

Greater White-fronted Goose

Anser albifrons albifrons

(Baltic-North Sea population) in Britain

1960/61 – 1999/2000

Richard Hearn

The Wildfowl & Wetlands Trust, Slimbridge, Glos GL2 7BT, UK



Waterbird Review Series

© The Wildfowl & Wetlands Trust/Joint Nature Conservation Committee

All rights reserved. Apart from any fair dealing for the purpose of private study, research, criticism or review (as permitted under the Copyright Designs and Patents Act 1988), no part of this publication may be reproduced, sorted in a retrieval system or transmitted in any form or by any means, electronic, electrical, chemical, optical, photocopying, recording or otherwise, without prior permission of the copyright holder.

ISBN 0 900806 44 3

This publication should be cited as:

Hearn, RD. 2004. *Greater White-fronted Goose* *Anser albifrons albifrons (Baltic-North Sea population) in Britain 1960/61 – 1999/2000*. Waterbird Review Series, The Wildfowl & Wetlands Trust/Joint Nature Conservation Committee, Slimbridge.

Published by:

The Wildfowl & Wetlands Trust
Slimbridge
Gloucestershire
GL2 7BT

Joint Nature Conservation Committee
Monkstone House
City Road
Peterborough
PE1 1JY

T: 01453 891900
F: 01453 890827
E: research@wwt.org.uk

T: 01733 562626
F: 01733 555948
E: communications@jncc.gov.uk

Design and typeset by Paul Marshall
Cover design by Pyneapple

Printed by Crowes Complete Print, 50 Hurricane Way, Airport Industrial Estate, Norwich, Norfolk, NR6 6JB

Front cover: Greater White-fronted Geese by Chris Gomersall
Back cover: The Swale NNR, Kent (England) by David Tipling/Windrush

CONTENTS

Summary	v
1 The Greater White-fronted Goose	1
1.1 Introduction	1
1.2 Background	1
1.3 Population monitoring and assessment	4
1.3.1 Counts	4
1.3.2 Productivity	4
1.3.3 Ringing	4
1.3.4 Hunting bags	4
1.3.5 Population assessment	5
1.4 Annual cycle	7
1.4.1 Breeding Season	7
1.4.2 Autumn migration	8
1.4.3 Winter distribution	9
1.4.4 Spring migration	9
1.5 Conservation and legislation	10
1.5.1 International	10
1.5.2 Britain	10
1.5.3 Hunting	11
1.5.4 Agricultural conflict	11
2 Survey of wintering areas	12
2.1 Southwest England and South Wales	14
2.1.1 Background	14
2.1.2 Historical status	14
2.1.3 Nationally important sites	14
2.1.4 Other sites	15
2.1.5 Key references	16
2.2 South and Southeast England	16
2.2.1 Background	16
2.2.2 Historical status	16
2.2.3 Nationally important sites	17
2.2.4 Other sites	19
2.2.5 Key references	22
2.3 East Anglia	22
2.3.1 Background	22
2.3.2 Historical status	22
2.3.3 Nationally important sites	23
2.3.4 Other sites	27
2.3.5 Key references	28
2.4 Northeast England	28
2.4.1 Background	28

2.4.2	Historical status	28
2.4.3	Nationally important sites	28
2.4.4	Other sites	28
2.4.5	Key references	28
2.5	Northwest England and North Wales	28
2.5.1	Background	28
2.5.2	Historical status	28
2.5.3	Other sites	29
2.5.4	Key references	29
3	Future monitoring and data needs	31
4	Acknowledgements	32
5	References	33

SUMMARY

This review aims to describe changes in the abundance and distribution of the Baltic-North Sea population of the Greater White-fronted Goose *Anser albifrons albifrons* in Britain since winter 1960/61, compile available historical information prior to that year, provide current estimates of population size, review published data on the ecology and biology of this population, and describe numbers, trends and site use at the key resorts in Britain.

The subspecies *albifrons* has traditionally been divided into four groups, based upon their winter distribution: the Baltic-North Sea, Pannonic, Pontic/Anatolian and Caspian/Iran/Iraq (non-breeding). These biogeographic populations may not be as discrete as previously thought, given that there is some exchange between these flyways, with birds from one breeding area found at numerous sites during winter. The Baltic-North Sea population breeds in European Arctic Russia and northwest Siberia and winters in Northwest Europe, including Britain.

The most recent population estimates suggest that there may be as many as 1,740,000 Greater White-fronted Geese in the Western Palearctic, around one million of which comprise birds from the Baltic-North Sea population. This population has increased ten-fold since the late 1960s, but this may be the result of redistribution of birds from the other biogeographic populations in the Western Palearctic.

Numbers of Greater White-fronted Geese visiting the UK remained relatively stable through the 1950s and early 1960s and then increased to more than 10,000 between 1967 and 1971. Since the late 1960s, numbers have declined dramatically, falling by 53% between 1969/70 and 1999/2000, and only 3,862 were recorded in winter 2000/01.

The decline in Britain may be a case of 'short-stopping', whereby birds benefit from wintering closer to their breeding grounds. This is likely to

have arisen as a result of increasing winter temperatures in these areas, although changes in agricultural practices and levels of hunting are also likely to have influenced this change in distribution.

In Britain, the winter distribution is highly localised. Most regular wintering sites are in the south of England, with the largest flock occurring at the New Grounds, Slimbridge, on the banks of the Severn Estuary, and smaller flocks found regularly in Kent and East Anglia.

Greater White-fronted Geese traditionally wintered on coastal grasslands and inland floodplains in Britain, grazing on natural vegetation. After decades of habitat degradation and loss, as a result of drainage and agricultural intensification, the species now feeds on cropped habitats. There is, however, minimal conflict with agricultural interests.

No sites in Britain support internationally important numbers of Greater White-fronted Geese, but, in the latter half of the 1990s, nationally important numbers occurred at 16 sites. At most sites in the western half of Britain, including the most important site at Slimbridge, numbers have declined in recent years. In East Anglia, however, numbers are increasing at many sites that were not occupied before 1980, although overall numbers remain low at these locations. Information on numbers, trends and site use at the key resorts is provided within this review.

Given the large gaps in knowledge about numbers, movements and site importance, co-ordinated monitoring of demographic variables should be prioritised throughout the range. There is a need to understand, and to be able to predict the impacts of, potential threats, e.g. the effects of climate change and changes to agricultural policy. In Britain, the role of key sites as 'cold weather refuges' for birds normally wintering on the continent requires further attention.

1 THE GREATER WHITE-FRONTED GOOSE

1.1 Introduction

The status of the Baltic-North Sea population of the Greater White-fronted Geese *Anser a. albifrons* has been monitored in Britain for longer than that of any other species of goose, particularly at its most important haunt, the New Grounds at Slimbridge, on the Severn Estuary (Mitchell *et al.* 1997). This early interest arose because the then Severn Wildfowl Trust (now Wildfowl & Wetlands Trust, WWT) established its headquarters at Slimbridge in the late 1940s. A result of this was that biologists working at Slimbridge initiated a series of pioneering research and monitoring projects, and many standard techniques for monitoring geese, and other waterbirds, were developing during this time while working on Greater White-fronted Geese (Mitchell *et al.* 1997). Hugh Boyd, Sir Peter Scott's first Research Scientist, conducted pioneering studies on the dominance hierarchy that exists within a goose flock (Boyd 1953a, b). The capture of geese was made easier at this time through the advent of rocket-netting, allowing many birds to be marked for studies of survival rates and movements. The first such capture in Britain was of 30 Greater White-fronted Geese, and one Pink-footed Goose *Anser brachyrhynchus*, at the New Grounds on 18 February 1948.

In Britain, the Baltic-North Sea population of Greater White-fronted Geese is at the very western edge of its winter range (Mooij *et al.* 1999). Consequently, the numbers visiting vary considerably, particularly in relation to the severity of winter weather in more favoured parts of their range (in recent years, the Low Countries) (Owen *et al.* 1986). Despite the large amount of early work, this population has received relatively little attention in Britain in recent decades. Although some detailed accounts exist for the New Grounds, the latest of these was published some years ago and barely overlaps with the period of this review (Ogilvie 1966).

In recent decades, information on numbers and distribution has been collected principally through a co-ordinated waterbird monitoring scheme (originally the National Waterfowl Counts, now the Wetland Bird Survey (WeBS)). In addition, much information is presented in annual County Bird Reports and data from many of these, as well as from more detailed County Bird Club archives, has been collated for the first time in this report.

This report uses these data to assess the changes in numbers and distribution of the Baltic-North Sea population of the Greater White-fronted Goose in Britain since 1960, and provides current estimates of population levels. Information on the historical (pre-1960) status of this population is also provided, where known.

The report is split into two sections. The first provides a summary of our present knowledge of the status, ecology and conservation of the Greater White-fronted Goose in the Western Palearctic. Much of this information has been drawn from the text by Mooij *et al.* (1999) in *Goose Populations of the Western Palearctic*, since they also summarises basic information about these factors for this population. Some new information is also presented here in order to update this text.

The second section explores the results of the monitoring of the Baltic-North Sea population of the Greater White-fronted Goose in Britain from 1960 onwards on a regional basis. An introduction to each region is followed by more-detailed information for nationally important sites, i.e. those that supported more than the currently accepted 1% threshold for the population during the most recent five-year period (1995/96–1999/2000). There are no internationally important sites for Greater White-fronted Geese in the UK. Data concerning trends in numbers and phenology at each site are presented, along with information about the status and habitats of the site and the surrounding feeding areas used by the geese.

1.2 Background

The Greater White-fronted Goose is the most widespread and numerous goose species in the Western Palearctic (Wetlands International 2002). It breeds in the tundra zone of northern Eurasia, including a number of Arctic islands, from the Kanin Peninsula (44°E) to the Kolyma River (155°E), between the latitudes of 66°N and 77°N, an area of some 770,000 km² (Fig. 1). Historical accounts suggest that breeding may also have occurred further west into Fennoscandia, with evidence of its presence there during the late 19th century (see Mooij & Zöckler 2000). South of the Taimyr Peninsula Greater White-fronted Geese have been found breeding at 1,000 m above sea level (asl) in the northwestern Putorana Mountains (Mooij *et al.* 1999). The breeding range is located between the 4°C and 10°C July isotherms. Within the current

range, those birds breeding to the west of the Khatanga River (107°E) migrate predominantly west and southwest to winter in Europe and southwest Asia; those to the east of Khatanga move southeast to winter in southeast and east Asia. The *albifrons* breeding to the east of Khatanga are joined on the wintering grounds by birds of the race *Anser a. frontalis* that breed between the Kolyma River and the Bering Strait. However, uncertainty exists over the validity of this subspecific separation. Recently, Mooij & Zöckler (2000) reviewed the evidence for the existence of a subspecific limit within the Khatanga to Bering Strait zone and concluded that it is unsound. They suggest that birds within this area belong to the same subspecies and proposed to call this population *Anser a. albicans*, following the proposal of Gmelin, quoted by Alphéraky (1904). Some workers, however, prefer to classify all White-fronted Geese breeding between the Kanin Peninsula and the Bering Strait as *albifrons* (J. Mooij pers. comm.).

A second subspecies, *flavirostris* or 'Greenland White-fronted Goose', also occurs in the Western Palearctic. It breeds in west Greenland between 65°N and 72°N and spends the winter in Britain and Ireland. This subspecies has been treated elsewhere (Fox *et al.* 1994) and will not be discussed in this review.

Within the Western Palearctic and adjacent areas of southwest Asia, *albifrons* has traditionally been divided into four groups, based upon their winter distribution: the Baltic/North Sea, the Pannonic, the Pontic/Anatolian, and the Caspian/Iran/Iraq (non-breeding) (Wetlands International 2002). Recent ringing studies have shown, however, that these biogeographic populations are not as discrete as previously thought, and that there is some exchange between these flyways, with birds from one breeding area found at numerous sites during winter (e.g. Mooij 1996). These ringing programmes, together with counts from countries along migratory pathways, suggest that five major routes may be followed by the Greater White-fronted Geese in the Western Palearctic. These flyways can be defined as:

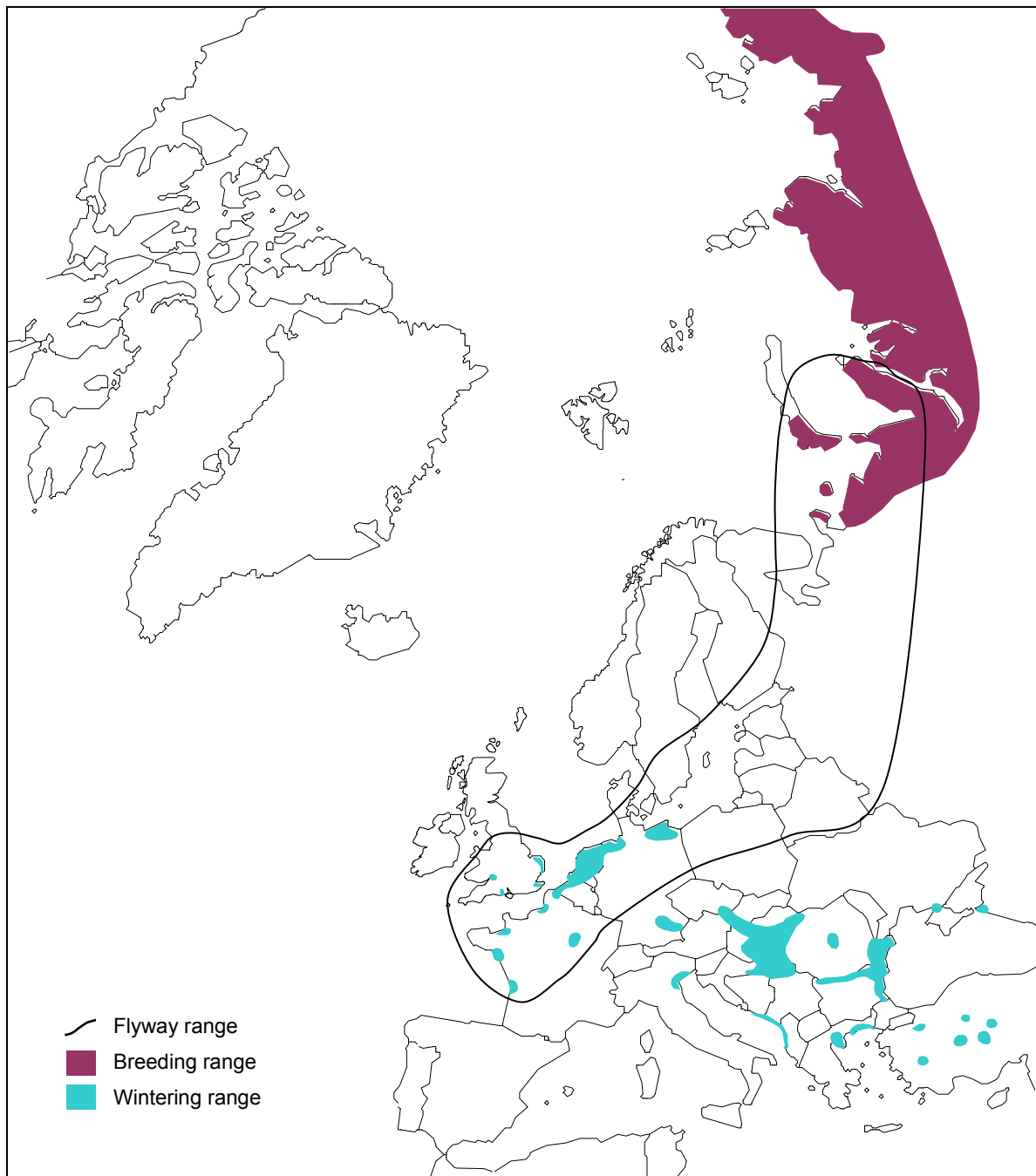
- A northern, **White Sea flyway** – following the coast of the Kara, White and Baltic Seas, with a branch crossing Finland, southern Sweden and Denmark, taking the birds mainly to western, central and southern Europe (Baltic/North Sea and Pannonic wintering groups);
- A central, **Russian flyway** – from northwestern Kazakhstan, passing through central Russia and Belarus, taking the birds mainly to western, central and southeastern Europe (Baltic/North Sea, Pannonic and Pontic wintering groups);
- A southern, **Caspian/Black Sea flyway** – crossing Siberia along the River Ob to the Turgayskaya Region in Kazakhstan, from there crossing the Volga delta to the northern Black Sea coast, taking the birds mainly to southeastern Europe, Turkey and Azerbaijan (Pontic, Anatolian and Caspian wintering groups);
- A western, **Ukrainian flyway** – from the western breeding areas, crossing western parts of European Russia and the Ukraine, taking the birds mainly to southeastern Europe and Turkey (Pontic and Anatolian wintering groups); and
- An eastern, **Volga flyway** – west of the Ural Mountains, following the Volga valley and taking the birds mainly to southeastern Europe, Turkey and Azerbaijan (Pontic, Anatolian and Caspian wintering groups).

Birds from different 'populations' mix at staging sites along these flyways. There is also evidence of interchange between the wintering areas used by the different groups. For example, birds marked at the New Grounds on the Severn Estuary have been recovered in later years in Italy, Greece, Macedonia (Stroud *et al.* 2002) and Kazakhstan.

The mixing of these populations increases the probability of genetic interchange and may explain why there has been no sub-speciation within the *albifrons* complex (Mooij *et al.* 1996). However, there remain large gaps in our knowledge of the migratory routes and population delimitation of this species in the Western Palearctic. For a full treatment of the complex nature of population delimitation in Eurasia, see Mooij (2000a).

