



**Feeding areas for Dark-bellied Brent  
Geese *Branta bernicla bernicla* around  
Special Protection Areas (SPAs) in the UK**

**WWT Research Report**

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**JNCC/WWT Partnership**

**March 2004**

Published by:

**The Wildfowl & Wetlands Trust**

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This publication should be cited as:

Rowell, H.E. & Robinson, J.A. 2004. Feeding areas for Dark-bellied Brent Geese *Branta bernicla bernicla* around Special Protection Areas (SPAs) in the UK. The Wildfowl & Wetlands Trust, Slimbridge.

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## Executive Summary

In 2003, WWT undertook a survey to identify and characterise the inland feeding areas of Dark-bellied Brent Geese around the 19 Special Protection Areas (SPAs) in the UK for which it is a qualifying species. To investigate the use of cropped habitats by Dark-bellied Brent Geese, a questionnaire was designed and sent out to relevant local experts for each SPA. Detailed accounts of the information provided by experts at each of these sites are presented in this report together with maps showing the locations of areas used by feeding birds. Given the marked differences in the amount and types of information provided, general patterns in habitat use across the SPA suite have been treated with caution.

Inland feeding was recorded at all sites for which information was provided. The use of inland feeding areas was recorded to varying extent at all surveyed sites during December-February, at nine out of eleven sites during September –November, and ten sites during March-May. The maps show that for each SPA, inland feeding areas are generally located within a few kilometres of the statutory boundary. Overall, at those sites for which data had been provided, feeding on permanent pasture was recorded at 38%, on fertilized pasture at 63%, on winter cereals at 88%, on oil seed rape at 38%, on golf courses at 19%, on amenity/recreational land at 25%, and on other grassed habitats at 19%. There were no records of birds feeding on spring cereals or stubbles.

The relative use of different habitats by Dark-bellied Brent Geese remained very similar through the non-breeding season, with winter cereals being used more frequently than any other habitat in the each of the three seasons defined. The percentage of time spent feeding on improved permanent pasture, winter cereals and oil seed rape peaked in December-February. In contrast, the use of permanent pasture increased through until spring. Birds only used golf courses and amenity/recreational land beyond November.

This study has demonstrated that, although there is a large amount of information gathered on habitat use by Dark-bellied Brent Geese, detail varies markedly between sites and information is generally not collected using any standard methodology. To improve the monitoring of habitat use for this and other large herbivorous waterbirds, there is a need to develop standardised methods to inform the future conservation and management of site networks across the African-Eurasian flyway.





# 1 Introduction

The Dark-bellied Brent Goose *Branta bernicla bernicla* is a winter visitor to Britain from its breeding grounds in Siberia (Ebbingge *et al.* 1999). Almost the entire 215,000 population of Dark-bellied Brent Geese winters on the northeast coast of Europe, with around 98,100 spending the winter in Britain (Wetlands International 2002; Kershaw & Cranswick 2003).

In the UK, the majority of Dark-bellied Brent Geese occur at a small number of estuarine sites in southern and eastern England (Ward 2004). Numbers build up from late September and reach a maximum in January (Pollitt *et al.* 2003). In March, most birds leave for staging grounds in the Wadden Sea (Rowcliffe & Vickery 2002). However, there is some regional variation in this pattern. In autumn, numbers build up earliest on the outer Thames Estuary; a large proportion of the UK population passes through this area in October and November (Rowcliffe & Vickery 2002). In Dorset and south Devon, numbers also peak relatively early, with maximum numbers seen in early December, followed by movement to other sites (Rowcliffe & Vickery 2002). Most other sites broadly follow the national pattern of numbers peaking from December to February, although large numbers remain on the Wash and in north Kent into May.

Most birds spend the winter along shallow coasts and estuaries with extensive mudflats and intertidal areas (Owen *et al.* 2003). A population increase of c. 22,000 in winter 1960/61 to around 300,000 in the late 1990s resulted in a rapid seasonal depletion of natural foods such as *Zostera*, *Enteromorpha*, and saltmarsh plants. This has led to an increase in the use of cropped habitats such as coastal grasslands and cultivated cereal crops (Ebbingge *et al.* 1999).

## 1.1 Feeding ecology

Historically, Dark-bellied Brent Geese have fed exclusively on intertidal habitats, predominantly on mudflats, during the winter where the main plants exploited are *Zostera* spp. and green algae (*Enteromorpha* spp. and *Ulva* spp.). Traditionally, saltmarshes have also been important winter feeding habitats. It appears that *Zostera* and algae were preferred when available, and saltmarshes were a second choice, at least during early and mid-winter (Rowcliffe & Mitchell 1998). It has been shown that Dark-bellied Brent Geese in Sussex and Essex fed mainly on *Zostera* and algae, and the saltmarsh was almost untouched (Campbell 1946; Burton 1961). In contrast, early studies carried out in Norfolk found that saltmarsh plants formed the main component of the birds' diet in late winter and early spring, after the *Zostera* and algae stocks had been depleted (Burton 1961; Charman & Macey 1978). This pattern of feeding on both mudflats and saltmarshes is now recorded for Dark-bellied Brent Geese across Britain. However, the relative importance of these habitats in different areas depends on their local availability. At sites where large quantities of *Zostera* are available, such as the Exe Estuary in Devon, this resource is the most important food source. In contrast, in Norfolk, where the formerly important *Zostera* beds have largely disappeared and algal beds are of limited extent, the relatively extensive saltmarshes now provide the most important intertidal habitat (Vickery *et al.* 1995; Rowcliffe & Mitchell 1998).

Inland feeding by Dark-bellied Brent Geese was rare in the early part of the 20<sup>th</sup> century (Ticehurst 1932). This habit occurred in the Netherlands before 1970, but it was not until the 1970s that regular and significant inland feeding was recorded, initially by Dark-bellied Brent Geese in Essex (Charman 1979; St. Joseph 1979). By the late 1970s, up to 40,000 geese were feeding on arable crops and improved pasture, and conflicts with agriculture became increasingly common (St. Joseph 1982). In an area of North Norfolk, the proportion of time spent on cropped habitats increased in the 1980s, and nearly two thirds of the geese in the area fed on grass fields in 1988/89 (Summers & Critchley 1990). Since then, inland feeding by large numbers of birds has become a regular occurrence at almost all the key sites in the southeast of England. This phenomenon has been associated with a three-fold increase in the population since the 1970s (Salmon & Fox 1991; Rowcliffe & Mitchell 1998). The loss of the birds' natural habitat due to development and agriculture may also have contributed to the change in feeding habits (Hampshire Brent Goose Strategy Group 2002). At most sites in the core range, from the Wash to the Solent, a large proportion of the total feeding time of Dark-bellied Brent Geese during midwinter is now spent inland (Summers & Critchley 1990; McKay *et al.* 1994). Inland habitats used by Dark-bellied Brent Geese include grasslands (particularly fertilised grassland), winter cereals, oilseed rape, and even recreation and sports grounds. Where grazing has been intense, significant damage to crops has been recorded (Summers 1990; Summers & Stansfield 1991; McKay *et al.* 1993; Hampshire Brent Goose Strategy Group 2002).

The suitability of inland sites for Dark-bellied Brent Geese depends on a number of factors, including distance from the coast, the size of the grazing area, the type of grassland management, visibility and disturbance. Most sites used by the birds are within 5 km from the coast, and they prefer large, open sites where they have clear sight lines (McKay *et al.* 2001; Hampshire Brent Goose Strategy Group 2002). Many of the fields on the reclaimed marshes still show the old creek structure and the birds do not use the fields (A. St. Joseph pers. comm.) due to the poor visibility. Arable land (particularly oilseed rape and winter cereals) and grassland (including sports and recreation grounds) has been shown to be the most important of inland feeding habitats (Hampshire Brent Goose Strategy Group 2002). However, oilseed rape becomes unpalatable to the birds after a certain time of year (A. St. Joseph pers. comm.). Suitably located grasslands are likely to provide attractive feeding areas for birds irrespective of the cutting or grazing regime, so long as the resulting sward is short (<5cm). The addition of fertilisers (organic or inorganic) significantly improves the attractiveness of sites to geese (Vickery *et al.* 1994). McKay *et al.* (2001) showed that Dark-bellied Brent Geese show a clear preference for White Clover (*Trifolium repens* L.) to Perennial Ryegrass (*Lolium perenne* L.) or Timothy (*Phleum pratense* L.). No apparent differences in preference between the grass species have been recorded. The best grassland for Dark-bellied Brent Geese is that grazed by a dairy herd and then cut for silage, or grassland grazed by sheep. If fields are grazed by cattle, then their use by geese depends on the cattle density (A. St. Joseph pers. comm.).

There is evidence to show that intertidal habitats are preferred to inland habitats if they hold sufficient food resources of sufficiently high nutrient quality (Rowcliffe & Mitchell 1998). There is also evidence that suggests that, within sites, the first habitats used when the birds arrive in autumn are intertidal, and that inland feeding only occurs once the intertidal resources have been depleted (Vickery *et al.* 1995). Summers and Critchley (1990) described a sequential pattern of habitat use for Dark-bellied Brent Geese in Essex, Kent and Hampshire, with habitats used in the following order during autumn and winter; *Zostera* spp., *Enteromorpha* spp., saltmarsh and lastly agricultural land. Supporting this, it has been shown that in the autumn intertidal food resources have considerably higher nutrient qualities than inland resources (Ranwell & Downing 1959; Lane 1994). In contrast, by late winter/early spring, inland pasture has been shown to have a higher nutrient quality than saltmarsh resources, but this situation reverses as the spring progresses. This process helps explain the general shift back to saltmarsh feeding in spring (Boudewijn 1984).

The use of inland feeding sites is greatest at high tide, when the availability of intertidal food resources is limited. In years where there are large numbers of juvenile birds present in the flocks, greater use is made of inland sites. This is partly because there is more competition for food on the intertidal sources from older, more efficient feeders, and partly because grass is more nutritious. In harsh winters, more use is made of inland sites as the *Zostera* resources die back (Hampshire Brent Goose Strategy Group 2002).

## 1.2 The Dark-bellied Brent Goose SPA suite

Article 4.1 of the Council Directive of 2 April 1979 on the conservation of wild birds (79/409/EEC) states that regularly occurring migratory species and Annex I species *shall be the subject of special conservation measures concerning their habitat in order to ensure their survival and reproduction in their area of distribution. To achieve this, Member States shall classify in particular the most suitable territories in number and size as special protection areas for the conservation of these species, taking into account their protection requirements in the geographical sea and land area where the Directive applies.* To meet with its obligations under Article 4, around 250 Special Protection Areas (SPAs) have been designated for birds in the UK (Stroud *et al.* 2001). The Dark-bellied Brent Goose is recognised as a regularly occurring migrant in the UK, and therefore 19 SPAs have been selected for this species. Sites have been selected under Stage 1.2 (an area used by 1% or more of the Great Britain population) or Stage 1.3 (an area used regularly by over 20,000 waterfowl) of the selection guidelines for SPAs, as defined by the Joint Nature Conservation Committee in 1999 (Stroud *et al.* 2001).

**Table 1.** The SPA suite for Dark-bellied Brent Geese in the UK

SPA name	% of national population	Selection stage
Benfleet and Southend Marshes	3.7	1.2
Blackwater Estuary	14.9	1.2
Chesil Beach and The Fleet	3.1	1.2
Chichester and Langstone Harbours	16.6	1.2
Colne Estuary	4.8	1.2
Crouch and Roach Estuaries	3.0	1.2
Dengie	2.2	1.2
Exe Estuary	1.8	1.2
Foulness	12.7	1.2
Hamford Water	6.7	1.2
Humber Flats, Marshes and Coast (Phase 1)	2.5	1.2
Medway Estuary and Marshes	3.1	1.2
North Norfolk Coast	11.1	1.3
Poole Harbour	1.4	1.3
Portsmouth Harbour	2.8	1.3
Solent and Southampton Water	7.3	1.3
Stour and Orwell Estuaries	2.6	1.3
The Swale	1.9	1.3
The Wash	21.5	1.3

Section 4.5 of Volume 1 of the SPA Review (Stroud *et al.* 2001) outlines the general principles underlying boundary determination of SPAs in the UK. In summary, the *first stage of boundary determination involves defining the extent of area required by the qualifying species concerned ... scientific judgements made in light of the ecological requirements of the relevant species that may be delivered by that particular site, and the extent to which the site can fulfil these requirements.* Then every attempt is made to define an identifiable boundary on the ground and can be recognised by those responsible for management of the site. They must provide for the conservation requirements of the species in the season(s) and for the particular purposes for which they are classified.

