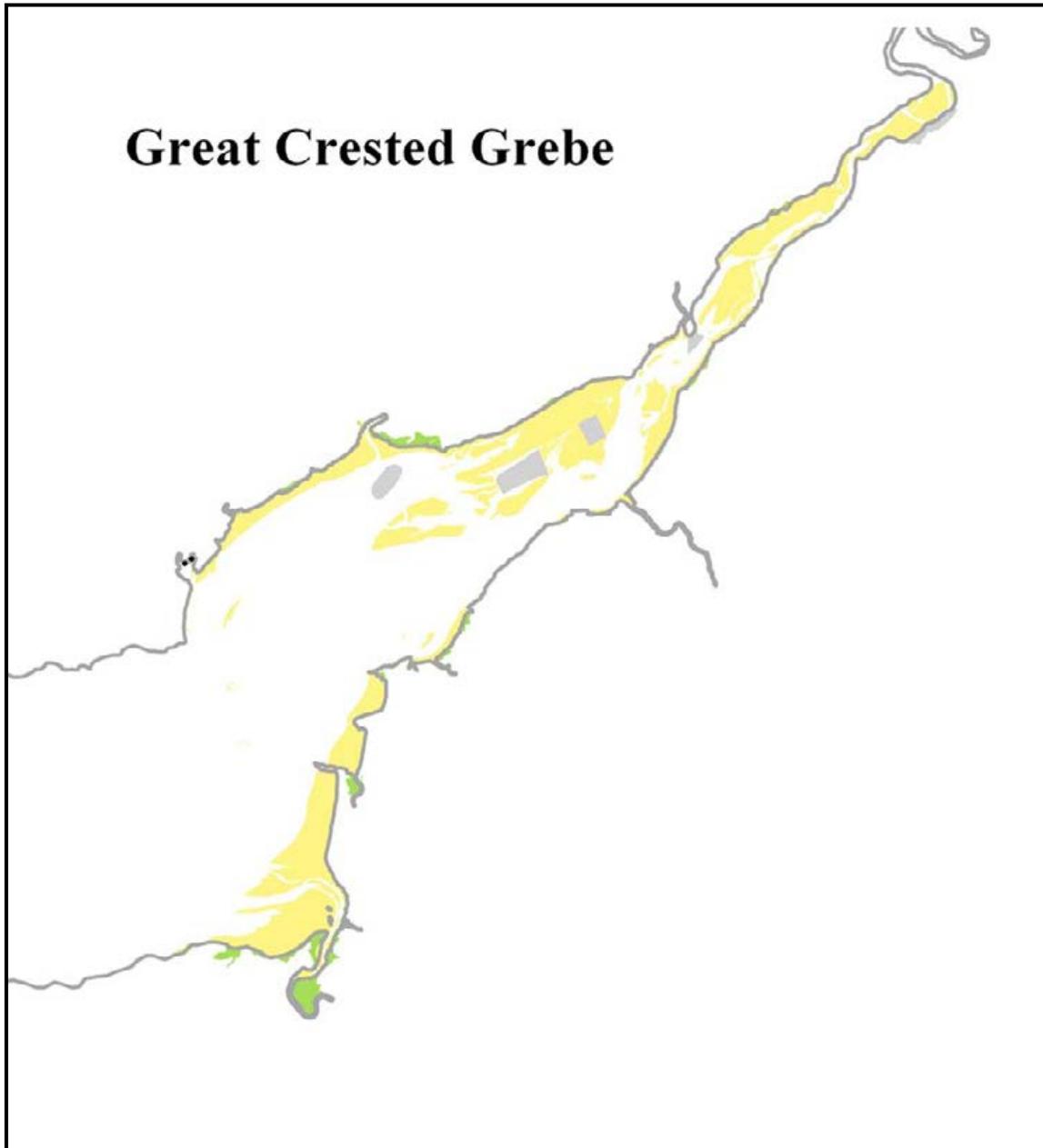


Figure 3.2.1 The mean numbers and distribution of Great Crested Grebe on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

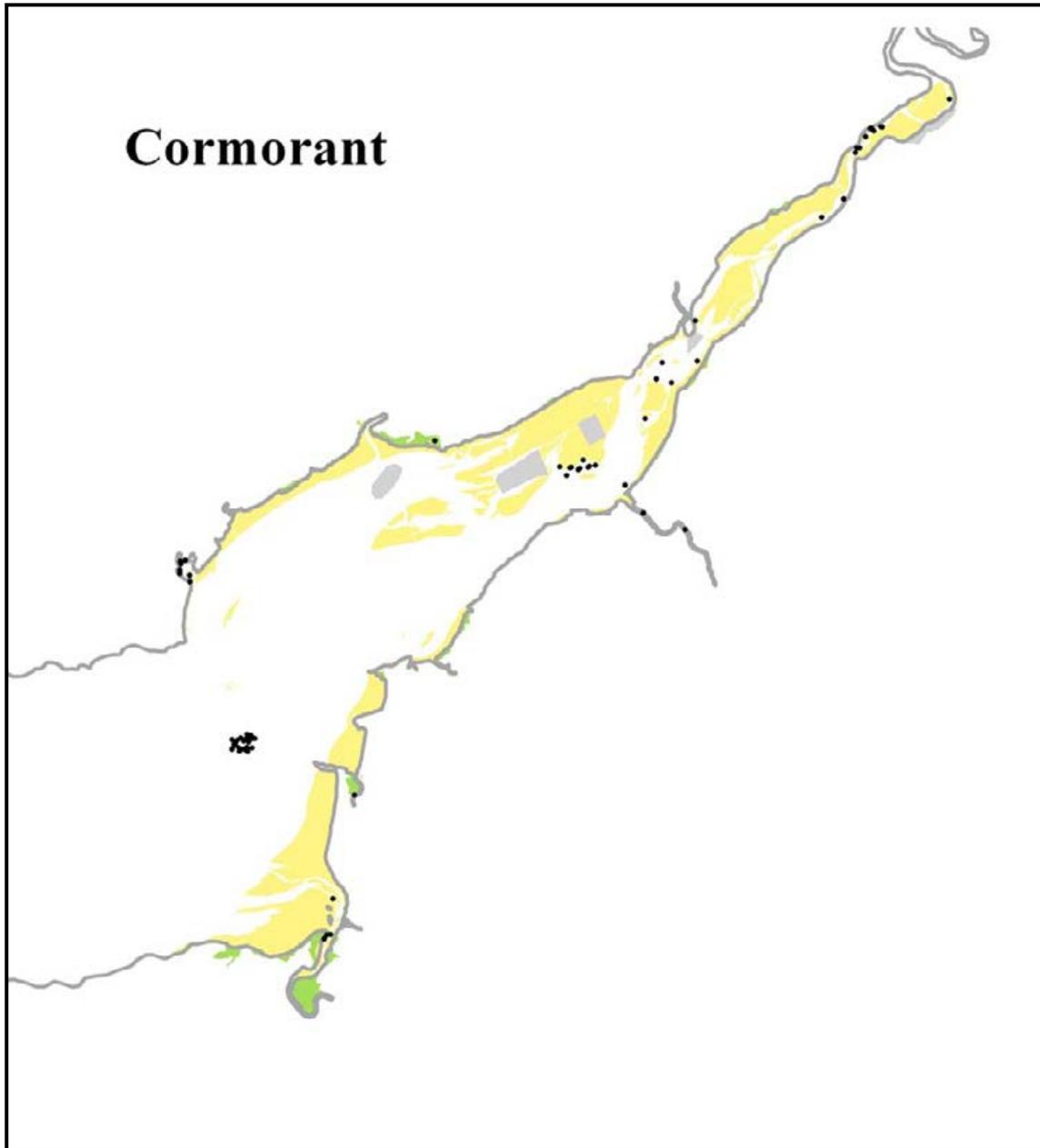


Figure 3.3.1 The mean numbers and distribution of Cormorant on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

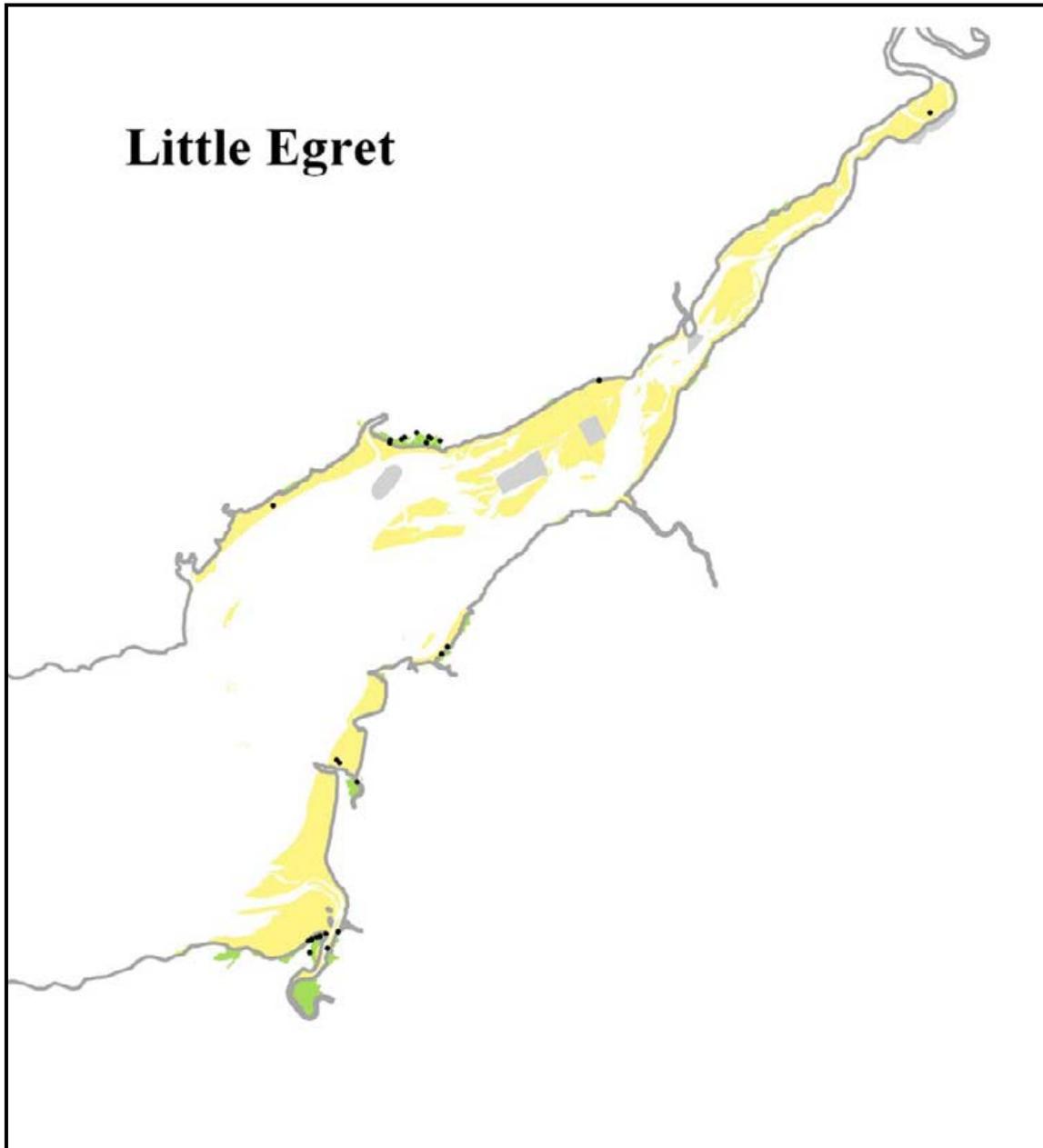


Figure 3.5.1 The mean numbers and distribution of Little Egret on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

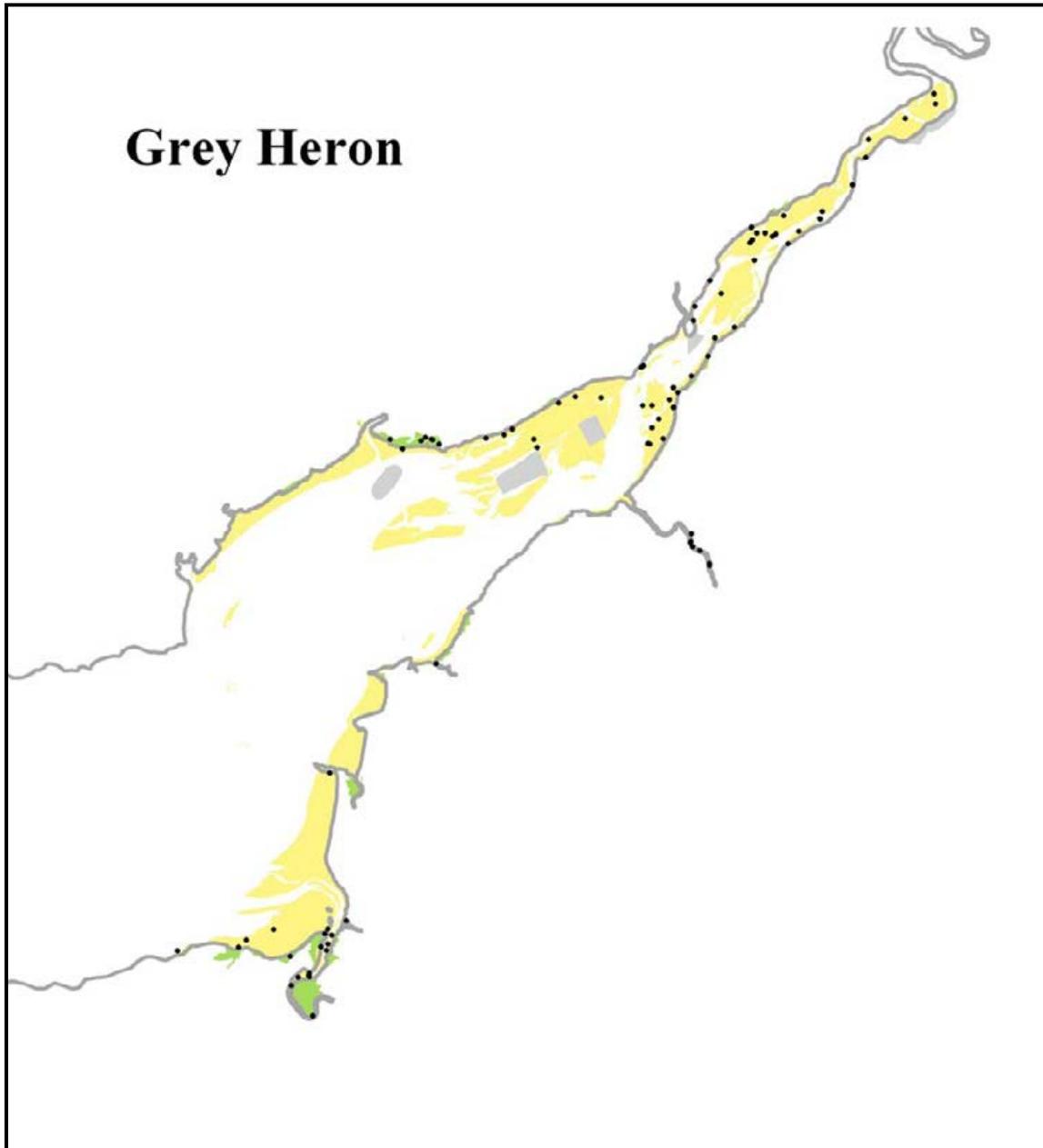


Figure 3.6.1 The mean numbers and distribution of Grey Heron on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

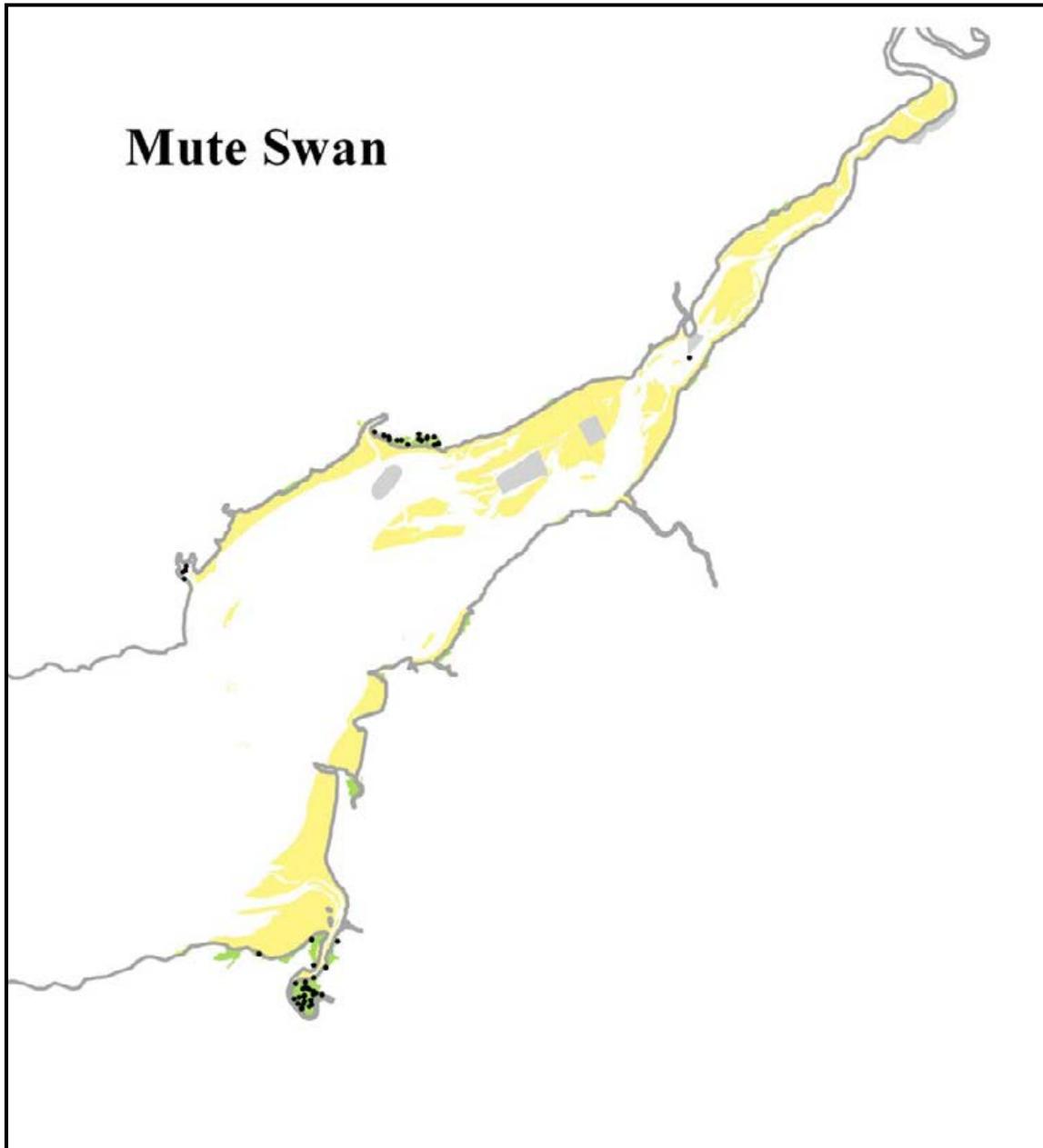


Figure 3.7.1 The mean numbers and distribution of Mute Swan on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

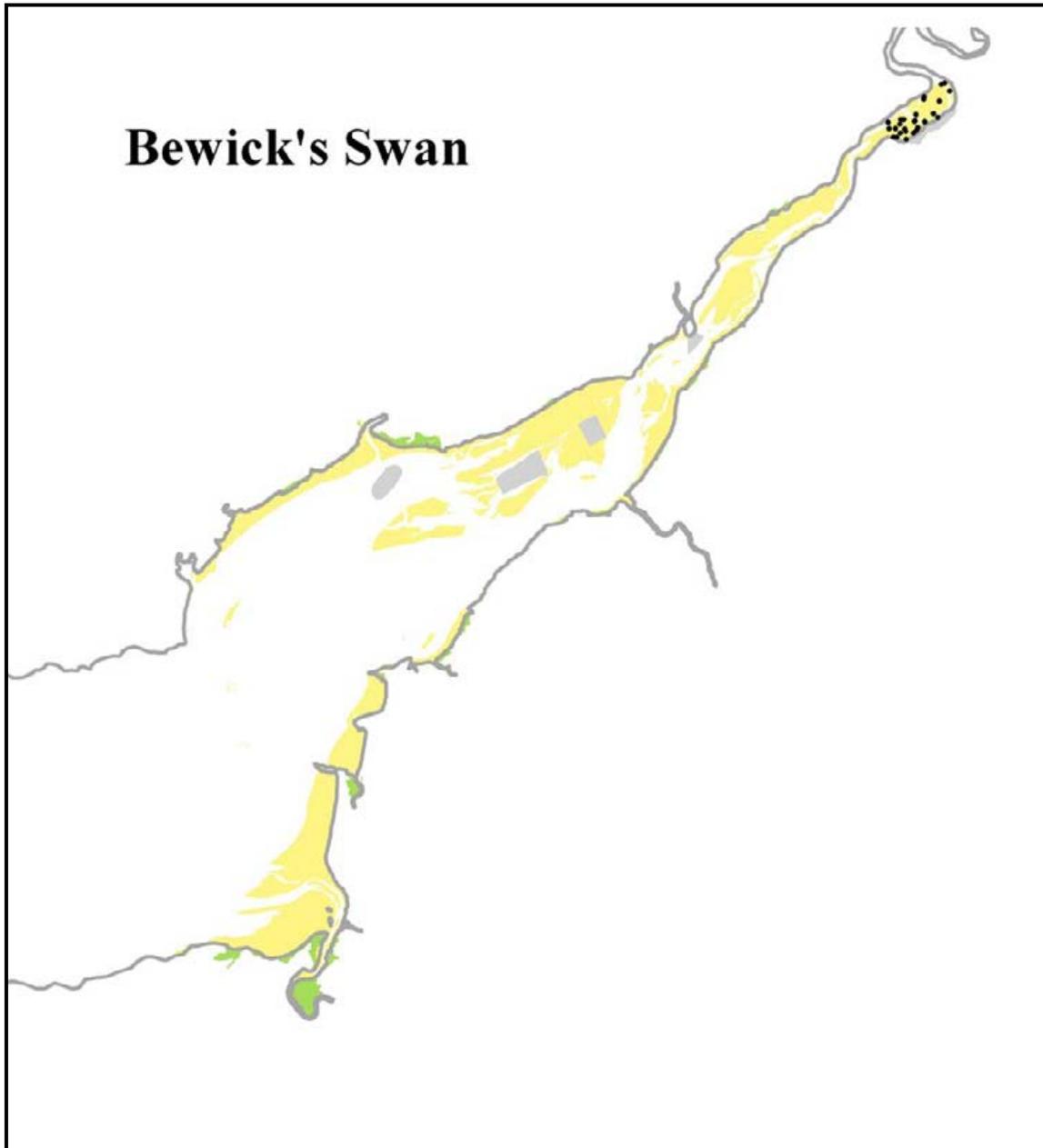


Figure 3.8.1 The mean numbers and distribution of Bewick's Swan on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

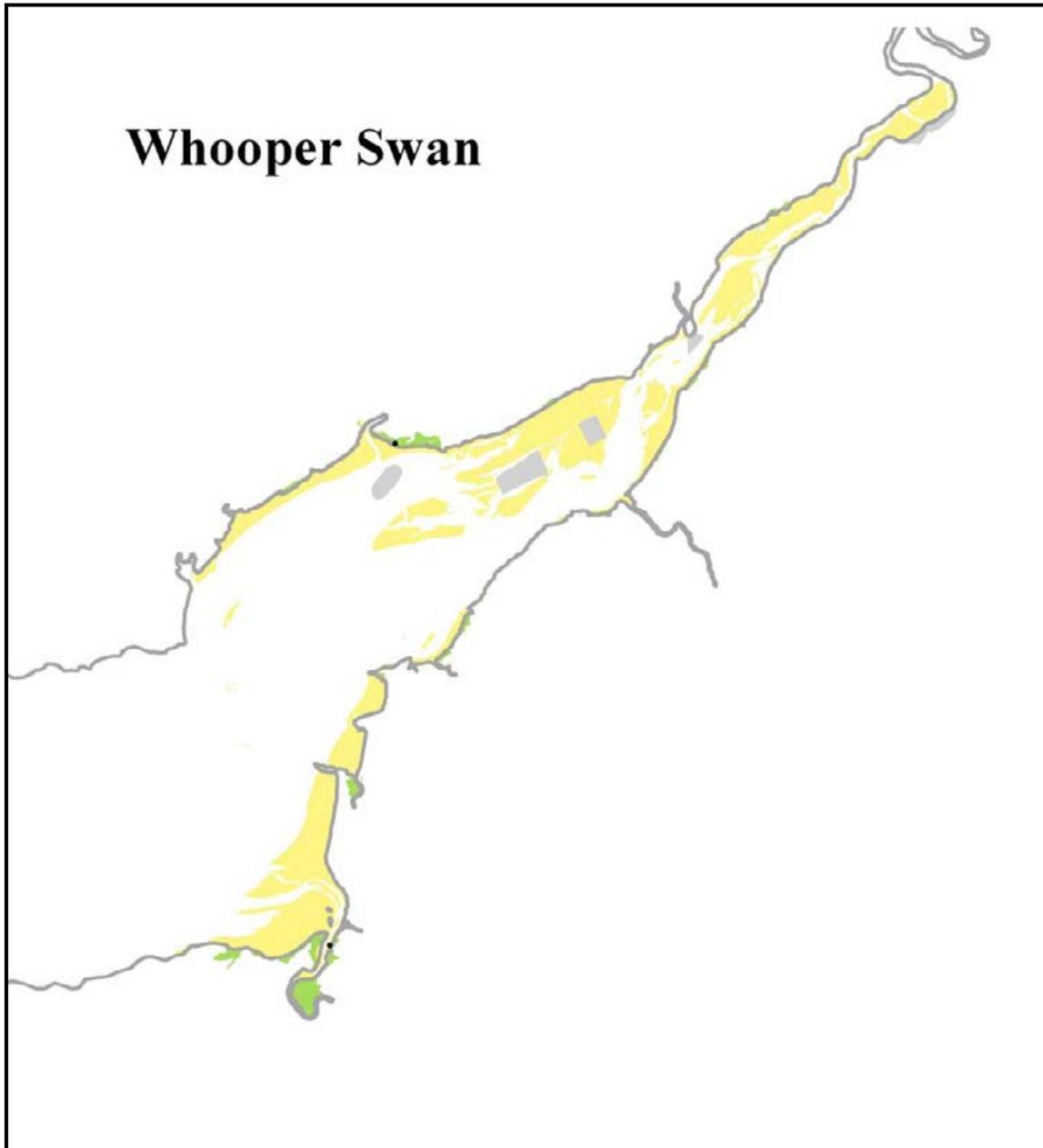


Figure 3.9.1 The mean numbers and distribution of Whooper Swan on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

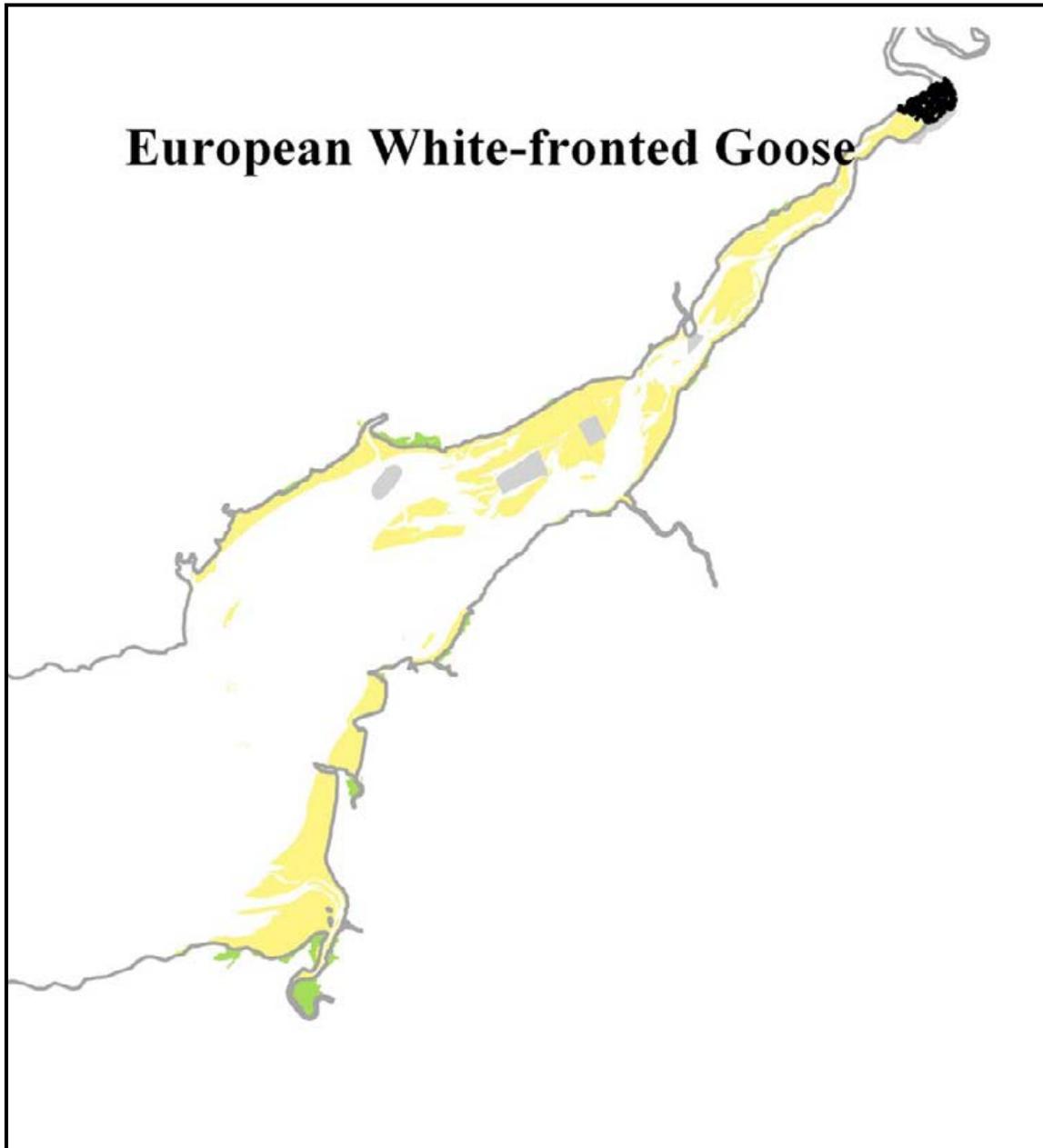


Figure 3.10.1 The mean numbers and distribution of European White-fronted Goose on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

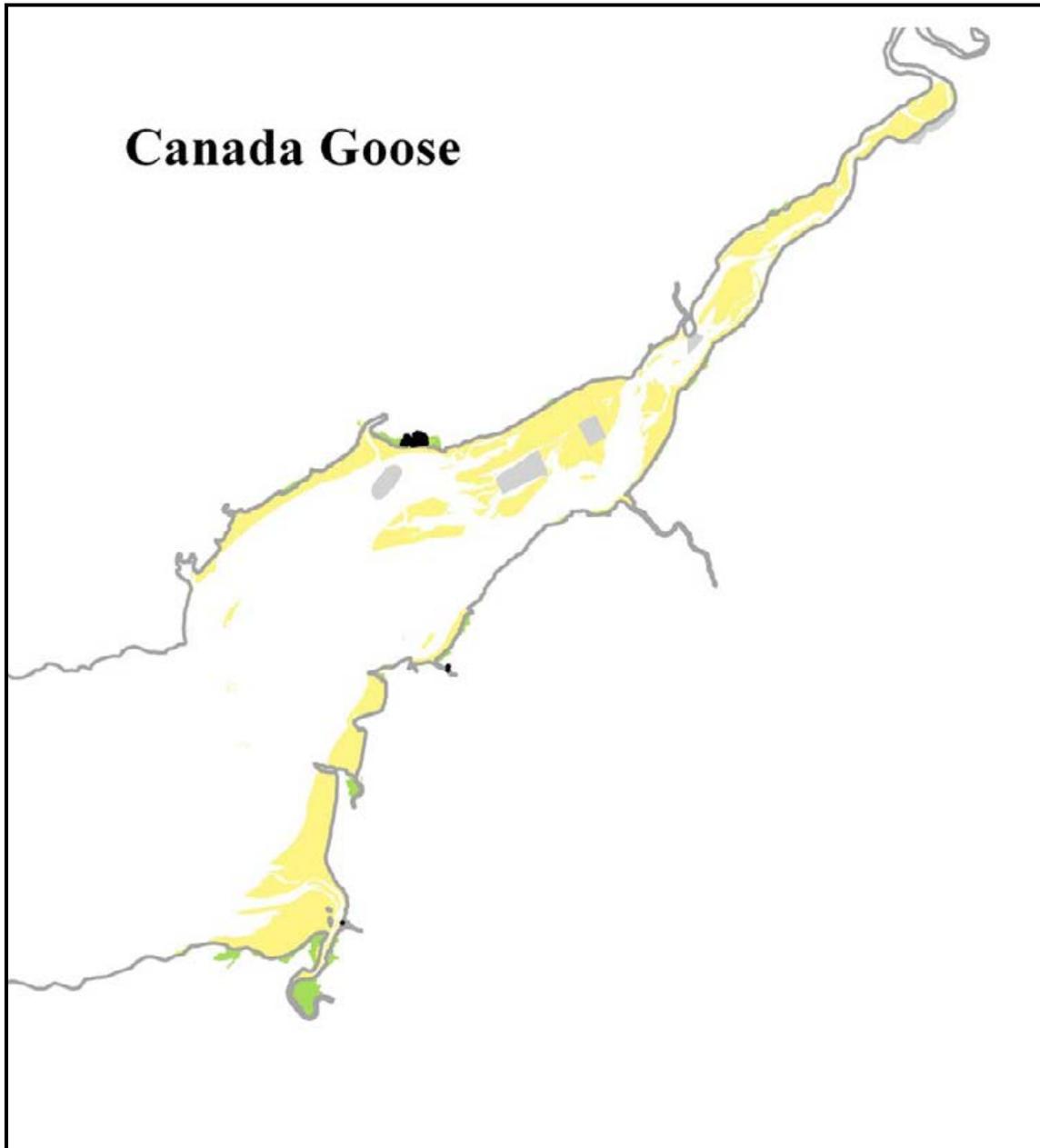


Figure 3.12.1 The mean numbers and distribution of Canada Goose on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

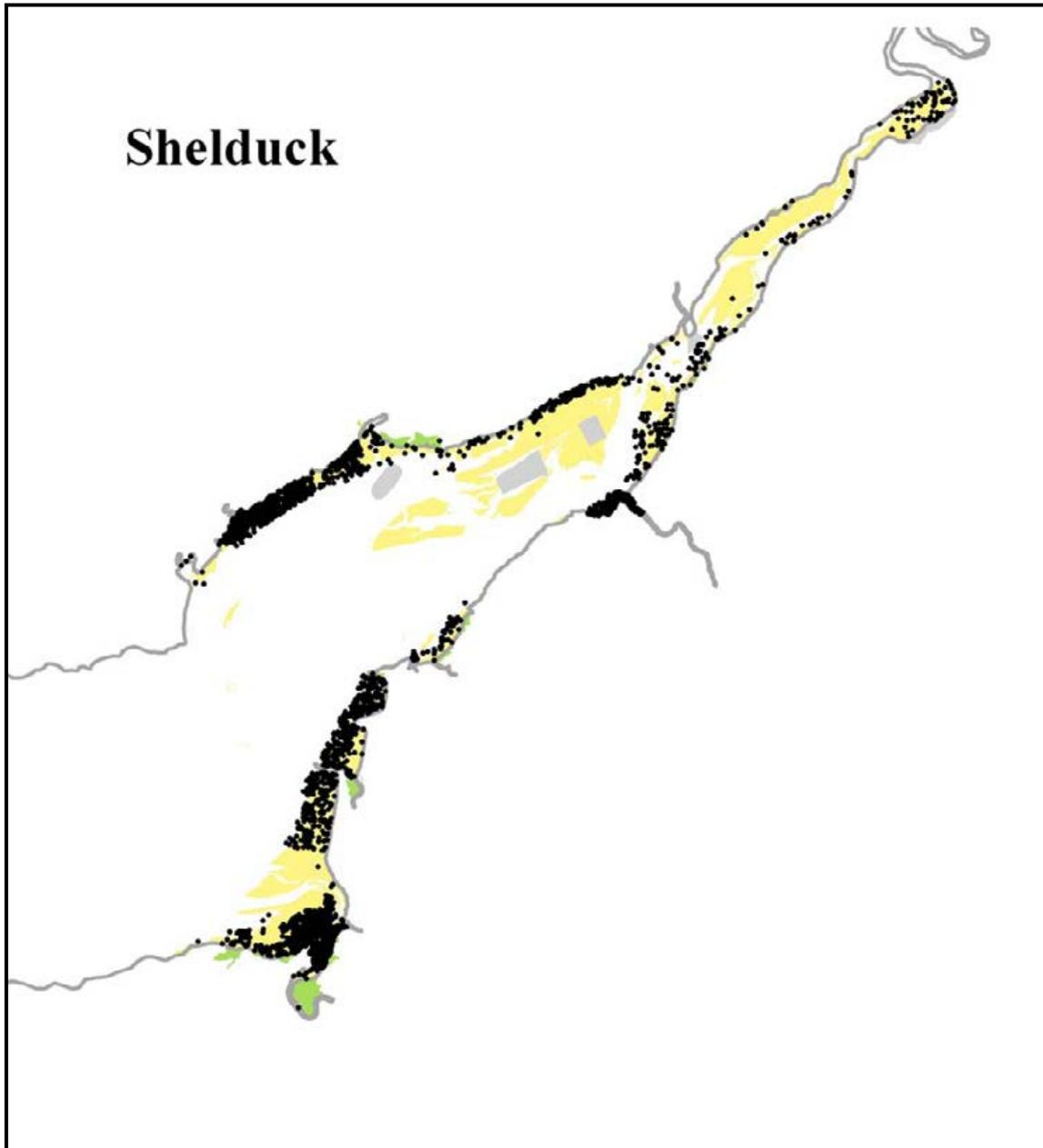


Figure 3.14.1 The mean numbers and distribution of Shelduck on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

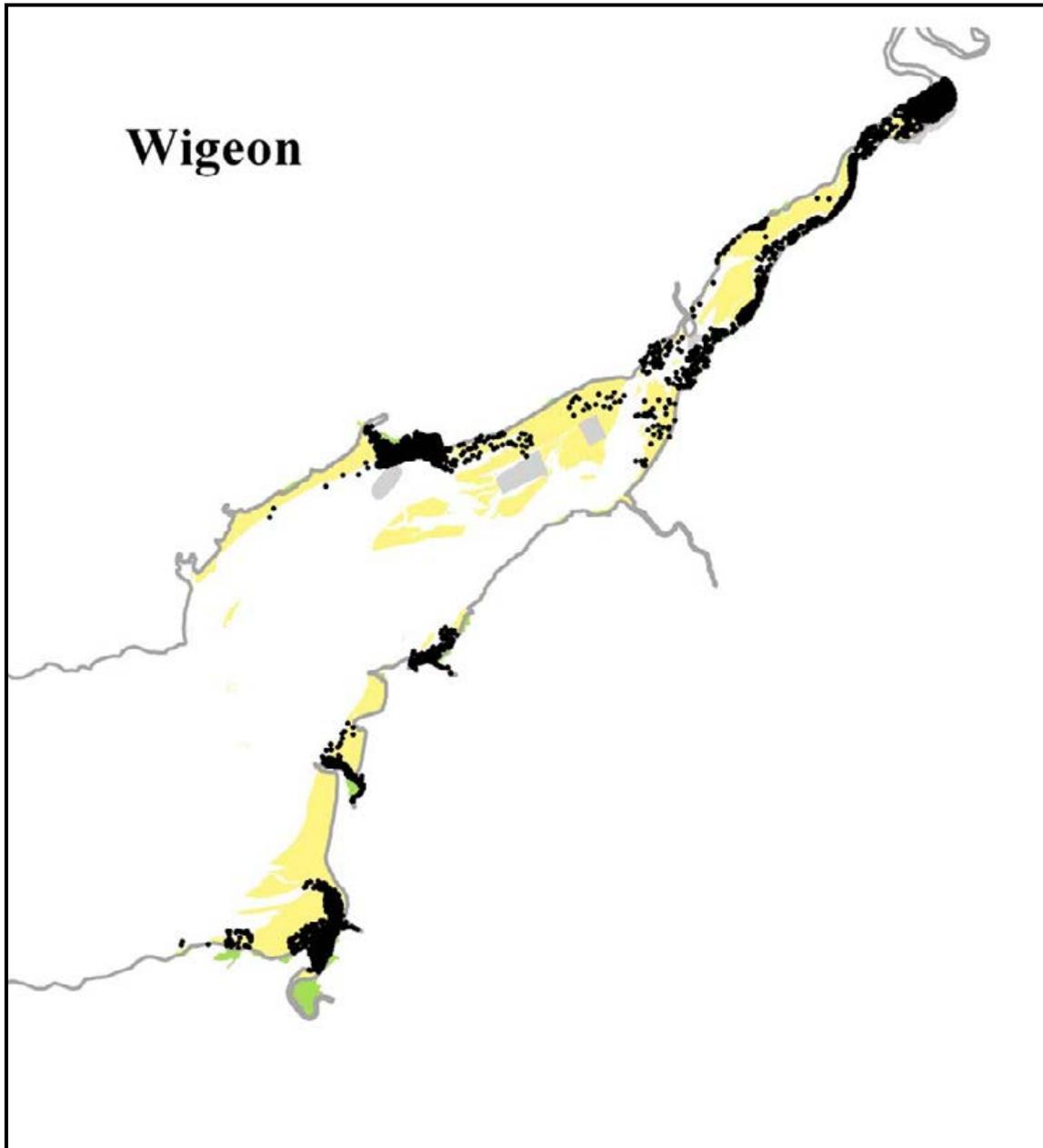


Figure 3.15.1 The mean numbers and distribution of Wigeon on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

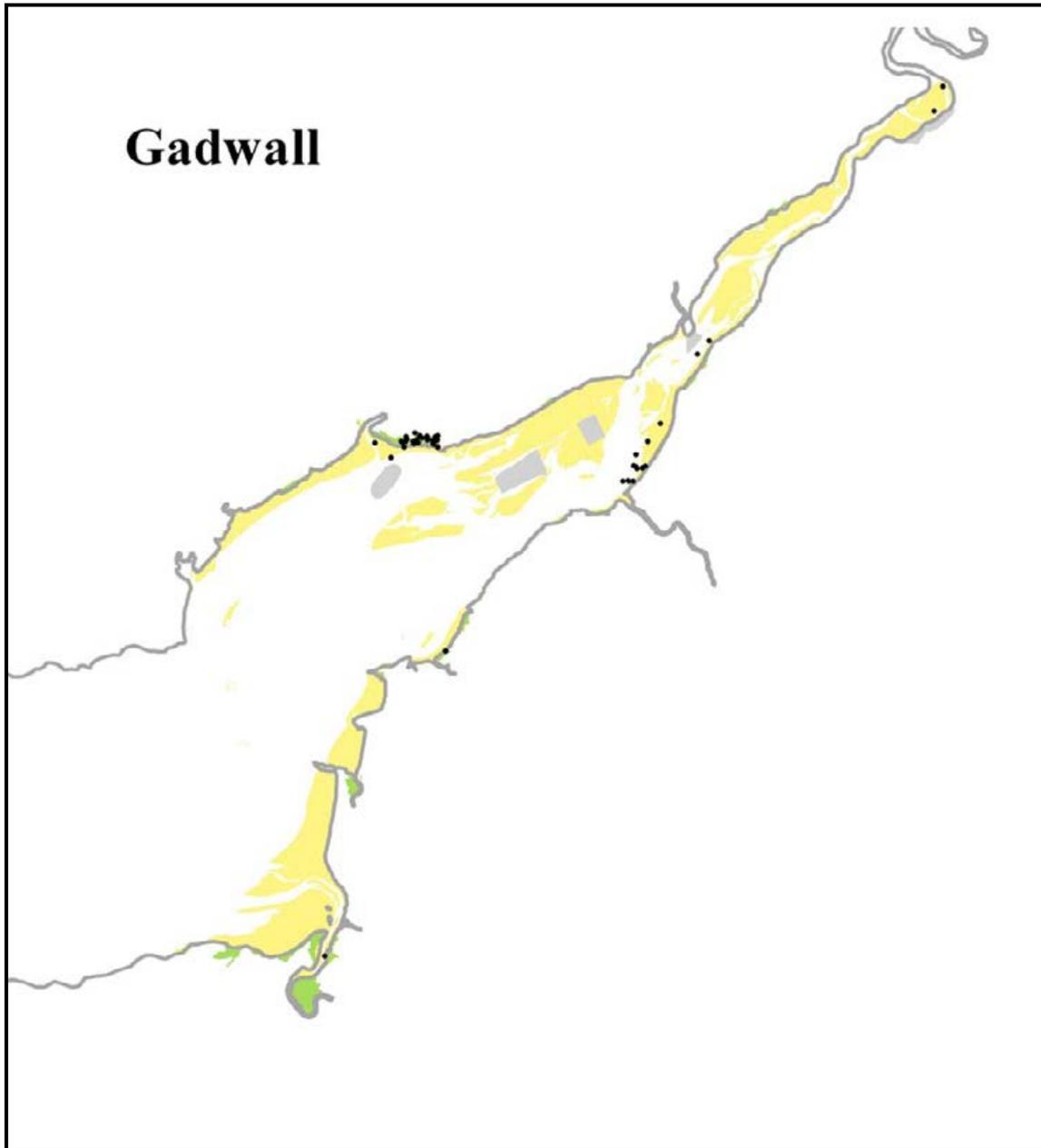


Figure 3.17.1 The mean numbers and distribution of Gadwall on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

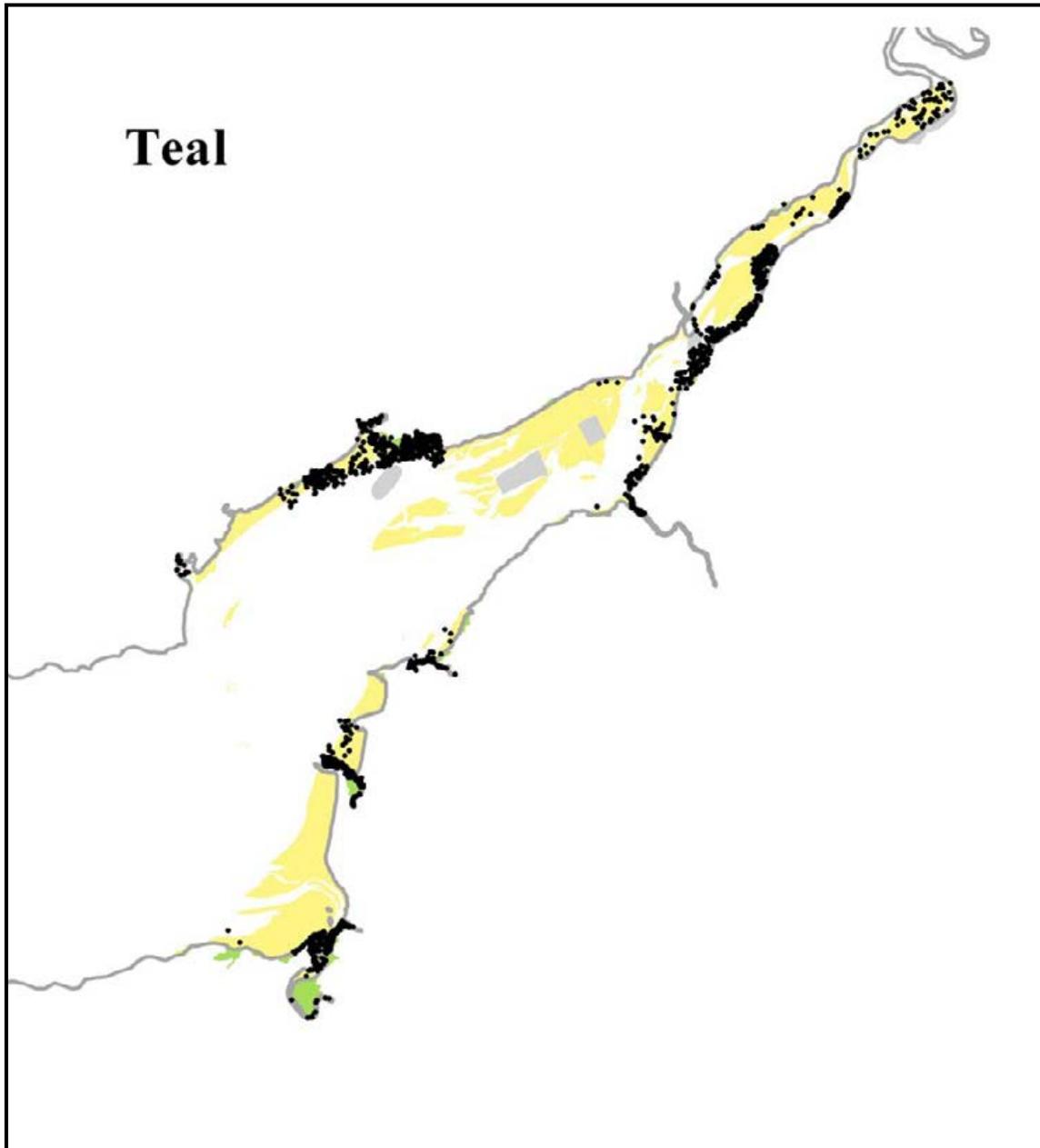


Figure 3.18.1 The mean numbers and distribution of Teal on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