Greater White-fronted Geese were once regular visitors to the Nile Delta, and were the most common goose in Egypt during the Palearctic winter. They were known there for thousands of years, and are depicted on numerous ancient monuments (Brown *et al.* 1982). These sites have since been abandoned by the species.

Figure 1. Breeding and wintering ranges of Greater White-fronted Goose *Anser albifrons albifrons* and approximate flyway range of Baltic/North Sea population (see text) (adapted from Scott & Rose 1996, Snow & Perrins 1998 and Mooij *et al.* 1999).



1.3 Population Monitoring and Assessment

1.3.1 Counts

International monitoring

Monitoring is difficult at the breeding grounds because of the highly dispersed distribution of breeding pairs over vast expanses of the Russian Arctic. Surveys on the breeding grounds have been attempted, however, and the results used to generate population estimates for Eurasia (e.g. Krivenko 1996). The most accurate and cost-effective way to monitor population size is to undertake the counts during the non-breeding season, when birds congregate at traditional wintering sites.

Since the 1960s, counts have been carried out on a regular basis in most Northwest European countries (e.g. Belgium, Germany, Britain and the Netherlands). These counts have been co-ordinated by Wetlands International. The abundance and extensive range of the Greater White-fronted Goose in the Western Palearctic during the winter means, however, that co-ordinated censuses and hence estimates of population size are difficult to achieve. Nevertheless, there are some conservative estimates of population size from counts made at key sites since the 1950s.

National monitoring

Unlike other 'grey' geese in Britain, White-fronted Geese are generally not counted as they fly to or from their roost sites at dawn or dusk but, instead, are counted during daylight hours when they are feeding.

Annual site-based monitoring in Britain has been ongoing since the late 1940s and is now undertaken primarily through WeBS. Since 1947, WeBS counts have been made by volunteer ornithologists at a variety of wetland habitats, generally on the middle Sunday of each month and primarily between September and March (Atkinson-Willes 1963, Owen *et al.* 1986, Cranswick *et al.* 1997). Count dates are co-ordinated nationwide and are chosen to occur on days when high tide occurs during the morning, thus concentrating waterbirds into a small number of roosting areas at coastal sites (Gilbert *et al.* 1998). Counters are encouraged to make their count during the morning to ensure co-ordination across sites.

Detailed monitoring of numbers at the New Grounds began in winter 1946/47, and records of the arrival date of wintering geese in the area dating back to the middle of the 19th century are kept by the Berkeley Estate.

1.3.2 Productivity

Productivity is measured as the proportion of first-winter birds amongst the sample of birds aged, and the average size of family groups. In Britain, estimates of annual productivity are made only at the New Grounds. These data have also been collected throughout Western Europe since 1957.

1.3.3 Ringing

Ringing in Britain has been carried out almost entirely at the New Grounds, and all colour-marked birds have been caught there. Ringing has been carried out in two distinct periods: (1) 612 birds were metal-ringed up to 1981 (Owen *et al.* 1986), primarily from the late 1940s to the 1960s; and (2) 94 birds have colour-marked since 1996, with leg rings from 1996–2000 and with neck collars since 2001. This project is continuing as part of a wider colour-marking programme being carried out in northwest Europe (H. Kruckenberg pers. comm., also see <http://www.anser.de>). Elsewhere in the Baltic and North Sea wintering grounds, most birds have been ringed in the Netherlands, with more than 20,000 fitted with conventional metal rings since the 1950s (Doude van Troostwijk 1974, Ebbinge 1991, Mooij *et al.* 1996). Birds have also been captured and marked during expeditions to breeding areas in Russia (Borzhonov 1975, Rogacheva 1992, Mooij *et al.* 1999). Elsewhere, marking has been infrequent.

Of the birds ringed abroad, only those conventionally metal-ringed in the Netherlands are represented in the British and Irish recoveries held by the British Trust for Ornithology. There have also been a number of re-sightings of colour-marked birds, including at least two individuals marked on the Taimyr Peninsula between 1989 and 1991 that were seen at the New Grounds in subsequent winters (J. Mooij pers. comm.), a German neck-collared bird seen at the New Grounds in the mid-1990s (Stroud *et al.* 2002), and several in the late 1990s from the ongoing project in the Netherlands and Germany (pers. obs., H. Kruckenberg pers. comm.).

1.3.4 Hunting bags

The monitoring of hunting bags varies considerably across the range of the Greater White-fronted Goose, and in most countries no more than a crude estimate can be made (Table 2).

1.3.5 Population assessment

1.3.5.1 Abundance

International

It is difficult to determine from available data whether there has been an increase in the number of Greater White-fronted Geese in the Western Palearctic since the 1950s. Although population estimates suggest an increase, particularly during the 1990s (Table 1), estimates from individual flyways are broad and there has been a marked improvement in the coverage of counts, particularly since the late 1980s, when some key countries (e.g. Bulgaria, Romania and Ukraine) began to contribute data to the Wetlands International Goose Database. Thus, although the number of birds counted in the Western Palearctic has increased to about 1.3–1.7 million birds, it is likely that, given annual fluctuations in mortality and productivity, that the population has fluctuated between 1.0 and 1.5 million since the 1950s (Mooij 1996a, b, 1997, 1999).

Data collected on the breeding grounds indicate that the Eurasian population of the Greater White-fronted Goose was about 1.3 million birds during the 1980s and around one million birds in the early 1990s (Krivenko 1996). Rogacheva (1996) estimated that there were 700,000 individuals in the Western Palearctic during the early 1990s. Flint & Krivenko (1990) and Rogacheva (1992) have suggested that the Eurasian populations have decreased markedly since the 1940s but have stabilised more recently. There have been recent increases in the numbers of birds recorded in the breeding/moulting areas on the

northern Russian tundra and on the northern Taimyr Peninsula (Tomkovich *et al.* 1994, Mineyev 1995), and increases or stability in numbers on the Yamal and Gydan Peninsulas (Molochaev & Kalyakin 1990, Ryabitsev 1995). In contrast, there has been a sharp decrease in the Eastern Palearctic populations (Mooij *et al.* 1999).

There are currently estimated to be 100,000–180,000 birds breeding on the north Russian tundra, about 200,000–250,000 on the Yamal and Gydan Peninsulas and about 400,000–450,000 on the Taimyr Peninsula.

The most recent population estimates from Wetlands International (2002), derived from data presented in Gilissen *et al.* (2002), suggest that there may be as many as 1,740,000 individuals in the Western Palearctic, of which one million are within the Baltic/North Sea population, although these estimates may lean towards the upper limit of the likely population size (J. Mooij pers. comm.). This population has increased ten-fold since the late 1960s and may be the result of redistribution of birds from the other biogeographic populations/flyways elsewhere in the Western Palearctic (Mooij *et al.* 1999). However, improved survival resulting from improved food availability and better policed harvesting regulations may have also contributed to this increase (Owen *et al.* 1986, Mooij *et al.* 1999).

Overall, it appears that the number of Greater White-fronted Geese in the Western Palearctic has remained more or less stable over recent decades, with coincidental declines in the Eastern Palearctic (Mooij *et al.* 1999).

Table 1. Estimated population sizes of Greater White-fronted Goose populations since the 1950s, according to estimates from the wintering grounds. From data presented in Mooij *et al.* (1999; reproduced with permission from J. Mooij) and the most recent estimates from Wetlands International (2002).

Period	Baltic/North Sea	Pannonic	Pontic/Anatolian	Population size
1950–60	10,000–50,000	400,000–500,000	?	410,000–550,000 ¹
1960–70	50,000–100,000	100,000–150,000	500,000–600,000	650,000–850,000
1970–80	200,000–300,000	100,000–175,000	250,000–300,000 ²	550,000–775,000
1980–90	c. 400,000	c. 100,000	c. 250,000 ²	c. 750,000
1990–93	400,000–600,000	10,000–40,000	350,000–700,000 ³	760,000–1,340,000
2002	1,000,000	10,000–40,000	350,000–700,000	1,360,000–1,740,000

¹ incomplete count

² total does not include counts from Ukraine, where 200,000–500,000 geese have been counted annually since the 1990s

³ includes c. 330,000 unidentified geese

National

WeBS sites are not necessarily all covered each year, and therefore population trends cannot be determined simply by comparing the total number of birds counted in each year. Consequently, indexing techniques have been developed that allow between-year comparisons of numbers, even if the true population size is unknown (see Pollitt *et al.* 2003 for further details).

Index results and count data indicate that the numbers of White-fronted Geese visiting the UK remained relatively stable through the 1950s and early 1960s and then increased to more than 10,000 between 1967 and 1971, with a maximum of 7,600 at the New Grounds in winter 1968/69 (Ogilvie 1968, Owen *et al.* 1986). Since the late 1960s, numbers have declined steadily: only 3,862 birds were recorded in winter 2000/01, with 2,244 of these at the New Grounds (Fig. 2). Records of large numbers in Britain in recent decades have been associated with cold weather events, for example, in winter 1978/79 cold weather in the Netherlands forced a late-winter dispersal of birds into Belgium and Britain. Gregory *et al.* (2002a) suggest a national decline of 53% between 1969/70 and 1999/2000.

The decline in the number of birds wintering in the UK is thought to be due to birds wintering further east, especially in the Netherlands, where feeding conditions may have improved, winters are becoming milder and hunting pressure has been reduced. Notably high counts have generally been recorded during cold winters (Lack 1986). The 'decline' in Britain may, therefore, be a classic case of 'short-stopping', where birds benefit from wintering closer to their breeding grounds (Owen *et al.* 1986).

1.3.5.2 Productivity

The proportion of juvenile birds in flocks in Northwest Europe varies markedly between years but appears to have declined over the last 40 years, from around 34% at the end of the 1950s to about 27% in the first half of the 1990s. In recent years, the flocks at the New Grounds have comprised 25–30% juveniles, in keeping with the estimates made throughout Northwest Europe. Estimates from a former, and the westernmost, key British wintering site, the Twyi Valley at Dryslwyn, Carmarthenshire, suggest that around 10–15% of winter flocks comprised first-winter birds in most years during the 1980s, although 26% were recorded in 1982/83 (R. Davies pers. comm.).

In general, years with poor reproductive success follow one year after peak lemming years in eight out of 12 cases (Mooij *et al.* 1995, Mooij 1997, Mooij & Kostin 1997, and see Summers & Underhill (1987) for further information on the link between waterbird reproductive success and lemming abundance).

1.3.5.3 Hunting mortality

The size of the hunting bag in Britain has never been quantified, but is probably quite small (Mooij *et al.* 1999). Estimated bag sizes for other European countries are presented in Table 2. There appears to have been an increase in the size of European bag sizes since the 1960s, particularly in Western Europe (Mooij *et al.* 1999).

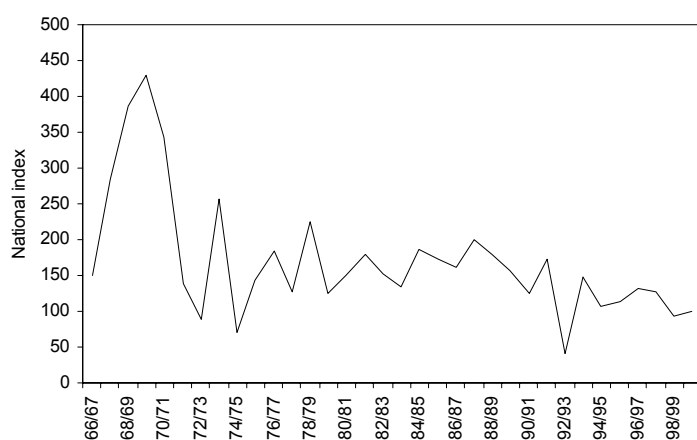


Figure 2. Index of Greater White-fronted Goose *Anser albifrons albifrons* abundance in Great Britain

Table 2. Estimated annual Greater White-fronted Goose bags in the Western Palearctic since the 1960s. From Mooij *et al.* (1999) and Mooij (2000a). Reproduced with permission from J. Mooij.

	1960s	1970s	1980s	1990s
Former USSR	c. 230,000	c. 210,000	c. 180,000	c. 200,000
Poland	c. 6,300	c. 12,000	c. 12,600	12,000–13,000
Denmark	c. 10,000	c. 11,000	12,000–13,000	c. 14,500
Sweden	c. 2,000	c. 5,000	c. 10,000	Unknown
Germany	c. 6,000	c. 7,500	c. 10,000	20,000–40,000
The Netherlands	c. 7,000	c. 10,000	c. 35,000–50,000	60,000–70,000
Hungary	c. 7,500	c. 5,000	c. 7,300	Unknown
Former Czechoslovakia	c. 1,500	c. 2,000	1,500–2,000	Unknown
Austria	c. 1,700	c. 2,000	c. 3,000	c. 1,500
Romania	c. 5,000	c. 3,000	3,000–5,000	> 3,000
Former Yugoslavia	Unknown	c. 4,000	Unknown	Unknown
Bulgaria	c. 7,000	c. 14,000	7,000–14,000	> 7,000
Greece	Unknown	Unknown	Unknown	Unknown
Albania	Unknown	c. 2,000	Unknown	Unknown
Turkey	Unknown	Unknown	Unknown	Unknown
Total	c. 284,000	c. 287,500	c. 294,000	c. 333,500

More recently, updated estimates of hunting mortality that included an estimate of crippling loss, were made by Mooij (1999) and Mooij (2000b). These suggested that more than 350,000 geese were killed by hunting in the 1960s, more than 375,000 in the 1970s, more than 412,500 in the 1980s and more than 500,000 in the 1990s (Mooij 1999). For 2000, Mooij (2000b) estimated that more than 480,500 Greater White-fronted Geese were shot in the Western Palearctic, with a total estimated mortality, including crippling loss, of more than 600,500.

1.3.5.4 Survival

Estimates of the annual rate of mortality vary from 16% to 36% (Doude van Troostwijk 1966, 1974, Bauer & Glutz von Blotzheim 1968, Boyd in Kuijken 1975, Kuijken 1975, Rutschke 1987, Ebbsinge 1991, Mooij 1995a, b, 1996a, 1997, Mooij *et al.* 1995), although most estimate an annual mortality rate of between 25% and 30%. At present, hunting mortality is the most important factor affecting survival, responsible for about 80–95% of all annual mortality (Ebbsinge 1991, Mooij 1997, Mooij & Kostin 1997).

1.4 Annual cycle

1.4.1 Breeding Season

Range

The Greater White-fronted Goose has an almost circumpolar distribution during the breeding season, and is a characteristic tundra species (Mooij *et al.* 1999). In southern areas, it is common in shrub-tundra but not in the forest-tundra zone. The species is less frequent in the northern part of the arctic tundra, but is generally the most common goose species there. The breeding area occupied by Western Palearctic birds covers about 770,000 km². The breeding range includes the broad zone of the northern coast of Eurasia as well as several arctic islands, e.g. Kolguyev, Vaygach and Nova Zemlya (Voous 1960, Rogacheva 1992, Mineyev 1995). Greater White-fronted Geese have also been found breeding south of the Taimyr Peninsula, in the northwesternmost Putorana mountains, 1,000 m asl.

Ringed recoveries on the breeding grounds of birds marked in England have been concentrated around the Kanin Peninsula, Kolguyev Island and the Pechora Peninsula and Delta, with others further east on Vaygach Island and the coast of the east Kara Sea, and to the north along the Nenets coast from Kanin to c. 55°E (Stroud *et al.* 2002). These westerly breeding grounds are those known to be occupied by Dutch wintering birds, indicating some

link between birds in England and the Netherlands. However, observations at the New Grounds of a bird marked on the Taimyr much further east than these areas, as well as a bird ringed at the New Grounds and then recovered on Dickson Island in eastern Taimyr (80° E), indicate that a proportion of birds may come from breeding grounds further east (Stroud *et al.* 2002).

Breeding ecology

Arrival on the breeding grounds is typically around one week after the mean daily temperature there exceeds 0°C. In western areas this is usually the second half of May, and further east, for example the Taimyr Peninsula, this is around early June.

Greater White-fronted Geese occur in a broad range of wetland habitat types with an abundance of grasses and sedges, e.g. marshes, lakes, pools and rivers. Immediately after arrival, much of the breeding grounds are still snow-covered, and birds are forced to feed primarily upon dead leaves of grasses and sedges. Once the upper soil layer has thawed, the geese begin to uproot the rhizomes and stolons of grasses and sedges. Finally, they switch to feeding exclusively on fresh leaves once vegetation growth has begun. The most important species are cotton-grasses (*Eriophorum angustifolium* and *E. scheuchzeri*), horsetails (*Equisetum* spp.), grasses (especially *Alopecurus alpinus*, *Arctophila fulva* and *Poa* spp.), herbs (*Atropis angustata*, *Oxytropis* spp. and *Pleuropogon sabinii*), sedges (*Carex stans*), mosses, berries (e.g. of *Empetrum nigrum*), *Polemonium acutiflorum*, *Polygonum viviparum*, and *Saxifraga cernua* (see Mooij *et al.* 1999).

Foraging Greater White-fronted Geese have been shown to have considerable local influence on tundra vegetation, especially during the early breeding season when they uproot below-ground biomass, and during the late summer when birds are concentrated into large moulting and pre-migratory flocks (Remmert 1980, Walter & Breckle 1986, Mooij *et al.* 1995).

There is considerable variation between breeding areas in the density of nests. In European sites the density has been recorded as 0.01–12.7 nests/km² and on the Taimyr as 0.2–1.7 nests/km² (Kokorev 1985, Rogacheva 1992, Mineyev 1995). Breeding birds are generally solitary but have been recorded nesting within gull colonies on islands or in association with Peregrines *Falco peregrinus* nesting of cliffs (Mooij *et al.* 1999). The density of breeding birds has been shown to vary between years according to weather conditions and predation (Mooij *et al.* 1999). Females lay a single clutch of 3–7 eggs and incubation lasts for 27–28 days (Cramp &

Simmons 1977). The fledging period lasts 40–43 days with the young remaining with their parents for at least the first winter and autumn. First breeding occurs at three years. Mean brood sizes, as measured on the wintering grounds, range between 1.8 and 3.8 juveniles.