However, whilst Stage 1 guidelines have been used to identify possible sites for SPA classification, Stage 2 judgements have been used to decide which are the “most suitable”. One factor applied in making Stage 2 judgements is that of naturalness (para 4.6.6). In general *sites having a low degree of naturalness (for example, urban and other industrialised landscapes) have not been selected for SPA classification. However, some less “natural” sites, with large numbers of species or high species diversity, have been chosen as SPAs. This, typically, reflects appropriate management over long periods that has benefited the species concerned. Such areas include low-intensity and small-scale arable areas (which can be of particular importance for species such as Corncrake and Stone-curlew) and some water storage reservoirs.*

The Review goes on to state (para 4.5.2) that where species requirements are not met entirely by means of SPA classification, additional provision is achieved through other policies (for example, agri-environment incentives to manage areas surrounding SPAs in an environmentally sensitive manner).

In its judgement against The Netherlands (Case C-3/96), the ECJ declared that Member States are obliged to classify all sites, which applying the ornithological criteria, appear to be the most suitable territories for the species in question and that this duty cannot be avoided by adopting other conservation measures. As a result, the Commission has advised that the fact a site is improved agricultural land is not, in itself, a sufficient reason not to designate it as an SPA if the area in question is one of the most suitable territories for birds listed in Annex I and migratory species. Whilst other scientific factors may lead one to conclude that an area is not the most suitable (e.g. if the area is not regularly used), the nature of the habitat should not be the basis of excluding an area from an SPA.

The judgement against France in relation to the Marais Poitevin (Case C-96/98) is also relevant in that the ECJ declared that the French Government had failed to classify a sufficiently large area of SPA and, in addition, that those areas classified as SPA did not have a legal status such as to guarantee protection of habitats and the survival and reproduction of the protected species. In particular, agri-environment measures were inadequate to offer the level of protection required by Article 4, as these were voluntary in nature.

The application of “naturalness” as one of the criteria at Stage 2 has led to some sites containing improved agricultural land or commercial forestry land not being designated (affecting, at one time, Nightjar *Caprimulgus europaeus* and Capercaillie *Tetrao urogallus*) and the size of others being too small, (affecting a significant number of species including Whimbrel *Numenius phaeopus*, geese (including Greenland White-fronted *Anser albifrons flavirostris*, Pink-footed *Anser brachyrhynchus*, and Barnacle Geese *Branta leucopsis*), Curlew *Numenius arquata*, Golden Plover *Pluvialis apricaria*, Marsh Harrier *Circus aeruginosus*, Hen Harrier *Circus cyaneus*, Montagu’s Harrier *Circus pygargus*, and Merlin *Falco columbarius*).

At this stage, it has not been possible to identify the reasons for this policy presumption against the designation of such land. In recent years, the naturalness criterion has been applied less strictly to the designation of commercial conifer plantations for Nightjar, Woodlark *Lullula arborea* and Capercaillie, croftland for Corncrake *Crex crex*, and tillage for Stone Curlew *Burhinus oedinenus*. Therefore, the SPA network may be incomplete for wintering waterbird species that are reliant on agriculturally improved habitats for roosting or feeding if the ‘most suitable territories’ have not been included. Given its reliance on ‘cropped’ habitats during the winter, the Dark-bellied Brent Goose is a species that may be affected by this issue. However, before decisions made regarding the criteria by which cropped habitats may be considered for designation for this species, it is timely to investigate the regularity of use of cropped habitats by Dark-bellied Brent Geese around existing SPA boundaries, thus informing any subsequent process for site identification.

### 1.3 Aims and objectives

This report aims to identify and characterise the inland feeding areas of Dark-bellied Brent Geese around the 19 Special Protection Areas (SPAs) in the UK for which the species is a qualifying species.

To meet the aims of the study, a number of objectives were identified. These were:

- i) to identify the locations of feeding areas used by Dark-bellied Brent Geese around the SPAs for which the species qualifies as an interest feature.
- ii) to identify the relative importance of these feeding areas in terms of the number of geese present and the frequency of use.
- iii) to characterise the feeding areas used in terms of land use, distance from roost, field size, visibility and disturbance.

## 2 Methodology

To investigate the use of cropped habitats by Dark-bellied Brent Geese, a questionnaire was designed and sent out to relevant local experts for each of the 19 SPAs for which it is a qualifying species. The format of the questionnaire is presented in Appendix 1. Experts chosen included contributors to the Wetland Bird Survey (WeBS) or WWT/JNCC's Goose Monitoring Programme. Site managers, nature reserve wardens and other relevant professionals were also consulted. Each expert was also sent a photocopied 1:25 000 Ordnance Survey map of the site for which they were asked to submit information. The map showed the boundary of the relevant SPA and additional land up to 5 km from the boundary. This 'buffer' distance was chosen because Dark-bellied Brent Geese tend to fly no more than 5 km from their roost to inland feeding areas (McKay *et al.* 2001).

The first section of the questionnaire requested details on the experts and the SPA for which they were providing information.

The second section requested information on the feeding areas used by Dark-bellied Brent Geese using SPAs. Information was required on whether or not Dark-bellied Brent Geese had used coastal/estuarine feeding areas within/around the SPA during the last five winters (1998/99-2002/03). Experts were also asked to indicate which estuaries birds recorded within the SPA visited (especially for those SPAs located close to other estuaries where between-site movements may occur). The questionnaire then requested information on whether or not birds had used inland feeding areas within/around the SPA during the last five winters. Experts were asked to mark these areas on the attached map.

The third section requested information on the regularity of use of different cropped habitats. Local experts were asked to quantify the average total numbers of Dark-bellied Brent Geese present within/around the SPA in autumn (September-November), winter (December-February) and spring (March-May). They were then asked to estimate, for each season, the percentage of the total population using land use types specified in the questionnaire: permanent pasture, improved (fertilised) permanent pasture, winter cereals, spring cereals, stubble, oilseed rape, golf courses, recreation/amenity grounds, or other. These land use categories have been used previously for studies of Dark-bellied Brent Goose feeding areas (e.g. Summers 1990; Summers & Critchley 1990; Hampshire Brent Goose Strategy Group 2002).

The final section requested information on the use of individual fields. Each expert was then asked to mark on the map provided the land use in each field used by the birds, using the categories mentioned above. They were also asked to provide counts of birds within individual fields made over the last five winters (including dates of counts). If they did not have accurate counts available, they were asked if they could give an indication of average numbers in each field using one of the following categories: <10 birds, 10-50, 50-100, 100-500, 500-1000, >1000).

### 3 Results

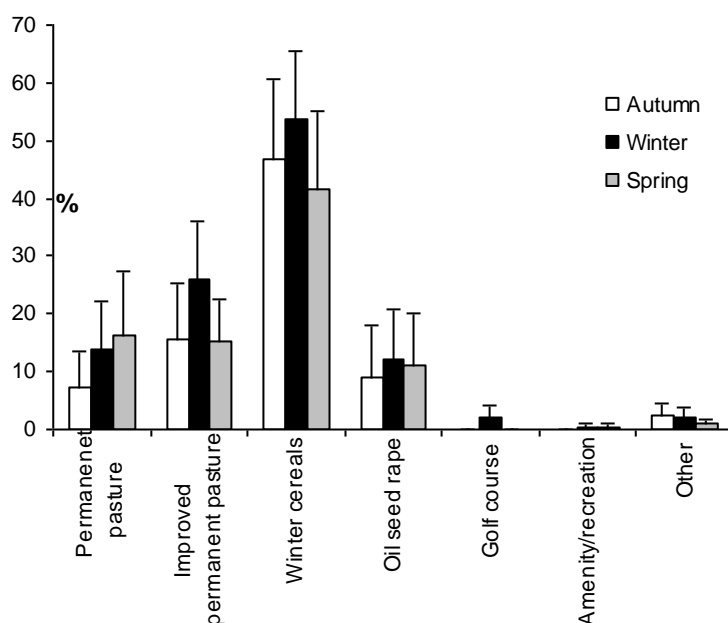
The results of the consultation exercise are summarised for each SPA in the tables below. Each expert contributor is acknowledged at the head of the site account. Information was received from all sites except Poole Harbour, yet the detail varied markedly between sites according to the data available. For the Humber Flats, Marshes and Coast and the Solent and Southampton Water, the information presented relates to only a very small section of the site. No information was received from beyond these areas and therefore may not provide a complete picture of inland feeding by this species at these sites. Given this difference in the quantity and quality of data collated, the following synthesis of the use of inland habitats by Dark-bellied Brent Geese should be treated with caution.

Inland feeding was recorded at all sites for which information was provided, although recent information on the use of habitats outside the statutory boundary was not available for Benfleet and Southend Marshes SPA. In general, the results show the expected pattern of birds feeding on their traditional estuarine habitats when they arrive in autumn (September to November), then moving inland to feed as the winter progresses (December to February), with a movement back to estuarine areas in the spring (March to May). However, feeding on cropped land was recorded during the autumn at nine out of eleven sites (no autumn feeding inland at Colne Estuary or Exe Estuary) and during spring at ten sites (no spring feeding inland at Foulness). The use of inland feeding areas was recorded to varying extent at all surveyed sites during the winter.

The maps show that for each SPA, inland feeding areas are generally located just outside the SPA boundary. Overall, at those sites for which data had been provided, feeding on permanent pasture was recorded at 38%, on fertilized pasture at 63%, on winter cereals at 88%, on oil seed rape at 38%, on golf courses at 19%, on amenity/recreational land at 25%, and on other grassed habitats at 19%. There were no records of birds feeding on spring cereals or stubbles.

Seasonal differences in the use of inland habitats across the SPA suite are shown in Fig. 1. The relative use of different habitats by Dark-bellied Brent Geese remained very similar through the non-breeding season, with winter cereals being used more frequently than any other habitat in the each of the three seasons defined. The percentage time spent feeding on improved permanent pasture, winter cereals and oil seed rape peaked in December-February. In contrast, the use of permanent pasture increased through until spring. Birds only used golf courses and amenity/recreational land beyond November.

**Figure 1.** Mean percentage use of different inland feeding habitats by Dark-bellied Brent Geese in and around SPAs in the UK (bars represent 1SE)



### 3.1 Benfleet and Southend Marshes

Information on feeding areas around Benfleet and Southend Marshes was kindly supplied by Derek Wood.

<b>3.1.1 Site details</b>			
SPA name	Benfleet & Southend Marshes		
Area (ha)	2251.31		
Latitude	51 31 42 N		
Longitude	00 41 00 E		
SSSI	Benfleet & Southend Marshes		
Ramsar	Benfleet & Southend Marshes		
IBA	Benfleet & Southend Marshes		
Site description	Benfleet and Southend Marshes are located on the north shore of the Outer Thames Estuary in southern England. The site comprises an extensive series of saltmarshes, cockle shell banks, mudflats, and grassland that supports diverse flora and fauna. The productive mudflats, cockle shell banks and diverse saltmarsh communities provide a wide range of feeding and roosting habitats for the waterbirds that use the site, including the over-wintering Dark-bellied Brent Geese (Stroud <i>et al.</i> 2001).		
WeBS site total (92/93-96/97)	3,819		
<b>3.1.2 Location and type of inland feeding areas used</b>			
Estuaries used	In the autumn, 3,000-4,000 birds use the outer Thames (Wakering and Foulness) and the Medway Estuaries.		
Inland habitats used for feeding	No recent information is available. However, it is possible that wintering birds (seldom more than 50-100 birds) use inland feeding areas. In the early 1990s, up to 400 birds fed on cereal fields around the SPA (at national grid reference TQ8185) and up to 100 on grass at Newlands (TQ8183). Since then, the only reports have been of the small group feeding on <i>Zostera</i> beds, where all autumn staging birds are known to feed.		
Locations of fields used for feeding	No information available.		
<b>3.1.3 Relative importance of the inland feeding areas</b>			
	Autumn (Sept-Nov)	Winter (Dec-Feb)	Spring (March-May)
Typical numbers of Dark-bellied Brent Geese present within/around the SPA	2,500	360	105 (in March)

## 3.2 Blackwater Estuary

Information on feeding areas around the Blackwater Estuary was kindly supplied by Derek Wood.