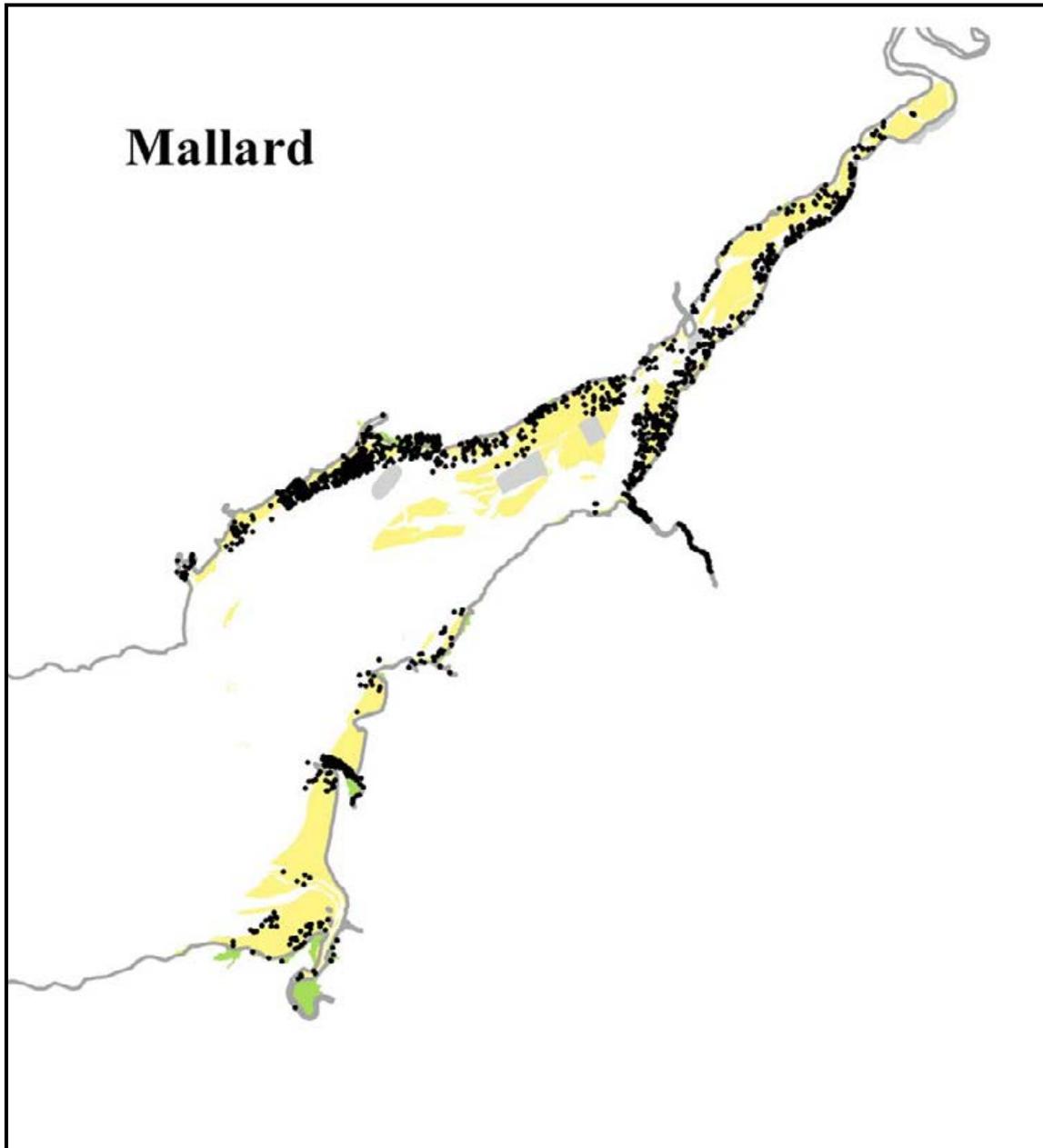


Figure 3.19.1 The mean numbers and distribution of Mallard on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

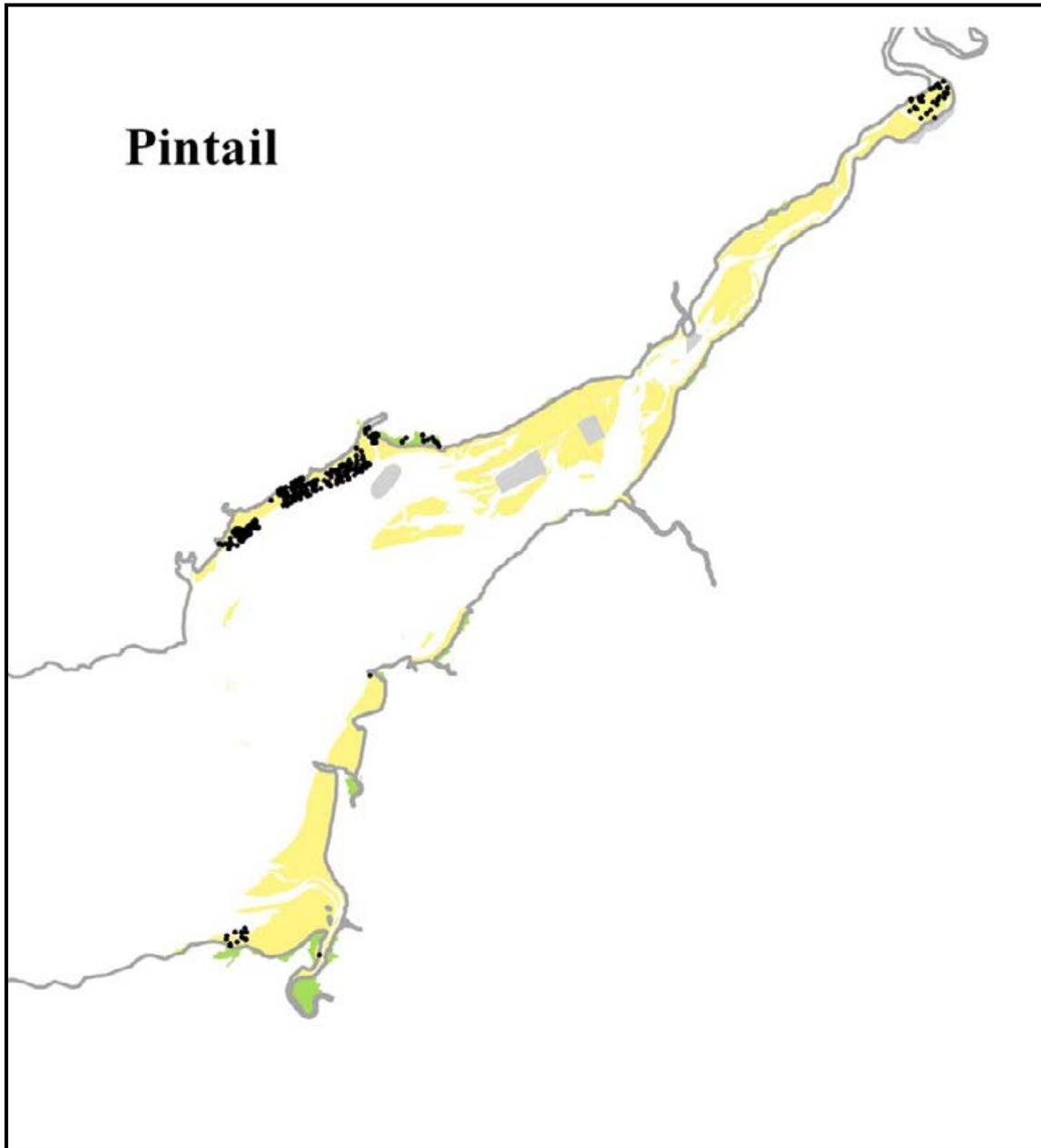


Figure 3.20.1 The mean numbers and distribution of Pintail on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

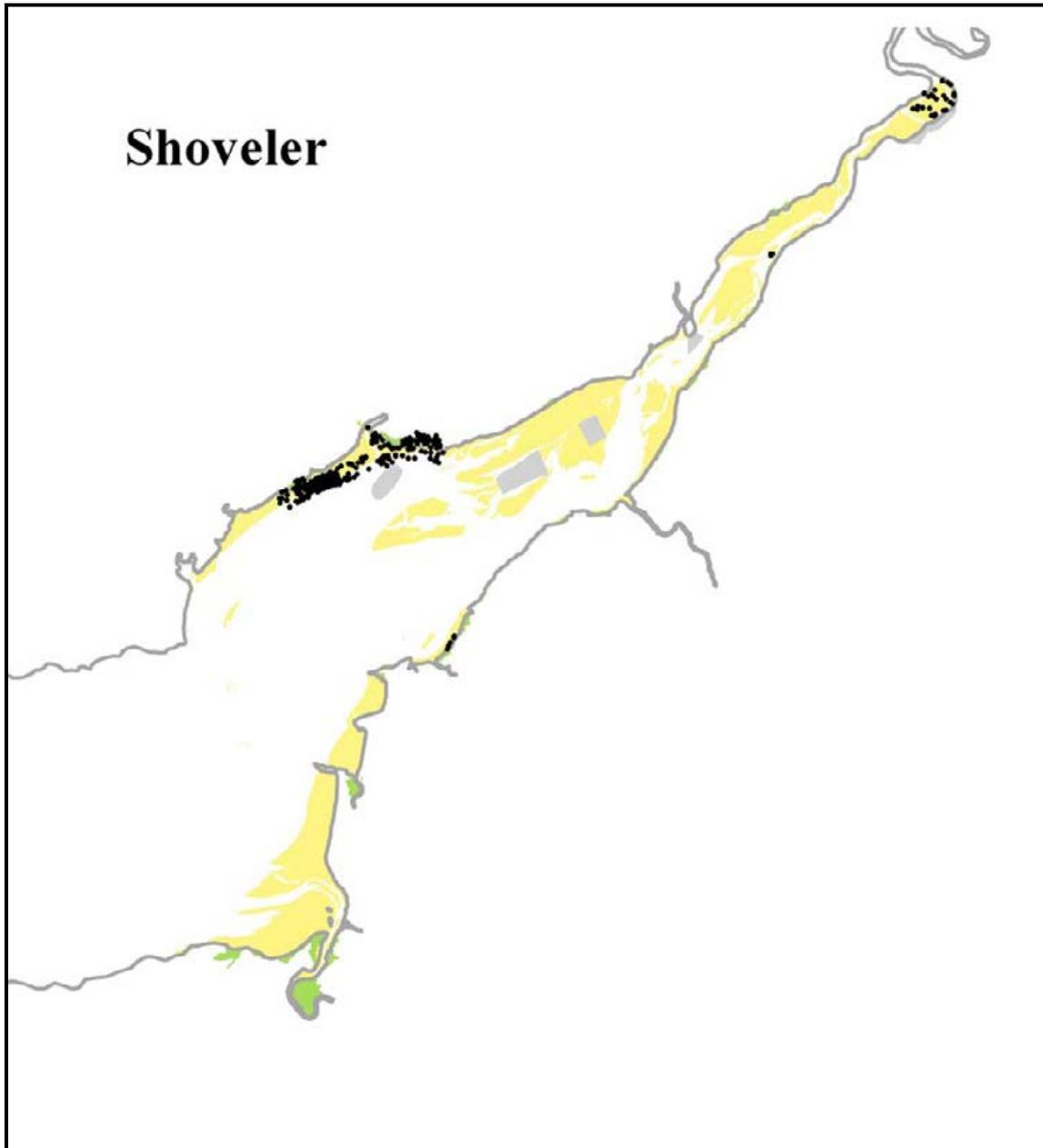


Figure 3.21.1 The mean numbers and distribution of Shoveler on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

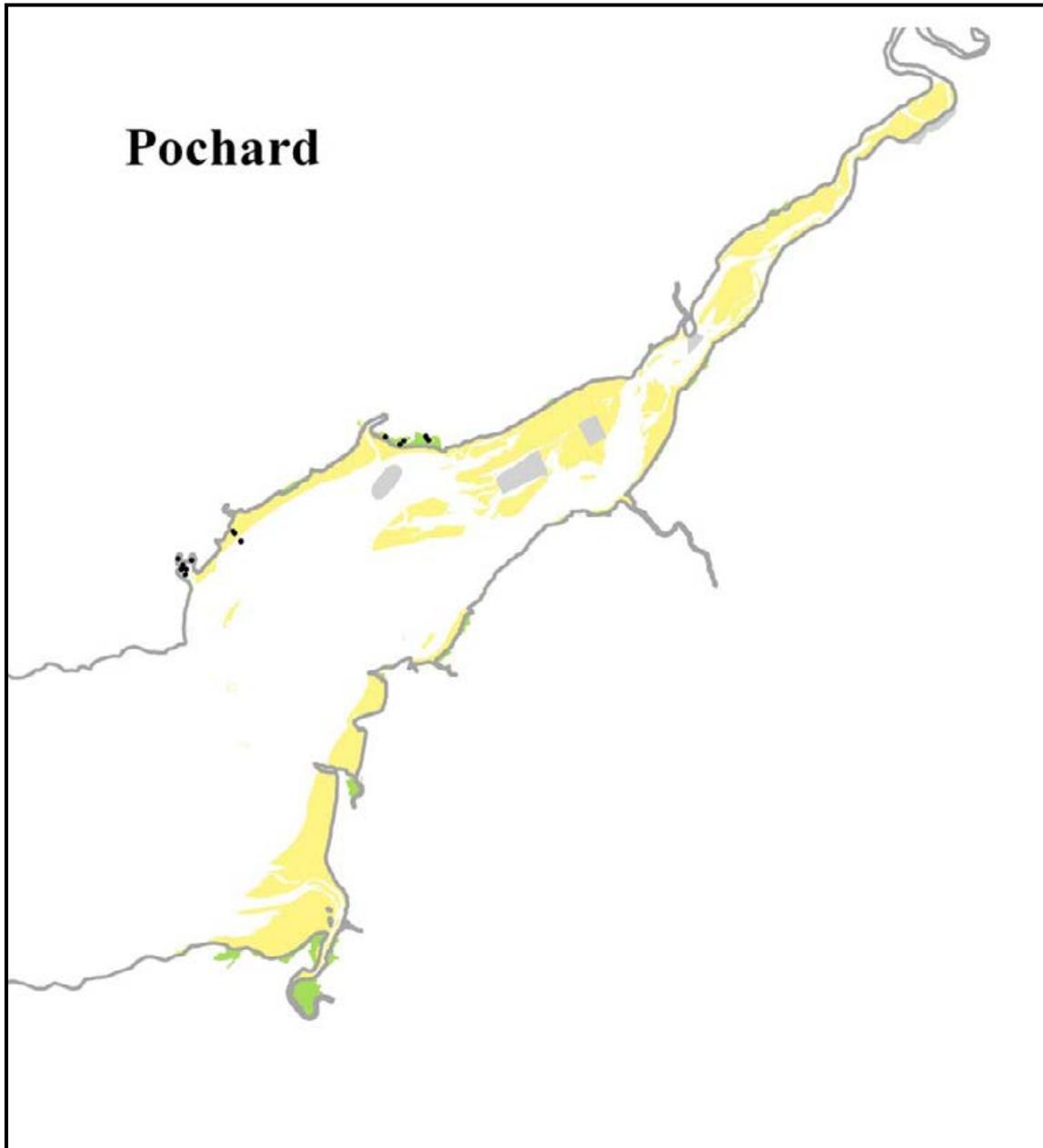


Figure 3.22.1 The mean numbers and distribution of Pochard on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

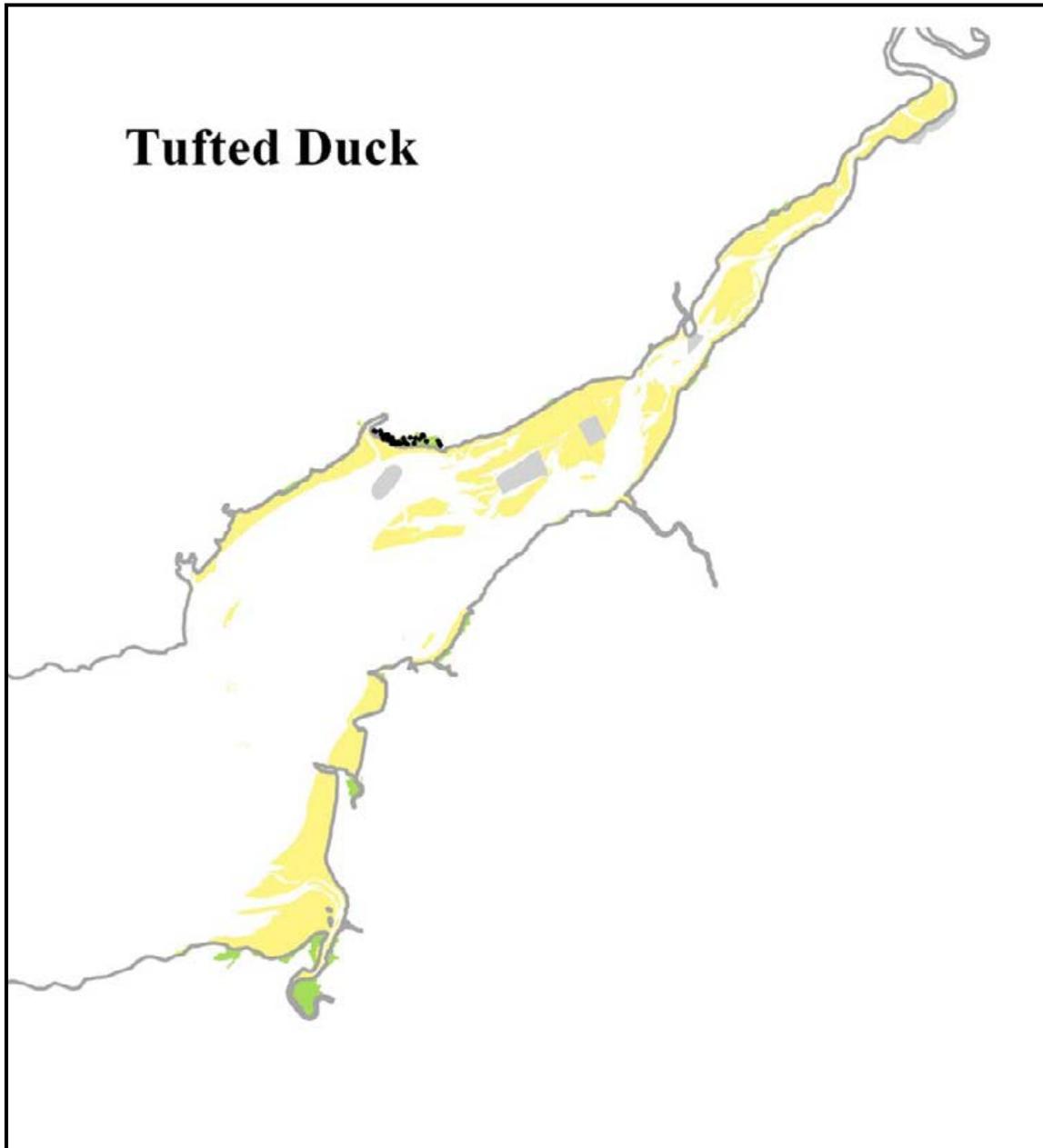


Figure 3.23.1 The mean numbers and distribution of Tufted Duck on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

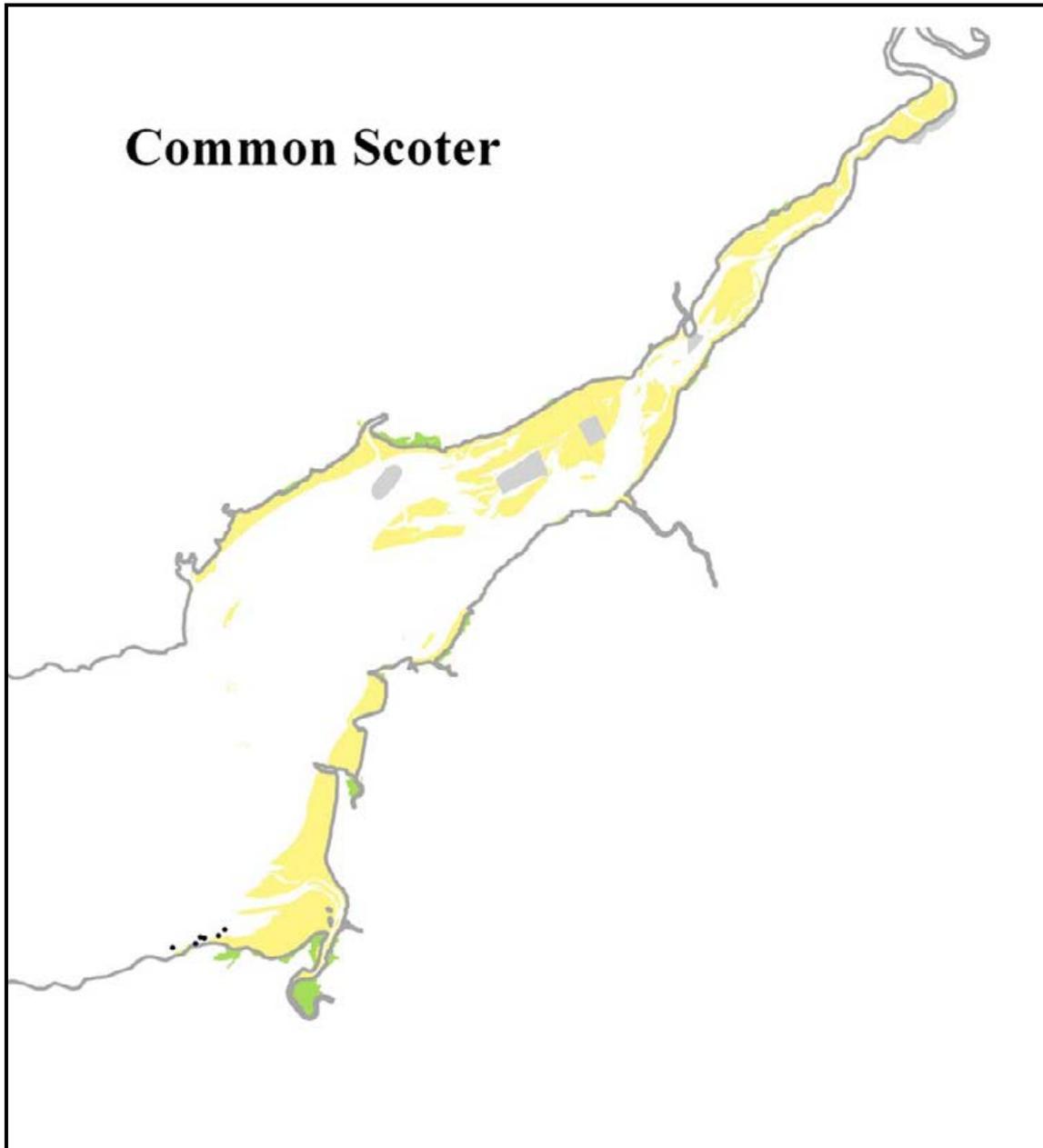


Figure 3.25.1 The mean numbers and distribution of Common Scoter on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

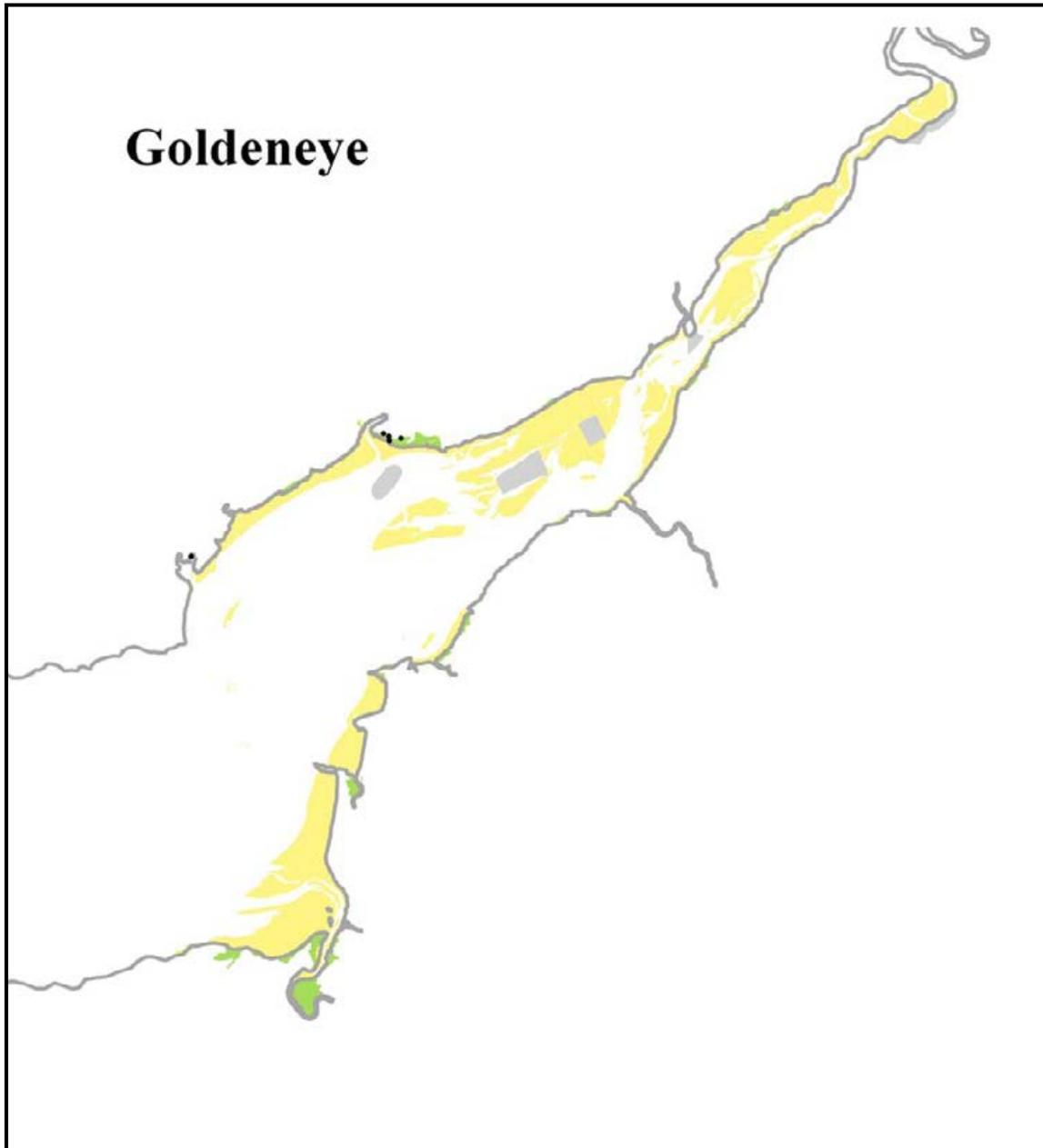


Figure 3.26.1 The mean numbers and distribution of Goldeneye on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

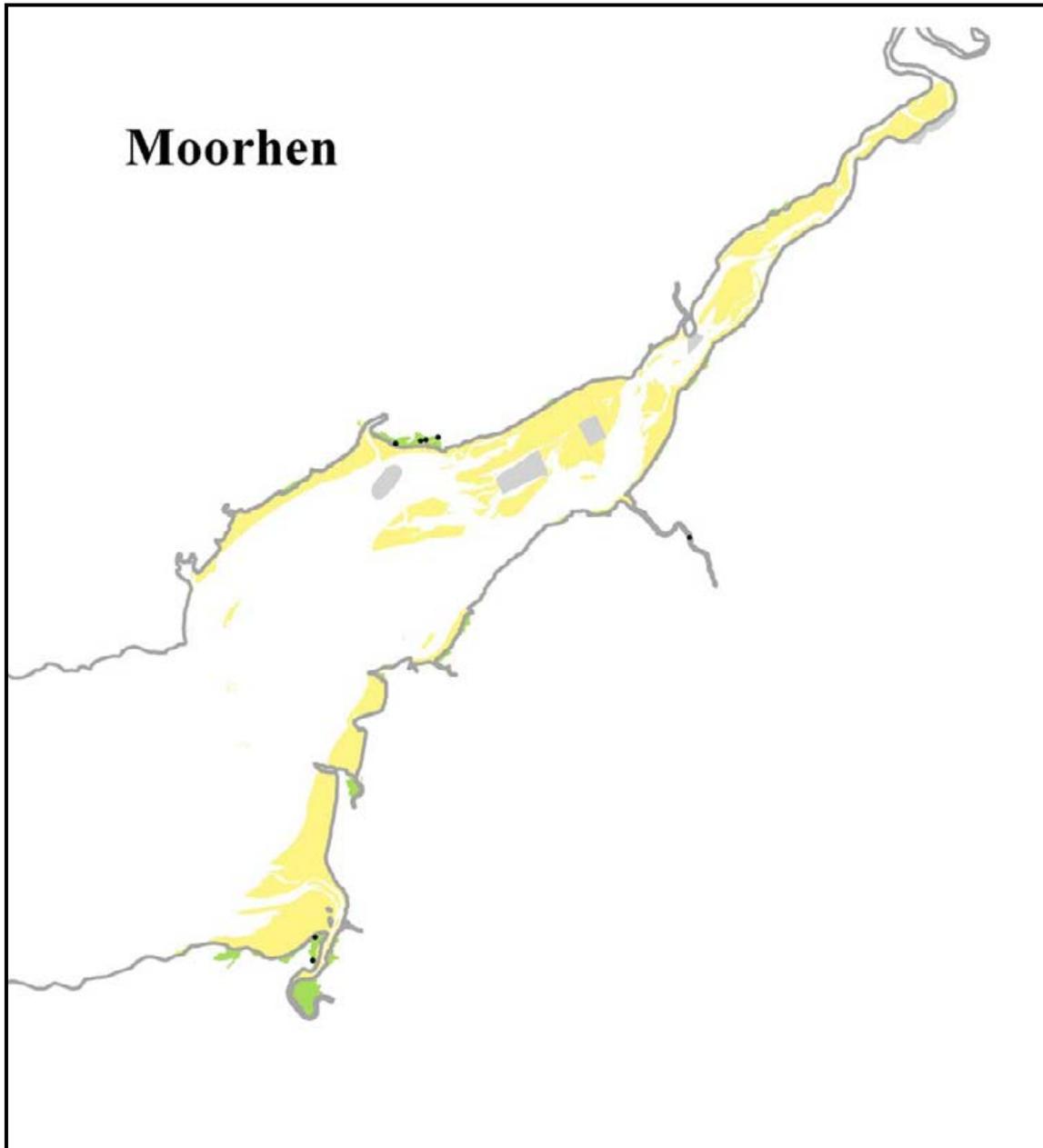


Figure 3.29.1 The mean numbers and distribution of Moorhen on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

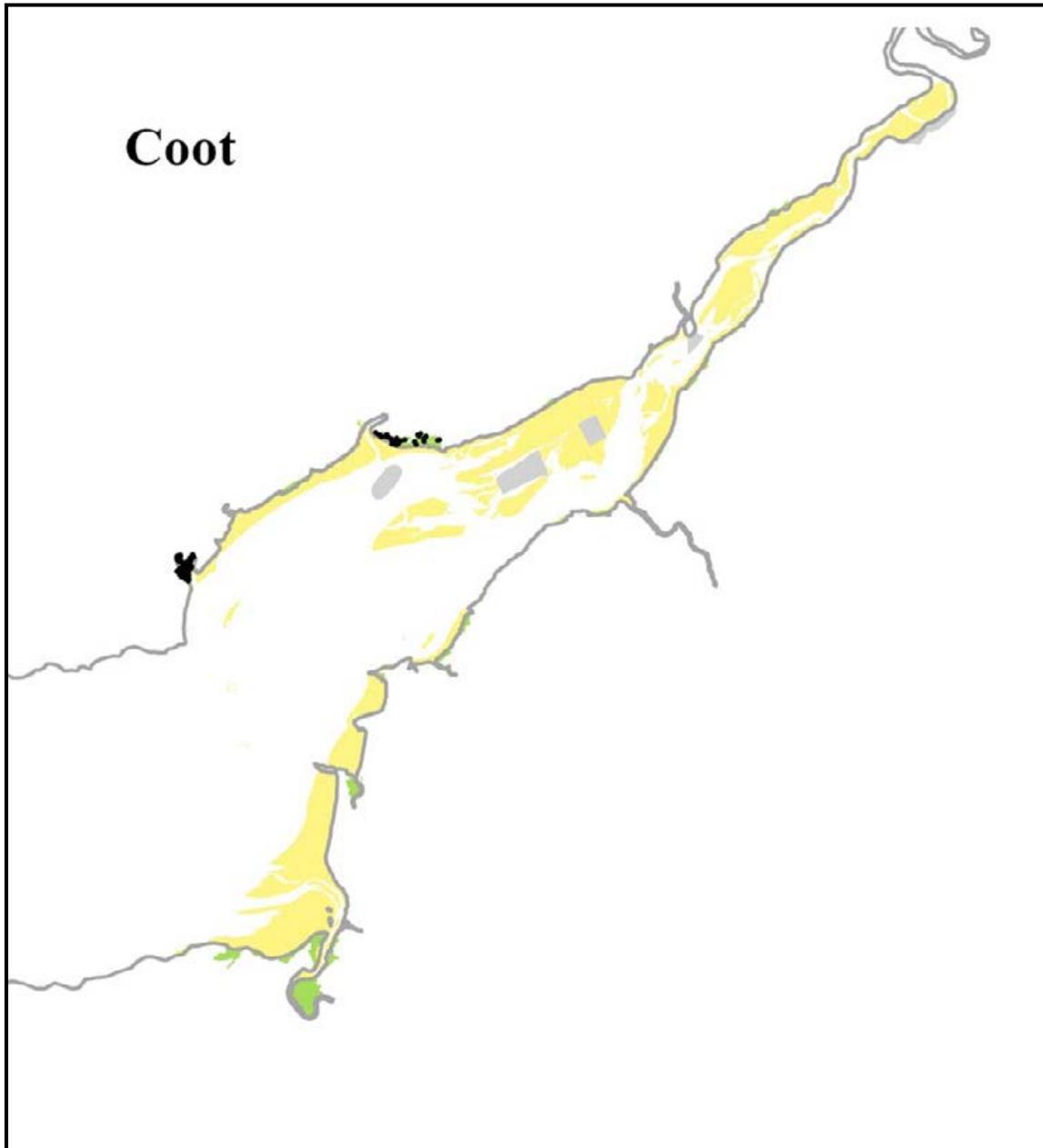


Figure 3.30.1 The mean numbers and distribution of Coot on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

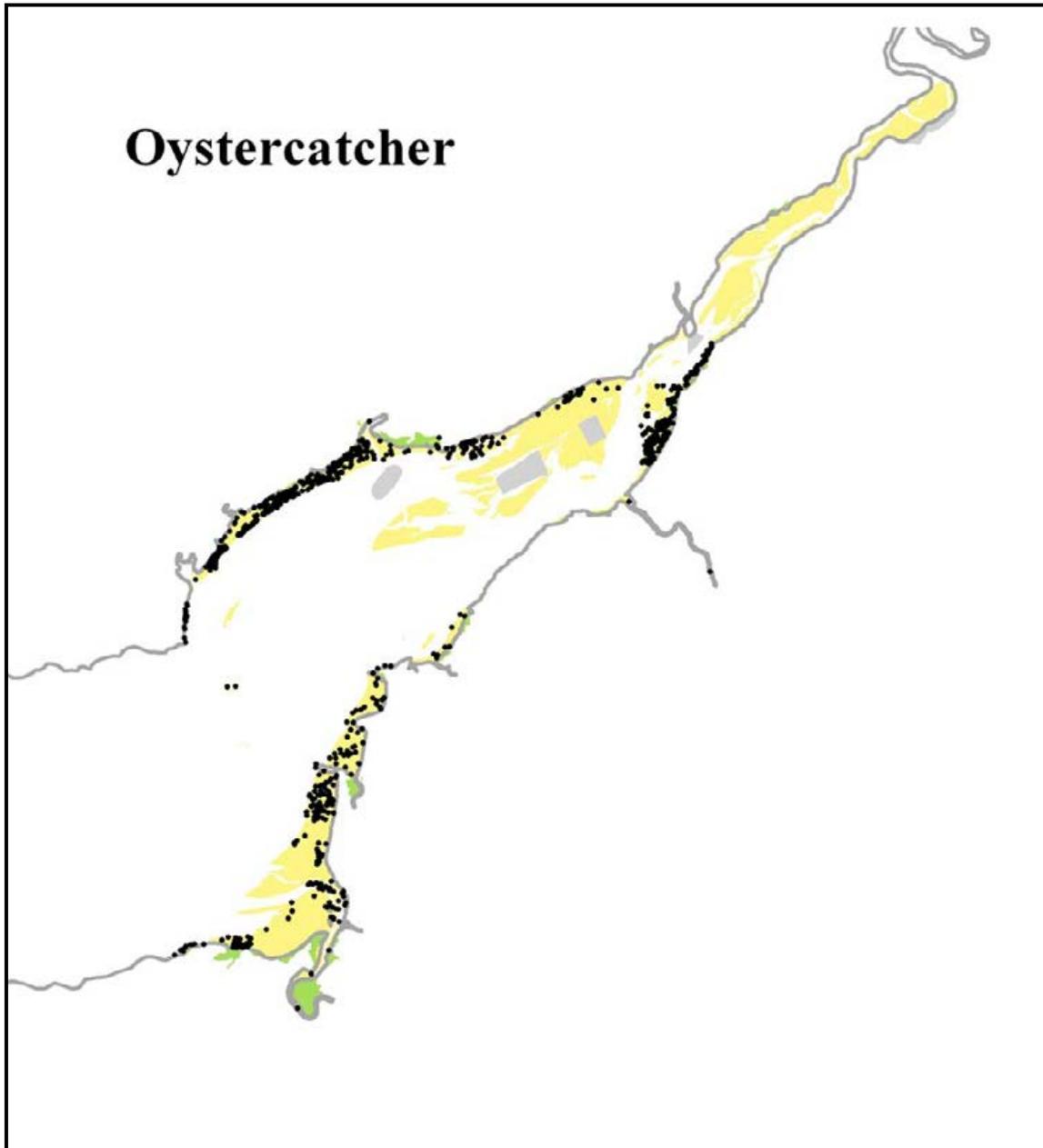


Figure 3.31.1 The mean numbers and distribution of Oystercatcher on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

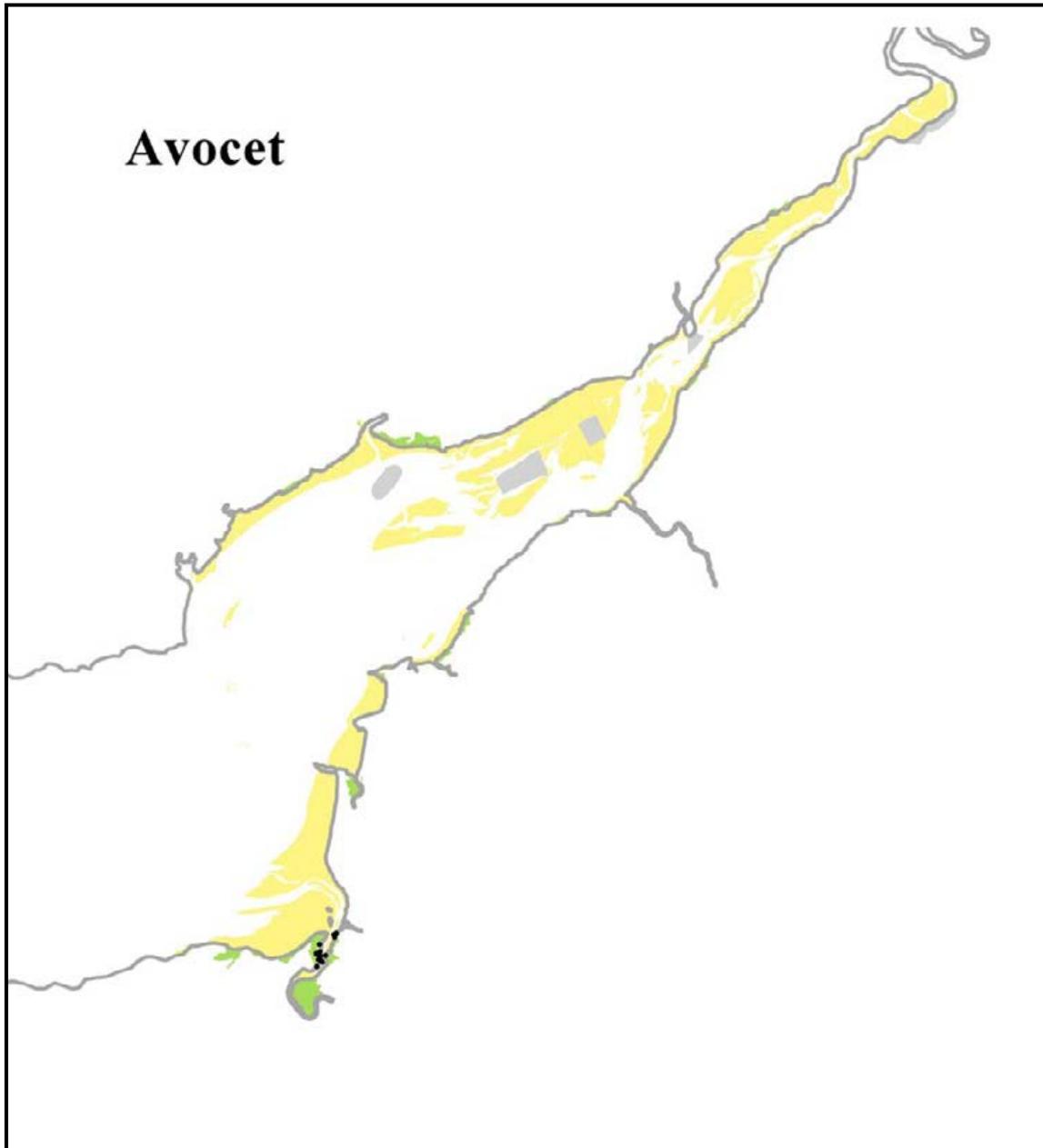


Figure 3.32.1 The mean numbers and distribution of Avocet on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

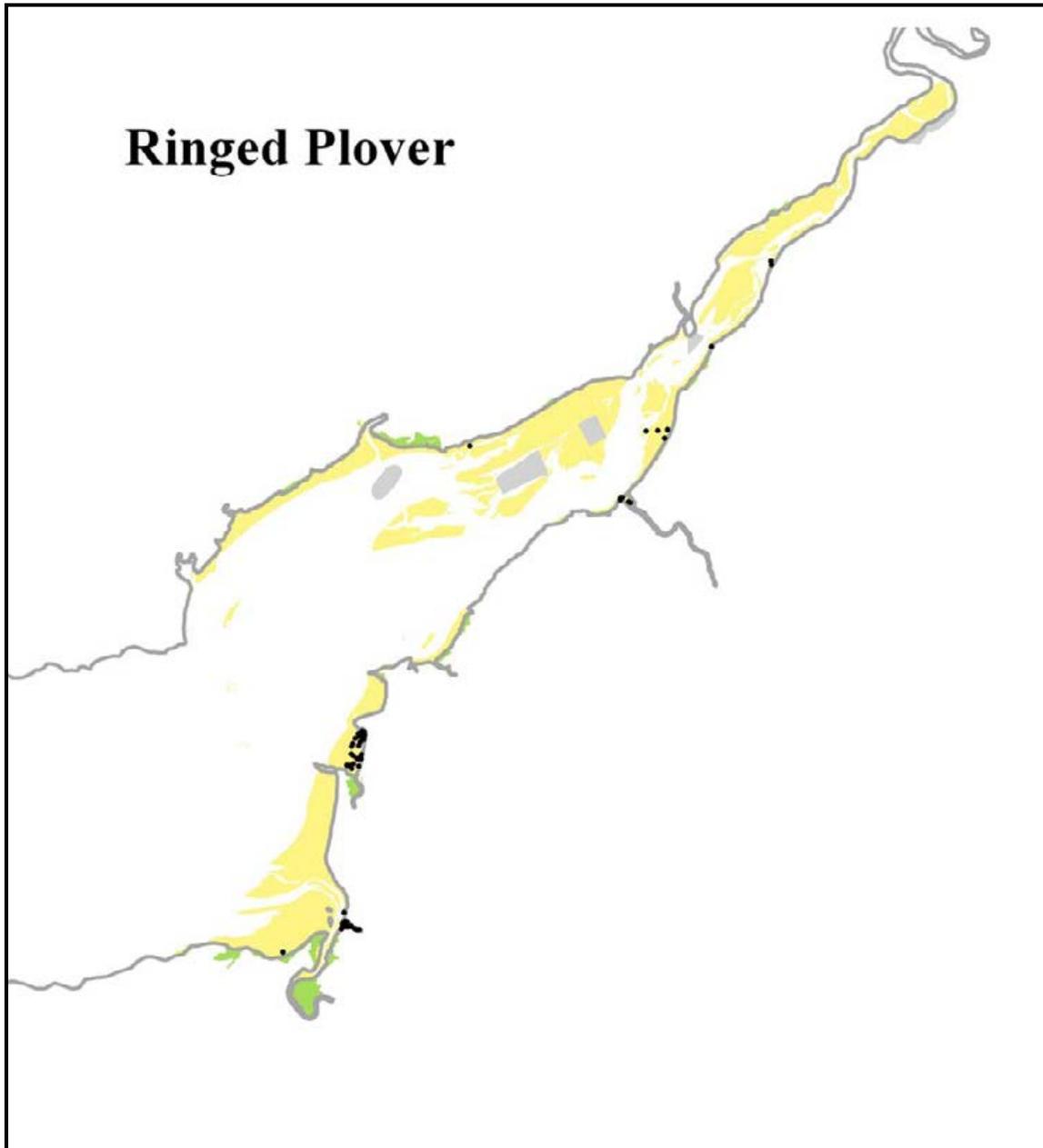


Figure 3.33.1 The mean numbers and distribution of Ringed Plover on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

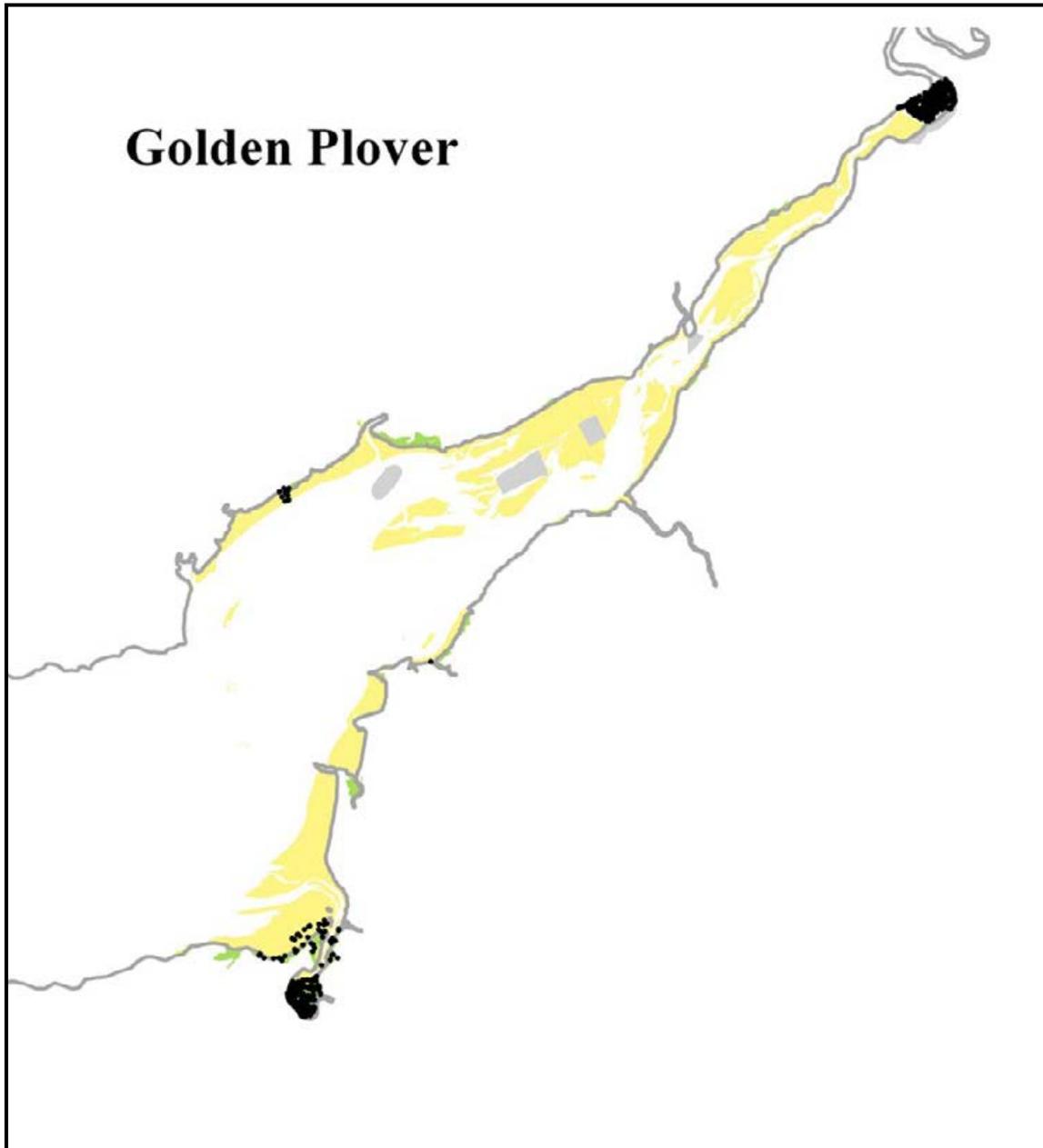


Figure 3.34.1 The mean numbers and distribution of Golden Plover on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

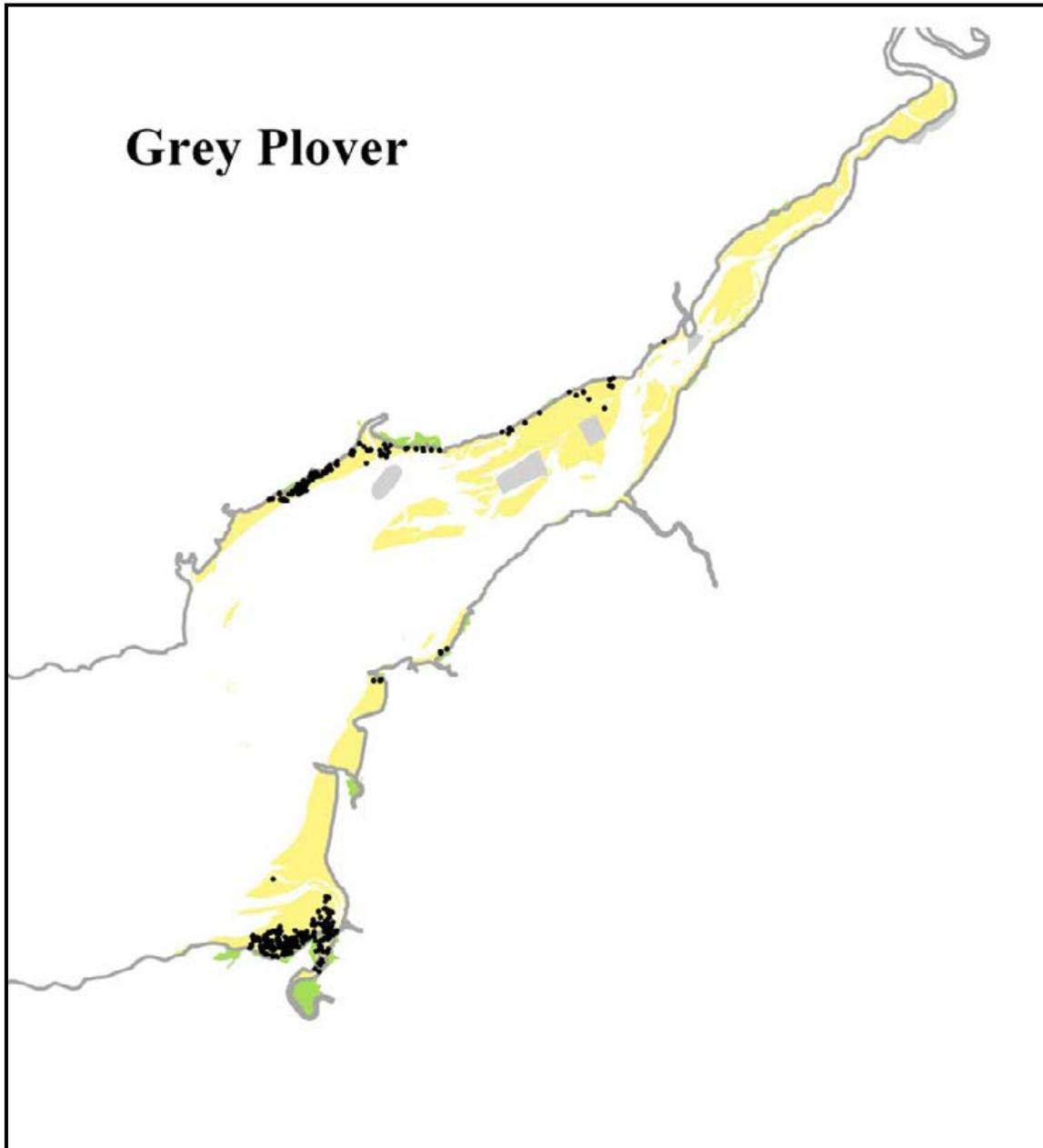


Figure 3.35.1 The mean numbers and distribution of Grey Plover on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