If birds have not started to breed within 14 days of arrival at the breeding grounds, e.g. because of late snowmelt, they desert the site and move directly to the moulting grounds (Kostin 1985, Mooij *et al.* 1995). In years when predation levels are high or weather conditions are unfavourable, very few birds attempt to breed. Of these attempts, up to 50% of clutches and 25% of goslings will be lost (Kokorev 1985, Mooij *et al.* 1995, Mooij *et al.* 1999).

Moult migration and moulting areas

In July, non-breeding birds move to moulting sites comprising sedge-dominated graminous lowland areas with an abundance of rivers and lakes (Mooij *et al.* 1999). In many places they gather in their thousands, e.g. along sections of the Pyassina and Taimyra Rivers, although in most parts of the European range they gather in flocks of around 20–250 birds. Birds seek safety on the water during the moult period, which lasts for around one month. Most birds finish primary moult in mid-August. Families moult close to the nest site, whereas non-breeders move considerable distances (Mineyev 1995, Mooij *et al.* 1995, Mooij 1996b). There are, however, large gaps in our knowledge of the location and importance of many key moult sites, moult migration patterns and the composition of moulting flocks (Mooij *et al.* 1999).

1.4.2 Autumn migration

Eurasian Greater White-fronted Geese fly 3,000–7,000 km within two months on their migration from the breeding grounds to the wintering grounds. Birds generally leave the Arctic breeding grounds in September and early October (Stroud *et al.* 2002) and travel over many countries to their ultimate wintering grounds. Those moving to Britain pass through Germany, the Netherlands and Belgium, with a few also migrating through southern Sweden. Autumn migration is more rapid than spring migration (Mooij *et al.* 1999): the first birds usually arrive at the New Grounds, on the Severn Estuary, in October.

On migration, birds feed on cropped habitats such as cereals, peas and grassland, as well as on semi-natural and natural wetland habitats such as marshes, bogs, lakes and floodplains (Cramp & Simmons 1977, Kozulin *et al.* 1995). Through the migratory period,

birds gradually shift from natural to cropped habitats to feed. In Germany, 45% of autumn food consists of grasses, 39% is made up of spilt grain and the remainder of potatoes, grass rhizomes, clover and arable weeds (Schröder 1975).

1.4.3 Winter distribution

Range

During mid-winter, Greater White-fronted Geese occupy an extensive range, stretching from Britain in the northwest, across Europe to the Near East. Peak numbers are present in Germany in October and November, in the Netherlands during December and January and in January or February at the New Grounds (Pollitt *et al.* 2003).

In Britain the winter distribution of the Baltic-North Sea Greater White-fronted Goose is highly localised (Owen *et al.* 1986). Most regular wintering sites are in the south of England, with by far the largest flock occurring at the New Grounds, Slimbridge, on the banks of the Severn Estuary. Around 2,200 birds have been recorded there in recent winters, comprising more than 50% of the national total (Musgrove *et al.* 2001). Owen *et al.* (1986) demonstrated that the national total is positively correlated with the number of birds visiting the New Grounds.

Elsewhere, sites regularly supporting more than 60 birds in recent winters include the Swale Estuary, Dungeness Gravel Pits and Walland Marsh in Kent, several localities along the Norfolk coast, and North Warren, Minsmere Levels and the Alde Complex in Suffolk (Musgrove *et al.* 2001). The only site north of the Humber Estuary that supports more than 60 birds annually is the Lower Derwent Valley in Yorkshire, where a mean of 118 has been recorded since winter 1995/96. The Tywi Valley in south Wales used to support a flock of around 2,500 until the early 1970s, but this site has not been used regularly since the late 1980s. Other sites that used to support large numbers but which are now deserted include Margam Moors (Port Talbot), which used to hold around 2,000 birds, the Severn/Camlad Marshes near Welshpool, which held around 1,000 birds, the Mersey Marshes, where around 1,000 birds were recorded regularly in the 1940s, Bridgwater Bay (Somerset), which held around 500 birds in the 1950s, and the Avon Valley (Hampshire), which held a large flock until the 1980s but has also recently been abandoned.

Habitat and feeding ecology

Traditionally, Greater White-fronted Geese wintered on coastal grasslands and inland floodplains in

Britain, grazing on natural vegetation. Since natural habitats have been drained and claimed for agriculture, however, they have also taken to feeding in cropped habitats (Owen *et al.* 1986). Permanent grasslands are the preferred agricultural habitat (e.g. Kuijken 1969), although over recent decades a shift from permanent grasslands to crops such as winter wheat and maize stubble has been observed in Belgium (Kuijken *et al.* 2001). Birds generally roost on estuarine sandbanks, rivers or on shallow freshwater lakes, often very close (less than 10 km) to daytime feeding habitats. Birds feed for the majority of daylight hours, often feeding under moonlight at night (Owen 1972a). In suitable habitat, flock size can be large, with many thousands of birds feeding together (Owen *et al.* 1986).

Owen (1976) found that the most commonly taken foods on saltmarsh habitats at the New Grounds were *Puccinellia maritima*, *Festuca rubra*, *Alopecurus bulbosus* and *Hordeum secalinum*, whilst on inland pastures *Lolium perenne*, *Poa trivialis* and *Holcus lanatus* were favoured. The selection of feeding sites and food may be determined, in part, by the nutritional quality of the food, which may be increased through appropriate summer grazing management (Owen 1973). At the New Grounds it was estimated that between 650 and 800 g of fresh food is consumed per day by an individual bird (Owen 1972b) but in the Lower Rhine area of North Rhine-Westphalia, Germany, Mooij (1992) estimated the daily intake of grass by one goose as 1,300–1,700 g fresh weight or 257–340 g dry weight.

1.4.4 Spring migration

At the edge of the wintering range, in Britain and Belgium, spring migration begins in late February or early March and very few birds are present at haunts in Britain by the second half of March. Birds move east from the Netherlands through northern Germany, with known stop-over sites in the Brandenburg region of Germany. From there, some continue east to the Ryazan and Tula districts of Russia, where they stay until late April or early May. En route, other known stop-over areas include the Gomel area of Belarus. The final stage of the migration is a direct movement to the breeding grounds in May. Other birds follow a more northerly route, passing along the Baltic coast to the Karelia region of Russia, just north of St. Petersburg, moving from there to the tundra. Other stop-over areas may exist closer to the breeding grounds, but a lack of research means these remain unidentified. Whether the migration of known British-wintering birds is different from that of individuals remaining

further east is unknown, due to a lack of ringing and colour-marking.

The habitats used and foods taken during spring migration are similar to those taken during the autumn with pastures and winter wheat favoured (Owen *et al.* 1986). There is a general trend to switch from cropped to natural habitats as the spring migration progresses, the reverse of the pattern observed in the autumn (Mooij *et al.* 1999).

1.5 Conservation and legislation

1.5.1 International

Conservation status

In BirdLife International's Species of European Conservation Concern, the Greater White-fronted Goose is classified as a Non-SPEC species which means that it is not of conservation concern in Europe (Tucker & Heath 1994). It is listed under Category C (1) of the Africa-Eurasian Waterbird Agreement, prepared under the Bonn Convention on Migratory Species, because it is a population numbering more than around 100,000 individuals that could benefit significantly from international cooperation.

Habitat protection

The EC Directive on the Conservation of Wild Birds (79/409/EEC) requires Member States to classify Special Protection Areas (SPAs) for migratory species. In the UK, the SPA suite comprises eight sites where the 'Russian White-fronted Goose' has been listed as a qualifying species, supporting on average 4,586 individuals and representing 76% of the British population and 0.8% of the international population (Stroud *et al.* 2001). Further international protection of important wetland habitats for Greater White-fronted Geese is provided through the Convention on Wetlands (Ramsar, 1971) and through the Convention on the Conservation of European Wildlife and Natural Habitats 1979.

In the Russian Federation, three Ramsar sites in the Taimyr region protect breeding and moulting Greater White-fronted Geese. The 'Area between the Pura & Mokoritto Rivers' is a large (1,125,000 ha) area of tundra and the second most important location for breeding geese on Taimyr, supporting approximately 125,000 Greater White-fronted Geese during late summer. The 'Gorbita Delta' supports a further 25,000 during late summer, and the species is also found at the 'Brekhovsky Islands in the Yenisei Estuary' site.

Species protection

The species is listed in Annex II/2, of the EC Directive on the conservation of wild birds which means that it may be hunted under national legislation, in specified Member States. Member States are obliged to ensure that the hunting of species on this Annex does not jeopardise conservation efforts in their distribution area. The species is also listed in Appendix III of the Bern Convention, which offers it protection yet allows hunting under similar conditions to Birds Directive.

1.5.2 Britain

Conservation status

The Greater White-fronted Goose is listed on the 'Green' list of 'The Population Status of Birds in the UK' (Gregory *et al.* 2002b), i.e. a species of least conservation concern in the UK. 'European White-fronted Goose' would qualify for addition to the 'Amber' list, as the non-breeding population has declined by 25–49% over the last 25 years, but this assessment process does not recognise subspecies and biogeographic populations.

Habitat protection

The key site designation in Britain is Site of Special Scientific Interest (SSSI). Guidelines for the selection of sites were published formally by the Nature Conservancy Council in 1989 under the title *Guidelines for the selection of biological SSSIs*. National Nature Reserves (NNR) are areas of national and sometimes international importance that are owned or leased by the appropriate statutory conservation body, or bodies leased by them, or are managed in accordance with Nature Reserve Agreements with landowners and occupiers. NNRs are also classified as SSSIs and attract similar protection. Legislative protection for these sites derives from the Wildlife & Countryside Act 1981. Under these provisions, operations likely to damage the nature conservation interest of SSSIs are subject to control.

Species protection

The White-fronted Goose is listed on Schedule 2, part 1 of the Wildlife & Countryside Act 1981. This means that it can be shot legally from 1 September to 31 January in England and Wales, with an extension to 20 February in places below the high-water mark of tidal areas, but not in Scotland (in order to protect the Greenland *flavirostris* population).

1.5.3 Hunting

Hunting is the most significant cause of mortality for the Greater White-fronted Goose in the Western Palearctic (Mooij 2000a) and the species remains a popular quarry for hunters throughout its wintering range. Of the countries supporting large numbers, Belgium and the Netherlands afford it complete protection from hunting (since 1981 in the former country), and all other countries operate a closed season in the spring.

1.5.4 Agricultural conflict

Given that there are few birds wintering in Britain, with a fragmented distribution and short period of

residency, there is minimal conflict with agricultural interests. Flocks feed on wet grasslands mainly at a time when the geese are not competing with stock or affecting the spring yield of pasture, hay or silage (Owen *et al.* 1986). Elsewhere, serious goose damage may occur and Greater White-fronted Geese are a major component of this conflict, particularly in the Netherlands and Germany. In the Netherlands, up to €2 million are paid annually as compensation for goose damage. In Germany, several million Euros are also paid annually as compensation, but in eastern Germany, where there is an estimated annual goose damage of more than €10 million, no compensation is paid (see Mooij 2000b).

2 SURVEY OF WINTERING AREAS

The following section provides a detailed site-by-site review of the status of Greater White-fronted Geese wintering in Britain. For all sites in this review, the principal source of data was WeBS. These data have been supplemented by additional counts submitted for this review by volunteer counters and site managers throughout the wintering range.

Exhaustive datasets were available for some counties (via the County Bird Recorder), whilst in other counties no information in addition to the WeBS dataset was available. Political regions containing sites of importance for wintering Greater White-fronted Geese are considered and split into the following sections:

Background

A brief overview of the region's landscape and the availability of suitable habitat for Greater White-fronted Geese found there.

Historical status

An overview of the status of Greater White-fronted Geese up to 1960, when the current review period begins. Additional information for the period 1960/61–1999/2000 that is not provided elsewhere is also given here.

Nationally important sites

Detailed accounts of nationally important sites are presented. Sites are selected using the threshold for national importance at the time of the last year under consideration in this report (60; Kirby 1995, Rose & Scott 1997). Population estimates, and subsequent thresholds, are revised periodically and the threshold for Greater White-fronted Goose now stands at 58 (Kershaw & Cranswick 2003). In line with accepted practice, however, this threshold has not been applied retrospectively, and so some sites that may qualify as of national importance in future assessments may not be identified as such in this review. Each site account contains information on status, site safeguards, habitat, trends, site usage and threats. For definitions of international site safeguards and selection criteria/guidelines used, see Ramsar (1999) for Ramsar sites, Stroud *et al.* (2001) for Special Protection Areas (SPAs) and Heath & Evans (2000) for Important Bird Areas (IBAs).

For each site, a figure is presented showing the peak counts recorded in each season since winter 1960/61. In addition, the GB index (derived from WeBS data) is shown as a plain line. Unless otherwise stated, years in which no counts were made at a site are highlighted by a dot. Figures illustrating the phenology of use are presented for

those sites with adequate data. Columns represent the mean peak count made in each fortnight between 1995/96 and 1999/2000. A list of these sites is provided in Table 3, and their locations are shown in Fig. 3.

Other sites

Brief accounts of sites that were previously of international or national importance but no longer support such numbers, or have supported large numbers for short periods of time, are presented.

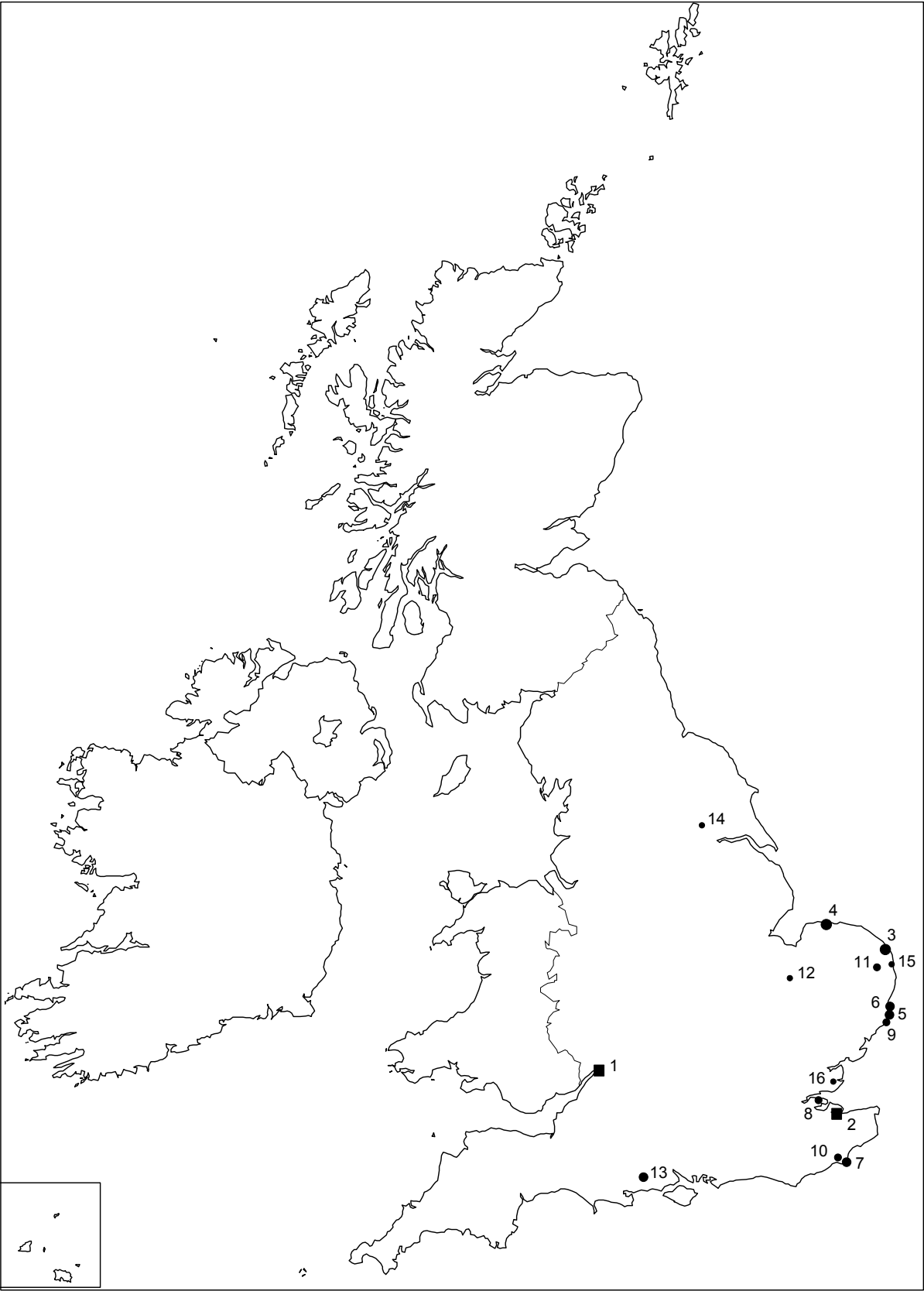
Key references

This section provides a comprehensive list of relevant literature and published monitoring data on Greater White-fronted Geese in each region.

