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**Indexing winter gull populations in
England, Wales, Scotland and
Northern Ireland: an analysis of data
from the 1953 to 2004 Winter Gull
Roost Surveys**

Authors

**N.H.K. Burton, A.N. Banks, J.R. Calladine, G.E. Austin,
M.J.S. Armitage, & S.J. Holloway**

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British Trust for Ornithology, The Nunnery, Thetford, Norfolk IP24 2PU
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EXECUTIVE SUMMARY

1. Since a first survey of gulls using inland roosts in England in January 1953, gulls have been counted at winter roost sites in England, and later in the rest of the UK, every 10 years. The latest survey covers the winters of 2003/04 to 2005/06 and aims to provide population estimates for the five main species that winter in the country: Black-headed Gull *Larus ridibundus*, Common Gull *L. canus*, Lesser Black-backed Gull *L. fuscus*, Herring Gull *L. argentatus* and Great Black-backed Gull *L. marinus*.
2. In this report, we compare results obtained from roost sites surveyed in January 2004 with data from the same sites from earlier surveys in order to evaluate how wintering populations of these species have changed over the last five decades.
3. As previous surveys did not provide complete population estimates (for the whole of the UK or for individual countries) it is difficult to assess the change in gull populations by simply comparing the summed totals from these surveys. Instead, we used generalized linear models, relating numbers of gulls counted to site and year factors, to create indices of the numbers of gulls of each species in each country.

Limitations of the models caused by the accuracy of the counts themselves, difficulties in species identification, differences between inland and coastal sites and the lack of 'nil' counts in early datasets are considered.

Models for England considered data from 1953 to 2004; those for Wales, data from 1973; and those for Scotland and Northern Ireland, data from 1983. The models for Northern Ireland were perhaps less representative as only a small number of sites had been surveyed in more than one year.

4. Indices for Black-headed Gull (the most numerous species of gull wintering in the UK) showed that the numbers of this species wintering in England rose by over 200% between 1953 and 1983, but that they have declined by 27% since 1993. Recent declines were also recorded in Wales and Scotland. No trend was apparent for Northern Ireland.
5. Common Gulls have risen by over 300% in number in England in winter since the first survey in 1953, though were similar in 1993 and 2004. In Wales, numbers peaked in 1993 and showed a sharp decline between 1993 and 2004. There were no significant differences between years in Scotland. In Northern Ireland, the species' index showed a marked decline between 1983 and 1993, but a subsequent increase.
6. The Lesser Black-backed Gull was formerly an uncommon wintering species in the UK, but has increased hugely in numbers over the last 50 years (by an estimated 30,000% in England). The indices show a continued increase in England and Scotland, but a decline in Wales since 1993. No Lesser Black-backed Gulls were reported in Northern Ireland by the surveys prior to 2004.
7. Wintering numbers of Herring Gull rose in England between 1953 and 1973, but fell by 45% over the following decade. Numbers have shown negligible change since then. In Wales, indices show a continued decline since 1973, while in Scotland numbers declined after 1993 following a slight increase over the previous decade. There were insufficient data to ascertain a representative trend for Northern Ireland.
8. Wintering numbers of Great Black-backed Gull also rose (by over 300%) in England between 1953 and 1993, but declined by 39% between 1993 and 2004. There were no significant differences in numbers between years in Wales, Scotland or Northern Ireland.

9. The changes seen in wintering gull populations in the UK to a great extent reflect those recently recorded by the Seabird 2000 survey of breeding seabird populations in Britain and Ireland (Mitchell *et al.* 2004). They also reflect changes in the sizes of the other populations of gulls that winter in the UK and changes in species' wintering distributions.

The increases in gull populations seen through much of the 20th century are thought to be primarily the result of a reduction in human persecution (e.g. from hunters and egg-collection) and an increase in food availability from fishery waste, refuse tips, sewage outfalls and some forms of agriculture (notably outdoor pig farms).

Increases in wintering numbers over this period may also reflect the increased availability of inland roost sites (in the form of gravel pits and water reservoirs) which will have aided the inland spread of species. The large increase in Lesser Black-backed Gull numbers reflects a northward shift in this species' wintering distribution over the last century.

Recent population declines have been attributed to reductions in fish catches and thus in the amount of discarded waste, decreased use and improved management of refuse tips and improved sewage treatment. Inland wintering Black-headed Gulls might also have been affected by agricultural intensification. The declines in Herring Gull populations since the 1970s are thought to have been in large part due to outbreaks of botulism.

10. Previous population estimates will be updated, taking into account areas away from the key gull roosts, following the completion of the current survey in 2005/06. By calculating more complete estimates (with confidence limits) of the total numbers of these species wintering in each country, this survey will provide a benchmark against which future changes in gull populations in both Great Britain and Northern Ireland can be better assessed.

1. INTRODUCTION

Since a first survey of gulls using inland roosts in England in January 1953, gulls have been counted at winter roost sites in England, and later in the rest of the UK, every 10 years (Hickling 1954, 1967, 1977, Bowes *et al.* 1984, Burton *et al.* 2003). The latest survey covers the winters of 2003/04 to 2005/06 and aims to provide population estimates for the five main species that winter in the country: Black-headed Gull *Larus ridibundus*, Common Gull *L. canus*, Lesser Black-backed Gull *L. fuscus*, Herring Gull *L. argentatus* and Great Black-backed Gull *L. marinus*. Key roost sites were surveyed in January 2004 and over the subsequent two winters, other inland and coastal areas of the UK, Channel Islands and Isle of Man will be sampled in order to obtain more complete estimates (with confidence limits) of the total numbers of these species wintering across Great Britain and Northern Ireland. From these population estimates, new threshold levels will be calculated so that sites of national importance for wintering gulls can be identified.

This report evaluates how populations of wintering Black-headed, Common, Lesser Black-backed, Herring and Great Black-backed Gulls in the UK have changed over the last five decades. As previous surveys did not provide complete population estimates (for the whole of the UK or for individual countries) it is difficult to assess the change in gull populations by simply comparing the summed totals from these surveys. Instead, we compare results obtained from individual sites in January 2004 and in earlier surveys in order to produce indices of the numbers of each species wintering in each country.

In spite of their limitations, it is clear from the earlier surveys that there was a substantial increase in the numbers of wintering gulls between the 1950s and 1970s (at least at inland sites in England). Subsequent to this, the minimum population estimates obtained by these surveys suggest that the rate of increase in most species' populations slowed and that the population of Herring Gulls has declined (Burton *et al.* 2003). Although the observed increases may have been in small part due to an increase in coverage over the surveys, the results are corroborated by the considerable evidence that breeding populations of gulls rose over the same period (Harris 1970, Chabrzyk & Coulson 1976, Monaghan & Coulson 1977, Lloyd *et al.* 1991, Mitchell *et al.* 2004). The relationships between changes in breeding and wintering gull populations in the UK and the causes of observed changes in gull populations are considered at greater length in the discussion to this report.

2. METHODS

2.1 Coverage and Field Methods

The Winter Gull Roost Surveys have varied in their coverage. The January 1953 survey recorded inland (and some coastal) roosts in England and some parts of Scotland (Hickling 1954). The next survey, again primarily of inland sites in England, was planned for December 1962 and January 1963, but owing to the exceptionally severe weather that winter, the majority of counts were undertaken in December 1963 (Hickling 1967). The survey undertaken in January 1973 also included inland roosts in Wales (Hickling 1977). The survey in January 1983 was the first to cover the whole of Great Britain (and also the Channel Islands, though not the Isle of Man) and additionally the first to cover key coastal roost sites; furthermore this survey obtained limited coverage in Northern Ireland. The surveys in January 1993 and January 2004 covered coastal and inland sites in Great Britain and Northern Ireland and included counts from the Isle of Man and the Channel Islands (Burton *et al.* 2003).

The 'key sites' identified for the January 2004 survey were chosen on the basis that the previous Winter Gull Roost Surveys (between 1953 and 1993) or local bird reports had shown that they had held significant numbers of roosting gulls (over 1,000 birds). In total, data were received for 387 (80%) of 482 identified sites. In addition, supplementary data were received for some smaller roosts that had been previously surveyed, and thus were also suitable for use in these analyses.

The survey in 2004 followed the same field methodology used by those in 1953, 1963, 1973, 1983 and 1993 (Hickling 1954, 1967, 1977, Bowes *et al.* 1984, Burton *et al.* 2003). Observers were asked to count or estimate the numbers of gulls at roosts at dusk during the month of January, preferably on the 17th or 18th of that month. Forms included a map of the site to be surveyed and suggested methods of counting gulls. Counts of birds flying into roosts typically give more accurate estimates than counts of the numbers of birds already settled at a site, particularly if birds roost on choppy water. At larger roosts, several observers were stationed around the site to cover birds arriving on different flight-lines simultaneously. Counts at individual sites may have underestimated overall numbers if many birds arrived after dark. However, a pilot study (Austin *et al.* 2003) and previous observations by Shedden (1983) suggest that at many sites, there are only limited movements to and from roosts after dusk.

At some roosts, identification of individual species was not possible throughout the period of observation. In these cases, observers instead provided information on the numbers of unidentified 'small' gulls (Black-headed and Common Gulls) and unidentified 'large' gulls (Lesser Black-backed, Herring and Great Black-backed Gulls) counted. If it was not possible to identify birds to species or place them into one of these size classes, birds were classified as 'unidentified'. It is assumed that the numbers of other species that may have been present in these groupings were negligible.

2.2 Data Analysis and Data Limitations

Changes in wintering gull numbers between surveys were assessed by comparison of the numbers recorded roosting at individual sites. Data for the 1953, 1963 and 1973 surveys were taken from Hickling (1954, 1967 & 1977) and it should be noted that these papers give only limited information concerning those sites which were surveyed but which held no gulls. For the 1983 and 1993 surveys, the original datasets were available, though even in these surveys data were apparently often not received for sites with 'nil' counts.

For inland areas, it was usually possible to match sites covered in different surveys by name alone, though information on the central grid references of sites provided in the 1973, 1983 and 1993 datasets was also used. These central grid references were of limited use in matching up coastal sites, however, and it was often not possible to determine whether the extent of named sites was the same in different surveys. In a number of cases it was clear that coastal sites counted in the 1983 and 1993 surveys did not match at all, but rather overlapped each other. Thus it was only possible to use data

from a relatively small proportion of coastal sites in the analyses. Mapping of both inland and coastal sites in the current survey should reduce this problem in the future.

A number of sites were counted in sections in one survey but as a single consolidation in another. For these sites, it was thus necessary to consolidate data to the same 'parent' level for all years. This was the case for a number of estuarine sites, such as the Dee and Mersey estuaries and Chichester Harbour, where individual count sections were not comparable between surveys.