<b>3.2.1 Site details</b>			
SPA name	Blackwater Estuary (Mid-Essex Coast Phase 4)		
Area (ha)	4395.15		
Latitude	51 45 13 N		
Longitude	00 51 59 E		
SSSI	Blackwater Estuary		
NNR	Blackwater Estuary		
Ramsar	Blackwater Estuary (Mid-Essex Coast Phase 4)		
IBA	Mid-Essex Coast		
Site description	The Blackwater Estuary is located on the Essex coast in eastern England. Its mudflats are fringed by saltmarsh on the upper shores, with shingle, shell banks and offshore islands a feature of the tidal flats. The surrounding terrestrial habitats: the sea wall, ancient grazing marsh and its associated fleet and ditch system, plus semi-improved grassland, are of high conservation interest (Stroud <i>et al.</i> 2001).		
WeBS site total (92/93-96/97)	15,392		
<b>3.2.2 Location and type of inland feeding areas used</b>			
Estuaries used	There are four fairly separate groups all confined to the Blackwater Estuary. In very hard winters birds have moved to the Crouch Estuary.		
Inland feeding habitats used	Improved (fertilised) permanent pasture Winter cereals Oil seed rape (occasionally) Amenity/recreation (football pitch) Other (grassed over rubbish tip)		
Locations of fields used for feeding	See Maps 1a and 1b		
<b>3.2.3 Relative importance of the inland feeding areas</b>			
	Autumn (Sept-Nov)	Winter (Dec-Feb)	Spring (March-May)
Typical numbers of Dark-bellied Brent Geese present within/around the SPA	4,000	6,500 (however, up to 14,000 were present during the early 1990s)	500-4,500 (in March)



Estimated % of the total site population in each season using:			
Improved permanent pasture	90%	70%	70%
Winter cereals	0%	15%	20%
Amenity/recreation	0%	5%	5%
Other	10%	10%	5%

See Appendix 2 for counts of Dark-bellied Brent Geese on fields around the Blackwater Estuary.

### 3.3 Chesil Beach and The Fleet

Information on feeding areas around Chesil Beach and The Fleet was kindly supplied by Steve Groves.

3.3.1 Site details			
SPA name	Chesil Beach and The Fleet		
Area (ha)	748.11		
Latitude	50 36 40 N		
Longitude	02 31 10 W		
SSSI	Chesil and The Fleet		
Ramsar	Chesil Beach and The Fleet		
IBA	Chesil Beach and The Fleet		
Site description	Chesil Beach and The Fleet are located on the south coast of England in Dorset. Chesil Bank is a long, linear shingle beach, which encloses a brackish lagoon (The Fleet). The Fleet is a barrier built saline lagoon. The salinity gradient, peculiar hydrographic regime and varied substrates, together with associated reedbed and intertidal habitats, and the relative lack of pollution in comparison to most other lagoons, have resulted in the Fleet being extraordinarily rich in wildlife. Outstanding communities of aquatic plants and animals are present, supporting large numbers of wintering waterbirds, including Dark-bellied Brent Geese (Stroud <i>et al.</i> 2001).		
WeBS site total (92/93-96/97)	3,182		
3.3.2 Location and type of inland feeding areas used			
Estuaries used	The Fleet lagoon and Portland Harbour		
Inland habitats used for feeding	Improved (fertilised) permanent pasture Winter cereals		
Locations of fields used for feeding	See Map 2		
3.3.3 Relative importance of inland feeding areas			
	Autumn (Sept-Nov)	Winter (Dec-Feb)	Spring (March-May)
Typical numbers of Dark-bellied Brent Geese present within/around the SPA	2,000 by Nov	1,000 in Dec, 200 by Feb	< 100
Estimated % of the total site population in each season using:			
Improved permanent pasture	10% by end of Nov	50% at times	10%

Winter cereals	10% by end Nov	50% at times	10%
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### 3.4 Chichester and Langstone Harbours

Information on feeding areas around Chichester and Langstone Harbours was kindly supplied by Anne de Potier and Bob Chapman.

3.4.1 Site details			
SPA name	Chichester and Langstone Harbours		
Area (ha)	5810.03		
Latitude	50 48 23 N		
Longitude	00 55 12 W		
SSSI	Chichester Harbour, Langstone Harbour		
Ramsar	Chichester and Langstone Harbours		
IBA	Chichester and Langstone Harbours		
Site description	Chichester and Langstone Harbours are located on the south coast of England in Hampshire and West Sussex. They are large, sheltered estuarine basins comprising extensive sand and mudflats that are exposed at low tide. The two harbours are joined by a stretch of water that separates Hayling Island from the mainland. Tidal channels drain the basin and penetrate far inland. The mudflats are rich in invertebrates and also support extensive algae beds, especially <i>Enteromorpha</i> species, and Eelgrass <i>Zostera</i> spp (Stroud <i>et al.</i> 2001).		
WeBS site total (92/93-96/97)	17,119		
3.4.2 Location and type of inland feeding areas used			
Estuaries used	Chichester and Langstone Harbours		
Inland feeding habitats used	Permanent pasture Improved (fertilised) permanent pasture Winter cereals Oil seed rape Golf course Amenity/recreation Other (sports ground, airfield, ley)		
Locations of fields used for feeding	See Maps 3a and 3b		
3.4.3 Relative importance of the inland feeding areas			
	Autumn (Sept-Nov)	Winter (Dec-Feb)	Spring (March-May)
Typical numbers of Dark-bellied Brent Geese present within/around the SPA	15-30 (in Sept)- 8,500 (in Nov)	12,000-14,000	5,200 in March declining to around 10 in May
Estimated % of the total			

Chichester Harbour population in each season using:			
Permanent pasture	63.27%	58.02%	93.18%
Improved permanent pasture	0%	2.2%	0%
Winter cereals	34.5%	18.9% (thought to be an underestimate as well-used fields were often missed during WeBS counts)	3.5%
Amenity/recreation	0%	0.17%	0%
Other (Airfield)	11.37%	7.07%	4.24%
Other (Ley)	4.42%	5.18%	1.16%

See Appendix 4 for monthly counts of Dark-bellied Brent Geese within Chichester Harbour for each of the last five winters, percentages of the population within Chichester Harbour on different land use types in each season for each of the last five winters, and counts of Dark-bellied Brent Geese on individual fields within Chichester Harbour for each of the last five winters.

#### 3.4.4 Other information provided

Experience suggests that the state of the field is the most important factor governing field choice by Dark-bellied Brent Geese. If there is no crop, or the grass is too long, then the birds will not use the field.

If the birds are given a choice of suitable cereal or rape fields, they will choose traditionally used fields first. Reserve fields are used if the traditional fields are unsuitable, or have been eaten out, although they will return to the latter if the crop recovers. Characteristics of the traditionally used fields include open aspect, large size, distance from the coast and disturbance levels (Hampshire Brent Goose Strategy Group 2002). However, this does not mean that small fields with hedgerows, or fields some way from the estuary are not used (such as fields coded BC at Northney and AK at Southbourne on Map 3a).

The birds are very site faithful (as shown by colour-ring sightings). Habituation to disturbance varies between flocks, with those constantly harassed by farmers and/or dogs being more wary of passers by than those who are not. However, after a while even the farmers do not effectively disturb the birds.

### 3.5 Colne Estuary

Information on feeding areas around the Colne Estuary was kindly supplied by Derek Wood.

<b>3.5.1 Site details</b>			
SPA name	Colne Estuary (Mid-Essex Coast Phase 2)		
Area (ha)	2701.43		
Latitude	51 48 57 N		
Longitude	00 57 36 E		
SSSI	Colne Estuary		
NNR	Colne Estuary		
Ramsar	Colne Estuary (Mid-Essex Coast Phase 2)		
IBA	Mid-Essex Coast		
Site description	<p>The Colne Estuary is located on the Essex coast in eastern England. It has a narrow intertidal zone, which is predominantly composed of flats of fine silt with mudflat communities typical of southeastern English estuaries. There are a wide variety of coastal habitats, which include mudflat, saltmarsh, grazing marsh, sand and shingle spits, disused gravel pits and reedbeds. These provide feeding and roosting opportunities for the waterbirds using the site, including the over-wintering Dark-bellied Brent Geese (Stroud <i>et al.</i> 2001).</p>		
WeBS site total (92/93-96/97)	4,907		
<b>3.5.2 Location and type of inland feeding areas used</b>			
Estuaries used	<p>Two flocks winter on the Colne Estuary:</p> <p>i) the largest flock is found on and to the north of Mersea Island. The main feeding area at the ECC reserve at East Mersea has become a wildflower meadow, and since then the population has declined faster than in most areas in Essex.</p> <p>ii) the smaller flock is found around Colne Point. In the past two winters (2001/02-2002/03) there has been no evidence of inland feeding at Colne Point, as there is sufficient food on the saltmarshes between St. Osyth Beach and Brightlingsea Creek to sustain the flock of several hundred Brent Geese.</p>		
Inland feeding habitats used	<p>Permanent pasture Winter cereals</p>		
Location of fields used for feeding	See Map 4		
<b>3.5.3 Relative importance of the inland feeding areas</b>			
	Autumn (Sept-Nov)	Winter (Dec-Feb)	Spring (March-May)
Typical numbers of Dark-bellied Brent Geese present	0	Around 2,000	9-1,200 (in March)

within/around the SPA			
Estimated % of the total site population in each season using:			
Permanent pasture	0%	70%	70%
Winter cereals	0%	30%	30%

See Appendix 4 for counts of Dark-bellied Brent Geese on fields around the Colne Estuary.

#### 3.5.4 Other information provided

At this site, the number of birds and the amount of time they spend feeding on saltmarsh is greatest in late winter.

### 3.6 Crouch and Roach Estuaries

Information on feeding areas around the Crouch and Roach Estuaries was kindly supplied by Derek Wood.

3.6.1 Site details			
SPA name	Crouch and Roach Estuaries (Mid-Essex Coast Phase 3)		
Area (ha)	1735.58		
Latitude	51 38 23 N		
Longitude	00 43 06 E		
SSSI	Crouch and Roach Estuaries		
Ramsar	Crouch and Roach Estuaries (Mid-Essex Coast Phase 3)		
IBA	Mid-Essex Coast		
Site description	<p>The Crouch and Roach Estuaries are located on the south Essex coast in eastern England. The River Crouch occupies a shallow valley between two ridges of London clay, whilst the River Roach is set predominantly between areas of brick earth and loams with patches of sand and gravel. The intertidal zone along the Rivers Crouch and Roach is 'squeezed' between the sea walls along both banks and the river channel. Unlike more extensive estuaries elsewhere in Essex, this leaves a relatively narrow strip of intertidal mud, which, nonetheless, is used, by significant numbers of waterbirds including Dark-bellied Brent Geese (Stroud <i>et al.</i> 2001).</p>		
WeBS site total (92/93-96/97)	3,074		
3.6.2 Location and type of inland feeding areas used			
Estuaries used	<p>There are two similar sized flocks that use the area:</p> <p>i) the upper Crouch flock roosts by Bridgemarsh Island and feeds between Blue House Farm Essex Wildlife Trust Reserve and South Woodham Ferrers. This flock moves east earlier.</p> <p>ii) the outer Crouch flock roosts on Ray Sands and feeds on the south Dengie and both sides of the Crouch.</p>		
Inland habitats used for feeding	<p>Improved (fertilised) permanent pasture Winter cereals Oil seed rape (in years when it is grown)</p>		
Location of fields used for feeding	See Map 5		
3.6.3 Relative importance of the inland feeding areas			
	Autumn (Sept-Nov)	Winter (Dec-Feb)	Spring (March-May)
Typical numbers of Dark-bellied Brent Geese present within/around the SPA	2,500	4,200	2,500 (in March)



Estimated % of the total site population in each season using:			
Improved permanent pasture	50%	50%	30%
Winter cereals	50%	50% (or less if oil seed rape is grown)	70%
Oil seed rape	0%	10% (in years when oil seed rape is grown)	0%

See Appendix 5 for counts of Dark-bellied Brent Geese on fields around the Crouch and Roach Estuaries.