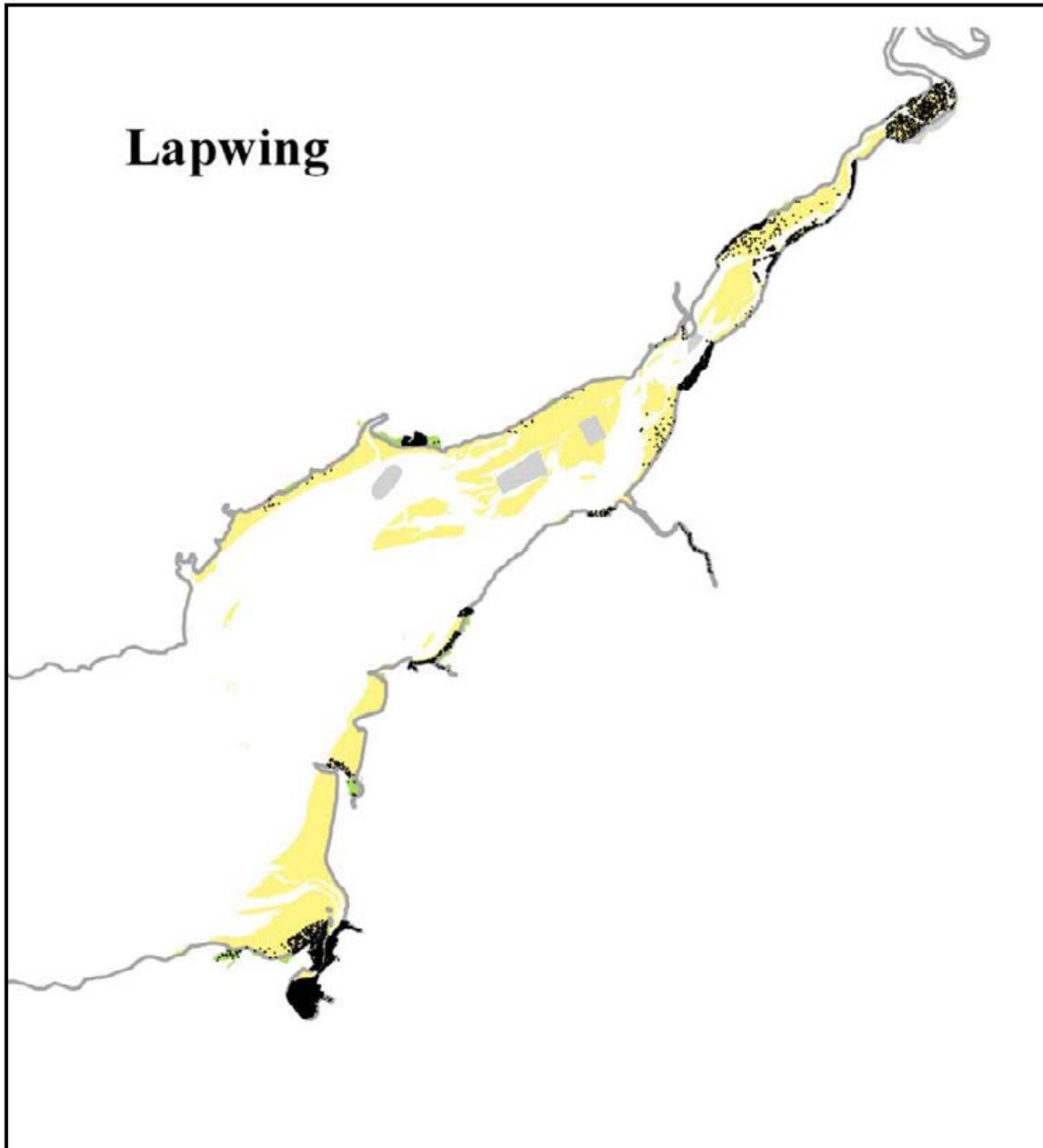


Figure 3.36.1 The mean numbers and distribution of Lapwing on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

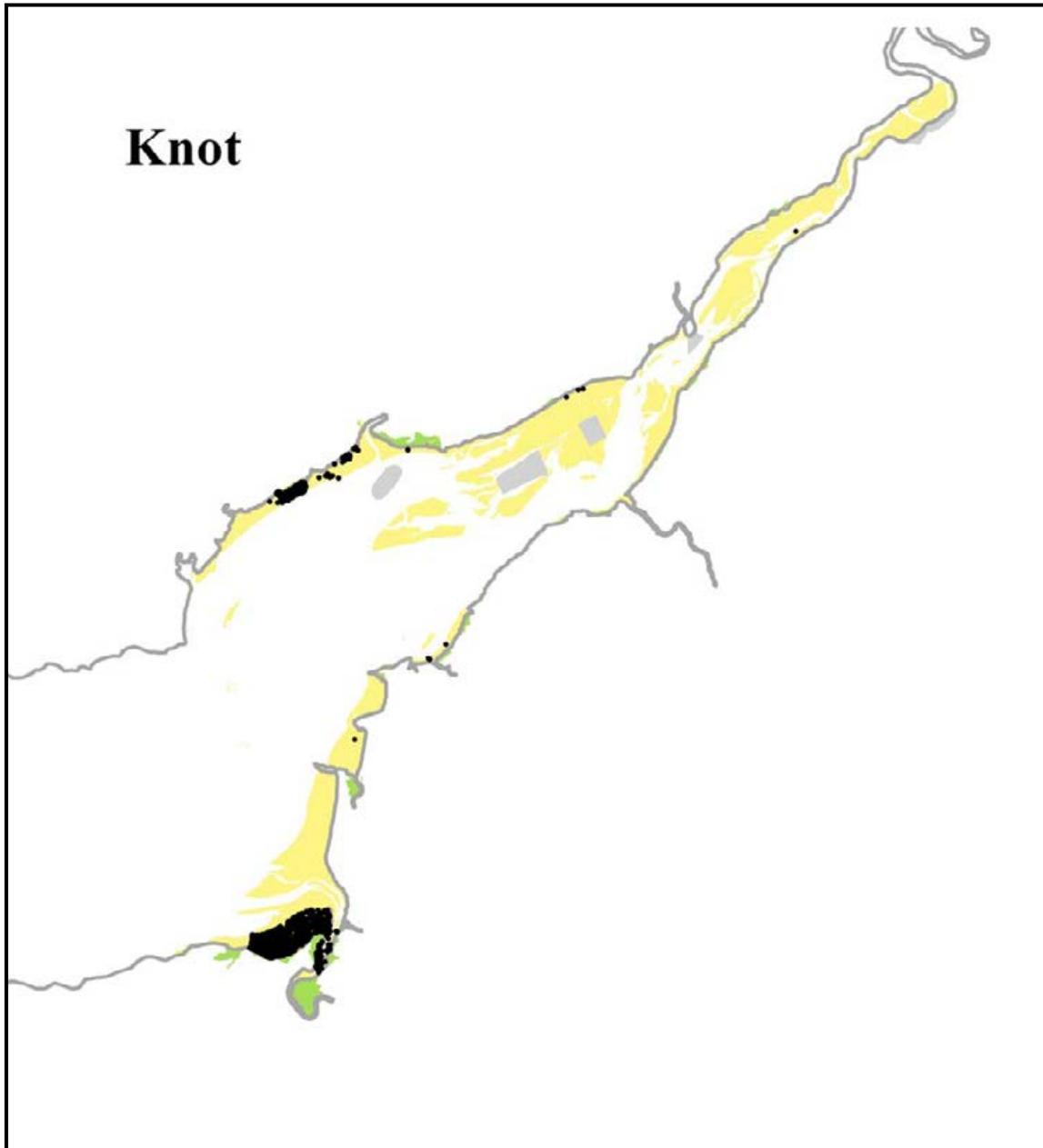


Figure 3.37.1 The mean numbers and distribution of Knot on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

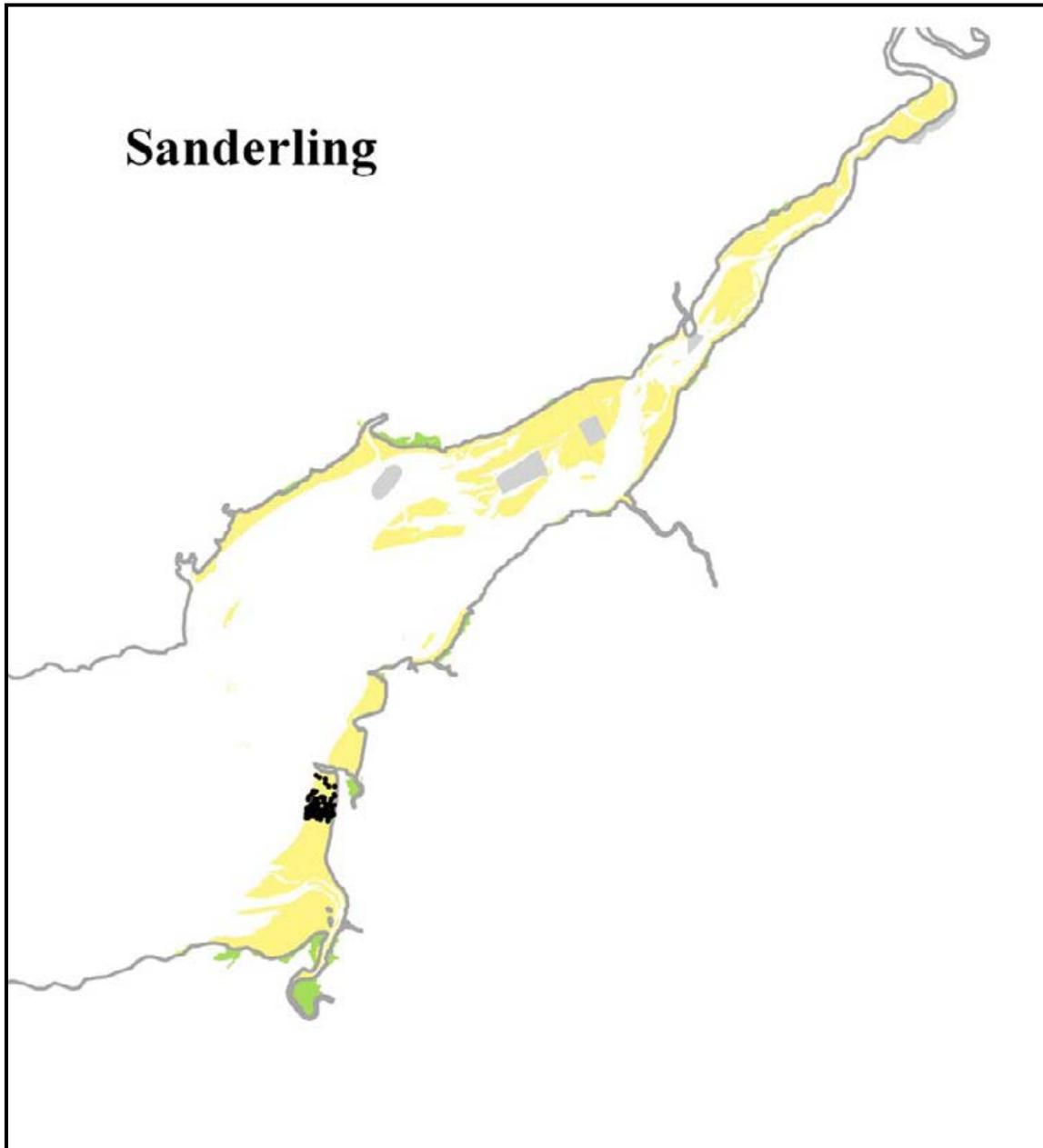


Figure 3.38.1 The mean numbers and distribution of Sanderling on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

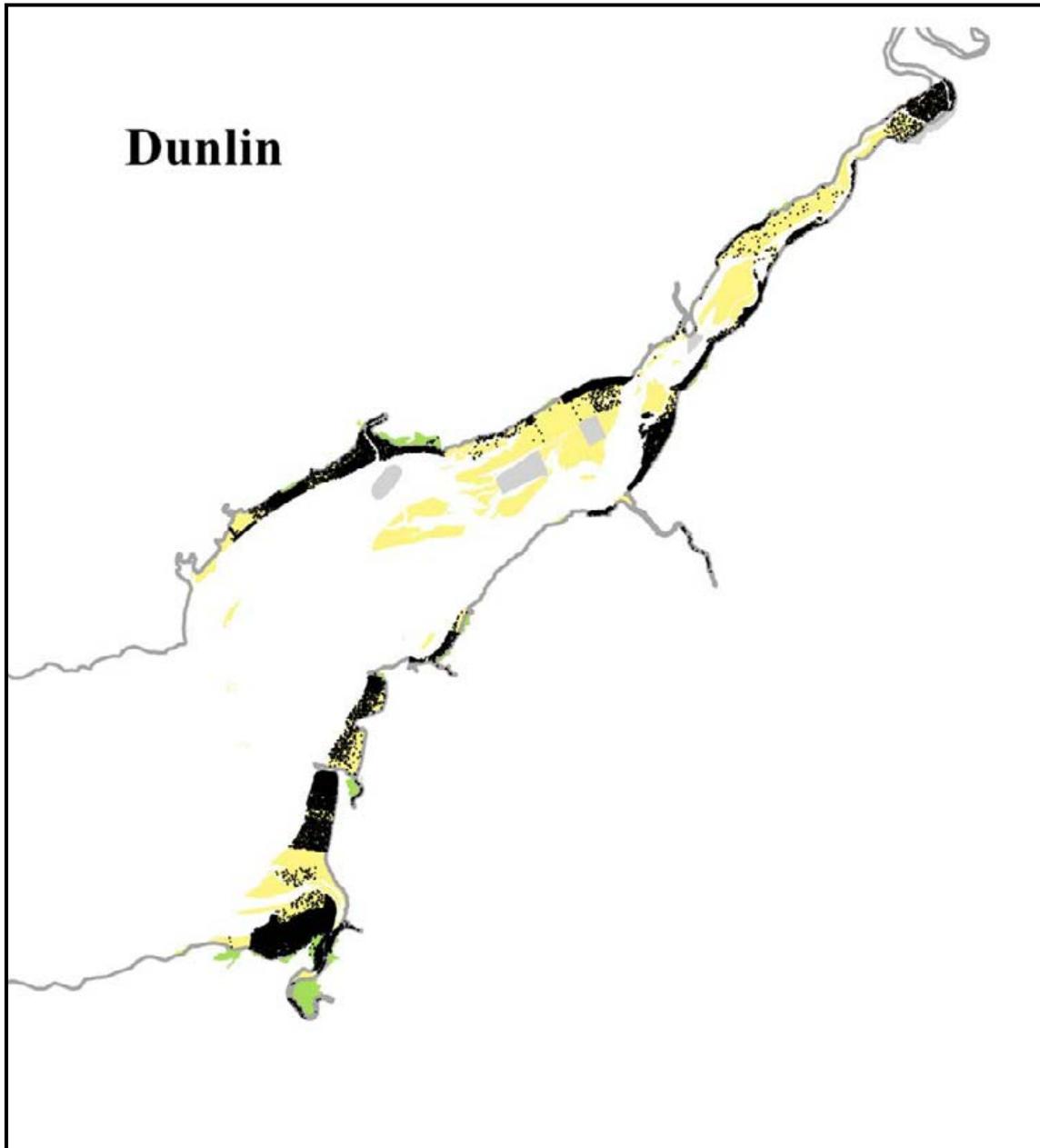


Figure 3.40.1 The mean numbers and distribution of Dunlin on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

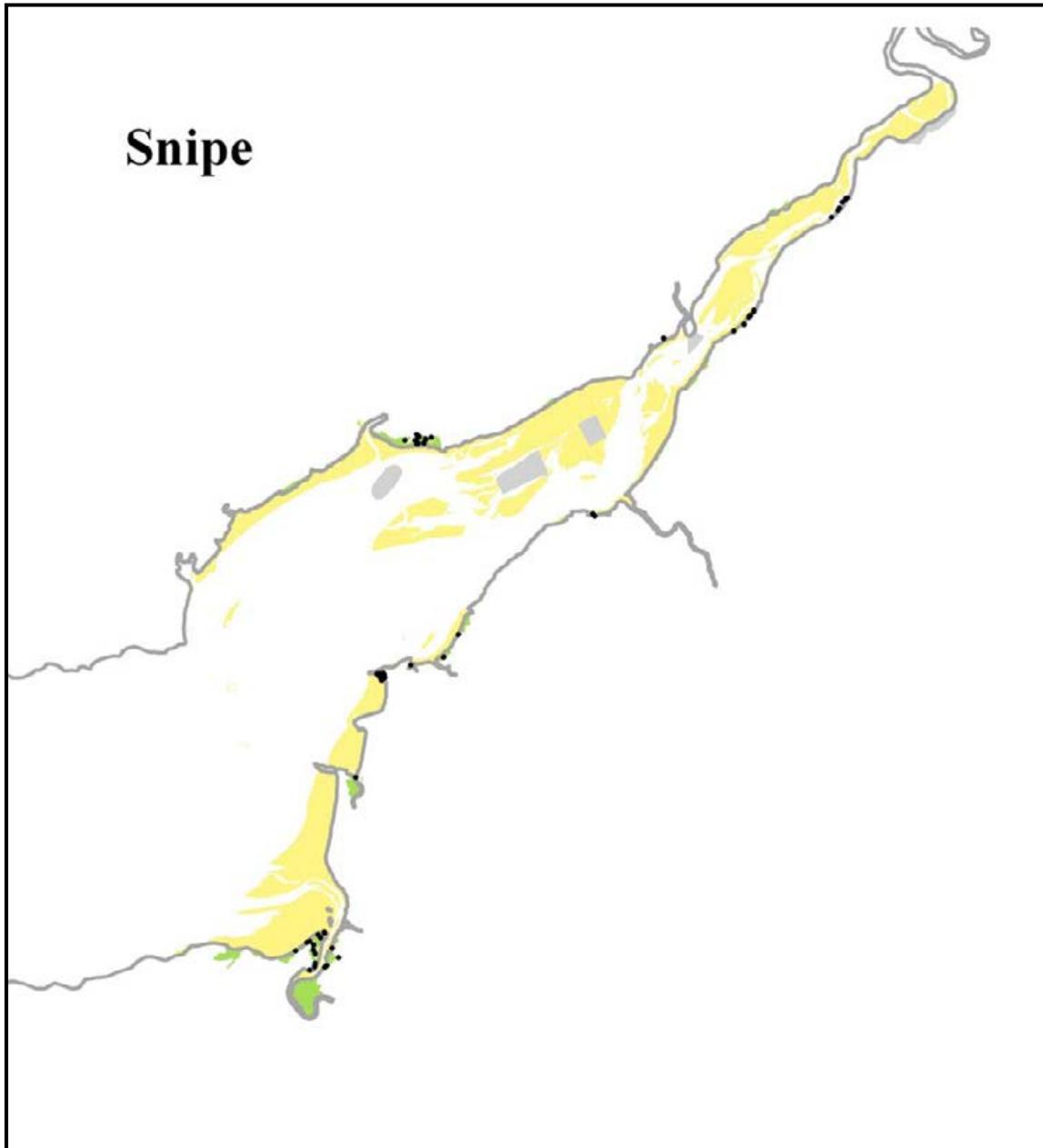


Figure 3.42.1 The mean numbers and distribution of Snipe on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

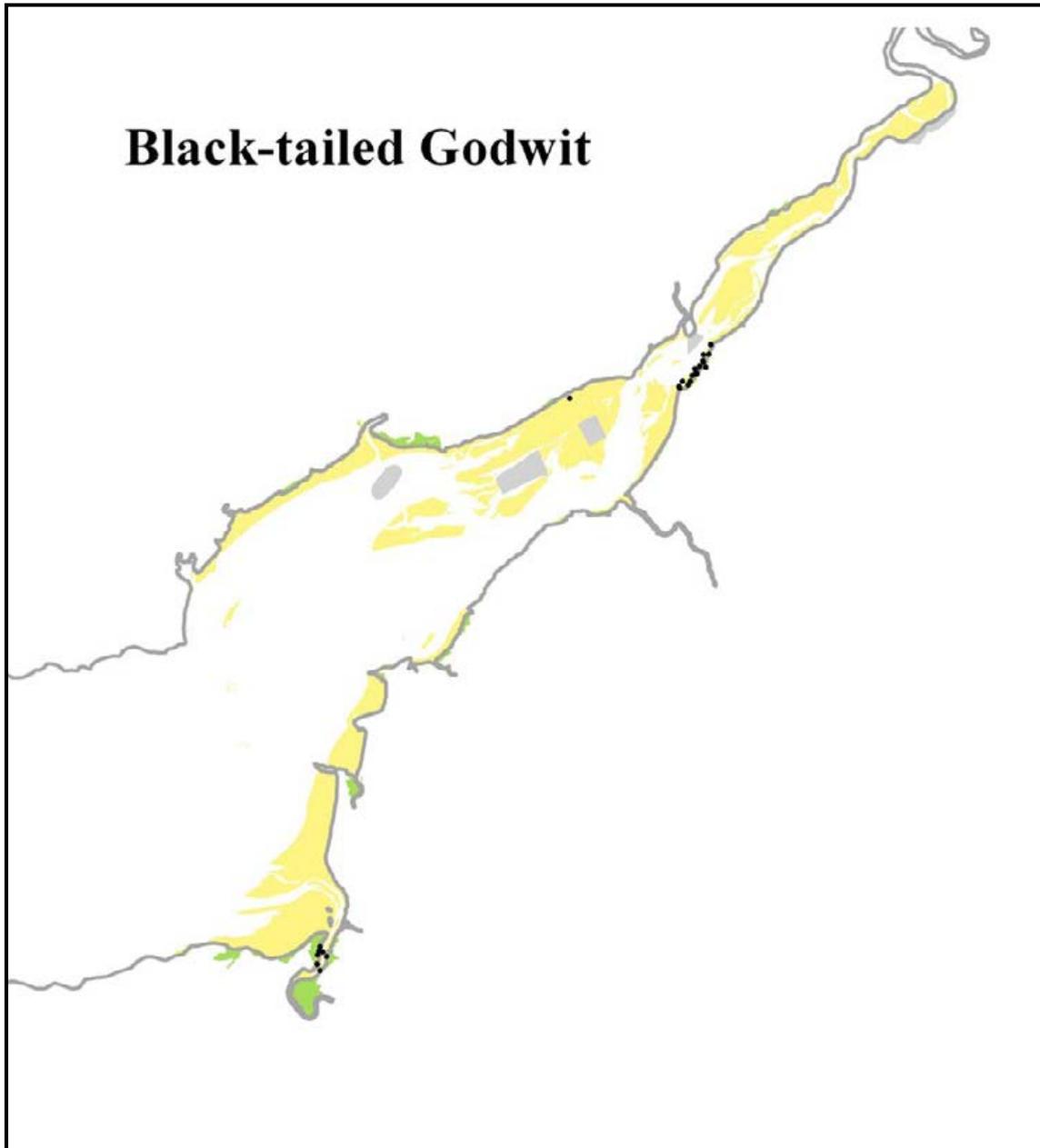


Figure 3.43.1 The mean numbers and distribution of Black-tailed Godwit on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

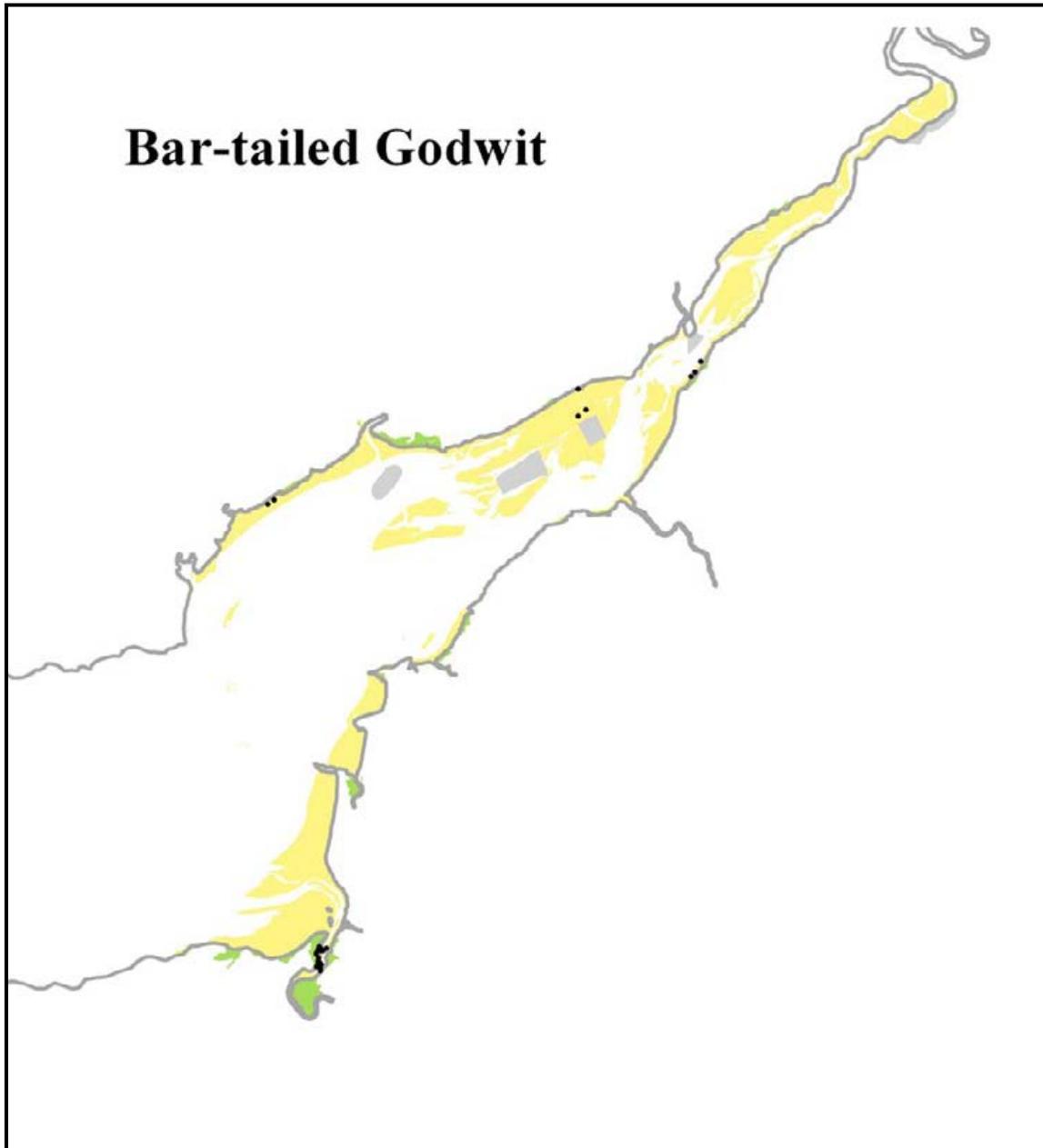


Figure 3.44.1 The mean numbers and distribution of Bar-tailed Godwit on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

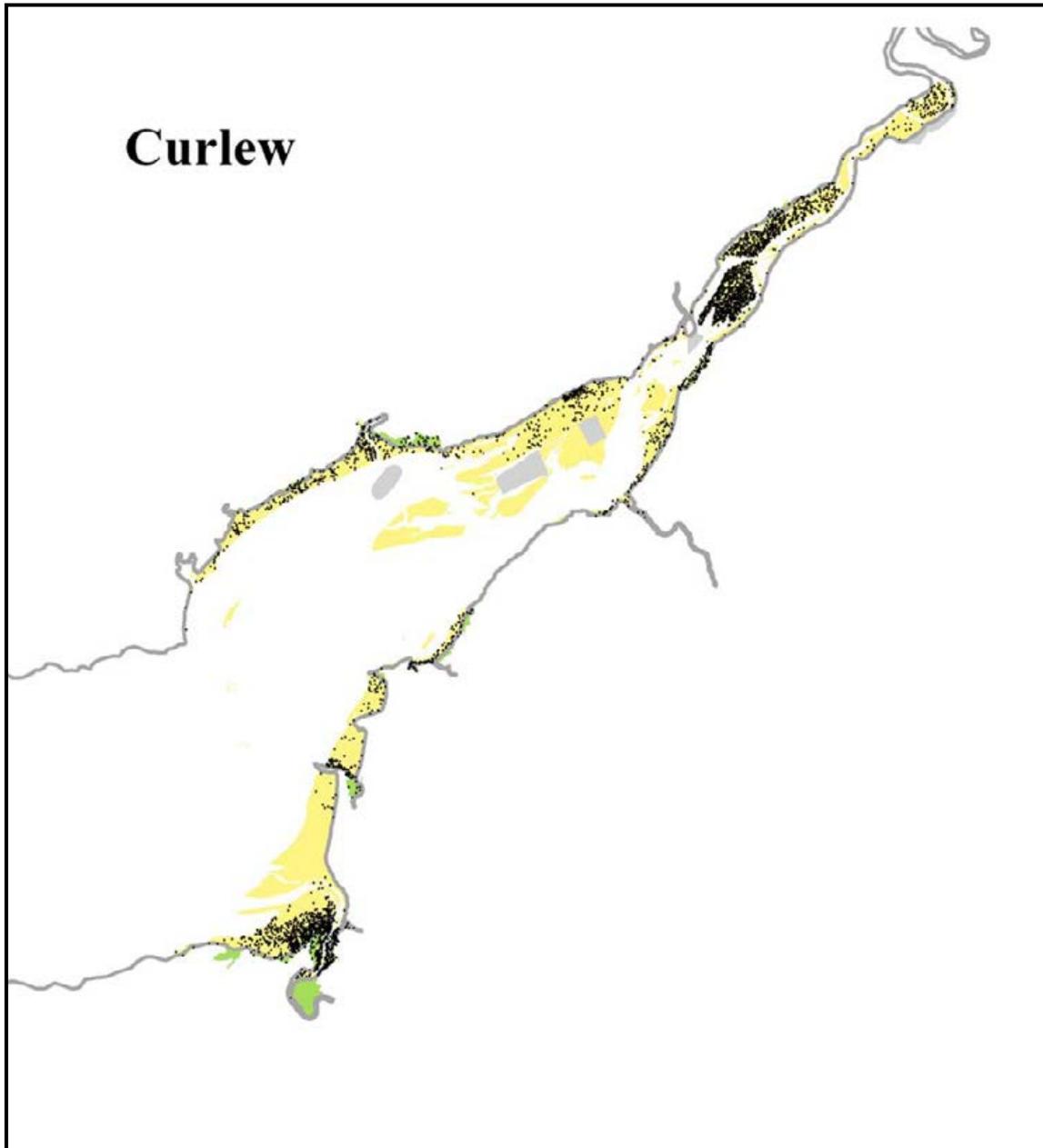


Figure 3.45.1 The mean numbers and distribution of Curlew on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

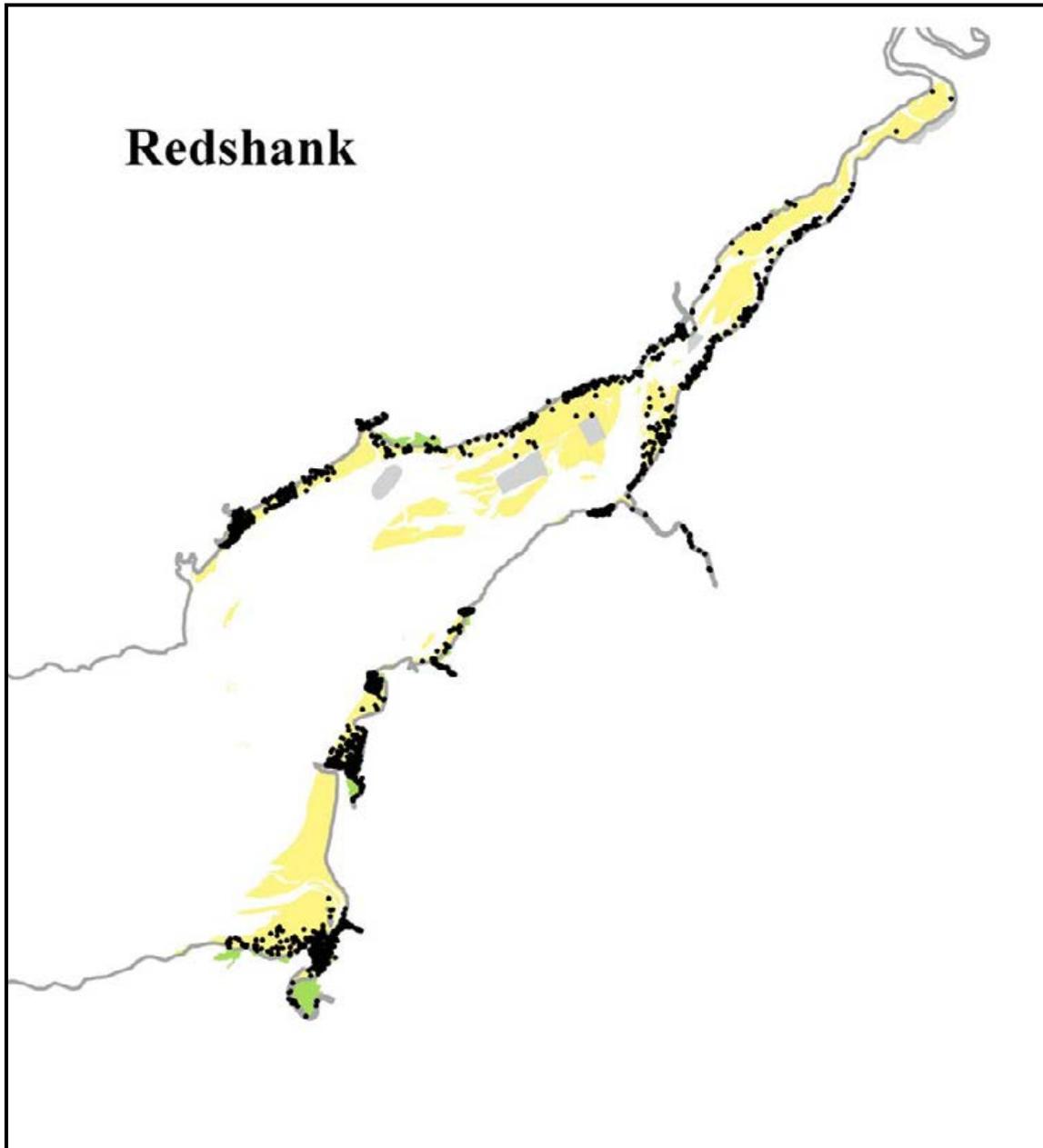


Figure 3.47.1 The mean numbers and distribution of Redshank on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

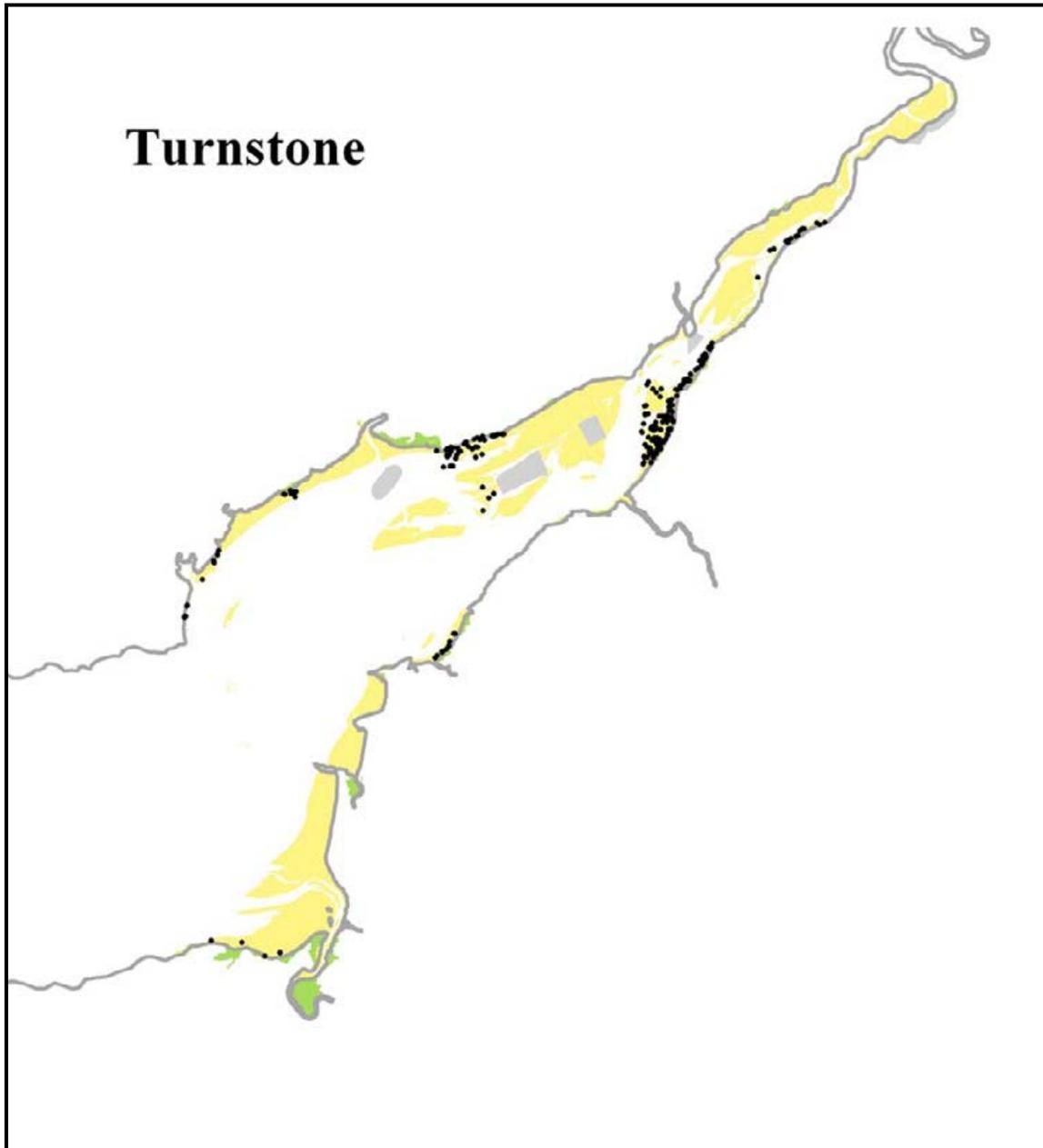


Figure 3.51.1 The mean numbers and distribution of Turnstone on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

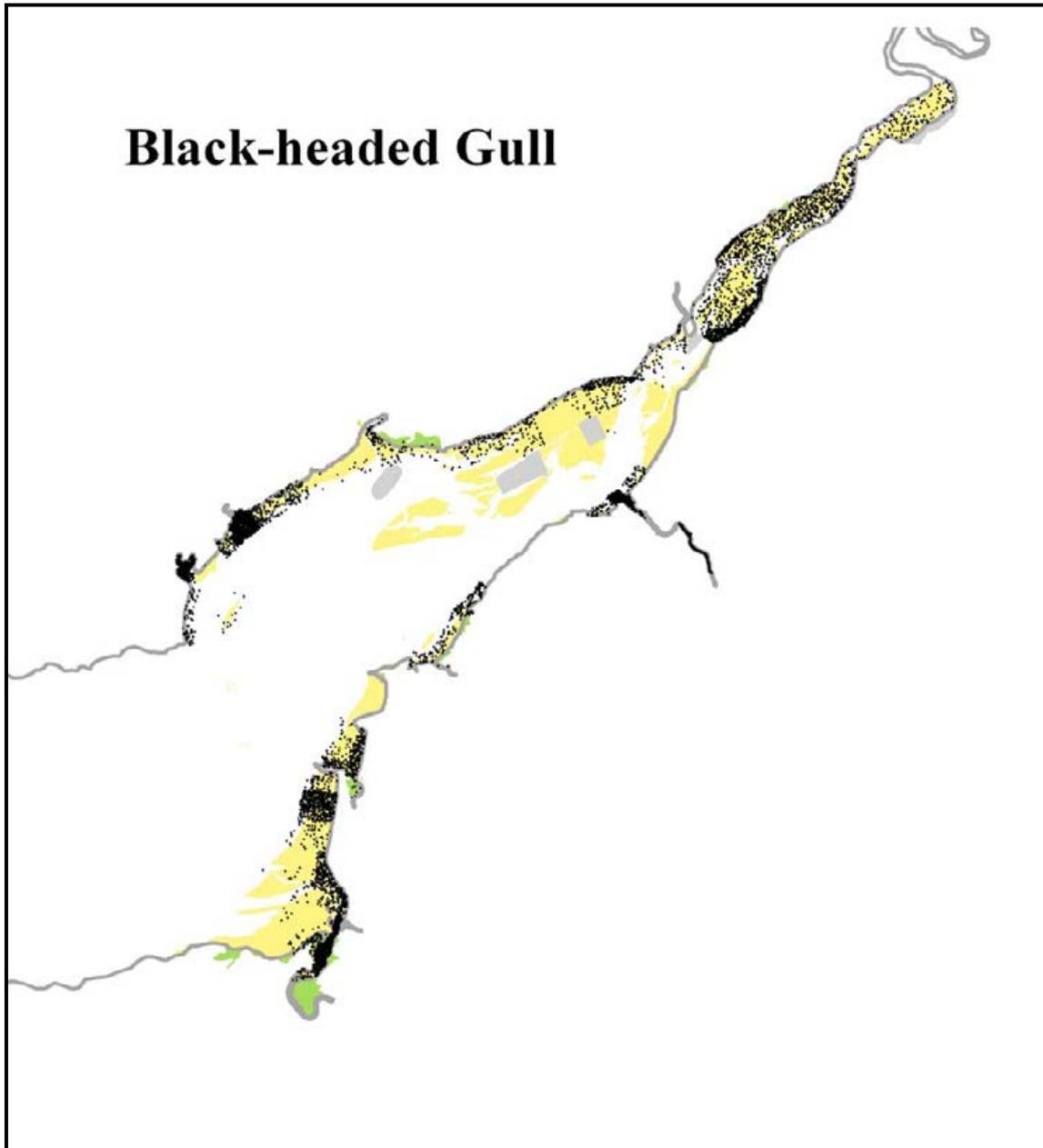


Figure 3.53.1 The mean numbers and distribution of Black-headed Gull on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

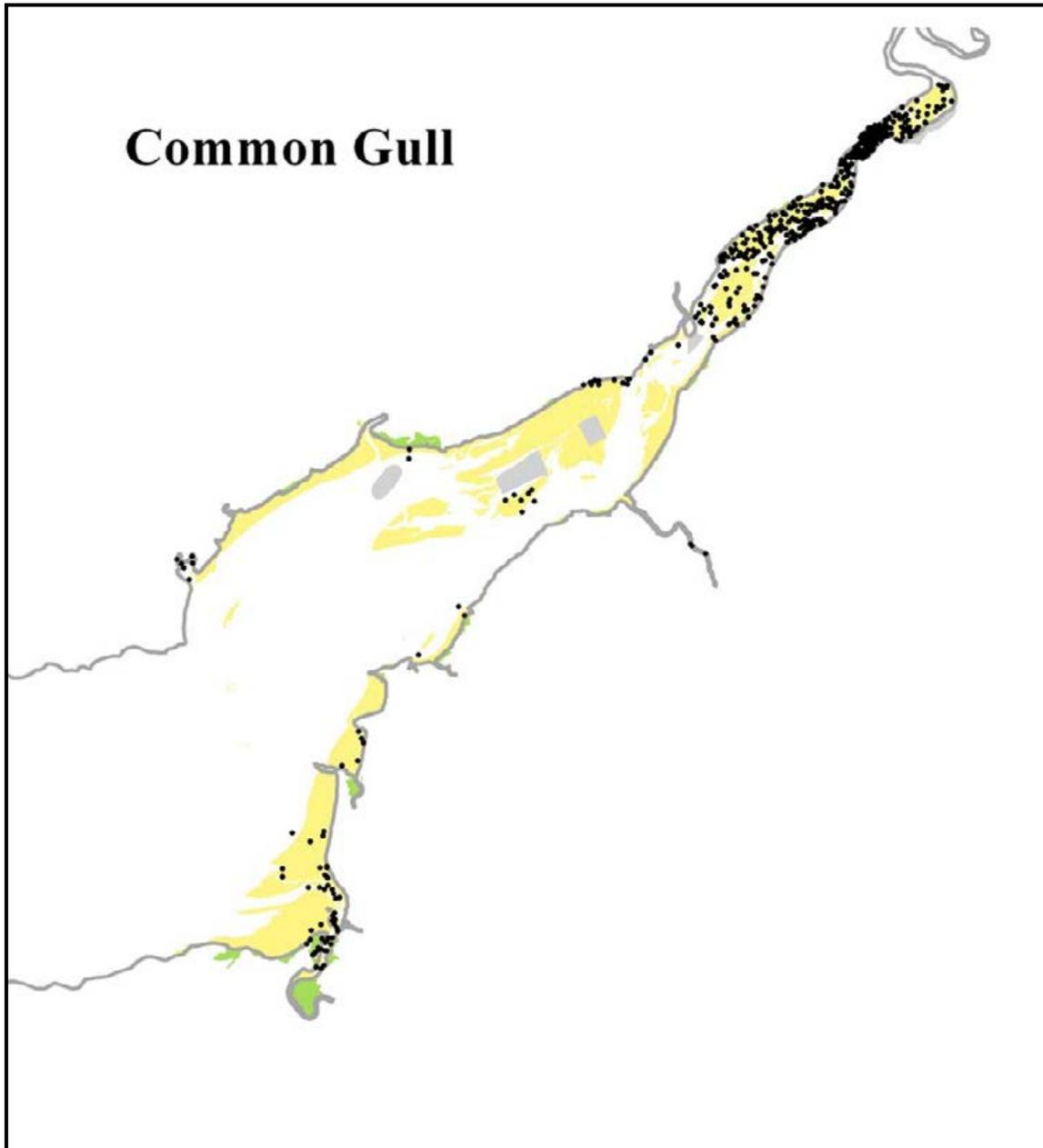


Figure 3.54.1 The mean numbers and distribution of Common Gull on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

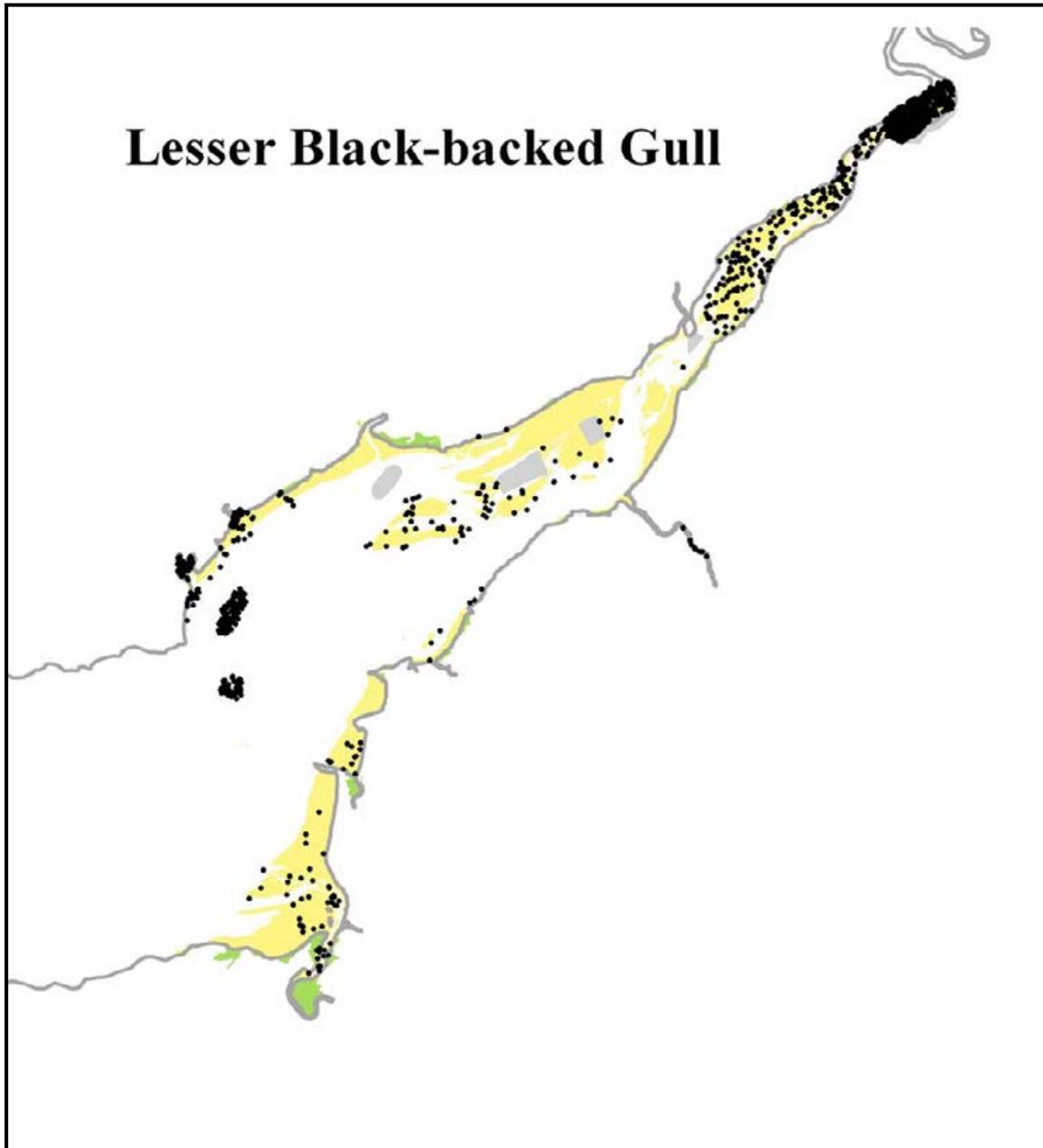


Figure 3.55.1 The mean numbers and distribution of Lesser Black-backed Gull on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