For each species and country (England, Wales, Scotland and Northern Ireland), generalized linear models (GLMs) (McCullagh & Nelder 1989; SAS Institute Inc. 2001) were used to relate the number of birds counted (or estimated – see below) to the individual roost site and year, both factors being treated as class variables. Models assumed a Poisson distribution and specified a log link function. The problem of overdispersion caused by a combination of a large number of zero counts with several very high counts, typical of flocking species, was addressed by the application of a scale factor estimated from the square root of the Pearson's Chi-squared statistic divided by its degrees of freedom. The estimated values of the model parameters for the year factor indicate how the numbers of birds varied each winter relative to January 2004. The year estimates from the final models have been converted to indices (setting the value for 2004 to equal 1) and plotted in a series of graphs, for each species, to indicate trends in their numbers.

With a few exceptions, coastal sites were only monitored from 1983. It is assumed, though, that there were no significant differences in the trends on the coast and inland within each country – this assumption is discussed in more detail later. Models for England considered data from 1953 to 2004; those for Wales data from 1973 and those for Scotland and Northern Ireland data from 1983. Due to limited coverage and problems matching sites between surveys, it was not possible to analyse changes in winter gull populations in the Isle of Man or Channel Islands. No overall model was considered for Great Britain or the UK, due to the variable coverage between countries and as Great Britain and the UK as a whole have only been covered in the last three surveys. The population estimates resulting from the current survey will provide a better benchmark against which future change at the Great Britain or UK level can be quantified.

Aside from possible problems with over-dispersion of data, models were also limited by the accuracy of the counts themselves (though error was reduced through the guidelines provided to counters). In the majority of cases, the numbers of birds using roosts had to be estimated by observers rather than counted. Further error was introduced when converting counts of small, large or unidentified gulls into estimates of the numbers of individual species to add onto actual counts. Models were also limited by the lack of data in early surveys from sites which were surveyed but which held no gulls (see below). It should be noted, therefore, that although the results of the models do provide a good description of change between the surveys, confidence in the year estimates produced by the models is likely to be overestimated.

To convert counts of small, large or unidentified gulls into estimates of numbers of individual species, the numbers of each species counted were first summed by region and habitat (coastal or inland). Regional definitions followed Bowes *et al.* (1984) and Burton *et al.* (2003).

Estimates of the numbers of Black-headed and Common Gulls that made up counts of unidentified small gulls at individual sites were then calculated using the following formula:

$$\text{estimate of species } x = \text{count of small gulls} \times p_{\text{species } x}$$

where $p_{\text{species } x} = \frac{\text{the number of species } x \text{ counted in the region and habitat}}{\text{the total number of Black-headed Gull and Common Gulls counted in the region and habitat}}$

A similar approach was used to estimate the numbers of Lesser Black-backed, Herring and Great Black-backed Gulls that made up counts of large gulls and of each species among the unidentified

gulls. Counts from earlier surveys were also reanalysed using similar methodologies to estimate counts of gull species from counts of unidentified species where necessary.

The subsequent GLMs did not account for any error in the estimation of species numbers from unidentified birds. It should be noted, though, that in many cases, the actual counts provided by observers are likely to have also been estimates based on counts of unidentified species and recorded proportions of individual species in the roost or on a flight-line.

Initial models were limited by the lack of data from sites which were surveyed but which held no gulls. Only in the 2004 survey were nil counts always submitted. However, it is clear from the reports of the earlier surveys that few occupied roost sites were likely to have been missed. The report for the 1953 survey, for example, states that there was no inland roosting in Suffolk and that no roosting had ever been recorded in Derbyshire (Hickling 1957). The final models that were generated assumed, therefore, that inland sites held no gulls until they were first monitored by the surveys.

It is also assumed in the analyses that the changes in gull numbers on the sites monitored by the surveys were representative of changes at other sites in each country. The numbers of roost sites for which more than one year's data were available for analysis (and thus which contributed to the year effect in the models) are shown in Table 2.1. As this table shows, the models for Northern Ireland were based on counts from only a small number of sites and thus the trends for this country are likely to have wide confidence limits and also perhaps be unrepresentative.

3. RESULTS

Indices of the numbers of Black-headed, Common, Lesser Black-backed, Herring and Great Black-backed Gulls wintering in England, Wales, Scotland and Northern Ireland are shown respectively in Figures 3.1-3.5 for the years that these countries were surveyed. In each figure indices (from the final models) are shown with 95% confidence limits, together with a line showing the results of preliminary models in which numbers at inland sites were not assumed to equal zero until the site was first visited. Due to the paucity of nil counts in the early data sets, the preliminary models typically overestimate numbers in the early surveys (i.e. 1953, 1963 and 1973). The indices produced for Wales, Scotland and Northern Ireland tend to have wider confidence limits than those produced for England, due to the smaller numbers of sites surveyed and the shorter runs of data. Instances where there were no significant differences in numbers between years are highlighted below.

To help put the indices in context, Appendix 1 shows the most recent (minimum) population estimates for each species in England, Wales, Scotland and Northern Ireland, which resulted from the 1993 survey (Burton *et al.* 2003). These population estimates will be updated, taking into account areas away from the key gull roosts, following the completion of the current survey in 2005/06.

The Black-headed Gull is the most numerous species of gull wintering in the UK, with a minimum population of 1,682,385 recorded in Great Britain in 1993 and a further 15,412 in Northern Ireland (Appendix 1). Indices for Black-headed Gulls wintering in England show that numbers of this species rose considerably between 1953 and 1983, but that there was a decline of 27% between 1993 and 2004 (Table 3.1; Figure 3.1a). A similar pattern was seen for Wales, where indices indicate that numbers rose from 1973 to 1983, but have since declined, falling by 63% between 1993 and 2004 (Table 3.1; Figure 3.1b). A decline of 63% was also recorded in Scotland between 1993 and 2004, following a slight increase over the previous decade (Table 3.1; Figure 3.1c). In Northern Ireland, there was no significant difference in numbers between years ($\chi^2_2 = 0.46$, ns), though there was also some evidence that there may have been a decline here between 1993 and 2004 (Table 3.1; Figure 3.1d).

Common Gull was the second most numerous species in the 1993 survey, with a minimum population of 429,331 in Great Britain and a further 1,596 in Northern Ireland (Appendix 1). Indices show that the numbers of this species wintering in England rose considerably between the first survey in 1953 and 1993 (Figure 3.2a). Numbers were similar in the 1993 and 2004 surveys (Table 3.1). In Wales, the species' index peaked in 1993 and, in contrast to England, there was a decline of 85% between 1993 and 2004 (Table 3.1; Figure 3.2b). There was no significant difference in Common Gull numbers between years in Scotland ($\chi^2_2 = 4.75$, ns), though the index plot suggests a possible recent decline (Table 3.1; Figure 3.2c). In Northern Ireland, the species' index shows a marked decline between 1983 and 1993, but a subsequent increase of 161% (Table 3.1; Figure 3.2d).

The Lesser Black-backed Gull was formerly an uncommon wintering species in the UK (Barnes 1952, 1961, Hickling 1954), but has increased hugely in numbers over the last 50 years. A minimum population of 60,830 was recorded in Great Britain in 1993, including 48,892 in England (Appendix 1), in comparison to only 153 individuals in England in the 1953 survey. The indices show that this increase has continued in England and Scotland, where numbers rose between 1993 and 2004 by 71% and 106% respectively (Table 3.1; Figures 3.3a and 3.3c). In Wales, however, indices indicate a decline of 76% since 1993 (Table 3.1; Figures 3.3b). No Lesser Black-backed Gulls were reported in Northern Ireland by the surveys prior to 2004, when 135 individuals were recorded on Lough Neagh.

A minimum population of 376,775 Herring Gulls was recorded in Great Britain in the 1993 survey, with a further 1,973 in Northern Ireland (Appendix 1). Indices indicate that, in common with other species, numbers of Herring Gull rose in England between 1953 and 1973, but that there was a large decline over the following decade (Figure 3.4a). Numbers have shown a negligible change since then, with only a 1% decline between 1993 and 2004 (Table 3.1). In Wales, indices show a continued decline in numbers since 1973, with a fall of 33% between 1993 and 2004 (Table 3.1; Figure 3.4b). In Scotland, there was a slight rise in Herring Gulls numbers between 1983 and 1993, but a 45% decline

between 1993 and 2004 (Table 3.1; Figure 3.4c). The presence of Herring Gulls at the sites in Northern Ireland that it was possible to include in the analysis varied greatly between years. Indices suggest a peak in 1993 and a subsequent decline (Table 3.1; Figure 3.4d). However, the species was only recorded at one site in 2004, six in 1993 and none in 1983 and thus the results are unlikely to be representative.

The Great Black-backed Gull is the least numerous of the five main gull species to winter in the UK. A minimum population of 43,108 was recorded in Great Britain in 1993 with just a further 48 in Northern Ireland (Appendix 1). Indices show that the numbers of this species in England rose between 1953 and 1993, but that there was a decline of 39% between 1993 and 2004 (Table 3.1; Figure 3.5a). There were no significant differences between years in the other three countries (Wales: $\chi^2_3 = 3.71$, ns; Scotland $\chi^2_2 = 3.94$, ns; Northern Ireland: $\chi^2_2 = 2.97$, ns). In Wales, though, there was some evidence from the indices that numbers rose between 1973 and 1983, before stabilising (Table 3.1; Figure 3.5b). In contrast, indices suggest that numbers may have declined in Scotland between 1983 and 2004 (Table 3.1; Figure 3.5c) and also in Northern Ireland between 1983 and 1993 (Table 3.1; Figure 3.5d).

An impression of how numbers of gulls have changed at individual roosts is given in Figure 3.6, where numbers are plotted for the inland roosts that held the highest numbers of each species in the UK in January 2004. For both Black-headed and Common Gull, the most important inland roost in 2004 was Chew Valley Lake in the new Bath & North East Somerset Unitary Authority (part of the old county of Avon). Since this reservoir was first opened in 1956, numbers have risen sharply. Totals of 29,800 Black-headed Gulls and 18,200 Common Gulls were recorded at Chew Valley Lake in January 2004. For Lesser Black-backed Gull, the most important inland site in 2004 was Queen Mary Reservoir in Surrey. Again, this species was absent from this site in the 1953 survey, but numbers have risen since and, though there was a relatively low count in 1993, an estimated 7,178 Lesser Black-backed Gulls roosted at the reservoir in January 2004. For Herring Gull, the most important inland site in 2004 was Roughrigg Reservoir in Strathclyde. This site was first included in the 1983 survey and, though the species was absent in 1993, an estimated 16,067 Herring Gulls roosted in January 2004. Lastly, for Great Black-backed Gull, the most important inland roost in January 2004 was Hoveringham in Nottinghamshire. This site was first included in the 1973 survey and no more than 100 Great Black-backed Gulls were recorded there until January 2004, when the species' total rose to 1,600.