## 3.7 Dengie

Information on feeding areas around Dengie was kindly supplied by Derek Wood.

3.7.1 Site details			
SPA name	Dengie (Mid-Essex Coast Phase 1)		
Area (ha)	3127.23		
Latitude	51 41 26 N		
Longitude	00 57 34 E		
SSSI	Dengie		
NNR	Dengie		
Ramsar	Dengie (Mid-Essex Coast Phase 1)		
IBA	Mid-Essex Coast		
Site description	Dengie is located on the Essex coast in eastern England. It is a large, remote area of tidal mudflats and saltmarshes at the eastern end of the Dengie peninsula, between the adjacent Crouch and Roach estuaries. The saltmarsh is the largest continuous example of its kind in Essex. The foreshore, saltmarsh and beaches support an outstanding assemblage of rare coastal flora, which provide feeding areas for waterbirds, including Dark-bellied Brent Geese (Stroud <i>et al.</i> 2001).		
WeBS site total (92/93-96/97)	2,308		
3.7.2 Location and type of inland feeding areas used			
Estuaries used	There are two separate flocks, which are divided by the Howe Outfall: i) the northern flock uses the Blackwater to Bradwell-on-Sea; a few birds come from Tollesbury Wick. This flock is often not present. ii) the southern flock uses the outer Crouch Estuary, Foulness, Wallasea Island and, until recently, south Dengie. A few hundred birds still feed on the big saltmarsh at south Dengie at high tide, and birds still roost here on Ray Sands. However, numbers at south Dengie have declined as shooting occurs.		
Inland habitats used for feeding	Winter cereals Oil seed rape (in years when grown)		
Location of fields used for feeding	See Map 6		
3.7.3 Relative importance of inland feeding areas			
	Autumn (Sept-Nov)	Winter (Dec-Feb)	Spring (March-May)
Typical numbers of Dark-bellied Brent Geese present within/around the SPA	150	500	up to 500 have stayed until late March

Estimated % of the total site population in each season using:			
Winter cereals	100% (in Nov)	100% (if no oil seed rape grown)	100% (if no oil seed rape grown)
Oil seed rape	0%	20% (in years when grown)	20% (in years when grown)

See Appendix 6 for counts of Dark-bellied Brent Geese on fields around Dengie.

#### 3.7.4 Other information provided

When the birds arrive in late September and October they feed on their traditional habitats of saltmarsh and *Enteromorpha*.

### 3.8 Exe Estuary

Information on feeding areas around the Exe Estuary was kindly supplied by Richard Caldwell.

3.8.1 Site details			
SPA name	Exe Estuary		
Area (ha)	2345.71		
Latitude	50 38 50 N		
Longitude	03 26 32 W		
SSSI	Dawlish Warren, Exe Estuary		
Ramsar	Exe Estuary		
IBA	Exe Estuary		
Site description	<p>The Exe Estuary is located in Devon on the English south coast. The site extends 10km south from Exeter to the open sea at Dawlish Warren. The site comprises the waters, foreshore, low-lying land, three saltmarshes and an unusual double spit across the mouth of the estuary, and the sand dunes of Dawlish Warren. The mud and sand flats support Eelgrass <i>Zostera</i> spp. and <i>Enteromorpha</i> beds, and contain an abundance of invertebrates including extensive Mussel <i>Mytilus edulis</i> beds. Together, these provide rich feeding habitats for wintering wildfowl and waders, including Dark-bellied Brent Geese (Stroud <i>et al.</i> 2001).</p>		
WeBS site total (92/93-96/97)	1,905		
3.8.2 Location and type of inland feeding areas used			
Estuaries used	Exe Estuary		
Inland habitats used for feeding	Improved (fertilised) permanent pasture Golf course		
Locations of fields used for feeding	See Map 7		
3.8.3 Relative importance of the inland feeding areas			
	Autumn (Sept-Nov)	Winter (Dec-Feb)	Spring (March-May)
Typical numbers of Dark-bellied Brent Geese present within/around the SPA	0-1,600	1,500	0-500
Estimated % of the total site population in each season using:			
Improved permanent pasture	0%	80%	35%

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Golf course	0%	20%	0%
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See Appendix 7 for: counts of Dark-bellied Brent Geese on fields around the Exe Estuary SPA.

#### 3.8.4 Other information provided

From the time the birds arrive on the estuary until around mid November, the entire population feeds on the estuary. The birds then begin to move inland with most birds using inland feeding areas during the winter. In the spring the majority of the population (65%) moves back to feed on the estuary until departing from the site.

### 3.9 Foulness

Information on feeding areas around Foulness was kindly supplied by Chris Lewis.

3.9.1 Site details			
SPA name	Foulness (Mid-Essex Coast Phase 5)		
Area (ha)	10968.9		
Latitude	51 34 26 N		
Longitude	00 55 17 E		
SSSI	Foulness		
Ramsar	Foulness (Mid-Essex Coast Phase 5)		
IBA	Mid-Essex Coast		
Site description	Foulness is located on the Essex coast, on the east coast of England north of the mouth of the Thames Estuary. The site is part of an open coast estuarine system comprising grazing marsh, saltmarsh, intertidal mudflats, cockle shell banks and sand flats. It contains one of the three largest continuous sand-silt flats in the UK (Stroud <i>et al.</i> 2001).		
WeBS site total (92/93-96/97)	13,075		
3.9.2 Location and type of inland feeding areas used			
Estuaries used	Thames Estuary and Crouch/Roach Estuaries		
Inland habitats used for feeding	Permanent pasture Winter cereals		
Field location	See Map 8		
3.9.3 Relative importance of the inland feeding areas			
	Autumn (Sept-Nov)	Winter (Dec-Feb)	Spring (March-May)
Typical numbers of Dark-bellied Brent Geese present within/around the SPA	7,000	5,000	200
Estimated % of the total site population in each season using:			
Permanent pasture	10%	10%	0%
Winter cereals	90%	90%	0%

### 3.10 Hamford Water

Information on feeding areas around Hamford Water was kindly supplied by Derek Wood.

3.10.1 Site details			
SPA name	Hamford Water		
Area (ha)	2187.21		
Latitude	51 52 46 N		
Longitude	01 14 29 E		
SSSI	Hamford Water		
NNR	Hamford Water		
Ramsar	Hamford Water		
IBA	Hamford Water		
Site description	Hamford Water is located on the Essex coast in eastern England. It is a large, shallow estuarine basin comprising tidal creeks and islands, intertidal mud and sand flats, and saltmarsh. The rich invertebrate fauna and sheltered nature of the site results in its importance for waterbirds, including over-wintering Dark-bellied Brent Geese (Stroud <i>et al.</i> 2001).		
WeBS site total (92/93-96/97)	6,892		
3.10.2 Location and type of inland feeding areas used			
Estuaries used	In years when there have been high numbers (up to 1,000), birds have moved south to Holland Haven. Small numbers still move south past Harwich from the Stour or possibly the Orwell to feed on the north eastern saltings around Pewit Island, within the Hamford Water SPA.		
Inland habitats used for feeding	Permanent pasture Improved (fertilised) permanent pasture Winter cereals		
Locations of fields used for feeding	See Map 9		
3.10.3 Relative importance of the inland feeding areas			
	Autumn (Sept-Nov)	Winter (Dec-Feb)	Spring (March-May)
Typical numbers of Dark-bellied Brent Geese present within/around the SPA		Variable, subject to large fluctuations, currently up to 1,000	Variable, subject to large fluctuations, currently up to 1,000

See Appendix 8 for counts of Dark-bellied Brent Geese around Hamford Water.

### 3.11 Humber Flats, Marshes and Coast

Information on feeding areas around the Humber Flats, Marshes and Coast was kindly supplied by John Walker.

<b>3.11.1 Site details</b>			
SPA name	Humber Flats, Marshes and Coast		
Area (ha)	15202.53		
Latitude	53 37 58 N		
Longitude	00 00 39 W		
SSSI	Humber Flats and Marshes (Various), North Lincolnshire Coast		
Ramsar	Humber Flats, Marshes and Coast		
IBA	Humber Flats, Marshes and Coast		
Site description	<p>The Humber Flats, Marshes and Coast SPA is located on the east coast of England. It comprises the extensive wetland and coastal habitats within the Humber Estuary. The estuary drains a catchment of some 24,240km<sup>2</sup> and provides the single largest input of freshwater from Britain into the North Sea. It has the second highest tidal range in Britain (7.2m) and approximately one third of the estuary is exposed as mud or sand flats at low tide. The inner estuary supports extensive areas of reedbed with areas of mature and developing saltmarsh backed by grazing marsh in the middle and outer estuary. On the north Lincolnshire coast, the saltmarsh is backed by low sand dunes with marshy slacks and brackish pools (Stroud <i>et al.</i> 2001).</p>		
WeBS site total (92/93-96/97)	2,553		
<b>3.11.2 Location and type of inland feeding areas used</b>			
Estuaries used	Humber Estuary. The birds found between Cleethorpes and Tetney are probably a discrete flock, as Light-bellied Brent Geese were recorded with the Dark-bellied flock here in the 2001/02 winter, and these birds were not recorded further south. The flock found between Horseshoe and Saltfleetby NNR seem to be a larger more mobile group.		
Inland habitats used for feeding	Permanent pasture Improved (fertilised) permanent pasture Winter cereals Oil seed rape		
Locations of fields used for feeding	See Maps 10a and 10b		
<b>3.11.3 Relative importance of the inland feeding areas</b>			
	Autumn (Sept-Nov)	Winter (Dec-Feb)	Spring (March-May)
Typical numbers of Dark-bellied Brent Geese present	1,500-2,000	1,800-2,000	800-1,000



within/around the SPA			
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### 3.12 Medway Estuary and Marshes

Information on feeding areas around the Medway Estuary and Marshes was kindly supplied by Alan Parker.

3.12.1 Site details			
SPA name	Medway Estuary and Marshes		
Area (ha)	4684.36		
Latitude	51 24 02 N		
Longitude	00 40 38 E		
SSSI	Medway Estuary and Marshes		
Ramsar	Medway Estuary and Marshes		
IBA	Medway Estuary and Marshes		
Site description	<p>The Medway Estuary feeds into and lies on the south side of the Outer Thames Estuary in Kent, southeast England. It forms a single tidal system with the Swale and joins the Thames Estuary between the Isle of Grain and Sheerness. It has a complex arrangement of tidal channels, which drain around large islands of saltmarsh and peninsulas of grazing marsh. The mudflats are rich in invertebrates and also support <i>Enteromorpha</i> beds and some Eelgrass <i>Zostera</i> spp. Small shell beaches occur, particularly in the outer part of the estuary. Grazing marshes are present inside the sea walls around the estuary (Stroud <i>et al.</i> 2001).</p>		
WeBS site total (92/93-96/97)	3,205		
3.12.2 Location and type of inland feeding areas used			
Estuaries used	Medway Estuary.		
Inland habitats used for feeding	Not known, but Dark-bellied Brent Geese have used inland feeding areas within/around this SPA in the last five years.		
Locations of fields used for feeding	See Map 11		
3.12.3 Relative importance of the inland feeding areas			
	Autumn (Sept-Nov)	Winter (Dec-Feb)	Spring (March-May)
Typical numbers of Dark-bellied Brent Geese present within/around the SPA	500-1,100	1,070	1,300 declining to around 200 in May

### 3.13 North Norfolk Coast

Information on feeding areas around the North Norfolk Coast was kindly supplied by Michael Rooney.