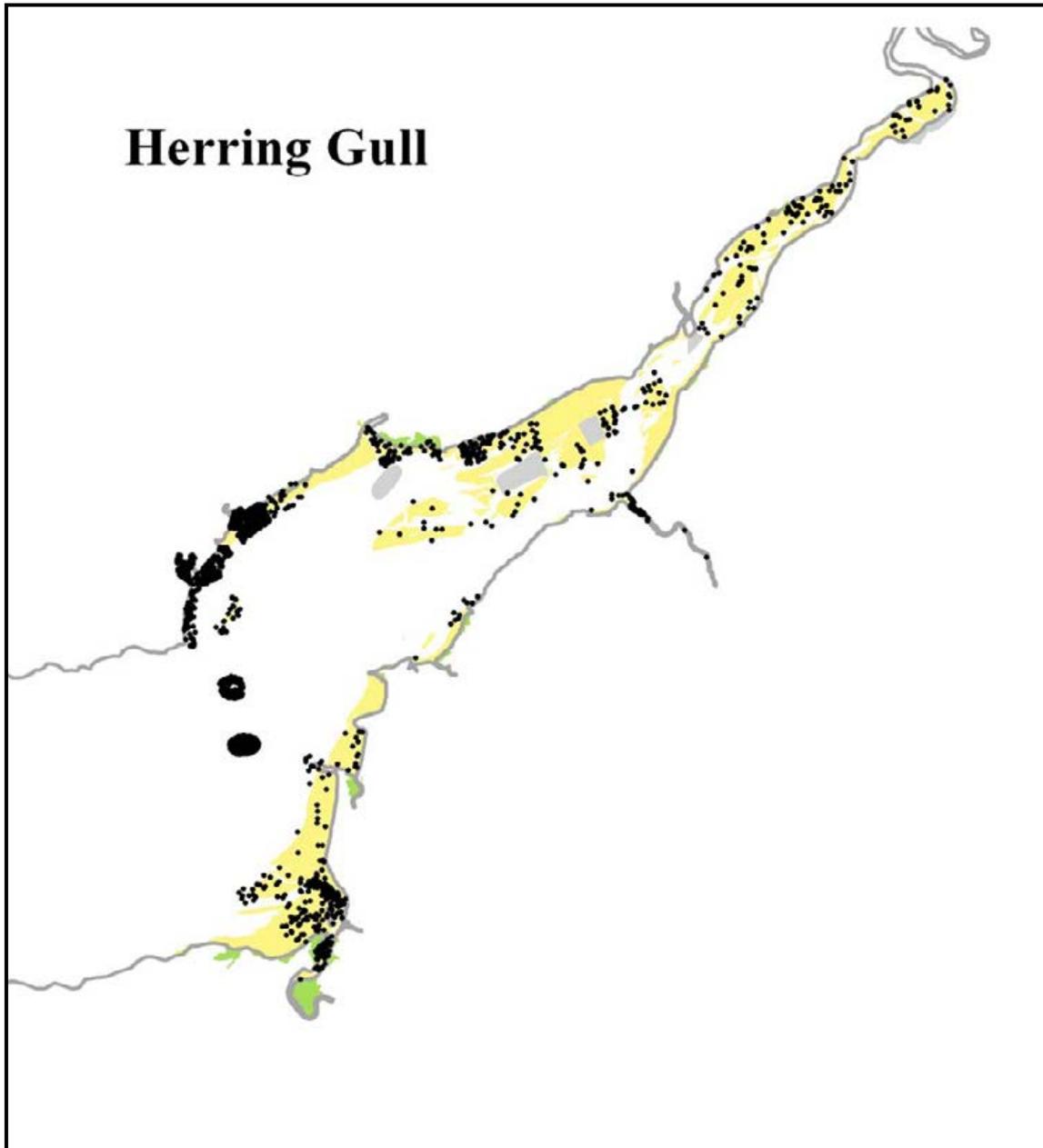


Figure 3.56.1 The mean numbers and distribution of Herring Gull on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

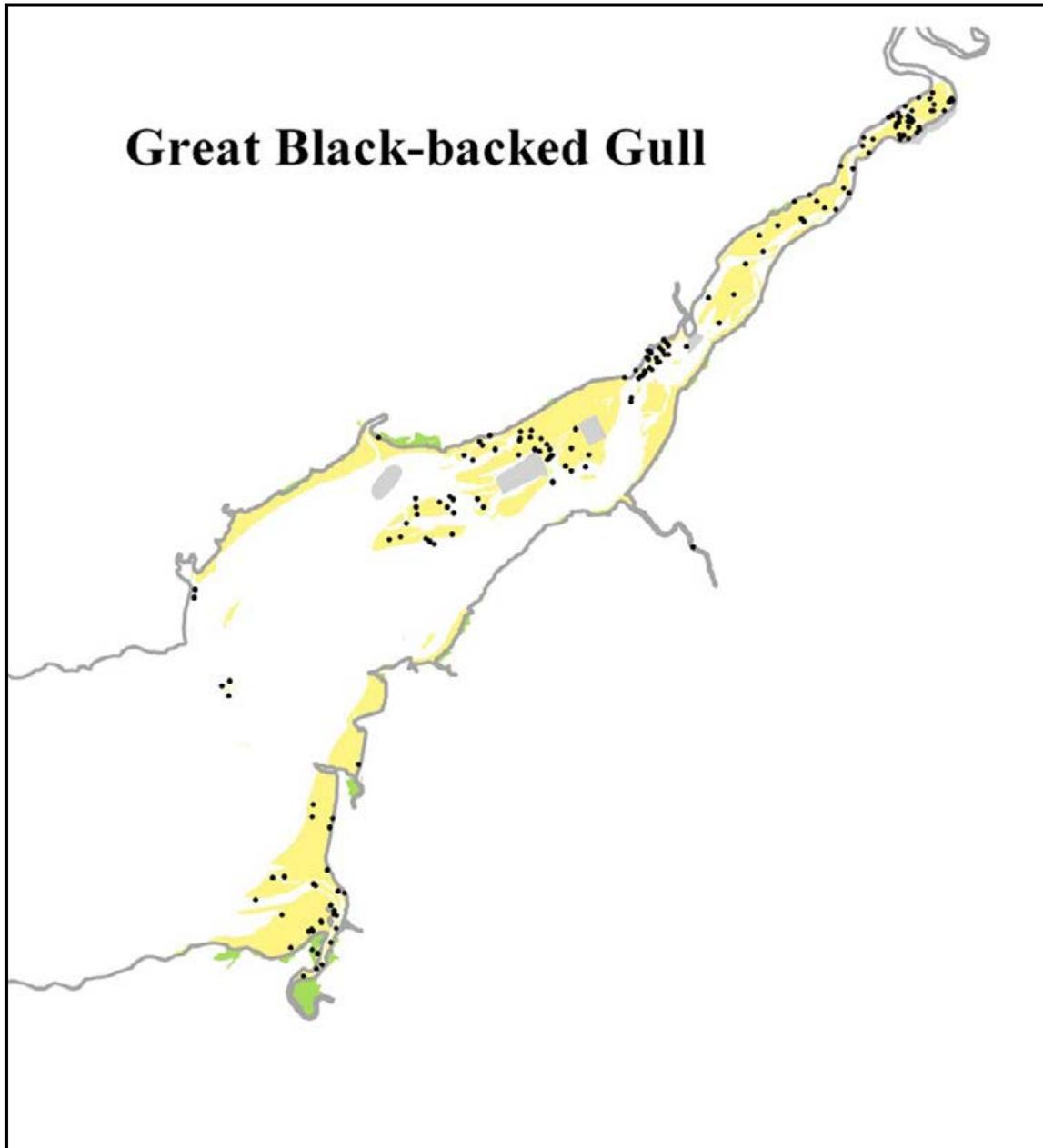


Figure 3.58.1 The mean numbers and distribution of Great Black-backed Gull on the Severn Estuary in the winter of 2002/03, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

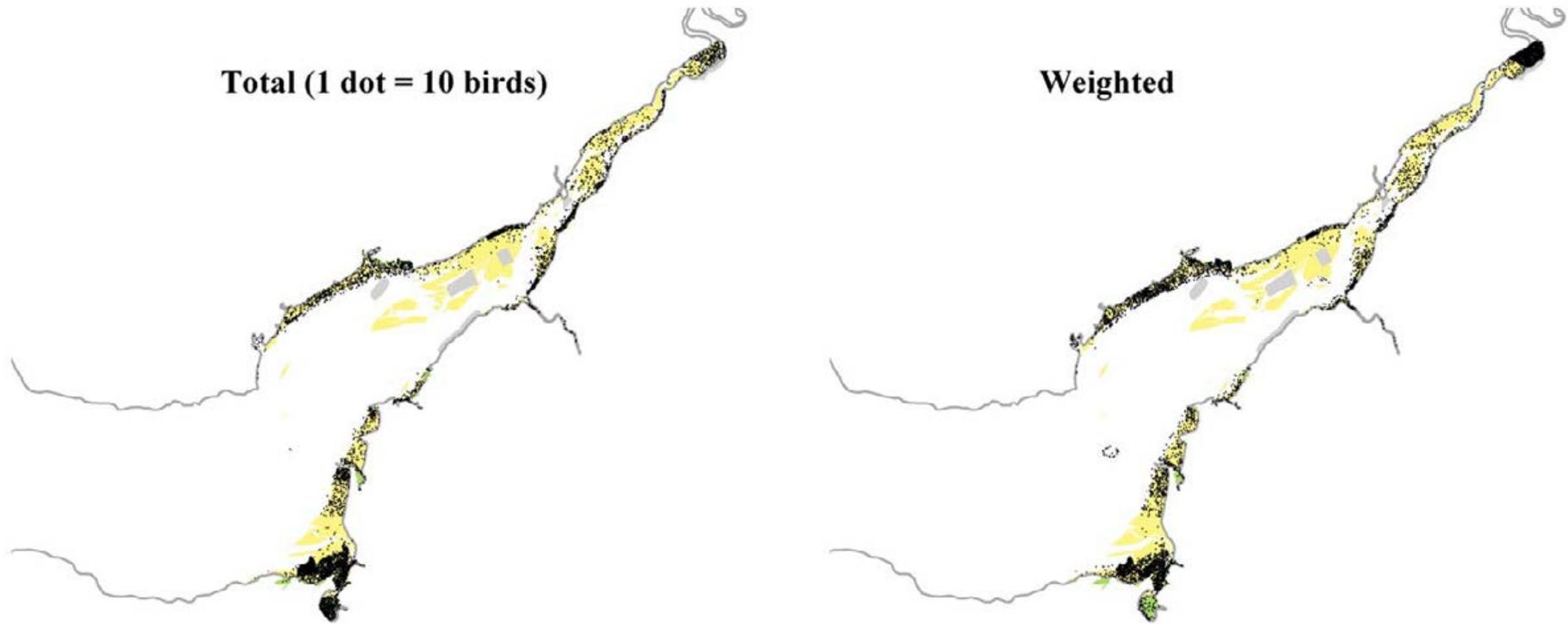


Figure 3.59.1 a. The mean number of all waterbird species (excluding gulls) recorded on each count section in the winter of 2002/03, as shown by WeBS Low Tide Count data.

b. The mean number of all waterbird species (excluding gulls) recorded on each WeBS Low Tide count section in the winter of 2002/03, with numbers of each species weighted by its national population size.

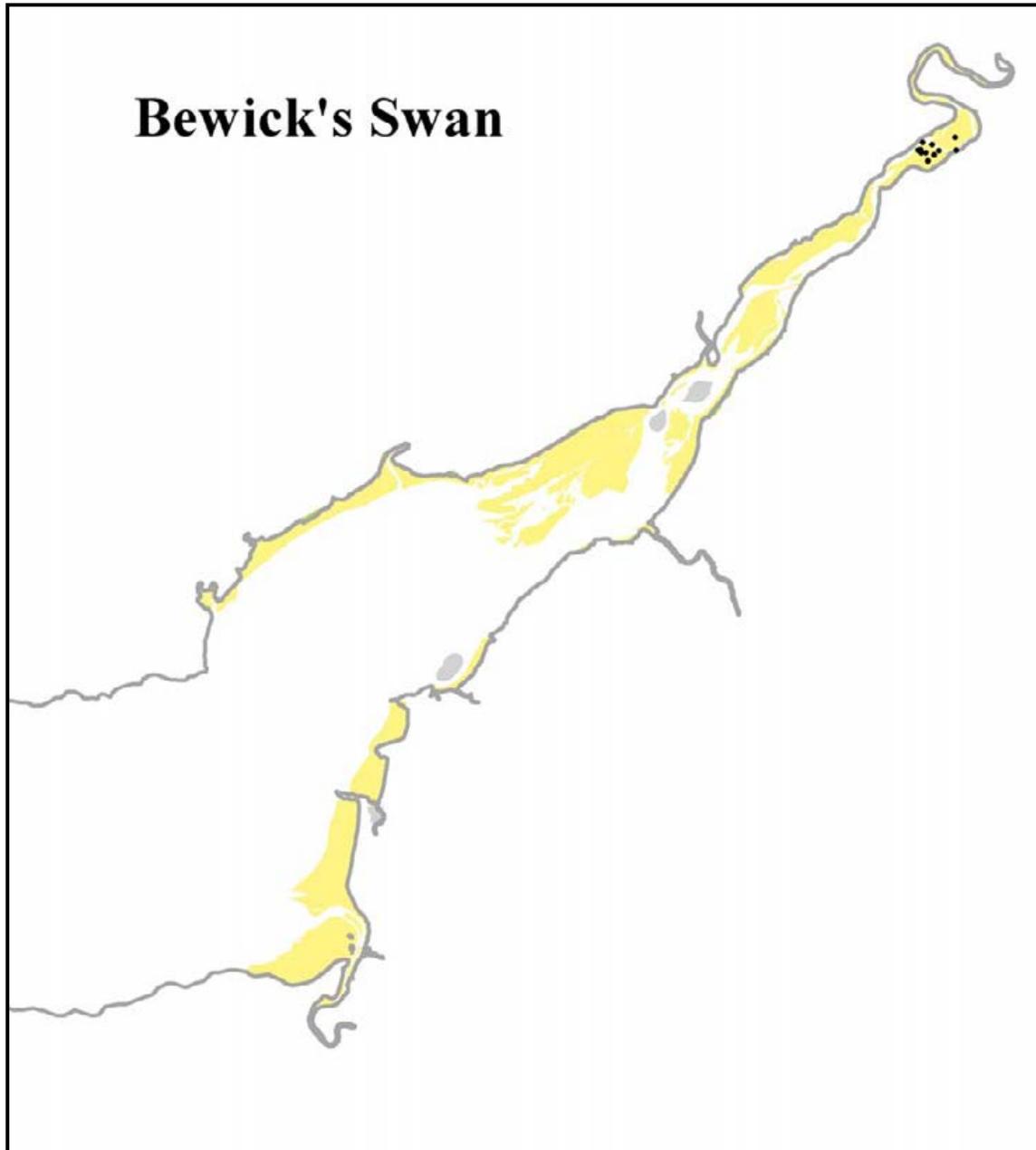


Figure 7.1.1 The mean numbers and distribution of Bewick's Swan on the Severn Estuary in the winters of 1987/88 to 1991/92, as shown by BTO low tide count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

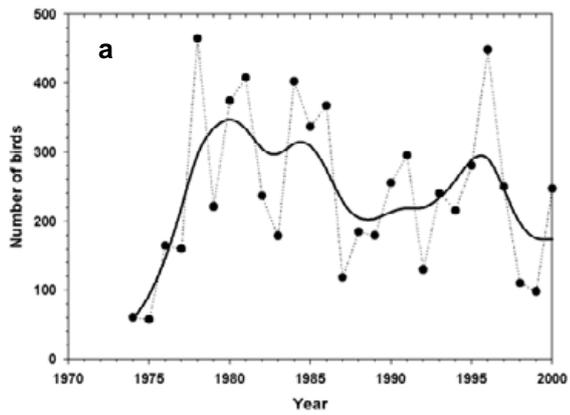


Figure 7.1.2 Trends in the numbers of Bewick's Swan on sub-sites of the Severn Estuary as shown by WeBS Core Count data.

a = Severn Gloucestershire.

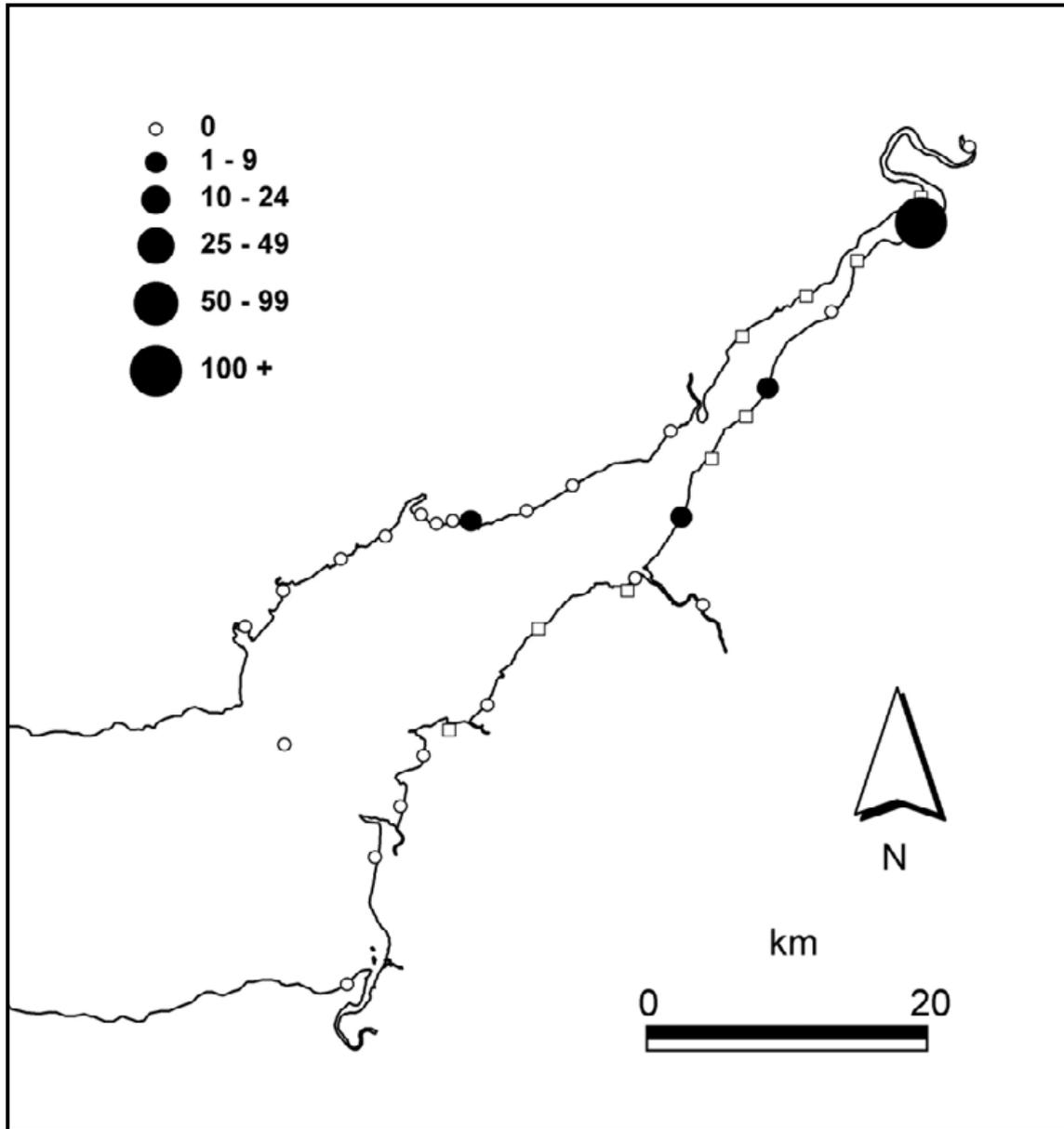


Figure 7.1.3 The mean numbers and distribution of Bewick's Swan on the Severn Estuary in the winter, as shown by data from WeBS Core Counts (1996/97 to 2000/01). Open squares indicate sites not covered.

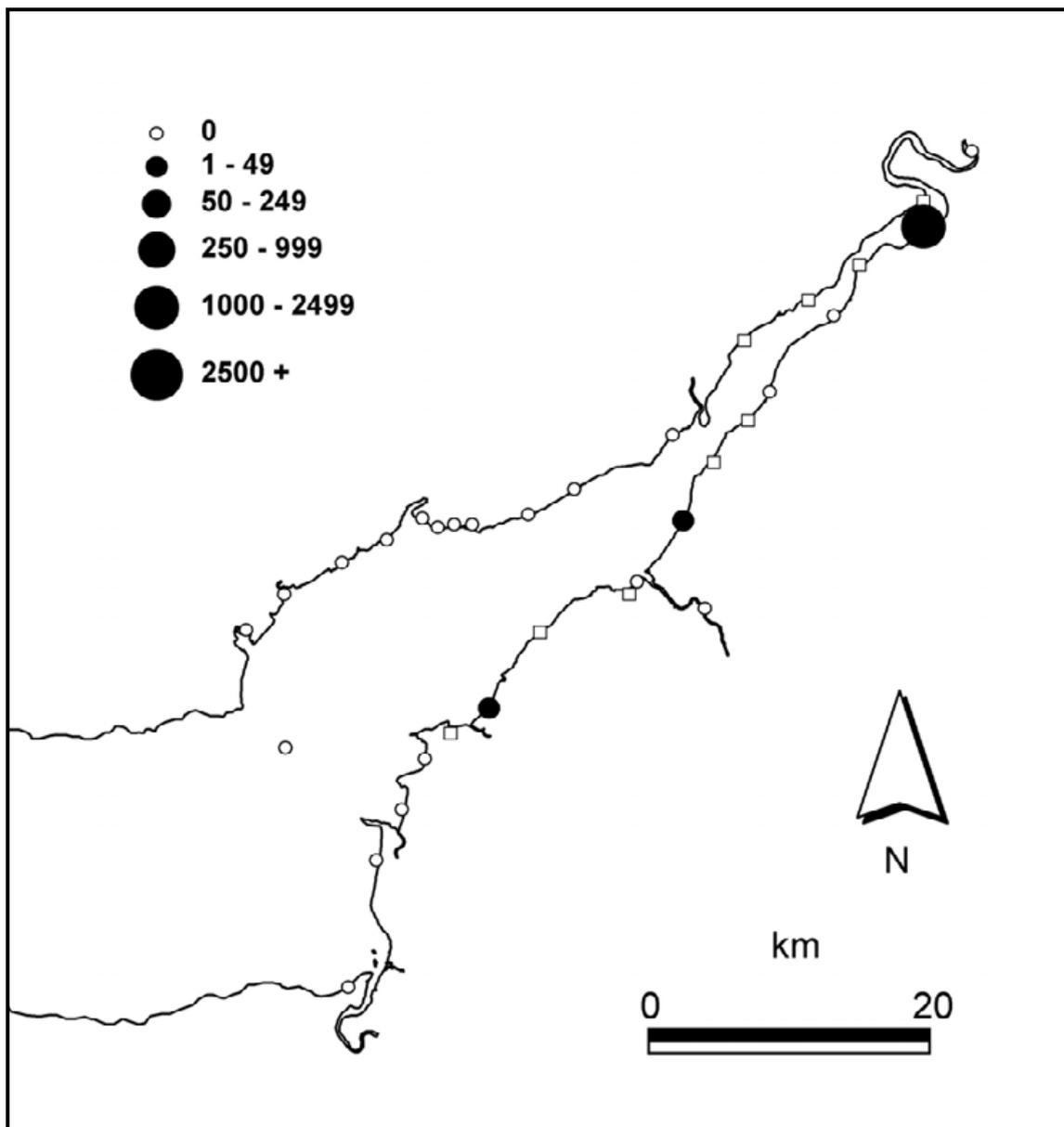


Figure 7.2.1 The mean numbers and distribution of European White-fronted Goose on the Severn Estuary in the winter, as shown by data from WeBS Core Counts (1996/97 to 2000/01). Open squares indicate sites not covered.

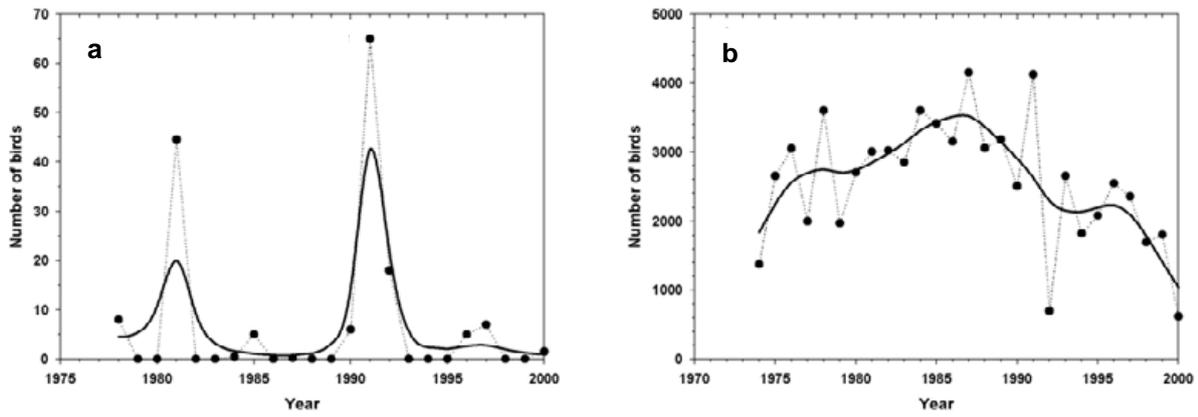


Figure 7.2.2 Trends in the numbers of European White Fronted Geese on sub-sites of the Severn Estuary as shown by WeBS Core Count data.

a = Severn Avon; b = Severn Gloucestershire.

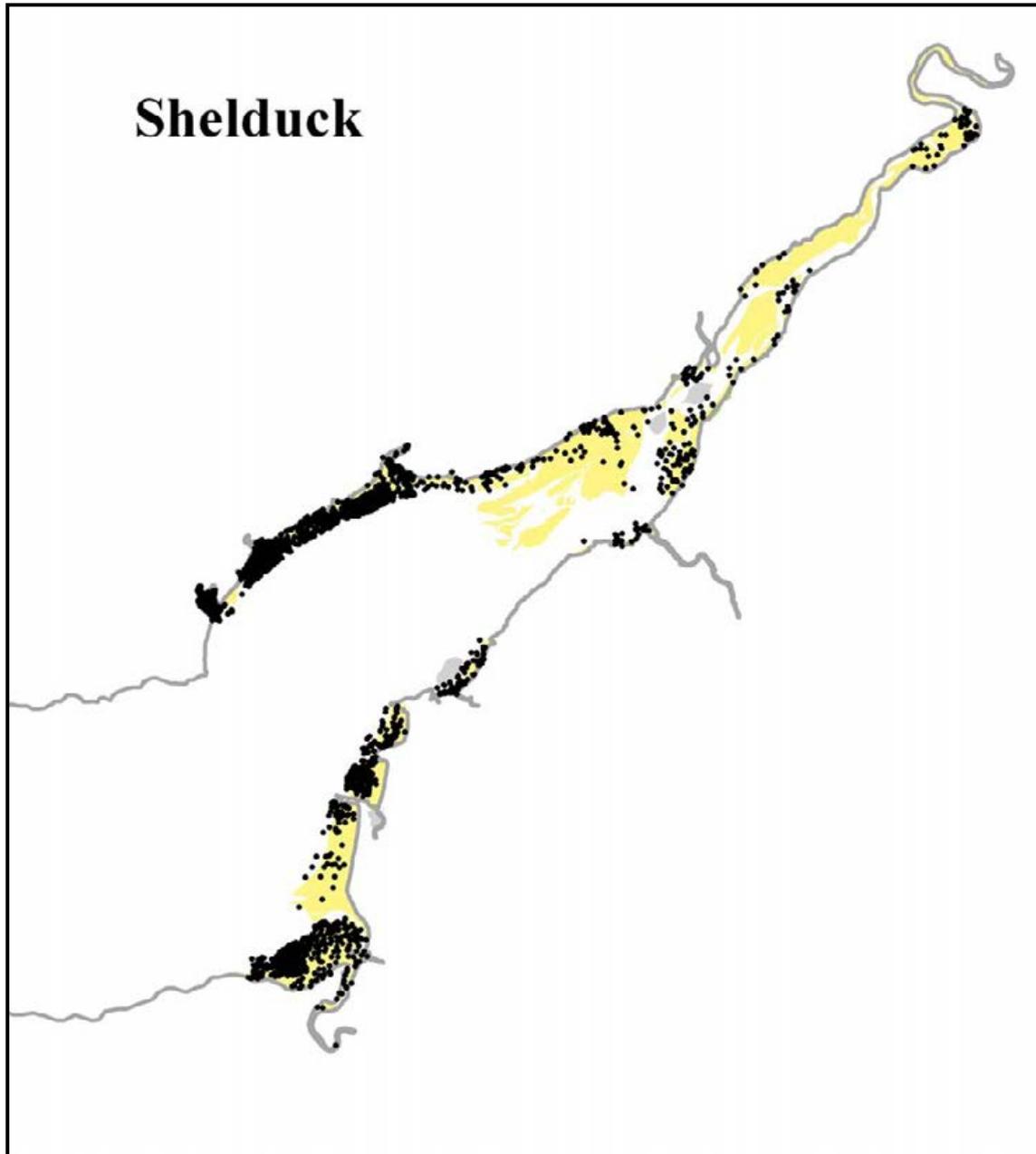


Figure 7.3.1 The mean numbers and distribution of Shelduck on the Severn Estuary in the winters of 1987/88 to 1991/92, as shown by BTO low tide count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

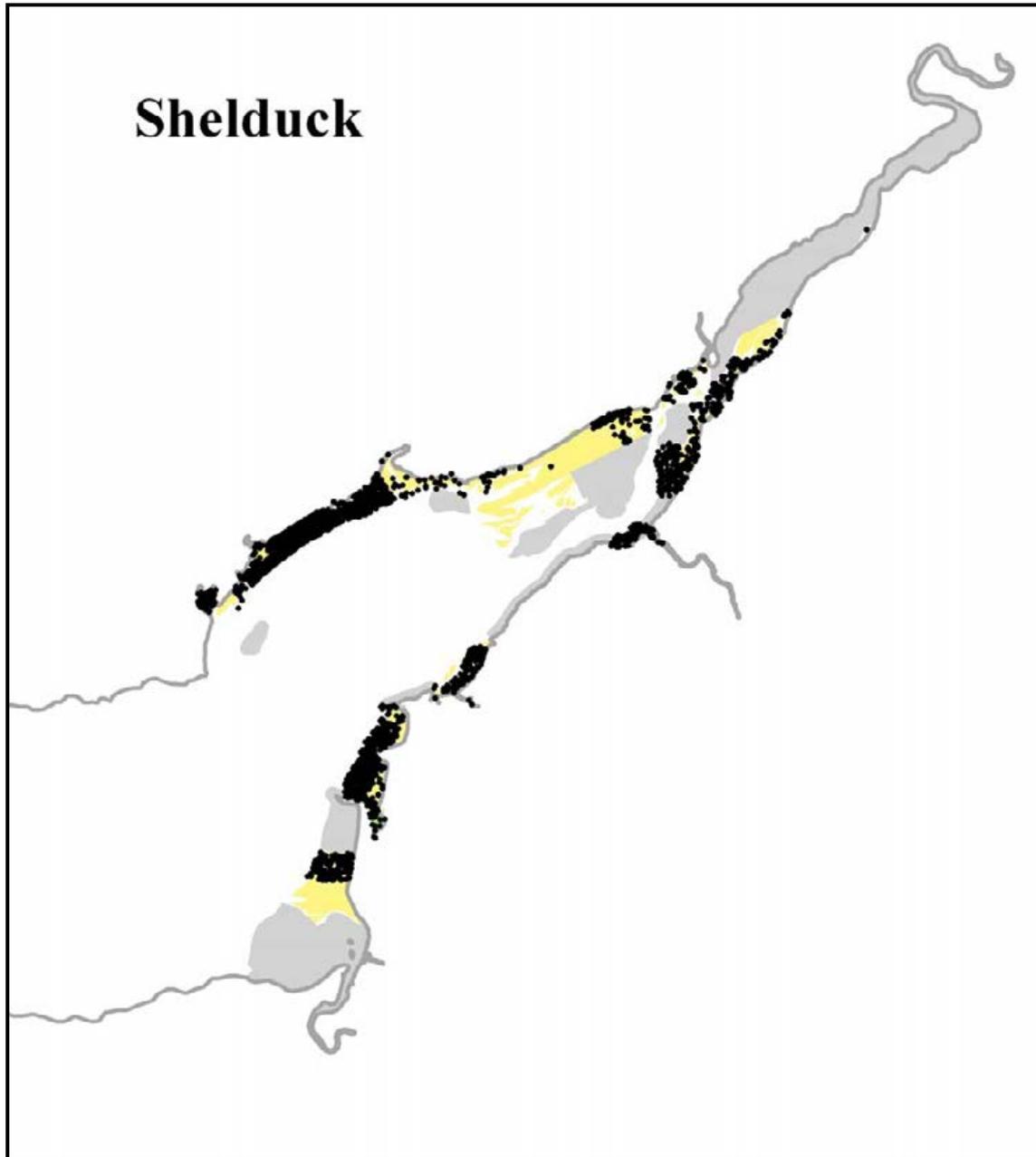


Figure 7.3.2 The mean numbers and distribution of Shelduck on the Severn Estuary in the winter of 1998/99, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

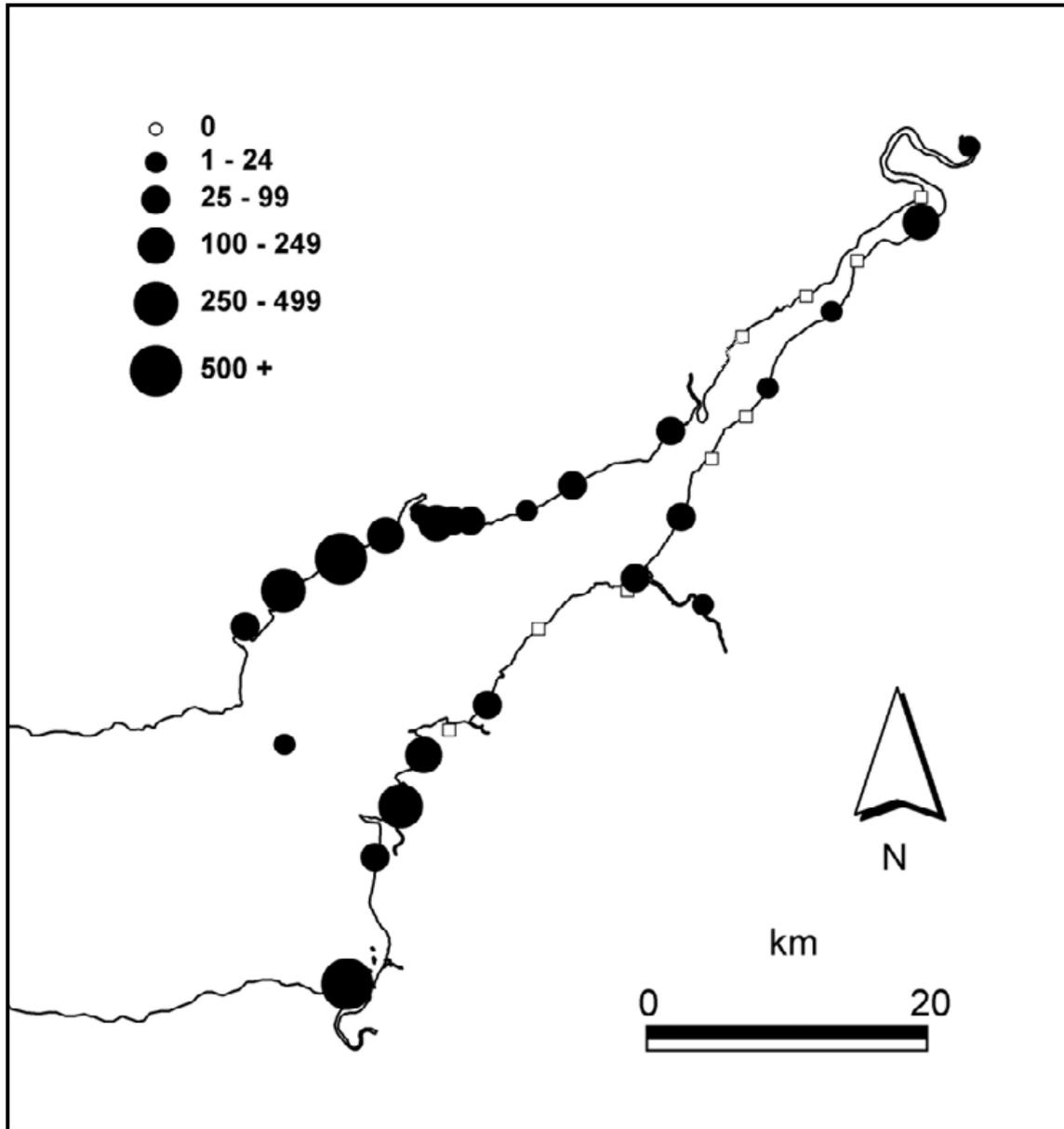


Figure 7.3.3 The mean numbers and distribution of Shelduck on the Severn Estuary in the winter, as shown by data from WeBS Core Counts (1996/97 to 2000/01). Open squares indicate sites not covered.

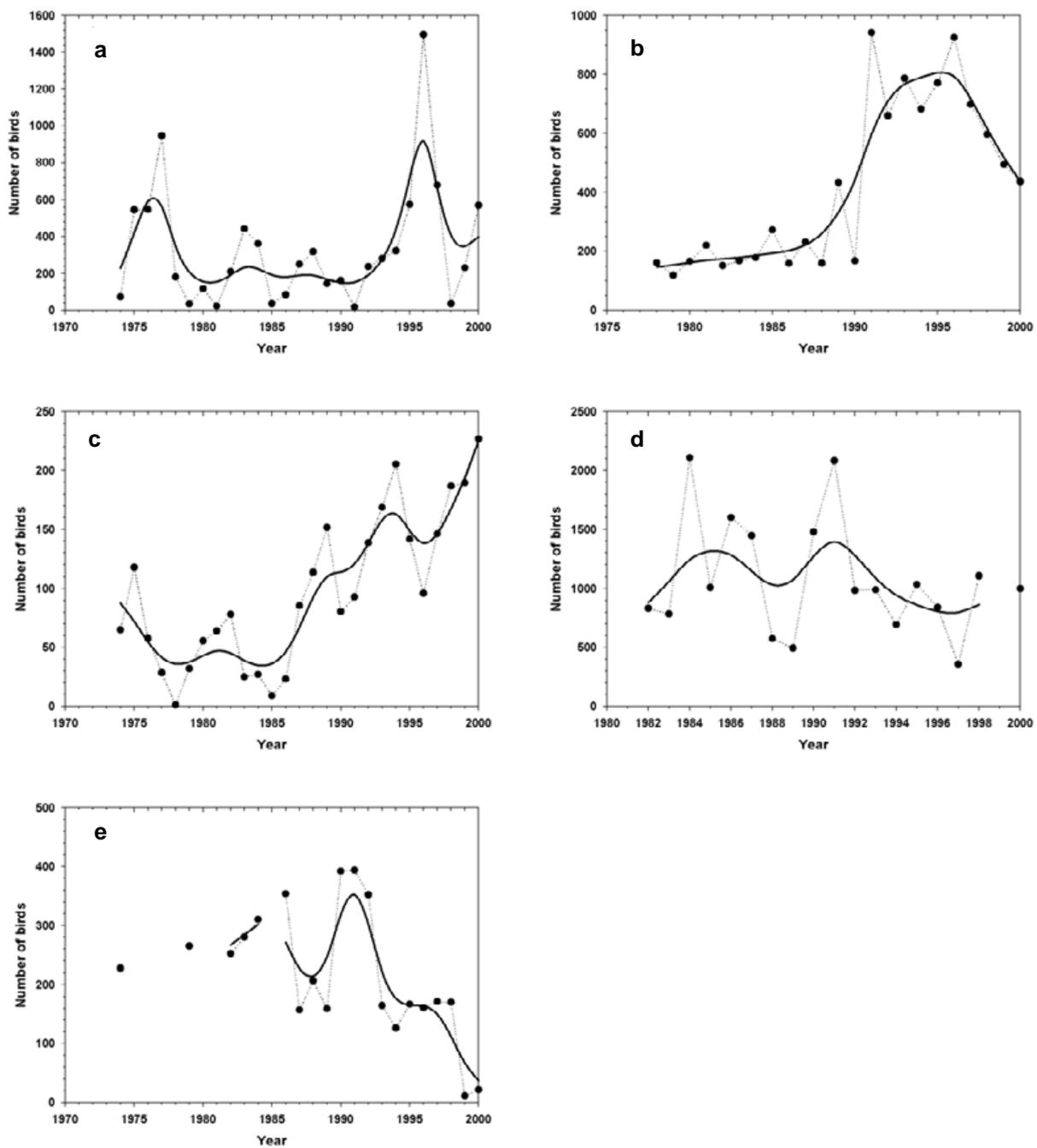


Figure 7.3.4 Trends in the numbers of Shelduck on sub-sites of the Severn Estuary as shown by WeBS Core Count data.

a = Severn Bridgwater; b = Severn Avon; c = Severn Gloucestershire; d = Gwent Severn; e = Cardiff Bay.

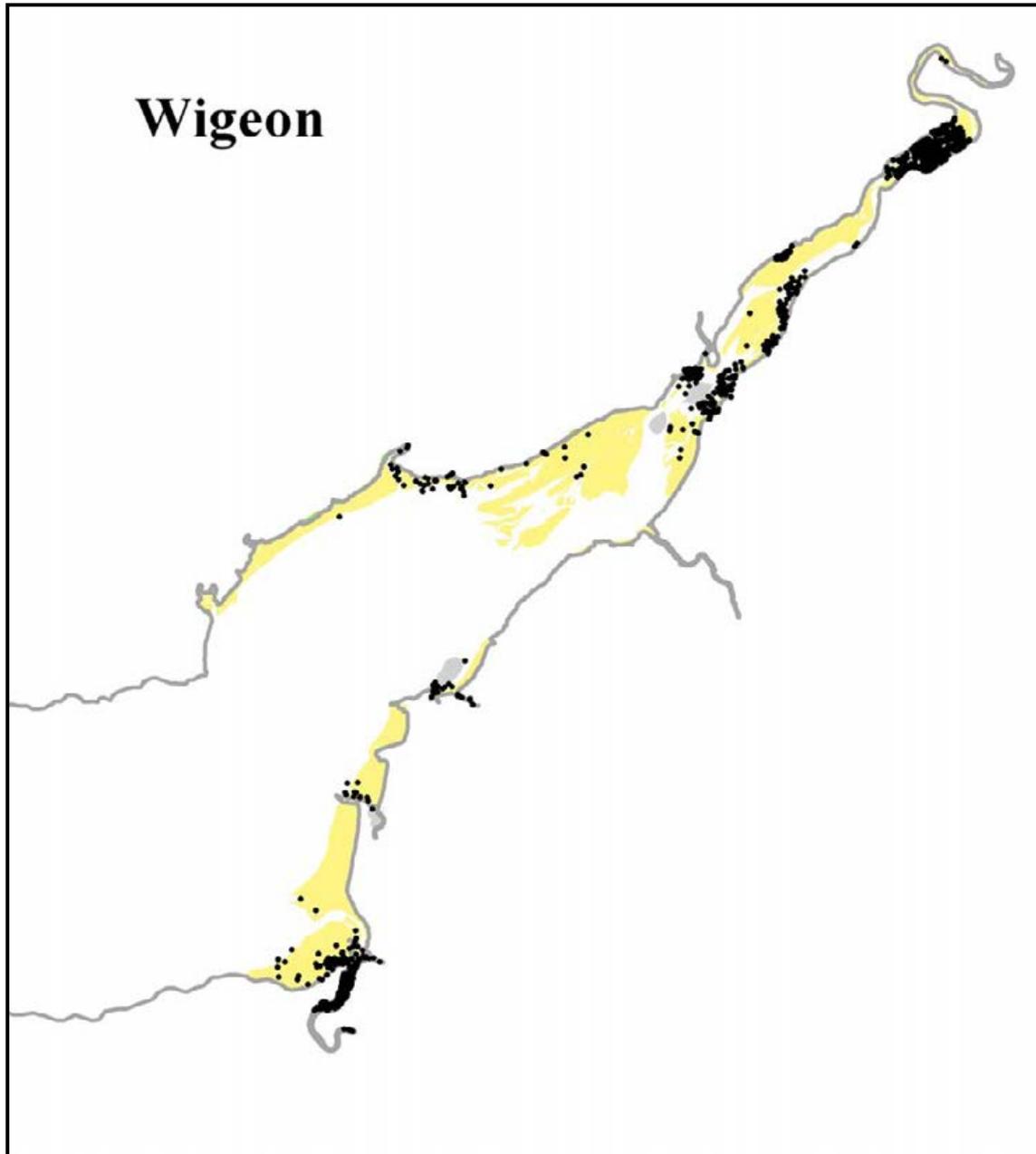


Figure 7.4.1 The mean numbers and distribution of Wigeon on the Severn Estuary in the winters of 1987/88 to 1991/92, as shown by BTO low tide count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

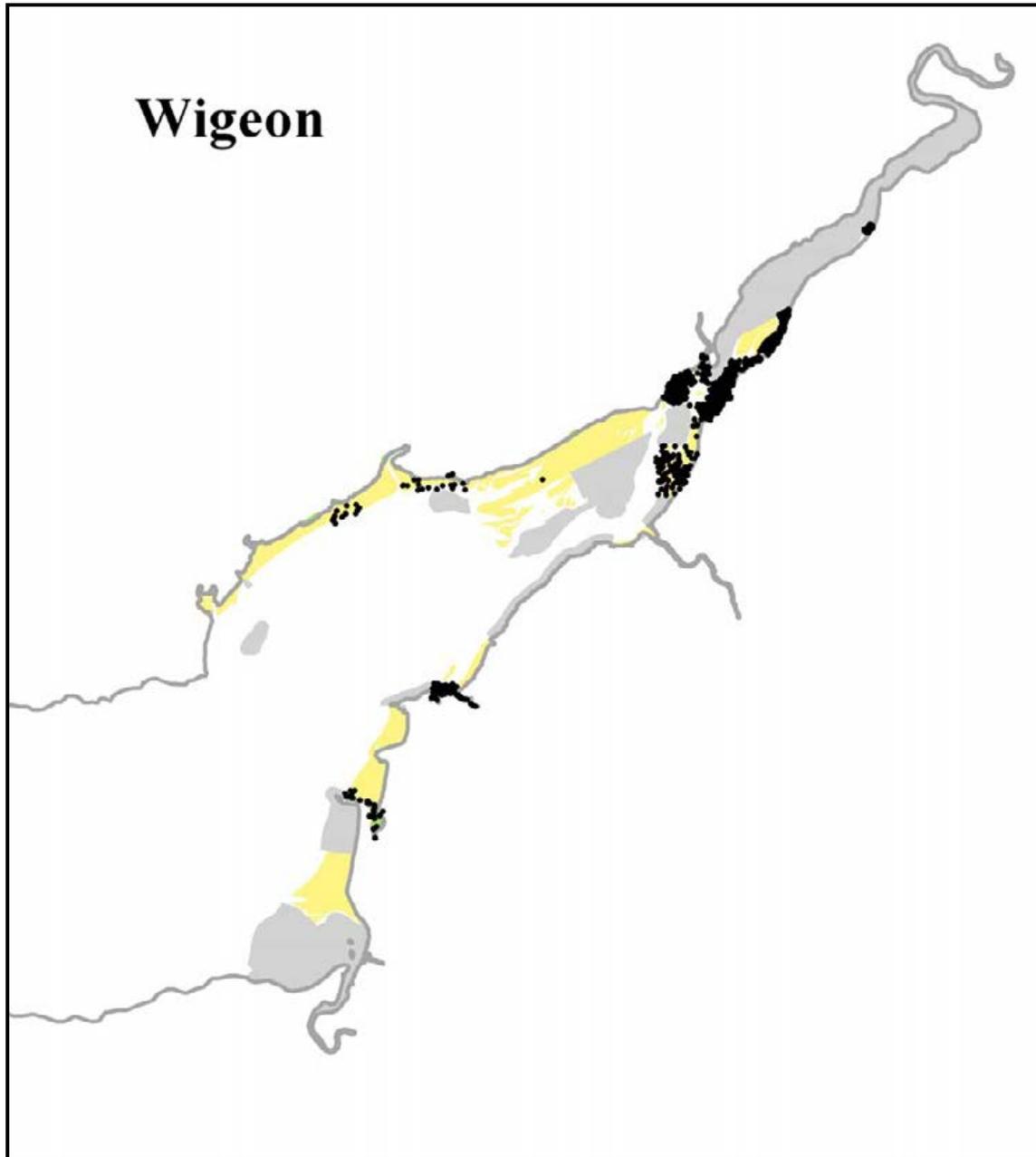


Figure 7.4.2 The mean numbers and distribution of Wigeon on the Severn Estuary in the winter of 1998/99, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

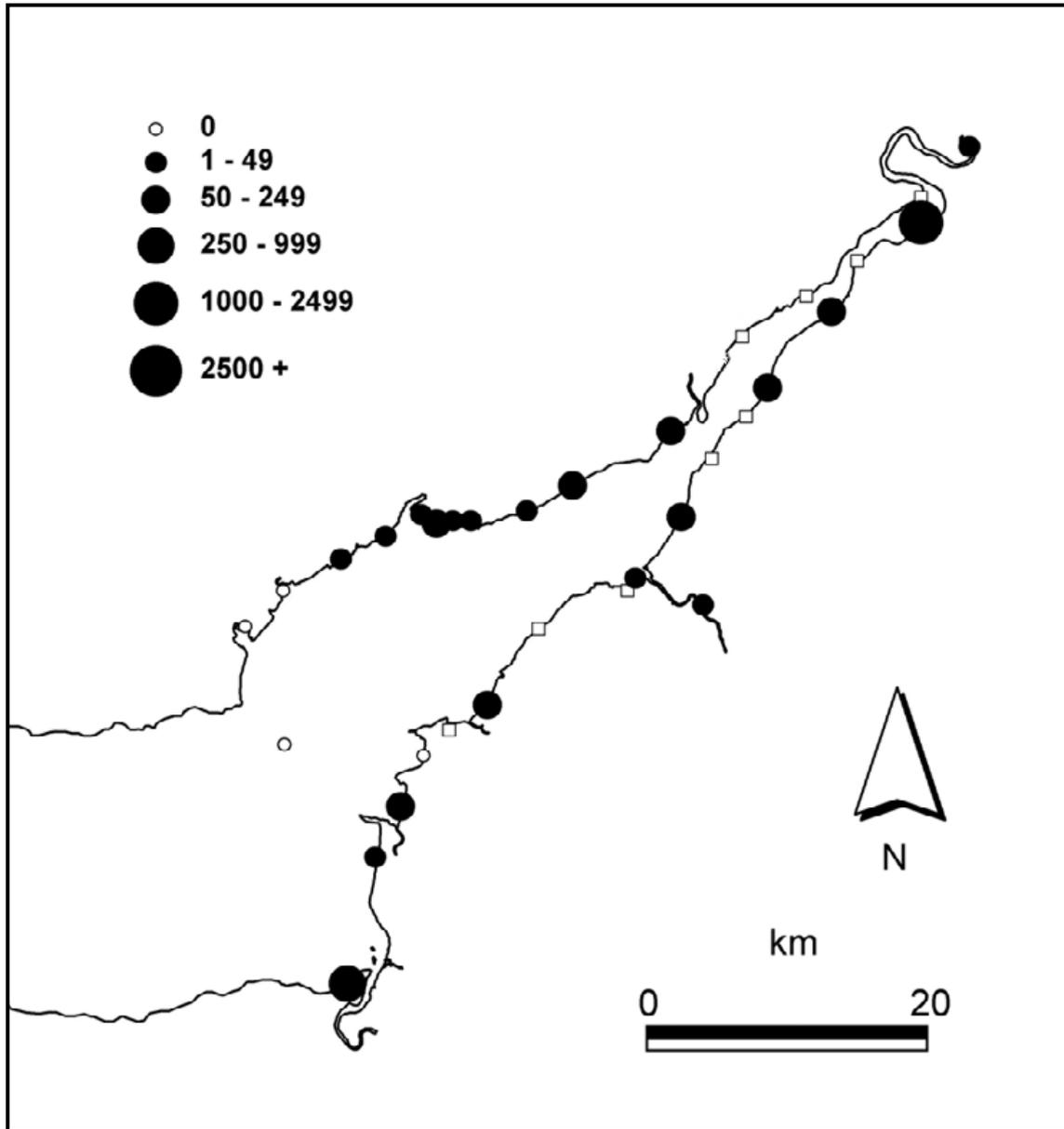


Figure 7.4.3 The mean numbers and distribution of Wigeon on the Severn Estuary in the winter, as shown by data from WeBS Core Counts (1996/97 to 2000/01). Open squares indicate sites not covered.