4. DISCUSSION

4.1 Representativeness and Reliability of Indices

Although the previous surveys of winter gull roosts in the UK have underestimated the overall populations of wintering gulls (Burton *et al.* 2003), it has been possible to use the results from individual sites to index population change. The indices produced corroborate the findings of the earlier surveys and also much of what has previously been understood about recent changes in winter gull populations. For all five species considered, there have been clear increases in numbers since 1953. For Herring Gull, winter numbers in England peaked in the early 1970s and numbers in all parts of the UK have decreased since then. Numbers of Black-headed Gull and Great Black-backed Gull peaked in the 1980s and have likewise shown recent decreases in most parts of the UK. The most dramatic increases have been in the numbers of Common Gull and, in particular, Lesser Black-backed Gull, and in England, at least, numbers of the latter are continuing to rise.

The rates of increase in gull populations in England in the two to three decades following the first survey, notably for Black-headed, Herring and Great Black-backed Gulls, may have been overestimated due to the assumption that inland sites held no gulls until they were first included in the surveys. However, we do not believe this to be the case, not least because the early surveys aimed to cover all roosts known at the time. The first survey of inland roosts in 1953 was initiated due to the noted increase in inland roosting since the habit was first reported in the late 19th century (Hickling 1954, 1967). However, that survey reported that inland roosts were still rare or even absent in many counties (e.g. Suffolk and Derbyshire). The 1963 survey reported further increases, not just in the numbers of gulls at previously occupied roosts, but also in newly formed roosts. A total of 22 roosts were recorded in 1963 that had not been used in 1953 and in all but one case these were reported as newly occupied (Hickling 1957). Many reservoirs and gravel pits now used as roost sites did not exist at the time of the earlier surveys; in these cases it is obviously safe to assume that gulls would not have been present. Hilfield Park Reservoir in Hertfordshire, for example, was only completed in 1957 and Draycote Water in Warwickshire in 1969. In assessing the trends in species' indices, it should additionally be noted that the more complete recording of nil counts in the 2004 survey may have resulted in recent decreases being overestimated.

By assuming that inland sites held no gulls until they were first included in the surveys, the indices reflect the expansion in the distribution of wintering gulls as well as changes at already occupied sites. Previously reported changes in gull populations at individual reservoirs corroborate the changes apparent from the indices. Changes in gull numbers in the London area during the 1960s, for example, were reported by Sage (1970). His comparison of counts from December 1968 and January 1969 with those made in December 1963 as part of the national Winter Gull Roost Survey (Sage 1964) indicated that numbers of Black-headed Gull numbers had risen from 165,050 to 192,212 (*i.e.* by 16%) over this period, those of Common Gull from 20,050 to 31,104 (55%), those of Lesser Black-backed Gull from 2,340 to 6,520 (179%) and those of Herring Gull from 26,700 to 30,044 (13%), whilst Great Black-backed Gull numbers fell from 6,325 to 5,865 (a 7% decrease). Similar increases at individual sites were also recorded in the 1950s and 1960s by Homes (1955) and Meadows (1961). It is unclear, though, as to whether sites may have a carrying capacity for the numbers of roosting gulls that they can hold – the reduced rates of increases seen recently at individual sites may reflect changes affecting populations at a larger scale or limitation in local food resources.

Although the analyses assume that trends on coastal and inland sites have been similar, it is probable that there have been differences. Notably, due to the increased availability of inland roost sites (in the form of gravel pits and water reservoirs) during the middle of the 20th century, it is likely that the increases in wintering gull numbers seen at this time will have been greater inland than on the coast. As the analyses were biased towards inland sites, particularly prior to 1983, the indices may thus have overestimated the increases in numbers in countries as a whole at this time.

4.2 Causes of Population Change

The changes recorded by the indices reflect changes in the sizes of breeding populations both within Britain and Ireland and elsewhere in northern Europe as well as changes in species' wintering distributions (both between habitats and over a larger scale). They are particularly reflective of the changes recently recorded by the Seabird 2000 survey of breeding seabird populations in Britain and Ireland (Mitchell *et al.* 2004) (summarised in Appendix 2). In Britain and Ireland as a whole, the numbers of Black-headed Gulls breeding at coastal colonies increased between 1969-70 and 1998-2002. At inland sites, however, there was a 30% decrease between 1985-88 and 1998-2002. This decline is mirrored in the recent trend for the wintering population. The continued increase in the winter numbers of Lesser Black-backed Gulls reflects increases in breeding numbers in Britain and Ireland between 1969-70 and 1998-2002. A similar increase in wintering numbers of Lesser Black-backed Gull has also been recorded in Ireland over the last three decades (Creme *et al.* 1997). The numbers of coastally breeding Common Gulls also rose between 1969-70 and 1998-2002, though the overall trend for the species in Britain and Ireland is unclear due to uncertainties over changes at inland colonies. The decline in the winter population of Herring Gulls since 1973 is matched by a large decline in the British and Irish breeding population between 1969-70 and 1985-88. The breeding population of Great Black-backed Gulls in Britain and Ireland showed a shallow decline between 1969/70 and 1998-2002, though this is insufficient to fully explain the observed decrease in wintering numbers between 1993 and 2004.

Population Increases

The increases in breeding gull populations seen in the UK and western Europe through much of the 20th century have been attributed to a variety of factors. In part, they reflect increased protection after a long-history of human persecution and exploitation, e.g. from hunters and egg-collection. Over the same period, though, gulls have also shown a dynamic ability to take advantage of an increase in food availability from fishery waste, refuse tips, sewage outfalls and some forms of agriculture (notably outdoor pig farms) (Lloyd *et al.* 1991, Mitchell *et al.* 2004).

Black-headed Gulls have particularly benefited from the food associated with refuse tips (Horton *et al.* 1983). The increase in their wintering population through the 20th century is thought to be partly a result of a gradual increase in the numbers of continental Black-headed Gulls using Great Britain as a wintering area (Horton *et al.* 1984). MacKinnon & Coulson (1987) suggested that 71% of Black-headed Gulls wintering in England and Wales came from continental Europe (see also Christmas *et al.* 1986).

Likewise, although many British and Irish Common Gulls remain in the winter (Wernham *et al.* 2002), Great Britain and Ireland are also very important wintering areas for birds from elsewhere in Europe, notably Scandinavia, the Baltic and Russia. The increase in the wintering population recorded here, if it does not reflect changes in the British and Irish breeding population, may in part be a consequence of changes in these breeding areas.

The dramatic increase in the numbers of wintering Lesser Black-backed Gulls is thought to have been aided by the increased availability of food from refuse tips and waste from fisheries (Bergman 1982, Furness *et al.* 1992, Noordhuis & Spaans 1992, Camphuysen *et al.* 1995, Garthe *et al.* 1996). This has led to a reduced tendency of British and Irish birds to migrate from their breeding range (Baker 1980) and the species now winters much farther north than earlier in the twentieth century. It is also possible that this shift in distribution has been aided by the recent milder climate. Great Britain, in particular the Southwest, also supports *intermedius* and *graellsii* birds from Iceland, the Faeroes, Scandinavia and other west European breeding grounds in winter (Wernham *et al.* 2002). Much larger numbers of Lesser Black-backed Gulls occur in the UK during autumn and spring passage.

Most British and Irish Herring Gulls remain for the winter, though many nominate *argentatus* Herring Gulls from Scandinavia also winter in the east of Great Britain (Stanley *et al.* 1981, Coulson *et al.*

1984a, Wernham *et al.* 2002). The increase in their population through the middle of the last century is thought to have been particularly driven by the easy availability of food from refuse tips (Monaghan 1980, Greig *et al.* 1983, 1985, Horton *et al.* 1984) and sewage outfalls (Ferns & Mudge 2000), as well as increases in fishery waste (Mitchell *et al.* 2004). Previous studies have shown that Herring Gulls nesting in colonies close to refuse tips may have significantly better breeding success than those further away (Spaans 1971).

Great Black-backed Gulls from British and Irish colonies are mainly sedentary and thus predominate in the west in winter (Harris 1962); many east coast birds originate from Norway and Russia (Coulson *et al.* 1984b). Of the species considered here, the Great Black-backed Gull is the most maritime of species and the increase seen in their numbers through the 20th century is thus most likely to be associated with an increase in food availability from fishery waste (Furness *et al.* 1992, Camphuysen *et al.* 1995). However, over the period covered by the Winter Gull Roost Surveys, Great Black-backed Gulls have also become more widespread inland in winter, with particular concentrations in the East Midlands, for example at Hoveringham in Nottinghamshire and Brogborough and Stewartby in Bedfordshire (see also Burton *et al.* 2003). This is perhaps due to the use of refuse tips which the species readily exploits (Poole 1995).

Recent Population Declines

The decline in wintering Herring Gull numbers since the 1970s is thought to have been in large part due to outbreaks of botulism (Lloyd *et al.* 1991, Mitchell *et al.* 2004). The effects of botulism have been particularly severe at breeding colonies in Ireland (e.g. Buckley & O'Halloran 1986, Whilde *et al.* 1993, Merne & Madden 1999) and it is here and on the west coast of Great Britain that declines in breeding populations have been greatest. In many cases, outbreaks have been associated with the use of refuse tips (Mitchell *et al.* 2004). However, due to their dependency on the food from these sites, the decreased use of such tips and improved management at existing sites may also now be causing further declines, not just in Herring Gulls but also other species. This problem is likely to be exacerbated by a recent EC Directive (1999/31/EC) which aims to reduce the unnecessary use of landfills for waste and to better their management (Anon 1999).

Recent improvements to the treatment and discharge of sewage resulting from the EC Waste Water Treatment Directive (91/271/EEC and its Amending Directive 98/15/EEC: Anon 1991, 1998) and earlier initiatives have also reduced food supplies used by gulls. On the Tyne Estuary, declines of 93% and 91% in the numbers of Common Gulls and Great Black-backed Gulls respectively were recorded between 1969/70 and 1993/94 following improved treatment and an 86% decrease in the volume of untreated waste discharged into the river (Raven & Coulson 2001). In the former case at least, there was no evidence that numbers had changed elsewhere within the region. Numbers of Black-headed and Herring Gulls, the two species most linked with sewage outfalls (Fitzgerald & Coulson 1973), did not change significantly, however, whilst those of Lesser Black-backed Gull rose, probably due to increases in the sizes of breeding colonies nearby.

Declines in Herring Gull numbers, as well as those seen in the numbers of Lesser Black-backed Gulls in some regions (winter numbers declined in Wales between 1993 and 2004), have also been linked with a reduction in fish catches since the mid-1980s and thus in the amount of discarded waste (Hiom *et al.* 1991, Strann & Vader 1992). Whilst it is possible that this might also be a cause for the observed decline in Great Black-backed Gull numbers since 1993, Mitchell *et al.* (2004) suggest that this species is less likely to have been affected due to their competitive dominance. It is also unclear as to how changes affecting birds feeding offshore (whether in the breeding or non-breeding seasons) might have affected the numbers of birds at the inland and inshore sites monitored by the Winter Gull Roost Surveys.