Table 3. Sites of national importance for Greater White-fronted Goose in Britain (arranged in descending order of importance)

Site	Fiver year mean (1995/96-1999/2000)
1. New Grounds	2,244
2. Swale Estuary/Isle of Sheppey	2,200
3. Upper Thurne Broads and Marshes	761
4. Holkham and Burnham Overy Marshes	659
5. North Warren and Thorpeness Mere	419
6. Minsmere Levels	365
7. Dungeness/Dengemarsh	354
8. South Thames Marshes	279
9. Alde Complex	267
10. Walland Marsh	255
11. Middle Yare Marshes	228
12. Ouse Washes	97
13. Avon Valley	88
14. Lower Derwent Valley	86
15. Breydon Water and Berney Marshes	73
16. Crouch/Roach Estuary	67

Figure 3. Nationally important sites for Greater White-fronted Goose *Anser albifrons albifrons* in Britain (see Table 3 for key to sites)



2.1 Southwest England and South Wales

2.1.1 Background

This region is dominated by the Severn Estuary, some 24,700 ha of estuarine habitats that include extensive intertidal mudflats and sandflats, fringed by saltmarsh and grazing marshes. The estuary has an extremely large tidal range, which results in plant and animal communities tolerant to the harsh conditions this provides. Large areas of saltmarsh and grazing marsh, however, have now been reclaimed for agriculture.

The Severn Estuary is the most important site in Britain for Greater White-fronted Geese, with the majority being concentrated at the New Grounds at Slimbridge, Gloucestershire. Other sites within the Severn Estuary that were formerly important now rarely support the species.

Away from the Severn, a number of floodplains in South Wales also provide suitable habitats for Greater White-fronted Geese, although most also no longer support the species. Further south, in Cornwall and Devon, little suitable habitat exists and as a result, the species has always been scarce there, except in occasional cold weather influxes.

2.1.2 Historical status

Greater White-fronted Geese have a long history of occupancy at the New Grounds and the date of their arrival each autumn has been recorded by the Berkeley Estate since the middle of the 19th century. Only since the late 1940s, however, when Peter Scott established the then Severn Wildfowl Trust (now WWI) there, have more detailed records on the size and distribution of this flock been maintained. These show that during the late 1940s and 1950s, numbers at the New Grounds were stable, with between 3,000 and 5,000 wintering each year.

Elsewhere on the Severn Estuary a number of other sites have also held Greater White-fronted Geese in the past, most notably Bridgwater Bay, Somerset. On the Welsh side of the estuary, around 50 birds used to occur regularly in the Caldicot/Undy area.

Prior to 1960, there were a number of other important sites in this region, particularly in South Wales between Carmarthen and Cardiff, although there have been few records of Greater White-fronted Geese in Wales since the early 1990s and none of these sites still support the species. This

decline is likely to have been the result of increased disturbance and development at wintering locations, as well as the more general withdrawal from the UK by this species that has also affected other sites.

The most notable site in South Wales in recent times was the Tywi Valley, centred on Dryslwyn. Large flocks of Greater White-fronted Geese occurred there between the 1920s and 1970s. Peak numbers, up to 1,700, were present during the 1960s and early 1970s, but fewer than 100 remained by the early 1990s and none winter there today.

Further south, a number of coastal areas were also used during the early part of the 20th century, but none supports the species today, particularly since the disappearance of the flock at Dryslwyn. At Margam Moors, just south of Port Talbot, large flocks peaking at 2,500 occurred in the late 1930s and early 1940s but, by the 1950s, industrial developments had made this site unsuitable (Lovegrove *et al.* 1994). At Pembrey, between the Tywi and Llwchwr estuaries, numbers declined as those at Dryslwyn increased (Lovegrove *et al.* 1994). Other sites such as the Thaw Valley and Ogmere Estuary also held large numbers on occasion, but these were associated primarily with cold weather influxes and large numbers were not present there in all years.

In the first half of the 20th century, Greater White-fronted Geese also frequented sites around the Taf/Tywi/Gwendraeth estuary complex and the Burry Inlet, although records there since 1960 have been scarce except during influxes of cold weather, such as in February 1963 when 120 birds were recorded at the Burry Inlet.

Elsewhere, Greater White-fronted Geese have always been scarce, except during influxes of cold weather, when numbers can reach several hundred at sites not normally used.

2.1.3 Nationally important sites

i) New Grounds, Slimbridge

Five-year mean 95/96–99/2000: 2,244

Site conservation status

SPA (Severn Estuary: selection stage 1.3)

Ramsar (Severn Estuary)

SSSI (Upper Severn Estuary)

IBA (Severn Estuary: non-qualifying species)

Site description and habitat

The New Grounds (SO7206) cover some 500 ha and comprise mostly reclaimed saltmarsh managed as

low-intensity grasslands and fallow, interspersed with ditches, flashes and lagoons. One remaining area of original saltmarsh ("The Dumbles") also exists alongside the Severn Estuary.

Numbers and trends

The number of White-fronted Geese at the New Grounds increased steadily during the 1960s, reaching a peak of 7,600 in 1969/70. Numbers then decreased again even more rapidly than they had increased, to a low of 1,500 in 1974/75, before remaining at around 3,000–4,500 birds each year until the early 1990s. Since then, the population has undergone another period of decline, in line with that at many other sites in the UK, with a steady decrease to under 2,000 (Fig. 4). As a result, the New Grounds no longer hold internationally important numbers of Greater White-fronted Geese, although it remains the foremost site in Britain.

Site use

The first arrivals usually occur in late October, with a small number present in early October in some years. Numbers increase during November and December and typically peak in February. Departure is rapid and in most years the last birds leave during early March, or even late February, with some remaining into late March in some years (Fig. 5).

The New Grounds flock has always exhibited an extremely small home range, although departures from the site during cold weather used to be a regular feature in earlier decades. Visits to Ashleworth Ham and Coombe Hill, some 20-km northeast up the Severn Vale, were also more regular, although they had already become unusual by the mid-1980s (Owen *et al.* 1986). Today, with a smaller population and improved conditions at the New Grounds, the flock rarely leaves the reserve and, when it does, it typically moves less than 1 mile to an area called "The Moors". The birds use two main areas for roosting, either the long-used River Severn or a new lagoon within the WWT reserve ("South Lake") that was constructed in the early 1990s. With larger areas of floodwater now a typical feature of the reserve during mid to late winter, there is also an increasing tendency for the birds to remain on the fields overnight.

2.1.4 Other sites

i) The Severn Estuary

Away from the New Grounds at Slimbridge, a number of other sites along the outer Severn have been important for Greater White-fronted Geese in the past. The most notable of these was at the Parrett Estuary in Bridgwater Bay (ST2744), where

birds occurred consistently from the 1950s to the mid-1980s. During the 1950s and early 1960s, up to 400 were typical in most years, increasing to as many as 1,000 in some years and 2,000 in the cold winter of 1962/63. These birds dispersed widely over north and central Somerset to feed (Somerset Ornithological Society 1988), but by the early 1970s numbers had decreased to under 150 and further still to under 50 by the early 1980s, although occasional influxes still took place, with 400 there in February 1979. Since the early 1990s, however, use of this area has ceased altogether.

Between 1941 and 1967, a second flock was also found on the Somerset coast at Minehead (SS9946), numbering 10–200 birds in most years, with as many as 1,000 in February 1945 (Somerset Ornithological Society 1988). This flock disappeared just after the development of the area for tourism.

Elsewhere, Caldicot Level (ST4486) and Nedern Brook (ST4889), near Chepstow, and the Undy to Uskmouth area at Newport (ST3884) have held small numbers from time to time, although this is now increasingly unusual, particularly since the habitat at the former area is no longer suitable since drainage schemes were carried out. At the latter area, however, a new wetland reserve has recently been created to mitigate for the Cardiff barrage development and may provide suitable habitat for Greater White-fronted Geese in the future.

Other high counts recorded during the cold weather influx in January and February 1963 were made at Dunster Beach, Somerset (SS9946, 350), and at Sand Bay, Avon (ST3264, 200).

ii) Tywi Valley at Dryslwyn

The status of Greater White-fronted Geese in the Tywi Valley at Dryslwyn (SN5720) prior to the 1950s is poorly known, although it is thought that the site may have been used at least since the 1880s (R. Davies pers. comm.). It appears that they began to increase during the 1950s as the flock at Pembrey, between the Tywi Estuary and Burry Inlet, declined (Lovegrove *et al.* 1994). Regular counts began in the mid-1960s, by which time around 1,000 birds were present each winter. Numbers increased to 2,500 in January 1971, making it one of the largest flocks of Greater White-fronted Geese in Britain at that time. Since then, as elsewhere, numbers declined and the geese no longer visit this site (Fig. 6). The last record was of 12 in 1996/97.

An increase in the number of sheep grazed in the valley and the level of disturbance from low-flying aircraft may have contributed to a decrease in the

number of Greater White-fronted Geese at this site (R. Davies pers. comm.), but the general contraction eastwards shown in Britain is thought to be the major cause of this site having been abandoned as a wintering haunt.

iii) Devon and Cornwall

The Camel Estuary, Cornwall (SW9474), supported between 50 and 200 birds in most winters during the 1960s and early 1970s, with an exceptional 2,000 recorded during February 1963. Other high counts in January and February 1963 include 210 on the Exe Estuary (SX9883) and 330 on the Taw/Torridge Estuary (SS4733).

2.1.5 Key references

Mellersh (1902), Ogilvie (1966), Swaine (1982), Lovegrove *et al.* (1994)

2.2 South and Southeast England

2.2.1 Background

With its extensive coastal marshes, floodplains and estuaries, and greater proximity to the core of the winter distribution of Greater White-fronted Geese, the south and, particularly, the southeast of England hold a number of important, and formerly important, winter haunts, although none surpass the Severn Estuary.

2.2.2 Historical status

The majority of Greater White-fronted Geese in this region occur in North Kent, on the Thames and Swale estuaries and their associated grazing marshes, with smaller numbers also found on the Medway from time to time. Records date back to at least the 1880s, although the species was still considered scarce in the mid-1930s (R.B. Sibson, quoted in Harrison 1972). Larger numbers began to occur more regularly from 1939/40, and since then there has been a steady increase in the number of birds in this area (Harrison 1972), although the number remained below 200 until the mid-1940s (Gillham & Homes 1950). The birds mainly frequented the Thames Marshes at this time, although use of The Swale and Isle of Sheppey by a smaller number of birds began soon after. Numbers continued to build and during the 1960s they increased more on The Swale and Isle of Sheppey than on the South Thames Marshes.

Although there is much exchange between these areas, the birds continue to show a clear preference for The Swale and the associated Sheppey Marshes. Use of the South Thames Marshes, which were favoured in the past, is now much diminished, due in part to the extensive drainage of some of the marshes there, such as St Mary's, Halstow and Cooling. The Medway has always been less favoured, no doubt a result of its small area of grazing marsh.

Other important sites for Greater White-fronted Geese are found in east and south Kent, around the Stour Valley and Walland and Romney Marshes. These sites are used less frequently and by fewer birds in most years, although, as with many other sites across England and Wales, the numbers there are greatly augmented during cold weather influxes.

Further west, in Sussex, Greater White-fronted Geese are less regular, although still annual visitors. No regular wintering haunts exist, however, and most birds are transient, remaining for just a few days unless forced to stay longer by harsh weather (James 1996).

In Hampshire, Greater White-fronted Geese were once considered the commonest grey goose visiting the coast of the mainland and the Isle of Wight in winter, frequently straying inland (Cohen 1963), although only one regularly used site remains today, namely the Avon Valley, primarily between Fordingbridge and Ringwood. Below Ringwood, the Avon forms the county boundary between Hampshire and Dorset, with the birds most frequently found on the Hampshire side of the valley. This site has been used for many years, with Walcott (1789, in Cohen 1963) detailing a record of two birds shot near Ringwood in 1788. The regular appearance of hundreds of geese, however, dates only from around 1940; prior to this they were not considered numerous (Earl of Normanton, in Cohen 1963). By the 1960s, they were found in considerable numbers (Cohen 1963), arriving in quantity during December and remaining until late March.

In Dorset, there are no regular wintering grounds, although the species occurs annually (Prendergast & Boys 1983). The highest numbers occur in the Lower Avon Valley, parts of which are now within Dorset, although most birds here are found more frequently in Hampshire. They are also relatively regular at the Fleet, and in the northwest at Sutton Bingham reservoir, particularly during harsh weather (Prendergast & Boys 1983).

2.2.3 Nationally important sites

i) Swale Estuary/Isle of Sheppey

Five-year mean 95/96–99/2000: 2,200

Site conservation status

SPA (The Swale: selection stage 1.3)

Ramsar (The Swale)

NNR (The Swale; Elmley)

SSSI (The Swale)

IBA (The Swale: non-qualifying species)

Site description and habitat

The Swale (TQ9765) is an invertebrate-rich intertidal creek around 300–1,500 m wide that separates the coastal grazing marshes of north Kent between Sittingbourne and Faversham from the more extensive marshes of the Isle of Sheppey. The grazing marshes surrounding The Swale form the largest remaining area of this habitat in Kent and the saltmarshes are among the most botanically diverse in Britain.

Numbers and trends

In contrast to all other major sites in the UK for Greater White-fronted Geese, numbers at The Swale and Sheppey Marshes since 1960 have shown an increase followed by a period of stability. Between 1960 and the mid-1970s, numbers were consistently around 500–1,000. A sharp increase then occurred during the cold winter of 1978/79, and since then numbers have remained at around 1,500–2,500 in most winters, with a peak of 5,000 in February 1996 (Fig. 7).

Site use

The majority of birds forage on the Sheppey Marshes, favouring the Capel Fleet area at Harty and Leysdown Marshes, as well as the Royal Society for the Protection of Birds (RSPB) reserve at Elmley. They occasionally wander further afield to sites on the south side of The Swale, notably Graveney Marshes.

ii) Dungeness/Dengemarsh

Five-year mean 95/96–99/2000: 354

Site conservation status

SPA (Dungeness to Pett Levels: non-qualifying species)

SSSI (Dungeness)

IBA (Dungeness to Pett Levels: non-qualifying species)

Site description and habitat

Dungeness and Dengemarsh (TR0619) comprise extensive shingle beaches, saltmarsh, freshwater marsh, open water (mostly artificially created lagoons and pits) and arable grassland.

Numbers and trends

Apart from occasional large flocks during cold weather influxes, Greater White-fronted Geese were scarce prior to the 1990s. Since then, however, a regular wintering flock of around 350 individuals has become established (Fig. 8).

Site use

The birds roost on the gravel pits found at this site between the grazing marshes and the extensive shingle beach on the Dungeness coast. They disperse into the grazing marshes to feed and regularly move between this site and nearby Walland Marsh.

iii) South Thames Marshes

Five-year mean 95/96–99/2000: 279

Site conservation status

SPA (Thames Estuary and Marshes: selection stage 1.3)

Ramsar (Thames Estuary and Marshes: qualifying criteria 2, 5, 6)

SSSI (South Thames Estuary and Marshes)

IBA (Thames Estuary and Marshes: non-qualifying species)

Site description and habitat

The South Thames Marshes (TQ8078) comprise an extensive mosaic of coastal grazing marshes and saltmarshes, interspersed by freshwater and brackish dykes that extend for approximately 15 km along the south side of the Thames Estuary, from Cliffe to Grain. Extensive areas of mudflat and shingle occur in adjoining intertidal zones. The grazing marshes support a wide range of micro-habitats, including fleets, dykes, runnels and seasonally-wet depressions, with a wide range of salinities, although much of this area has been drained in recent decades.

Numbers and trends

Numbers at this site have changed largely in line with the national trend. A sharp increase occurred during the late 1960s, when the site peak was recorded (1,625 in February 1969). Numbers using the site fell rapidly to below 100 in the early 1970s, before increasing again to around 600 until the late 1980s, although between-year fluctuations were large (range in this period 224–1,300). Since the late 1980s, numbers have decreased to around 200, although a count of 620 was made in January 2000 (Fig. 9).

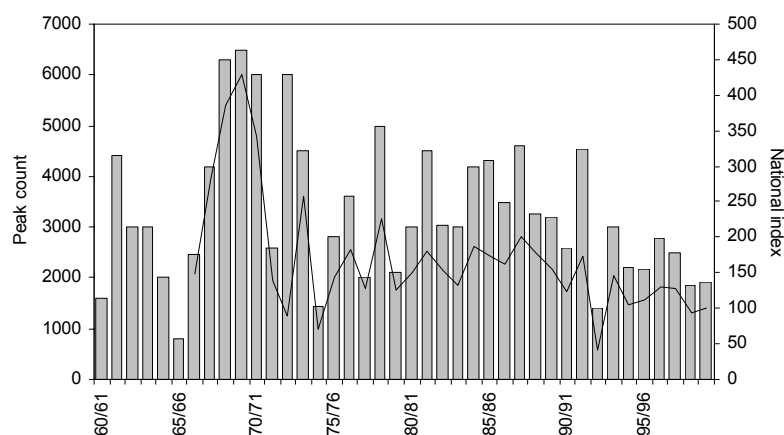


Figure 4. Greater White-fronted Geese at the New Grounds, Slimbridge, 1960/61-1999/2000: peak counts (bars) and British Index (line) (circles denote years with no known data)

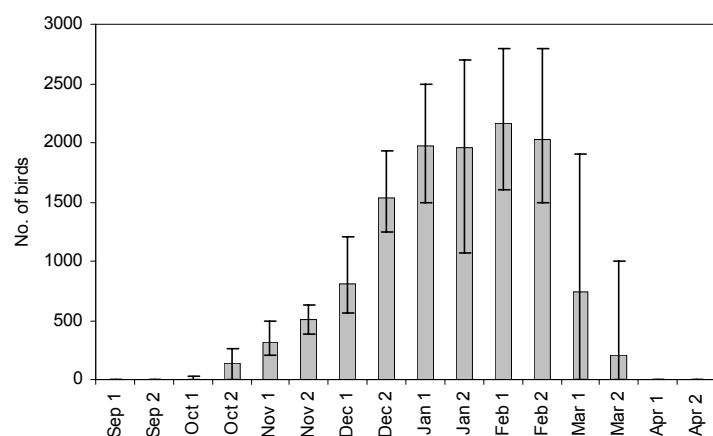


Figure 5. Greater White-fronted Geese at the New Grounds, Slimbridge, 1995/96-1999/2000: mean peak counts by fortnight, September to April (error bars denote minimum and maximum peak counts during the period).