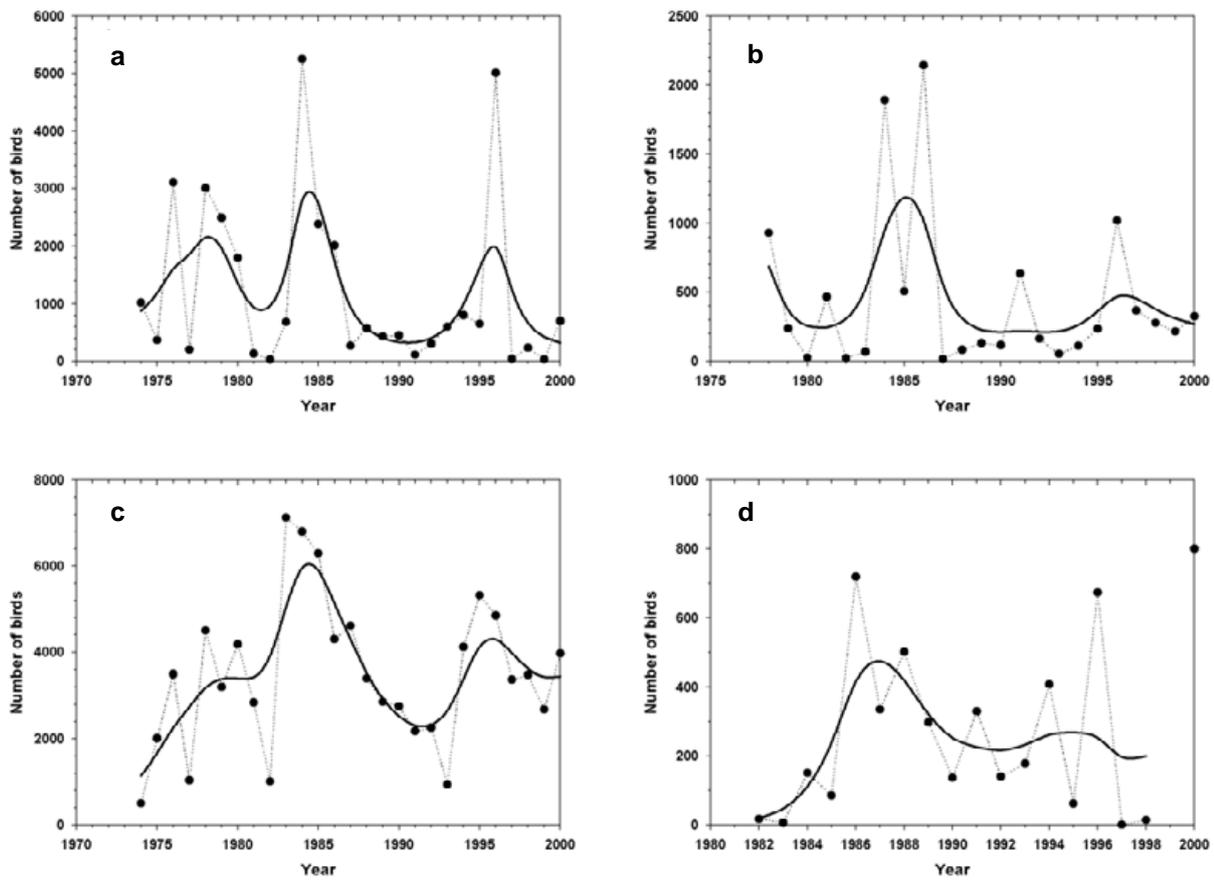


Figure 7.4.4 Wigeon.

a = Severn Bridgwater; b = Severn Avon; c = Severn Gloucestershire; d = Gwent Severn.

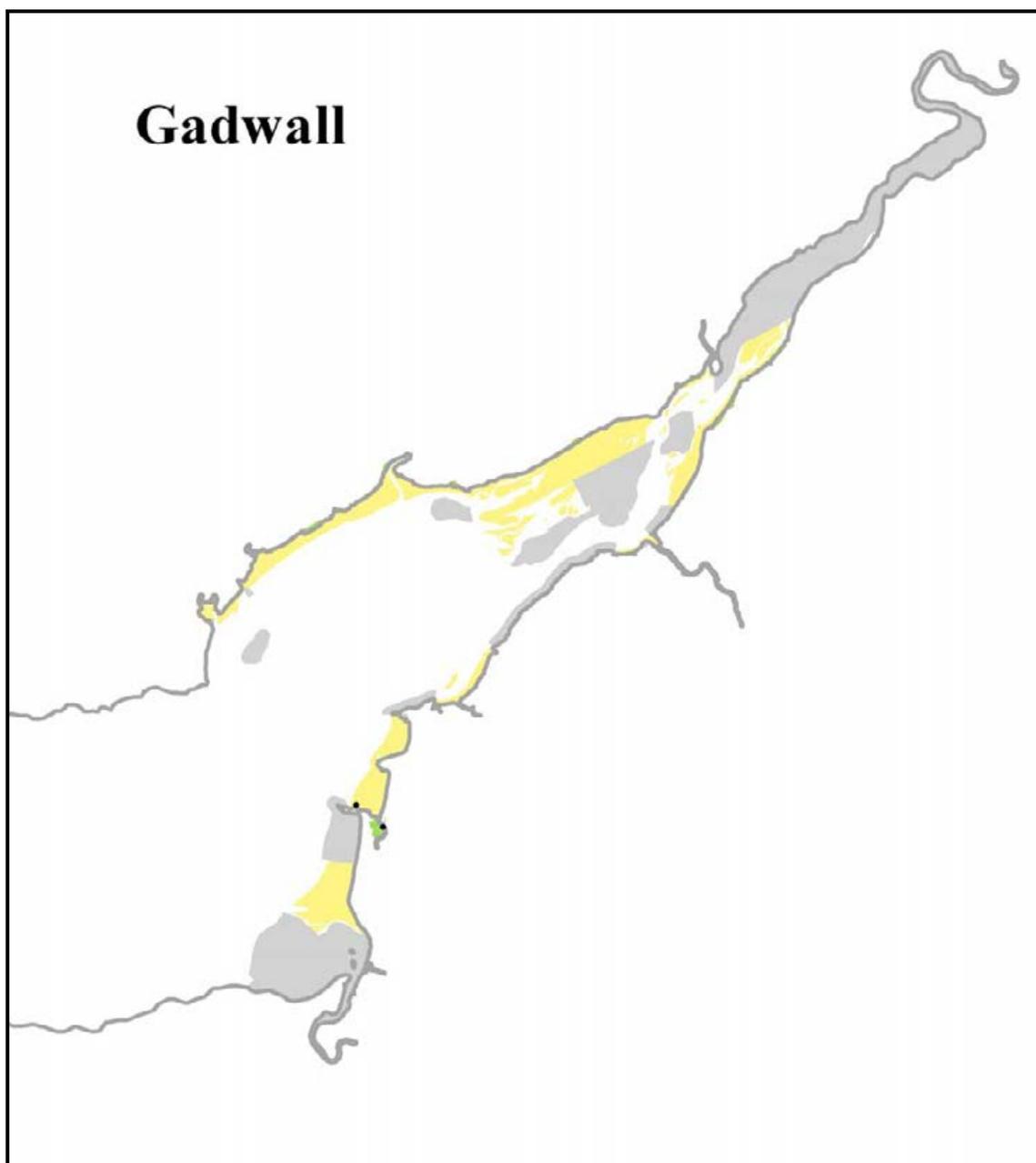


Figure 7.5.1 The mean numbers and distribution of Gadwall on the Severn Estuary in the winter of 1998/99, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

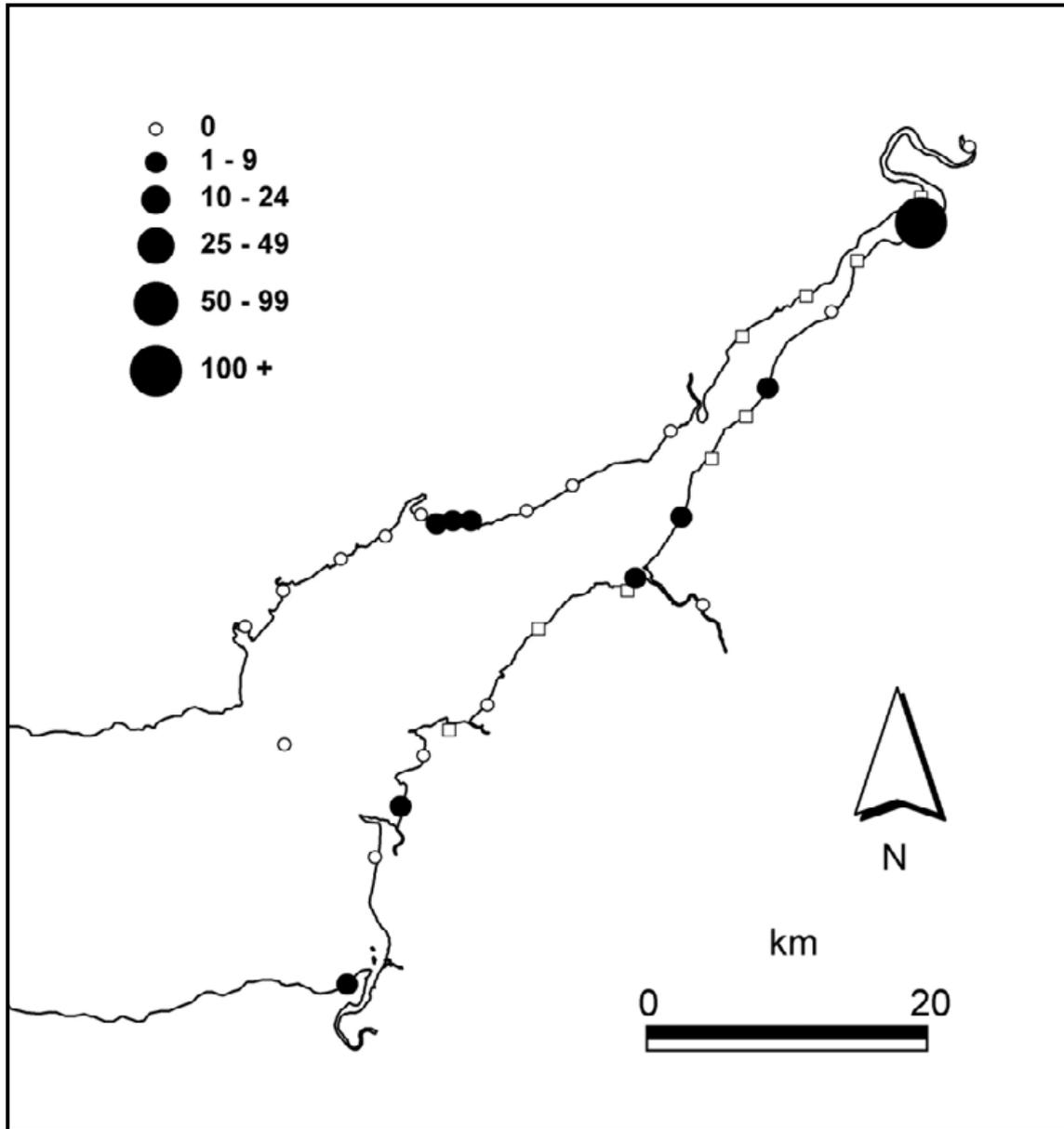


Figure 7.5.2 The mean numbers and distribution of Gadwall on the Severn Estuary in the winter, as shown by data from WeBS Core Counts (1996/97 to 2000/01). Open squares indicate sites not covered.

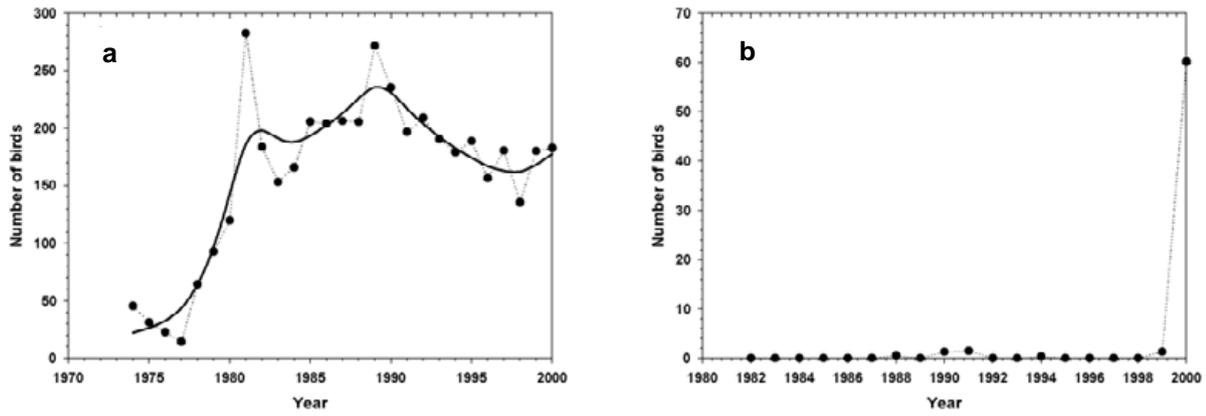


Figure 7.5.3 Trends in the numbers of Gadwall on sub-sites of the Severn Estuary as shown by WeBS Core Count data.

a = Severn Gloucestershire; b = Gwent Severn.

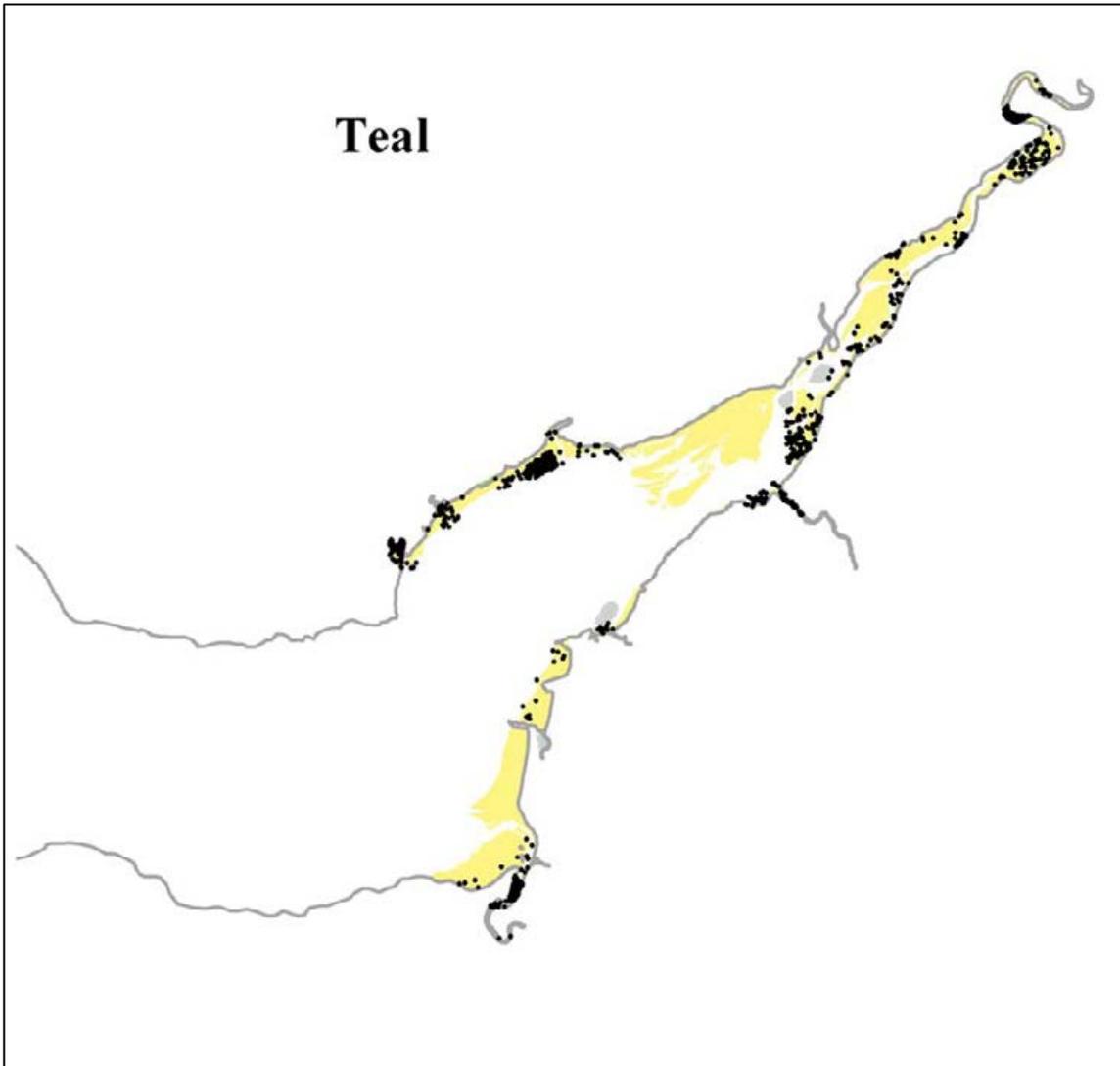


Figure 7.6.1 The mean numbers and distribution of Teal on the Severn Estuary in the winters of 1987/88 to 1991/92, as shown by BTO low tide count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

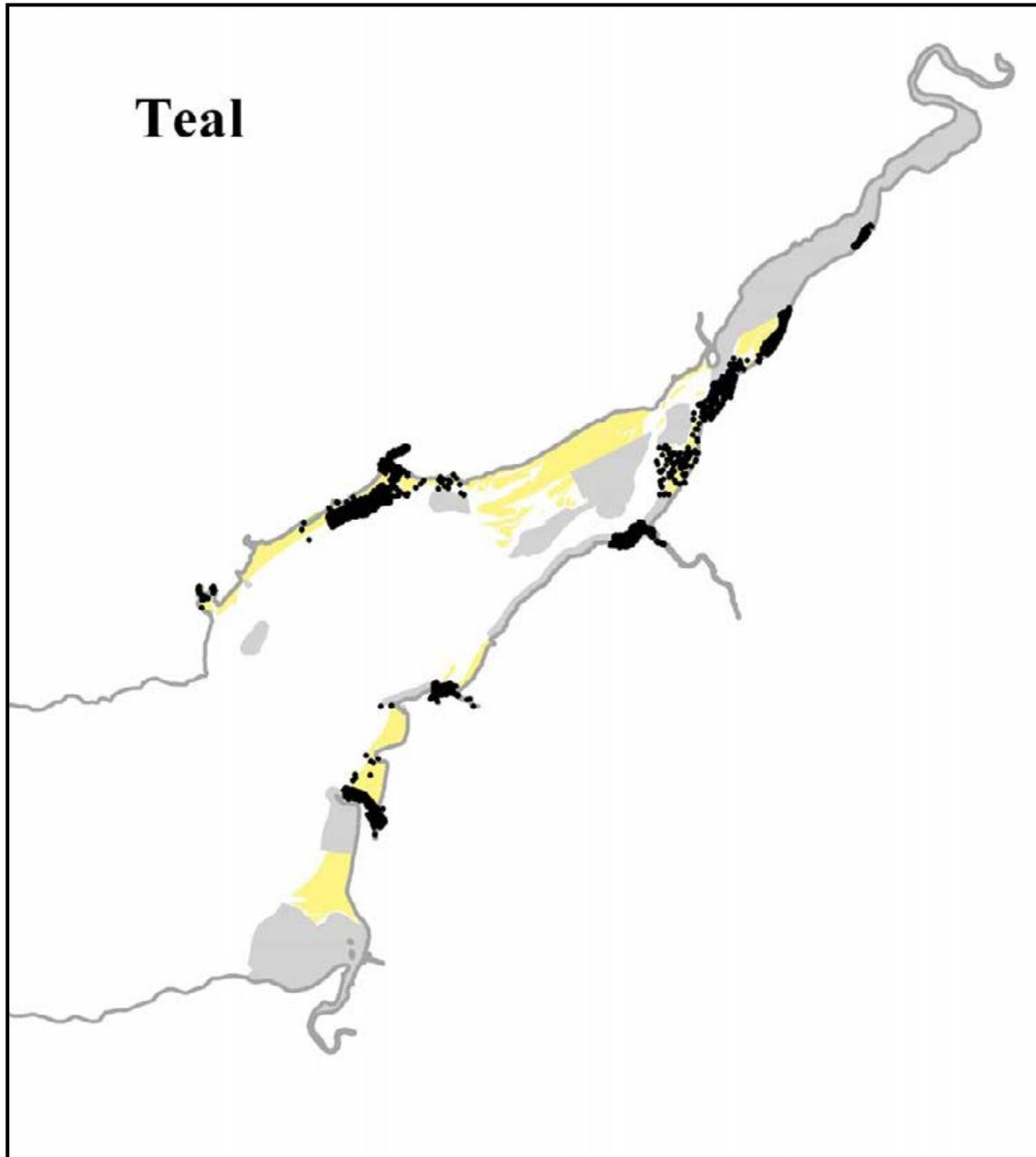


Figure 7.6.2 The mean numbers and distribution of Teal on the Severn Estuary in the winter of 1998/99, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

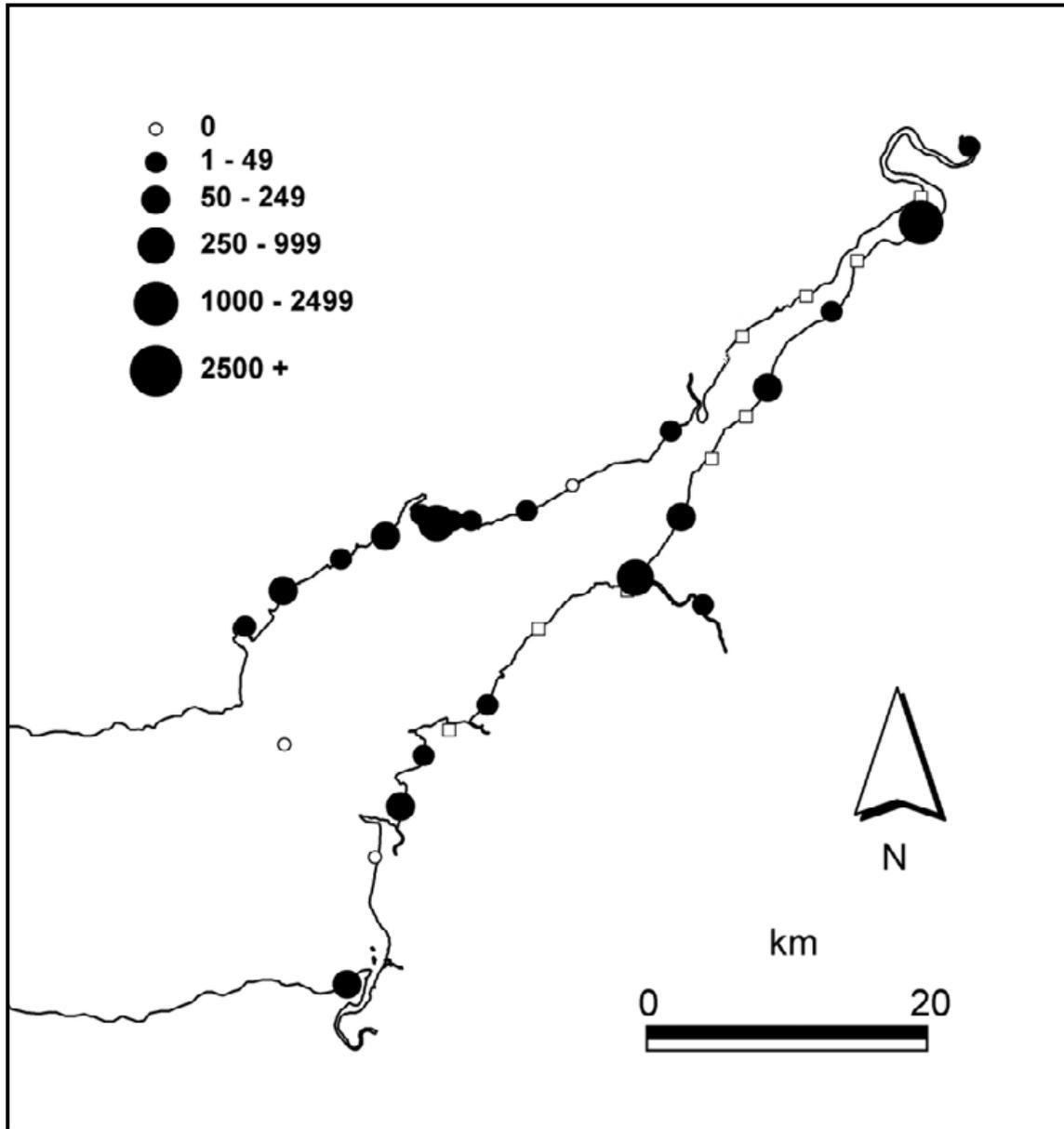


Figure 7.6.3 The mean numbers and distribution of Teal on the Severn Estuary in the winter, as shown by data from WeBS Core Counts (1996/97 to 2000/01). Open squares indicate sites not covered.

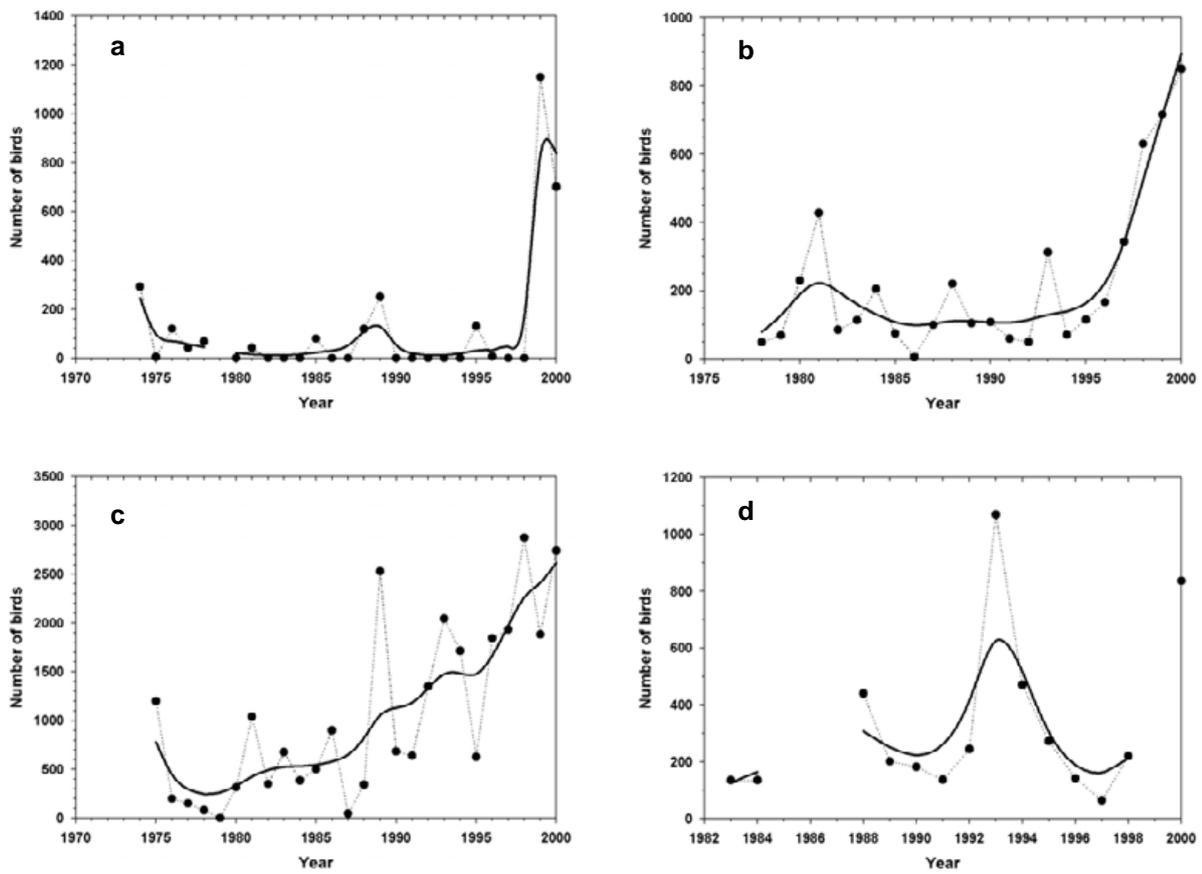


Figure 7.6.4 Trends in the numbers of Teal on sub-sites of the Severn Estuary as shown by WeBS Core Count data

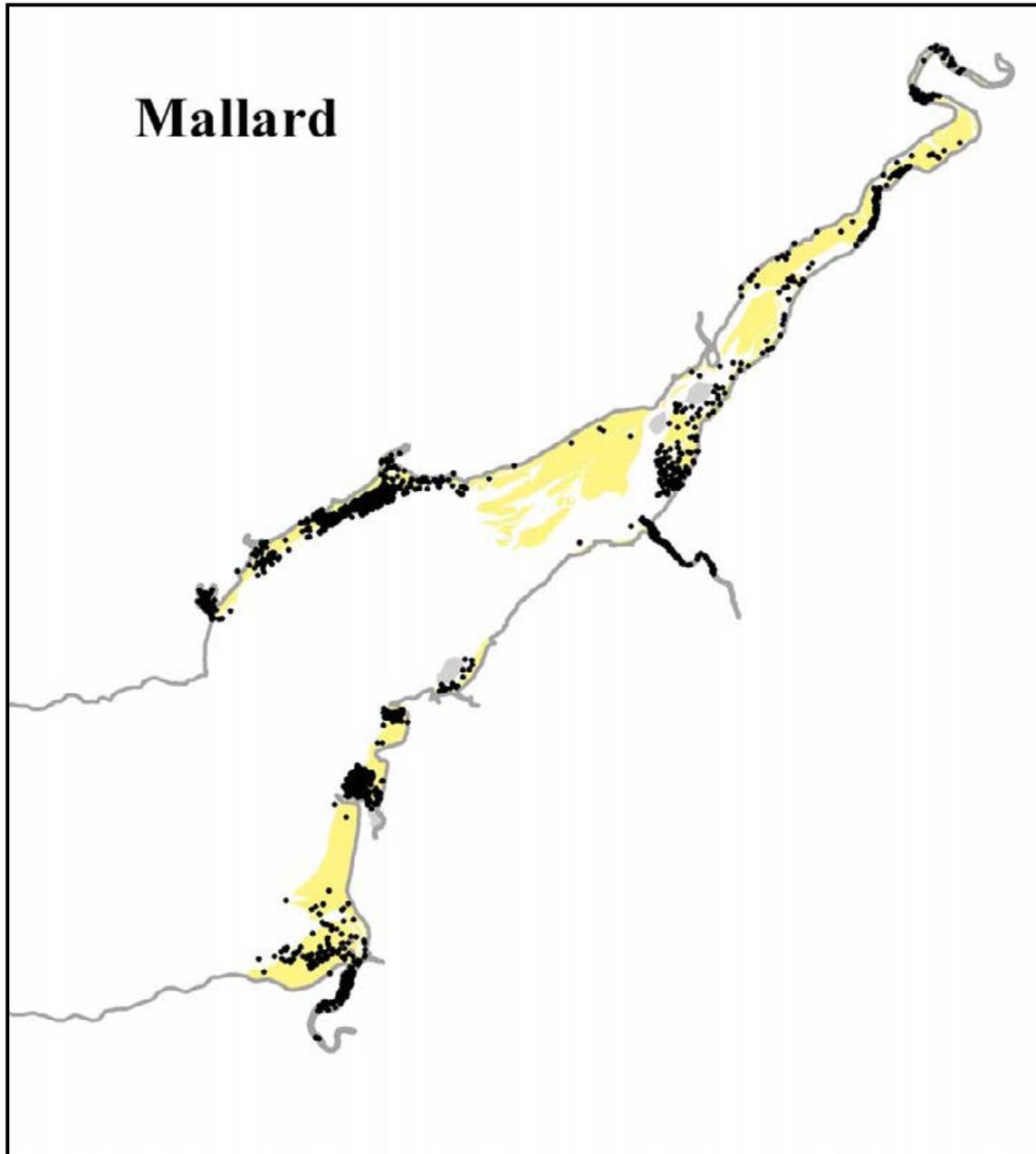


Figure 7.7.1 The mean numbers and distribution of Mallard on the Severn Estuary in the winters of 1987/88 to 1991/92, as shown by BTO low tide count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

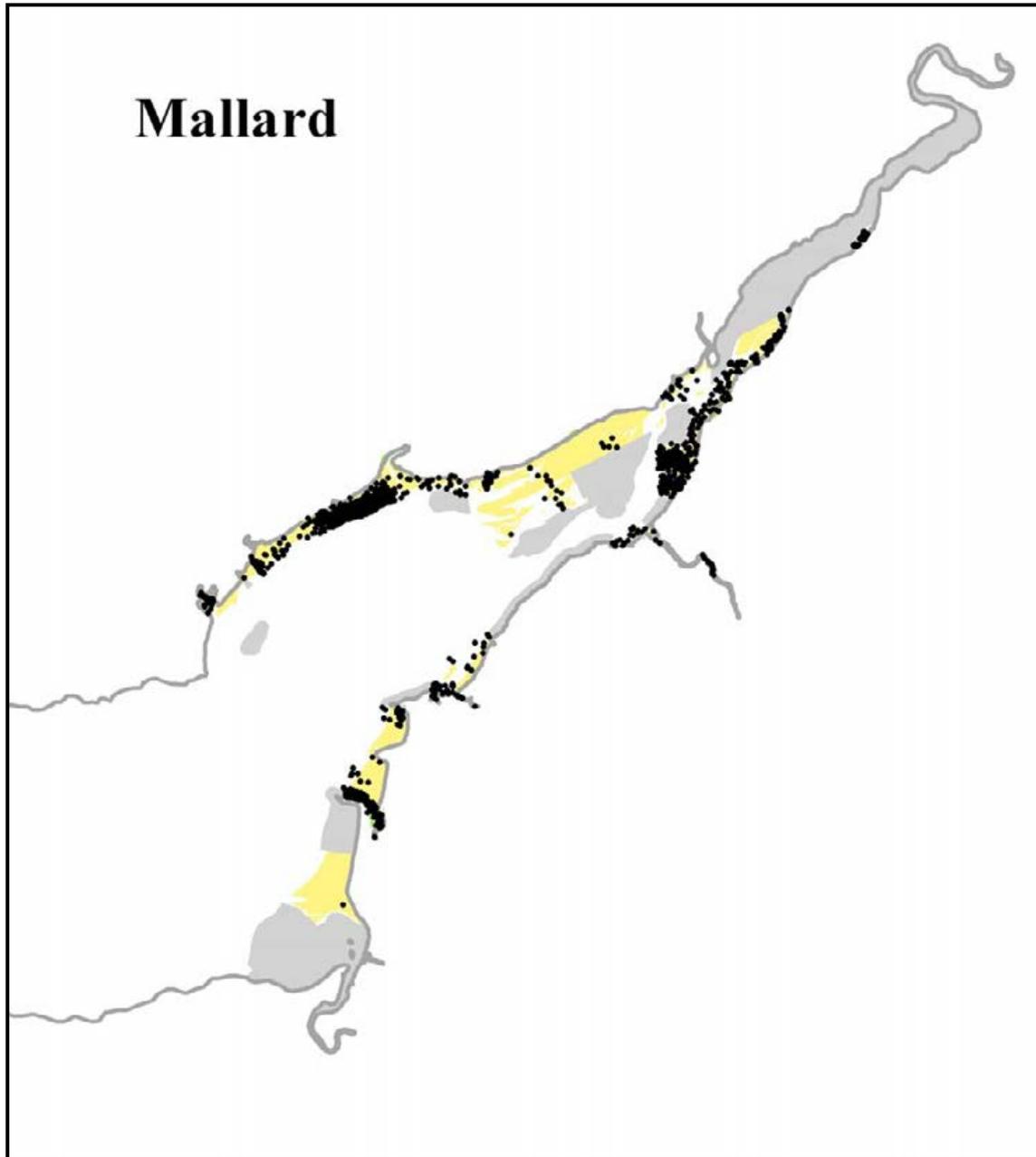


Figure 7.7.2 The mean numbers and distribution of Mallard on the Severn Estuary in the winter of 1998/99, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

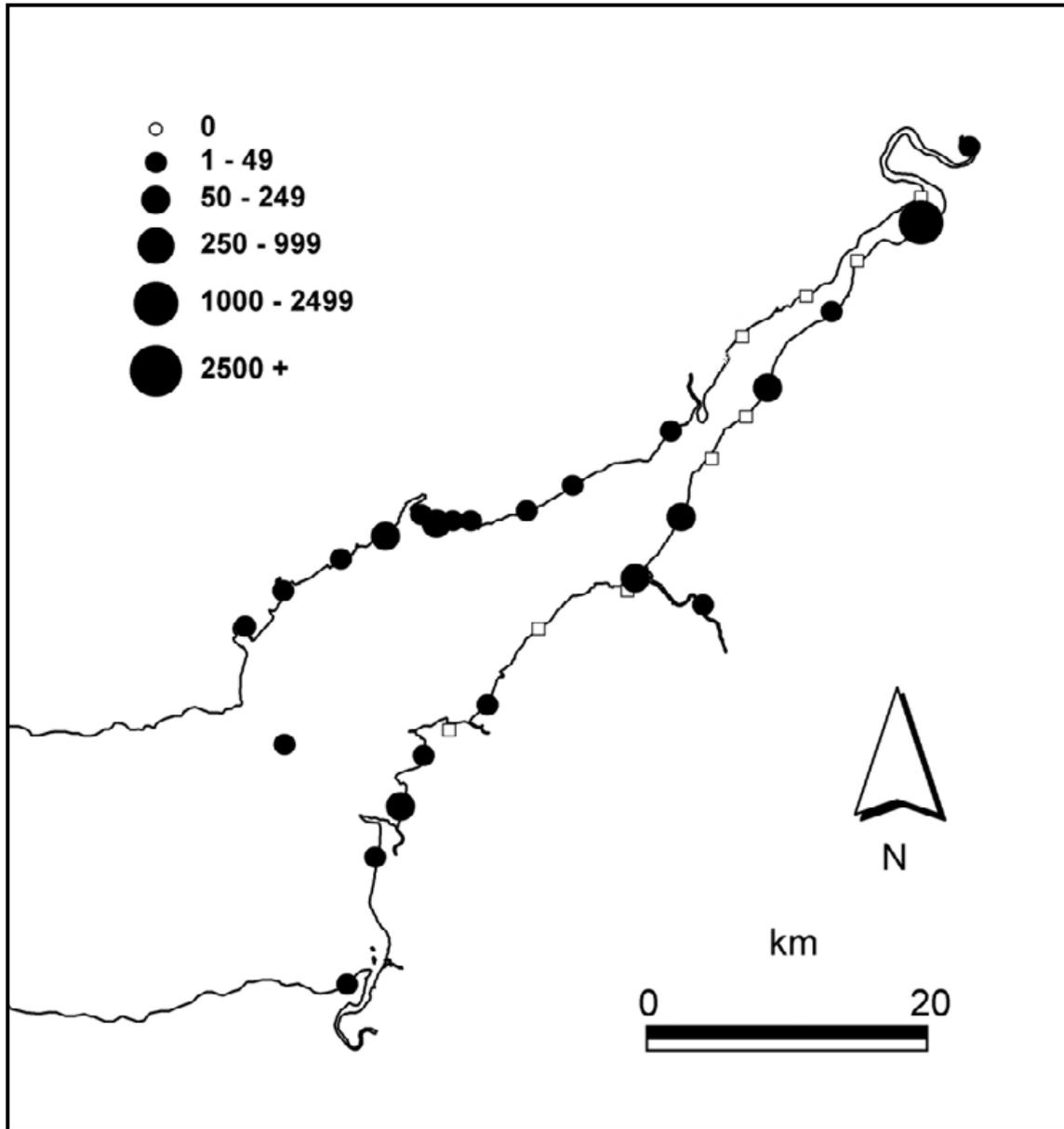


Figure 7.7.3 The mean numbers and distribution of Mallard on the Severn Estuary in the winter, as shown by data from WeBS Core Counts (1996/97 to 2000/01). Open squares indicate sites not covered.

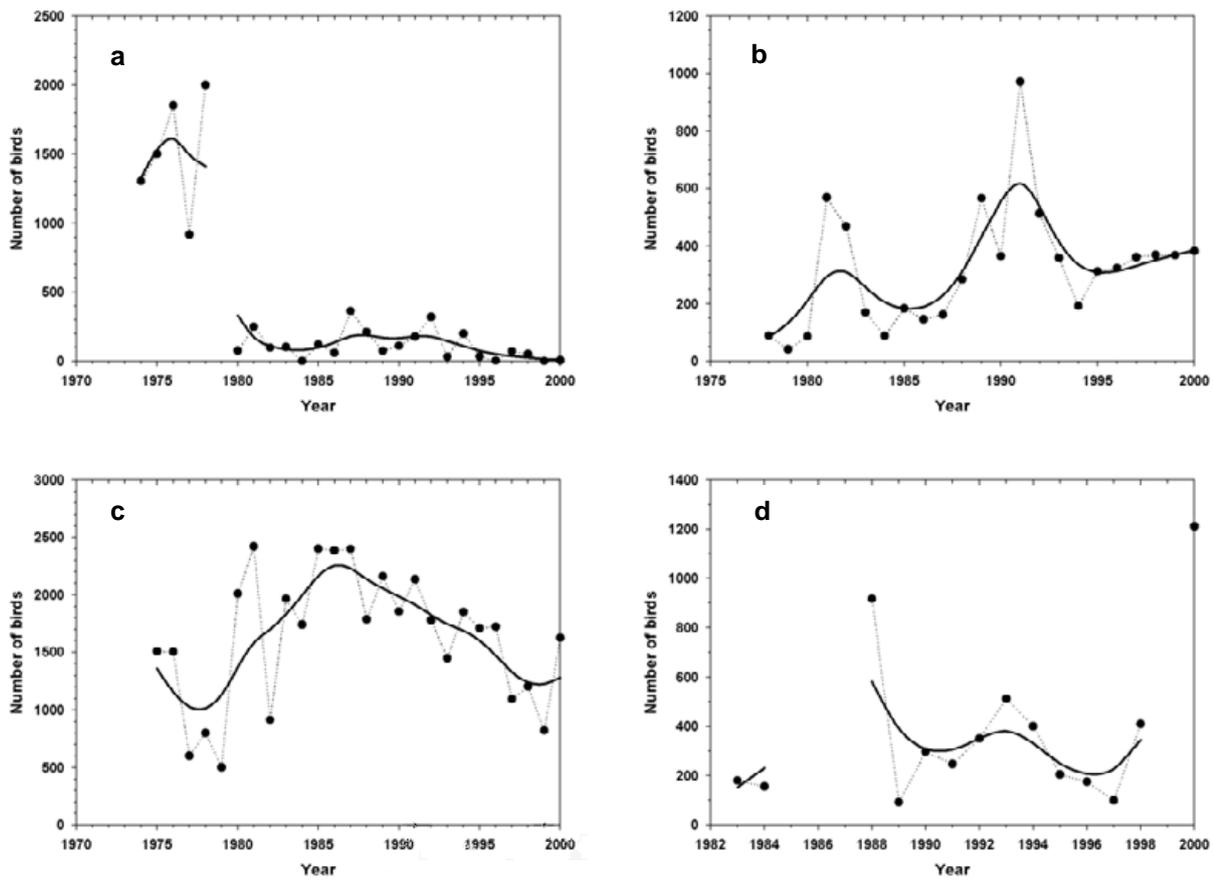


Figure 7.7.4 Trends in the numbers of Mallard on sub-sites of the Severn Estuary as shown by WeBS Core Count data

a = Severn Bridgwater; b = Severn Avon; c = Severn Gloucestershire; d = Gwent Severn.