Inland, intensification in agriculture over the last 30 years has resulted in a reduction of the food available for many bird species, the impacts being most clear for farmland passerines (Chamberlain *et al.* 2000). However, reductions in the availability of invertebrates, for example, through increased use

of pesticides and a reduction in tillage resulting from increased use of autumn-sown cereals, may have also affected the numbers of Black-headed Gulls using inland areas (Mitchell *et al.* 2004). It is possible, therefore, that this factor may have been partly responsible for the declines observed in winter numbers of this species in England, Wales and Scotland over the last 10-20 years.

Other factors may have impacted gull numbers at a more local scale. For example, although persecution of gulls is now much reduced, numbers may still be controlled at particular breeding colonies to reduce the perceived impacts of gulls on other nesting seabirds and gamebirds (Duncan 1978, Wanless *et al.* 1996, Finney *et al.* 2003) and on human health (Wanless & Langslow 1983). It is probable that such policies contributed to regional declines of in the breeding numbers of these species in the 1970s and 1980s (Coulson 1991, Lloyd *et al.* 1991), though the overall impact on the UK's breeding and wintering populations is likely to have been slight. Increased predation rates have also affected gulls at some breeding colonies. For example, American Mink *Mustela vison* impacted the breeding success of several species of gull in Argyll during the 1990s (Craik 1995, 1997) and may have affected gull colonies elsewhere. The effects on wider gull populations are unclear though.

It is unclear as to why wintering numbers of both Common and Lesser Black-backed Gulls have declined over the last 10 years in Wales, whilst numbers in England have been stable or continued to increase. The difference may reflect differing trends between the British (and Irish) breeding populations, which predominate in the west in winter, and other European breeding populations of these species which are more common in the east of the UK.

4.3 Future Assessment of Populations and Population Change

The 1993 Winter Gull Roost Survey reported minimum population estimates of 1,682,385 Black-headed Gulls *Larus ridibundus*, 429,331 Common Gulls *L. canus*, 60,830 Lesser Black-backed Gulls *L. fuscus*, 376,775 Herring Gulls *L. argentatus* and 43,108 Great Black-backed Gulls *L. marinus* in Great Britain, with a further 19,030 gulls counted in Northern Ireland, 3,853 in the Isle of Man and 8,477 in the Channel Islands (Burton *et al.* 2003). These estimates will be updated, taking into account areas away from the key gull roosts, following the completion of the current survey in 2005/06. By calculating more complete estimates (with confidence limits) of the total numbers of these species wintering in each country, this survey will provide a benchmark against which future changes in gull populations in both Great Britain and Northern Ireland can be better assessed.

Acknowledgements

Thanks are due to the hundreds of counters who took part in the survey in January 2004, as well as the regional representatives and other local organisers who helped to co-ordinate the survey. As noted in the report of the 1963 survey, winter gull counting may be difficult, arduous and often unpleasant! Mark Rehfisch helped to initiate the current survey and together with Andy Musgrove provided useful comments on the report. Steve Freeman provided advice on data analyses. Heidi Mellan helped with the administration of the survey and together with Emma Davis, Viv Hiom and Maria Knight helped with subsequent data inputting. Emma Davis helped to finalise the report.

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Tables

	England	Wales	Scotland	Northern Ireland
Black-headed Gull	392 (284)	72 (59)	87 (68)	7 (5)
Common Gull	330 (257)	55 (50)	86 (72)	6 (4)
Lesser Black-backed Gull	264 (209)	53 (48)	36 (30)	3 (3)
Herring Gull	333 (263)	78 (66)	91 (76)	6 (5)
Great Black-backed Gull	276 (230)	54 (50)	81 (70)	5 (5)

Table 2.1 Numbers of roost sites for which more than one year's data were available for analyses. Totals exclude sites where the species were never recorded. Figures in parentheses are for models where zeros were not assumed for inland sites prior to their first being monitored by the surveys (see methods for more details).

	England	Wales	Scotland	Northern Ireland
Black-headed Gull				
1953-1963	37			
1963-1973	124			
1973-1983	40	72		
1983-1993	3	-16	9	32
1993-2004	-27	-63	-63	-29
1953-2004	224	n/a	n/a	n/a
Common Gull				
1953-1963	154			
1963-1973	-3			
1973-1983	61	-15		
1983-1993	11	115	-16	-92
1993-2004	0	-85	-14	161
1953-2004	339	n/a	n/a	n/a
Lesser Black-backed Gull				
1953-1963	2952			
1963-1973	117			
1973-1983	238	442		
1983-1993	-22	462	206	
1993-2004	71	-76	106	¹
1953-2004	29898	n/a	n/a	n/a
Herring Gull				
1953-1963	81			
1963-1973	95			
1973-1983	-45	1		
1983-1993	17	-38	19	²
1993-2004	-1	-33	-45	-95
1953-2004	124	n/a	n/a	n/a
Great Black-backed Gull				
1953-1963	172			
1963-1973	82			
1973-1983	3	286		
1983-1993	72	-6	-25	-91
1993-2004	-39	-24	-15	5
1953-2004	434	n/a	n/a	n/a

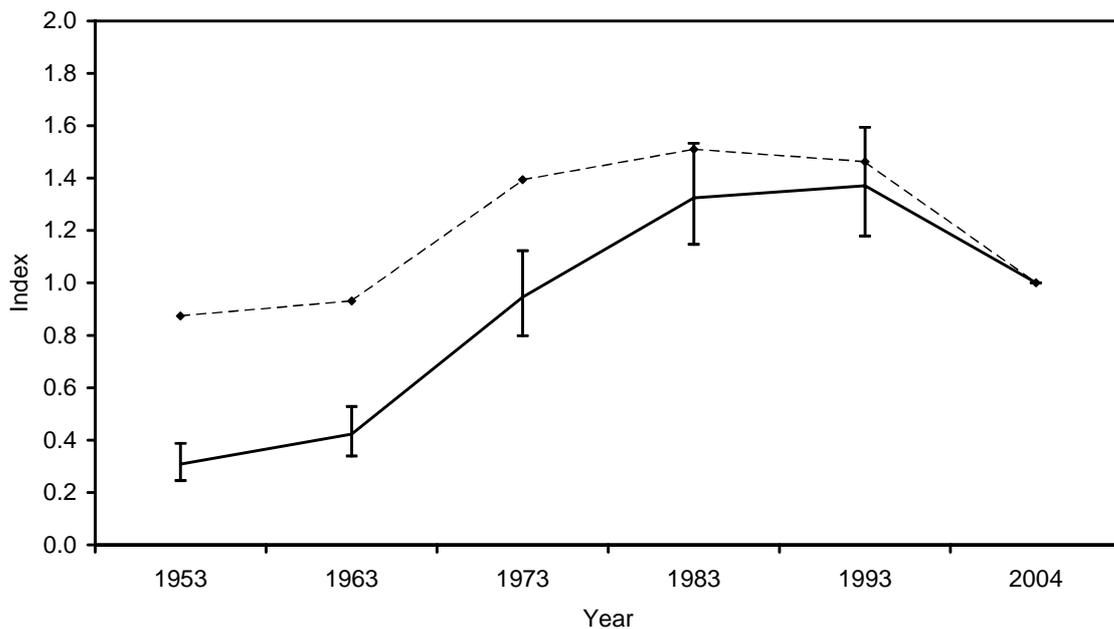
Table 3.1 Percentage change in gull numbers between successive Winter Gull Roost Surveys in the UK.

¹ No Lesser Black-backed Gulls were recorded in Northern Ireland prior to the 2004 survey.

² No Herring Gulls were recorded on the sites used in the analysis for Northern Ireland in the 1983 survey.

Figures

a



b

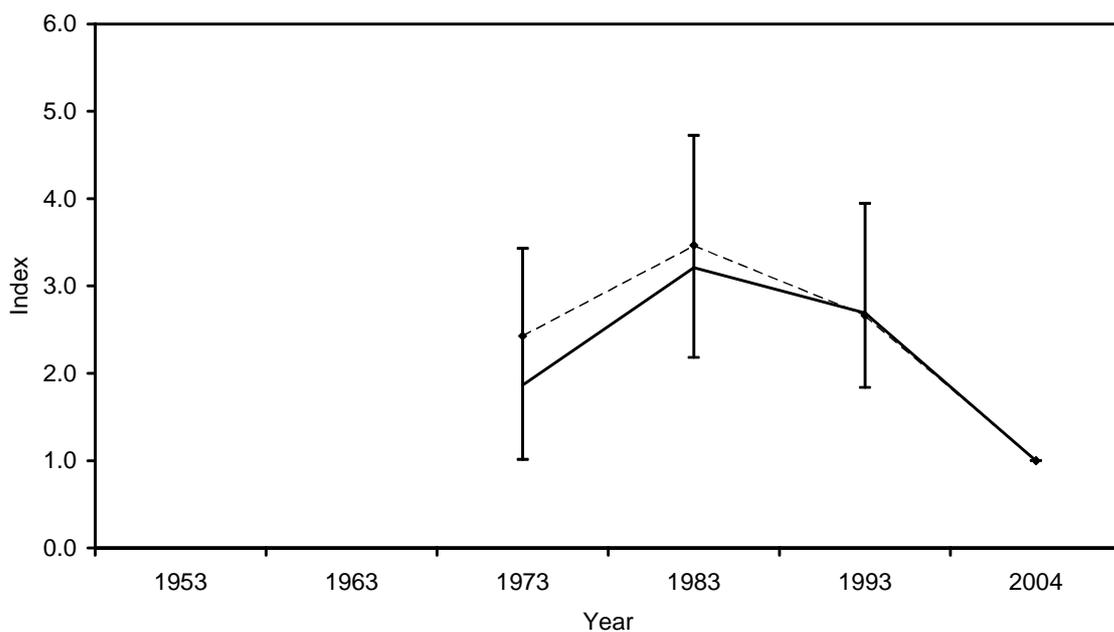


Figure 3.1 Trends in numbers of Black-headed Gulls wintering in **a.** England between 1953 and 2004 and **b.** Wales between 1973 and 2004 derived from models relating numbers to site and year. Index values are set to 1 in the most recent 2004 survey. Solid lines and 95% confidence limits indicate models in which numbers at inland sites were assumed to equal zero until the site was first visited. The dotted lines indicate the trends from preliminary models without this assumption (see methods).