<b>3.13.1 Site details</b>			
SPA name	North Norfolk Coast		
Area (ha)	7886.79		
Latitude	52 58 13 N		
Longitude	00 35 55 E		
SSSI	North Norfolk Coast		
Ramsar	North Norfolk Coast		
IBA	North Norfolk Coast		
Site description	<p>The North Norfolk Coast SPA includes much of the northern coastline of Norfolk in eastern England. It is a low-lying barrier coast that extends for 40km from Holme to Weybourne and includes a great variety of coastal habitats. The main habitats (found along the whole coastline) include extensive intertidal sand and mudflats, saltmarshes, shingle and sand dunes, together with areas of freshwater grazing marsh and reedbed, which has developed in front of rising land. The site contains some of the best examples of saltmarsh in Europe. There are extensive deposits of shingle at Blakeney Point, and major sand dunes at Scolt Head. Extensive reedbeds are found at Brancaster, Cley and Titchwell. Maritime pasture is present at Cley and extensive areas of grazing marsh are present all along the coast. The grazing marsh at Holkham has a network of clear water dykes holding a rich diversity of aquatic plant species. To the west, the coastal habitats of the North Norfolk Coast SPA are continuous with The Wash SPA, with which area the ecology of this site is intimately linked (Stroud <i>et al.</i> 2001).</p>		
WeBS site total (92/93-96/97)	11,512		
<b>3.13.2 Location and type of inland feeding habitats used</b>			
Estuaries used	Almost the entire area of the North Norfolk Coast.		
Inland habitats used for feeding	Winter cereals (primarily)		
Locations of fields used for feeding	See Maps 12a, 12b, 12c and 12d		
<b>3.13.3 Relative importance of the inland feeding areas</b>			
	Autumn (Sept-Nov)	Winter (Dec-Feb)	Spring (March-May)
Typical numbers of Dark-bellied Brent Geese present within/around the SPA	3,000-7,000	c. 10,000	5,000-7,000 in March with c. 1,000 remaining by May

### 3.13.4 Other information provided

Birds usually begin to arrive on the North Norfolk Coast during the second half of September, and the majority have arrived by the middle of November. Numbers tend to remain fairly stable through December, January and the first half of February. During the second half of February the birds begin to leave, and the final birds have left by the end of May (Lawton 2000). When the birds arrive they feed on the saltmarsh and *Zostera* and *Enteromorpha* beds, and when these resources are exhausted they then move to feed on grazing marshes and winter cereal. At dusk the birds leave their feeding areas for several roost sites located along the coast. However, when there is a full moon, nocturnal feeding regularly occurs (Summers & Critchley 1990; Lawton 2000).

Dark-bellied Brent Geese that roost at Thornham Harbour are known to feed in the arable fields located northwest of Thornham Village and on the grazing marshes and beach at Holme Dunes NNR, and on Thornham Saltmarsh, Titchwell Nature Reserve/Beach and Titchwell saltmarsh (Lawton 2000).

Birds using the Scolt Head/Brancaster Harbour roost feed on the saltmarsh, and away from the harbour they use Brancaster Grazing Marsh to the west, arable fields south of Brancaster Saltmarsh, arable fields at Burnham Deepdale, and grazing marshes at Burnham Norton and Burnham Overy (Lawton 2000).

The birds that roost at Burnham Overy Harbour feed at Burnham Overy Grazing Marsh as well as on the saltmarsh (Lawton 2000).

Birds from the Wells Harbour roost are known to feed in the arable fields at Wells Drifts, the arable fields east of Wells Town, and on the grazing marsh east of Lady Ann's Drive at Holkham NNR, as well as the saltmarsh to the south of the roost (Lawton 2000).

At the Blakeney Harbour roost site, daytime feeding areas apart from the saltmarsh, are the arable fields located to the south of the saltmarsh and the old Cockthorpe Airfield several kilometres inland (Lawton 2000).

Birds from the Blakeney Harbour Eastern Roost use the saltmarsh around the harbour along with the grazing marshes at Blakeney Freshes, grazing marsh at Cley and Salthouse and arable fields located several kilometres east of the roost site at Kelling and Weybourne (Lawton 2000).

Virtually all the birds using the Warham roost appear to feed exclusively on the saltmarsh adjacent to the roost (Lawton 2000).

### 3.14 Poole Harbour

<b>3.14.1 Site details</b>			
SPA name	Poole Harbour		
Area (ha)	2271.99		
Latitude	50 40 52 N		
Longitude	02 01 34 W		
SSSI	Arne, Holton and Sandford Heaths, Poole Harbour, Studland and Goldingham Heaths, The Moors, Wareham Meadows		
Ramsar	Poole Harbour		
IBA	Poole Harbour		
Site description	<p>Poole Harbour is a bar-built estuary of nearly 4,000ha located on the Dorset coast in southern England. The Harbour occupies a shallow depression towards the southwestern extremity of the Hampshire Basin, which has flooded over the last 5,000 years as a result of sea level rises. The unusual micro-tidal regime means that a significant body of water is retained throughout the tidal cycle. The Harbour therefore exhibits many of the characteristics of a lagoon. There are extensive intertidal mudflats and, away from the north shore that has become urbanised through the growth Poole itself, there are fringes of saltmarsh and reedbed. Several river valleys converge on the Harbour, notably the Frome and the Piddle, and these support grazing marsh. Parts of the Harbour, especially along the western and southern shores, adjoin the Dorset Heathlands SPA. Where the areas meet, there are unusual transitions from saltmarsh and reedbed to valley mire and heath habitats. The Harbour is separated from Poole Bay by the Studland Dunes and the SPA includes Littlesea, a large oligotrophic dune-slack lake (Stroud <i>et al.</i> 2001).</p>		
WeBS site total (92/93-96/97)	1,480		
<b>3.14.2 Location and type of inland feeding habitats used</b>			
Estuaries used	N/A		
Inland habitats used for feeding	N/A		
Locations of fields used for feeding	N/A		
<b>3.14.3 Relative importance of the inland feeding areas</b>			
	Autumn (Sept-Nov)	Winter (Dec-Feb)	Spring (March-May)
Typical numbers of Dark-bellied Brent Geese present within/around the SPA	160-650	840	100-400 (in March)

### 3.15 Portsmouth Harbour

Information on feeding areas around Portsmouth Harbour was kindly supplied by Bob Chapman.

3.15.1 Site details			
SPA name	Portsmouth Harbour		
Area (ha)	1248.77		
Latitude	50 49 41 N		
Longitude	01 07 32 W		
SSSI	Portsmouth Harbour		
Ramsar	Portsmouth Harbour		
IBA	Portsmouth Harbour		
Site description	<p>Portsmouth Harbour is located on the central south coast of England. It is a large industrialised estuary and includes one of the four largest expanses of mudflats and tidal creeks on the south coast of Britain. The mudflats support large beds of Narrow-leaved Eelgrass <i>Zostera angustifolia</i> and Dwarf Eelgrass <i>Z. noltii</i>, extensive green algae beds, mainly <i>Enteromorpha</i> species, and Sea Lettuce <i>Ulva lactuca</i>. Portsmouth Harbour only has narrow connection to the sea via the Solent, and receives comparatively little freshwater, thus giving it an unusual hydrology. This site supports internationally important numbers of Dark-bellied Brent Geese, which also feed in the surrounding agricultural areas away from the SPA (Stroud <i>et al.</i> 2001).</p>		
WeBS site total (92/93-96/97)	2,847		
3.15.2 Location and type of inland feeding areas used			
Estuaries used	Portsmouth Harbour		
Inland habitats used for feeding	Golf course Amenity/recreation Other (sports ground, firing range, not known)		
Locations of fields used for feeding	See Map 13		
3.15.3 Relative importance of the inland feeding areas			
	Autumn (Sept-Nov)	Winter (Dec-Feb)	Spring (March-May)
Typical numbers of Dark-bellied Brent Geese present within/around the SPA	300-1,300	1,700	200-800

### 3.16 Solent and Southampton Water

Information on feeding areas around the Solent and Southampton Water was kindly supplied by Eddie Wiseman.

<b>3.16.1 Site details</b>			
SPA name	Solent and Southampton Water		
Area (ha)	5505.86		
Latitude	50 44 25 N		
Longitude	01 31 33 W		
SSSI	Various (see Stroud <i>et al.</i> 2001)		
NNR	North Solent		
Ramsar	Solent and Southampton Water		
IBA	Southampton Water and Solent Marshes		
Site description	The Solent and Southampton Water are located on the south coast of England. The area covered by the SPA extends from Hurst Spit to Hill Head along the Hampshire coast, and from Yarmouth to Whitecliff Bay along the north coast of the Isle of Wight. The site comprises a series of estuaries and harbours with extensive mudflats and saltmarshes together with adjacent coastal habitats including saline lagoons, shingle beaches, reedbeds, damp woodland and grazing marsh. The mudflats support beds of <i>Enteromorpha</i> spp. and <i>Zostera</i> spp. and have a rich invertebrate fauna that forms the food resource for the estuarine birds. Dark-bellied Brent Geese also feed in surrounding areas of agricultural land outside the SPA (Stroud <i>et al.</i> 2001).		
WeBS site total (92/93-96/97)	7,506		
<b>3.16.2 Location and type of inland feeding areas used</b>			
Estuaries used	Hurst Castle/Lymington River Estuary SSSI, Beaulieu Estuary, Southampton Water, Hill Head/Brownwich.		
Inland habitats used for feeding	Permanent pasture Improved (fertilised) permanent pasture Winter cereals Amenity/recreation		
Locations of fields used for feeding	See Map 14		
<b>3.16.3 Relative importance of the inland feeding areas</b>			
	Autumn (Sept-Nov)	Winter (Dec-Feb)	Spring (March-May)
Typical numbers of Dark-bellied Brent Geese present within/around the SPA	100-3,900	4,700-5,500	2,800 declining to around 300

See Appendix 9 for: monthly percentages of the Hurst Castle/Lymington River Estuary Dark-bellied Brent Goose population at this SPA on each land use type for each of the last five winters, and counts of birds on individual fields within the Hurst Castle/Lymington River Estuary SSSI section of the SPA.



### 3.17 Stour and Orwell Estuaries

Information on feeding areas around the Stour and Orwell Estuaries was kindly supplied by Rick Vonk.

3.17.1 Site details			
SPA name	Stour and Orwell Estuaries		
Area (ha)	3323.62		
Latitude	51 57 15 N		
Longitude	01 09 26 E		
SSSI	Orwell Estuary, Stour Estuary		
Ramsar	Stour and Orwell Estuaries		
IBA	Stour and Orwell Estuaries		
Site description	<p>The Stour and Orwell estuaries straddle the eastern part of the Essex/Suffolk border in eastern England. The estuaries include extensive mudflats, low cliffs, saltmarsh and small areas of vegetated shingle on the lower reaches. The mudflats hold <i>Enteromorpha</i>, <i>Zostera</i> and <i>Salicornia</i> spp. The site also includes an area of low-lying grazing marsh at Shotley Marshes on the south side of the Orwell. The Dark-bellied Brent Geese over-wintering at the site also feed in the surrounding areas of agricultural land outside the SPA (Stroud <i>et al.</i> 2001).</p>		
WeBS site total (92/93-96/97)	2,711		
3.17.2 Location and type of inland feeding areas used			
Estuaries used	Stour Estuary.		
Inland feeding habitats used	N/A		
Field location and type	See Maps 15a and 15b		
3.17.3 Relative importance of the inland feeding areas			
	Autumn (Sept-Nov)	Winter (Dec-Feb)	Spring (March-May)
Typical numbers of Dark-bellied Brent Geese present within/around the Stour Estuary section of the SPA	800-1,400	up to 1,400	800-1,400
Estimated % of the total site population in each season using:			
Unspecified cropped habitats	50%	<50%	30%

#### 3.17.4 Other information provided

In the autumn, when the birds first arrive, between 20% and 40% of the Dark-bellied Brent Geese on the Stour Estuary section of the SPA feed on the saltmarsh and mudflats. During the winter the proportion feeding on this habitat declines to around 20%, but then increases in the spring with around 40% of the population on the saltmarshes.