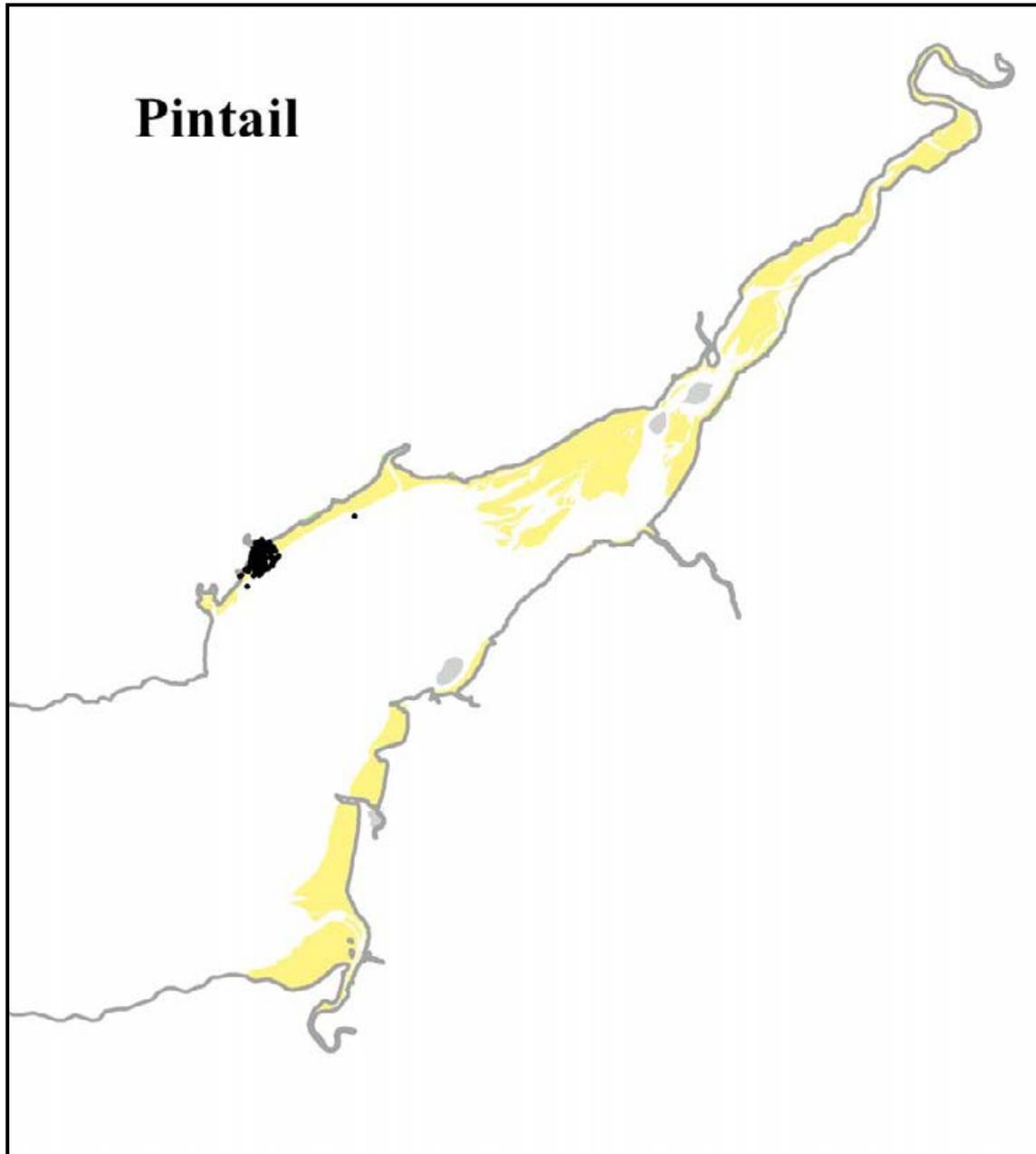


Figure 7.8.1 The mean numbers and distribution of Pintail on the Severn Estuary in the winters of 1987/88 to 1991/92, as shown by BTO low tide count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

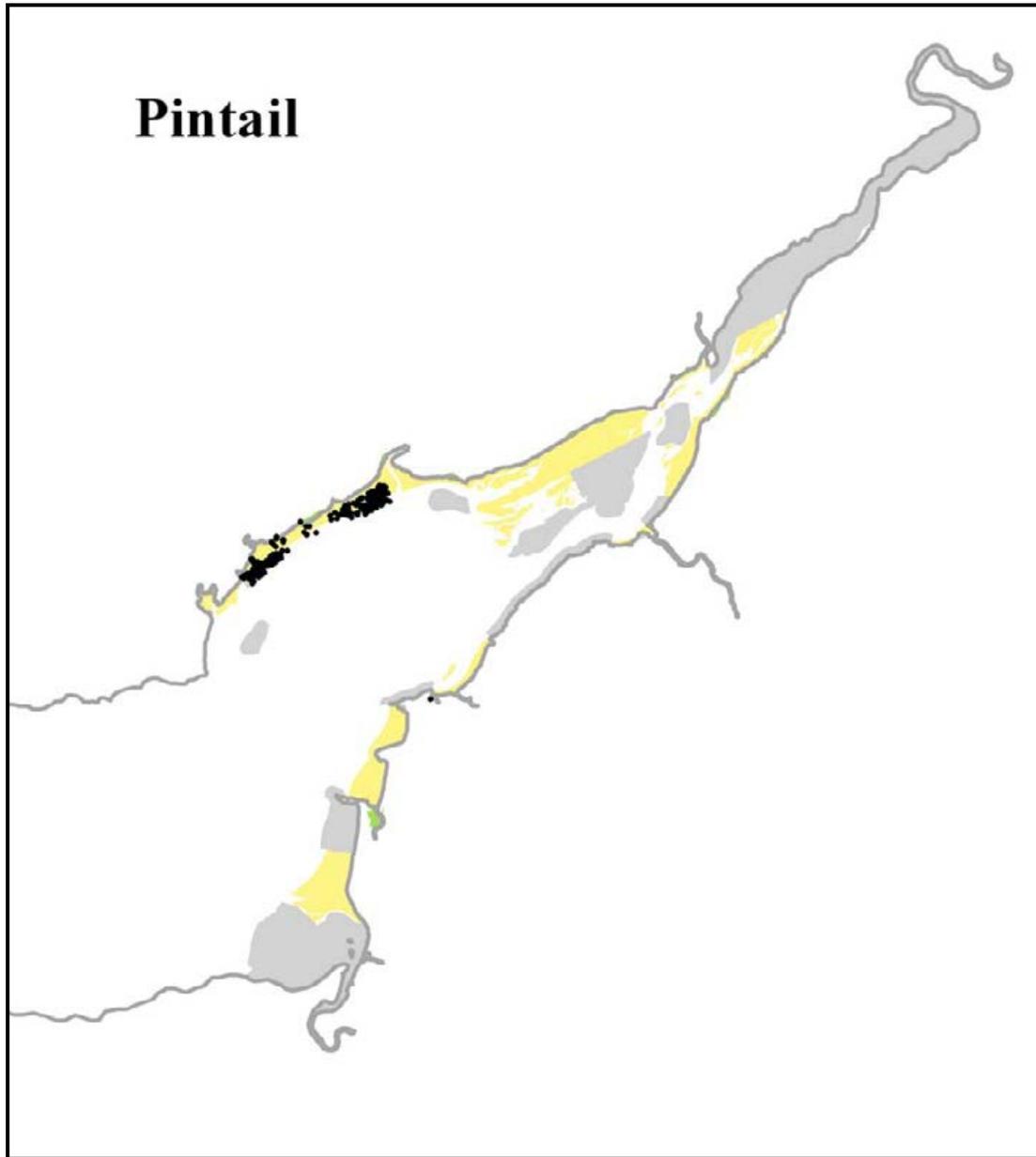


Figure 7.8.2 The mean numbers and distribution of Pintail on the Severn Estuary in the winter of 1998/99, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

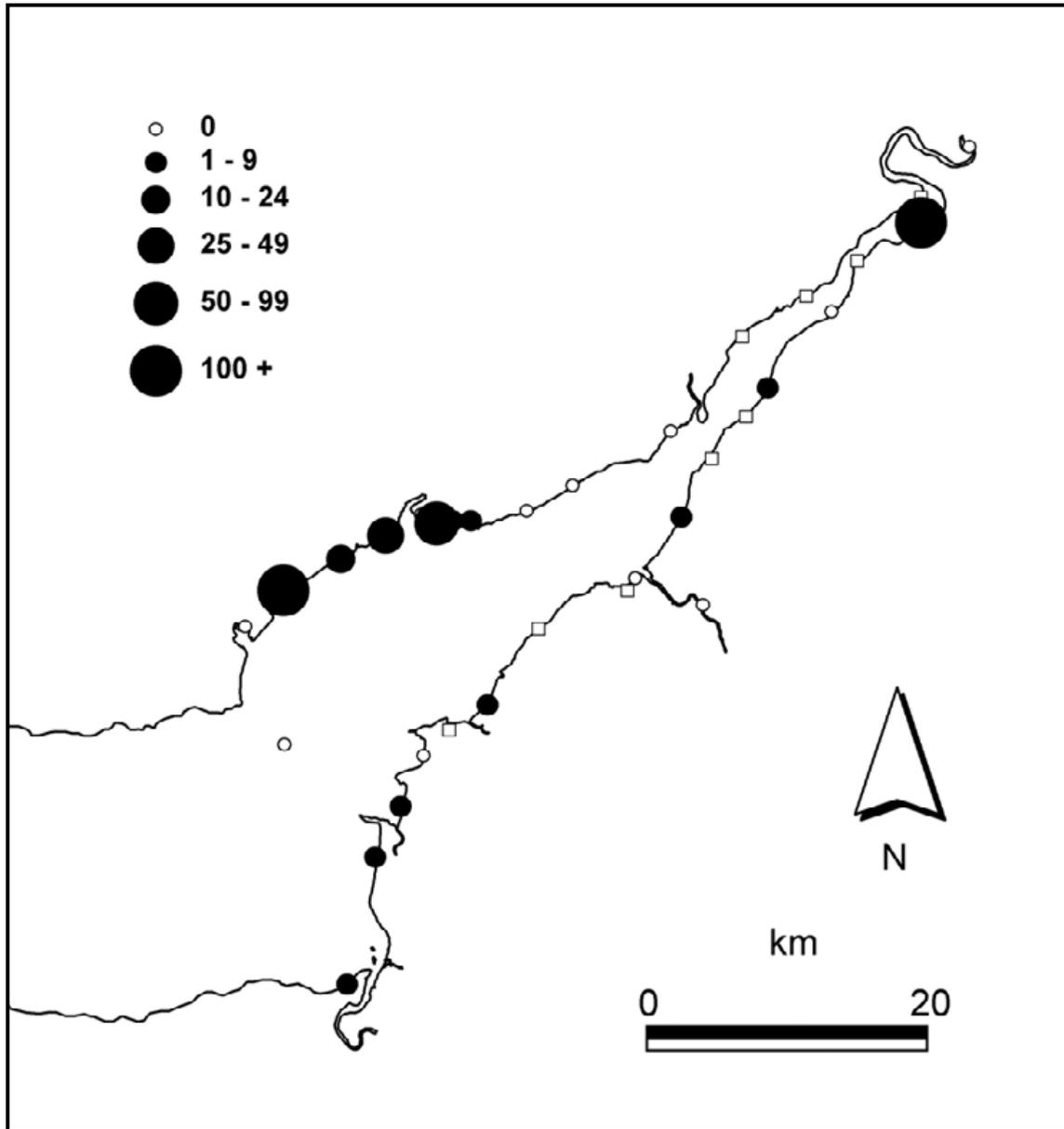


Figure 7.8.3 The mean numbers and distribution of Pintail on the Severn Estuary in the winter, as shown by data from WeBS Core Counts (1996/97 to 2000/01). Open squares indicate sites not covered.

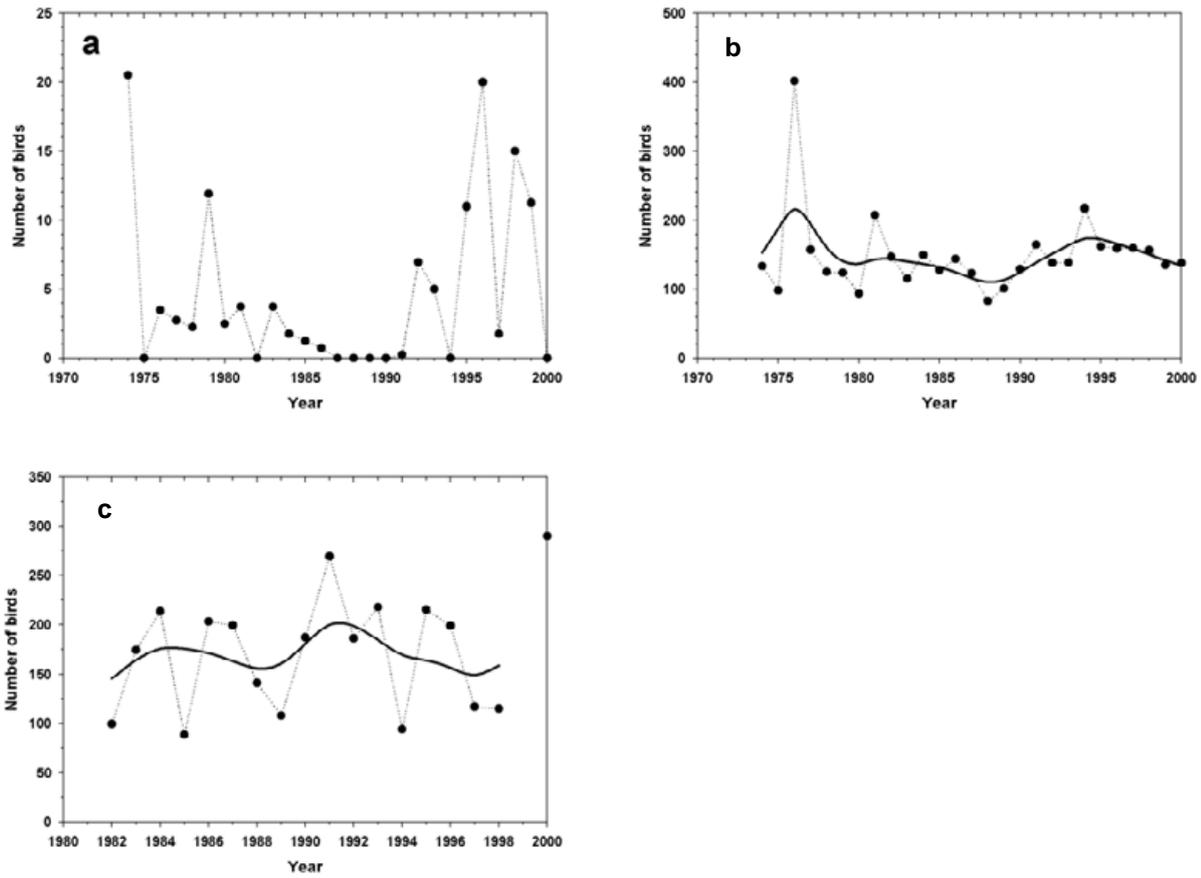


Figure 7.8.4 Trends in the numbers of Pintail on sub-sites of the Severn Estuary as shown by WeBS Core Count data

a = Severn Bridgwater; b = Severn Gloucestershire; c = Gwent Severn.

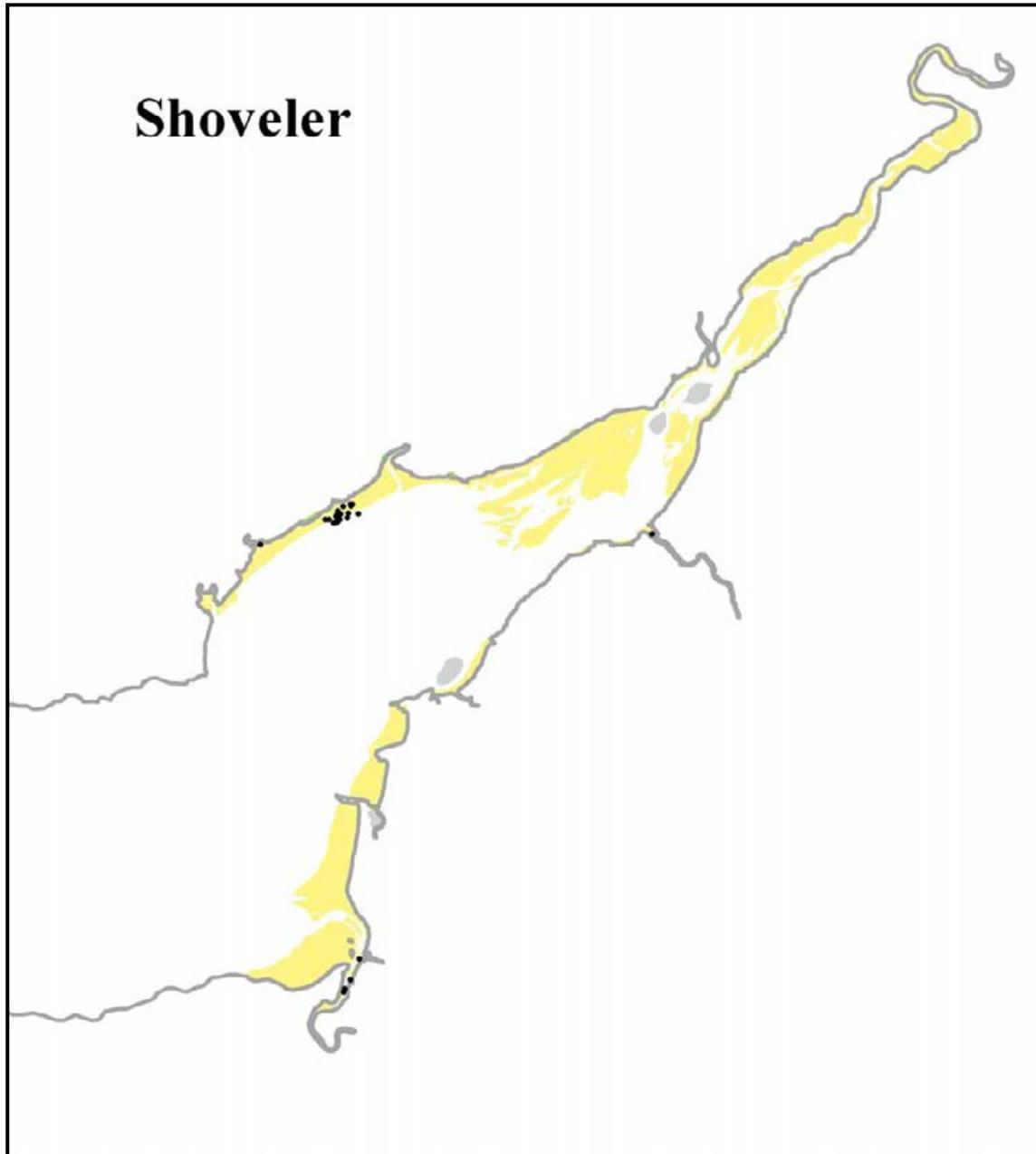


Figure 7.9.1 The mean numbers and distribution of Shoveler on the Severn Estuary in the winters of 1987/88 to 1991/92, as shown by BTO low tide count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

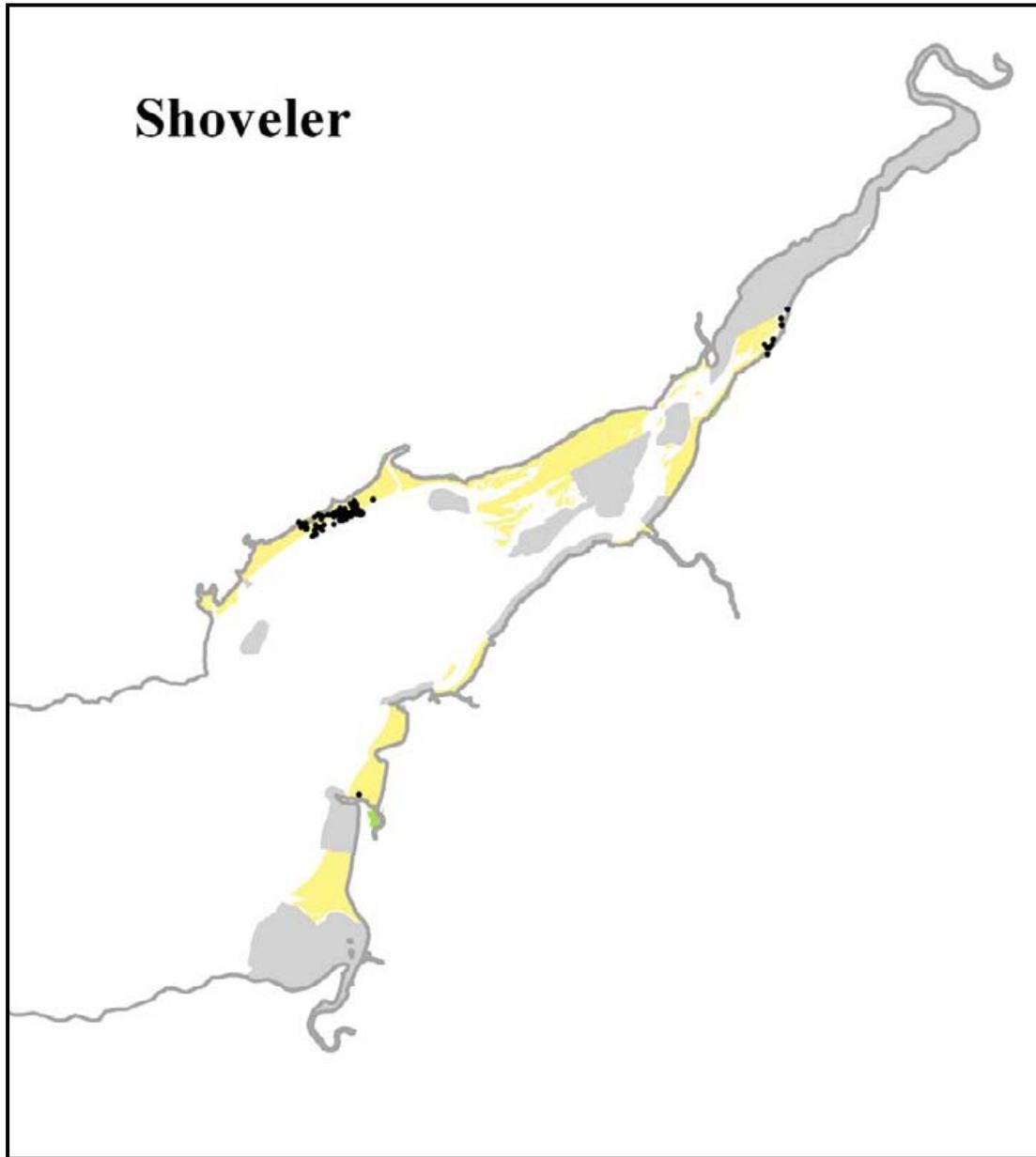


Figure 7.9.2 The mean numbers and distribution of Shoveler on the Severn Estuary in the winter of 1998/99, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

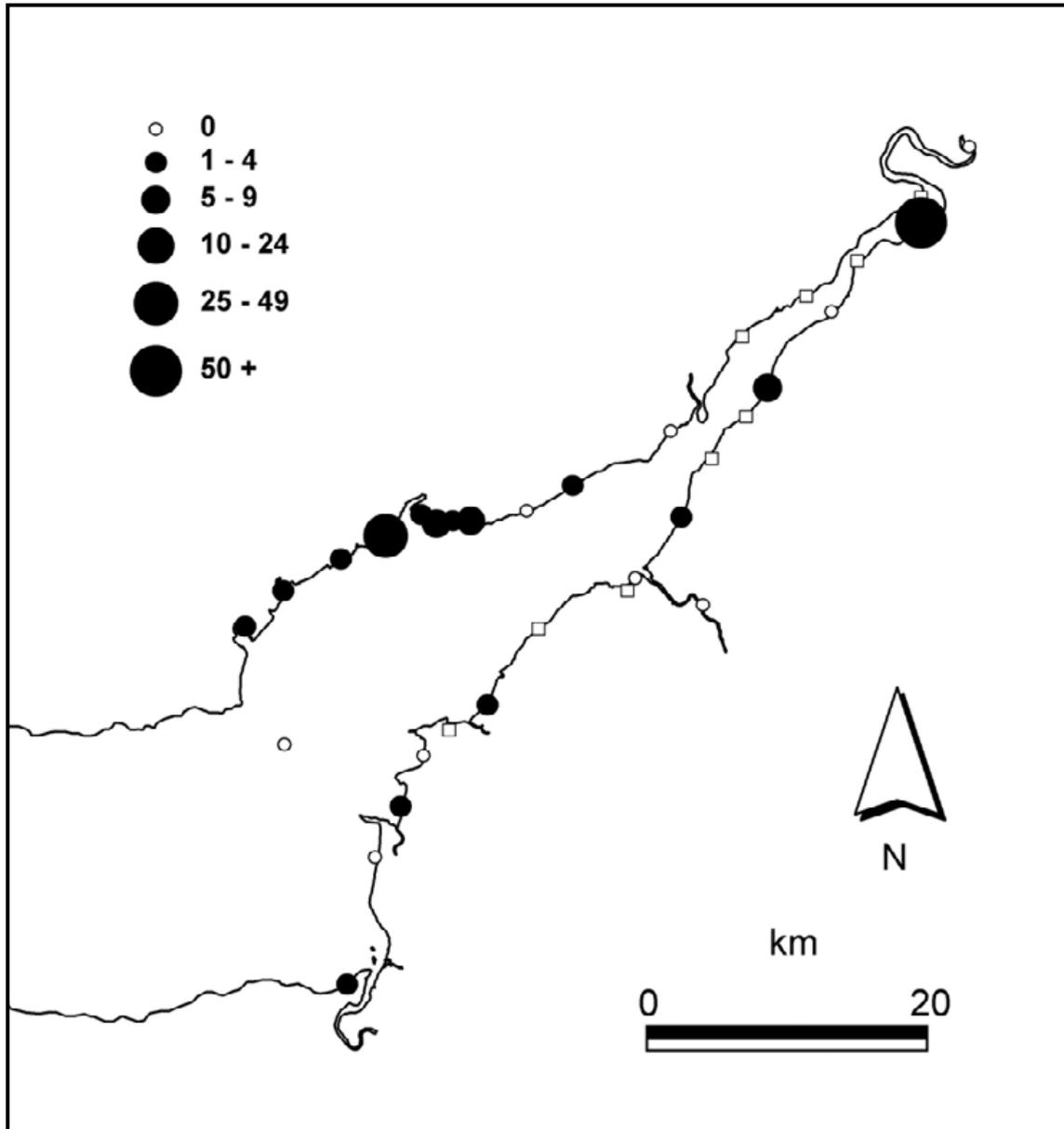


Figure 7.9.3 The mean numbers and distribution of Shoveler on the Severn Estuary in the winter, as shown by data from WeBS Core Counts (1996/97 to 2000/01). Open squares indicate sites not covered.

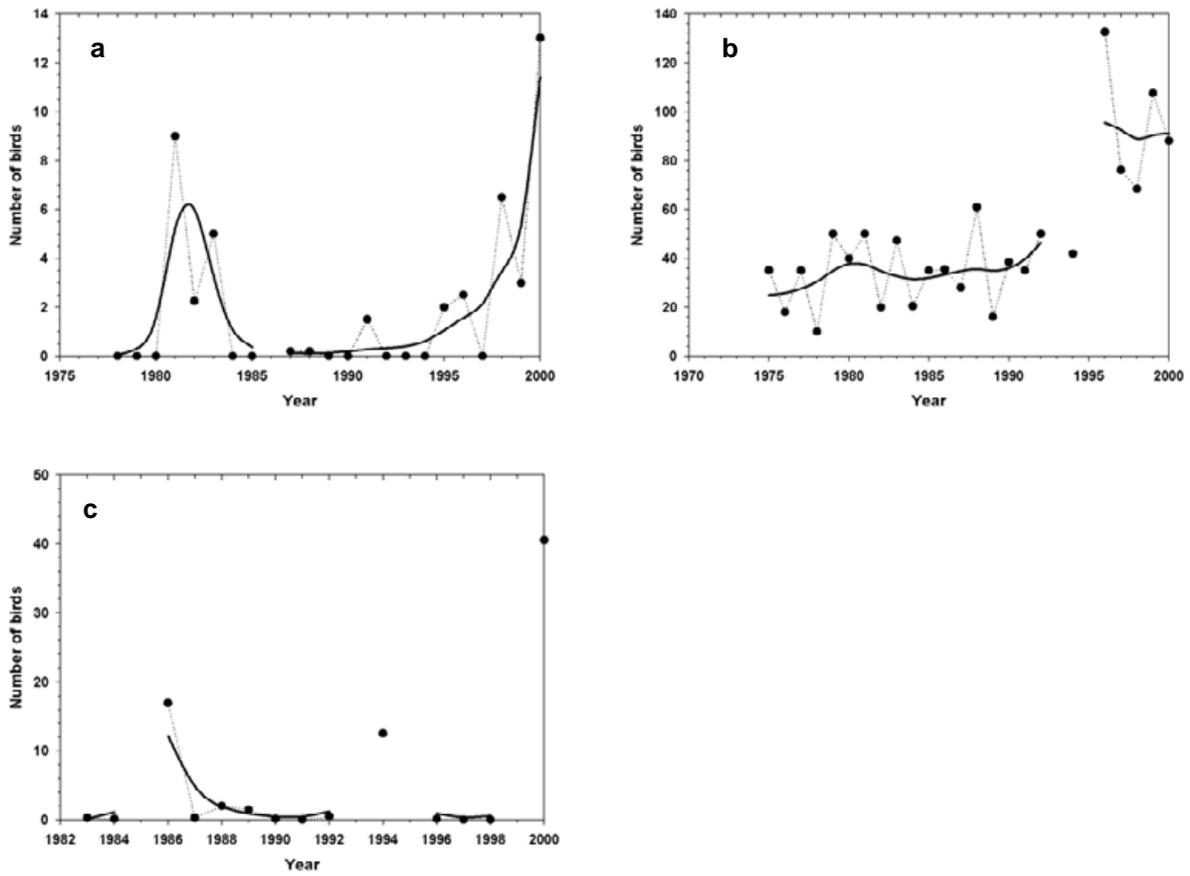


Figure 7.9.4 Trends in the numbers of Shoveler on sub-sites of the Severn Estuary as shown by WeBS Core Count data

a = Severn Avon; b = Severn Gloucestershire; c = Gwent Severn.

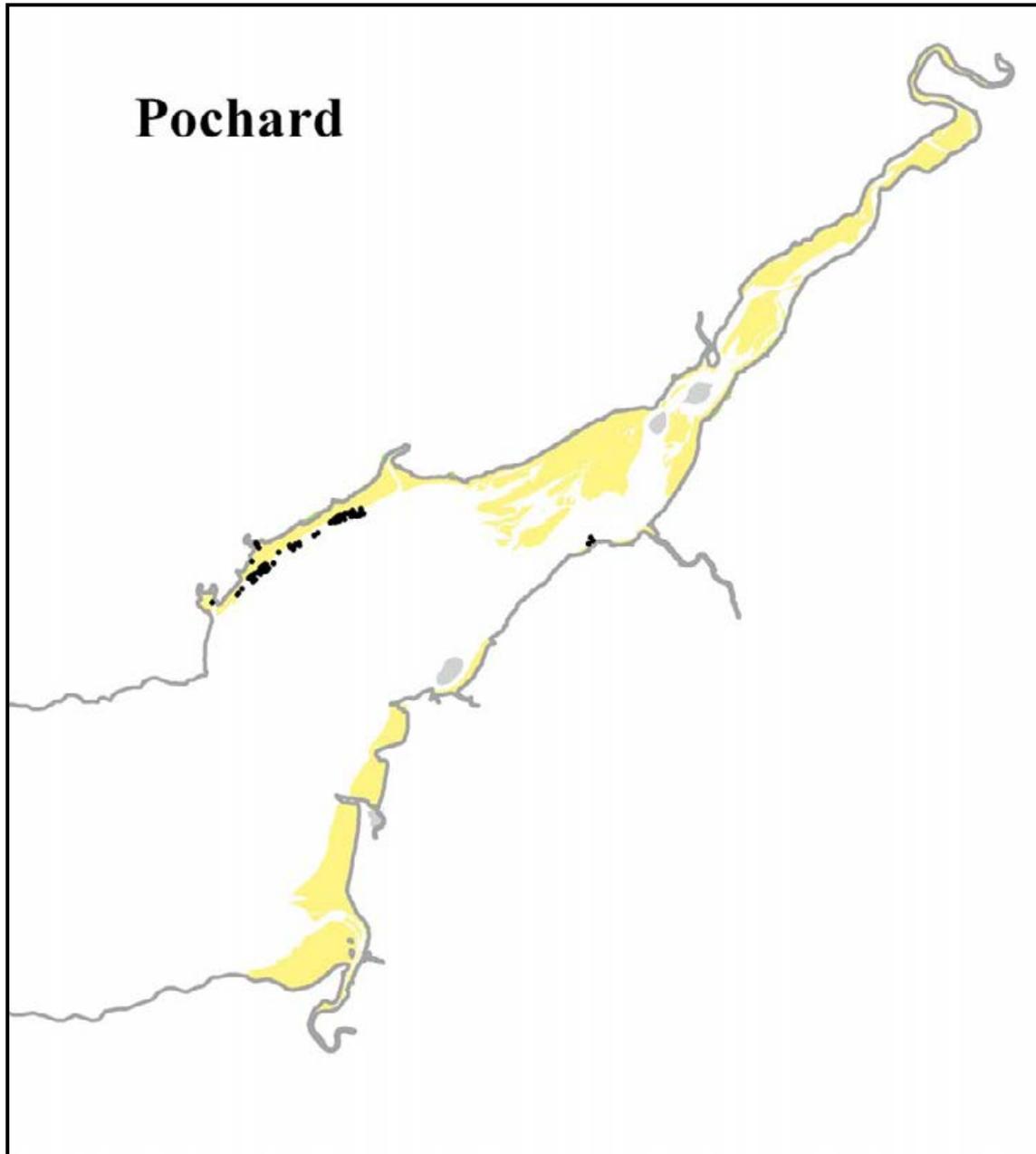


Figure 7.10.1 The mean numbers and distribution of Pochard on the Severn Estuary in the winters of 1987/88 to 1991/92, as shown by BTO low tide count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

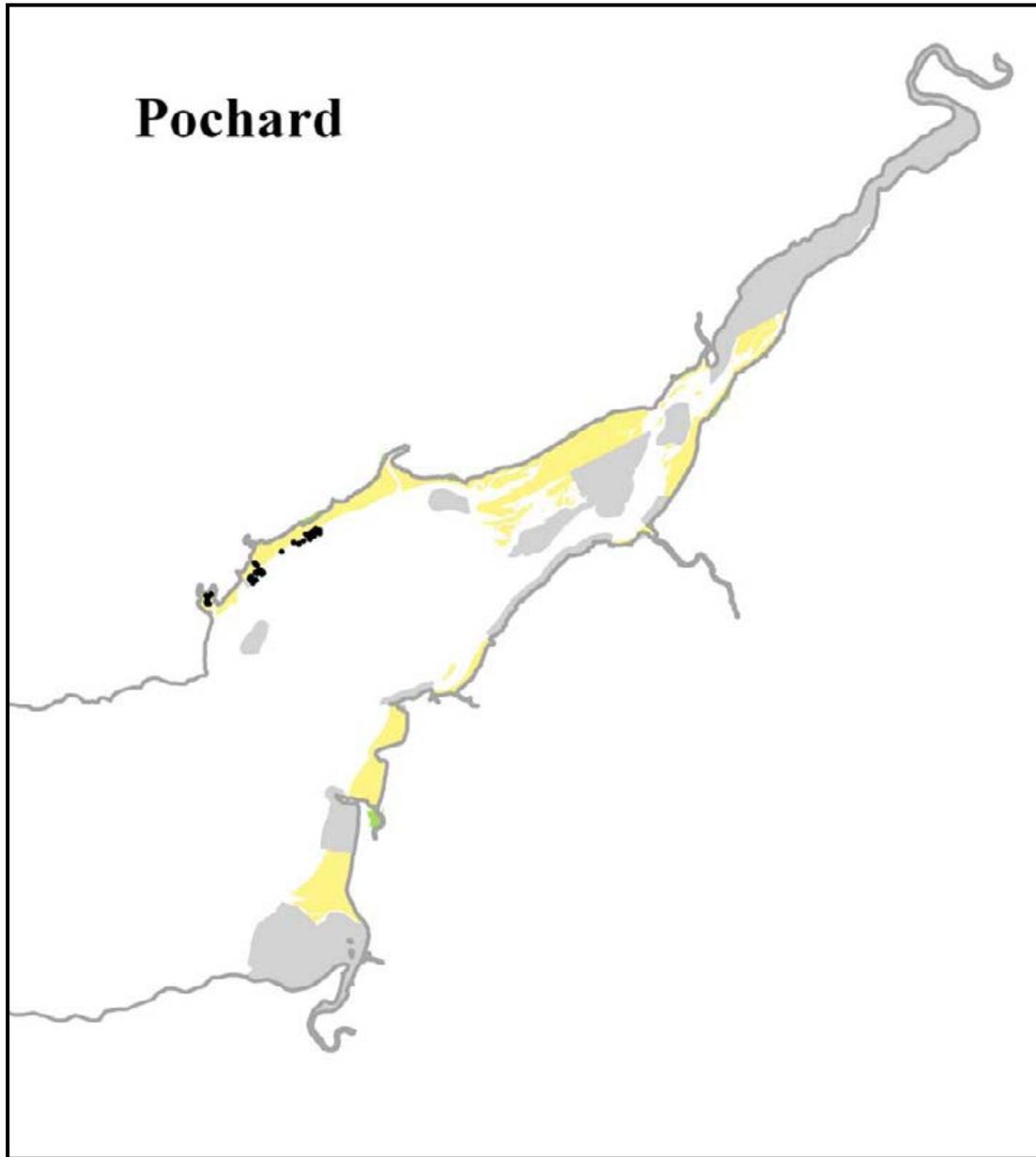


Figure 7.10.2 The mean numbers and distribution of Pochard on the Severn Estuary in the winter of 1998/99, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

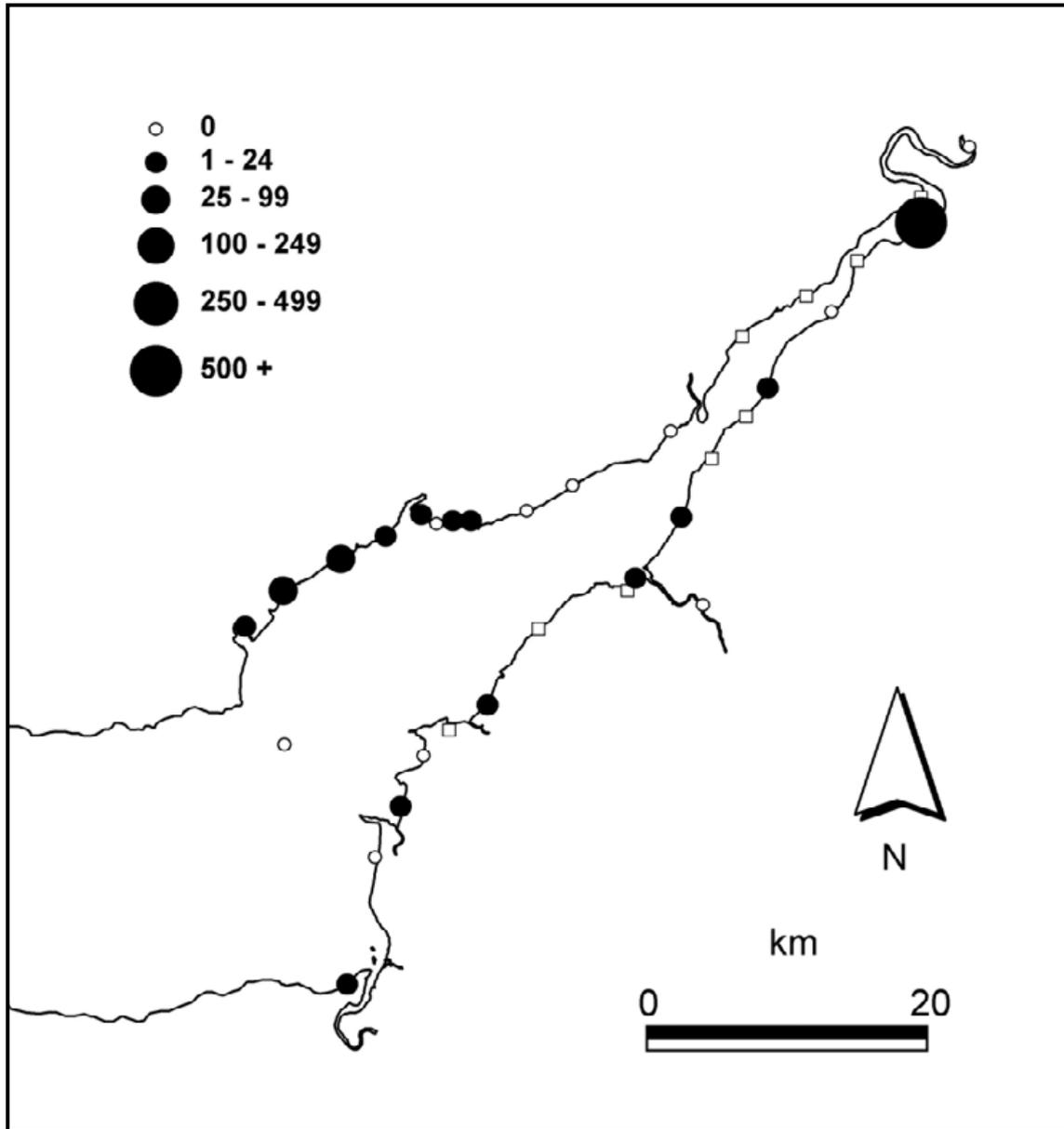


Figure 7.10.3 The mean numbers and distribution of Pochard on the Severn Estuary in the winter, as shown by data from WeBS Core Counts (1996/97 to 2000/01). Open squares indicate sites not covered.

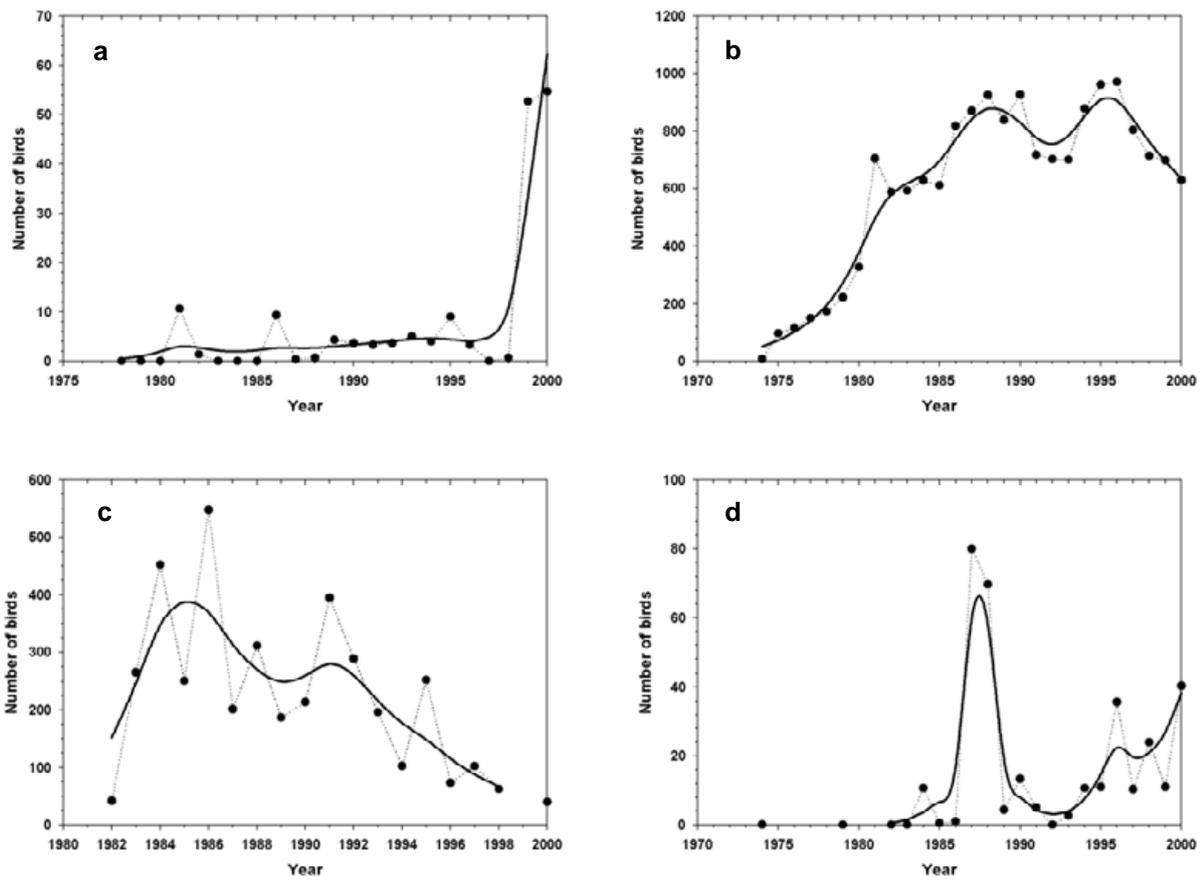


Figure 7.10.4 Trends in the numbers of Pochard on sub-sites of the Severn Estuary as shown by WeBS Core Count data

a = Severn Avon; b = Severn Gloucestershire; c = Gwent Severn; d = Cardiff Bay.

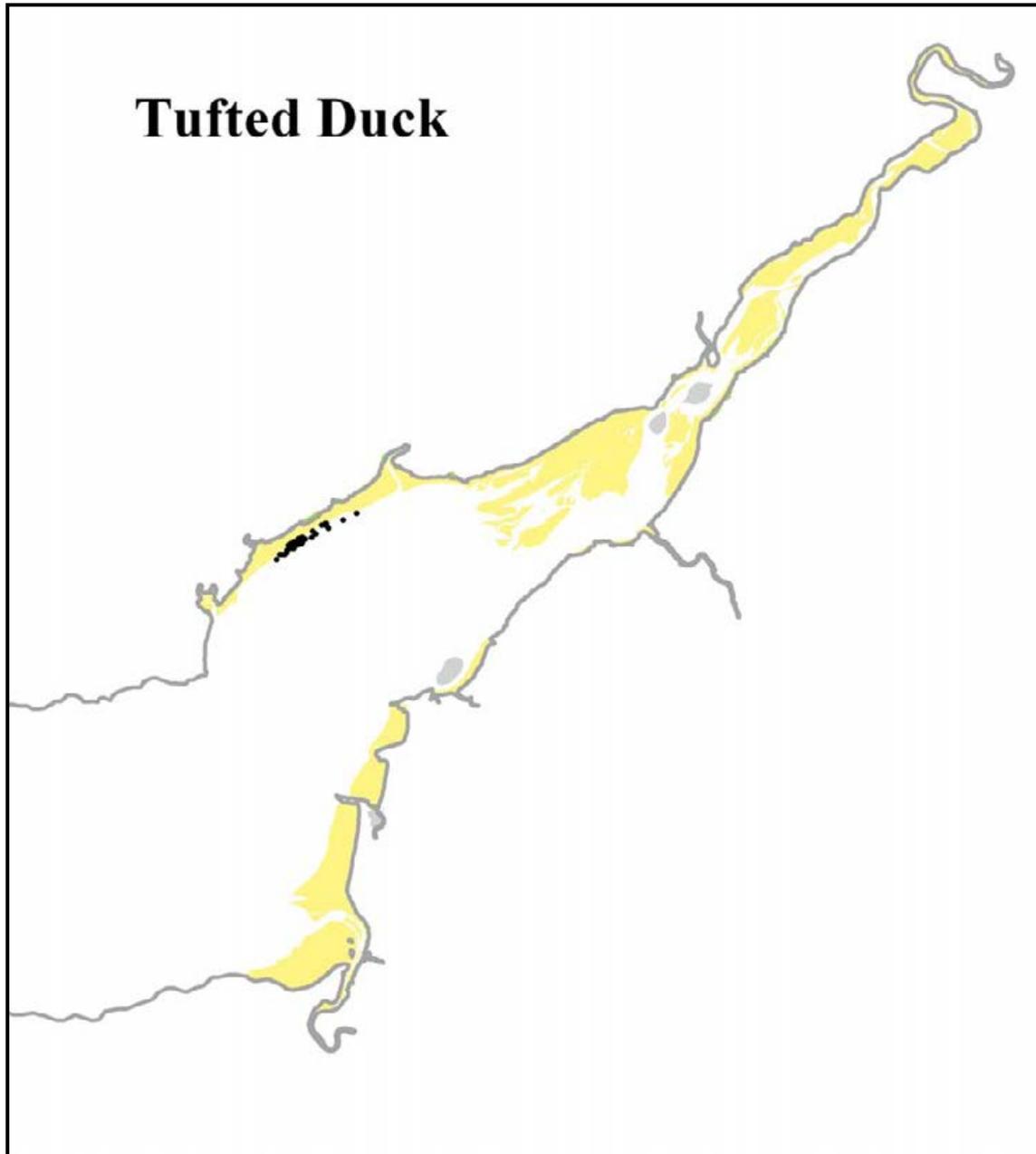


Figure 7.11.1 The mean numbers and distribution of Tufted Duck on the Severn Estuary in the winters of 1987/88 to 1991/92, as shown by BTO low tide count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

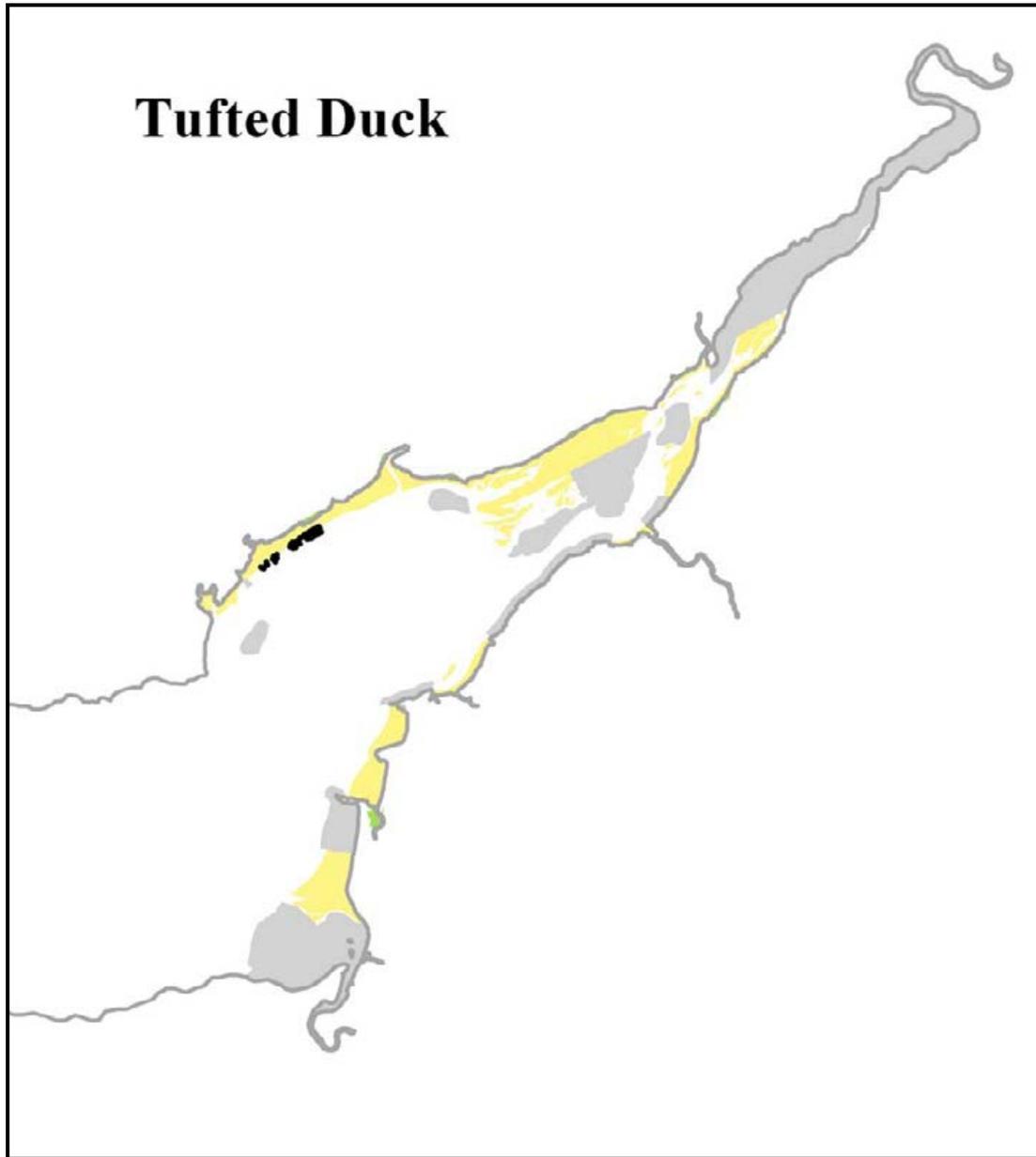


Figure 7.11.2 The mean numbers and distribution of Tufted Duck on the Severn Estuary in the winter of 1998/99, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

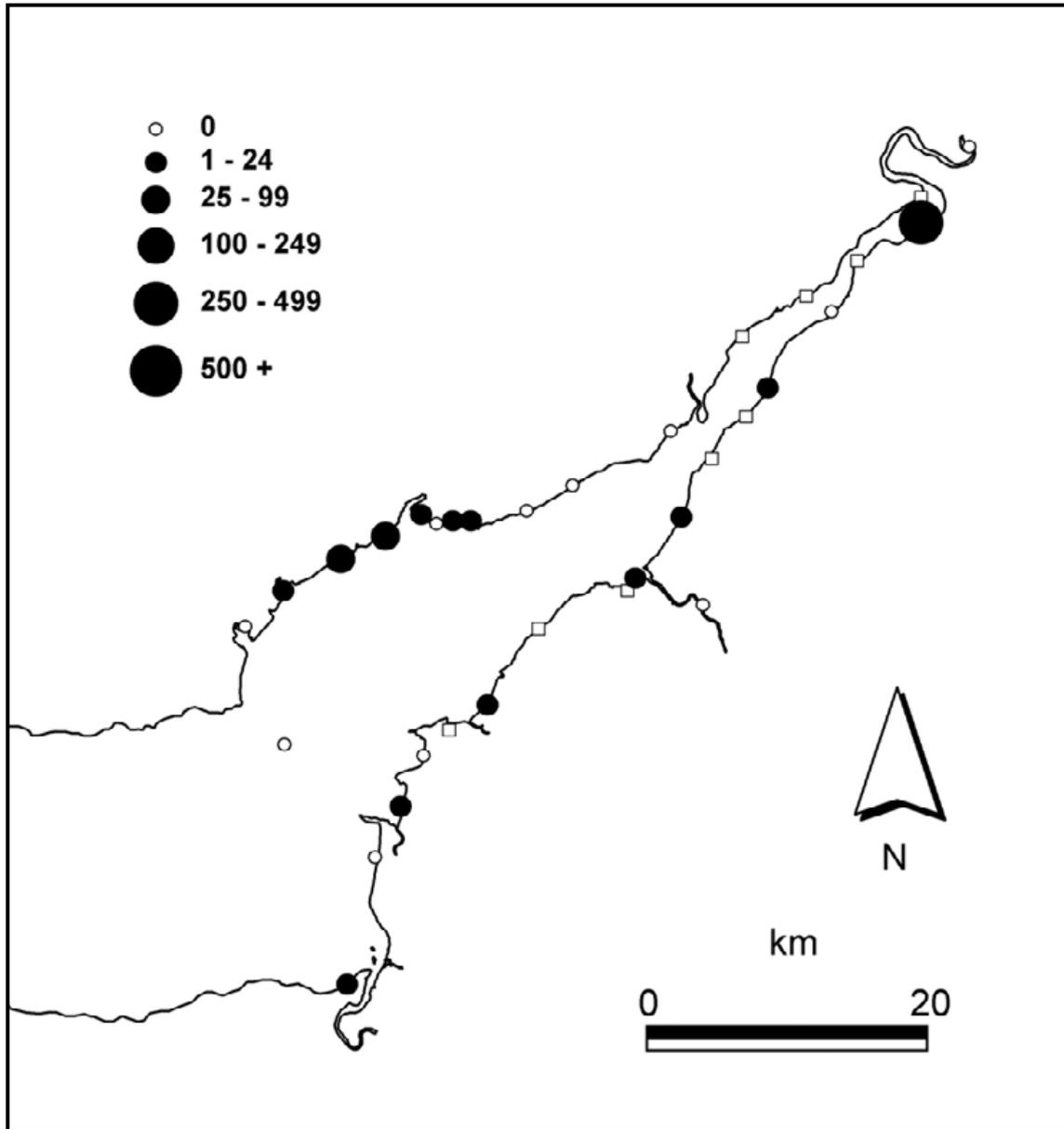


Figure 7.11.3 The mean numbers and distribution of Tufted Duck on the Severn Estuary in the winter, as shown by data from WeBS Core Counts (1996/97 to 2000/01). Open squares indicate sites not covered.