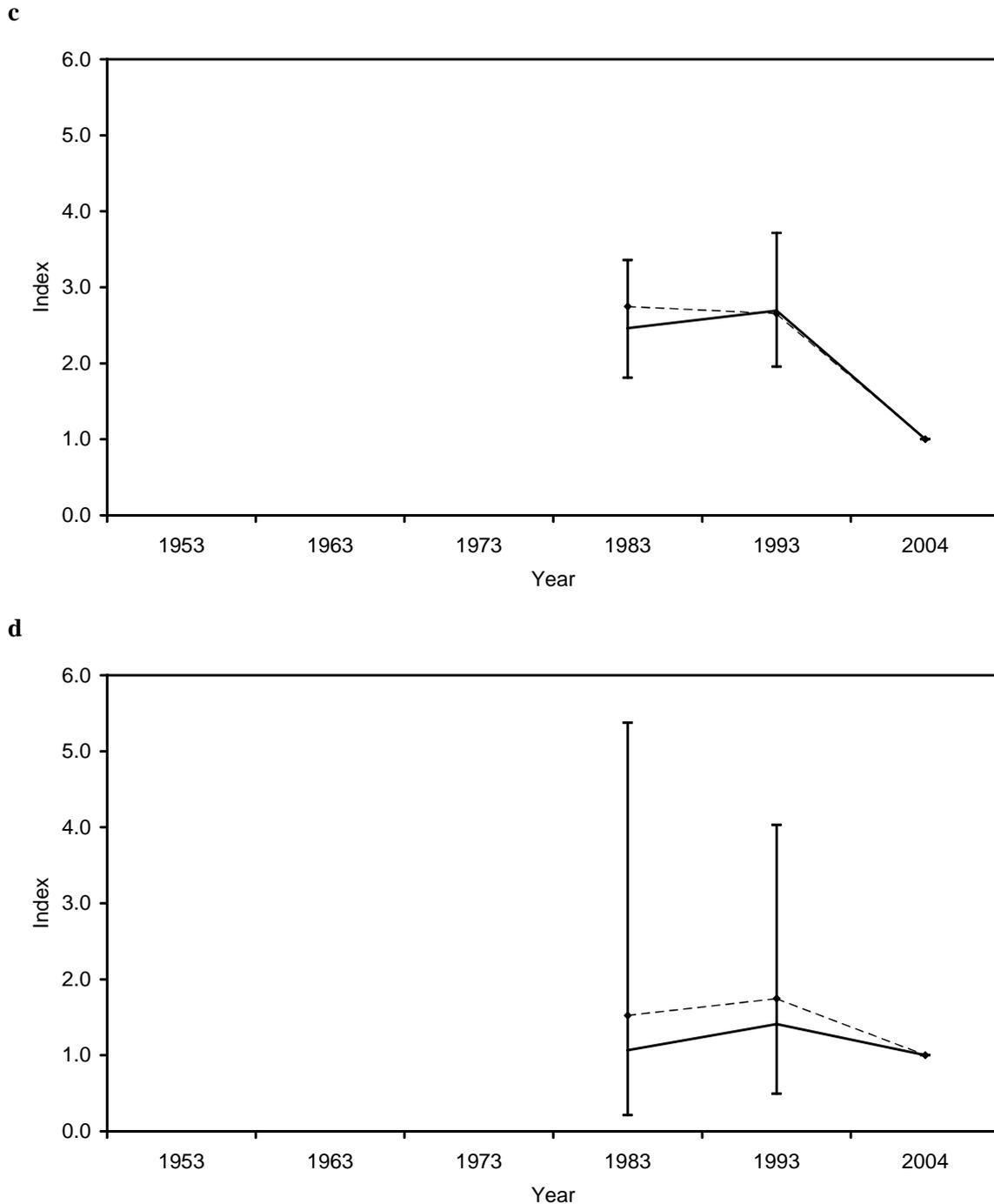
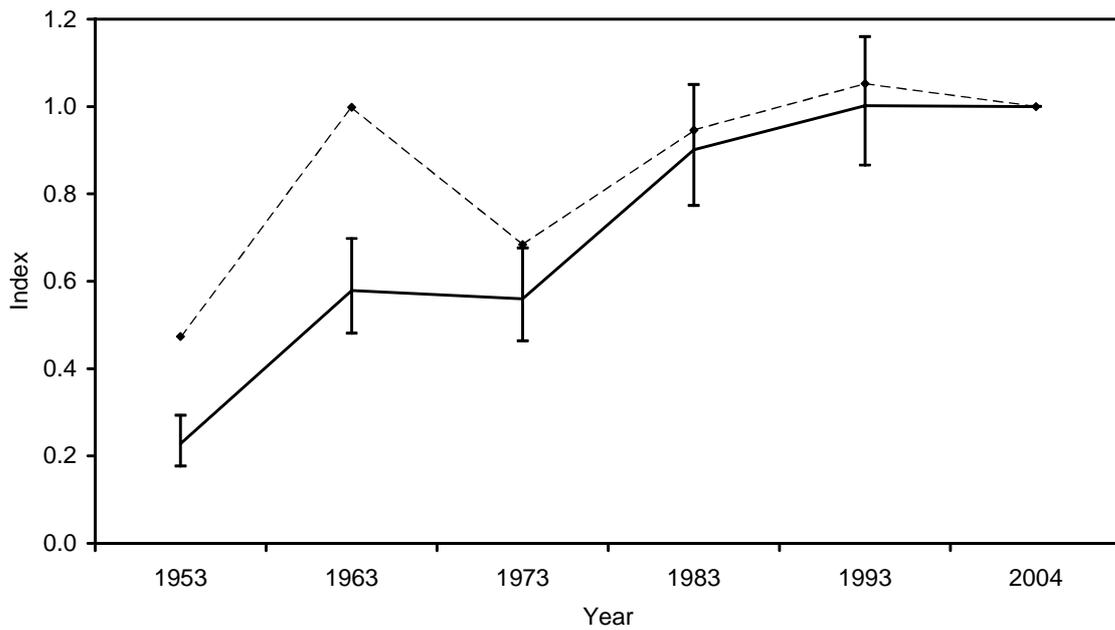


Figure 3.1 Trends in numbers of Black-headed Gulls wintering in **c.** Scotland between 1983 and 2004 and **d.** Northern Ireland between 1983 and 2004 derived from models relating numbers to site and year. Index values are set to 1 in the most recent 2004 survey. Solid lines and 95% confidence limits indicate models in which numbers at inland sites were assumed to equal zero until the site was first visited. The dotted lines indicate the trends from preliminary models without this assumption (see methods).

a



b

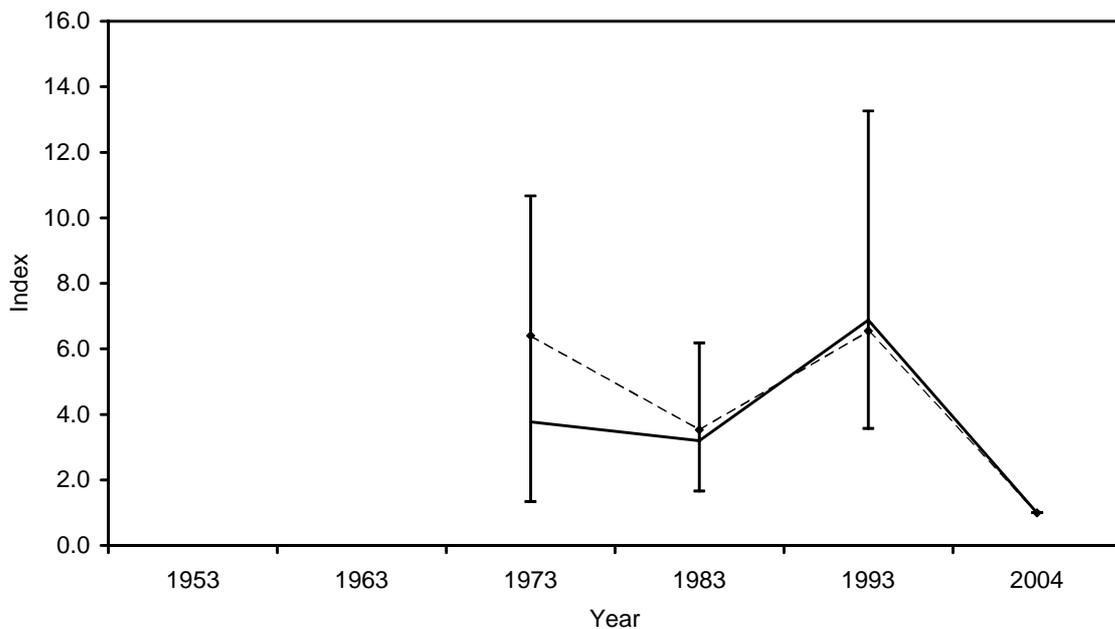


Figure 3.2

Trends in numbers of Common Gulls wintering in **a.** England between 1953 and 2004 and **b.** Wales between 1973 and 2004 derived from models relating numbers to site and year. Index values are set to 1 in the most recent 2004 survey. Solid lines and 95% confidence limits indicate models in which numbers at inland sites were assumed to equal zero until the site was first visited. The dotted lines indicate the trends from preliminary models without this assumption (see methods).