### 3.18 The Swale

Information on feeding areas around The Swale was kindly supplied by Rod Smith.

3.18.1 Site details			
SPA name	The Swale		
Area (ha)	6514.71		
Latitude	51 21 39 N		
Longitude	00 50 21 E		
SSSI	The Swale		
Ramsar	The Swale		
IBA	The Swale		
Site description	<p>The Swale is located on the south side of the outer part of the Thames Estuary in southeastern England. The Swale is an estuarine area that separates The Isle of Sheppey from the Kent mainland. To the west it adjoins the Medway Estuary. It is a complex of brackish and freshwater, floodplain grazing marsh with ditches, and intertidal saltmarshes and mudflats. The intertidal flats are extensive, especially in the east of the site, and support a dense invertebrate fauna. These invertebrates, together with beds of algae and Eelgrass <i>Zostera</i> spp., are important food sources for waterbirds. The SPA contains the largest extent of grazing marsh in Kent (although much reduced from its former extent). There is much diversity both in the salinity of the dykes (which range from fresh to strongly brackish) and in the topography of the fields (Stroud <i>et al.</i> 2001).</p>		
WeBS site total (92/93-96/97)	1,961		
3.18.2 Location and type of inland feeding areas used			
Estuaries used	The eastern Swale.		
Inland habitats used for feeding	Winter cereals Oil seed rape (Both habitats are used depending on which is planted)		
Locations of fields used for feeding	See Maps 16a and 16b		
3.18.3 Relative importance of the inland feeding areas			
	Autumn (Sept-Nov)	Winter (Dec-Feb)	Spring (March-May)
Typical numbers of Dark-bellied Brent Geese present within/around the SPA	Birds arrive in Oct, 800-1,000 are present in Nov	800-1,500	800 and decreasing

Estimated % of the total population in each season using:			
Winter cereals	90% Nov only (use depends on whether winter cereals/oil seed rape planted)	90% (as for autumn)	90% (as for autumn and winter)
Oilseed rape	90% Nov only (use depends on whether oil seed rape/winter cereals planted)	90% (as for autumn)	90% (as for autumn and winter)

### 3.19 The Wash

Information on feeding areas around The Wash was kindly supplied by Jim Scott.

3.19.1 Site details	
Site name	The Wash
Area (ha)	62211.66
Latitude	51 21 39 N
Longitude	00 50 21 E
SSSI	The Wash
NNR	The Wash
Ramsar	The Wash
IBA	The Wash
Site description	<p>The Wash is located on the east coast of England, and is the largest estuarine system in the UK. It is fed by the Rivers Witham, Welland, Nene and Great Ouse, which drain much of the east Midlands of England. The Wash comprises very extensive saltmarshes, major intertidal sand and mud banks, shallow waters and deep channels. The eastern end of the site includes the low chalk cliffs at Hunstanton. The intertidal flats have a rich invertebrate fauna and colonizing beds of Glasswort <i>Salicornia</i> spp., which are important food sources for the large numbers of waterbirds dependent on the site.</p> <p>To the north, the coastal habitats of the Wash are continuous with Gibraltar Point SPA, which consists of an actively accreting sand-dune system, saltmarsh, extensive intertidal flats, and small areas of freshwater grazing marsh and open water. Whilst to the east The Wash adjoins the North Norfolk Coast SPA (Stroud <i>et al.</i> 2001).</p>
WeBS site total (92/93-96/97)	22,248
3.19.2 Location and type of inland feeding areas used	
Estuaries used	The Wash
Inland habitats used for feeding	<p>Improved (fertilised) permanent pasture Winter cereals (mainly winter wheat) (Note: all Dark-bellied Brent recorded feeding inland at the Wash have been on winter cereals with the exception of one field).</p>
Locations of fields used for feeding	<p>See Maps 17a, 17b, 17c and 17d (Note: apart from the fields marked with *, the other arable areas identified on the map are WeBS sub-sectors and the exact fields used are not known. The birds probably move around relative to the distribution of winter wheat).</p>

### 3.19.3 Relative importance of the inland feeding areas

	Autumn (Sept-Nov)	Winter (Dec-Feb)	Spring (March-May)
Typical numbers of Dark-bellied Brent Geese present within/around the SPA	5,700-10,800	13,200-21,400	8,500-11,000
Estimated % of the total site population in each season using:			
Improved permanent pasture	up to 6% of the Wash total use one field of this type (marked *1 on Map 17b)	up to 6% use field marked *1	up to 6% use field marked *1
Winter cereals	94%	94%	94%

See Appendix 10 for monthly counts of Dark-bellied Brent Geese at the Wash for each of the last five winters and counts of Dark-bellied Brent Geese on arable (winter cereals) land in WeBS sub-sectors over the last five winters.

### 3.19.4 Other information provided

The field marked \*2 on Map 17b is only used by the birds when it is winter wheat. When used the numbers are in the hundreds. However, the birds are regularly chased off. Most, if not all, Dark-bellied Brent Geese feeding on winter wheat around the Wash SPA are regularly moved on.

The fields marked \*3 on Map 17d were regularly used by Dark-bellied Brent Geese in late March and April 2003 when winter wheat was grown in the fields. Several hundred birds were recorded in these fields during that time.

## 4 Conclusions

This consultation exercise has highlighted the importance of inland feeding areas for Dark-bellied Brent Geese outside the SPA suite in the UK; birds had been recorded feeding outside the boundaries of each of the SPAs surveyed. The results provide the first ever review of feeding habitats across the most important sites for the species in the UK, making it possible to examine some more generic patterns of habitat use for this species. However, the results have to be interpreted with care given that the coverage and methodologies used to collect the information at sites were often very different. At two sites at least, the information provided was restricted to only those areas where the use of inland habitats had been observed; the location and use of inland habitats elsewhere remaining unknown. There was very little information on the regularity of field use.

Given the importance of inland feeding areas for this species outside the SPA suite, there appears to be a need to design and implement a more systematic approach to the mapping and measurement of use of cropped habitats outside statutory boundaries. The information derived from such a scheme would allow decision-makers to assess whether these habitats are worthy of inclusion within a site boundary or, if this type of protection is deemed unnecessary, to identify and monitor areas adjacent to protected sites where agri-environment schemes could be used to ensure inland food resources remain available to birds. Such an approach could also be applied to the survey and monitoring of other large herbivorous waterbirds that spend some or all of their time feeding outside of SPAs or other protected sites.

Surveyors who count waterbirds at sites as part of the Wetland Bird Survey (WeBS) or the Goose Monitoring Programme may be willing to provide information on the *distribution* of feeding waterbirds around their sites. If so, they could be provided with site maps and instructions on how to map habitat types used and the assessments made as part of these surveys. If undertaken periodically, this may not impose heavily on the voluntary work of these surveyors and would be a cost-effective way of assessing distribution using, often, those people with the most complete knowledge of the use of a site by feeding waterbirds. For those sites where surveyors are unable or unwilling to provide this information, professional assistance could be sought, adopting the same methodology.

Once the distribution of feeding waterbirds has been assessed, it may be necessary to assess the regularity of use of individual fields if 'cropped' land is to be included within statutory site boundaries. Assessing the regularity of field use would require more intensive work than mapping distribution, given the amount of time required to make assessments of goose/swan days over the period during which the birds are present at sites. It remains unknown how statutory bodies will assess 'cropped' land for inclusion within statutory site boundaries based on regularity of use and, therefore, details of an appropriate methodology are difficult to predict at this time. It does seem, however, that the first stage of identifying those areas used could be undertaken under existing volunteer-based schemes and should be promoted.

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## 6 Acknowledgements

This report would have not been possible without kind contributions from the following: Richard Caldow, Bob Chapman, Anne de Potier, Steve Groves, Chris Lewis, Alan Parker, Michael Rooney, Jim Scott, Rod Smith, Andrew St. Joseph, Rick Vonk, John Walker, Eddie Wiseman, and Derek Wood. Peter Cranswick and Richard Hearn provided invaluable comments during the planning of this study. This work was supported by the WWT/JNCC Partnership, David Stroud (JNCC) provided useful comments on an early draft of the site questionnaire.

# Appendix 1. Questionnaire

## 1. Details

1.1 Name	
1.2 Address	
1.3 Telephone number/Email address	
1.4 Special Protection Area for which details have been provided (SPA boundary is marked in highlighter on the map)	

## 2. Location of feeding areas

2.1 Have Dark-bellied Brent Geese used coastal/estuarine feeding areas within/around this SPA in the last five winters?	Yes/No
2.2 If yes to 2.1, please indicate which estuaries you know or suspect these birds to use (e.g. based on flightline direction of arriving or departing birds). Please list as many as possible or simply indicate don't know.	
2.3 Have Dark-bellied Brent Geese used inland feeding areas within/around this SPA in the last five winters?	Yes/No
2.4 Please use the attached map to outline and shade in all the areas that are known to have been used by feeding Dark-bellied Brent Geese. If possible, please could you identify which of these areas are known to have been used in the last five winters.	

## 3. Relative importance of different inland land use types

3.1 Please give typical numbers for the total number of Dark-bellied Brent Geese present within/around this SPA in autumn, winter and spring.		
September-November	December-February	March-May

3.2 If possible, please use the following table to estimate the relative use of different land use types in the autumn, winter and spring by Dark-bellied Brent Geese at this SPA			
	Estimated % of total site population		
	September-November	December-February	March-May
A Permanent pasture			
B Improved (fertilized) permanent pasture			
C Winter cereals			
D Spring cereals			
E Stubble			
F Oil seed rape			
G Golf course			
H Amenity/recreation			
I Other (please specify)			

#### 4. Additional information (optional)

4.1 If you are able and willing to provide more detailed information, please mark on the map or on a separate sheet:

a) the land use in each inland field used by the birds using the following key:

A Permanent pasture

B Improved (fertilised) permanent pasture

C Winter cereals

D Spring cereals

E Stubble

F Oil seed rape

G Golf course

H Amenity/recreation

I Other (please specify)

b) counts of birds within individual fields made over the last five winters (please include dates). If you do not have actual counts of birds within individual fields, could you give an indication of numbers by using the following ranges:-

<10 birds

10-50

50-100

100-500

500-1000

>1000(where possible please include dates)

4.2 Please list below any published, or unpublished, sources of data on the distribution and/or characteristics of feeding areas used by Dark-bellied Brent Geese within/around the SPA. We are particularly interested in sources of data on the land use, distance from roost, field size, visibility and disturbance at each feeding site.

## Appendix 2. Data for Blackwater Estuary

The following data were kindly supplied by Derek Wood.

### i) Counts of Dark-bellied Brent Geese on fields around the Blackwater Estuary, 1998/99-2002/03

Area Code (see Maps 1a and 1b)	Month	Year	No. of Dark-bellied Brent Geese	Cropped habitat type
1	12	2000	60	Winter cereals
2	1	2000	650	Winter cereals
	1	2001	170	Winter cereals
3	1	2003	221	Winter cereals
4	1	2002	320	Winter cereals
5	12	2001	900	Winter cereals
6	3	2003	1600	Permanent pasture
7	3	2002	1900	Unknown
8	1	1999	3000	Permanent pasture
	1	2000	3500	Permanent pasture
	1	2001	2000	Permanent pasture
9	11	2002	1800	Winter cereals
	1	2003	800	Winter cereals
10	12	2001	2200	Improved permanent pasture
11	1	2002	480	Permanent pasture
	1	2003	342	Permanent pasture
12	1	2001	1170	Winter cereals
13	1	2001	1030	Winter cereals
14	1	1999	1700	Improved permanent pasture
	1	2000	850	Improved permanent pasture
	11	2001	630	Improved permanent pasture
15	1	1999	1700	Improved permanent pasture
	1	2001	920	Improved permanent pasture
16	1	2002	620	Improved permanent pasture
	11	2002	830	Improved permanent pasture
17	1	2001	900	Winter cereals
18	1	2003	750	Improved permanent pasture
19	2	2000	2000	Improved permanent pasture
20	12	1998	500	Improved permanent pasture
	1	2002	780	Improved permanent pasture
21	1	2003	180	Winter cereals
22	1	2003	400	Improved permanent pasture
23	3	1999	1100	Permanent pasture
	2	2001	534	Permanent pasture
	2	2002	415	Permanent pasture
	1	2003	498	Permanent pasture
24	12	2000	2250	Improved permanent pasture
25	2	2002	1800	Improved permanent pasture
26	12	1999	3500	Improved permanent pasture
	1	2003	1800	Improved permanent pasture
27	2	1999	2800	Improved permanent pasture
	1	2001	3500	Improved permanent pasture

## Appendix 3. Data for Chichester Harbour

The following data were kindly supplied by Anne de Potier.