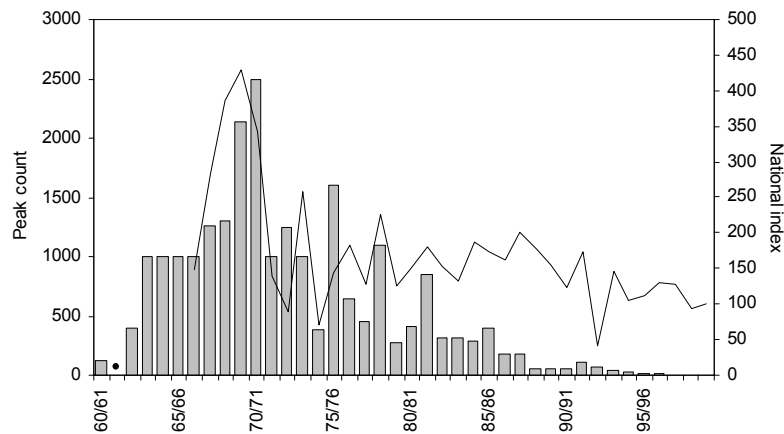


Figure 6. Greater White-fronted Geese at the Twyi Valley at Dryslwyn, 1960/61-1999/2000: peak counts (bars) and British Index (line) (circles denote years with no known data)

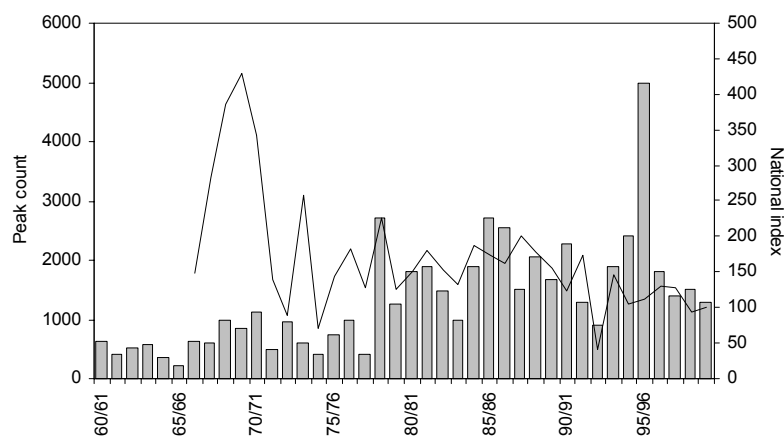


Figure 7. Greater White-fronted Geese at The Swale Estuary/Isle of Sheppey, 1960/61-1999/2000: peak counts (bars) and British Index (line) (circles denote years with no known data)

Site use

A range of marshes are used in this area, focusing on Cooling, Halstow and St Mary's. The area around Cliffe and the marshes to the east of Allhallows are also used on occasion.

iv) Walland Marsh

Five-year mean 95/96–99/2000: 255

Site conservation status

SSSI (Walland Marsh)

IBA (Dungeness to Pett Levels: non-qualifying species)

Site description and habitat

Walland Marsh (TQ9824) is an extensive area of grazing marsh just inland of Dungeness/Dengemarsh, with a largely disturbance-free lagoon that provides a safe roosting site. Most of the few remaining areas of long-established unimproved and permanent grassland of Walland Marsh and The Dowels are found here.

Numbers and trends

Numbers at Walland Marsh have increased in a similar way to those at Dungeness/Dengemarsh, and it is likely that these two sites share the same birds. Counts at Walland have been infrequent, however, but show that, in recent years at least, around 200–250 birds regularly visit this site (Fig. 10).

Site use

When at Walland, the Greater White-fronted Geese rarely move far as the site provides a secure roost and safe feeding areas within a small area.

v) Avon Valley

Five-year mean 95/96–99/2000: 88

Site conservation status

SPA (Avon Valley: non-qualifying species)

Ramsar (Avon Valley)

SSSI (Bickton to Christchurch)

IBA (Avon Valley: non-qualifying species)

Site description and habitat

The Avon Valley (SU1410) is the most biologically diverse chalk river valley in Britain. The flood plain and associated river terraces contain herb-rich hay meadows and pastures, traditionally managed water-meadows, and a range of fens and mires, as well as a diverse range of other important habitats, including riparian woods, dune grassland and heathland. The principal section used by Greater White-fronted Geese is part of the Somerley Estate and is well protected from disturbance.

Numbers and trends

The trend here follows closely that of the national trend, with a steady increase in numbers during the 1960s to a peak for the site of 1,550 in 1968/69 and 1969/70. With the exception of high counts in the cold winters of 1978/79 and 1981/82, however, there has been a steady decline since then to an average of fewer than 100 birds during the most recent five-year period (Fig. 11).

Site use

The favoured section of the Avon Valley has consistently been that between Fordingbridge and Ringwood, particularly around Blashford and Ibsley. The birds are found on the water-meadows both during the day and frequently at night, although they may also roost on the gravel pits around Blashford. Some use is also made of the valley south of Ringwood as far as Sopley and, on occasions, some birds may wander south to Stanpit Marsh, on the edge of Christchurch Harbour.

2.2.4 Other sites**i) North Kent**

Considering the proximity of the South Thames Marshes and The Swale, the Medway Estuary (TQ8471) is surprisingly less important for Greater White-fronted Geese. Large flocks have been recorded there only during cold weather influxes, with a peak count of 1,000 in January 1985. Small flocks continue to occur regularly, but the mean peak count (1995/96–1999/2000) is just 24.

Three areas of floodplain and grazing marsh in inland Kent also hold varying numbers of Greater White-fronted Geese. The Stour Valley between Fordwich and Upstreet (TR2161) holds between 20 and 100 in most winters, with a mean peak count (1995/96–1999/2000) of 35. Ash Level and Minster Marshes (TR3063), between Upstreet and Sandwich, are rarely used by Greater White-fronted Geese, however, although a large flock of 1,290 was present in February 1979. More recently, the area has again been infrequently used, with just one flock of 20 recorded during the 1990s. They are almost annual visitors at the adjacent Sandwich and Pegwell Bay (TR3662), although many of these flocks are transient, moving between more consistently used sites in Kent and the near continent. The maximum counted is 485 in February 1979, and flock size varies from a few to a few hundred, reflecting the temporary nature of flocks there. Chislet Marshes (TR2466) regularly held Greater White-fronted

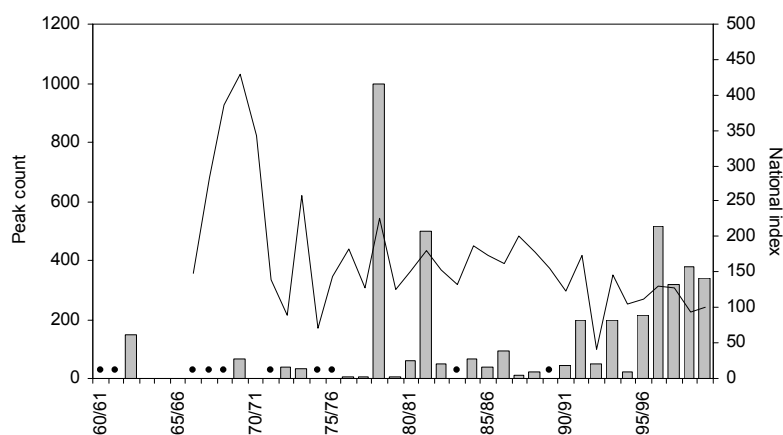


Figure 8. Greater White-fronted Geese at Dungeness/Dengemarsh, 1960/61-1999/2000: peak counts (bars) and British Index (line) (circles denote years with no known data)

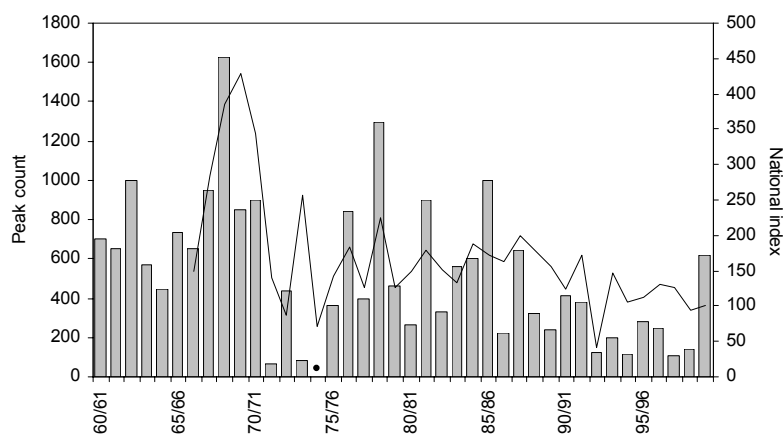


Figure 9. Greater White-fronted Geese at the South Thames Marshes, 1960/61-1999/2000: peak counts (bars) and British Index (line) (circles denote years with no known data)

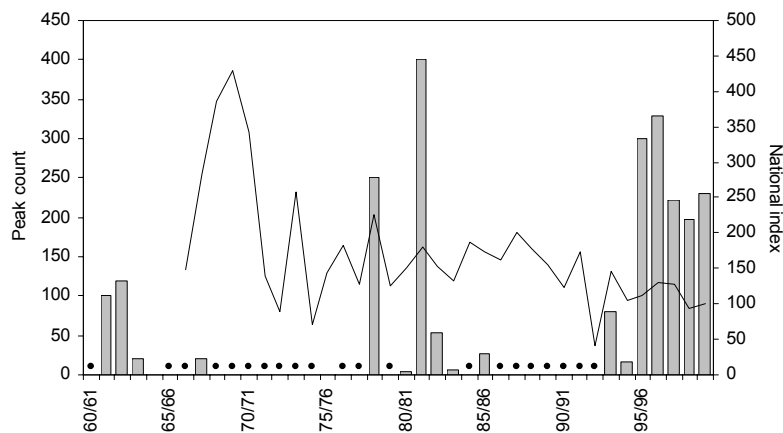


Figure 10. Greater White-fronted Geese at Walland Marsh, 1960/61-1999/2000: peak counts (bars) and British Index (line) (circles denote years with no known data)

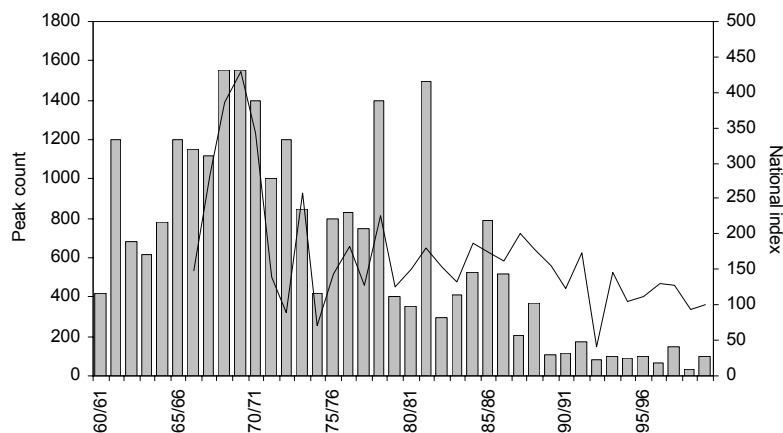


Figure 11. Greater White-fronted Geese at the Avon Valley, 1960/61-1999/2000: peak counts (bars) and British Index (line) (circles denote years with no known data)

Geese from the late 1970s to the early 1990s, with a peak of 455 in January 1985. There have been few records in recent years, however. Birds occasionally visit the Isle of Thanet (TR3367), with flocks of fewer than 50 birds recorded there at times. A count of 1,080 in January 1985 was exceptional, and coincided with a period of cold weather further east.

ii) South Kent and Sussex

Just west of Dungeness, the lagoons and grazing marshes at Rye Harbour (TQ9418) hold Greater White-fronted Geese almost annually, with under 50 birds in most years, increasing to several hundred during cold weather influxes. The peak count is 400 in March 1979 and the mean peak count (1995/96–1999/2000) is 19.

In Sussex, Greater White-fronted Geese are an annual winter visitor in small numbers. As in other regions in Britain, numbers swell greatly during cold weather influxes and during the cold months of winter 1962/63, some 1,670 birds were counted in the county. In February 1979 there was a minimum of 1,580, including 858 on Pevensey Levels and 330 on Pett Level.

The Pevensey Levels (TQ6307) are occasionally visited by small flocks of Greater White-fronted Geese, with flocks of more than 800 during cold weather influxes. Fewer than 50 is more typical, however, and whilst this number occurred almost annually during the 1960s, birds have been present in fewer than half the years since.

The Arun Valley, primarily the section between Pulborough and Arundel (TQ0314) that encompasses Pulborough Brooks and Amberley Wild Brooks, is used regularly by small numbers of Greater White-fronted Geese, with a peak count of 120 in March 1963. During 1995/96–1999/2000, the mean peak count was six, with an overall peak during that period of 20 in December 1997 and January 1998. Some birds are occasionally seen to the south of Arundel, with a peak count of 54 in January 1985.

The Cuckmere Valley between Arlington and Cuckmere Haven (TQ5202) also supports small numbers of Greater White-fronted Geese in most years. The mean peak count during 1995/96–1999/2000 was 14, peaking at 40 in January 1996. Numbers are variable, however, and in three of the most recent five years the peak count has been fewer than five. The maximum number recorded there is 100 in February 1979. These birds are often recorded at nearby Arlington Reservoir, and it seems likely they use this site as a roost. The peak count is greater than that recorded in the adjacent valley, highlighting

the benefit from counting geese at roost: 132 in March 1979.

Further west along the Sussex coast, the Ouse Valley (TQ4205) and environs occasionally hold small flocks. The Glynde Levels are the most important area and supported a small flock regularly during the 1960s and 1970s, peaking at 155 in February 1979. During the 1980s and early 1990s, there were almost no records, but recently there has once again been a small flock there, with a mean peak count (1995/96–1999/2000) of 13 and a maximum of 57 in December 1998. The adjacent, and larger, Lewes Brooks have held up to 110 (in March 1979), but birds are generally not present, having being recorded there in just six winters since 1960/61. South of Southease they are also scarce, with a flock of 70 from January to March 1963 being the largest of just four occurrences.

These birds also make use of Barcombe Mills Reservoir (TQ4314), presumably as an evening roost. The peak count recorded there is 57 in November and December 1985, and the mean peak count (1995/96–1999/2000) is five, peaking at 20 in November and December 1998.

On the other side of Brighton, the Adur Valley (TQ1914) is less important and records are few in number, although it has supported large flocks during years of cold weather influxes, for example 110 in January 1963 and 240 in February 1979.

Inland, the large Bewl Water reservoir (TQ6733), southeast of Tunbridge Wells, has attracted small numbers of Greater White-fronted Geese during two periods, the late 1980s and the late 1990s, with a peak count of 60 in February 1986. During 1995/96–1999/2000, the mean peak count was five birds, with a flock of 20 present for much of the 1998/99 winter. To the northwest, Bough Beech Reservoir (TQ4948) also holds small numbers at times, with a mean peak count (1995/96–1999/2000) of six, although the use of this site has a longer history, with birds present in most winters since the late 1970s.

iii) Coastal Hampshire and Dorset (including Pagham Harbour)

At Pagham Harbour (SZ8797), Greater White-fronted Geese are almost annual visitors, occurring in 31 of the 40 years since 1960/61. Numbers are small, however, with fewer than 50 in most years, peaking as high as 400 in cold weather influxes. The mean peak count (1995/96–1999/2000) is eight. Nearby Chichester Harbour (SU7700) attracts occasional flocks, although few have been recorded

recently. The peak period was during the early 1980s, when a small flock, peaking at 66, was present during most winters. At Langstone Harbour (SU6902), small flocks occurred from the late 1960s to early 1980s, but none have been recorded more recently.

Southampton Water (SU4507) is visited infrequently, with the largest recorded flock being 54 in February 1979.

Christchurch Harbour (SX1792) attracts flocks of Greater White-fronted Geese from time to time, presumably as they wander from the Avon Valley to the north. Between 1977/78 and 1982/83, 150–500 birds were present each winter, although there have been few records outside of this period.

Poole Harbour (SY9988) is an irregular refuge, with small flocks in some years during the 1980s and late 1990s, and larger numbers during cold weather, peaking at 300 in February 1963.

At Abbotsbury and The Fleet (SY6180), the occurrence of Greater White-fronted Geese is sporadic, with a peak count of 400 in January 1963, but with many years without any records at all. There has been a recent increase in the regularity of occurrence, however, with a mean peak count (1995/96–1999/2000) of eight birds.

On the Beaulieu Estuary (SZ4297), records were regular during the 1960s, but then very few birds were recorded during the 1970s and 1980s. In contrast to the national trend, however, records have increased during the 1990s, although the number of birds is small and the mean peak count (1995/96–1999/2000) is six.

2.2.5 Key references

Harrison (1972), James (1996), Kelsall & Munn (1905), Oliver (1972).

2.3 East Anglia

2.3.1 Background

East Anglia and Lincolnshire contain a large number of suitable areas for Greater White-fronted Geese, from the extensive wetlands of the North Norfolk Coast, to Broadland and the estuaries of Suffolk and Essex. This profusion of suitable habitat is reflected in the region's containing the largest number of sites with nationally important wintering flocks of this species, nine in all. Furthermore, in contrast to the

trend nationally and at key haunts further west, numbers are increasing at many of these sites.