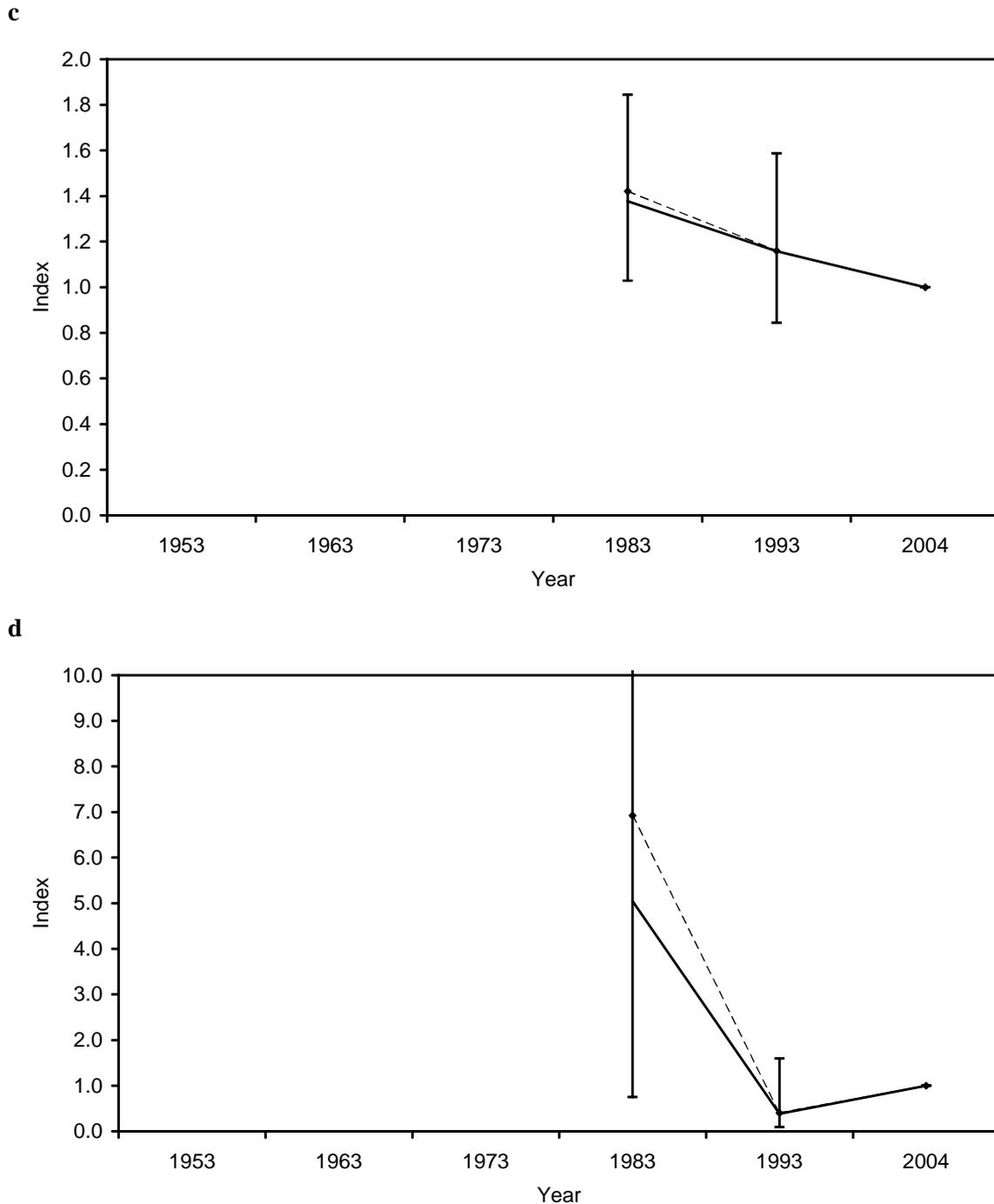


Figure 3.2 Trends in numbers of Common Gulls wintering in **c.** Scotland between 1983 and 2004 and **d.** Northern Ireland between 1983 and 2004 derived from models relating numbers to site and year. Index values are set to 1 in the most recent 2004 survey. Solid lines and 95% confidence limits indicate models in which numbers at inland sites were assumed to equal zero until the site was first visited. The dotted lines indicate the trends from preliminary models without this assumption (see methods).

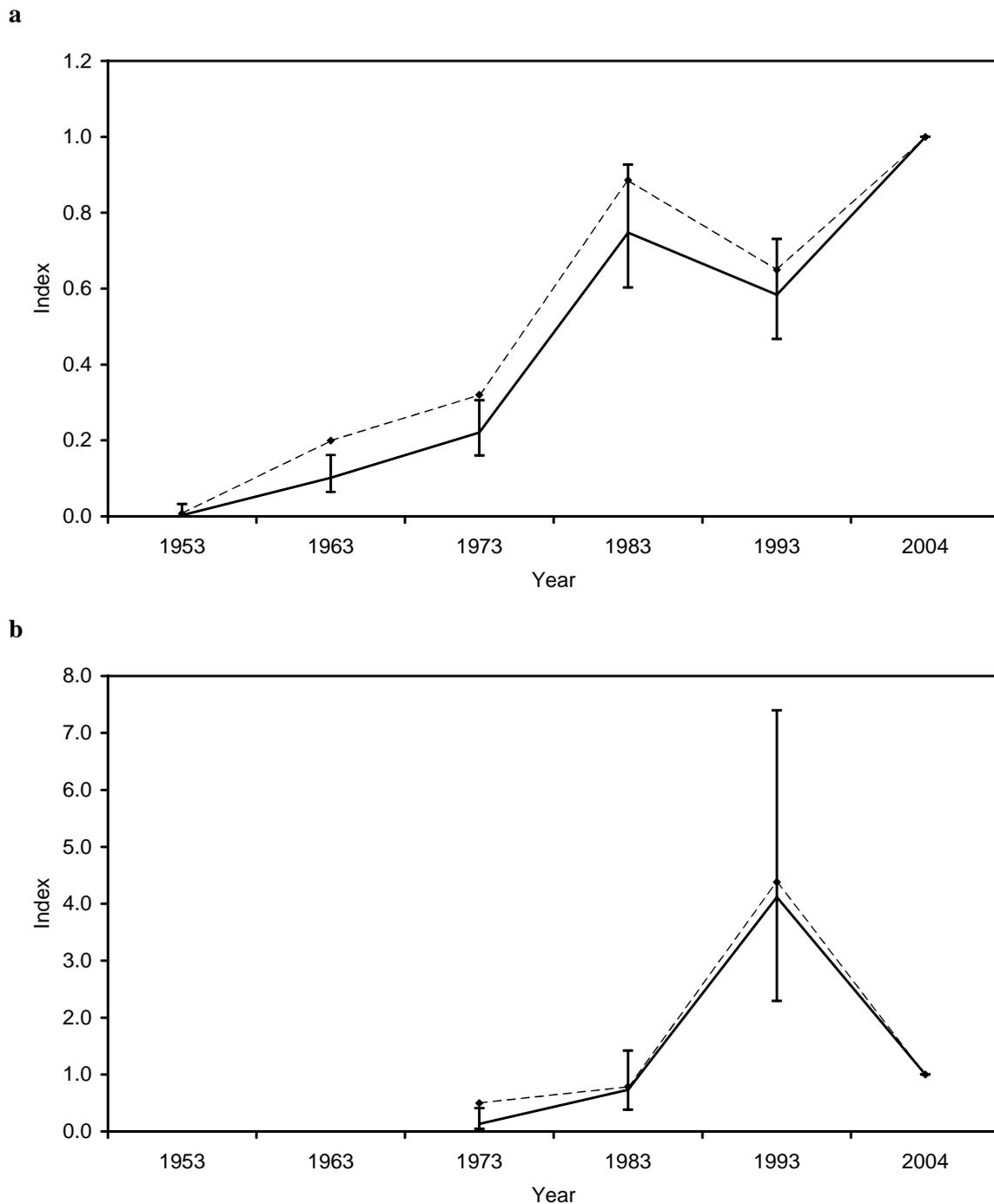


Figure 3.3 Trends in numbers of Lesser Black-backed Gulls wintering in **a.** England between 1953 and 2004 and **b.** Wales between 1973 and 2004 derived from models relating numbers to site and year. Index values are set to 1 in the most recent 2004 survey. Solid lines and 95% confidence limits indicate models in which numbers at inland sites were assumed to equal zero until the site was first visited. The dotted lines indicate the trends from preliminary models without this assumption (see methods).

c

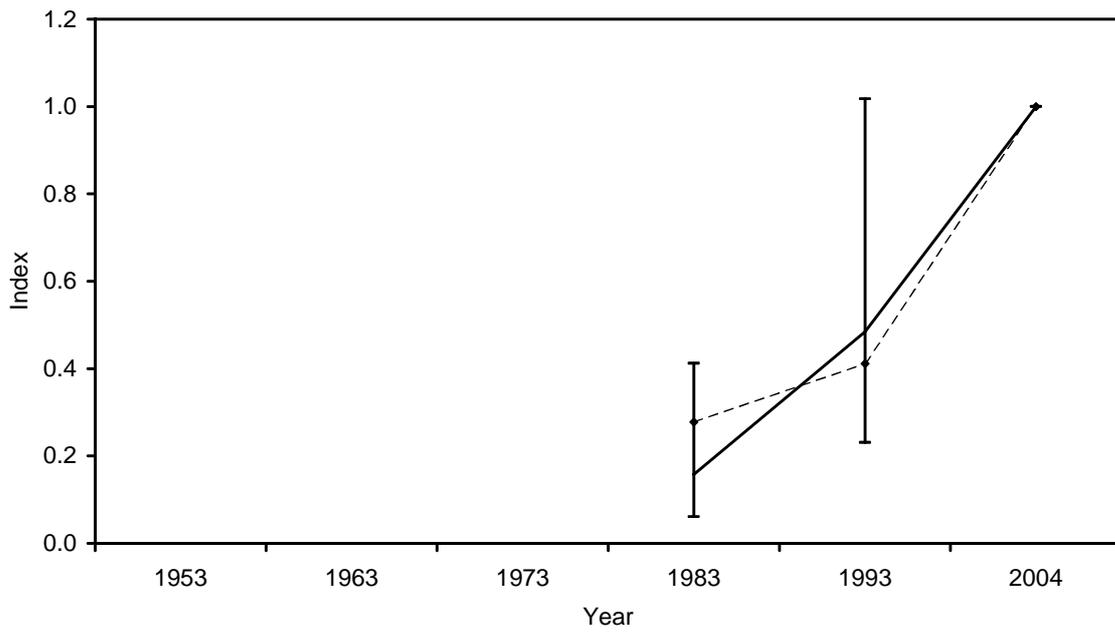


Figure 3.3 Trends in numbers of Lesser Black-backed Gulls wintering in c. Scotland between 1983 and 2004 derived from models relating numbers to site and year. Index values are set to 1 in the most recent 2004 survey. Solid lines and 95% confidence limits indicate models in which numbers at inland sites were assumed to equal zero until the site was first visited. The dotted lines indicate the trends from preliminary models without this assumption (see methods).