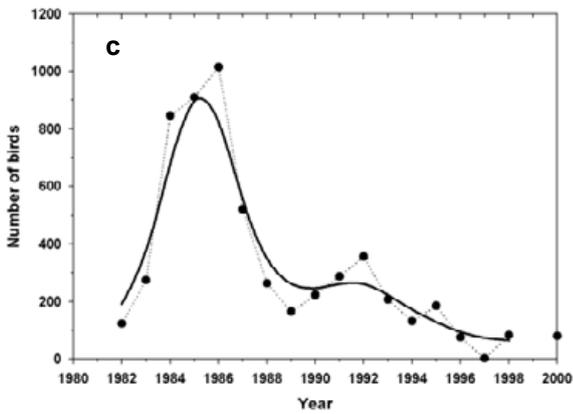
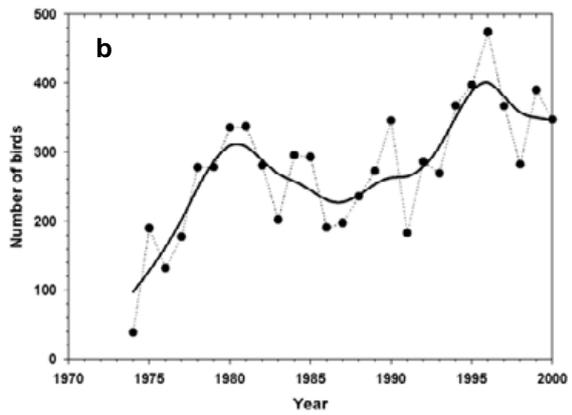
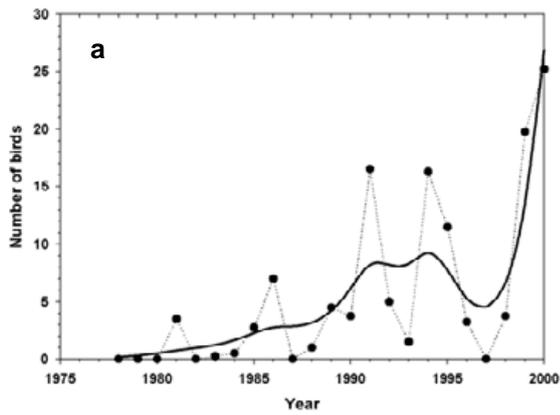


Figure 7.11.4 Trends in the numbers of Tufted Duck on sub-sites of the Severn Estuary as shown by WeBS Core Count data

a = Severn Avon; b = Severn Gloucestershire; c = Gwent Severn.

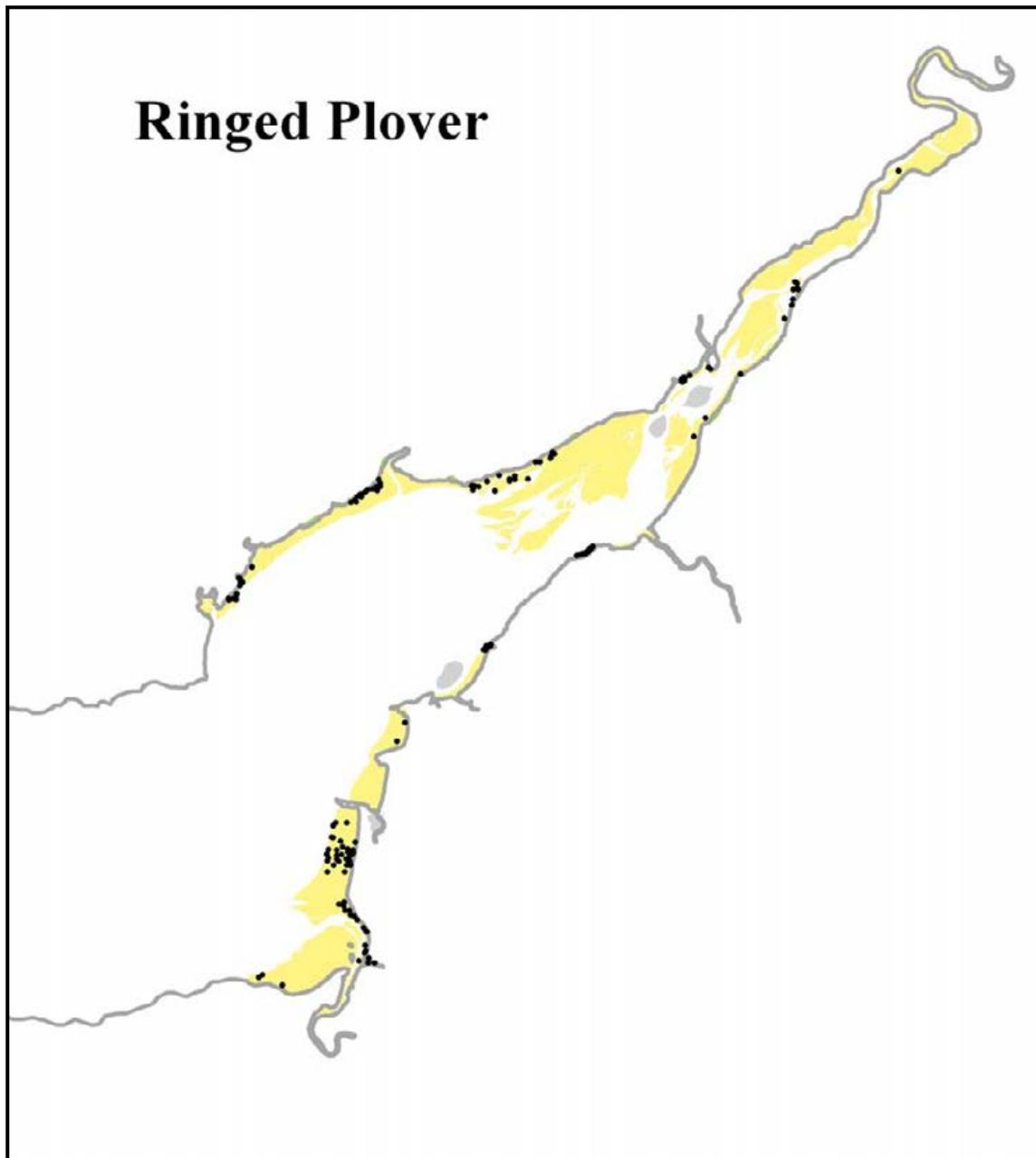


Figure 7.12.1 The mean numbers and distribution of Ringed Plover on the Severn Estuary in the winters of 1987/88 to 1991/92, as shown by BTO low tide count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

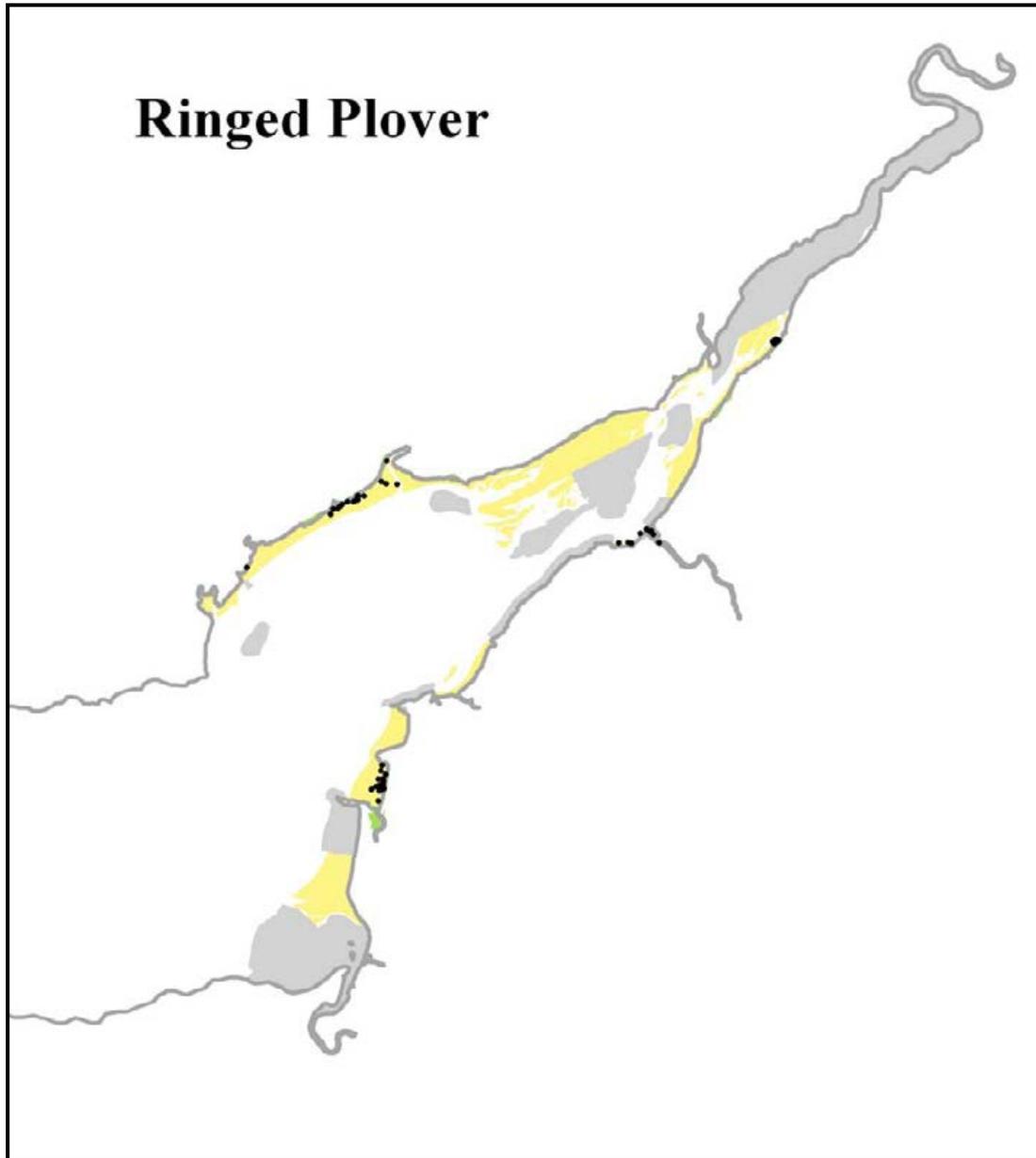


Figure 7.12.2 The mean numbers and distribution of Ringed Plover on the Severn Estuary in the winter of 1998/99, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

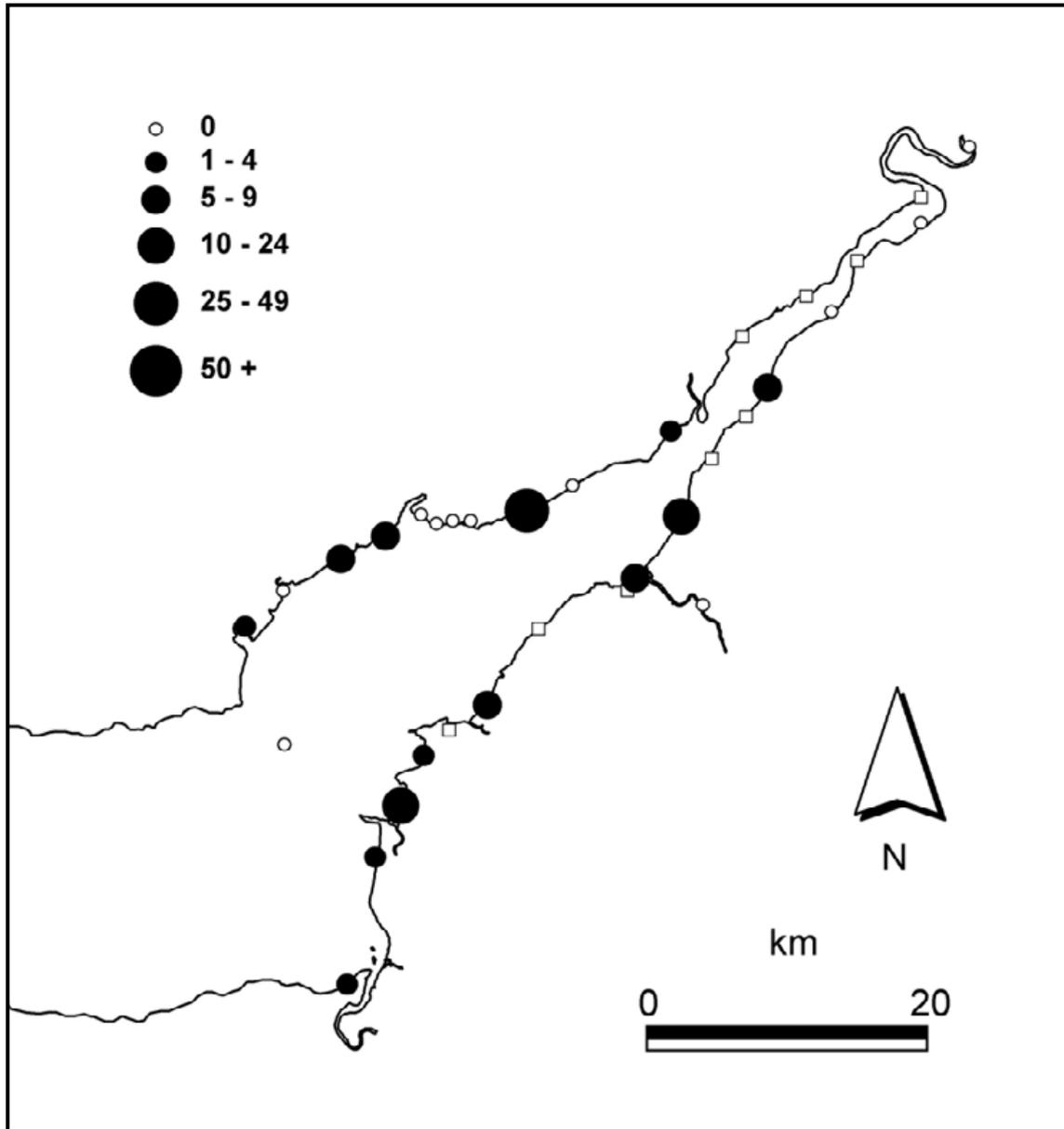


Figure 7.12.3 The mean numbers and distribution of Ringed Plover on the Severn Estuary in the winter, as shown by data from WeBS Core Counts (1996/97 to 2000/01). Open squares indicate sites not covered.

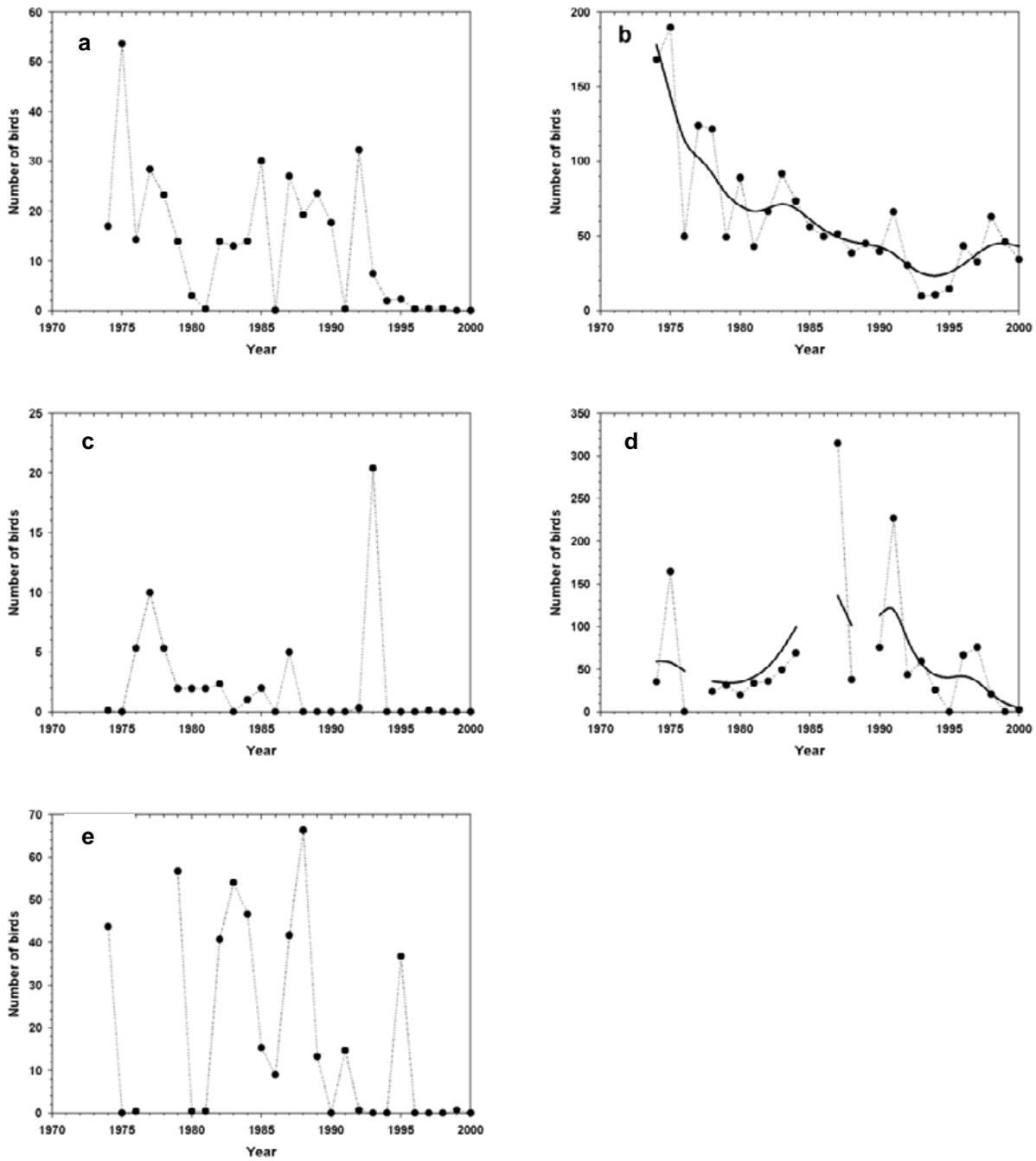


Figure 7.12.4 Trends in the numbers of Ringed Plover on sub-sites of the Severn Estuary as shown by WeBS Core Count data

a = Severn Bridgewater; b = Severn Avon; c = Severn Gloucestershire; d = Gwent Severn; e = Cardiff Bay.

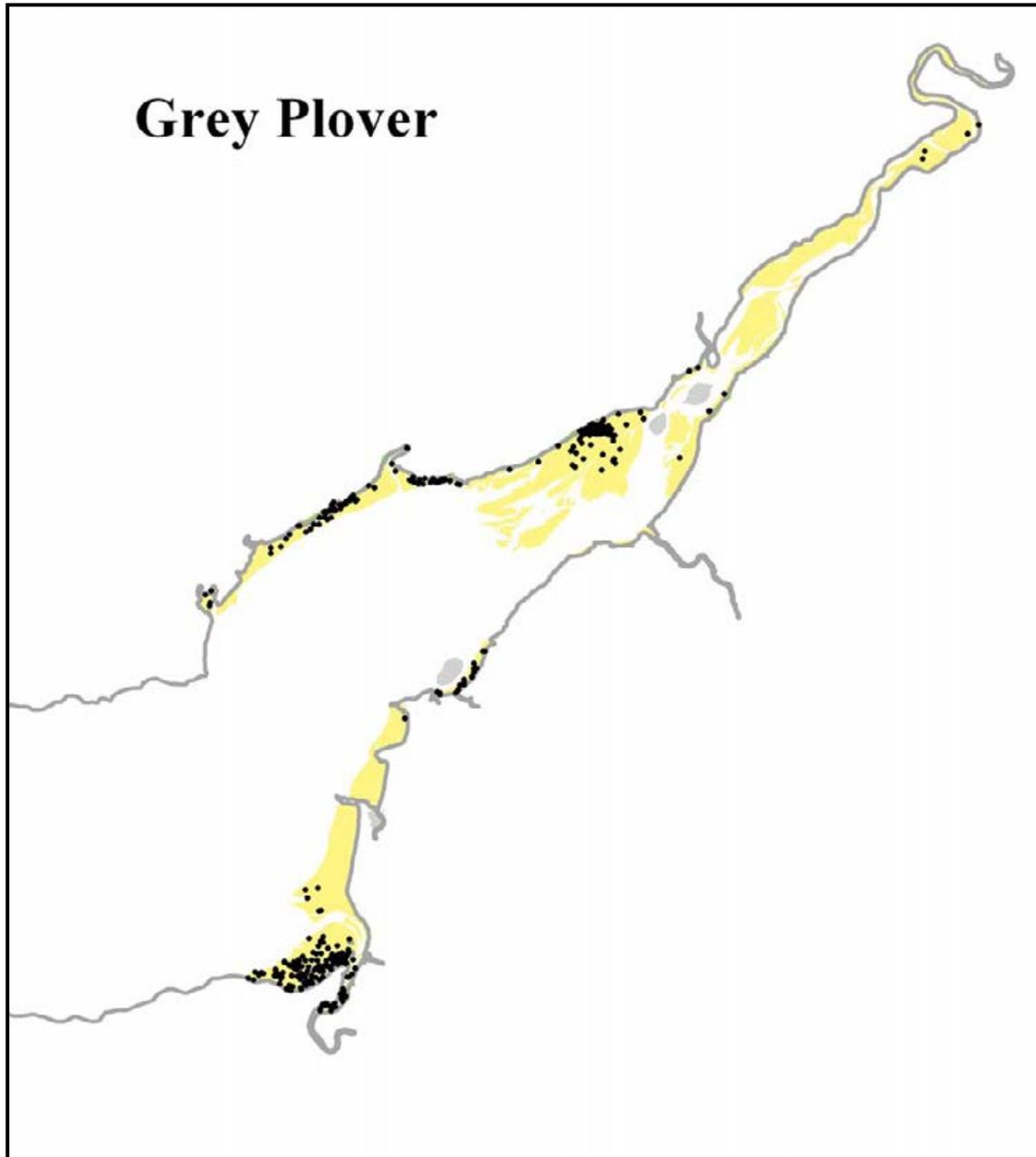


Figure 7.13.1 The mean numbers and distribution of Grey Plover on the Severn Estuary in the winters of 1987/88 to 1991/92, as shown by BTO low tide count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

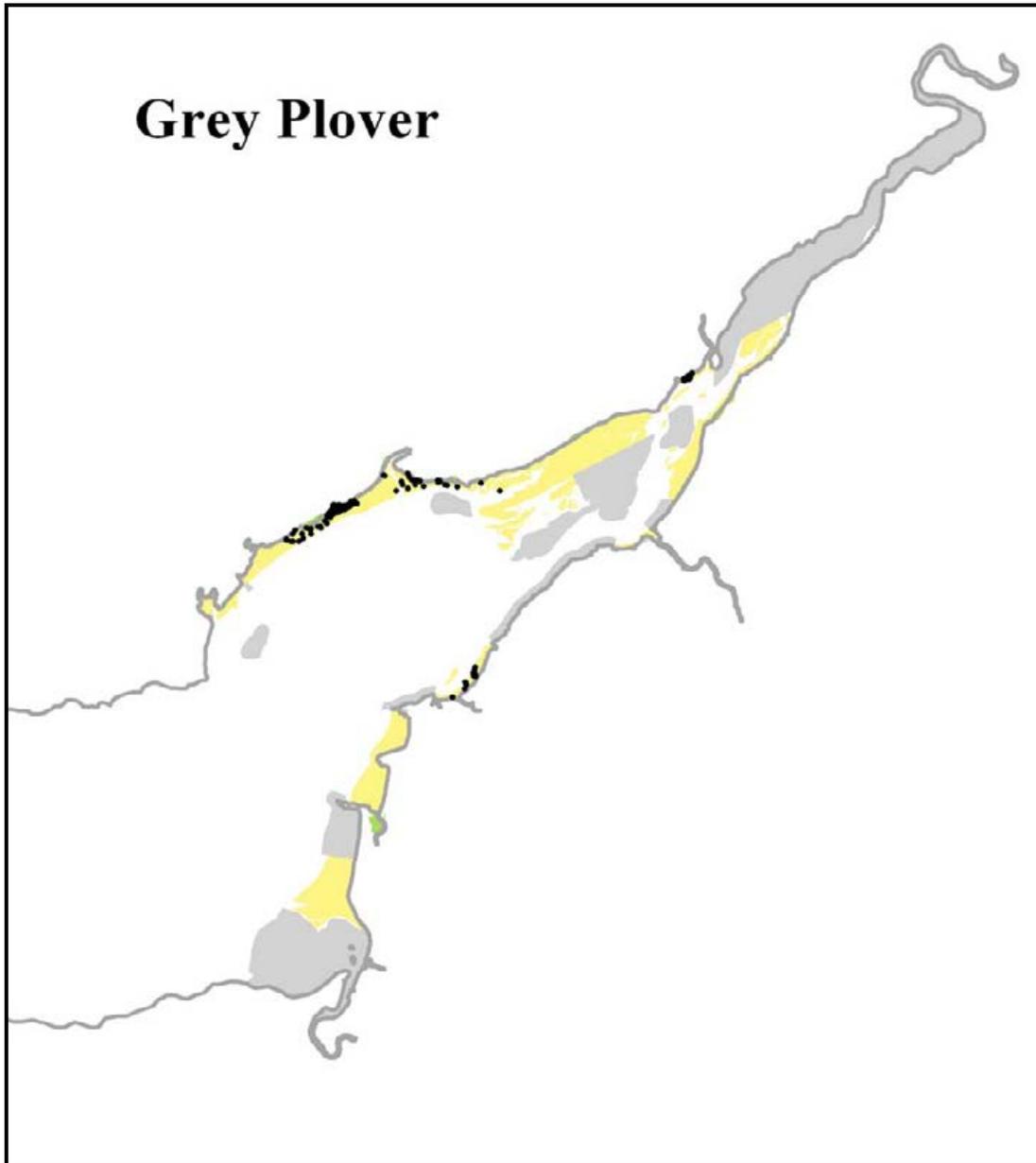


Figure 7.13.2 The mean numbers and distribution of Grey Plover on the Severn Estuary in the winter of 1998/99, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

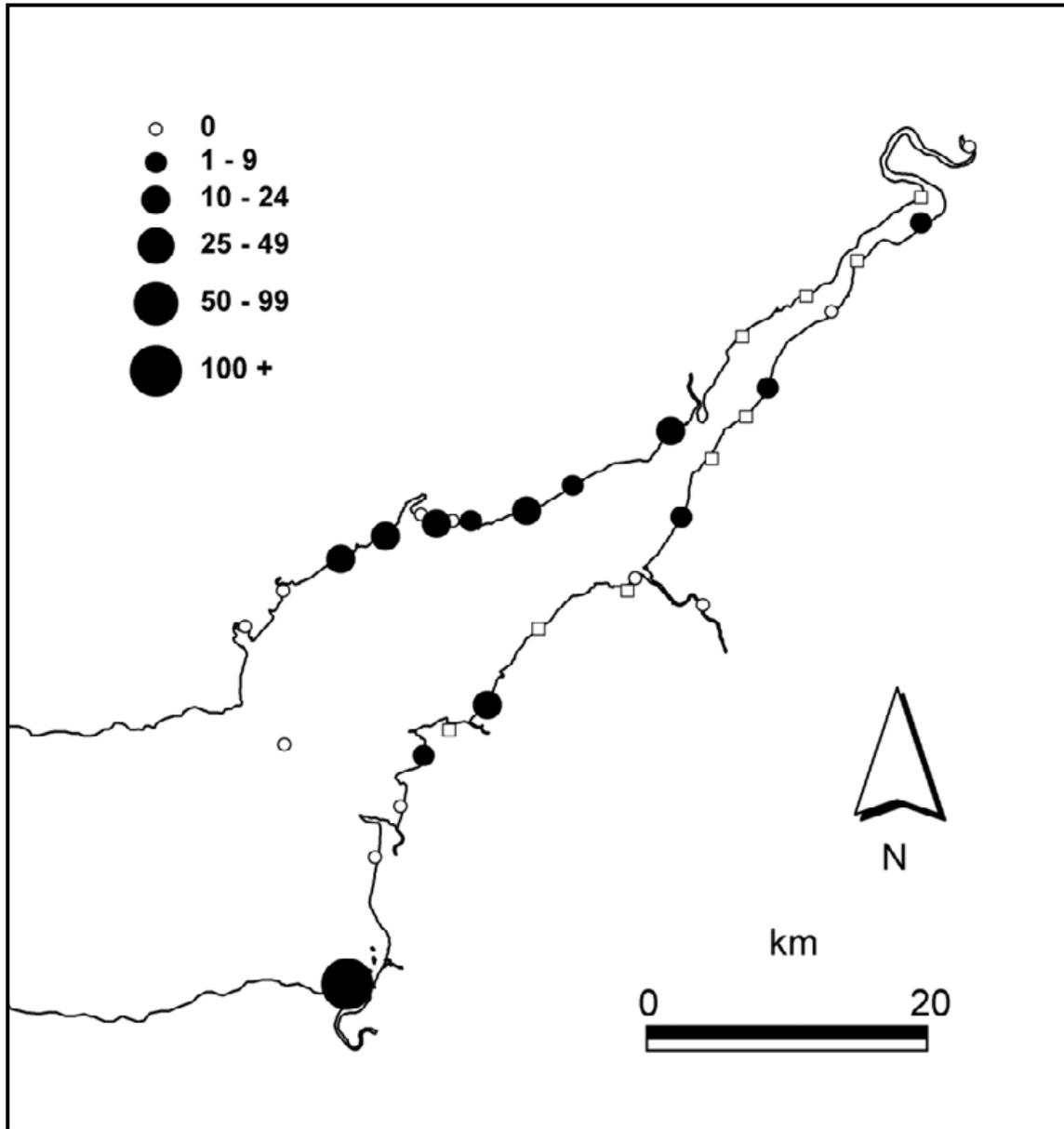


Figure 7.13.3 The mean numbers and distribution of Grey Plover on the Severn Estuary in the winter, as shown by data from WeBS Core Counts (1996/97 to 2000/01). Open squares indicate sites not covered.

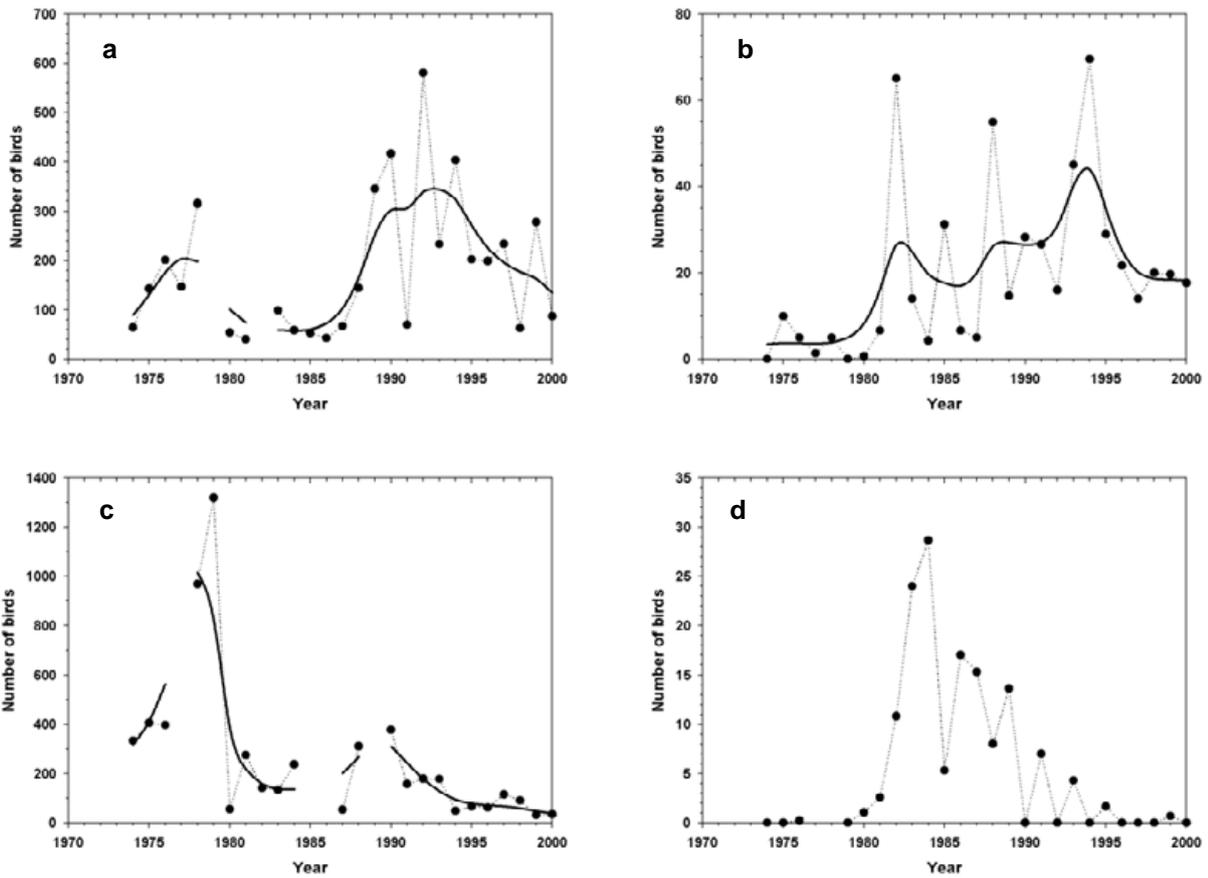


Figure 7.13.4 Trends in the numbers of Grey Plover on sub-sites of the Severn Estuary as shown by WeBS Core Count data.

a = Severn Bridgwater; b = Severn Avon; c = Gwent Severn; d = Cardiff Bay.

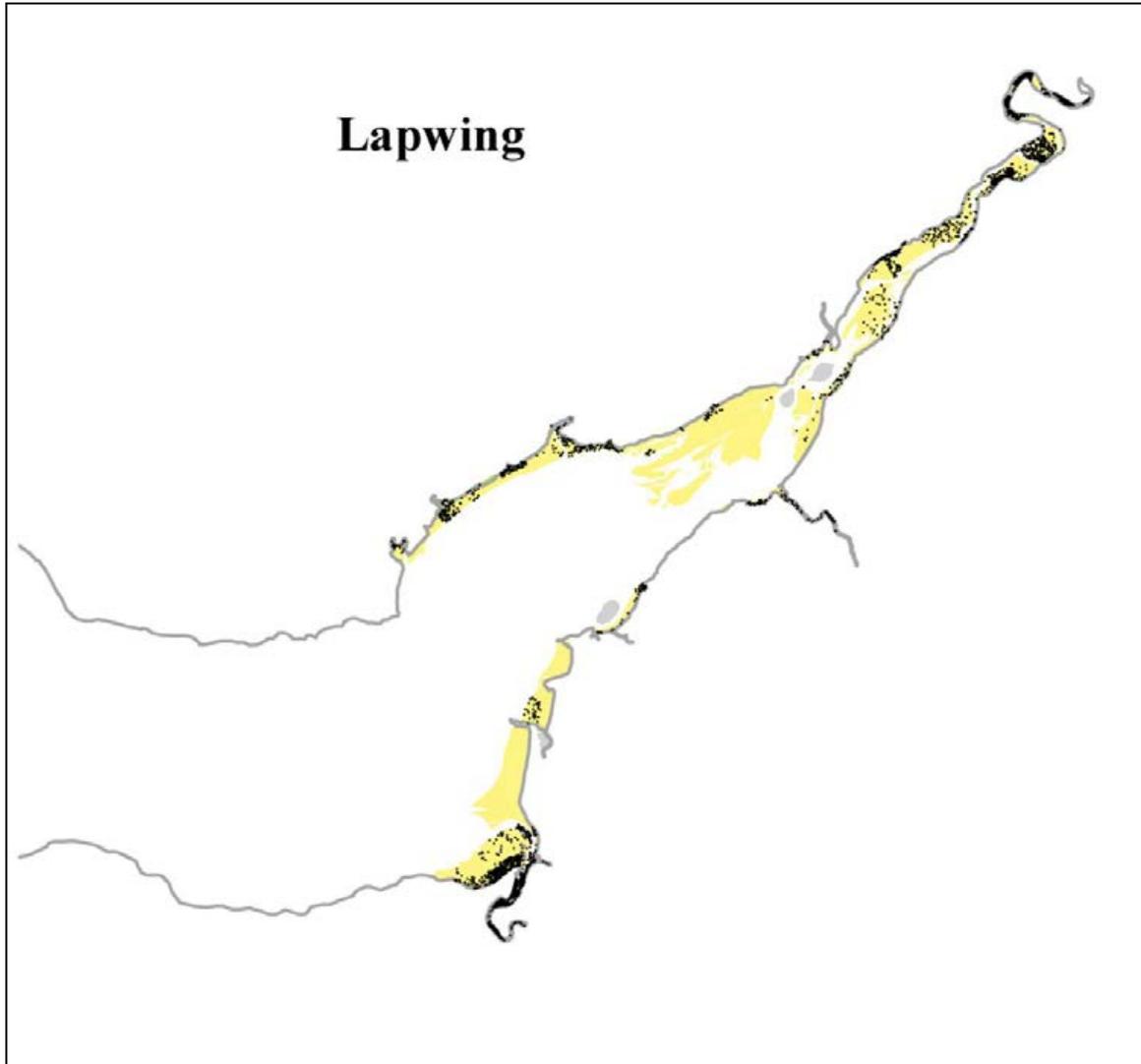


Figure 7.14.1 The mean numbers and distribution of Lapwing on the Severn Estuary in the winters of 1987/88 to 1991/92, as shown by BTO low tide count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

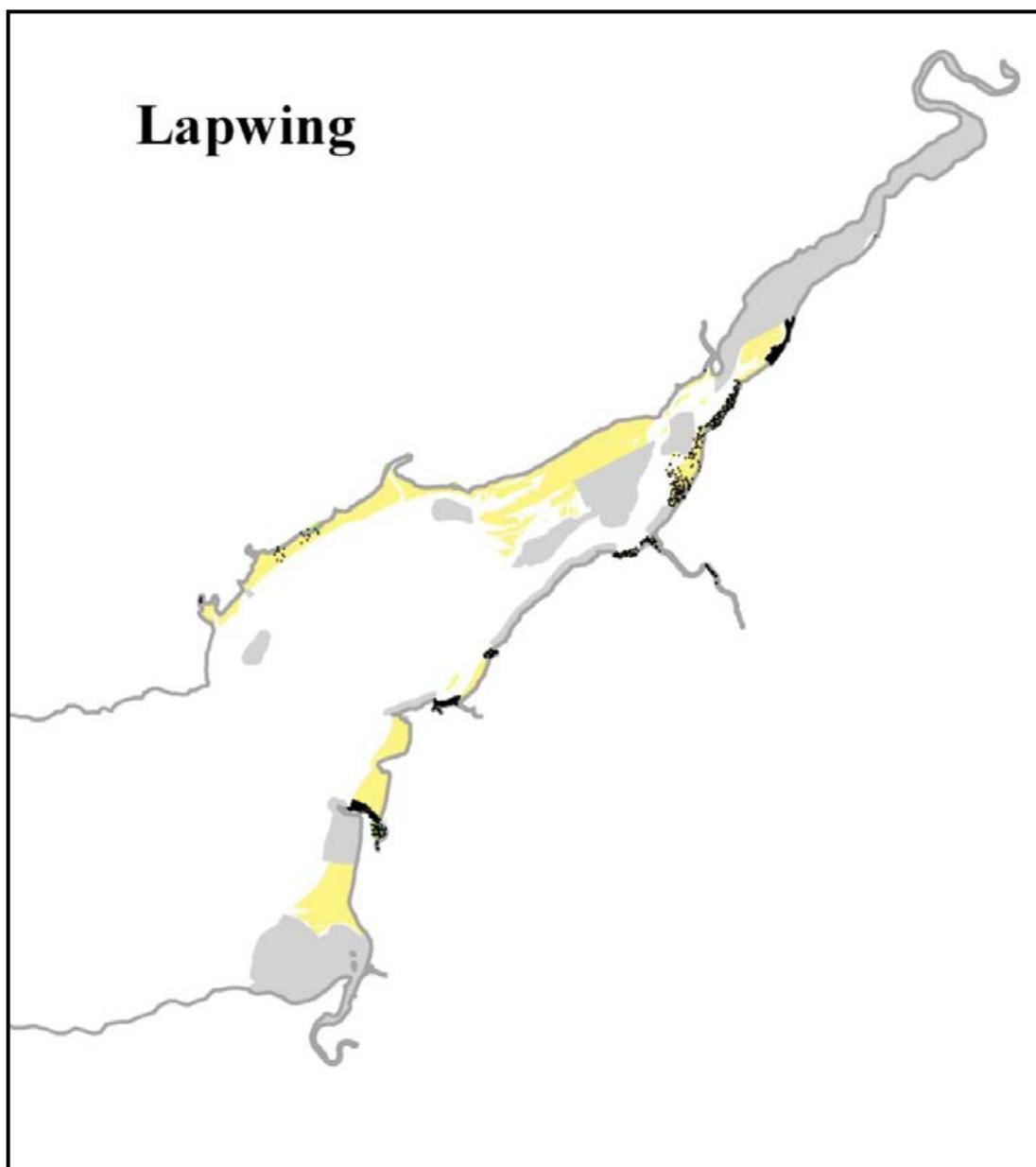


Figure 7.14.2 The mean numbers and distribution of Lapwing on the Severn Estuary in the winter of 1998/99, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

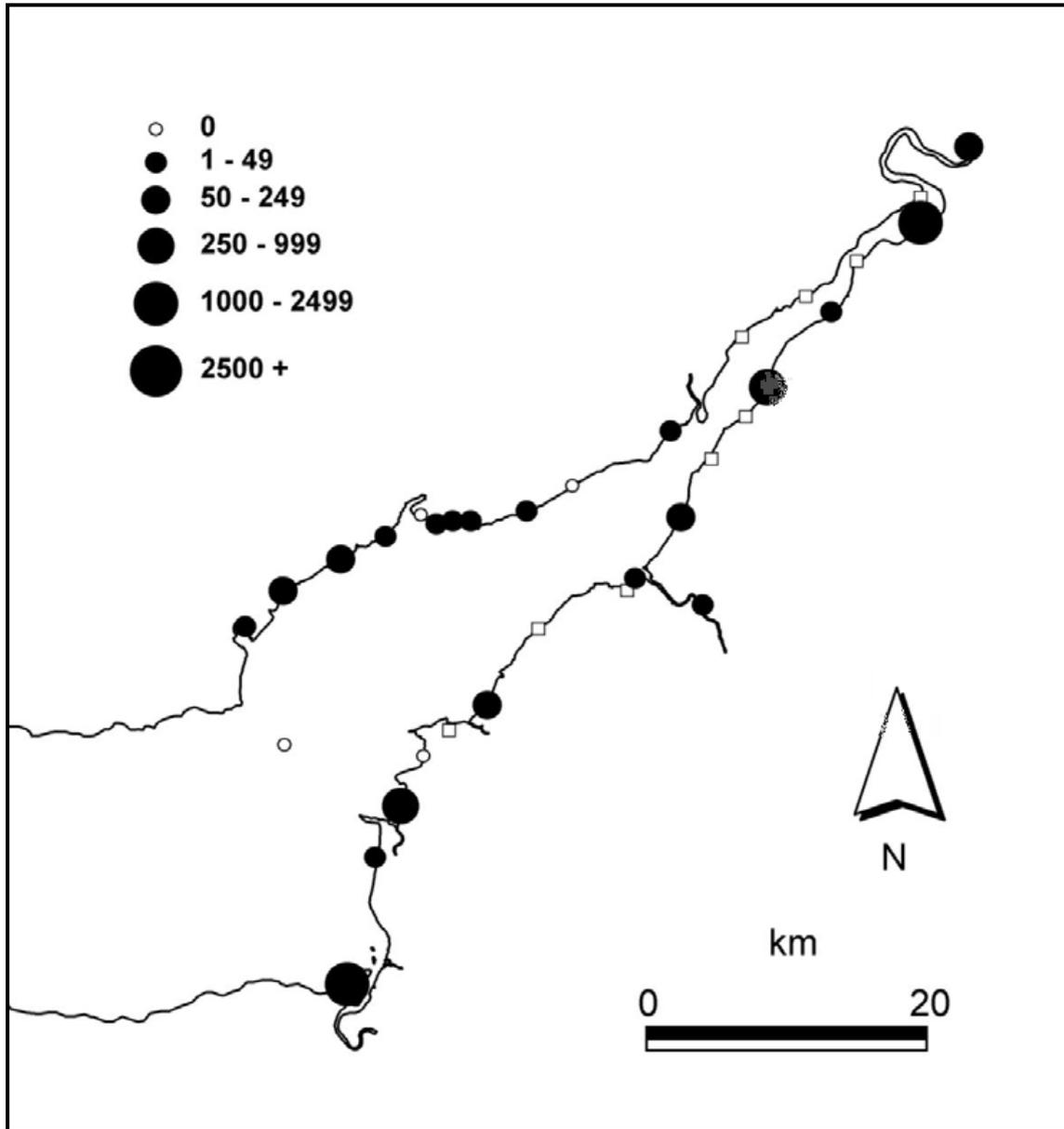


Figure 7.14.3 The mean numbers and distribution of Lapwing on the Severn Estuary in the winter, as shown by data from WeBS Core Counts (1996/97 to 2000/01). Open squares indicate sites not covered.