2.3.2 Historical status

In the late 19th and early 20th centuries, Greater White-fronted Geese were considered an unusual visitor to Norfolk (Taylor *et al.* 2000). In Suffolk too, the species was considered uncommon in the late 19th century (Payn 1978), although large numbers were noted in periods of cold weather, e.g. January and February 1871 (Hele 1890) and at Kessingland in 1923 (Ticehurst, in Piotrowski 2003). In Essex, it was considered irregular by Glegg (1929), although still the most numerous of the *Anser* geese. In Cambridgeshire, it was uncommon to rare prior to the 1930s (Bircham 1989).

Around the 1920s and 1930s, however, an increase seems to have occurred over the region. In Norfolk, the vast area of marshland to the west of Breydon Water attracted increasing numbers from this time (Taylor *et al.* 2000), with the principal feeding area being Halvergate Marsh. By the late 1930s, some 2,000–3,000 Greater White-fronted Geese were wintering in the area, and this is likely to have remained the case until the late 1940s, but wartime restrictions meant that counts between these periods were impossible. In the late 1940s, changes in the drainage of Halvergate saw less and less winter flooding, resulting in a steady decline in the use of this marsh by Greater White-fronted Geese until it was completely abandoned by the mid-1970s.

An increase was also noted in Suffolk around the 1920s, the Greater White-fronted Geese being described at that time as the common goose of the Stour and at Southwold, a description strong contrasting with that just a few decades earlier. It remained rare inland, however (Payn 1978), and the increase was of a much smaller magnitude than that in Norfolk. Similarly, in Cambridgeshire it appears that numbers on the Ouse and Nene Washes began to increase in the late 1930s and 1940s (Bircham 1989).

2.3.3 Nationally important sites

i) Upper Thurne Broads and Marshes

Five-year mean 95/96–99/2000: 761

Site conservation status

SPA (Broadland: selection stage 1.3)
Ramsar (Broadland)
NNR (Hickling Broad; Martham Broad)
SSSI (Upper Thurne Broads and Marshes)
IBA (Broadland: non-qualifying species)

Site description and habitat

The Upper Thurne Broads and Marshes (TG4321) are located about 5-km inland from the northeast coast of Norfolk and are one of the finest examples of an unreclaimed wetland complex in Britain. The site comprises four large, shallow lakes formed through the flooding of peat cuttings prior to the 13th century. They are surrounded by extensive reedbeds and areas of species-rich sedge-fen, and associated grazing marsh and fen meadow.

Numbers and trends

The number of Greater White-fronted Geese in this area has increased considerably since they began to use Heigham Holmes in the early 1990s (Fig. 12). Before then, most counts had been from Horsey Mere or Hickling Broad, where this flock still roosts at times.

Site use

The birds are found primarily at Heigham Holmes, between Heigham Sound and Martham Broad, where they feed on the grazing marsh and remain to roost on floodwaters. Occasionally, they return to the more secure waterbodies of Horsey Mere and Hickling Broad in order to roost.

ii) Holkham and Burnham Overy Marshes

Five-year mean 95/96–99/2000: 659

Site conservation status

SPA (North Norfolk Coast: selection stage 1.3)
Ramsar (North Norfolk Coast)
NNR (Holkham)
SSSI (North Norfolk Coast)
IBA (North Norfolk Coast: non-qualifying species)

Site description and habitat

An area of winter flooded grazing marsh on the coast at Holkham Bay (TF8744), north Norfolk that was reclaimed in the 17th and 18th centuries. The area is bounded by the woodland at Holkham Meals to the north and Holkham Hall to the south.

Numbers and trends

As at many other sites in this region, a steady increase in numbers has occurred at Holkham since the mid-1960s (Fig. 13).

Site use

The geese feed and roost almost entirely on this site, only occasionally wandering further afield to other suitable areas in north Norfolk.

iii) North Warren and Thorpeness Mere

Five-year mean 95/96–99/2000: 419

Site conservation status

None

Site description and habitat

A relatively small area of grazing marsh and a small lagoon, located between Aldeburgh and Thorpeness (TM4658) on the Suffolk coast just north of the Alde Complex.

Numbers and trends

Greater White-fronted Geese have only recently been counted at this site, although given the longer history of occurrence at the adjacent Alde Complex, it is likely that birds occurred here prior to 1990. Since then, however, numbers have increased quickly, so that it is now the third most important site in East Anglia (Fig. 14).

Site use

A number of other suitable areas that were formerly more important for Greater White-fronted Geese are still used from time to time by the North Warren flock. These include Sudbourne Marshes and Aldeburgh Marshes. At North Warren, however, the birds typically frequent a small home range, feeding on the marshes and roosting either on temporary floodwater or at Thorpeness Mere.

iv) Minsmere Levels

Five-year mean 95/96–99/2000: 365

Site conservation status

SPA (Minsmere-Walberswick: non-qualifying species)
Ramsar (Minsmere-Walberswick)
SSSI (Minsmere-Walberswick Heaths and Marshes)
IBA (Minsmere-Walberswick: non-qualifying species)

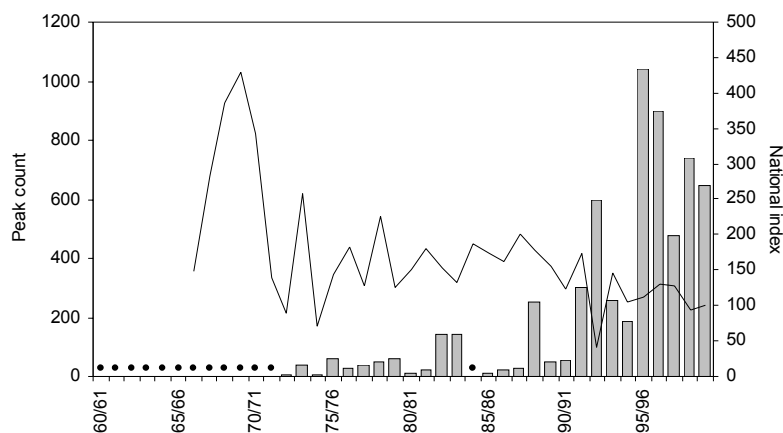


Figure 12. Greater White-fronted Geese at the Upper Thurne Broads and Marshes, 1960/61-1999/2000: peak counts (bars) and British Index (line) (circles denote years with no known data)

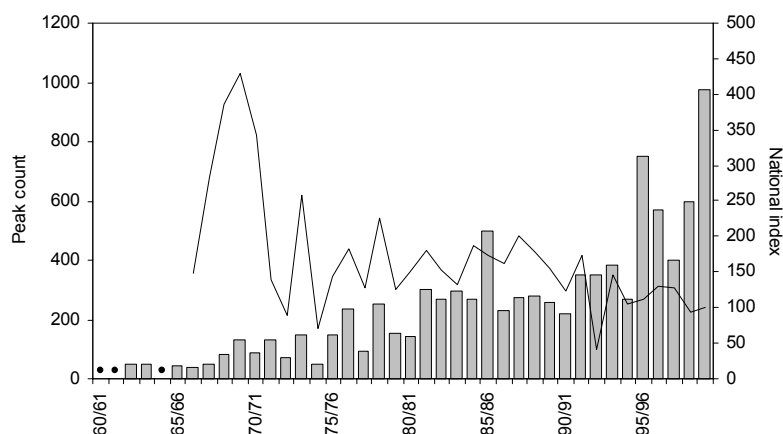


Figure 13. Greater White-fronted Geese at Holkham and Burnham Overy Marshes, 1960/61-1999/2000: peak counts (bars) and British Index (line) (circles denote years with no known data)

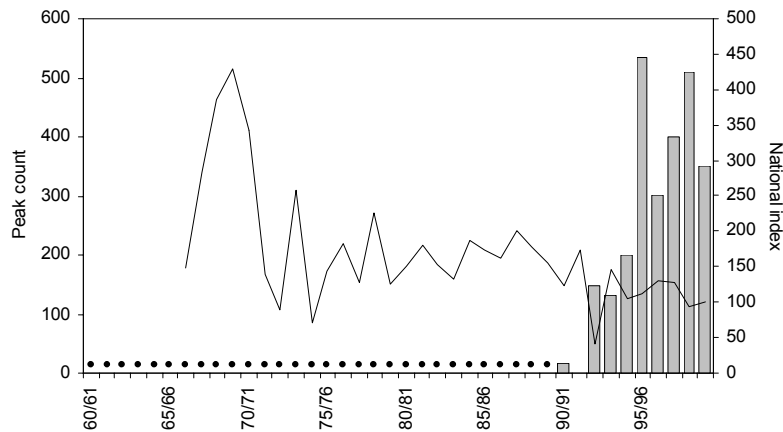


Figure 14. Greater White-fronted Geese at North Warren and Thorpeness Mere, 1960/61-1999/2000: peak counts (bars) and British Index (line) (circles denote years with no known data)

Site description and habitat

Minsmere Levels (TM4666) are an area of coastal grazing marsh and lagoons to the north of Leiston. They contain a wide range of habitat types, including areas of grazing marsh and open water that provide a suitable environment for Greater White-fronted Geese.

Numbers and trends

Numbers of Greater White-fronted Geese at Minsmere fluctuated during the 1960s and were low for most of the 1970s. A sudden increase to around 150 birds then occurred in the early 1980s and, more recently, numbers increased rapidly again during 1996/97, with around 450 birds wintering there in recent years (Fig. 15).

Site use

When feeding, the geese are found mainly to the south of the Levels, below Goose Hill. Roosting occurs on floodwater, or on the artificial scrapes created on the RSPB reserve to the north.

v) Alde Complex

Five-year mean 95/96–99/2000: 267

Site conservation status

SPA (Alde/Ore Estuary: selection stage 1.3)
Ramsar (Alde/Ore Estuary)
NNR (partial, Orfordness-Havergate)
SSSI (Alde/Ore Estuary)
IBA (Alde/Ore Estuary: non-qualifying species)

Site description and habitat

A complex site comprising the sheltered estuaries of the Alde, Butley and Ore (TM4257) and extensive areas of adjacent grazing marsh, including those at Iken, Sudbourne, Raydon, Hazlewood, Gedgrave and Boyton.

Numbers and trends

Apart from an exceptional 1,500 during the cold weather of 1978/79, numbers at the Alde Complex have generally remained below 200, although since the mid-1990s this site has averaged almost 300 birds (Fig. 16).

Site use

During the 1970s, Sudbourne Marshes were the favoured haunt, although this site became less suitable from the late 1980s due to agricultural improvements (Piotrowski 2003). More recently, the majority of reports have come from the marshes at Gedgrave, Iken and Hazlewood.

vi) Middle Yare Marshes

Five-year mean 95/96–99/2000: 228

Site conservation status

SPA (Broadland: selection stage 1.3)
Ramsar (Broadland)
SSSI (Yare Broads and Marshes)
IBA (Broadland: non-qualifying species)

Site description and habitat

The Yare floodplain between Brundall and Reedham (TG3504) comprises extensive areas of unreclaimed fen, carr woodland, open water and grazing marsh on shallow fenland peats. It includes the marshes at Buckenham, Cantley, Langley and Hardley, and the broads at Surlingham, Rockland and Hassingham.

Numbers and trends

Numbers here increased rapidly during the 1980s (Fig. 17). Since then, numbers have declined slightly, with around 250 birds are now wintering at this site annually.

Site use

The principal marshes used are Buckenham and Cantley, although the birds disperse further afield at times. Roosting takes place either on the floodlands or at nearby Buckenham Carrs, a small, undisturbed waterbody surrounded by trees to the north of the site.

vii) Ouse Washes

Five-year mean 95/96–99/2000: 97

Site conservation status

SPA (Ouse Washes: non-qualifying species)
Ramsar (Ouse Washes)
SSSI (Ouse Washes)
IBA (Ouse Washes: non-qualifying species)

Site description and habitat

The Ouse Washes (TL5394) lie between the Old and New Bedford Rivers and are one of the few remaining extensive areas of washland in Britain. The site is managed using traditional cattle grazing and hay cutting and acts as a floodwater storage system during the winter. Consequently, the marshes are subject to regular and prolonged winter flooding.

Numbers and trends

Apart from occasional large flocks recorded during periods of cold weather, Greater White-fronted Geese were scarce at the Ouse Washes during the 1960s and 1970s (Fig. 18). Numbers increased slightly during the 1980s, although peak counts fluctuated considerably between years.

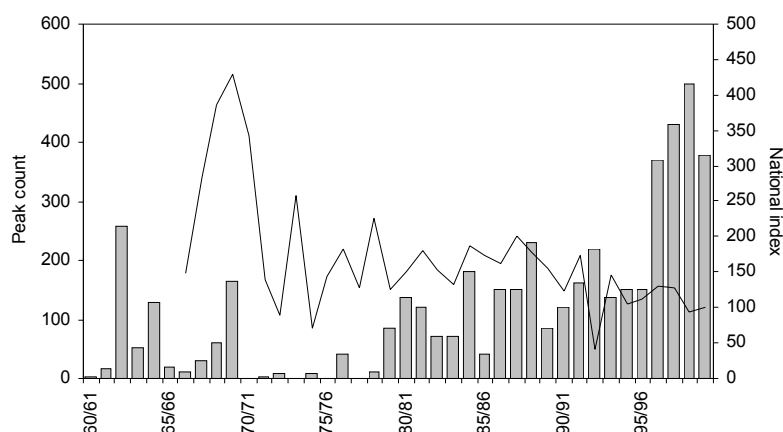


Figure 15. Greater White-fronted Geese at the Minsmere Levels, 1960/61-1999/2000: peak counts (bars) and British Index (line) (circles denote years with no known data)

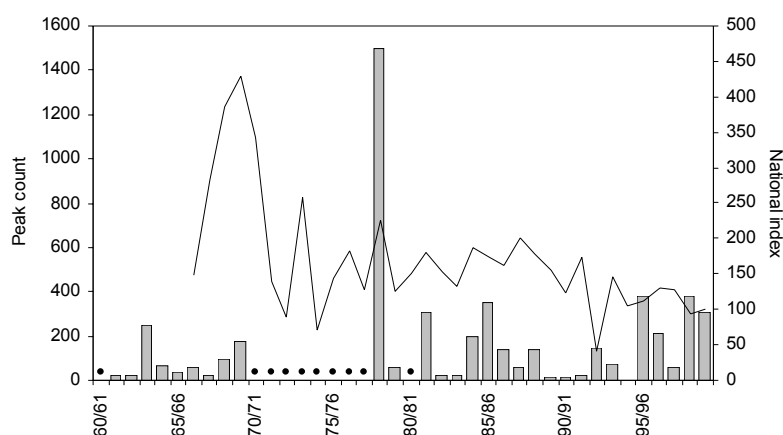


Figure 16. Greater White-fronted Geese at the Aide Complex, 1960/61-1999/2000: peak counts (bars) and British Index (line) (circles denote years with no known data)

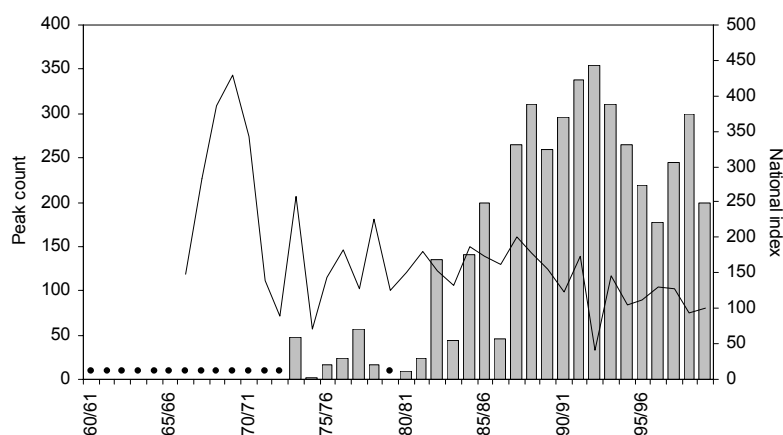


Figure 17. Greater White-fronted Geese at the Middle Yare Marshes, 1960/61-1999/2000: peak counts (bars) and British Index (line) (circles denote years with no known data)

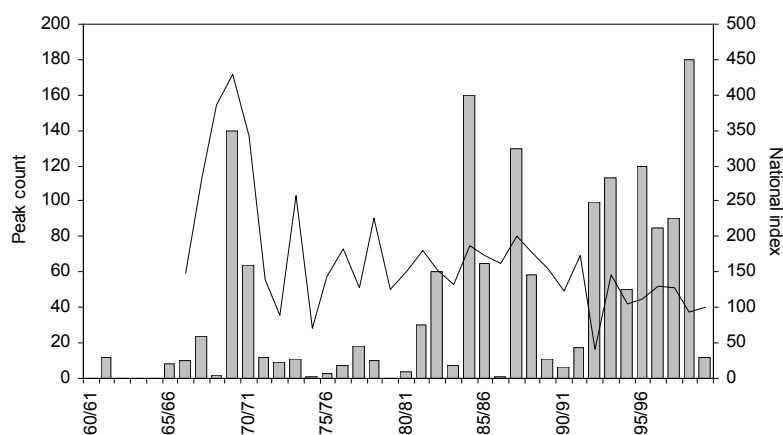


Figure 18. Greater White-fronted Geese at the Ouse Washes, 1960/61-1999/2000: peak counts (bars) and British Index (line) (circles denote years with no known data)

It was not until the 1990s that a steady increase took place, with around 100 birds present each winter by the end of that decade, although in 1999/2000 just 12 birds were recorded.