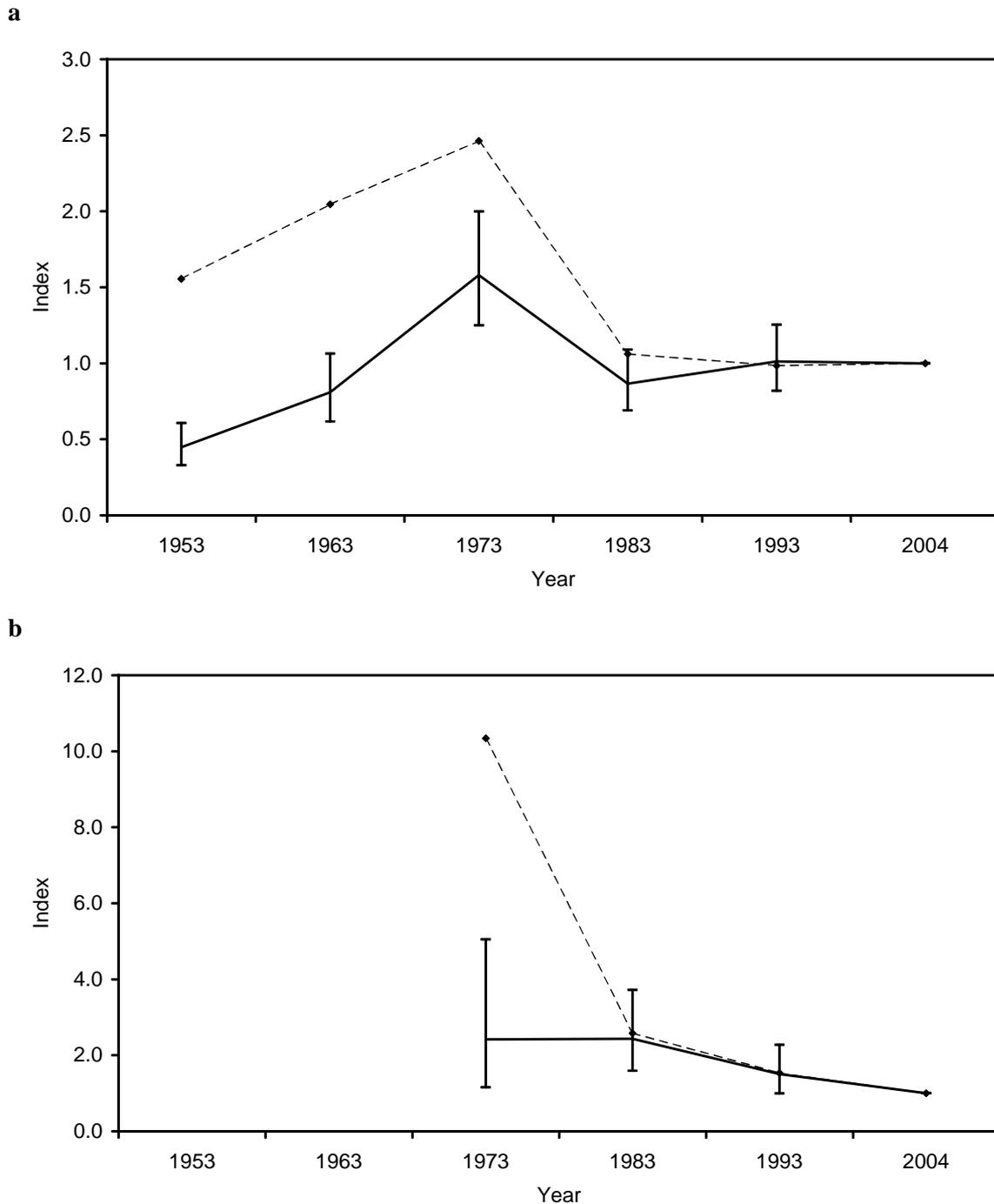


Figure 3.4 Trends in numbers of Herring Gulls wintering in **a.** England between 1953 and 2004 and **b.** Wales between 1973 and 2004 derived from models relating numbers to site and year. Index values are set to 1 in the most recent 2004 survey. Solid lines and 95% confidence limits indicate models in which numbers at inland sites were assumed to equal zero until the site was first visited. The dotted lines indicate the trends from preliminary models without this assumption (see methods).

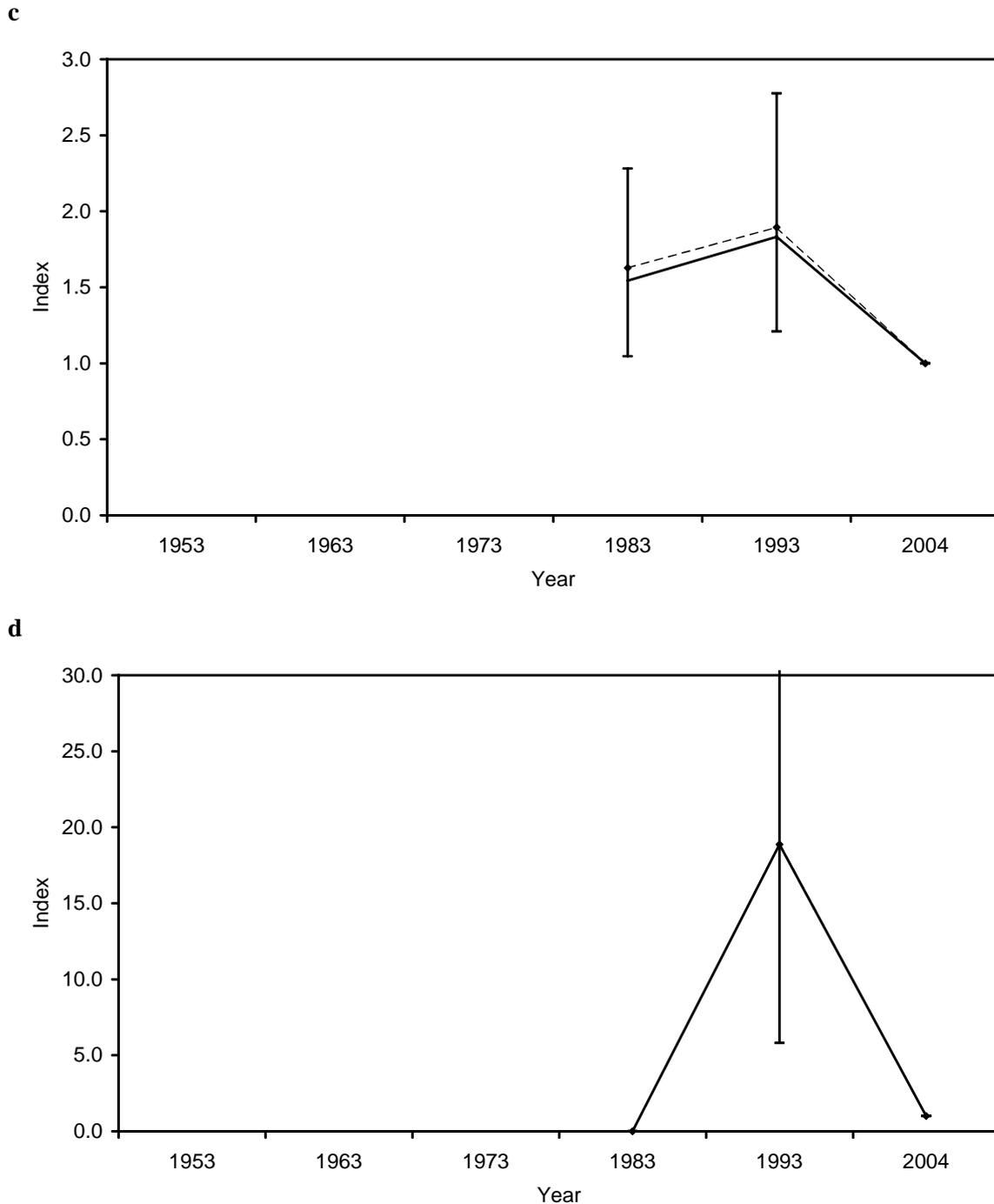


Figure 3.4 Trends in numbers of Herring Gulls wintering in **c.** Scotland between 1983 and 2004 and **d.** Northern Ireland between 1983 and 2004 derived from models relating numbers to site and year. Index values are set to 1 in the most recent 2004 survey. Solid lines and 95% confidence limits indicate models in which numbers at inland sites were assumed to equal zero until the site was first visited. The dotted lines indicate the trends from preliminary models without this assumption (see methods).

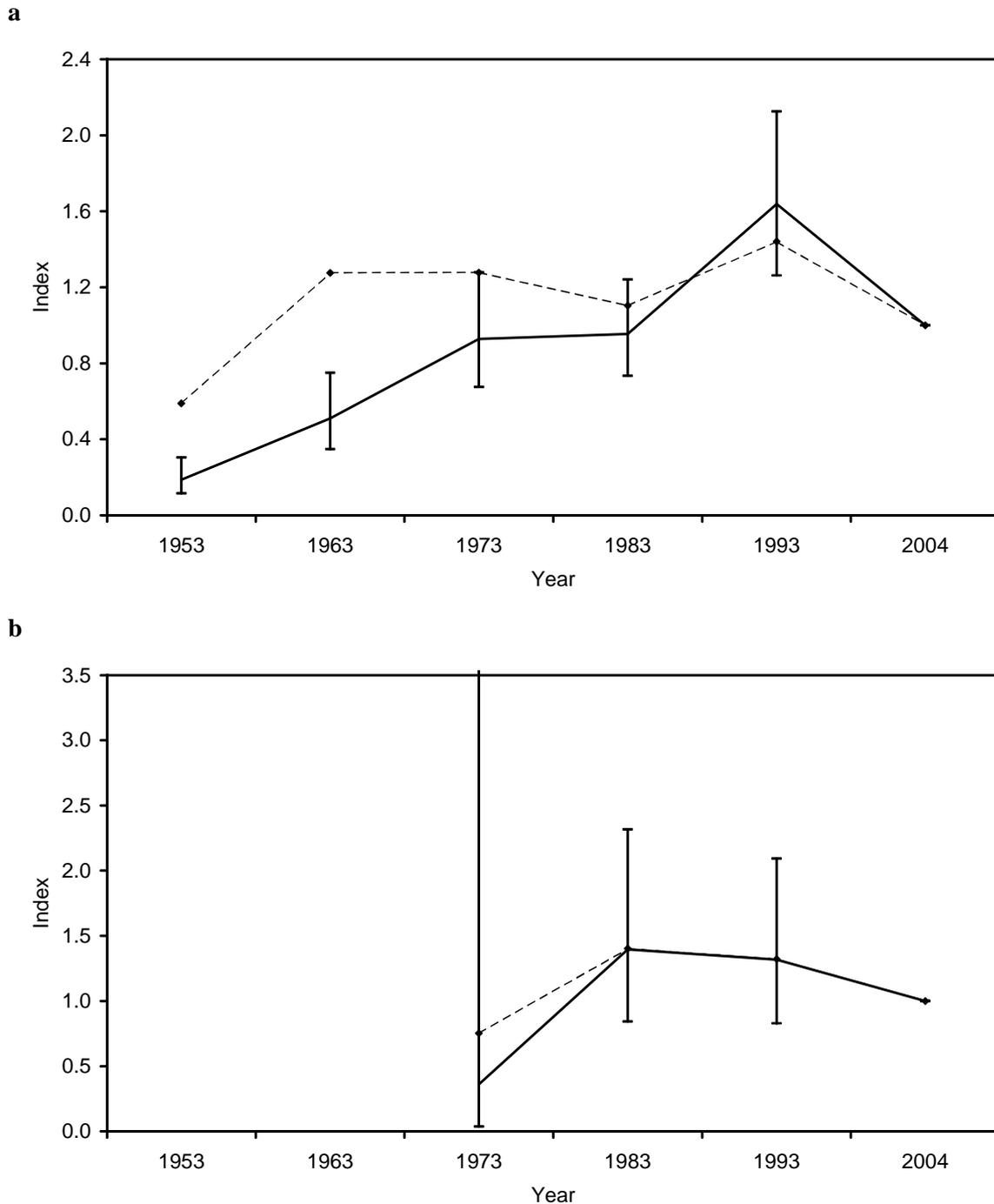


Figure 3.5 Trends in numbers of Great Black-backed Gulls wintering in **a.** England between 1953 and 2004 and **b.** Wales between 1973 and 2004 derived from models relating numbers to site and year. Index values are set to 1 in the most recent 2004 survey. Solid lines and 95% confidence limits indicate models in which numbers at inland sites were assumed to equal zero until the site was first visited. The dotted lines indicate the trends from preliminary models without this assumption (see methods).