### i) Monthly total numbers of Dark-bellied Brent Geese within Chichester Harbour (from WeBS counts)

Month	1998/99	1999/00	2000/01	2001/02	2002/03	5-yr monthly mean
September	15	14	20	11	6	13
October	3610	474	2377	636	1093	1638
November	6611	6365	5929	4124	3960	5398
December	7312	8588	6383	6342	5886	6902
January	8142	9267	7480	7470	7358	7943
February	7839	7666	6628	6111	7090	7067
March	1845	2595	nc	5288	1431	2790
April	31	27	nc	20	39	29
May	3	20	nc	5	8	9

### ii) Monthly total numbers of Dark-bellied Brent Geese recorded inland at Chichester Harbour (from information provided by counters on WeBS days)

Month	1998/99 (% of site population)	1999/00 (% of site population)	2000/01 (% of site population)	2001/02 (% of site population)	2002/03 (% of site population)
September	0	0	0	0	0
October	0	0	0	0	0
November	3002 (45%)	3190 (50%)	2737 (46%)	1320 (32%)	2501 (63%)
December	3231 (44%)	5636 (66%)	1230 (19%)	3500 (55%)	3854 (65%)
January	5242 (64%)	2509 (27%)	3438 (46%)	2771 (37%)	5762 (78%)
February	2540 (32%)	731 (9%)	5593 (84%)	3984 (65%)	4004 (56%)
March	296 (16%)	7 (0.20%)	nc	2112 (40%)	189 (13%)
April	0	0	nc	0	0
May	0	0	nc	0	0

### iii) Percentage of total site population of Dark-bellied Brent Geese on different land use types in autumn, winter and spring

#### % of population on permanent pasture

Month/Season	1998/99	1999/00	2000/01	2001/02	2002/03	5-yr mean
Nov (Autumn)	26.98	68.65	64.30	100	56.42	63.27
Dec-Feb (Winter)	50.30	63.60	58.30	61.70	56.20	58.02
March (Spring)	100	100	nc	95.36	77.37	93.18

**% of population on improved pasture**

<b>Month/Season</b>	<b>1998/99</b>	<b>1999/00</b>	<b>2000/01</b>	<b>2001/02</b>	<b>2002/03</b>	<b>5-yr mean</b>
Nov (Autumn)	0	0	0	0	0	0
Dec-Feb (Winter)	0	0	4	0	7	2.20
March (Spring)	0	0	nc	0	0	0

**% of population on winter cereals**

<b>Month/Season</b>	<b>1998/99</b>	<b>1999/00</b>	<b>2000/01</b>	<b>2001/02</b>	<b>2002/03</b>	<b>5-yr mean</b>
Nov (Autumn)	53.63	10.97	0	0	10.00	14.92
Dec-Feb (Winter)	45.10	22.30	1.16	10.43	15.60	18.92
March (Spring)	0	0	nc	0	14.39	3.60

**% of population on amenity land**

<b>Month/Season</b>	<b>1998/99</b>	<b>1999/00</b>	<b>2000/01</b>	<b>2001/02</b>	<b>2002/03</b>	<b>5-yr mean</b>
Nov (Autumn)	0	0	0	0	0	0
Dec-Feb (Winter)	0.89	0	0	0	0	0.18
March (Spring)	0	0	nc	0	0	0

**% of population on airfield land**

<b>Month/Season</b>	<b>1998/99</b>	<b>1999/00</b>	<b>2000/01</b>	<b>2001/02</b>	<b>2002/03</b>	<b>5-yr mean</b>
Nov (Autumn)	0.07	20.38	16.44	0	19.99	11.38
Dec-Feb (Winter)	0.05	8.00	5.10	4.60	17.60	7.07
March (Spring)	0	0	nc	0	16.98	4.25

**% of population on grass ley**

Month/Season	1998/99	1999/00	2000/01	2001/02	2002/03	5-yr mean
Nov (Autumn)	19.32	0	19.00	0	0	7.66
Dec-Feb (Winter)	3.60	4.40	14.30	3.60	0	5.18
March (Spring)	0	0	nc	4.64	0	1.16

**iv) Counts of Dark-bellied Brent Geese around Chichester Harbour, 1998/99-2002/03**

Area code (see Map 3a)	Count date	No. of Dark-bellied Brent Geese	Cropped habitat type
A	7/11/1998	460	Permanent pasture
	5/12/1998	1050	Permanent pasture
	2/1/1999	1000	Permanent pasture
	20/2/1999	1150	Permanent pasture
	20/3/1999	260	Permanent pasture
	27/11/1999	up to 1370	Permanent pasture
	22/1/2000	1680	Permanent pasture
	19/2/2000	600	Permanent pasture
	11/11/2000	1500	Permanent pasture
	9/12/2000	425	Permanent pasture
	13/1/2001	772	Permanent pasture
	10/2/2001	1022	Permanent pasture
	3/11/2001	1150	Permanent pasture
	15/12/2001	1100	Permanent pasture
	12/1/2002	up to 1740	Permanent pasture
	2/2/2002	1200	Permanent pasture
	2/3/2002	950	Permanent pasture
	9/11/2002	1016	Permanent pasture
	7/12/2002	1300	Permanent pasture
	4/1/2003	1200	Permanent pasture
1/2/2003	1000	Permanent pasture	
1/3/2003	112	Permanent pasture	
B	28/10/1999	650	Cereal
	11/12/1999	1800	Cereal
C	9/12/2000	39	Oil seed rape/Cereal
	7/12/2002	197	Oil seed rape/Cereal
F (1&2)	6/11/1998	600	Cereal
	7/11/1998	1610	Cereal
	5/12/1998	950	Cereal
	2/1/1999	at least 2400	Cereal
	20/2/1999	1000	Cereal
	11/12/1999	1500	Cereal
	9/12/2000	3	Oil seed rape/Cereal
	13/1/2001	45	Oil seed rape/Cereal
	10/2/2001	124	Oil seed rape/Cereal
	12/1/2002	200	Oil seed rape/Cereal
D	28/10/1999	250	Cereal
G	29/11/1999	300	Cereal
	30/11/1999	450	Cereal



Area code (see Map)	Count date	No. of Dark-bellied Brent	Cropped habitat type
	2/2/2002	320	Cereal
J	20/12/1999	700	Cereal
E	12/1/2002	390	Cereal
K	9/11/1998	9	Unimproved pasture
	28/11/1998	13	unimproved pasture
	14/12/1998	180	unimproved pasture
	2/1/1999	32	unimproved pasture
	14/12/1999	8	unimproved pasture
	1/1/2000	500	unimproved pasture
	10/3/2001	750	unimproved pasture
	29/11/2002	29	unimproved pasture
L	10/2/2001	600	Ley
Q	20/2/1999	150	Cereal
R (1&2)	6/1/2000	100	Cereal
	10/2/2001	150	Cereal
	15/12/2001	250	Cereal
	4/1/2003	500	Cereal
N	Dec-01	600	Cereal
S	2/2/2002	190	Oil seed rape/Cereal
X	11/12/1999	209	Cereal
	13/1/2001	4	Cereal
Z	22/1/2000	2	Unimproved pasture
	13/1/2001	82	Unimproved pasture
	4/1/2003	2	Unimproved pasture
	1/2/2003	4	Unimproved pasture
	1/3/2003	1	Unimproved pasture
W	13/1/2001	92	Cereal
	4/1/2003	1426	Cereal
	1/2/2003	6	Cereal
V	9/11/2002	340	Oil seed rape/Cereal
AA	1/2/2003	570	Cereal
AG	5/12/1998	106	Unimproved wet pasture
	20/3/1999	12	Unimproved wet pasture
	22/1/2000	33	Unimproved wet pasture
	19/2/2000	59	Unimproved wet pasture
	18/3/2000	7	Unimproved wet pasture
	13/1/2001	35	Unimproved wet pasture
	7/12/2002	29	Unimproved pasture
AB	2/1/1999	170	Cereal
	10/2/2001	46	Cereal
AF	9/11/1998	350	Cereal
	2/1/1999	32	Cereal
	11/12/1999	175	Cereal
	9/11/2002	250	Cereal
AD	27/11/1999	350	Cereal
	21/11/1999	150	Cereal
	28/11/1999	400	Cereal
AH	20/2/1999	140	Ley
	22/1/2000	212	Ley
	19/2/2000	16	Ley
	11/11/2000	77	Ley
	9/12/2000	265	Ley

Area code (see Map)	Count date	No. of Dark-bellied Brent	Cropped habitat type
	13/1/2001	33	Ley
	10/2/2001	235	Ley
	2/2/2002	430	Ley
	2/3/2002	98	Ley
AJ	4/1/2003	84	Permanent pasture
	1/2/2003	58	Permanent pasture
Y	1/2/2001	35	Unimproved pasture
AC	15/12/2001	450	Cereal
AK	1/12/2002	200	Cereal
AP	10/2/2001	550	Permanent pasture
	15/12/2001	100	Permanent pasture
	12/1/2002	300	Permanent pasture
AL	15/12/2001	300	Unimproved pasture
	2/3/2002	800	Unimproved pasture
AM (1&2)	7/11/1998	2	Airfield
	5/12/1998	5	Airfield
	27/11/1999	650	Airfield
	11/12/1999	150	Airfield
	11/11/2000	450	Airfield
	9/12/2000	30	Airfield
	13/1/2001	1000	Airfield
	10/2/2001	700	Airfield
	15/12/2001	500	Airfield
	9/11/2002	500	Airfield
	7/12/2002	850	Airfield
	4/1/2003	800	Airfield
	1/2/2003	680	Airfield
AN (1&2)	22/1/2000	232	Unimproved pasture
	9/12/2000	22	Unimproved pasture
AR	2/1/1999	400	Cereal
	20/2/1999	85	Cereal
AQ	23/1/1999	500	Cereal
AT	11/12/1999	150	Ley
	14/11/1999	1500	Improved pasture
	7/12/2002	800	Improved pasture
AU	10/2/2001	660	Improved pasture
AY	7/11/1998	580	Ley
	2/1/1999	280	Ley
	11/12/1999	172	Ley/Cereal
	13/1/2001	412	Grass/Cereal
	15/12/2001	350	Grass/Cereal
	2/2/2002	100	Grass/Cereal
	11/9/2002	115	Permanent pasture
	4/1/2003	1200	Permanent pasture
	1/2/2003	375	Permanent pasture
AZ (1&2)	11/12/1999	1295	Grass/Cereal
	11/11/2000	450	Ley
	10/2/2001	330	Ley
	12/1/2002	95	Grass/Cereal
	2/2/2002	760	Grass/Cereal
	7/12/2002	520	Grass/Cereal
AX	11/12/1999	95	Cereal

Area code (see Map)	Count date	No. of Dark-bellied Brent	Cropped habitat type
AW	13/1/2001	400	Permanent pasture
AV	1/2/2003	55	Grass/Cereal
BA (1,2,3&4)	1/2/2003	800	Unimproved pasture
BD	5/12/1998	400	Unimproved pasture
	2/1/1999	570	Unimproved pasture
	27/11/1999	200	Unimproved pasture
	13/1/2001	93	Unimproved pasture
	10/2/2001	175	Unimproved pasture
	3/11/2001	170	Unimproved pasture
	2/2/2002	12	Unimproved pasture
	2/3/2002	124	Unimproved pasture
	7/12/2002	28	Unimproved pasture
	4/1/2003	140	Unimproved pasture
BC	5/12/1998	90	Permanent pasture
	22/1/2000	150	Permanent pasture
	13/1/2001	330	Permanent pasture
	1/2/2003	6	Permanent pasture
BB	22/1/2000	200	Permanent pasture
	10/2/2001	59	Permanent pasture
BF	7/11/1998	350	Unimproved pasture
	5/12/1998	630	Unimproved pasture
	20/2/1999	15	Unimproved pasture
	20/3/1999	24	Unimproved pasture
	27/11/1999	620	Unimproved pasture
	11/12/1999	90	Unimproved pasture
	19/2/2000	56	Unimproved pasture
	11/11/2000	260	Unimproved pasture
	9/12/2001	444	Unimproved pasture
	13/1/2001	140	Unimproved pasture
	10/2/2001	942	Unimproved pasture
	15/12/2001	140	Unimproved pasture
	12/1/2002	46	Unimproved pasture
	2/2/2002	960	Unimproved pasture
	2/3/2002	140	Unimproved pasture
	9/11/2002	280	Unimproved pasture
	7/12/2002	130	Unimproved pasture
4/1/2003	410	Unimproved pasture	
1/3/2003	76	Unimproved pasture	
BG	2/1/1999	140	Amenity
BE	13/1/2001	135	Permanent pasture
U	9/12/2000	2	Oil seed rape/Cereal
BH	2/1/1999	250	Unimproved pasture
BJ	1/1/2003	36	Unimproved pasture

## Appendix 4. Data for Colne Estuary

The following data were kindly supplied by Derek Wood.