Site use

No information on the site use of Greater White-fronted Geese at the Ouse Washes was available.

viii) Breydon Water and Berney Marshes

Five-year mean 95/96–99/2000: 73

Site conservation status

SPA (Breydon Water: selection stage 1.3)

Ramsar (Breydon Water)

SSSI (Breydon Water)

IBA (Breydon Water: non-qualifying species)

Site description and habitat

Breydon Water is a large enclosed estuary (TG4907) to the west of Great Yarmouth at the mouth of the River Yare and its confluence with the Rivers Bure and Waveney. Extensive areas of mud are exposed at low tide and these support growths of green algae and eelgrass. To the southeast and, particularly, the west lie extensive areas of grazing marsh, such as Halvergate and Berney Marshes.

Numbers and trends

Forty years ago, Breydon Water and its associated marshes, primarily those at Halvergate, was the principal site in East Anglia. With increased drainage, however, numbers declined so that by the late 1970s and early 1980s, almost no birds wintered there (Fig. 19). Since then, a general increase in numbers of Greater White-fronted Geese has taken place at most other sites in East Anglia and, whilst this has also occurred at Breydon Water, the increase there has been much smaller.

Site use

The birds disperse primarily to Berney Marshes in order to forage, returning to Breydon Water to roost. There are extensive areas of grazing marsh in the vicinity of Breydon Water, however, and these are also used occasionally.

ix) Crouch/Roach Estuary

Five-year mean 95/96–99/2000: 67

Site conservation status

SPA (Crouch & Roach Estuaries (Mid-Essex Coast Phase 3): non-qualifying species)

Ramsar (Crouch & Roach Estuaries (Mid-Essex Coast Phase 3))

SSSI (Crouch and Roach Estuaries, Dengie, Foulness)

IBA (Mid-Essex Coast: non-qualifying species)

Site description and habitat

The Crouch/Roach Estuary (TQ9496) is an extensive area of estuary and coastal marsh to the northeast of Southend-on-Sea and includes the Crouch and Roach estuaries, Foulness Island and Wallasea Island. The intertidal zone along the two rivers lies between sea walls on both banks and is therefore narrow. The surrounding land is predominantly arable, with areas of saltmarsh and lingering patches of grazing marsh, some of which has been intensively improved. There are also areas of open fresh to brackish water, and a freshwater reservoir.

Numbers and trends

Apart from two high counts in years when Britain experienced cold weather influxes of Greater White-fronted Geese, numbers at this site have generally remained relatively low during the period of this review. However, there is some indication of a slight increase in numbers at this site since the mid-1990s, and this is enough for the site to qualify as nationally important (Fig. 20).

Site use

Most records come from the marshes in the Fambridge area, just east of South Woodham Ferrers.

2.3.4 Other sites

Despite the relatively large number of sites in East Anglia supporting nationally important numbers of Greater White-fronted Geese, few other sites support anything other than occasional flocks.

Among the more regularly visited sites is Abberton Reservoir (TL9717) and the adjacent Blackwater Estuary (TL9307), where small flocks occur from time to time, the largest being 69 in January 1986 and 61 in February 1986, respectively. Further north, the Deben Estuary (TM2942) has held up to 109 birds (in December 1987), but occasional flocks of 5–20 birds are more typical.

Hamford Water (TM2225) is frequented by small numbers in most years, typically by flocks of between 5 and 40 birds, peaking at 74 in January 2000.

2.3.5 Key references

Glegg (1929), Payn (1978), Cox (1984), Bircham (1989), Taylor *et al.* (2000), Piotrowski (2003)

2.4 Northeast England

2.4.1 Background

Northeast England does not abound with suitable habitat for Greater White-fronted Geese, and this is reflected in their status there. Just one site currently supports nationally important numbers, and the occurrence of the species there is far from established.

2.4.2 Historical status

Greater White-fronted Geese have never been a common visitor to Northeast England, although large flocks have occurred at times during cold weather influxes simply due to the region's proximity to continental Europe.

2.4.3 Nationally important sites

i) Lower Derwent Valley

Five-year mean 95/96–99/2000: 86

Site conservation status

SPA (Lower Derwent Valley: non-qualifying species)
Ramsar (Lower Derwent Valley)
SSSI (River Derwent; Derwent Ings)
IBA (Lower Derwent Valley: non-qualifying species)

Site description and habitat

The Lower Derwent Valley (SE6939) is a mixture of freshwater floodplain habitats, such as flood-meadow, fen and swamp, adjacent to Pocklington Canal, Thornton Beck and the nutrient-rich and relatively unpolluted River Derwent. The flood-meadows are particularly pristine and are amongst the most important in Europe.

Numbers and trends

Up to 200 Greater White-fronted Geese have been supported since 1990, although numbers have been erratic and have decreased in the two most recent winters (Fig. 21). Whether this site will become an established wintering area for this species remains uncertain.

Site use

Use of this site is still relatively infrequent and no information exists of the areas within the Lower Derwent Valley that have supported Greater White-fronted Geese.

2.4.4 Other sites

With the exception of the Lower Derwent Valley, only one site in Northeast England has ever held more than 100 birds, namely Lindisfarne (NU1041) where 106 were present in February 1996. In recent decades, birds have been recorded there in most years, although numbers at this site are more typically between five and 30.

Elsewhere, a small number of other coastal sites support small flocks in some winters. These include Cresswell Pond (NZ2894), Druridge Pools (NZ2796), Holywell Pond (NZ3175) and Hornsea Mere (TA1947).

2.4.5 Key references

Nelson (1907)

2.5 Northwest England and North Wales

2.5.1 Background

This region previously held a number of wintering flocks of White-fronted Geese. The status of Greater White-fronted Geese is, however, confused at many of the formerly important areas by the presence of Greenland White-fronted Geese, most notably on the Dyfi Estuary and at Cors Caron in Cardiganshire.

2.5.2 Historical status

During the early 20th century, Greater White-fronted Geese appeared regularly on the Dee and, in particular, the Mersey estuaries. On the Dee, they were found mainly on Burton Marsh, where in some winters (e.g. 1904/05 and 1939/40) good numbers were present: the largest number was 400 in January 1950. On the Mersey, however, numbers were considerably larger, reaching 4,000 to 5,000 in 1947 (Williams 1977). These flocks declined rapidly during the 1950s, however, and the species is now a scarce visitor to this area.

Along the coast in Flintshire and Denbighshire they are also scarce, although records suggest that they were formerly more numerous, particularly when the Dee Marshes held an important concentration. Occasional flocks are still seen along the Clwyd Valley, from the estuary inland as far as Ruthin.

In Caernarfonshire, the White-fronted Goose was considered the most numerous goose species in the Porthmadoc area at the start of the 20th century, although it is now no longer recorded regularly. In Anglesey, both races are recorded, although neither is numerous. It appears that Greenland White-fronted Geese were more numerous during the 1950s, but by the 1970s Greater White-fronted Geese had become more prevalent (Lovegrove *et al.* 1994). More recently, flocks of around 40 are regularly recorded from a suite of lakes including Llyn Alaw, Llyn Bodgylched and Llyn Coron.

The Dyfi Estuary, in northwest Wales, may also have been frequented regularly by Greater White-fronted Geese, although their former status there is difficult to ascertain. This site also holds a wintering flock of Greenland White-fronted Geese, a race not described until 1948 (Dalgety & Scott 1948), and accounts of the habits of geese around the Dyfi Estuary from around 1910 to the early 1940s very much suggest that they were Greenland White-fronted Geese (A.D. Fox pers. comm.). It seems, however, that a regular wintering flock of Greater White-fronted Geese became established there during the late 1940s or early 1950s. By the 1950s,

numbers peaked at around 200 between January and March, with up to 600 in some, presumably harsh, winters (Lovegrove *et al.* 1994). These birds may have been linked to the flock that wintered in the upper Severn Valley until the 1970s, although no confirmation of this exists. By the 1960s, however, the population had declined to around 100 (Ogilvie 1968) and by the early 1980s had all but disappeared completely. Today, Greater White-fronted Geese are no more than vagrants, although occasional small parties still occur there from time to time, most recently in 1990/91.

2.5.3 Other sites

i) Camlad Meadows

The only site to have held large numbers of Greater White-fronted Geese since 1960 is Camlad Meadows, just south of Welshpool (SJ2400). Several hundred birds were present every winter during the 1960s, peaking at 1,200 in 1968/69. The site was abandoned extremely rapidly, however, with 750 in 1969/70, 500 in 1970/71, 150 or fewer from 1971/72 to 1976/77, and none since (Fig. 22).

2.5.4 Key references

Lovegrove *et al.* (1994)

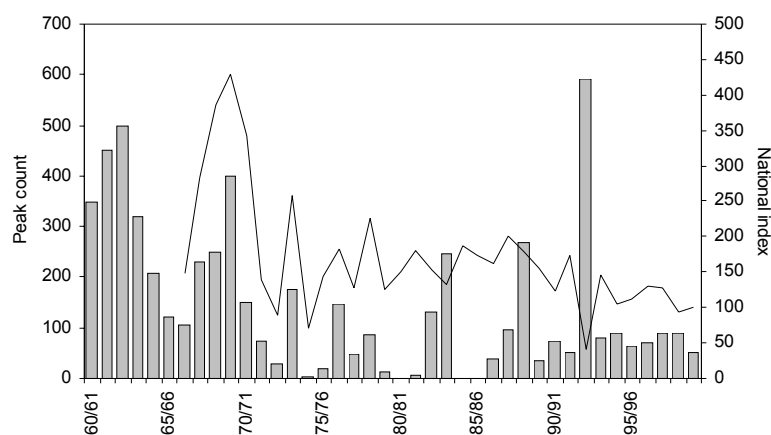


Figure 19. Greater White-fronted Geese at Breydon Water and Berney Marshes, 1960/61-1999/2000: peak counts (bars) and British Index (line) (circles denote years with no known data)

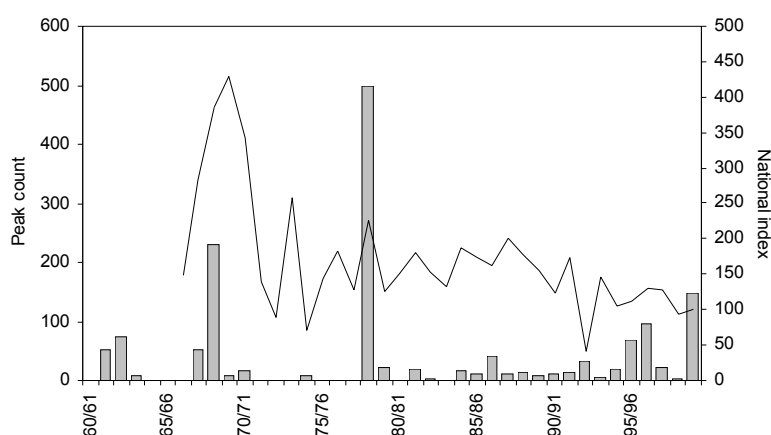


Figure 20. Greater White-fronted Geese at the Crouch/Roach Estuary, 1960/61-1999/2000: peak counts (bars) and British Index (line) (circles denote years with no known data)

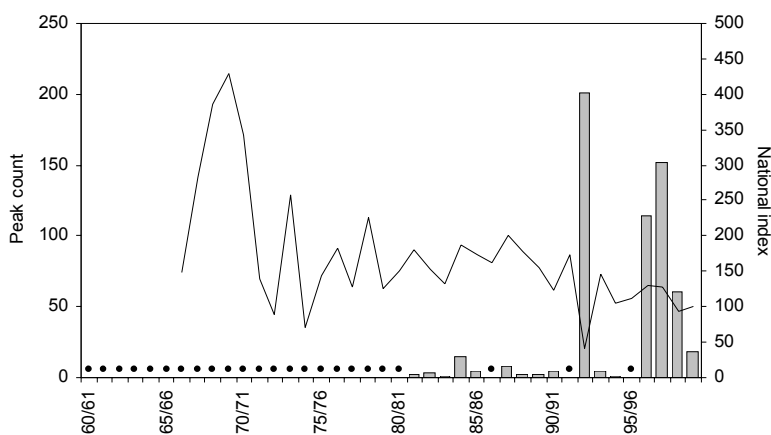


Figure 21. Greater White-fronted Geese at the Lower Derwent Valley, 1960/61-1999/2000: peak counts (bars) and British Index (line) (circles denote years with no known data)

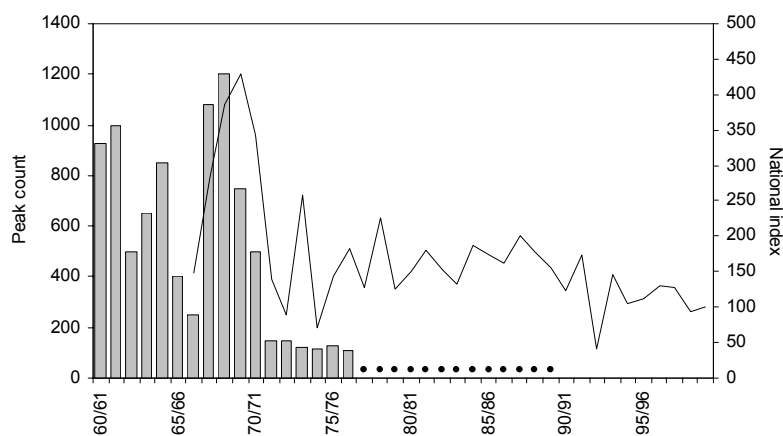


Figure 22. Greater White-fronted Geese at the Camlad Meadows, 1960/61-1999/2000: peak counts (bars) and British Index (line) (circles denote years with no known data)

3 FUTURE MONITORING AND DATA NEEDS

Across the Palearctic, there is an urgent need to improve the monitoring of basic population parameters, such as estimates of abundance and hunting mortality. A co-ordinated ringing programme operating throughout the range is urgently needed in order to better understand the delimitation between flyways and changes in distribution. The marking of wintering birds in south and east Europe is a vital component of this. Surveys that identify moulting areas and assess their importance are also required, as this part of the life cycle remains poorly understood; a satellite telemetry study would be of particular value in this regard. Given the large number of countries that support large numbers of Greater White-fronted Geese throughout its life cycle, the species would benefit greatly from co-ordinated conservation action across its many flyways in Eurasia.

Although some demographic data available, it is not yet possible to predict the effects of future conservation threats, such as climate change, habitat loss and agricultural policy changes, on population trends and distribution. There is a need to develop population models, which can predict the impacts of novel circumstances; studies of the effects of density-dependence, resource depletion dynamics

and state-dependent behaviour will be required to develop these models. These studies will require co-ordinated collaboration from research teams across the range.

In the light of continued changes in agricultural land use throughout Britain and Ireland, it is important to monitor variation in the distribution of feeding areas at key sites. In general, the agricultural feeding areas used by Greater White-fronted Geese are not protected under any national legislation. Effective monitoring of feeding distribution is required, therefore, in order to identify key feeding areas that occur on agricultural land so that appropriate management measures that benefit Greater White-fronted Geese can be implemented.

In addition, the role of British sites as 'refuges' for birds normally wintering on the continent requires further attention to ensure that currently important sites are managed appropriately to account for future scenarios, e.g. cold weather events. Given the magnitude of recent redistributions of the species in Eurasia, understanding the consequences of the contracting range, and smaller number of key sites, should remain a priority for future research.

4 ACKNOWLEDGEMENTS

This review would not have been possible without the dedicated network of volunteer and professional counters that contribute to the Wetland Bird Survey, and the vast number of birdwatchers that contribute records of Greater White-fronted Geese to their County Bird Recorder. I am extremely grateful for their efforts and strongly encourage them to continue their valuable work into the future. Unfortunately they are too numerous to list here individually, but my sincere thanks go to them all.

I am also extremely grateful to the County Bird Recorders who supplied information and records for their respective counties: Jonathan Bowley (Warwickshire), Daniel Carmichael (Angus & Dundee), John Clark (Hampshire), Martin Cook (Moray & Nairn), Steve Coney (Herefordshire), Geoff Dobbs (Yorkshire), Ian Fisher (Northumberland), Rob Fray (Leicestershire & Rutland), George Gordon (Northern Ireland), Jon Green (Wales), Andy Harding (Buckinghamshire), John Hobson and John Newnham (Sussex), Tim Hodge (Kent), Angus Hogg (Ayrshire), Chris Jones (Gwent), Rod Key (Derbyshire), David Kramer (Bedfordshire), Rob Little (Cleveland), John Oates (Cambridgeshire), David Ogilvie (Fife), Hywel Roderick (Ceredigion), Deryk Shaw (Fair Isle), Judith Smith (Greater Manchester), Andrew Stevenson (Outer Hebrides), Howard Vaughan (Essex), Andy Warr (Worcestershire), Jeffery Wheatley (Surrey), Jim

Williams (Orkney) and Steve White (Lancashire & North Merseyside). Richard Davies supplied additional information for the Tywi Valley, for which I am also grateful.

Much of the information in Section 1 came from the comprehensive text compiled by Johan Mooij for *Goose Populations of the Western Palearctic*. Thanks must go to Johan and to Jesper Madsen for their permission to use this text extensively in this review. Linda Birch, at the Edward Grey Institute library in Oxford, kindly helped me during the compilation of records of Greater White-fronted Geese from the County Bird Report archive.

Finally, I also wish to thank Helen Baker, Peter Cranswick, Mark Grantham, Colette Hall, Paul Marshall, Nancy Robb, James Robinson and Mark Thomas for their assistance during the production of this review. Eckhart Kuijken and Johan Mooij kindly provided comments that allowed an earlier draft to be improved.

I have made every effort to include all known data in this review. Given, however, that a number of unpublished reports and databases may have been overlooked, I urge readers to submit new and additional data to WWT, especially where there are apparent gaps in this data set.