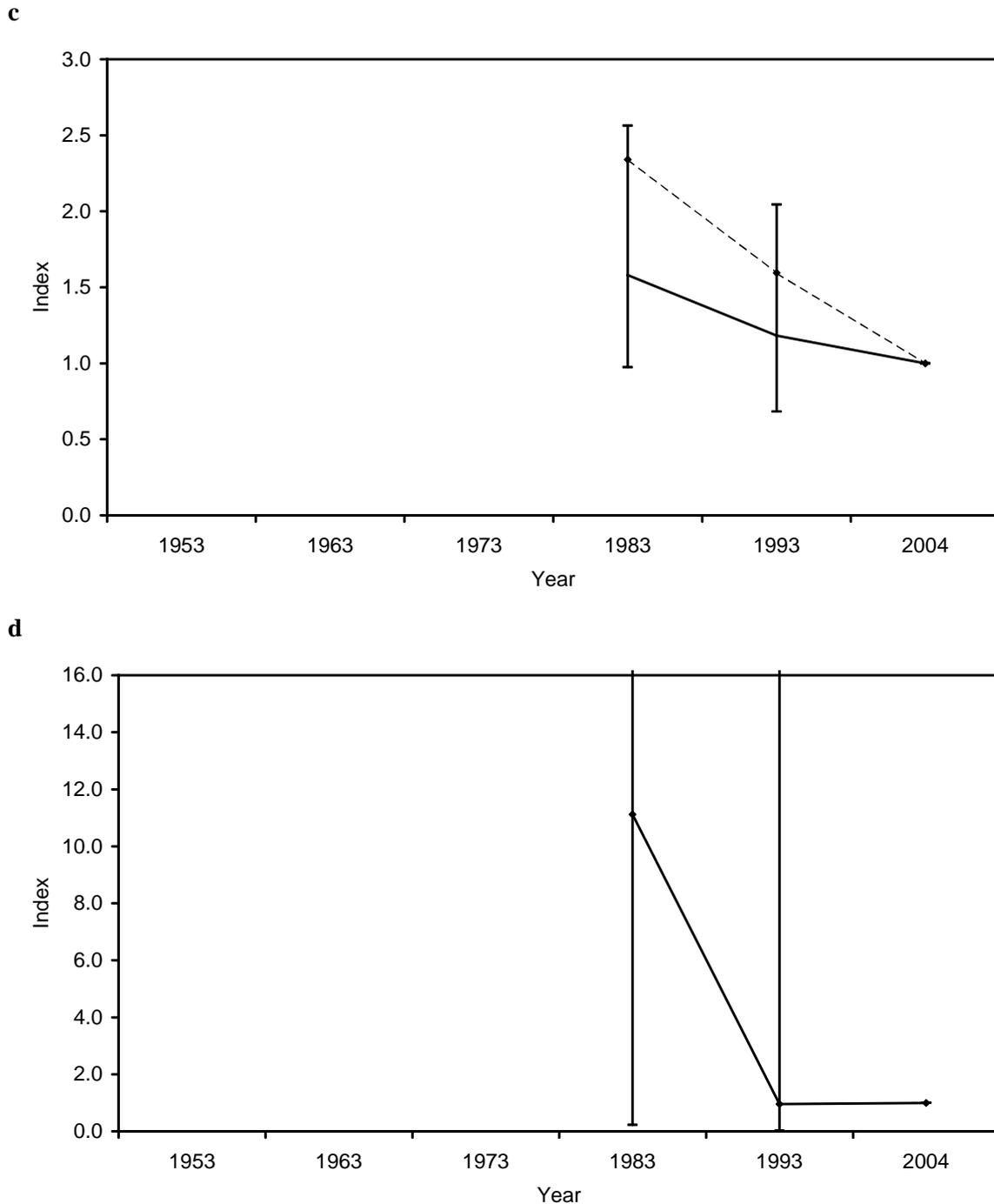


Figure 3.5 Trends in numbers of Great Black-backed Gulls wintering in **c.** Scotland between 1983 and 2004 and **d.** Northern Ireland between 1983 and 2004 derived from models relating numbers to site and year. Index values are set to 1 in the most recent 2004 survey. Solid lines and 95% confidence limits indicate models in which numbers at inland sites were assumed to equal zero until the site was first visited. The dotted lines indicate the trends from preliminary models without this assumption (see methods).

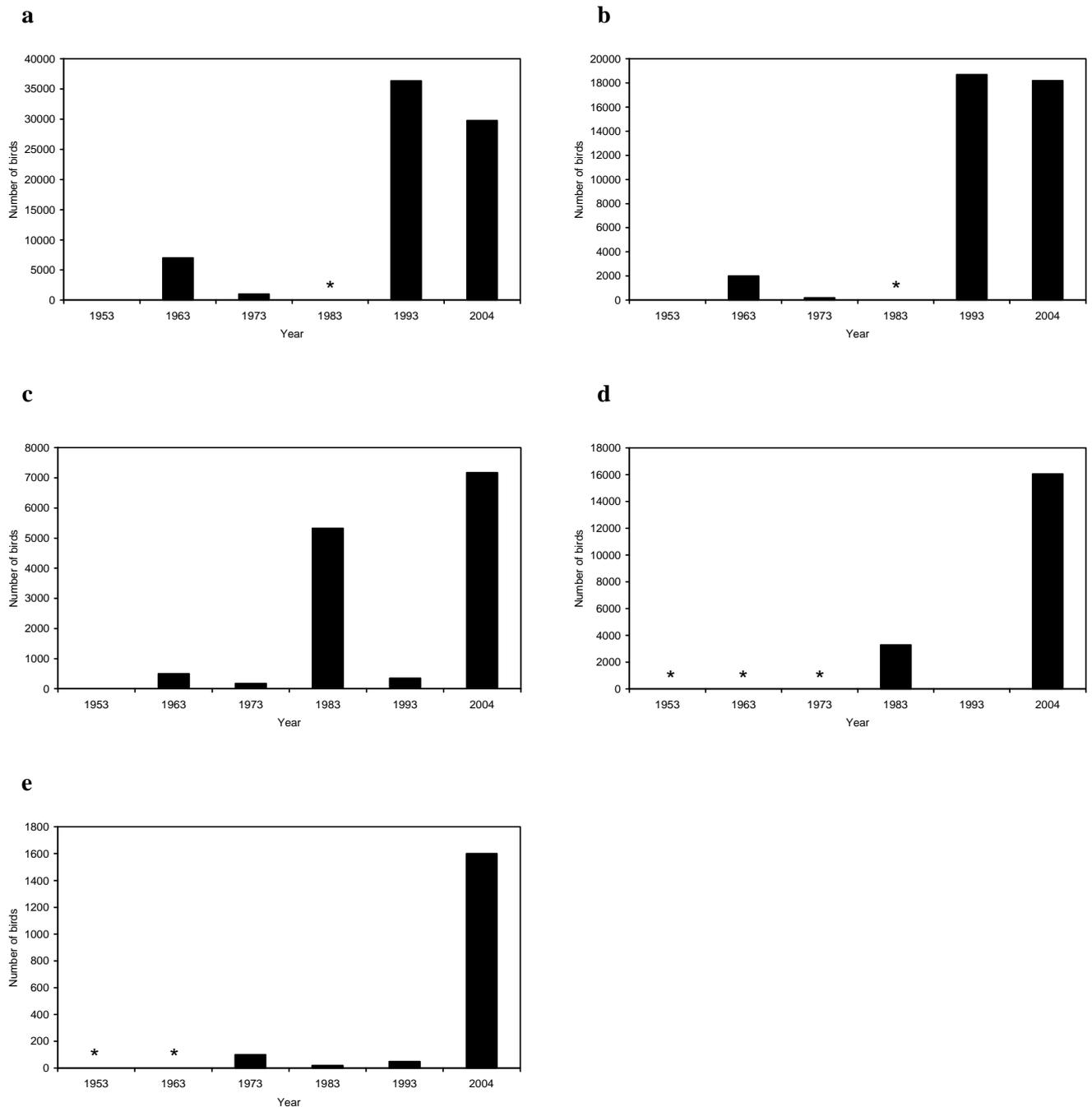


Figure 3.6 Numbers of gulls at the most significant (inland) roosts in the UK for respective species in January 2004 in comparison with numbers recorded in earlier surveys. **a.** Black-headed Gull numbers at Chew Valley Lake (Bath & North East Somerset Unitary Authority) **b.** Common Gull numbers at Chew Valley Lake **c.** Lesser Black-backed Gull numbers at Queen Mary Reservoir (Surrey) **d.** Herring Gull numbers at Roughrigg Reservoir (Strathclyde) and **e.** Great Black-backed Gull numbers at Hoveringham (Nottinghamshire).

* - site not surveyed.

APPENDIX 1

	England	Wales	Scotland	Northern Ireland
Black-headed Gull	1,441,117	85,729	155,539	15,412
Common Gull	322,996	26,593	79,742	1,596
Lesser Black-backed Gull	48,892	11,486	452	0
Herring Gull	256,626	29,177	90,972	1,973
Great Black-backed Gull	38,915	1,223	2,970	48

Appendix 1 Minimum population estimates of wintering gulls in England, Wales, Scotland and Northern Ireland from the 1993 Winter Gull Roost Survey (taken from Burton *et al.* 2003).

APPENDIX 2

	England	Wales	Scotland	Northern Ireland	Britain & Ireland ⁴
Black-headed Gull					
<i>At coastal colonies</i>					
1969-70 ¹	53,142	800	18,226	1,439	74,927
1985-88 ²	62,046	1,002	9,554	4,595	77,573
1998-2002 ³	65,551	850	6,888	4,037	79,392
<i>At inland colonies</i>					
1985-88 ²	21,163	2,008	25,105	33,851	90,520
1998-2002 ³	17,179	1,136	36,303	6,070	62,498
Common Gull					
<i>At coastal colonies</i>					
1969-70 ¹	8	2	12,229	56	12,983
1985-88 ²	31	0	15,134	192	15,471
1998-2002 ³	33	0	20,467	383	21,475
Lesser Black-backed Gull					
<i>At coastal colonies</i>					
1969-70 ¹	24,434	11,529	12,031	223	50,035
1985-88 ²	22,306	20,043	19,524	448	64,417
1998-2002 ³	44,133	20,682	21,565	1,033	91,323
Herring Gull					
<i>At coastal colonies</i>					
1969-70 ¹	62,114	48,576	159,237	16,002	343,586
1985-88 ²	27,597	11,089	92,950	17,561	177,065
1998-2002 ³	43,932	13,930	71,659	709	147,114
Great Black-backed Gull					
<i>At coastal colonies</i>					
1969-70 ¹	1,676	905	15,950	240	22,412
1985-88 ²	1,534	289	15,315	277	20,892
1998-2002 ³	1,466	425	14,773	71	19,691

Appendix 2 Numbers of breeding gulls (apparently occupied nests) in the UK between 1969 and 2002 (from Mitchell *et al.* 2004). With the exception of Black-headed Gull (which breeds in large numbers at both inland and coastal sites), figures are only reported for coastal colonies, as inland colonies were poorly monitored prior to Seabird 2000.

¹ 1969-70 – Operation Seafarer.

² 1985-88 – Seabird Colony Register Census. Note, figures for 1985-88 are actual counts and do not include adjustments to take into account unsurveyed colonies.

³ 1998-2002 – Seabird 2000.

⁴ Totals for Britain and Ireland include the Isle of Man and Channel Islands.