### i) Counts of Dark-bellied Brent Geese on fields around the Colne Estuary, 1998/99-2002/03

Area code (see Map 4)	Month	Year	No. of Dark-bellied Brent Geese	Cropped habitat type
1	2	2003	364	Winter cereals
2	2	2003	384	Unknown
3	3	1999	530	Improved permanent pasture
	12	2000	213	Improved permanent pasture
	2	2000	820	Improved permanent pasture
4	12	1999	1500	Improved permanent pasture
	2	2003	395	Improved permanent pasture
5	2	2002	680	Winter cereals
	2	2003	346	Winter cereals
6	1	1999	1200	Winter cereals
	2	2000	900	Winter cereals

## Appendix 5. Data for Crouch and Roach Estuaries

The following data were kindly supplied by Derek Wood.

### i) Counts of Dark-bellied Brent Geese on fields around the Crouch and Roach Estuaries, 1998/99-2002/03

Area code(see Map 5)	Month	Year	No. of Dark-bellied Brent Geese	Cropped habitat type
1	1	2000	600	Unknown
2	1	2002	1700	Unknown
	2	2003	1100	Unknown
3	1	2000	1650	Unknown
	1	2001	2700	Unknown
	1	2002	1700	Unknown
4	2	2003	50	Unknown
5	2	1999	1700	Improved permanent pasture
	2	2003	2020	Improved permanent pasture
6	1	2003	400	Unknown

## Appendix 6. Data for Dengie

The following data were kindly supplied by Derek Wood.

### i) Counts of Dark-bellied Brent Geese on fields around Dengie, 1998/99-2002/03

Area code (see Map 6)	Month	Year	No. of Dark-bellied Brent Geese	Cropped habitat type
1	3	2002	760	Unknown
2	12	2000	2030	Unknown
3	12	2002	1370	Unknown
4	12	1999	2200	Unknown
5	3	1999	2000	Unknown
	12	2001	1600	Unknown
6	1	1999	2450	Winter cereals
	2	2000	1400	Winter cereals
	1	2001	1820	Winter cereals
7	3	2002	430	Winter cereals
8	1	2001	725	Winter cereals
	3	2002	488	Winter cereals

## Appendix 7. Data for Exe Estuary

The following data were kindly supplied by Richard Caldow.

### i) Counts of Dark-bellied Brent Geese on fields around the Exe Estuary, 1998-1999

Area code (see Map 7)	Count date	No. of Dark-bellied Brent Geese	Cropped habitat type
20	22/11/1998	397	Improved permanent pasture
	27/11/1998	550	Improved permanent pasture
24	9/1/1999	896	Improved permanent pasture
	17/2/1999	510	Improved permanent pasture
26	2/2/1999	690	Improved permanent pasture
	11/2/1999	647	Improved permanent pasture
	17/2/1999	289	Improved permanent pasture
27	10/11/1998	68	Golf course
	14/11/1998	67	Golf course
	28/11/1998	154	Golf course
	4/12/1998	237	Golf course
	1/1/1999	439	Golf course
	9/1/1999	318	Golf course
	17/2/1999	300	Golf course

## Appendix 8. Data for Hamford Water

The following data were kindly supplied by Derek Wood.

### i) Counts of Dark-bellied Brent Geese on fields around Hamford Water, 1998/99-2002/03

Area code (see Map 9)	Month	Year	No. of Dark-bellied Brent Geese	Cropped habitat type
1	2	2002	13	Winter cereals
2	3	2000	150	Unknown
	3	2002	420	Unknown
3	12	2000	850	Improved permanent pasture
4	3	2003	313	Winter cereals
5	3	2000	1050	Permanent pasture
6	3	2002	700	Winter cereals
7	1	1999	800	Winter cereals



## Appendix 9. Data for Solent and Southampton Water

The following data were kindly supplied by Eddie Wiseman.

### i) Monthly % of Dark-bellied Brent Geese on different land use types within the Hurst Castle/Lymington River Estuary area of the Solent and Southampton Water SPA

#### % of site population on permanent pasture

Month	1998/99	1999/00	2000/01	2001/02	2002/03
September					
October					
November					47.20
December	7.70	38.60	47.70		
January	15.40	95.70	28.70	17.50	100
February		8.20			7.00
March		42.10		27.20	
April					
May					

#### % of site population on improved pasture

Month	1998/99	1999/00	2000/01	2001/02	2002/03
September					
October					
November					4.00
December			23.80	11.30	
January		18.40	57.50		
February				23.50	
March					
April					
May					

#### % of site population on winter cereals

Month	1998/99	1999/00	2000/01	2001/02	2002/03
September					
October					
November					9.20
December					
January					
February					
March					
April					
May					

**% of site population on amenity/recreation land**

Month	1998/99	1999/00	2000/01	2001/02	2002/03
September					
October					21.50
November				37.20	
December					
January			23.90		
February					
March					
April					
May					

**% of site population on saltmarsh inside the sea wall**

Month	1998/99	1999/00	2000/01	2001/02	2002/03
September					
October					1.80
November	3.30	7.70		11.90	4.80
December					11.00
January					
February					
March					
April					
May					

**ii) Counts of Dark-bellied Brent Geese on fields within the Hurst Castle/Lymington River Estuary area of the Solent and Southampton Water SPA, 1998/99-2002/03**

Field code (see Map 14)	Count date	No. of Dark-bellied Brent Geese	Cropped habitat type
A1	13/1/2000	1500	Permanent pasture (restored landfill site)
	15/1/2000	1500	Permanent pasture (restored landfill site)
	26/1/2000	2000	Permanent pasture (restored landfill site)
	14/1/2003	1000	Permanent pasture (restored landfill site)
A2	18/11/2002	550	Permanent pasture (landfill site)
A3	15/1/2000	47	Rough coastal grazing marsh
	15/1/2001	600	Rough coastal grazing marsh
A4	5/1/1999	300	Permanent pasture
	5/12/1999	500	Permanent pasture
	13/1/2000	500	Permanent pasture
	15/1/2000	500	Permanent pasture
	2/3/2000	400	Permanent pasture
	3/12/2000	400	Permanent pasture
	17/12/2000	600	Permanent pasture
	13/1/2001	600	Permanent pasture
	20/1/2002	100	Permanent pasture
	5/3/2002	80	Permanent pasture
	14/3/2002	300	Permanent pasture
	1/11/2002	8	Permanent pasture

Field code (see	Count date	No. of Dark-bellied Brent	Cropped habitat type
	12/11/2002	48	Permanent pasture
	19/11/2002	112	Permanent pasture
	15/1/2003	408	Permanent pasture
	17/1/2003	300	Permanent pasture
	28/1/2003	355	Permanent pasture
	30/1/2003	300	Permanent pasture
A5	22/1/2002	250	Permanent pasture
B1	16/1/2001	700	Improved permanent pasture
B2	4/1/2000	500	Improved permanent pasture
	18/1/2002	57	Improved permanent pasture
B3	21/12/2000	9	Improved permanent pasture
	25/12/2000	68	Improved permanent pasture
	28/12/2000	200	Improved permanent pasture
	30/12/2000	300	Improved permanent pasture
	31/12/2000	200	Improved permanent pasture
	1/1/2001	320	Improved permanent pasture
	24/12/2001	200	Improved permanent pasture
	7/2/2002	250	Improved permanent pasture
	8/2/2002	400	Improved permanent pasture
	C	4/11/2002	130
H	2/1/2001	500	Amenity/recreation
	5/11/2001	400	Amenity/recreation
	11/11/2001	400	Amenity/recreation
	26/10/2002	160	Amenity/recreation
	28/10/2002	184	Amenity/recreation
I	1/11/1998	50	Saltmarsh inside sea wall
	13/11/1999	106	Saltmarsh inside sea wall
	24/11/1999	93	Saltmarsh inside sea wall
	3/11/2001	43	Saltmarsh inside sea wall
	4/11/2001	34	Saltmarsh inside sea wall
	10/11/2001	128	Saltmarsh inside sea wall
	16/10/2002	16	Saltmarsh inside sea wall
	4/11/2002	45	Saltmarsh inside sea wall
	9/11/2002	60	Saltmarsh inside sea wall
	11/11/2002	68	Saltmarsh inside sea wall
	16/11/2002	50	Saltmarsh inside sea wall
	3/12/2002	194	Saltmarsh inside sea wall
	7/12/2002	44	Saltmarsh inside sea wall

## Appendix 10. Data for The Wash

The following data were kindly supplied by Jim Scott.

### i) Monthly total numbers of Dark-bellied Brent Geese at The Wash (from WeBS counts)

Month	1997/98	1998/99	1999/00	2000/01	2001/02	5-yr monthly mean
September	36	3	26	610	76	150.20
October	4262	13426	3802	6874	5143	6701.40
November	19181	17736	28811	12109	11977	17962.80
December	24297	13212	25002	8012	14378	16980.20
January	17078	21428	20797	21102	7398	17560.60
February	14625	12060	18323	19868	17924	16560.00
March	12265	9149	16183	nc	17864	13865.25
April	10650	8723	8721	nc	9267	9340.25
May	10140	7552	8190	nc	28	6477.50

### ii) Counts of Dark-bellied Brent Geese on fields around The Wash, 1998/99-2002/03

Area code (see Maps 17a, 17b, 17c, 17d)	Month	Year	No. of Dark-bellied Brent Geese	Cropped habitat type
1.02.42	1	2001	45	Arable
	12	2002	1	Arable
1.03.40	11	1999	1000	Arable
	2	2001	30	Arable
1.07.40	11	2002	1	Arable
1.07.41	11	1999	320	Arable
	12	1999	1434	Arable
1.08.43	11	1999	327	Arable
	12	2000	3	Arable
1.08.44	12	2001	170	Arable
1.11.40	11	1998	1	Arable
	11	1999	270	Arable
	1	2001	1	Arable
	2	2001	3	Arable
1.11.41	11	1999	783	Arable
	12	1999	800	Arable
1.12.41	11	1999	3500	Arable
	1	2001	4	Arable
1.13.40	12	1999	125	Arable
	2	2001	120	Arable
1.13.42	11	1999	1400	Arable
	1	2001	1	Arable
1.14.42	11	1999	110	Arable
	12	1999	2300	Arable
1.15.40	11	1999	18	Arable
	12	1999	550	Arable
	1	2000	1	Arable
	3	2000	16	Arable
1.16.42	12	1999	120	Arable

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<b>Area code (see Maps)</b>	<b>Month</b>	<b>Year</b>	<b>No. of Dark-bellied Brent</b>	<b>Cropped habitat type</b>
1.17.40	11	1999	16	Arable
	12	1999	720	Arable
1.18.40	2	1999	30	Arable
1.20.41	3	2000	20	Arable
1.20.44	3	2003	30	Arable