5 REFERENCES

- Alphéraky, S. 1994. *Geese of Russia*. Kutschnerew & Co., Moscow.
- Atkinson-Willes, G.L. 1963. *Wildfowl in Great Britain, First Edition*. HMSO, London.
- Bauer, K. M. & Glutz von Blotzheim, U.N. 1968. *Handbuch der Vögel Mitteleuropas*, Band 2: *Anatidae – Entenvögel*. 2. Akademische Verlagsgesellschaft, Frankfurt/Main.
- Bircham, P.M.M. 1989. *The Birds of Cambridgeshire*. Cambridge University Press, Cambridge.
- Borzhonov, B.B. 1975. *Migration of Taimyr geese derived from ringing results*. Materials for the All Union Conference on Bird Migration, Moscow, 2-5 June 1975. [In Russian.]
- Boyd, H. 1953a. Notes on field counts of age-group ratios and brood-size. *Wildfowl* 5: 14-19.
- Boyd, H. 1953b. On encounters between wild white-fronted geese in winter flocks. *Behaviour* 5: 85-129.
- Brown, L.H., Urban, E.K. & Newman, K. 1982. *The Birds of Africa*, Volume 1. Academic Press, London.
- Cohen, E. 1963. *Birds of Hampshire and the Isle of Wight*. Oliver & Boyd, London.
- Cox, S. 1984. *A New Guide to the Birds of Essex*. Essex Bird Watching and Preservation Society, Ipswich.
- Cramp, S. & Simmons, K.E.L. 1977. *Handbook of the birds of Europe, the Middle East, and North Africa: the birds of the Western Palearctic*, Vol. 1. *Ostrich-Ducks*. Oxford University Press, Oxford.
- Cranswick, P.A., Kirby, J.S., Salmon, D.G., Atkinson-Willes, G.L., Pollitt, M.S. & Owen, M. 1997. A history of wildfowl counts by WWT. *Wildfowl* 47: 217-230.
- Dalgety, C.T. & Scott, P. 1948. A new race of the White-fronted Goose. *Bulletin of the British Ornithologists' Club* 68: 109-121.
- Doude van Troostwijk, W.J. 1966. Invloed van de jacht op ganzenpopulaties. *Het Vogeljaar* 14: 203-207.
- Doude van Troostwijk, W.J. 1974. Ringing data on White-fronted Geese *Anser a. albifrons* in the Netherlands, 1953-1968. *Ardea* 62: 98-110.
- Ebbinge, B.S. 1991. The impact of hunting on mortality rates and spatial distribution of geese wintering in the Western Palearctic. *Ardea* 79: 197-210.
- Flint, V.Ye. & Krivenko, V.G. 1990. The present status and trends of waterfowl in the USSR. Pp. 23-26 in: *Managing Waterfowl Populations*, (ed. G.V.T. Matthews), IWRB Special Publication No. 12. International Waterfowl and Wetlands Research Bureau, Slimbridge, UK.
- Fox, A.D., Norriss, D.W., Stroud, D.A. & Wilson, H.J. 1994. *Greenland White-fronted Geese in Ireland and Britain 1982/83-1993/94*, Greenland White-fronted Goose Study Research Report No. 8.
- Gilbert, G., Gibbons, D.W., & Evans, J. 1998. *Bird Monitoring Methods*. RSPB, Sandy.
- Gilissen, N., Haanstra, L., Delany, S., Boere, G. & Hagemerijer, W. 2002. *Numbers and Distribution of Wintering waterbirds in the Western Palearctic and Southwest Asia in 1997, 1998 and 1999 – Results from the International Waterbird Census*, Wetlands International Global Series No. 11. Wetlands International, Wageningen, the Netherlands.
- Gillham, E.H. & Homes, R.C. 1950. *The Birds of the North Kent Marshes*. Collins, London.
- Glegg, W.E. 1929. *A History of the Birds of Essex*. Witherby, London.
- Gregory, R.D., Noble, D.G., Robinson, J.A., Stroud, D.A., Campbell, L.H., Rehfish, M.M., Cranswick, P.A., Wilkinson, N.I., Crick, H.Q.P. & Green, R.E. 2002a. *The state of the UK's birds 2001*. Royal Society for the Protection of Birds, British Trust for Ornithology, The Wildfowl & Wetlands Trust and Joint Nature Conservation Committee, Sandy.
- Gregory, R.D., Wilkinson, N.I., Noble, D.G., Robinson, J.A., Brown, A.F., Hughes, J., Procter, D., Gibbons, D.W. & Galbraith, C.A. 2002b. The population status of birds in the United Kingdom, Channel Islands and Isle of Man: an analysis of conservation concern 2002-2007. *British Birds* 95: 410-448.
- Harrison, J.G. 1972. *Wildfowl of the North Kent Marshes*, WAGBI Conservation Publication.

- Heath, M.F. & Evans, M.I. (eds.) 2000. *Important Bird Areas in Europe: Priority sites for conservation. I: Northern Europe*, BirdLife Conservation Series No. 8. Birdlife International, Cambridge, UK
- Hele, N.F. 1890. *Notes or jottings about Aldeburgh, Suffolk. 2nd edition*. S. & W.J. King, Ipswich.
- James, P. 1996. *Birds of Sussex*. Sussex Ornithological Society.
- Kalyakin, V.N. 1995. Notes on the distribution of goose species in coastal regions of the Barents Sea and in the North of West Siberia. *Bulletin of Geese Study Group of Eastern Europe and Northern Asia* 1: 150-157. [In Russian.]
- Kelsall & Munn 1905. *The Birds of Hampshire and the Isle of Wight*. Witherby, London.
- Kershaw, M. & Cranswick, P.A. 2003. Numbers of wintering waterbirds in Great Britain, 1994/1995 – 1998/1999: I. Wildfowl and selected waterbirds. *Biological Conservation* 111: 91-104.
- Kirby, J.S. 1995. Winter population estimates for selected waterfowl species in Britain. *Biological Conservation* 73: 189-198.
- Kokorev, Y.I. 1985. Number of gamebirds and their dynamics in the typical tundra habitat on Taimyr. *Scientific-technical Bulletin of the Siberian Division of the Academy of Agricultural Sciences, Novosibirsk* 23: 36-45. [In Russian.]
- Kostin, I.O. 1985. The biology of the Red-breasted Goose: problems of conservation. PhD thesis, USSR Institute for Nature Conservation.
- Kozulin, A.V., Nikiforov, M.E. & Pareiko, O.A. 1995. Goose migration in Belarus. *IWRB Goose Research Group Bulletin* 6: 20-23.
- Krivenko, V.G. 1996. Anatidae in the former USSR. In: *Proceedings of the Anatidae 2000 Conference, Strasbourg, France, 5-9 December 1994*, (eds. M. Birkanvan, J. van Vessem, P. Havet, J. Madsen, B. Trolliet & M. Moser). *Gibier Faune Sauvage, Game and Wildlife* 13: 303-317.
- Kuijken, E. 1969. Grazing of wild geese on grasslands at Damme, Belgium. *Wildfowl* 20: 47-54.
- Kuijken, E. 1975. Oecologie van overwinterende ganzen te Damme (W.VI.) in Westeuropes verband. PhD Thesis, Gent.
- Kuijken, E., Courtens, W., Teunissen, W., van Tieghem, S., Verscheure, C. & Meire, P. 2001. *Aantalsverloop en verspreidingsdynamiek van overwinterende ganzen in Vlaanderen*. Rapport VLINA-project 2000/03. (RUG & UIA m.m.v. IN), AMINAL (Min. Vlaamse Gemeenschap).
- Lack, P. 1986. *The Atlas of Wintering Birds in Britain and Ireland*. T. & A.D. Poyser, Calton.
- Lovegrove, R., Williams, G. & Williams, I. 1994. *Birds in Wales*. T. & A.D. Poyser, London.
- Mellersh, W.L. 1902. *A Treatise on the Birds of Gloucestershire*. John Bellows, Gloucester.
- Minyev, Y.N. 1995. White-fronted Goose *Anser albifrons* in the tundra of Nentskiy Autonomous District of Archangelskaya Region. *Bulletin of Geese Study Group of Eastern Europe and Northern Asia* 1: 121-128.
- Mitchell, C., Boyd, H., Owen, M. & Ogilvie, M.A. 1997. Fifty years of goose research and conservation by The Wildfowl & Wetlands Trust. *Wildfowl* 47: 230-239.
- Molochaev, A.V. & Kalyakin, V.N. 1990. Changes of goose numbers in the tundras of West Siberia. *Proceedings of the 10th All Union Ornithological Conference, Minsk, Part 2, Volume 2*: 87. [In Russian].
- Mooij, J.H. 1992. Behaviour and energy budget of wintering geese in the Lower Rhine area of North Rhine-Westphalia, Germany. *Wildfowl* 43: 121-138.
- Mooij, J.H. 1995a. Gänsezählungen in Deutschland 1988/89 bis 1992/93. *Die Vogelwelt* 116: 119-132.
- Mooij, J.H. 1995b. Bestandsentwicklung der Gänse in Deutschland und der westlichen Paläarktis sowie Bemerkungen zu Gänseschäden und Gänsejagd. *Berichte zum Vogelschutz* 33: 7-59.
- Mooij, J.H. 1996a. *Ecology of geese wintering at the Lower Rhine area (Germany)*. Biologische Station im Kreis Wesel, Wesel.
- Mooij, J.H. 1996b. Migration, winter distribution and population size of White-fronted Geese in the Western Palearctic. *Wetlands International Goose Specialist Group Bulletin* 8: 13-21.
- Mooij, J.H. 1997. The status of White-fronted Goose (*Anser a. albifrons*) in the Western Palearctic. *Die Vogelwarte* 39: 61-81.

- Mooij, J.H. 1999. Gänse, Gänsejagd und Gänsemanagement in Deutschland. *Berichte zum Vogelschutz* 37: 51-67.
- Mooij, J.H. 2000a. Population dynamics and migration of White-fronted Geese (*Anser albifrons*) in Eurasia. In: *Heritage of the Russian Arctic: Research, Conservation and International Co-operation*, (eds. B.S. Ebbinge, Yu.L. Mazourov & P.S. Tomkovich). Ecopros, Moscow.
- Mooij, J.H. 2000b. Gänse und Landwirtschaft – Entwicklung der Bestandszahlen und Schadensprobleme im Norden Deutschlands. *Beitr. Jagd & Wildforschung* 25: 293-315.
- Mooij, J.H. & Kostin, I.O. 1997. Bestände der Saat- und Bläßgans in Deutschland und der westlichen Paläarktis. *Beiträge zur Jagd- und Wildforschung* 22: 23-41.
- Mooij, J.H. & Zöckler, C. 2000. Reflections on the systematics, distribution and status of *Anser albifrons*. *Casarca* 6: 91-107.
- Mooij, J.H., Ebbinge, B.S., Kostin, I.O., Burgers, J. & Spaans, B. 1996. Panmixia in White-fronted Geese (*Anser a. albifrons*) of the Western Palearctic. In: *Ecology of geese wintering in the Lower Rhine area (Germany)*, (ed. J.H. Mooij). Biologische Station im Kreis Wesel, Wesel.
- Mooij, J.H., Faragó, J. & Kirby, J.S. 1999. White-fronted Goose *Anser albifrons albifrons*. In: *Goose Populations of the Western Palearctic*, (eds. J. Madsen, G. Cracknell & A.D. Fox.), Wetlands International Publication No. 48. Wetlands International, Wageningen, the Netherlands/National Environmental Research Institute, Rønde, Denmark; pp. 94-128.
- Mooij, J.H., Kostin, I.O., & Bräsecke, R. 1995. Deutsch-russische Gänseforschung auf der Halbinsel Taimyr – erste Ergebnisse. *Beiträge zur Jagd- und Wildforschung* 20: 275-301.
- Musgrove, A.J., Pollitt, M.S., Hall, C., Hearn, R.D., Holloway, S.J., Marshall, P.E., Robinson, J.A. & Cranswick, P.A. 2001. *The Wetland Bird Survey 1999–2000: Wildfowl & Wader Counts*. BTO/WWT/RSPB/JNCC, Slimbridge.
- Nelson, T.H. 1907. *The Birds of Yorkshire*. A. Brown & Sons, Hull.
- Ogilvie, M.A. 1966. White-fronted Geese at the New Grounds, 1946–47 to 1963–64. *Wildfowl* 17: 27-32.
- Ogilvie, M.A. 1968. The numbers and distribution of the European White-fronted Goose in Britain. *Bird Study* 15: 2-15.
- Oliver, P.J. 1972. White-fronted Geese in North Kent. *Kent Bird Report* 1971.
- Owen, M. 1972a. Movements and ecology of White-fronted Geese at the New Grounds, Slimbridge. *Journal of Applied Ecology* 9: 385-398.
- Owen, M. 1972b. Some factors affecting food intake and selection in White-fronted Geese. *Journal of Animal Ecology* 41: 79-92.
- Owen, M. 1973. The management of grassland areas for wintering geese. *Wildfowl* 24: 123-130.
- Owen, M. 1976. The selection of winter food by White-fronted Geese. *Journal of Applied Ecology* 13: 715-729.
- Owen, M., Atkinson-Willes, G.L. & Salmon, D.G. 1986. *Wildfowl in Great Britain*, 2nd edn. Cambridge University Press, Cambridge.
- Payn, W.H. 1978. *The Birds of Suffolk*. Ancient House, Ipswich.
- Piotrowski, S. 2003. *The Birds of Suffolk*. Christopher Helm, London.
- Pollitt, M.S., Hall, C., Holloway, S.J., Hearn, R.D., Marshall, P.E., Musgrove, A.J., Robinson, J.A. & Cranswick, P.A. 2003. *The Wetland Bird Survey 2000–01: Wildfowl & Wader Counts*. BTO/WWT/RSPB/JNCC, Slimbridge.
- Prendergast, E.D.V. & Boys, J.V. 1983. *The Birds of Dorset*. David & Charles, Newton Abbot.
- Ramsar. 1999. *Strategic Framework for the List of Wetlands of International Importance*. Ramsar Bureau, Gland, Switzerland.
- Remmert, H. 1980. *Arctic Animal Ecology*. Springer, Berlin/Heidelberg/New York.
- Rogacheva, H. 1992. *The Birds of Central Siberia*. Husum, Husum.
- Rogacheva, H. 1996. Research and Conservation of Migratory Birds in Russia. In: *Waterbirds of the Baltic Region*, (ed. H. Kalchreuter). Hoffmann, Mainz; pp. 96-102.

- Rose, P.M. & Scott, D.A. 1997. *Waterfowl Population Estimates*, 2nd edn., Wetlands International Publication No. 44. Wetlands International, Wageningen, the Netherlands.
- Rutschke, E. 1987. *Die Wildgänse Europas*. Aula, Wiesbaden.
- Ryabitsev, V.K. 1995. Short review of geese at Yamal Peninsula. *Bulletin of the Geese Study Group of Eastern Europe and Northern Asia* 1: 164-166.
- Schröder, H. 1975. Zur Ernährungsweise von Wildgänsen auf landwirtschaftlichen Nutzflächen in Müritzgebiet. *Der Falke* 22: 6-15 & 60-63.
- Scott, D.A. & Rose P.M. 1996. *Atlas of Anatidae Populations in Africa and Western Eurasia*. Wageningen, The Netherlands, Wetlands International Publication No. 44.
- Snow, D.W. & Perrins, C.M. 1998. *The Birds of the Western Palearctic Concise Edition*. Oxford University Press, Oxford.
- Somerset Ornithological Society. 1988. *Birds of Somerset*. Alan Sutton, Gloucester.
- Stroud, D.A., Chambers, D., Cook, S., Buxton, N., Fraser, B., Clement, P., Lewis, I., McLean, I., Baker, H. & Whitehead, S. (eds.) 2001. *The UK SPA network: its scope and content*. JNCC, Peterborough; 3 volumes.
- Stroud, D., Fox, A.D. & Walsh, A. 2002. White-fronted Goose. Pp.161-165 in: *The Migration Atlas: Movements of the Birds of Britain and Ireland*, (eds. C.V. Wernham, M.P. Toms, J.H. Marchant, J.A. Clark, G.M. Siriwardena & S.R. Baillie). T. & A.D. Poyser, London.
- Summers, R.W. & Underhill, L.G. 1987. Factors related to breeding production of Brent Geese *Branta b. bernicla* and waders (Charadrii) on the Taimyr Peninsula. *Bird Study* 34: 161-171.
- Swaine, C.M. 1982. *Birds of Gloucestershire*. Alan Sutton, Gloucester.
- Taylor, M., Seago, M., Allard, P. & Dorling, D. 2000. *The Birds of Norfolk*. Pica Press, Sussex.
- Tomkovich, P.S., Soloviev, M.Yu. & Stroeckovsky, E.E. Jr. 1994. Birds of the arctic tundra of northern Taimyr (Knipovich Bay area). Pp. 44-110 in: *Arctic tundras of Taimyr and Kara Sea islands*, Vol. 1. Institute for Ecology and Evolution of the Russian Academy of Science, Moscow.
- Tucker, G.M. & Heath, M.F. 1994. *Birds in Europe: their Conservation Status*, BirdLife Conservation Series No.3. BirdLife International, Cambridge, UK
- Voous, K.H. 1960. *Atlas van de Europese vogels*. Elsevier, Amsterdam/Brussels.
- Walter, H. & Breckle, S.-W. 1986. Ökologie der Erde: Geo-Biosphäre. Bd. 3. *Spezielle Ökologie der Gemäßigten und Arktischen Zonen Euro-Nordasiens*. Fischer, Stuttgart.
- Wetlands International. 2002. *Waterbird Population Estimates – Third Edition*. Wetlands International Global Series No. 12, Wageningen, the Netherlands.
- Williams, G.A. 1977. The status and distribution of wildfowl in the Dee Estuary. *Nature in Wales* 15: 166-179.