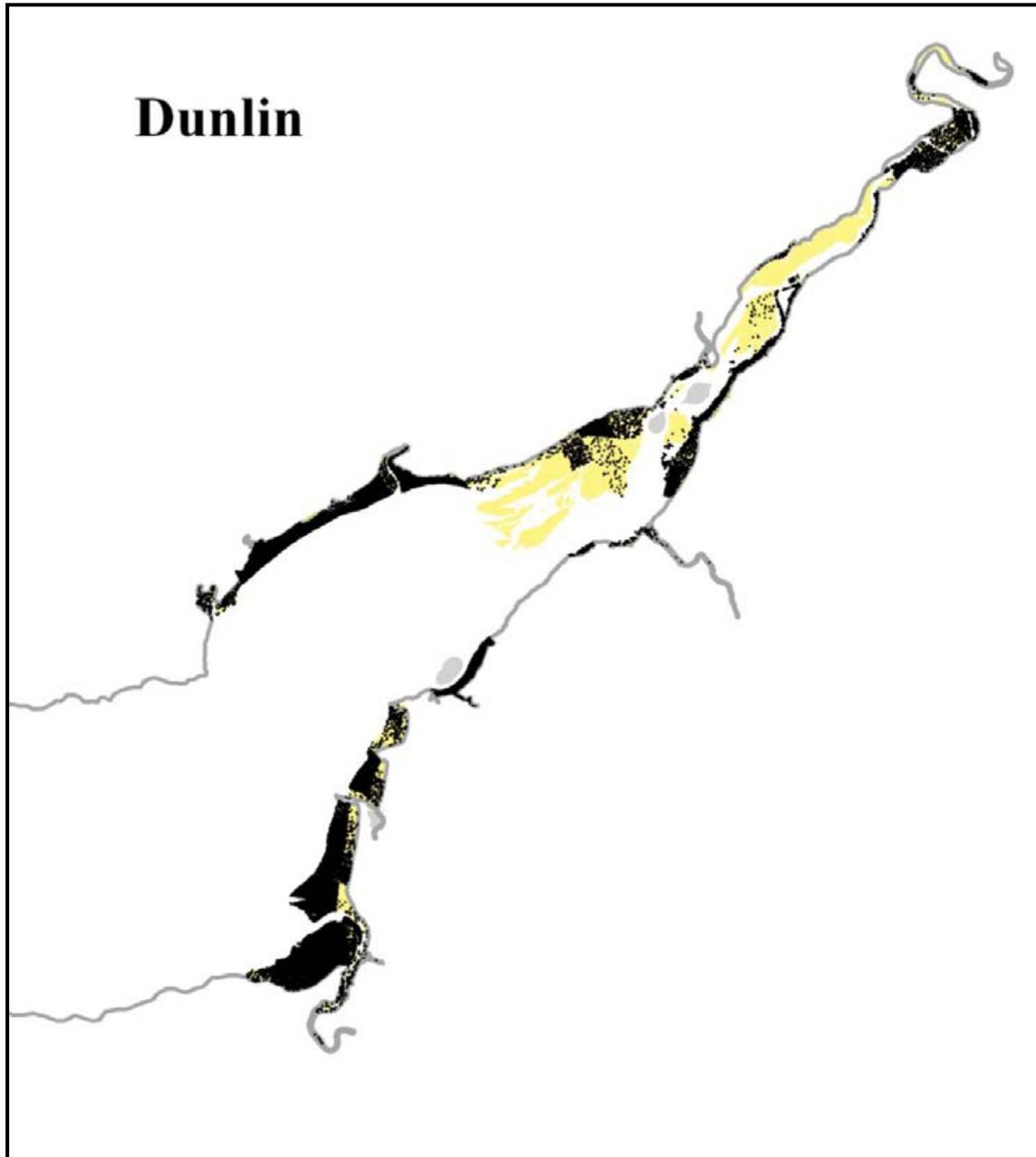


Figure 7.15.1 The mean numbers and distribution of Dunlin on the Severn Estuary in the winters of 1987/88 to 1991/92, as shown by BTO low tide count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

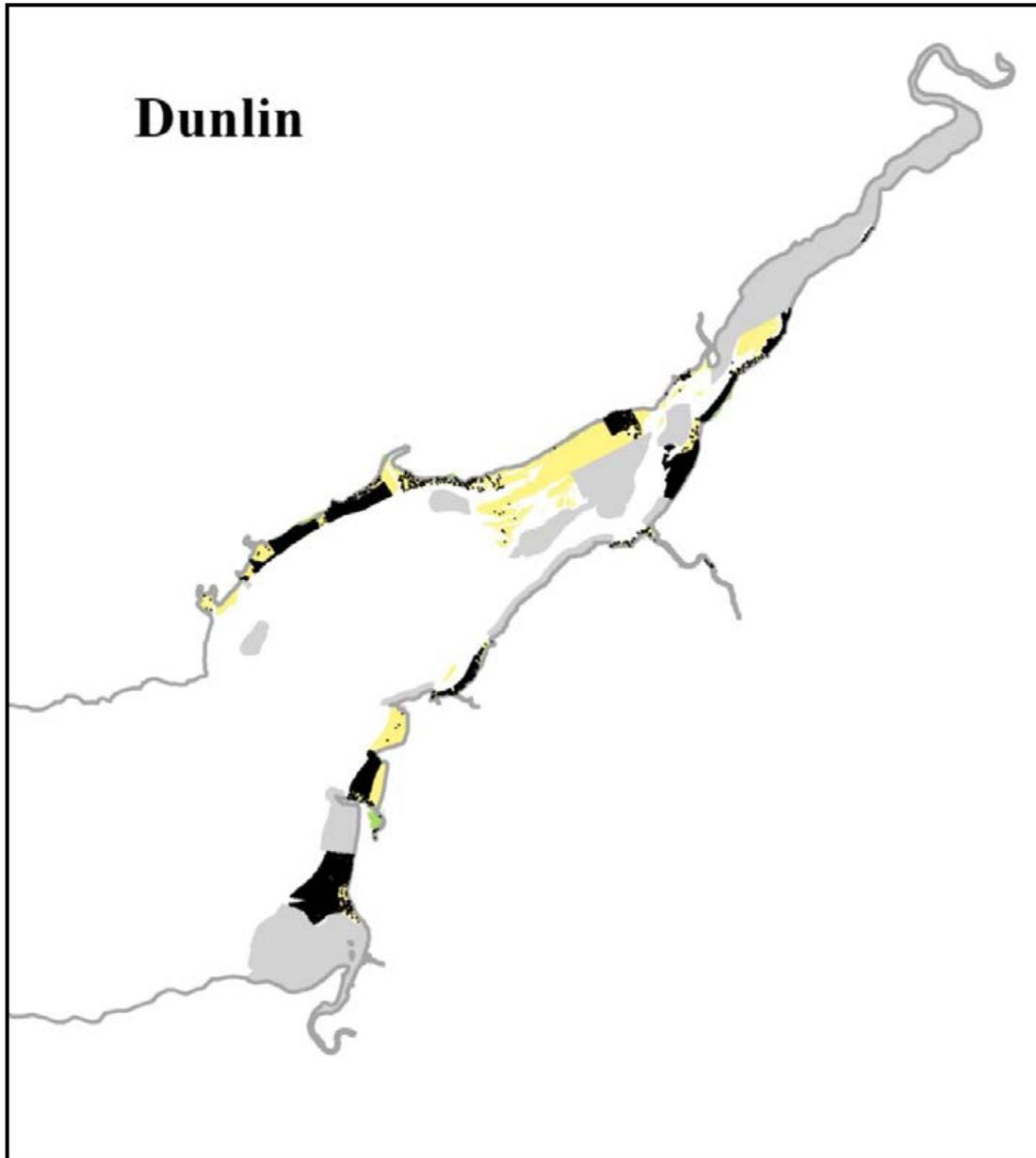


Figure 7.15.2 The mean numbers and distribution of Dunlin on the Severn Estuary in the winter of 1998/99, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

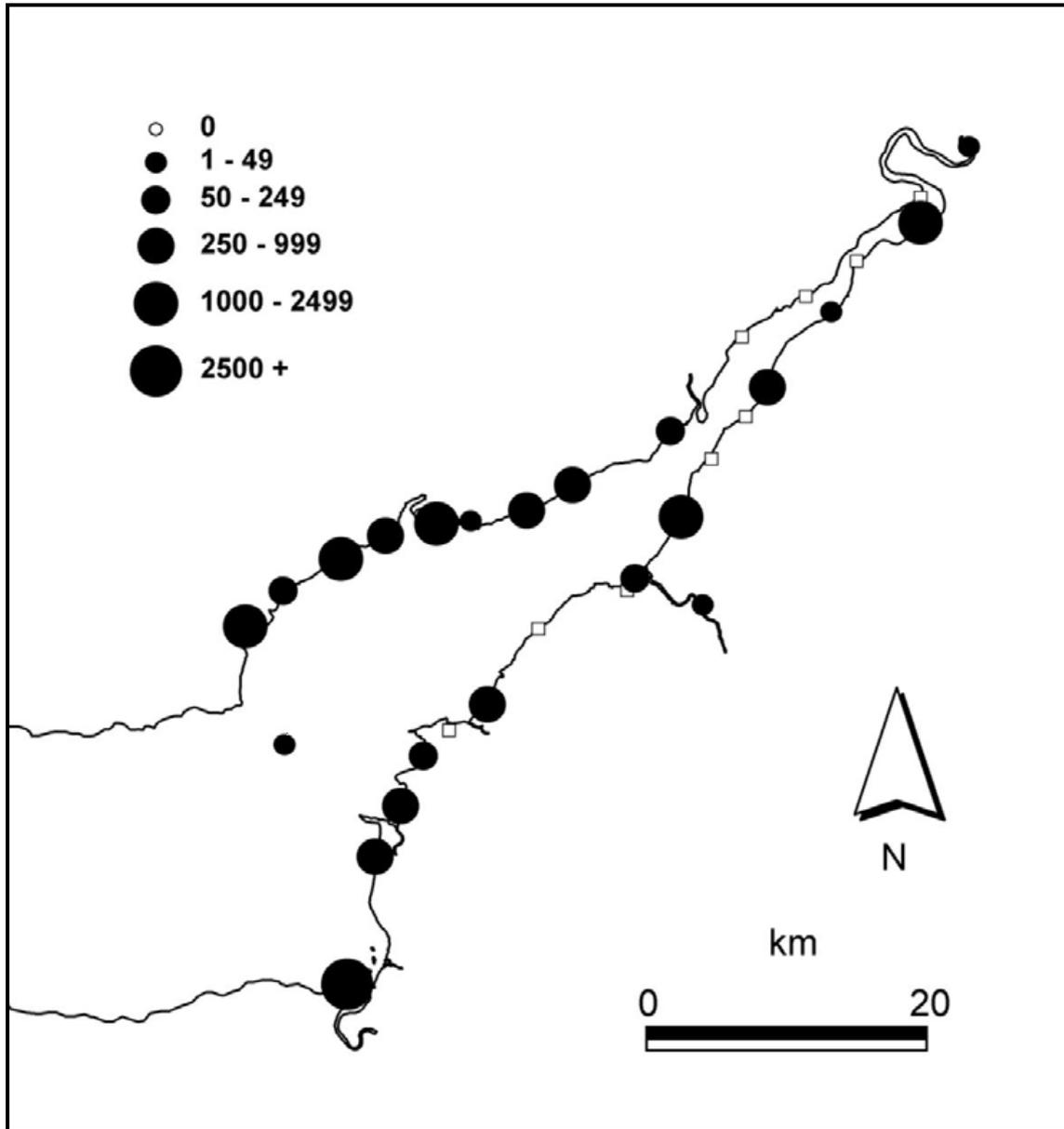


Figure 7.15.3 The mean numbers and distribution of Dunlin on the Severn Estuary in the winter, as shown by data from WeBS Core Counts (1996/97 to 2000/01). Open squares indicate sites not covered.

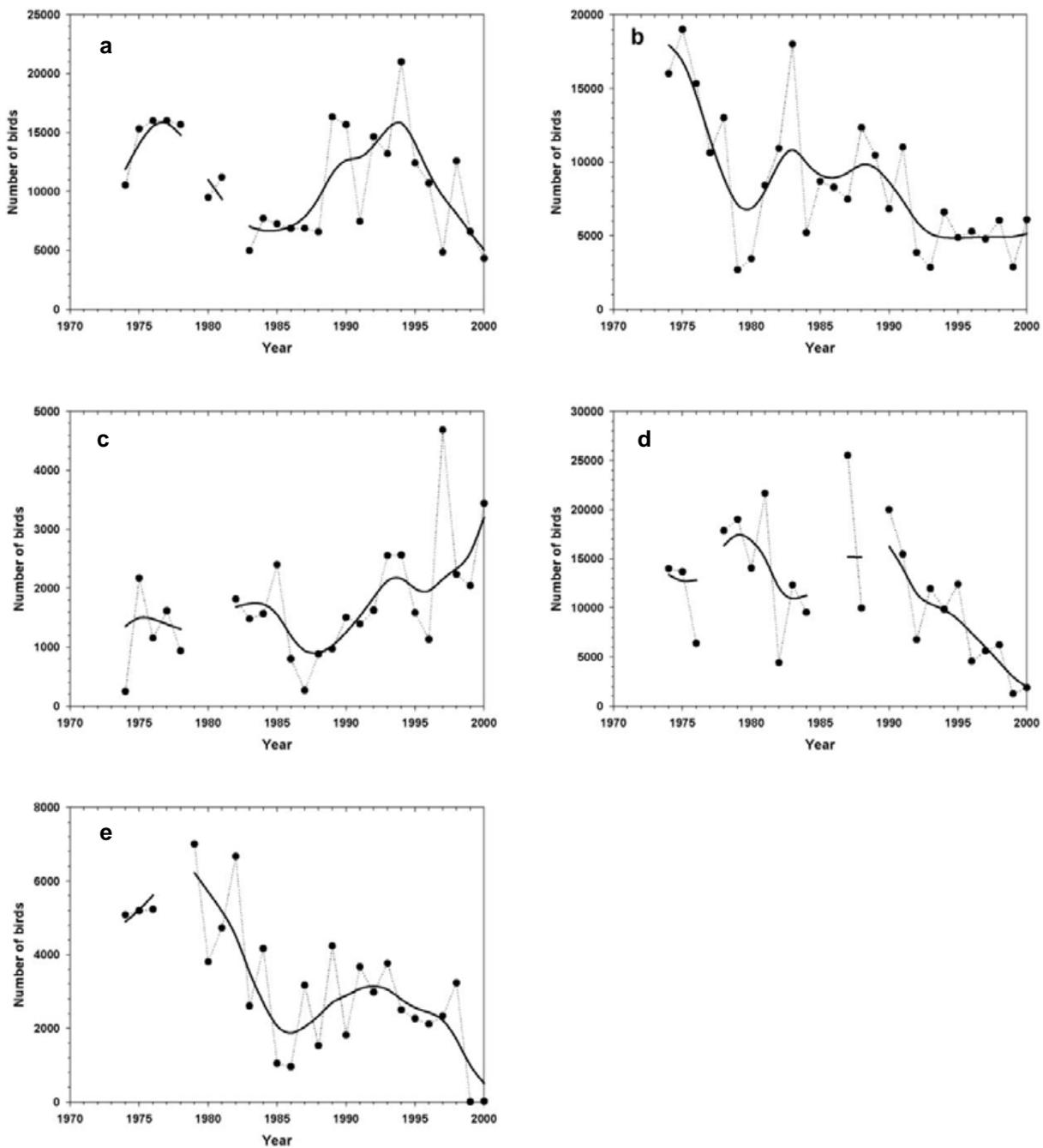


Figure 7.15.4 Trends in the numbers of Dunlin on sub-sites of the Severn Estuary as shown by WeBS Core Count data.

a = Severn Bridgwater; b = Severn Avon; c = Severn Gloucestershire; d = Gwent Severn; e = Cardiff Bay.

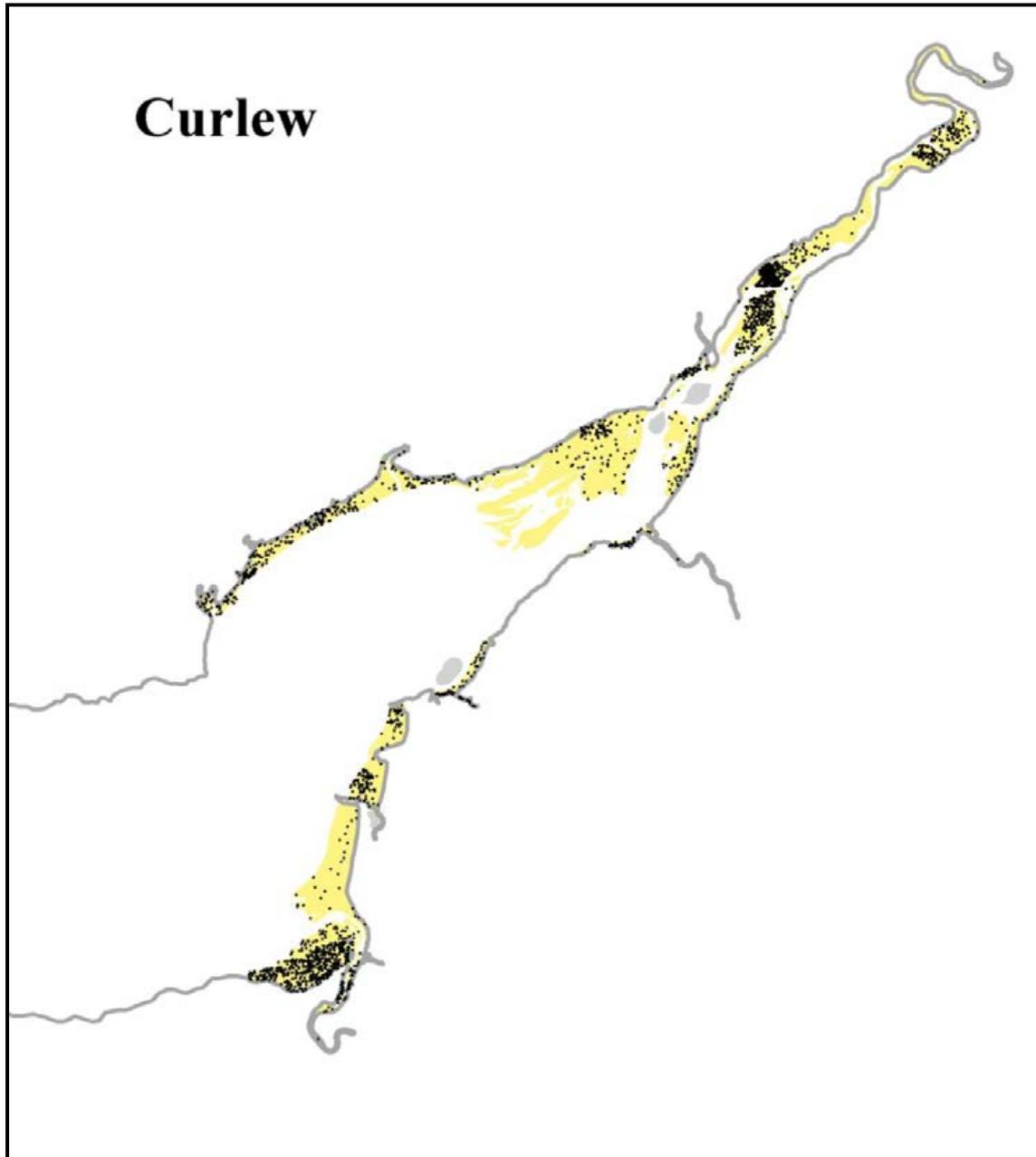


Figure 7.16.1 The mean numbers and distribution of Curlew on the Severn Estuary in the winters of 1987/88 to 1991/92, as shown by BTO low tide count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

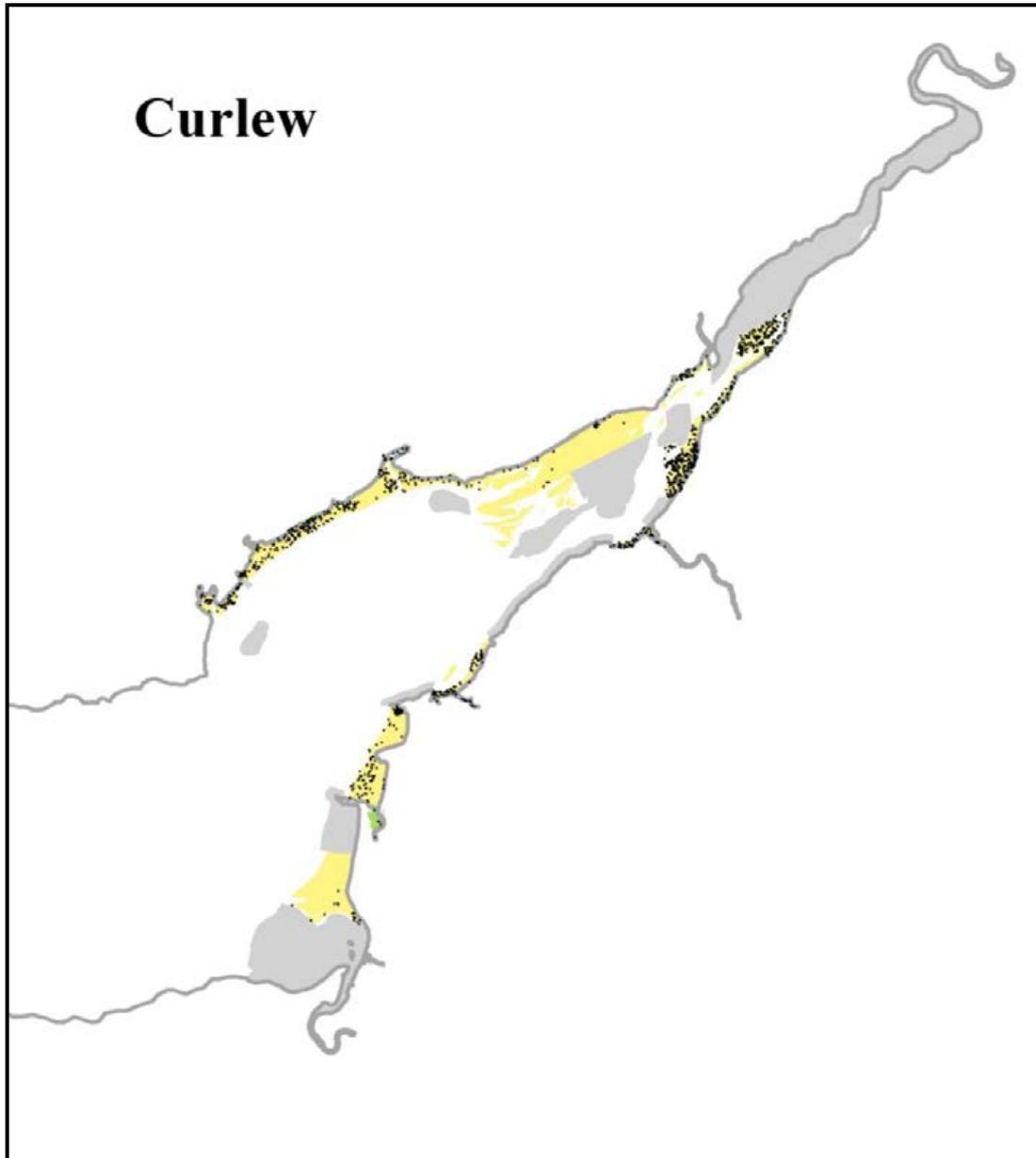


Figure 7.16.2 The mean numbers and distribution of Curlew on the Severn Estuary in the winter of 1998/99, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

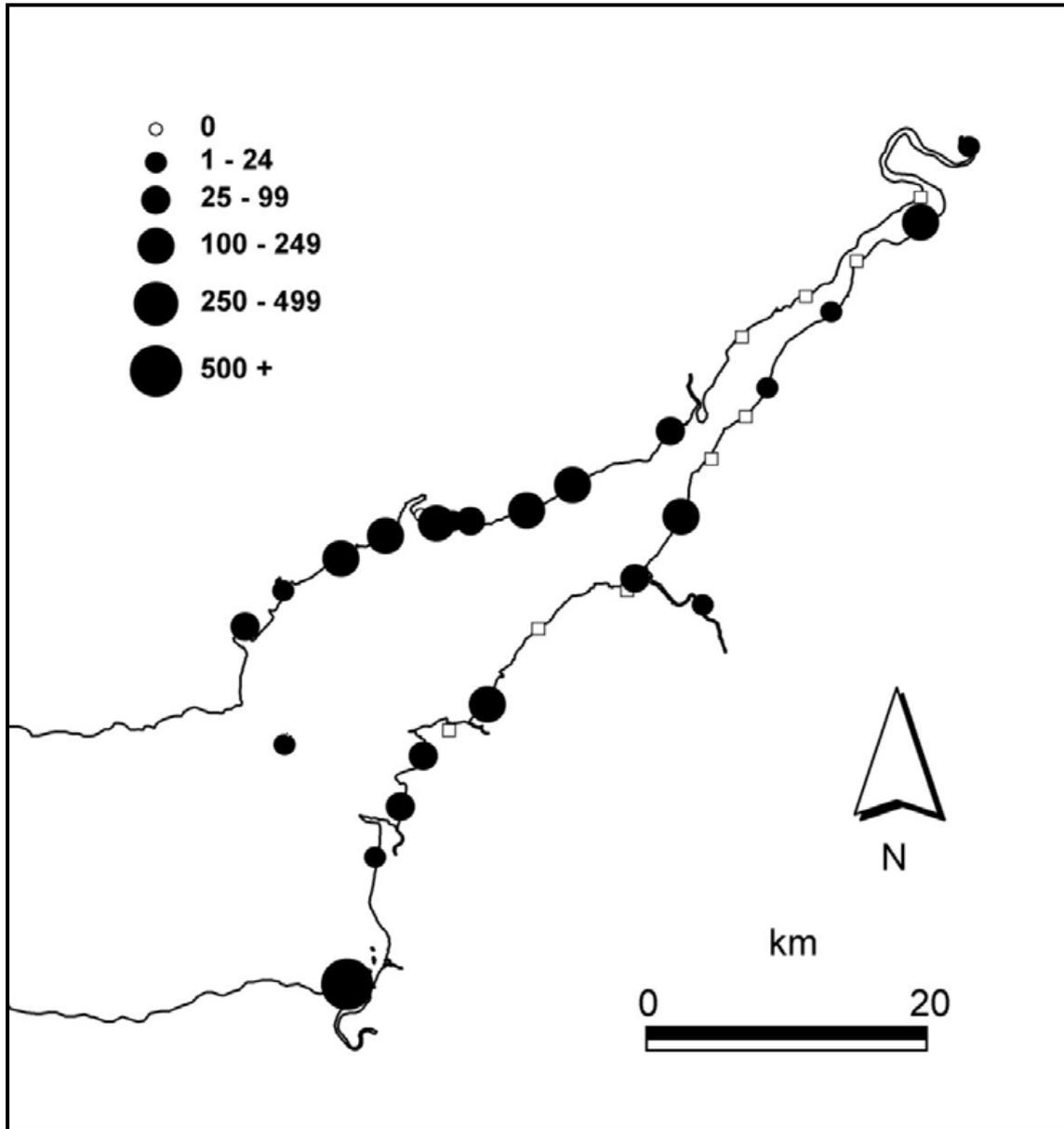


Figure 7.16.3 The mean numbers and distribution of Curlew on the Severn Estuary in the winter, as shown by data from WeBS Core Counts (1996/97 to 2000/01). Open squares indicate sites not covered.

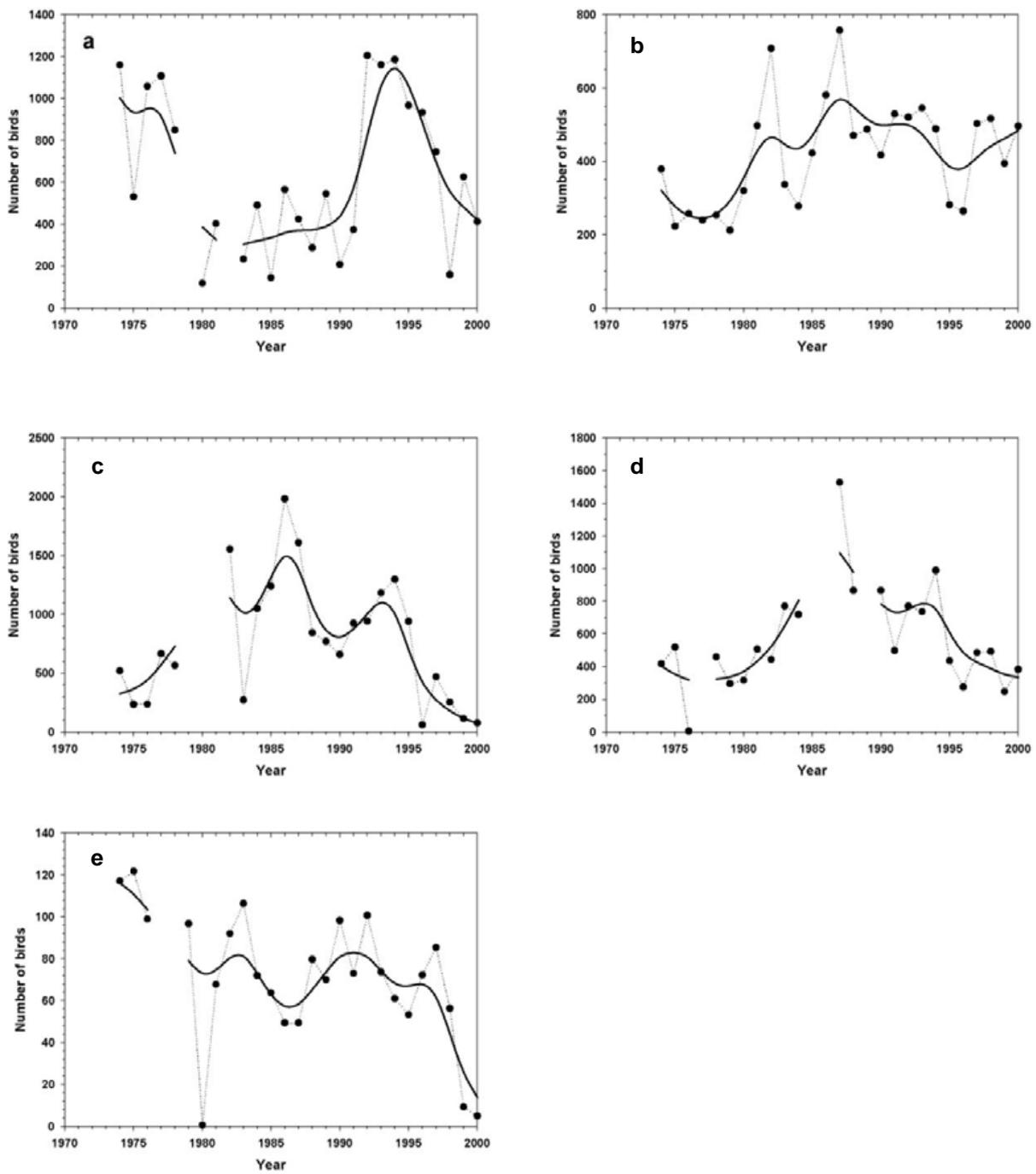


Figure 7.16.4 Trends in the numbers of Curlew on sub-sites of the Severn Estuary as shown by WeBS Core Count data.

a = Severn Bridgwater; b = Severn Avon; c = Severn Gloucestershire; d = Gwent Severn; e = Cardiff Bay.

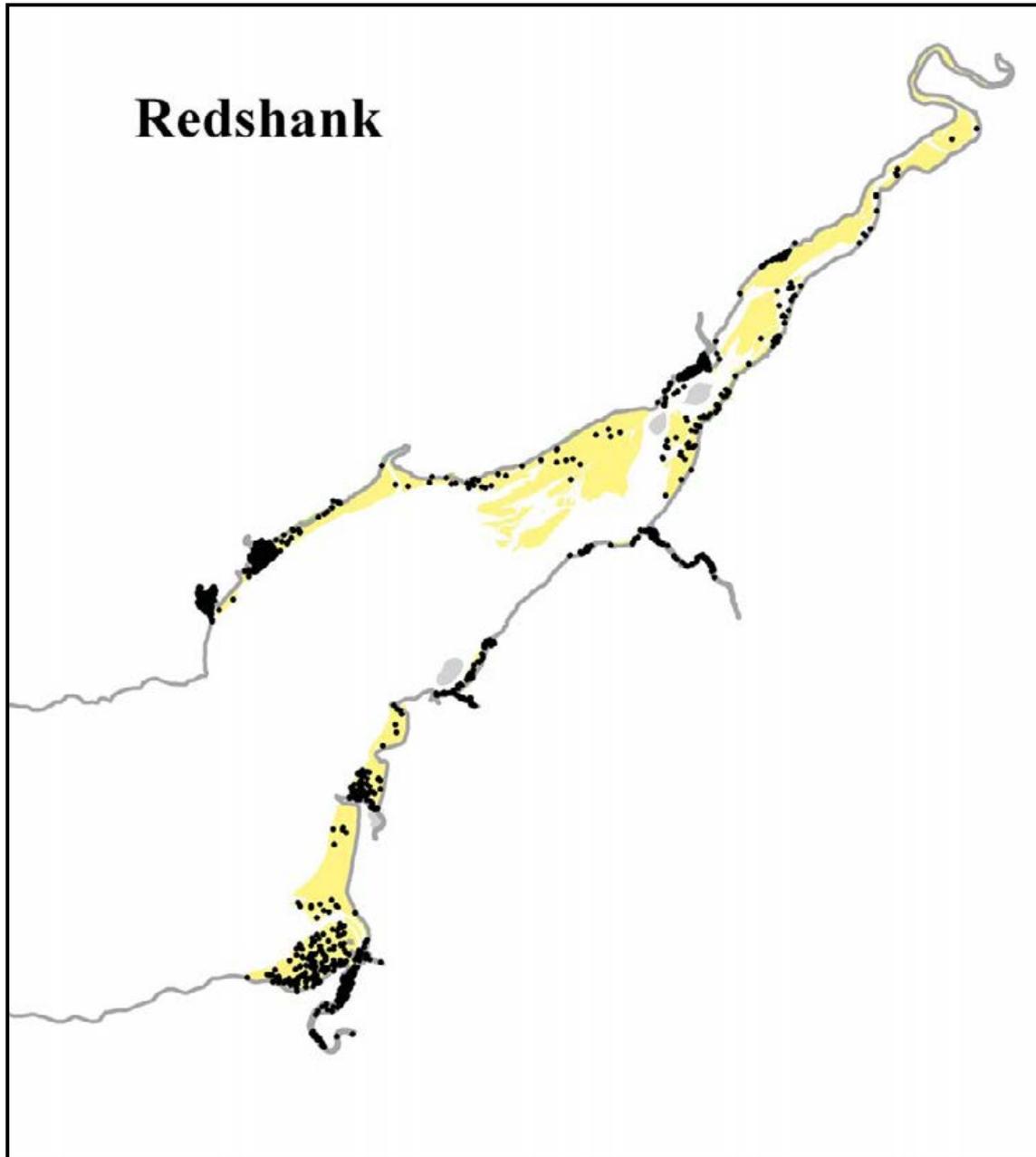


Figure 7.17.1 The mean numbers and distribution of Redshank on the Severn Estuary in the winters of 1987/88 to 1991/92, as shown by BTO low tide count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

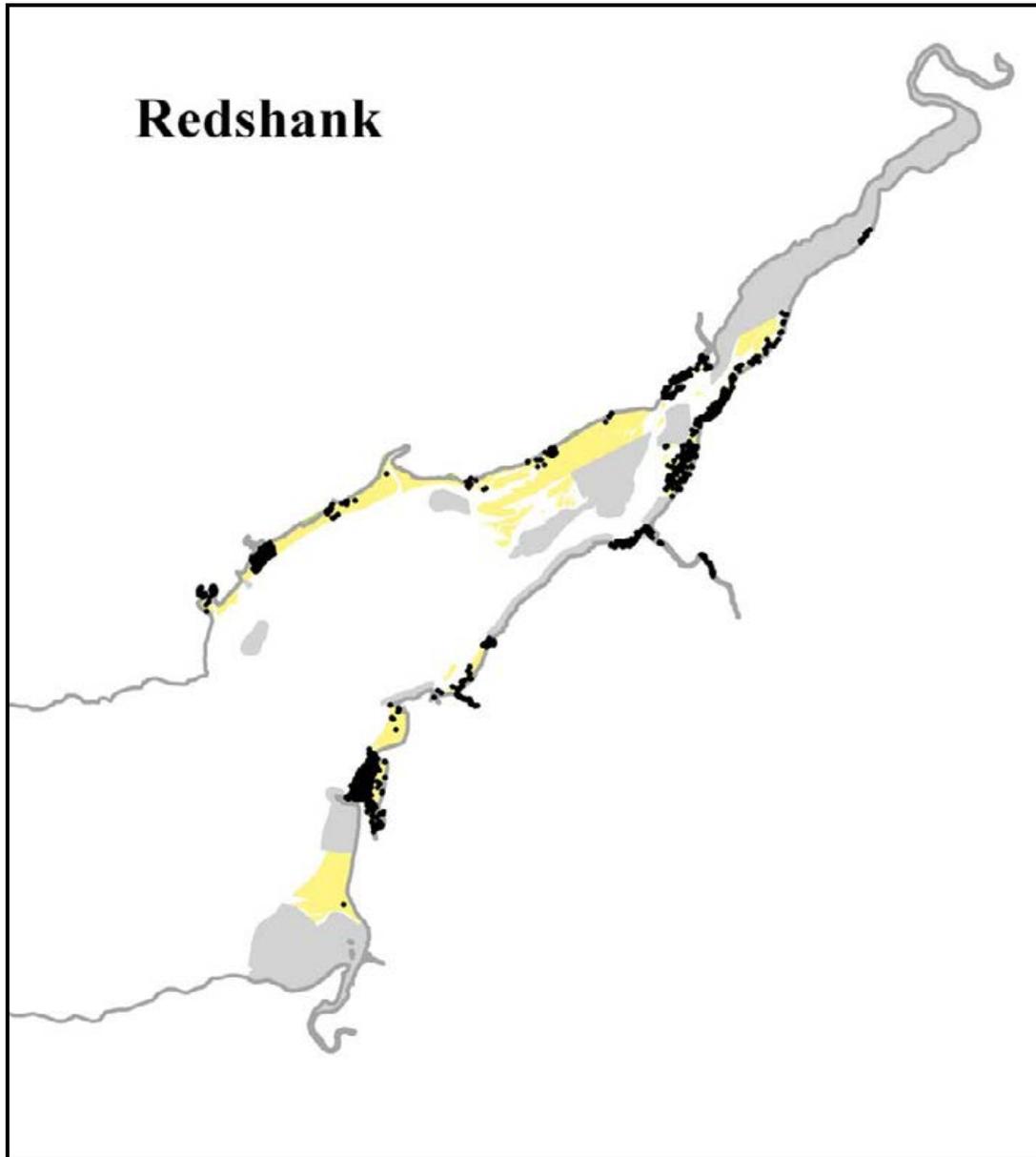


Figure 7.17.2 The mean numbers and distribution of Redshank on the Severn Estuary in the winter of 1998/99, as shown by WeBS Low Tide Count data. Grey shading indicates areas not counted; yellow shading indicates surveyed intertidal areas and green shading surveyed areas above the mean high water mark.

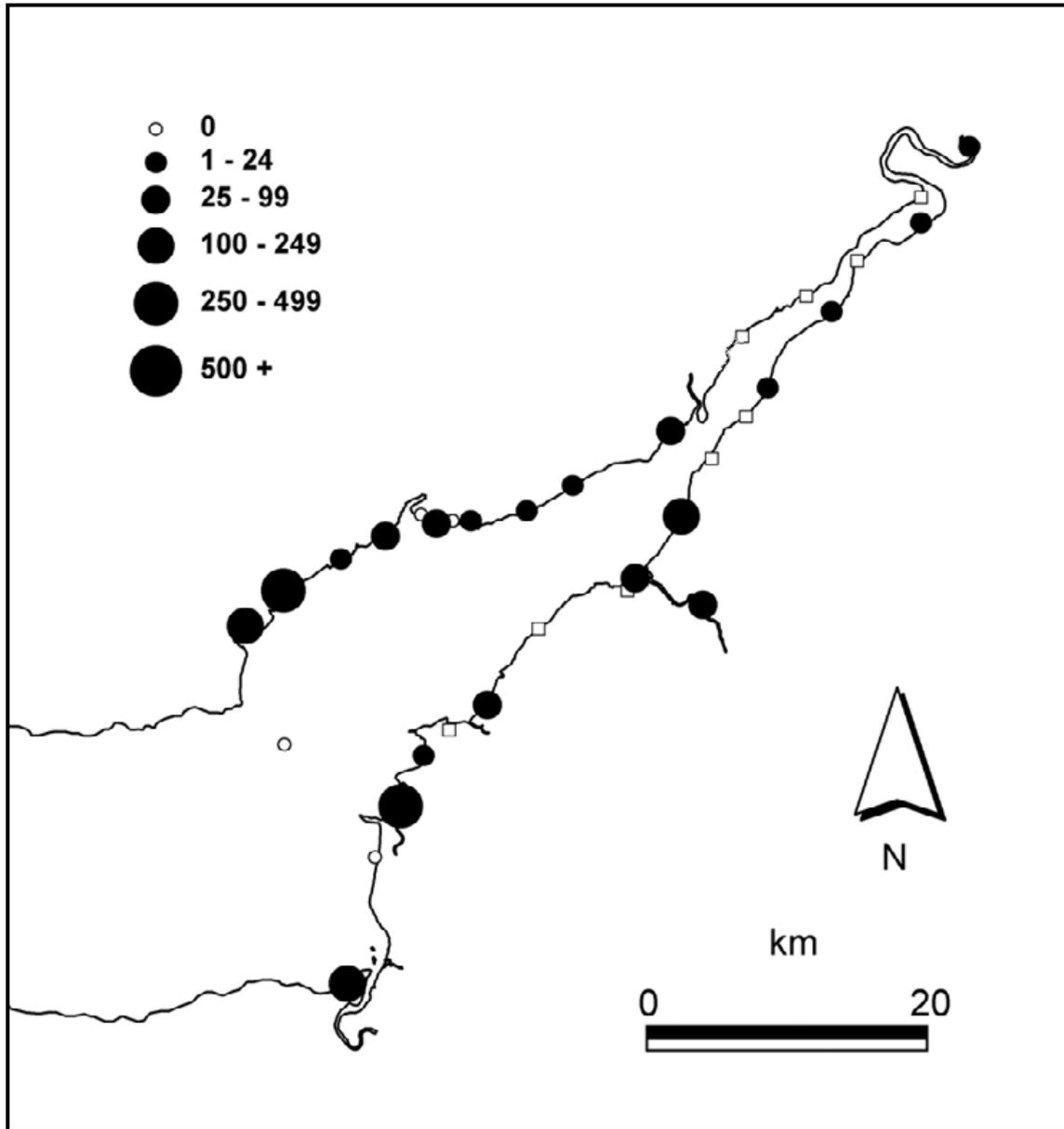


Figure 7.17.3 The mean numbers and distribution of Redshank on the Severn Estuary in the winter, as shown by data from WeBS Core Counts (1996/97 to 2000/01). Open squares indicate sites not covered.

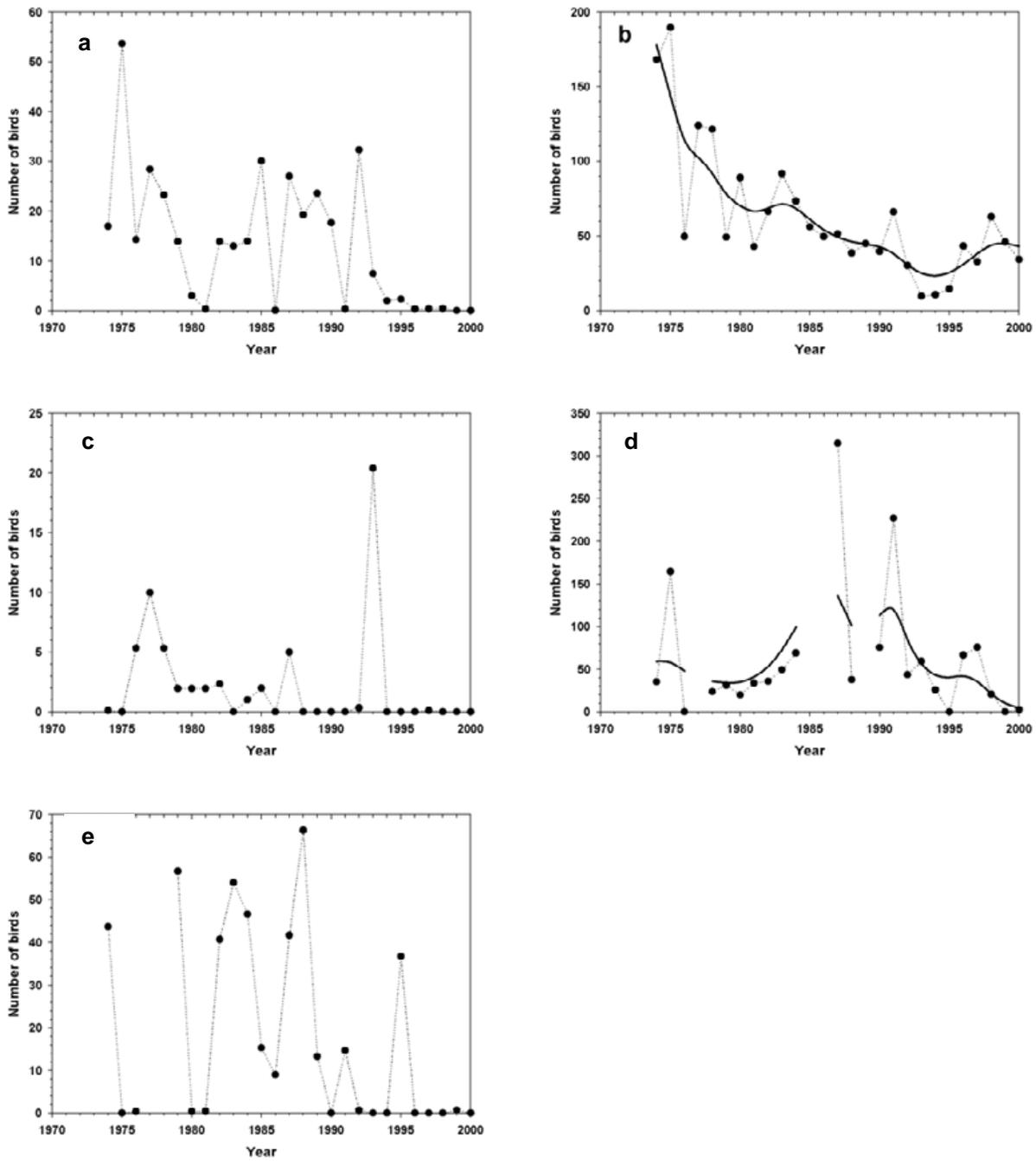


Figure 7.17.4 Trends in the numbers of Redshank on sub-sites of the Severn Estuary as shown by WeBS Core Count data

a = Severn Bridgewater; b = Severn Avon; c = Severn Gloucestershire; d = Gwent Severn; e = Cardiff Bay.

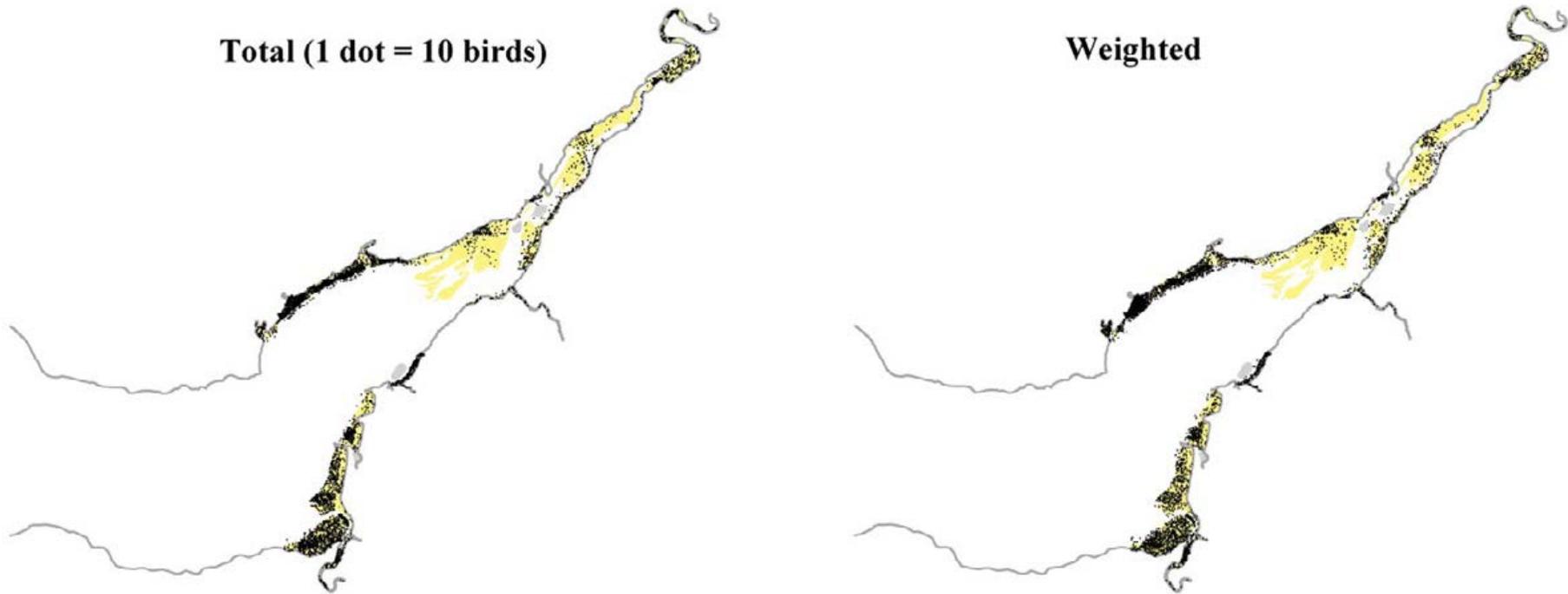


Figure 7.18.1 a. The mean number of all waterbird species (excluding gulls) recorded on each count section in the winters of 1987/88 to 1991/92, as shown by BTO low tide count data.

b. The mean number of all waterbird species (excluding gulls) recorded on each low tide count section in the winters of 1987/88 to 1991/92, with numbers of each species weighted by its national population size.

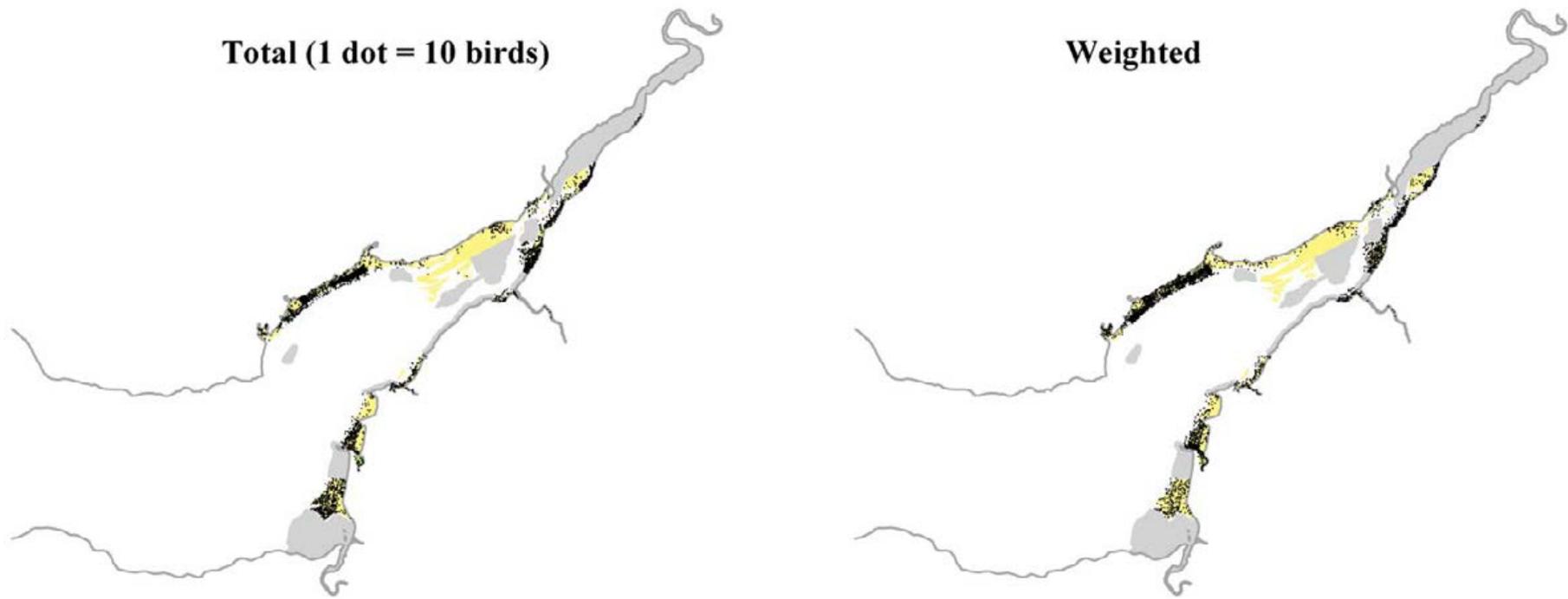


Figure 7.18.2 a. The mean number of all waterbird species (excluding gulls) recorded on each count section in the winter of 1998/99, as shown by WeBS Low Tide Count data.

b. The mean number of all waterbird species (excluding gulls) recorded on each WeBS Low Tide count section in the winter of 1998/99, with numbers of each species weighted by its national population size.